

# FLORA OF BHUTAN

INCLUDING A RECORD OF PLANTS  
FROM SIKKIM AND DARJEELING

VOLUME 2 PART 2

A. J. C. GRIERSON & D. G. LONG

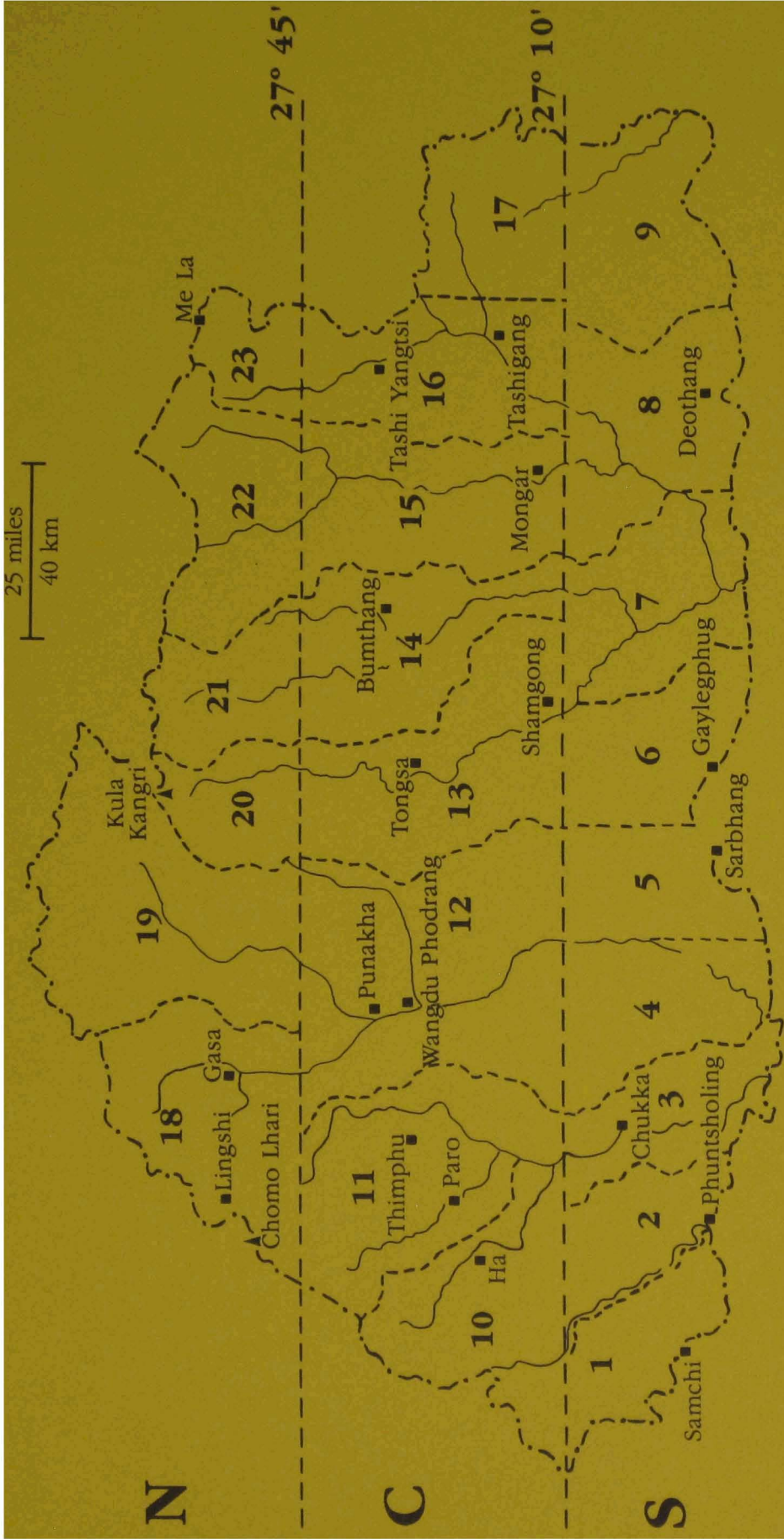
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ILLUSTRATIONS BY MARY BATES

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ROYAL BOTANIC GARDEN EDINBURGH  
ROYAL GOVERNMENT OF BHUTAN  
1999





Map of Bhutan showing botanical districts:

South (S): 1, Samchi; 2, Phuntsholing; 3, Chukka; 4, Sankosh; 5, Sarbhang; 6, Gaylephug; 7, Manas; 8, Deothang; 9, Dhansiri.

Central (C): 10, Ha; 11, Thimphu; 12, Punakha; 13, Tongsa; 14, Bumthang; 15, Mongar; 16, Tashigang; 17, Sakden.

North (N): 18, Upper Mo Chu; 19, Upper Pho Chu; 20, Upper Mangde Chu; 21, Upper Bumthang Chu; 22, Upper Kuru Chu; 23, Upper Kulong Chu.

Drawn by Abi Lezemore/S.J. Rae.

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ROYAL BOTANIC GARDEN EDINBURGH  
ROYAL GOVERNMENT OF BHUTAN  
1999

*This volume is dedicated to*

*His Majesty, King Jigme Singye Wangchuk, the fourth Druk Gyalpo of Bhutan,  
in the year of his Silver Jubilee, 1999*

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## INTRODUCTION

Most of the research for this part of the *Flora of Bhutan* was completed between 1990 and 1993 but, due to financial constraints, publication has not been possible until now. The volume contains several large and important families, in particular Umbelliferae, Primulaceae, Gentianaceae, Asclepiadaceae, Rubiaceae, Boraginaceae and Labiatae. Among these the families Primulaceae and Gentianaceae contain many species highly valued as ornamental 'alpines' in the West; many of these species are endemic to the East Himalaya or Bhutan.

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## BIBLIOGRAPHY

The bibliography is divided into three parts:

Part 1: References for Volume 2 Part 2 repeated from earlier volumes.

17. Brandis, D. 1906. *Indian Trees*. London: Constable & Co.
34. Cowan, A.M. & Cowan, J.M. 1929. *The Trees of Northern Bengal*. Calcutta: Bengal Secretariat Book Depot.
38. Deb, D.B., Sen Gupta, G. & Malick, K.C. 1969. A Contribution to the Flora of Bhutan. *Bull. Bot. Soc. Bengal* 22(2): 169–217.
45. Fletcher, H.R. 1975. *A Quest for Flowers. The Plant Explorations of Frank Ludlow and George Sherriff*. Edinburgh: Edinburgh University Press.
48. Gamble, J.S. 1902. *A Manual of Indian Timbers*, 2nd edn. London: Sampson low, Marston & Co.
58. Grierson, A.J.C. & Long, D.G. 1978. Notes relating to the Flora of Bhutan: I. *Notes R.B.G. Edinburgh* 36: 139–150.
67. Handel-Mazzetti, H. 1938. Plantae novae tibeticae et bhutanicae in herbario musei britannici. *J. Bot. (London)* 76: 281–292.
69. Hara, H. (ed.) 1967. *The Flora of Eastern Himalaya*. Tokyo: University of Tokyo.
71. Hara, H. (ed.) 1971. Flora of Eastern Himalaya. Second Report. *Bulletin of the University Museum, University of Tokyo* 2: 1–393.
73. Hara, H. & Williams, L.H.J. 1979. *An Enumeration of the Flowering Plants of Nepal*. Volume 2. London: British Museum (Natural History).



80. Hooker, J.D. (ed.) 1875–1897. *The Flora of British India*. 7 volumes. London: Reeve & Co.
85. Lacaita, C.C. 1916. Plants collected in Sikkim, including the Kalimpong District, April 8th to May 9th, 1913. *J. Linn. Soc., Botany* 43: 457–492.
95. Mathew, K.M. 1967. A preliminary list of plants from Kurseong. *Bull. Bot. Surv. India* 8: 158–168.
104. Rao, R.S. 1964. A botanical tour in the Sikkim state, eastern Himalayas. *Bull. Bot. Surv. India* 5: 165–205.
113. Smith, W.W. & Cave, G.H. 1911. The vegetation of the Zemu and Llonakh valleys of Sikkim. *Rec. Bot. Surv. India* 4(5): 141–260.
117. Subramanyam, K. (ed.) 1973. Materials for the Flora of Bhutan. *Rec. Bot. Surv. India* 20(2): 1–278.
126. Watt, G. 1908. *The Commercial Products of India*. London: John Murray.
130. Ayensu, E.S. (ed.) 1980. *Firewood Crops*. Washington: National Academy of Sciences.
135. Hara, H., Chater, A.O. & Williams, L.H.J. 1982. *An Enumeration of the Flowering Plants of Nepal*. Volume 3. London: British Museum (Natural History).
157. Herklots, G.A.C. 1972. *Vegetables in South-East Asia*. London: George Allens Unwin.
160. Long, D.G. 1983. Notes relating to the Flora of Bhutan: VI. A new species of *Erycibe* (Convolvulaceae). *Notes R.B.G. Edinburgh* 41: 127–131.
167. Polunin, O & Stainton, J.D.A. 1984. *Flowers of the Himalaya*. Dehli: Oxford University Press.
174. Sikdar, J.K. & Samanta, D.N. 1984. Herbaceous flora (excluding Cyperaceae, Poaceae and Pteridophytes) of Jalpaiguri District, West Bengal – A check list. *J. Econ. Tax. Bot.* 4: 525–538.
220. Naithani, H.B. 1990. *Flowering plants of India, Nepal and Bhutan (not recorded in Sir J.D. Hooker's Flora of British India)*. Dehra Dun: Surya Publications.
231. Sikdar, J.K. & Rao, R.S. 1984. Further contribution to the flora of Buxa Forest Division, Jalpaiguri District (West Bengal). *J. Bombay Nat. Hist. Soc.* 81: 123–148.

Part 2: new references for Volume 2 Part 2.

245. Aitken, E. & Long, D.G. 1994. Notes relating to the Flora of Bhutan: XXVII. *Gentianella griersonii*, a new species from Bhutan. *Edinburgh J. Bot.* 51: 165–167.
246. Aitken, E. & Long, D.G. 1996. Notes relating to the Flora of Bhutan: XXX. Gentianaceae. *Edinburgh J. Bot.* 53: 81–94.
247. Bhatti, G.R. & Ingrouille, M. 1997. Systematics of *Pogostemon* (Labiatae). *Bull. Nat. Hist. Mus., Botany Series* 27: 77–147.
248. Biju, S.D. et al. 1992. Notes in the identification and nomenclature of two more species of *Hedyotis* L. (Rubiaceae). *Rheedea* 2: 11–18.
249. Chakravarty, H.L. 1955. Revision of Indo-Burmese *Rauwolfia*. *Bull. Bot. Soc. Bengal* 9: 1–9.

250. Clement, R.A. 1993. Notes relating to the Flora of Bhutan: XVIII. New taxa and a new combination in the Labiatae. *Edinburgh J. Bot.* 50: 33–38.
251. Cowan, J.M. 1932. The genus *Wendlandia*. *Notes R.B.G. Edinburgh* 16: 233–314.
252. Das, S.N. & Roy, S.C. 1984. A note on the occurrence of *Chassalia staintonii* (Hara) Deb & Mondal (Rubiaceae) in India. *J. Econ. Tax. Botany* 5: 473–474.
253. Deb, D.B. 1986. Taxonomic revision of *Mycetia* Reinw. (Rubiaceae) in Indian subcontinent. *Bull. Bot. Surv. India* 28: 114–132.
254. Deb, D.B. 1989. Taxonomic revision of the genus *Hymenodictyon* (Rubiaceae) in India. *J. Econ. Tax. Botany* 13: 673–682.
255. Deb, D.B. & Gangopadhyay, M. 1991. Taxonomic study of the genus *Lasianthus* Jack (Rubiaceae) in India. *J. Econ. Tax. Botany* 15: 265–308.
256. Halda, J.J. 1992. *The Genus Primula in Cultivation and in the Wild*. Denver: Tethys Books.
257. Ho, T.-N. & Pringle, J.S. 1995. Gentianaceae. In: Wu, Z.Y. & Raven, P.H. (eds) *Flora of China* 16: 1–139. Beijing & St Louis: Science Press & Missouri Botanical Garden.
258. Krishna, B. & Dutta, R. 1979. New plant records for West Bengal. *Bull. Bot. Surv. India* 21: 211.
259. Li, H.-W. 1988. Taxonomic revision of *Isodon* (Labiatae). *J. Arnold Arboretum* 69: 289–400.
260. Li, X.-W. & Hedge, I.C. 1994. Labiatae. In: Wu, Z.Y. & Raven, P.H. (eds) *Flora of China* 17: 50–299. Beijing & St Louis: Science Press & Missouri Botanical Garden.
261. Maheshwari, J.K. 1961. On the identity and nomenclature of some Indian plants. *Bull. Bot. Surv. India* 3: 91–94.
262. Mill, R.R. 1994. Notes relating to the Flora of Bhutan: XXV. Boraginaceae. I. *Onosma griersonii*, a new species from Bhutan. *Edinburgh J. Bot.* 51: 145–146.
263. Mill, R.R. 1996a. Notes relating to the Flora of Bhutan: XXXII. Boraginaceae. II. New taxa, combinations and lectotypifications in subfamily Boraginoideae. *Edinburgh J. Bot.* 53: 113–125.
264. Mill, R.R. 1996b. The *Galium acutum* and *G. asperifolium* species complexes in the Eastern Himalaya. *Edinburgh J. Bot.* 53: 193–213.
265. Mill, R.R. 1996c. Notes relating to the Flora of Bhutan: XXXIV. Convolvulaceae. *Edinburgh J. Bot.* 53: 229–246.
266. Mill, R.R. 1996d. Notes relating to the Flora of Bhutan: XXXV. Boraginaceae. III. *Ehretia wallachiana*: a tangle disentangled. *Edinburgh J. Bot.* 53: 247–270.
267. Mukherjee, P.K. 1978. A Resume of Indian Umbellifers. In: Cawet-Marc, A.M. & Carbonnier, J. (eds) *Les Ombellifères*, pp. 47–70. Perpignan: Centre Universitaire de Perpignan.

268. Mukherjee, P.K. & Constance, L. 1993. *Umbelliferae (Apiaceae) of India*. New Delhi: Oxford and IBH Publishing Co.
269. Mukherjee, S.K. 1940. A revision of the Labiatae of the Indian Empire. *Rec. Bot. Surv. India* 14: 1–228.
270. Murata, G. 1969. Labiatae of Himalaya collected by S. Nakao, K. Nishioka, O. Namikawa, R. Fujimura, J. Kawakita, T. Namba and K. Itoh. *Acta Phytotax. Geobot.* 24: 77–89.
271. Nasir, Y.J. 1984. Primulaceae. In: Nasir, E. & Ali, S.I. (eds) *Flora of Pakistan* 157: 1–103. Karachi: University of Karachi.
272. Parker, C. 1992. *Weeds of Bhutan*. Thimphu: Royal Government of Bhutan.
273. Peter, E. 1936. Revision der indischen und tibetanischen arten der gattung *Salvia* L. *Feddes Repert.* 39: 173–186.
274. Prain, D. 1890. Noviciae Indicae III. Some additional species of Labiatae. *J. Asiatic Soc. Bengal.* 59: 294–318.
275. Richards, A.J. 1993. *Primula*. London: Batsford.
276. Sikdar, J.K. 1981a. Some new plant records for West Bengal from Jalpaiguri District. *J. Bombay Nat. Hist. Soc.* 78: 103–106.
277. Sikdar, J.K. 1981b. Notes on some plant records from Bengal. *J. Bombay Nat. Hist. Soc.* 78: 419–421.
278. Sivarajan, V.V. & Biju, S.D. 1990. Taxonomic and nomenclatural notes on the *Hedyotis corymbosa-diffusa* complex (Rubiaceae). *Taxon* 39: 665–674.
279. Springate, L.S. 1996. Notes relating to the Flora of Bhutan: XXXI. Rubiaceae. *Edinburgh J. Bot.* 53: 95–111.
280. Srivastava, S.K. & Kapoor, S.L. 1987. Notes on the conservation status of taxa of Indian Oleaceae. *J. Econ. Tax. Botany* 9: 173–177.
281. Watson, M.F. 1996. Notes relating to the Flora of Bhutan: XXXIII. Umbelliferae. I. *Edinburgh J. Bot.* 53: 127–144.
282. Watson, M.F. 1998. Notes relating to the Flora of Bhutan: XXXVI. Umbelliferae. II. *Edinburgh J. Bot.* 55: 367–415.

Part 3: Additional bibliography (references of general interest but not referred to in the text). Papers relating to Monocotyledons are excluded as they are dealt with in Volume 3.

283. Akiyama, S., Ohba, H. & Suzuki, M. 1992. Notes on East Himalayan species of *Impatiens*. *J. Jap. Bot.* 67: 187–193.
284. Biswas, S. 1991. Rare and endangered flora of Eastern Himalaya and the measures for its conservation. In: Rajwar, G.S. (ed.) *Advances in Himalayan Ecology*, pp. 267–273. New Delhi: Today and Tomorrow's Publishers.
285. Chaudhuri, A.B. 1993. *Forest Plants of Eastern India*. New Delhi: Ashish Publishing House.
286. Cook, C.D.K. 1996. *Aquatic and Wetland Plants of India*. Oxford: Oxford University Press.
287. Das, A.P. 1995. Diversity of Angiospermic Flora of Darjeeling Hills. In: Pandey, A.K. (ed.) *Taxonomy and Biodiversity*, pp. 118–127. Delhi: CBS Publishers.



288. Das, A.P. & Chanda, S. 1987. Flowering Calendar of the Angiospermic Flora of Darjeeling Hills, West Bengal (India). *Trans. Bose Res. Inst.* 50: 99–133.
289. Dhar, U. (ed.) 1993. *Himalayan Biodiversity. Conservation Strategies*. Nainital: Gyanodaya Prakashan.
290. Dupka, Z. (ed.) 1991. *Bhutan and its Natural Resources*. New Delhi: Vikas Publishing House.
291. Farjon, A. 1994. *Cupressus cashmeriana*. *Kew Mag.* 11: 156–166.
292. Grierson, A.J.C. & Long, D.G. 1991. *Flora of Bhutan*. Volume 2 Part 1. Royal Botanic Garden Edinburgh.
293. Halda, J.J. 1996. *The genus Gentiana*. Dobré: SEN.
294. Hedge, I.C. & Long, D.G. 1994. Andrew John Charles Grierson (24 iv 1929–11 ix 1990). *Edinburgh J. Bot.* 51: iii–vii.
295. Issar, R.K. (ed.) 1991. *Medico-Ethno-Botanical Explorations of Sikkim Himalayas*. New Delhi: Central Council for Research in Ayurveda and Siddha.
296. Karan, P.P. 1991. Ecology, environmental conservation and development in Bhutan Himalaya. In: Rajwar, G.S. (ed.) *Advances in Himalayan Ecology*, pp. 167–197. New Delhi: Today and Tomorrow's Publishers.
297. Lidén, M. 1998. New species of *Corydalis* from Burma, Bhutan and India. *Edinburgh J. Bot.* 55: 343–350.
298. Mandal, N.R. & Singh, P. 1993. Four new plant records for Sikkim. *J. Econ. Tax. Bot.* 17: 555–556.
299. Mill, R.R. 1993. Notes relating to the Flora of Bhutan: XXIII. A new species of *Torenia* (Scrophulariaceae). *Edinburgh J. Bot.* 50: 211–215.
300. Namgyel, P. & Long, D.G. 1995. Zhidey: a new Bhutanese *Rhododendron* cultivar to commemorate the 50th anniversary of the United Nations and an account of *Rhododendron kesangiae* in Bhutan. *Tsenden* 5: 2–5.
301. Nayar, M.P. & Sastry, A.R.K. (eds) 1988. *Red Data Book of Indian Plants, Volume 2*. Calcutta: Botanical Survey of India.
302. Nayar, M.P. & Sastry, A.R.K. (eds) 1990. *Red Data Book of Indian Plants, Volume 3*. Calcutta: Botanical Survey of India.
303. Noltie, H.J. 1994. *Flora of Bhutan*. Volume 3 Part 1. Royal Botanic Garden Edinburgh.
304. Ohba, H. & Malla, S.B. (eds) 1991. *The Himalayan Plants, Volume 2*. Tokyo: University of Tokyo Press.
305. Ohba, H. & Malla, S.B. (eds) 1991. *The Himalayan Plants, Volume 3*. Tokyo: University of Tokyo Press.
306. Prasher, I.B. 1999. *Fungi of Bhutan*. Dehra Dun: International Book Distributors.
307. Rai, L. & Sharma, E. 1994. *Medicinal Plants of the Sikkim Himalaya*. Dehra Dun: Bishen Singh Mahendra Pal Singh.
308. Rai, T. & Rai, L. 1994. *Trees of the Sikkim Himalaya*. New Delhi: Indus Publishing Company.

309. Rushforth, K. 1992. Lectotypes for Himalayan *Sorbus* taxa (Rosaceae). *Edinburgh J. Bot.* 49: 299–310.
310. Samanta, A.K. & Das, A.P. 1995. Angiospermic climbers of Darjeeling Hills. In: Pandey, A.K. (ed.) *Taxonomy and Biodiversity*, pp. 139–147. Delhi: CBS Publishers.
311. Sharma, B.D. & Kumari, T. (eds) 1998. *Himalayan Natural Resources, Eco-Threats and Restoration Study*. New Delhi: Indus Publishing Company.
312. Srivastava, T.N. & Kapahi, B.K. 1992. Economic tree flora of Sikkim forests. *J. Econ. Tax. Bot. Addl. Ser.* 10: 339–354.
313. Thinley, U. 1996. *Know the Plants of Bhutan, Volume 1*. Thimphu: U. Thinley.
314. Tshering, S. & Hellum, A.K. 1990. *Identification of some Tree Seedlings in Bhutan*. Thimphu: Royal Government of Bhutan.
315. Wood, J.R.I. 1994. Notes relating to the Flora of Bhutan: XXIX. Acanthaceae, with special reference to *Strobilanthes*. *Edinburgh J. Bot.* 51: 175–273.

Taxonomic papers relevant to this volume have been published in the ‘Notes relating to the Flora of Bhutan’ series in the *Edinburgh Journal of Botany* as follows:

- XVIII Labiatae by R.A. King 50: 33–38 (1993).
- XXV Boraginaceae, I by R.R. Mill 51: 145–146 (1994).
- XXVII *Gentianella griersonii* by E. Aitken & D.G. Long 51: 165–167 (1994).
- XXX Gentianaceae by E. Aitken & D.G. Long 53: 81–94 (1996).
- XXXI Rubiaceae by L.S. Springate 53: 95–111 (1996).
- XXXII Boraginaceae, II by R.R. Mill 53: 113–125 (1996).
- XXXIII Umbelliferae, I by M.F. Watson 53: 127–144 (1996).
- XXXIV Convolvulaceae, by R.R. Mill 53: 229–246 (1996).
- XXXV Boraginaceae, III by R.R. Mill 53: 247–270 (1996).
- XXXVI Umbelliferae, II by M.F. Watson 55: 367–415 (1998).

## ABBREVIATIONS

Abbreviations for languages and dialects of common names of plants used in this volume are:

Dz: Dzongkha language (W Bhutan and official language)

Eng: English

Med: Bhutanese medicinal name

Nep: Nepali

Sha: Shachop dialect (E Bhutan)

For other abbreviations, e.g. botanical authorities, users are referred to Volume 1 Part 1, p.34.

## Family 144. UMBELLIFERAE

by M.F. Watson

Annual, biennial or perennial herbs. Leaves basal or alternate, rarely simple, usually pinnately or ternately divided; petioles usually with a sheathing base clasping the stem, often broadly so; mainly exstipulate. Flowers small, borne in simple or compound umbels, rarely in compact heads, hermaphrodite or sometimes male, 5-merous. Rays of umbels sometimes subtended by a whorl of bracts (involucre); stalks of umbellules often subtended by a whorl of bracteoles (involucel). Calyx tube wholly fused to ovary, teeth free, conspicuous to obsolete, persistent or not in fruit. Petals free, with or without inflexed apex, regular, or outer petals enlarged and radiant. Stamens alternating with petals and borne on nectary disc. Ovary of 2 carpels united to form an inferior bilocular ovary; styles distinct, usually swollen at base to form the stylopodium. Fruit a dry schizocarp consisting of 2 subterete or compressed mericarps joined by their faces (commissure); mericarps separating at maturity and attached at apex to a slender, entire to deeply bifid carpophore (carpophore rarely absent); mericarps smooth to variously ornamented with hairs, bristles or spines, usually with 5 primary vertical ribs or ridges (additional secondary ridges sometimes also present), ridges sometimes prominent or winged; vittae (oil tubes) usually present within mericarp wall and sometimes visible between ridges.

Preliminary investigations for this account were made by the late A.J.C. Grierson.

1. Leaves all simple, margin entire or toothed, sometimes shallowly lobed, but not more than half the width of the leaf ..... 2
- + Leaves compound, 1–5 × ternately or pinnately divided, or, if simple, then very deeply lobed or basal (see *Pimpinella*) ..... 5
  
2. Leaves and bracts spinous-toothed; flowers in compact heads sessile on a whorl of bracts ..... **4. Eryngium**
- + Leaves and bracts not spinous-toothed; flowers in distinct umbels ..... 3
  
3. Plants of dry habitats with erect to ascending stems; leaf margins entire; umbels compound ..... **19. Bupleurum**
- + Plants of damp habitats with creeping stems rooting at nodes; leaves lobed or not, margins crenate or serrate; umbels simple ..... 4
  
4. Bracts absent; dorsal ribs of fruit prominent, lateral ones obscure  

**1. Hydrocotyle**

- + Umbels sheathed by small bracts; lateral ribs of fruit as prominent as the dorsal, much wrinkled ..... **2. Centella**



5. High altitude plants (more than 3800m) with well-developed erect stems; umbels with flowers densely crowded into globose heads; flowers dark brown; fruits 5-angled in cross-section ..... **34. Haplosphaera**  
 + Low to high altitude plants, stems tall and robust to almost absent; umbels not globose; flowers white, yellow, greenish or purplish; fruits variously winged or ornamented ..... 6
6. Glabrous annuals; umbellules much reduced to 2–3 flowers; pedicels very short, unequal ..... **27. Pternopetalum**  
 + Glabrous or hairy, annuals or perennials; umbellules many- (more than 5-) flowered; pedicels not as above ..... 7
7. Marshland plants, stems usually weak and fleshy; bracteoles several, linear; fruits ovoid-ellipsoid, lateral ribs thick and corky ..... **28. Oenanthe**  
 + Plants of usually drier habitats, stems not weak and fleshy; bracteoles present or absent; fruits variously shaped and ornamented, but ribs not thick and corky ..... 8
8. Erect aromatic herbs (celery scented), 30–60cm tall; umbels subsessile, often leaf-opposed in the upper half of the stem ..... **20. Apium**  
 + Erect to dwarf plants, scented or not; umbels distinctly pedunculate or sometimes sessile in rosette plants ..... 9
9. Mature or semi-mature fruit present ..... 10  
 + Flowers or young fruit only present ..... 46
10. Fruits ornamented with papillae, hairs, bristles or spines ..... 11  
 + Fruits smooth, glabrous ..... 19
11. At least outer fruits of umbellule covered with stiff bristles or spines ... 12  
 + Fruits covered with soft hairs or papillae ..... 14
12. Fruits long and narrow, thickened above, pointed at base, covered with upwardly-pointing fine bristles, densest at base ..... **6. Osmorhiza**  
 + Fruits ovoid to ovoid-ellipsoid, covered with spines or stiff spreading bristles  
 13
13. Almost glabrous woodland perennials; leaves palmately divided; calyx teeth subulate ..... **3. Sanicula**  
 + Hairy annual weeds; leaves 1–3 × pinnately divided; calyx teeth minute  
**7. Torilis**
14. Ultimate segments of leaves linear, filiform, usually less than 0.5mm broad  
 15  
 + Leaflets or ultimate segments of leaves ovate or oblong-lanceolate, more than 0.5mm broad ..... 16

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15. Bracts and bracteoles 3-lobed at apex, semi-cartilaginous; calyx teeth subulate, conspicuous ..... **8. Cuminum**  
+ Bracts and bracteoles entire, membranous; calyx teeth obsolete  
**21. Trachyspermum**
16. Dwarf perennials, acaulescent with erect peduncles; leaves mostly basal, pinnate, linear-lanceolate in outline, ultimate segments oblong-lanceolate 0.5–1mm broad; fruits with dense white hairs ..... **41. Semenovia**  
+ Caulescent, stems usually leafy; leaflets or ultimate segments of leaves ovate-oblong to suborbicular, 5mm or more broad; fruits papillate or sparsely hairy ..... 17
17. Small to medium-sized perennials usually less than 1m tall; fruits slightly laterally compressed, unwinged, papillate ..... **24. Pimpinella**  
+ Medium to large-sized perennials often more than 1m tall; fruits greatly dorsally compressed with distinct lateral wings, sparsely hairy, glabrous when mature ..... 18
18. Bracts absent or few, falling early; bracteoles linear ..... **39. Heracleum**  
+ Bracts and bracteoles numerous, large, lanceolate-ovate, persistent  
**40. Tordyliopsis**
19. Fruits strongly dorsally compressed, main body almost flat and disc-like, or all ribs winged ..... 20  
+ Fruits subterete or sometimes slightly compressed (including *Anethum*) 27
20. Dorsal ribs of fruits with wings about as broad as those on the lateral ribs  
21  
+ Dorsal ribs of fruits prominent but not winged ..... 23
21. Plants more than 30cm tall with slender erect stems; flowers dark purple  
**31. Cnidium**  
+ Plants less than 30cm tall, acaulous or shortly stemmed, less than 30cm tall; flowers usually white or tinged purple ..... 22
22. Fruits rectangular-ellipsoid to suborbicular in outline, truncate at ends, asymmetric with one mericarp having the 2 outer dorsal ribs winged and only the central rib winged on the other ..... **30. Cortiella**  
+ Fruits oblong-ellipsoid, rounded to obtuse at ends, all dorsal ribs equally winged ..... **35. Cortia**

23. Bracts linear to lanceolate, usually entire (rarely 3-toothed); fruits ovoid to suborbicular, dark between ribs, but not with well-defined lines (vittae), lateral ribs narrowly winged ..... 24  
 + Bracts usually absent or lanceolate to ovate-lanceolate, usually entire; fruits ovoid to obovoid, with distinct dark lines (vittae) between ribs, lateral ribs broadly winged ..... 25
24. Leaves glabrous above; vittae in fruit usually 1 per dorsal furrow, 2–3 per lateral furrow and 4–6 on inner (commisural) face ..... **32. *Selinum***  
 + Leaves hairy above; vittae in fruit at least 2 per dorsal furrow, at least 3 per lateral furrow and at least 6 on inner face ..... **33. *Ligusticum***
25. Bracts and bracteoles numerous, large, lanceolate-ovate, persistent ..... **40. *Tordyliopsis***  
 + Bracts few or absent, bracteoles linear, often falling early ..... 26
26. Plants aromatic; vittae extending the full length of the fruit, fruit often notched at both ends ..... **36. *Angelica***  
 + Plants not aromatic; vittae usually not extending the full length of the fruit, fruit rounded to truncate at the ends ..... **39. *Heracleum***
27. Cultivated annuals (or short-lived perennials) sometimes weedy; leaves pinnatisect into linear segments; bracteoles absent; fruit somewhat dorsally compressed, very narrowly winged ..... **37. *Anethum***  
 + Annuals and perennials, weedy or not; leaf segments and bracteole combination not as above; fruits not dorsally compressed, usually subterete and rounded on the outer face ..... 28
28. Leaves simply pinnate; fruits globose to ovoid-oblong, prominently 5- or 10-ribbed ..... 29  
 + Leaves finely 2–3 × pinnately divided; fruits various (see also *Pleurospermum angelicoides*) ..... 31
29. Plants fibrous at base; fruit 5-ribbed ..... **13. *Physospermopsis***  
 + Plants with papery leaf remains at base; fruits 5- or 10-ribbed ..... 30
30. Calyx teeth present; stylopodium domed, not flanged; fruits 5-ribbed ..... **15. *Keraymonia***  
 + Calyx teeth obsolete; stylopodium flat-domed with a thick rim wider than ovary; fruits 10-ribbed ..... **18. *Chamaesium***
31. Bracts and bracteoles showy, leaf-like, pinnatifid or 3-fid ..... 32  
 + Bracts and bracteoles absent or few, linear to linear-lanceolate ..... 35

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32. Bracts and/or bracteoles finely dissected and deeply pinnatifid; fruits oblong, distinctly constricted below the stylopodium, ridges prominent, unwinged  
**17. Schulzia**  
 + Bract, bracteole and fruit characters not as above ..... 33
33. Bracteoles not showy, green, membranous ..... **15. Keryamonia**  
 + Bracteoles showy, with conspicuous pale, white or coloured margin, sometimes stiff and papery ..... 34
34. Bracteoles herbaceous, often white-margined, falling; pedicels moderately long; umbellules not dense ..... **12. Pleurospermum**  
 + Bracteoles stiff and papery, not white-margined, persistent; pedicels short; umbellules densely crowded ..... **14. Pleurospermopsis**
35. Dwarf, acaulescent to short-stemmed perennials; leaves hispid on margin; main umbel subsessile on crown ..... **16. Chamaescidium**  
 + Annuals or perennials with distinct stem; leaves glabrous to variously pubescent but not hispid; main umbel not as above ..... 36
36. Leaves 2–5-pinnate; stems and undersides of leaves villous; fruits narrowly oblong, c 3–6 × longer than broad, obscurely ribbed ... **5. Chaerophyllum**  
 + Leaves variously dissected but not to 5-pinnate; stems and leaves usually essentially glabrous, but if hairy then not villous; fruits suborbicular to oblong-ovate, less than 3 × longer than broad, prominently to obscurely ribbed ..... 37
37. Plants often aromatic or foetid; ultimate leaf segments (of upper leaves at least) long linear-filiform, less than 1mm broad ..... 38  
 + Plants usually not strongly scented; ultimate leaf segments not long linear-filiform, more than 1mm broad ..... 40
38. Large glaucous perennials to 2m tall or more, anise-scented when crushed; flowers yellow; fruits oblong-ovoid ..... **29. Foeniculum**  
 + Smaller green annuals or short-lived perennials less than 60cm tall, not smelling of anise; flowers white to purplish; fruits globose to oblong-ellipsoid  
39
39. Annuals, foetid when crushed; pedicels subequal; fruits globose to ellipsoid  
**9. Coriandrum**  
 + Biennials or short-lived perennials; pedicels very unequal; fruits oblong-ellipsoid ..... **22. Carum**
40. Plants 10–45cm tall, often suffused purple; rays less than 5 per umbel; flowers less than 6 per umbel; fruits ovoid-ellipsoid, ribs narrowly winged  
**38. Lalldhwojia**

- + Plants of varying stature, usually green; rays and flowers more numerous (or plants less than 15cm tall); fruits subglobose to narrowly ovoid, obscure to weakly ribbed ..... 41
- 41. Leaves 4-pinnate, held on one plane; bracts and bracteoles present; calyx teeth lanceolate to obsolete ..... 42
- + Leaves ternate or pinnately divided, but not to 4-pinnate; bracts and bracteoles present or not; calyx teeth obsolete to minute ..... 43
- 42. Flowers yellow; calyx teeth lanceolate ..... **10. Meeboldia**
- + Flowers white; calyx teeth obsolete ..... **11. Vicatia**
- 43. Leaf segments ovate, oblong or lanceolate, 0.5–4cm broad . **24. Pimpinella**
- + Leaf segments lanceolate to linear-lanceolate, less than 0.5cm broad ... 44
- 44. High altitude plants with woody tap root; bracteoles more than 3, linear-subulate; petals with a long claw ..... **25. Tongoloa**
- + Mid to high altitude plants with tuber or tuberous rhizome; bracteoles absent to few, falling early; petals not long clawed ..... 45
- 45. Rhizome usually cylindrical, sometimes tuberous; leaves broadly sheathing; outer flowers radiant; petals obovate ..... **23. Sinocarum**
- + Plants usually with short tuber, sometimes rhizomatous, leaves narrowly sheathing at base; flowers regular; petals acute to acuminate with a filiform tip ..... **26. Acronema**
- 46. Flowers yellow ..... 47
- + Flowers white, greenish-white, pink, purplish to dark purple ..... 52
- 47. Leaf segments long and linear to linear-filiform, less than 1mm broad and more than 6mm long, aromatic ..... 48
- + Leaf segments not long and linear, more than 1mm broad, or less than 6mm long, usually not aromatic ..... 49
- 48. Large glaucous perennials to 2m tall or more, strongly anise-scented when crushed ..... **29. Foeniculum**
- + Annuals or short-lived perennials, to 75cm tall, not glaucous **37. Anethum**
- 49. Dwarf, almost stemless plants with a tough fibrous base; leaves pinnate (leaflets pinnatifid), narrowly oblong in outline; ovary densely covered with white hairs ..... **41. Semenovia**
- + Plants with erect stems, fibrous at base or not; leaves (1–)2–4-pinnate, triangular to ovate in outline; ovary glabrous or only sparsely hairy ... 50
- 50. Plants to 45cm tall; leaves mainly basal, finely 4-pinnate into linear-lanceolate ultimate segments less than 1mm broad ..... **10. Meeboldia**

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- + Plants more than 45cm tall; leaves 1–2-pinnate into ovate to lanceolate ultimate segments more than 3mm broad ..... 51
- 51. Plants erect to scrambling, more than 1m tall; stem glabrous, leafy throughout; main umbel more than 25-rayed (or plant scrambling) .. **36. Angelica**
- + Plants erect, 0.5–1m tall; stem moderately hairy; leaves few, 1–2 basal and 1–2 cauline; main umbel less than 25-rayed .... **39. Heracleum** (*H. woodii*)
- 52. Outer flowers of umbels zygomorphic with distinctly enlarged outer radiant petals ..... 53
- + All flowers with petals sub-equal ..... 58
- 53. Annuals, foetid when crushed; at least upper leaves with long linear-filiform ultimate segments less than 1mm broad ..... **9. Coriandrum**
- + Slender to robust perennials, not strongly smelling; leaf segments not long linear-filiform, usually more than 1mm broad ..... 54
- 54. Glabrous, slender-stemmed plants, usually less than 40cm tall ..... 55
- + Hairy (especially around nodes and below umbels), usually robust-stemmed plants, mainly more than 40cm tall ..... 56
- 55. Plants with cylindric or tuberous rhizome; bracteoles absent to few, shorter than pedicels, falling early; petals without a long claw ..... **23. Sinocarum**
- + Plants with woody tap root; bracteoles more than 3, linear-subulate, usually longer than pedicels, not falling early; petals with a long claw  
**25. Tongoloa**
- 56. Bracts and bracteoles numerous, large, lanceolate-ovate, persistent  
**40. Tordyliopsis**
- + Bracts absent or few, falling early; bracteoles linear ..... 57
- 57. Dwarf, almost stemless herbs, less than 15cm tall ..... **6. Chamaescidium**
- + Taller, long-stemmed herbs, more than 15cm tall ..... **39. Heracleum**
- 58. Petals ovate to lanceolate, apex long acuminate into fine radiating tips, rarely acute (*A. bellum*) ..... **26. Acronema**
- + Petals obovate to ovate, apex rounded or notched, sometimes with an abruptly acuminate inflexed tip ..... 59
- 59. Leaves ternate; umbels small, umbellules 3–4-flowered; calyx teeth long and subulate; ovary of hermaphrodite flowers covered in developing hooked bristles ..... **3. Sanicula**
- + Leaves mainly pinnately divided; umbelules more than 4-flowered; calyx teeth obsolete to minute, rarely subulate; ovary smooth or variously ornamented but not with hooked bristles ..... 60

60. Ultimate segments of leaves long and filiform ..... 61  
+ Ultimate segments of leaves ovate to lanceolate or linear, but not long and filiform ..... 63
61. Bracteoles absent or few; pedicels very unequal ..... **22. Carum**  
+ Bracteoles present, linear or 3-lobed; pedicels subequal ..... 62
62. Bracts and bracteoles 3-lobed at apex, semi-cartilaginous; calyx teeth subulate, conspicuous ..... **8. Cuminum**  
+ Bracts and bracteoles entire, membranous; calyx teeth obsolete  
**21. Trachyspermum**
63. Bracts and bracteoles showy, leaf-like, pinnatifid or 3-fid ..... 64  
+ Bracts and bracteoles absent or few, both linear to linear-lanceolate ... 73
64. Bracts finely pinnatifid ..... 65  
+ Bracts leaf-like or 3-fid ..... 68
65. Erect plants more than 50cm tall ..... **32. Selinum**  
+ Dwarf plants less than 40cm tall ..... 66
66. Slender-stemmed plants with broad sheathing leaves up the stem; stem base naked ..... **17. Schulzia**  
+ Mainly stemless rosette plants with moderately sheathing basal leaves only; stem base clothed with fibrous leaf remains ..... 67
67. Styles long more than 1.75mm in young fruit ..... **30. Cortiella**  
+ Styles short less than 1.5mm in young fruit ..... **35. Cortia**
68. Bracteoles with conspicuous pale, white or coloured margin, sometimes stiff and papery ..... 69  
+ Bracteoles not with conspicuously coloured margin, usually green and membranous ..... 70
69. Bracteoles herbaceous, often white-margined, falling; pedicels moderately long, umbellules not dense ..... **12. Pleurospermum**  
+ Bracteoles stiff and papery, not white-margined, persistent; pedicels short, umbellules densely crowded ..... **14. Pleurospermopsis**
70. Leaves finely 2–3 × pinnately divided ..... **15. Keraymonia**  
+ Leaves simply pinnate ..... 71
71. Plants fibrous at base; fruit 5-ribbed ..... **13. Physospermopsis**  
+ Plants with papery leaf remains at base; fruits 5- or 10-ribbed ..... 72



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- 72. Calyx teeth present; stylopodium domed, not flanged; fruits 5-ribbed  
**15. Keraymonia**
  - + Calyx teeth obsolete; stylopodium flat-domed with thick rim wider than ovary; fruits 10-ribbed ..... **18. Chamaesium**
- 73. Very robust perennials, usually more than 1.5m tall ..... **36. Angelica**
  - + Slender annuals to moderately large perennials mainly less than 1.5m . 74
- 74. Short, almost stemless dwarf plants; leaves 1-pinnate, oblong in outline  
**18. Chamaesium**
  - + Plants usually not stemless and dwarf; leaves more than 1 × pinnately or ternately decomposed, triangular to ovate in outline ..... 75
- 75. Plants entirely glabrous ..... 76
  - + Plants villous or hairy, at least on main veins of leaves and around nodes  
77
- 76. Leaves very finely dissected, ultimate segments less than 0.5mm broad; rays very unequal ..... **11. Vicatia**
  - + Leaves less finely dissected, ultimate segments more than 0.5mm broad; rays subequal ..... **25. Tongoloa**
- 77. Umbels small, less than 6-rayed ..... 78
  - + Umbels larger, more than 6-rayed ..... 80
- 78. Plants sparsely villous on stem and leaves; leaves 2–5-pinnate; leaflets deeply pinnatifid ..... **5. Chaerophyllum**
  - + Plants not villous; leaves ternately decomposed; leaflets not deeply pinnatifid ..... 79
- 79. Stems and leaves sparsely villous below; bracts present, falling early; bracteoles lanceolate; calyx teeth obsolete ..... **6. Osmorhiza**
  - + Stems and leaves essentially glabrous; bracts absent; bracteoles few, small, linear; calyx teeth minute, triangular ..... **38. Lalldhwojia**
- 80. Plants almost glabrous, weakly stemmed to scrambling, 1–2m tall  
**36. Angelica** (*A. sikkimensis*)
  - + Plants erect-stemmed, pubescent, at least around the nodes, rarely more than 1m tall and not scrambling ..... 81
- 81. Flowers dark purple ..... **31. Cnidium**
  - + Flowers white to tinged purplish ..... 82
- 82. Erect annuals with downwardly pilose stems; ovary covered in developing spines ..... **7. Torilis**
  - + Erect annuals or perennials; stems not downwardly pilose; ovary smooth or variously ornamented but without developing spines ..... 83

83. Leaves ternate to 1–3-pinnate; bracts few or absent ..... **24. Pimpinella**  
 + Leaves 3–4-pinnate, bracts present ..... 84
84. Stem hairs short around nodes; leaves glabrous above ..... **32. Selinum**  
 + Stem hairs longer around nodes; leaves pubescent above (or whole plant essentially glabrous) ..... **33. Ligusticum**

### 1. HYDROCOTYLE L.

Prostrate herbs; stems usually rooting at nodes. Leaves simple, suborbicular in outline, usually lobed and base deeply cordate; petioles not sheathing, but with small, broadly ovate, membranous stipules. Umbels small and densely clustered, simple; bracts and bracteoles absent or minute. Calyx teeth minute or obsolete. Petals entire, small. Stylopodium domed. Fruits orbicular, laterally compressed, glabrous, mericarps keeled on the back but lateral primary ribs weak.

1. Leaves up to 1.5cm across, glabrous on upper surface; umbels 2–3mm diameter ..... **3. H. sibthorpioides**  
 + Leaves more than 2cm across, usually pubescent on upper surface with thick hairs; umbels 4–15mm diameter ..... 2
2. Leaves round in outline; umbels always solitary; fruiting pedicels more than 2mm ..... **1. H. himalaica**  
 + Leaves somewhat angular in outline; umbels usually several in leaf axils; fruiting pedicels less than 2mm ..... **2. H. nepalensis**

**1. H. himalaica** Mukherjee; *H. javanica* Thunberg var. *podantha* Clarke non Molkenboer, *H. podantha* auct. non Molkenboer. Nep: *Ghora Tophay*. Fig. 48a–d.

Stems sparsely brown pubescent. Leaves orbicular in outline with 5–7 broad, shallow, very rounded lobes (0.8–)1.5–3(–6) × 1.2–8cm, margins crenate-dentate, sparsely strigose pubescent on both surfaces; petioles 1–18cm, densely pubescent near apex. Umbels solitary in leaf axils, to 13mm across in fruit; peduncles 1.5–10cm, usually as long or longer than the petioles of the subtending upper leaves; pedicels (2–)4–7mm in fruit. Petals narrowly triangular, greenish-cream, 1–1.3mm, slightly incurved at apex. Styles persistent, spreading in fruit, (0.6–)0.8–1mm long. Fruits c 1 × 1.5mm.

**Bhutan:** S – Chukka district (Chukka Bridge) and Deothang district (Keri Gompa), C – Mongar district (Tashigang to Mongar) N – Upper Kuru Chu district (Denchung); **Darjeeling:** Chunabate, Darjeeling, Kurseong, Mungpoo, Senchal; **Sikkim:** Bitu, Gangtok, Karponang, Labdah, Penlang La, Yoksam. Damp shady areas, banks in forests, streamsides, etc., 1500–2450m. April–September.

**2. *H. nepalensis*** Hook.f.; *H. hispida* D.Don, *H. polycephala* Wight & Arnott, *H. javanica* sensu F.B.I. p.p.

Similar to *H. himalaica* in habit, but differing in leaf shape, umbel form, most noticeably in fruit. Leaves angular in outline, lobes usually triangular, 2–9 × 2.8–11cm, strigose hairs rather longer than *H. himalaica* and thus appearing coarser. Umbels often in clusters of 2–9(–12) at nodes, seldom solitary, 4–7mm across in fruit; peduncles 0.5–4cm, shorter than the subtending petiole; pedicels 0.5–1.5(–2)mm in fruit. Styles spreading to erect in fruit, 0.3–0.5mm.

**Bhutan:** S – Chukka district (Chukka, Chukka Bridge), Deothang district (Samdrup Jongkhar) and Gaylegphug district (Aie Bridge, Gaylegphug–Shemgang), C – Punakha district (Lobesa–Lomentsawa, Shenganga) and Mongar district (Shongar); **Darjeeling:** Birch Hill, Ghum, Kali, Kalimpong, Lebong, Senchal, Takvar; **Sikkim:** Badamtan, Damthang–Temi, Gangtok, Hi, Pemayangtse–Thingling, Rimbi, Sirong. Damp shady areas, banks in forests, streamsides, etc., 500–2500m. May–July.

The above two species are very closely related and poorly understood. They, and the other members of the *H. javanica* complex, need further study on a worldwide scale.

**3. *H. sibthorpioides*** Lamarck; *H. rotundifolia* DC., *H. tenella* D.Don

Similar to *H. himalaica* and *H. nepalensis*, but much smaller, with slender, filiform stems; leaves with rounded lobes, 7–11 × 9–15mm, glabrous above, glabrous or sometimes pubescent beneath; petioles 1–6cm, filiform; stipules rather conspicuous; umbels 2–3mm across in fruit, usually sessile or on peduncles up to 2(–3)cm; pedicels 0–0.5mm; fruits c 1 × 1.2mm.

**Bhutan:** S – Samchi district (Daina Khola) and Gaylegphug district (Norbuling), C – Thimphu districts (Simtokha–Dochu La), Punakha district (Punakha dzong) and Tongsa district (Tongsa); **Darjeeling:** Birik, Char Churabhandar, Siliguri, Takdah (69). Damp shady areas, banks in forests, streamsides, etc., 300–2350m. March–May.

Plants with leaves pubescent below may be distinguished as forma *pilosa* Hara.

## 2. CENTELLA L.

Very similar to *Hydrocotyle* but umbels sheathed by small bracts, and mature mericarps with secondary ridges as prominent as primary ones.

FIG. 48. **Umbelliferae.** a–d, *Hydrocotyle himalaica*: a, habit (× ½); b, infructescence (× 2); c, fruit (× 8); d, flower with 2 petals and 2 stamens removed (× 12). e–f, *Centella asiatica*: e, habit (× 1); f, fruit (× 8). g–j, *Sanicula elata*: g, part of flowering shoot (× ⅔); h, lower leaf (× ⅔); i, flower with 2 calyx teeth, 2 petals and 2 stamens removed (× 12); j, fruit (× 8). k–l, *Chaerophyllum villosum*: k, leaf and inflorescence (× ⅔); l, fruit (× 3). m–o, *Osmorhiza aristata*: m, part of flowering shoot (× ⅔); n, fruit (× 2); o, flower with 2 petals and 1 stamen removed (× 6). Drawn by M. Bates.



1. **C. asiatica** (L.) Urban; *Hydrocotyle asiatica* L. Dz: *Tuni Manakuni*. Fig. 48e&f.

Leaves suborbicular or reniform, unlobed or very shallowly lobed, 1–3 × 1.5–5cm, margin crenate-dentate, base cordate, glabrous or sparsely pubescent on both surfaces; petiole 1–14cm. Umbels 1–12, clustered at nodes, each 2–4-flowered; peduncles usually short, up to 7(–30)mm; bracts 2–4, ovate, 2–3mm, membranous. Flowers pinkish to deep red. Mericarps ellipsoid c 3 × 1.75mm, strongly ridged and often much wrinkled at maturity, sessile.

**Bhutan:** S – Phuntsholing district (Phuntsholing, Sorchen to Kharbandi) and Gaylegphug district (above Aie Bridge), C – Punakha district (Chusom, Wangdu Phodrang) and Tongsa district (Pertimi); **Darjeeling:** Kalimpong, Rangbe Chhu, (Great) Rangit River, Torsa River; **Sikkim:** Gangtok (69) and unlocalised specimen. Common in shaded marshy ground, roadside ditches, etc. 400–1500m. March–April.

### 3. SANICULA L.

Erect perennial herbs. Leaves ternate, lateral segments often deeply divided almost to base and leaf appearing palmate; petioles narrowly sheathing at base. Flowering stems irregularly dichotomously branched (in Bhutanese species); umbels small, compound; bracts and bracteoles present; umbellules usually 3–4-flowered. Flowers hermaphrodite or outer ones in umbellule often male; young ovary covered with short hooked bristles (in Bhutanese species). Calyx teeth subulate. Petals minute. Stylopodium domed. Fruits ovoid-oblong, subterete, covered with hooked bristles (in Bhutanese species).

1. **S. elata** D.Don; *S. europaea* sensu F.B.I. non L. Fig. 48g–j.

Stems 12–100cm. Leaves deeply 3–5 × divided to base or almost so, lower ones 4–9 × 5–10(–13)cm, segments again often deeply divided, acute or acuminate, margins serrate with spinulose tipped teeth, glabrous; petioles 2–22cm; upper leaves smaller. Rays 0–10mm; bracts linear-lanceolate to ovate, c 1–5mm; flowers almost sessile. Calyx teeth c 1.5mm, persistent. Petals greenish-white, sometimes tinged purple-red, shorter than calyx teeth. Styles longer than calyx teeth. Fruits c 2 × 1.5mm, subterete, covered with hooked bristles.

**Bhutan:** S – Chukka district (Chukka Bridge, Marichong) and Deothang district (Wamrung (117)), C – Thimphu district (Dukye Dzong, Motithang, Pumo La to Pyemitangka), Tongsa district (Shamgang to Pertimi, Tongsa), Mongar district (Shongar, Zimgang), and Tashigang district (Chorten Kora), N – Upper Mo Chu district (Gasa Dzong), Upper Mangde Chu district (Mangde Chu) and Upper Kulong Chu district (Lao, Shingbe to Lao, Tobrang); **Darjeeling; Sikkim; Chumbi.** A very common plant of warm, broad-leaved forests, 900–3200m. April–August.

Literature records of the Chinese species *S. astantifolia* Kretschmer from Chumbi may be based on misidentifications. This plant is very similar to *S.*

*elata*, but the leaves are consistently tripartite and lateral segments less deeply lobed. Further good quality herbarium collections are required to verify these records.

#### 4. ERYNGIUM L.

Erect perennial herbs. Leaves and bracts spinous margined; leaves simple (in Bhutanese species). Inflorescence dichotomously branched and flowers densely crowded in simple umbels of oblong heads, sessile on a whorl of radiating bracts. Bracteoles about as long as flowers, lanceolate. Calyx teeth rigid, subulate. Petals ovate-oblong, inwardly curved at apex, about as long as calyx teeth. Stylopodium obsolete. Fruits obovoid, subterete, covered with minute rounded scales; ribs obsolete.

##### 1. *E. foetidum* L.

Stems 10–50cm, leafless, glabrous. Leaves all basal, almost rosetted, oblanceolate, 4–12 × 1.3–2cm, obtuse, margin regularly serrate, base attenuate, glabrous. Bracts oblong-elliptic, lower ones lobed or toothed, upper ones entire, 2.5–4 × 0.5–1.5cm, margins and veins pale, coriaceous. Flower heads 6–8 × 4–5mm; bracteoles 1.5–2mm. Calyx teeth c 1.5mm. Petals greenish-yellow. Fruits (mature?) c 1mm, covered with vesicles.

**Bhutan:** S – Phuntsholing district (Phuntsholing). In garden, apparently cultivated. 350m. June.

Used as a culinary flavouring. Native of Central America.

#### 5. CHAEROPHYLLUM L.

Annual or perennial herbs. Bhutanese species have leaves 2–5-pinnate and petioles broadly sheathing at base. Umbels compound; bracts absent; bracteoles present. Flowers hermaphrodite or male. Calyx teeth obsolete. Petals obovate, entire or bilobed. Stylopodium conical. Fruits narrowly oblong, tapering upward, slightly laterally compressed, subterete; vittae usually conspicuous.

##### 1. *C. villosum* DC. Fig. 48k&l.

Flaccid branched annual, 30–100cm or more tall; stems sparsely villous with spreading or reflexed hairs, often spotted. Leaves basal and cauline, blade triangular in outline, attenuate at apex, 2–5-pinnate, up to 35 × 30cm (including petiole), villous beneath; ultimate segments ovate, deeply pinnatifid, up to 12 × 8mm; terminal segment attenuate at apex. Umbels leaf opposed on peduncles 2–7cm long, 2–5-rayed; rays 0.8–4cm; umbellules 5–6mm across, often few-flowered, some male; bracteoles few, 3–5 × 0.5mm, becoming reflexed; pedicels unequal, 0–5mm. Petals white flushed pink, elliptic, entire, 0.8–1mm. Styles minute. Fruits (1–)3–7(–10) per umbellule, 5–8 × 1–2mm, primary ridges pale, glabrous.

**Bhutan:** S – Chukka district (Chima Kothi to Bunakha) and Deothang district (Wamrung (117)), C – Thimphu district (Dochu La, Dodena) and Bumthang district (Bumthang), N – Upper Kulong Chu district (Lao); **Darjeeling:** Darjeeling; **Sikkim:** Chunthang, Lachen, Lachung, Tsoka, Zemu Valley; **Chumbi:** Chumbi. Moist banks in shady forest, rough grassland, 1830–3200m. May–July.

Literature records of the superficially similar *C. reflexum* Lindley from Sikkim and Bhutan refer to this species. *C. reflexum* is a West Himalayan plant which differs in its bilobed petals and long fruiting styles.

## 6. OSMORHIZA Rafinesque

Erect perennial or biennial herbs. Leaves ternately 2-pinnate. Umbels compound; bracts present or absent; bracteoles usually present. Flowers hermaphrodite or male. Calyx teeth obsolete. Petals entire. Styles slender, spreading, stylopodium conical. Fruits elongate club-shaped, terete, bristly.

1. ***O. aristata*** (Thunberg) Makino & Yabe; *O. claytonii* Clarke sensu F.B.I. Fig. 48m–o.

Stems 30–90cm, sparsely villous. Basal and cauline leaves triangular-ovate in outline, up to 28 × 24cm (including petiole), occasionally conspicuously smaller, sparsely pilose beneath; ultimate segments ovate, entire or deeply ternately divided, (0.2–)2–6(–9) × (0.2–)1–6(–9)cm, apex attenuate. Peduncles 9–20cm; umbels 2–6-rayed, 2–3cm across in flower; rays 1–2cm long in flower, extending to 3.5–10cm in fruit, widely diverging; bracteoles narrowly lanceolate, 0.5–1.5cm, spreading to deflexed; pedicels 0.5–1cm in flower; umbellules with 1–6 hermaphrodite flowers whose pedicels elongate to 1–3cm in fruit, male flowers appear clustered at base of infructescence as their short filiform pedicels do not extend. Petals white or cream, c 1mm. Styles 1–1.5mm. Fruits blackish at maturity, 15–20 × 1.5–2mm, long attenuate into the pedicel, sparsely covered with upward pointing bristles, densest at base.

**Bhutan:** C – Thimphu district (Drugye Dzong, Motithang and Tsalimaphe) and Tongsa district (Chendebi). Damp banks in shaded woodland, 2300–3050m. May–June.

The above plant with less dissected leaves has been referred to as var. ***laxa*** (Royle) Constance & Shan.

## 7. TORILIS Adanson

Hairy annual herbs, stems erect or decumbent, downwardly pilose. Leaves 1–3-pinnate or -pinnatisect, ultimate segments ovate-lanceolate, acute. Umbels compound; bracts and bracteoles linear. Flowers hermaphrodite, or inner ones sometimes male. Calyx teeth minute. Petals obovate with an acute incurved apex, slightly irregular, scarcely radiant. Stylopodium broadly conical; styles



short, spreading. Fruits ovoid, subterete, primary and secondary ribs obscured by spines or bristles.

**1. *T. japonica*** (Houttuyn) DC.; *Caucalis anthriscus* (L.) Hudson

Stems 20–100cm, much branched, appressed hispid with downward pointing hairs. Leaves triangular in outline, up to 18 × 16cm, pinnae 2–4 pairs; pinnules pinnatisect, 1–1.5cm; ultimate segments 4–6 × 2–3mm, often deeply pinnatisect into oblong lobes, appressed pilose on both surfaces. Peduncles (2–)5–17.5cm; umbels 6–12-rayed, 2–3cm across; rays 1–2cm long; pedicels 2–3mm; bracts and bracteoles 3–8mm; all appressed hispid with upward pointing hairs. Petals white or pale pink, c 2mm. Fruits often blackish-purple when mature, 2–5 × 1–2.5mm, covered with upwardly hooked bristles.

**Bhutan:** C – Ha district (Ha), Thimphu district (Raidak Valley, Taba, Thimphu), Bumthang district (Shabejetang) and Mongar district (Mongar); **Sikkim:** Hi; **Chumbi:** Bakcham, Chumbi. Common weed around houses, field margins, meadows, roadsides and wasteground, etc., 1200–3050m. July–August.

*T. leptophylla* (L.) Reichenbach

Similar to *T. japonica* but peduncles 2–5cm; rays 3–4, 0.7–1.5cm; spines on mericarps spreading, 1.5–2mm, minutely scabrid and subglochidiate.

A well-known species occurring in Pakistan and NW India, but only reported further east (to Sikkim) in a vague literature citation (267).

*T. nodosa* (L.) Gaertner

Similar to *T. japonica* but usually prostrate; umbels sessile or peduncles c 5mm (rarely up to 2.5cm), leaf-opposed; outer or outward facing mericarps covered with spreading spines 1.5–2mm, inner mericarps tuberculate.

A common European species occasionally introduced into Asia (Japan), only reported from Sikkim in a vague literature citation (267).

## 8. CUMINUM L.

Slender annuals, glabrous excepting the fruit. Leaves 2–3-pinnatisect; ultimate segments filiform; petiole bases with narrow membranous wings. Umbels compound; bracts and bracteoles 3-lobed at apex, segments similar to leaves but more cartilaginous and stiff. Calyx teeth unequal, subulate, persistent in fruit. Petals oblong, emarginate, subequal. Stylopodium conical, attenuate into short styles. Fruits ellipsoid, subterete, finely pubescent, distinctly 5-ribbed.

**1. *C. cyminum*** L. Eng: *Cumin*.

Stems erect, 15–30cm tall. Leaves 4–6cm long; ultimate segments 3–6 × 0.05cm. Umbels 3–6 rayed, c 2cm across; bracts c 2cm long; rays conspicuously unequal; umbellules c 6-flowered; bracteoles subulate, 7–10mm long. Calyx

teeth to 2mm. Petals white or pink, c 1mm. Fruits ellipsoid, c 6 × 2mm, sparsely pubescent; ribs pale.

**Bhutan:** S – Phuntsholing district (Torsa River). On damp shingle, 200m. February.

## 9. CORIANDRUM L.

Glabrous foetid annual herbs. Mature leaves very finely divided, 2–3-pinnatisect; juvenile leaves smaller and more broadly lobed. Umbels compound; bracts and bracteoles few or sometimes absent, linear. Calyx teeth often unequal, persistent in fruit. Petals obovate, unequal in outer flowers of the umbellule, with larger petals on the outside. Stylopodium conical. Fruits globose to ellipsoid; dorsal ribs somewhat prominent, lateral ones obscure.

1. **C. sativum** L. Eng: *Coriander*; Med: *U-su*; Hindi: *Daniya*.

Stems erect, 18–60cm tall. Lower leaves entire to ternate to pinnately lobed, 2.5–5 × 0.8–2cm; lobes oblong, up to 10–15 × 2–6mm; upper leaves pinnatisect into fine linear segments, 4–5 × 4–5cm, ultimate segments up to 15 × 1mm. Umbels 3–5-rayed, 2.5–5cm across in flower; bracts 1, c 7 × 0.4cm; rays 0.8–2.5cm; bracteoles 1–4, c 3 × 0.4mm; pedicels short. Outer flowers with calyx teeth oblong up to 1mm, and petals white or pinkish up to 4mm, deeply bilobed; inner flowers often male, with calyx teeth reduced to minute points, and petals c 1mm. Styles filiform, erect to spreading, c 2mm long. Fruits c 5 × 4mm.

**Bhutan:** S – Phuntsholing district (Phuntsholing), C – Tongsa district (Tongsa). Gardens and wasteground, 200–2350m. February–May.

Cultivated as a culinary herb (leaves) and spice (fruit), and sometimes naturalised.

## 10. MEEBOLDIA Wolff

Short-lived, almost glabrous, slender perennials; stems erect, terete. Leaves mainly basal, 4-pinnate, held on one plane; ultimate segments dark green, linear-lanceolate, acute; stem leaves similar but much smaller; petiole with narrowly sheathing base. Umbels compound; bracts and bracteoles present, lanceolate to linear-lanceolate. Calyx teeth lanceolate, acute. Petals yellow (in Bhutanese species), obovate, emarginate to rounded, apex somewhat incurved. Stylopodium broadly conical, abruptly merging into the spreading, curved styles. Fruits oblong-ovoid, subterete, slightly compressed laterally, rounded at base, attenuate towards stylopodium, glabrous; rib very narrow, scarcely prominent; mericarps grooved along inner (commissural) surface, vittae 3–4 between the ribs, 4 on the inner surface.

Sometimes misidentified as *Vicatia* species, which are readily distinguished by their obsolete calyx teeth.

1. *M. digitata* (Kljuykov) Watson; *Sinodielsia digitata* Kljuykov. Fig. 49a-d.

Plant 8–45cm tall. Basal leaves 9–11(–23) × 4–7(–9)cm (including petiole); ultimate segments (1.5–)2–6 × 0.3–0.4(–0.5)mm; petiole 2–6cm, sheathing base 3–5mm wide. Umbels 5–6(–7)-rayed, ray and pedicels sometimes minutely papillose puberulent; rays 1.2–4.6cm; bracts and bracteoles 2.5–5mm; pedicels 1–1.5mm in flower, elongating to 4mm in fruit. Calyx teeth unequal, the longest about equalling the stylopodium, 0.5–1mm. Petals yellow, c 1mm. Fruits 2.5–3 × 1.5–2mm.

**Bhutan:** S – Deothang district (Keri Gompa), C – Thimphu district (Chutang, Guljekha, Paga, Thimphu). Open areas in scrubland, dry turf, rocky ground, open coniferous forest, etc., 2000–2600m. July–September.

*M. digitata* is endemic to Bhutan (281). The white-flowered Nepalese species, *M. achilleifolia* (DC.) Mukherjee & Constance, has been recorded in the literature for Bhutan, but no voucher specimens have been found. Apart from flower colour, this species also differs from *M. digitata* in its 7–16-rayed umbels, and coarser leaves.

## 11. VICATIA DC.

East Himalayan representatives very similar in appearance to *Meeboldia* species, but flowers white and calyx teeth obsolete. Essentially glabrous, erect single-stemmed perennials. Leaves mid-green, triangular in outline, 3(–4)-pinnate; petiole narrowly sheathing at base. Umbels compound; bracts few or absent; bracteoles few, linear. Petals obovate. Stylopodium low, conical; styles short. Fruits ovoid-oblong, ribs very slender; vittae usually 2–4 per furrow and 4–6 on inner face.

1. *V. conifolia* DC.; *V. millefolia* Clarke

Plants to 30cm tall from a short rootstock. Leaves to 20 × 7cm, pinnatifid into linear acute ultimate segments 1.5–3 × 0.3–0.5mm. Umbels 7–10-rayed, 4–7cm across; bracts 1–2, similar to the upper leaves; rays 0.8–5cm, very unequal; bracteoles 1–4, to 5mm; umbellules 1–1.5cm across, 6–9-flowered; pedicels 1–4mm, elongating to 8mm in fruit. Fruits 3.5–4 × 1.5–1.7mm.

**Bhutan:** C – Thimphu district (Barshong). Shaded areas, streamside, moist to wet habitats, 3200m. July–August.

Many collections from Bhutan named as this species belong to *Meeboldia digitata* (282).

## 12. PLEUROSPERMUM Hoffmann

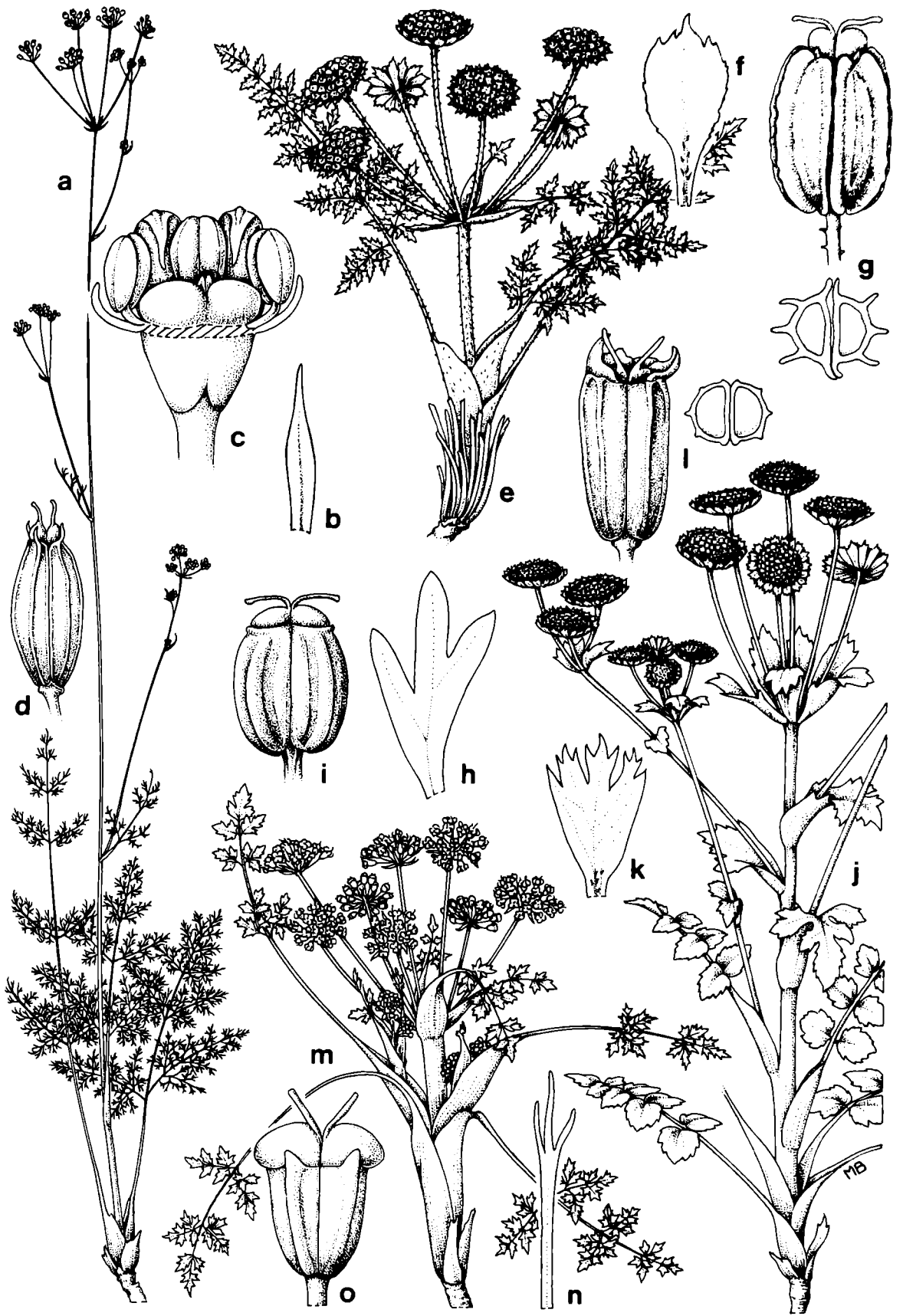
Perennials or biennials, mostly glabrous, sometimes pubescent. Stems erect, terete, sometimes surrounded by fibrous leaf remains at base. Leaves ternately, biternately, pinnately or 2–4-pinnately dissected, rather oblong in outline; ultimate pinnules variously shaped. Umbels compound; rays several or numerous;

144. UMBELLIFERAE

bracts usually present, sometimes deciduous, often with a membranous white margin; bracteoles present, broad and often showy, usually with a white margin, deciduous. Flowers hermaphrodite. Calyx teeth small or obsolete. Petals white or dark purple, obovate to ovate, almost equal. Stylopodium rounded or broadly conical. Fruits oblong, terete or dorsally subcompressed; mericarps 5-ribbed, narrowly winged.

1. Large robust plants, usually more than 70cm tall and stems more than 1.5cm thick at base ..... 2
- + Smaller plants less than 70cm, but taller specimens (*P. dentatum*) with stems less than 1.5cm thick at base ..... 3
2. Margin of pinnules serrate-dentate; styles short, up to 0.4mm  
**1. *P. angelicoides***
- + Margin of pinnules lacerate, deeply pinnatisect; styles longer, c 1.25mm  
**2. *P. benthamii***
3. Unbranched fleshy herb with solitary, erect stems 1–2cm broad at base; petiole wings greatly expanded to 4 × 6cm in upper leaves and enveloping the inflorescence ..... **3. *P. amabile***
- + Stems not fleshy, usually branched above, less than 1cm broad at base; petioles variously winged but not as above ..... 4
4. Stems, petioles and leaf rachis conspicuously white pubescent  
**4. *P. pilosum***
- + Plants glabrous or nearly so; umbels and/or leaf bases sometimes minutely puberulent ..... 5
5. Calyx teeth present, more than 0.5mm, sometimes deciduous in fruit .... 6
- + Calyx teeth obsolete ..... 7
6. Bracteoles more than 5mm wide, obovate with acuminate tip, silver-white with a green midrib, margin irregularly serrate; calyx teeth less than 1mm long, linear-lanceolate ..... **5. *P. album***
- + Bracteoles less than 5mm wide, lanceolate-oblong, green with a narrow pale edge, margin usually distinctly papillate; calyx teeth unequal, longest more than 1mm long, ovate-linear ..... **6. *P. hookeri***

FIG. 49. Umbelliferae. a–d, *Meeboldia digitata*: a, habit (× ½); b, bracteole (× 8); c, flower with 2 petals and 1 stamen removed (× 18); d, fruit (× 8). e–g, *Pleurospermum pilosum*: e, habit (× ½); f, bracteole (× 3); g, fruit and cross-section (× 6). h–i, *Physospermopsis kingdonwardii*: h, bracteole (× 3); i, fruit (× 8). j–l, *Pleurospermopsis sikkimensis*: j, habit (× ⅓); k, bracteole (× 1½); l, fruit and cross-section (× 6). m–o, *Keraymonia cortiiiformis*: m, habit (× ⅔); n, bracteole (× 6); o, fruit (× 8). Drawn by M. Bates.



7. Plants more than 50cm tall; bracteoles with a broad silver-white margin and dark purple-green midrib ..... 7. **P. dentatum**  
 + Plants usually less than 30cm; bracteoles pale green, often tinged purple, but without a conspicuously darkened midrib ..... 8. **P. apiolens**

**1. P. angelicoides** (DC.) Clarke; *Pterocyclus angelicoides* (DC.) Klotzsch.

Nearly glabrous, robust, erect-stemmed perennial to 1.2m or more; stems reddened, stout, 1.5–2cm broad, base clothed in the fibrous remains of petioles. Leaves biternately divided, up to 50 × 30cm (including petiole); primary divisions 2–3 pairs, up to 20cm long; ultimate pinnules ovate to obovate, 2.5–8 × 2–5cm, usually simple or shallowly 2–3-lobed, acute or rounded, margin serrate-dentate, sparsely pubescent beneath; petiole bases greatly expanded into rounded auricles, 4–9 × 4–5cm, clasping the stem. Umbels 4–15cm across, many-flowered, to 20- or more-rayed; bracts green or whitish, lanceolate, 30–40 × 3–7.5mm, deciduous; rays 1.5–6cm in flower, extending to 8–15cm and becoming erect in young fruit; bracteoles lanceolate, 10–20 × 2–5mm, white, deciduous; pedicels 2–9mm in flower, 12–18mm in fruit. Calyx teeth absent. Petals purple-pink, obovate, c 2.5 × 1.75mm. Styles short, 0.3–0.4mm, horizontally spreading in fruit. Fruits 8–12 × 3.5–4mm; mericarps slightly compressed, wings c 0.5mm broad.

**Bhutan:** C – Thimphu district (Barshong), N – Upper Pho Chu district (Gyophu La) and Upper Mangde Chu district (Saga La). Alpine meadows and grassy valleys, 3350–4250m. July–August.

**2. P. benthamii** (DC.) Clarke; *P. davidii* Franchet, *Hymenolaena benthamii* DC.

Very robust, nearly glabrous perennial to 1.5m tall or more; stems often tinged red. Leaves to 60 × 19cm (including petiole), pinnate, pinnules lacerate, deeply pinnatisect, ultimate segments deeply serrate, acuminate; petiole bases winged but not greatly so. Umbels aggregated at tips of branches into dense flowering heads, 10–25-rayed, 3–15cm across in flower; bracts persistent, similar to pinnules of leaves, lacerate-pinnatisect, 1.2–6 × 0.6–3.5cm, margin usually with a yellow-white margin; rays c 2cm long in flower, 5–15cm in fruit; bracteoles ovate-lanceolate, 0.4–3 × 0.3–1cm, serrate, distinctly white-margined; pedicels 3–15mm in flower, 8–35mm in fruit. Calyx teeth absent. Petals usually pink with a pale margin, or white, ovate acuminate, 2.5–3 × 1.25mm. Styles 1.25mm, diverging in fruit. Fruits ovoid-ellipsoid 6–8 × 2.5–4mm; mericarps rounded on the back, ribs scarcely winged (in Bhutanese specimen).

**Bhutan:** C – Thimphu district (Pajoding), Punakha district (Dungshinggang) and Bumthang district (Kitiphu), N – Upper Mangde Chu district (Goktang La), Upper Bumthang Chu district (Pangotang) and Upper Kulong Chu district (Me La); **Sikkim:** Chakung Chu, Changa, Chola Range, Dik Chhu, Zongri. Open hillsides, riversides and amongst shrubs, 3400–4300m. June–August.

**3. *P. amabile*** Craib & W.W.Smith. Med: *Tsed, Rtsad, Tsey*.

Erect single-stemmed plants, 15–50cm tall; stems unbranched, often reddened at base, stout, 1–2cm broad, aromatic when crushed. Leaves 3–4 × pinnately divided, up to 10cm long, including the distinctively winged petiole (lamina of upper leaves shorter than their greatly winged petioles); ultimate segments ovate, c 10 × 7mm, pinnatisect into linear segments 0.5–1mm broad; petioles wings whitish with purple veins, 2.5–4 × 2–6cm. Solitary terminal umbel 5–12cm across, c 25-rayed; rays 3–4cm long, stout, c 1.5mm thick; bracts similar to enlarged petioles of upper leaves, tightly enclosing umbel; umbellules c 1.5cm across; bracteoles silvery-white with dark purple midrib, obovate, 6–10 × 3–5mm, abruptly acuminate and toothed above; pedicels c 4mm. Calyx teeth absent. Petals dark purple, c 1.5mm. Stylopodium purple-black; style yellow-green, 0.75mm. Fruits small, oblong, 3–4 × 1.5mm, mericarps ridged but scarcely winged.

**Bhutan:** C – Thimphu district (Dungtshola, Somana, Wasa La), Tongsa district (Pele La) and Bumthang district (Towli Phu), N – Upper Mo Chu district (Chhew La, Yak La), Upper Pho Chu district (Gyophu La), Upper Bumthang Chu district (Marlung, Tolegong) and Upper Kulong Chu district (Shingbe); **Chumbi:** Chulong. Screes and exposed alpine turf, 3950–4700m. July–September.

This rather rare, but striking high-altitude plant is endemic to Bhutan and Tibet (south of Lhasa into the Chumbi Valley and across towards the border with NW Yunnan).

**4. *P. pilosum*** Wolff. Med: *Tangkuen*. Fig. 49e–g.

Slightly aromatic, thick tap-rooted perennial 8–30cm tall; stem, petiole, leaf rachis, rays and, to a lesser extent, pedicels conspicuously whitish pubescent; stems purplish, leaf remains often clothing the base. Leaves 2–3 × pinnately divided, to 10–25(–50) × 4–5(–12)cm (including petiole); primary divisions 4–6 pairs, 1–3.5cm long; ultimate segments ovate, 3–8 × 2–7mm, pinnatisect, whitish pubescent on veins, especially beneath; petioles winged at base to 6mm wide, wings purplish. Umbels 3–10(–16)cm across, 6–17-rayed; rays 1.2–7(–9)cm long in flower, little elongating in fruit; bracts 1–3, lanceolate, tips sometimes leafy, 1–3cm long, deciduous; umbellules 1.5–2cm across, 20–30-flowered; bracteoles purplish-green (sometimes pale margined), widely obovate, 6–10 × 4–5mm, abruptly acuminate to a short point, denticulate in upper half, pubescent on midrib, persistent; pedicels 2–5mm. Calyx teeth absent. Petals white within, purple-red or greenish on the reverse, c 2 × 1.2mm. Styles short, c 1mm, horizontal in fruit. Fruits oblong 3–6 × 1.5–2mm, mericarps tinged purple, with narrowly winged ridges.

**Bhutan:** C – Ha district (Chile La), Thimphu district (Somana) and Tongsa district (Padima Tso), N – Upper Mo Chu district (Jari La, Laya, Lingshi Dzong, Nelli La, Zambuthang); **Sikkim:** Kupup, Thungkarphumoo; **Chumbi:** Gautsa to Phari. Rough alpine pasture, rocky turf slopes, 4000–4500m. July–October.

**5. *P. album* Wolff**

Aromatic perennial 16–70cm tall, nearly glabrous, except for a minute pubescence at base of petioles, rays and veins of bracts, rays sometimes sparsely papillose pubescent; stems 0.5–0.75cm thick at base; tap-root stout, vertical. Leaves finely 3–4 × pinnately divided, lower ones up to 25cm long (including petiole), ultimate pinnules ovate c 6 × 4mm sharply pinnatifid into fine segments; petiole bases of lower leaves narrowly winged, those of upper leaves with widening wings up to 3cm broad, apex becoming more auriculate, and a pronounced white margin. Umbels 3.5–13cm across, 8–10-rayed; rays 1–5cm in flower, extending a little to 7cm in fruit; bracts 5–6, obovate, 2–3.5 × 0.8–1.5cm, shortly leafy at apex, margins broad, silvery-white; umbellules 1.5–2cm diameter; pedicels 5–8mm; bracteoles silvery-white with a green midrib, obovate, c 10 × 5–7mm, apex rounded-truncate to obcordate, acuminate to a point or sometimes trifid, margins irregularly serrulate. Calyx teeth linear-lanceolate, 0.5–0.75mm. Petals white or greenish-white, obovate, c 1 × 0.5mm. Styles 0.75mm, divergent. Mature fruit not known.

**Bhutan:** C – Thimphu district (Phajoding, Thimphu); **Sikkim:** Boktak, Zongri, Kupup, Prek Chu, Thangshing.; **Chumbi:** Buetang, Chomolhari, Pongling, Tokoo La, Zepla. Amongst boulders by streamsides, open wet grassland, 3950–4900m. July–September.

**6. *P. hookeri* Clarke; *Aulacospermum hookeri* (Clarke) Farille & Malla, *Pleurospermum wolffianum* Fedde, *P. pumilum* (DC.) Clarke. Med: *Tong-kun-nag-po*.**

Slender-stemmed perennial, almost glabrous apart from sparsely pubescent or papillose umbels; stems 5–50cm tall, stature much affected by the environment; tap-root rather slender. Leaves mostly basal, finely 2–3 × pinnately divided, 8–15(–30) × 2–5cm long (including petiole); ultimate segments ovate, c 5 × 4mm, margin pinnatisect; petiole bases with narrow wings, wings pale green or tinged purple, to 7mm, more prominent in upper stem leaves. Umbels 4–9cm across, 4–10-rayed; rays 1.5–7cm in flower, little elongated in fruit; bracts 1–5, ovate-lanceolate, 1–2(–3)cm, sometimes leafy at apex; umbellules c 1.5cm across; bracteoles green with pale edges, lanceolate to oblanceolate-obovate, 6–15 × 1.5–4mm, distinctly longer than flowers, acuminate, margin usually minutely papillose; pedicels 2–6mm. Calyx teeth unequal, ovate to lanceolate, c 2mm long, becoming reflexed, deciduous. Styles green, c 1mm long. Fruits 3–4 × 1.5mm, mericarps ridged but scarcely winged.

**Bhutan:** C – Thimphu district (Shodung to Barshong, Thimphu), Punakha district (Dungshelath, Dungshingong) and Bumthang district (Dhur Chu), N – Upper Mo Chu district (Yale La) and Upper Mangde Chu district (Upper Mangde Chu); **Sikkim:** Zongri, Gochung, Goecha La, Chiya Bhanjang, Lachung, Lambi, Tangkar La, Yume Samdong; **Chumbi:** Kalaeree, Sakkurgong. Common in open moist areas, stream beds, etc., 3650–4900m. May–October.



**7. *P. dentatum* (DC.) Clarke**

Nearly glabrous, erect perennial 60–100cm tall, bases of petioles and ends of rays and pedicels with dense short strigose pubescence; stems slender, up to 1cm broad at base. Leaves biternately or pinnately divided, to 30cm long or more (including petiole), primary divisions in 4–5 pairs; petiole with narrow wing at base, wings to  $6 \times 1.5$ cm, in upper leaves, extending to the first pair of pinnae; ultimate pinnules ovate in outline,  $1.2\text{--}4(-9) \times 1.5\text{--}3(-8.5)$ cm, acute or acuminate, margins serrate or somewhat pinnatifid. Umbels 3–8cm across in flower, 10–20-rayed; rays 1.2–4cm in flower, becoming erect but elongating little in fruit; bracts 3–7, broadly white-margined with dark midrib extending to acuminate tip, lanceolate-elliptic,  $1.5\text{--}2.5 \times 0.4\text{--}0.7$ cm, deciduous; umbellules c 1.5cm diameter; pedicels 3–4mm; bracteoles similar to bracts, as long as flowers,  $9\text{--}15 \times 3\text{--}5$ mm, margin sometimes serrulate at apex, persistent. Calyx teeth absent. Petals white, elliptic-obovate, c  $1.4 \times 1$ mm, with incurved acuminate tip. Styles 0.9–1.7mm, spreading in fruit. Fruits oblong-ellipsoid,  $7\text{--}8 \times 2\text{--}3$ mm, dorsally compressed, ridges narrowly winged.

**Bhutan:** C – Ha district (Bangri) and Thimphu district (Cheka, Dingtsho La to Phajoding); **Darjeeling:** Singalila; **Sikkim:** Zongri, Kaukola, Namgaythang and Yumthang; **Chumbi:** Natu La to Chubitang, Trakarpo. Moist open moorland slopes, disturbed rocky areas, 3050–4300m. August–September.

**8. *P. apiolens* Clarke; *P. apiolens* var. *nipaulensis* Farille & Malla. Med: Tangkuen.**

Nearly glabrous erect perennial 15–30(–50)cm tall, only ends of rays and pedicels with a dense short papillose pubescence; stems aromatic, smelling of celery or parsley when crushed; base of stems often clothed with leaf remains. Leaves mostly basal, pinnate,  $7\text{--}25(-40) \times 2\text{--}4(-11)$ cm (including petiole); pinnae 4–5 pairs, ovate in outline,  $1.5\text{--}4 \times 1.5\text{--}4$ cm, coarsely serrate and often ternately lobed; petioles narrowly winged at base, wing often purplish, to  $4 \times 1$ cm, upper leaves winged to first pair of pinnae. Umbels 3–9cm across in flower, 5–12-rayed; rays 1.5–4cm, scarcely elongated in fruit; bracts 4–5, lanceolate,  $1.5\text{--}2.5 \times 0.5\text{--}0.7$ cm, deciduous; umbellules c 15-flowered; bracteoles whitish-green, often tinged purple, midrib not darkened, widely obovate,  $9\text{--}12 \times 4\text{--}5.5$ mm, apex rounded-truncate (sometimes obcordate), abruptly acuminate to a short fine point, persistent; pedicels 2–4mm. Calyx teeth absent. Petals as in *P. dentatum*. Styles short, 0.2–0.5mm. Fruits ovoid,  $3.5\text{--}5 \times 2\text{--}3$ mm, mericarps dorsally compressed, narrowly winged.

**Bhutan:** C – Thimphu district (Pajoding, Talukah); N – Upper Mo Chu district (Laya, Timuzam) and Upper Bumthang Chu district (Tolegang); **Sikkim:** Bikbari to Chaunrikhiang, Boktak, Cheungsanthang, Chomnagu, Zongri, Lachung, Phalut, Pheonp, Tanglu, Tsomgo, Yak La, Yumthang. Amongst shrubs on moraine, scree, alpine turf, forest clearings, etc., 3350–4900m. August–September.

## 13. PHYSOSPERMOPSIS Wolff

Dwarf or medium-sized, glabrous perennials, usually with fibrous leaf remains at base. Leaves pinnate, leaflets serrate, pinnatifid or pinnatisect; petiole slightly winged and sheathing at base. Umbels compound, rays unequal; bracts leaf-like; umbellules small; bracteoles serrate, often 3-lobed. Calyx teeth minute or absent. Petals, white, greenish or purple, obovate, somewhat unequal, inflexed at apex, attenuate at base. Stylopodium thickly conical or flattened. Fruits ovoid-globose, slightly laterally compressed, glabrous, immature mericarps a characteristic verde-gris (emerald green) colour turning dark purple on maturity; young fruits prominently 5-ribbed, not winged.

A complex genus, with morphology apparently greatly affected by environmental conditions. Discontinuities in the observed variation in stature, leaf, bract and bracteole shape across the geographic range are difficult to determine. Field notes and literature records have suggested that this may be accounted for by phenotypic plasticity. Further experimental work on living plants is needed to elucidate the true picture, as herbarium material is so often inadequate.

1. Plants mainly more than 15cm tall; immature fruits obovate becoming ovoid, stylopodium conically domed ..... **1. P. obtusiuscula**
- + Plants mainly less than 15cm tall; fruits somewhat rectangular, stylopodium flattened ..... **2. P. kingdon-wardii**

**1. P. obtusiuscula** (DC.) Norman; *Trachydium hirsutum* Clarke, *T. obtusiusculum* (DC.) Clarke, *T. obtusiusculum* (DC.) Clarke var. *strictum* Clarke, *Physospermopsis farillei* Mukherjee & Constance, *P. hirsutula* (Clarke) Farille

Plants (6-)15-40(-60)cm tall, sometimes tinged red. Leaves 6-20 × 2-4cm (including petiole), mainly basal; pinnae in 2-4 pairs, ovate to elliptic in outline, 6-25 × 4-18(-24)mm, deeply ternately lobed to pinnatifid, ultimate segments lanceolate, apices acute, margins serrate and minutely denticulate; petioles 3.5-10cm. Flowering stems of greatly varying length, usually sparsely leafy, bearing a solitary terminal umbel and sometimes a few smaller laterals. Umbels 7-18cm across, 8-14-rayed; rays 2-13(-18)cm long, becoming more erect in fruit; bracts leaf-like, broadly oblanceolate in outline, 2-4 × 1-1.25cm, base winged (margin sometimes pale), blade pinnate to pinnatifid, midribs conspicuous, usually covered with minute flattened papillae; umbellules 1.2-3cm across, (8-)18-30-flowered; pedicels 3-7mm; bracteoles lanceolate to elliptic in outline, 6-20 × 1.5-6mm, simple or acutely 3-lobed (middle lobe sometimes coarsely 3-toothed), segments usually quite broad but occasionally narrow. Petals white, dark greenish or purple, obovate, c 2mm. Stylopodium conically-domed, more than half as tall as broad, base often forming a thickened ring with the top of the fruit. Fruits ovoid, often constricted in the upper half when young, 2.5-3 × 1.2mm.

**Bhutan:** C - Thimphu district (Bimelang Tso, Darkey Pang Tso, Gyida, Saga

La, Simtokha, Talukah), N – Upper Mo Chu district (Tharizam Chu); **Sikkim:** Cho La, Zongri, Kangling, Lachung, Thanggu, Yume Samdong; **Chumbi:** Yak La. Exposed upland and alpine turf, woodland margins, open rocky areas, 3000–4300m. July–August.

Some plants collected in Nepal (including the lectotype) and Sikkim are very long-stemmed and have larger leaves and bracts. They appear to intergrade continuously with the plants to the east. Stature appears to be variable according to environmental conditions, exposure, light availability, grazing pressure, etc.

**2. *P. kingdon-wardii*** (Wolff) Norman; *Trachydium kingdon-wardii* Wolff, *Physospermopsis bhutanensis* Farille & Malla. Fig. 49h&i.

Similar to *P. obtusiuscula* but acaulous or shortly stemmed up to 10(–30)cm. Leaves 3–7 × 1–2cm (including petiole); pinnae in 3–4 pairs, broadly ovate, 4–7 × 3–7mm, deeply ternately lobed, lobes becoming shallower towards the leaf apex; segments ovate-oblong, wider and somewhat less dissected than *P. obtusiuscula*. Umbels 5–8 rayed; rays 2–5cm; umbellules 10–14mm across; pedicels up to 6mm; bracteoles similar to *P. obtusiuscula*, but less dissected, 4–7mm, entire to 3-lobed, coarsely toothed near apex, often longer than the flowers and fringing the umbellule. Petals white to purple. Stylopodium broad and flat, styles cream. Fruits rather rectangular in outline, base truncate, immature dried mericarps often with wavy ridges.

**Bhutan:** C – Thimphu district (Kangla to Ha, Paglekacheram), N – Upper Mo Chu district (Chomo Lhari, Lingshi), Upper Pho Chu district (Gyophu La), Upper Bumthang Chu district (Pangtang), Upper Kuru Chu district (Gong La) and Upper Kulong Chu district (Shingbe); **Sikkim:** Bikbari, Chemathang, Chomnago, Zongri, Lachen, Lam Pokhri, Thanggu; **Chumbi:** Chaerlung. Alpine meadows, 3600–4880m. (June–)July–September.

Apparently flowering slightly later than *P. obtusiuscula*, and usually from somewhat higher elevations.

## 14. PLEUROSPERMOPSIS Norman

Glabrous, aromatic biennials or perennials with thick tap-root; stems stout, erect, usually with papery remains of leaves at base. Leaves mainly basal, pinnate, oblong in outline, stiffly subcoriaceous; leaflets ovate with coarsely serrate margin; petiole abruptly winged and sheathing at base. Umbels compound; bracts lobed and coarsely toothed at apex, stiffly-papery; umbellules crowded, pedicels very short; bracteoles numerous, similar to bracts but shorter, rigid, persistent and remaining erect after fruiting. Calyx teeth small, triangular-acute, persistent in fruit. Petals broadly oblong-obovate, entire. Stylopodium flat-domed. Fruits green with blackened tip, narrowly oblong, slightly compressed laterally, mericarps 5-ridged, ridges with narrow wing.

**1. *P. sikkimensis*** (Clarke) Norman; *Pleurospermum sikkimense* Clarke. Fig. 49j-l.

Stems 10–50cm tall, c 1cm thick at base. Lower leaves 10–28cm long (including petiole); pinnae in 3–7 pairs, green above, often purplish below, ovate or suborbicular, 0.8–1.75 × 0.7–2cm, acute, base rounded or truncate, margin coarsely serrate; petiole wings often spotted purple. Umbels 4–15(–25)cm across, 4–7-rayed; rays (1.5–)4–13cm, stout, to 3mm thick; bracts green, obovate, 2–3.5cm, sharply 3–5-lobed at apex, lobes coarsely toothed; umbellules 2–4cm across, pedicels c 1mm; bracteoles similar to bracts, 7–16 × 4–8mm, longer than and fringing the flowers, 3-lobed, lobes toothed, acute. Calyx teeth purple-black, c 0.5mm. Petals deep red-purple to blackish-purple. Fruits 3–4 × 1.5mm.

**Bhutan:** C – Ha district (Damthang to Sharithang) and Thimphu district (Bimelang Tso to Dingtsho La, Darkey Pang Tso, Phajoding), N – Upper Mo Chu district (Laya, Yale La); **Sikkim:** Cheumsanthang, Dzungri, Kaukola, Onglakthang, Thangshing, Yak La, Yeumthang; **Chumbi:** Meerik La, Yatung. Amongst rocks and shrubs in moorland, scree, etc., 3900–4250m. January–September(–October).

A distinctive monotypic genus endemic to high elevations in Bhutan, Chumbi and Sikkim.

**15. KERAYMONIA** Farille

Dwarf rosette perennial herbs with stout woody tap-root, stemless or almost so; crowns surrounded by papery leaf remains. Leaves horizontally spreading to ascending, oblong to oblong-triangular in outline, 1–3-pinnate; ultimate segments ovate to linear-lanceolate, entire or 3-lobed; petioles with pale broad sheathing bases. Umbels compound, primary umbel usually sessile on the crown of the plant, secondary lateral umbels with longer peduncles and shorter rays; bracts leaf-like; rays long, spreading to ascending; umbellules small; bracteoles linear-lanceolate, entire or sparingly lobed. Calyx teeth small, triangular. Petals obovate with acute inflexed tip. Stylopodium broad and slightly flattened; styles short, diverging in fruit. Fruits oblong-ovoid, mericarps weakly 5-winged.

1. Leaves 2–3-pinnate with linear ultimate segments ..... **1. *K. cortiformis***  
+ Leaves pinnate with ovate to lanceolate ultimate segments

**2. *K. pinnatifolia*****1. *K. cortiformis*** Cauwet & Malla. Fig. 49m–o.

Plants 10–20cm across, essentially glabrous. Leaves 4–10cm long, finely 2–3-pinnate; ultimate segments 2–3 × 0.75–1.5mm, linear-acute, often trifid at apex; petioles 1–5cm, wings often purplish, 1cm broad at base. Umbels 6–10-rayed; rays 2–15(–20)cm long; umbellules 1.2–2cm across, pedicels 5–7mm; bracteoles about as long as flowers; calyx teeth pale green, 0.5–1mm.

Petals white, 1.5–2mm. Stylopodium and immature fruits blackish. Fruits 3–4mm.

**Chumbi:** Chomo Lhari, Tem La (1 day NE of Phari Dzong). Scree and alpine turf, c 4800m–4900. July–September.

## 2. *K. pinnatifolia* Watson

Plants to 9cm tall, mainly glabrous, leaf and bracteole margins pubescent. Leaves pinnate, 3–4 × 1–1.2cm; leaflets in 5–7 pairs and the odd terminal, ovate to lanceolate, 4–8 × 0.75–7mm, usually 3-toothed at apex. Primary umbel sessile on the crown, 3- to 7-rayed; rays 2.5–8cm, rather stout, 1–1.3mm thick (secondary lateral umbels absent or few, pedunculate but much reduced); umbellules 1.2–1.8cm across, c 30–40-flowered; bracteoles numerous, c 12–15, obovate to oblanceolate, 7–9 × 1.5–3.5mm, equalling flowers, 3-toothed at apex; pedicels 3–5mm. Calyx teeth purple-black, ovate acute, to 0.75mm, unequal. Petals white, c 1.5 × 1.2mm. Stylopodium dark purple-black. Mature fruit unknown.

**Bhutan:** C – Tashigang distict (Preng La). Alpine turf, c 4000m. August.

Apparently endemic to Bhutan, only known from the type collection (281).

## 16. CHAMAESCIADIUM Meyer

Dwarf, almost stemless to shortly caulescent rosette perennial herbs from a stout woody tap-root; stem sometimes clothed in fibrous leaf remains. Leaves 2–3-pinnate; ultimate segments ovate to lanceolate; petiole sheathing at base. Umbels compound, the main umbel sometimes sessile on the crown in stemless plants, reduced secondary lateral umbels sometimes present; bracts and bracteoles present. Calyx teeth obsolete. Petals white. Stylopodium low domed. Fruits ovoid-oblong, slightly laterally compressed, glabrous; ribs filiform; vittae 3–4 per furrow.

1. *C. subnudum* (Wolff) Norman; *Trachydium subnudum* Wolff, *T. verrucosum* Shan & Pu, *T. lamondianum* Farille & Malla.

Plants to 20cm tall. Leaves ovate-triangular in outline, 3–10 × 3–7cm; ultimate segments ovate, serrate to pinnately divided, leaves and rachis below sparsely to moderately hispid. Rays 3–10, 2–18cm, spreading to ascending; umbellules 20–30-flowered; pedicels 1–5mm; bracteoles 1–6, to 3mm long. Petals obovate, to 1.5mm, radiant, unequal. Fruits c 3 × 2mm.

**Chumbi:** Dotag, Phari, Tawa Dzong. 4000–4500m. July–September.

## 17. SCHULZIA Sprengel

Small, nearly glabrous biennial or perennial herbs; stem not thickened, non-fibrous remains of leaves sometimes present at base. Leaves 2-pinnate, pinnae pinnatifid, ultimate segments linear-lanceolate, acute; petiole winged and sheathing at base. Umbels compound, compact, stem bearing one main terminal umbel

with 1–2 lateral smaller secondary umbels; bracts when present like upper stem leaves; bracteoles characteristically deeply pinnately divided into linear acute segments. Calyx teeth obsolete. Petals obovate, somewhat unequal, attenuate at base. Stylopodium rounded, slightly flattened, rugose in fruit. Fruits oblong, distinctly constricted below the stylopodium, mericarps subterete, slightly compressed laterally, ridges prominent but scarcely winged when mature.

1. Ultimate leaf segments short, less than 5mm ..... **1. *S. dissecta***  
 + Ultimate leaf segments long, usually more than 7mm ..... **2. *S. bhutanica***

**1. *S. dissecta*** (Clarke) Norman; *Trachydium dissectum* Clarke.

Slender erect, single-stemmed herb 3–35cm tall, often suffused purple; stems sparingly branched, 0.75–2.5mm thick; thickened rootstock short, 5–20 × 3–5mm. Leaves 2–9 × 1.5–3cm, very finely dissected, ultimate segments 1–5 × 0.5–0.75mm; sheathing petiole base usually minutely papillose puberulent especially on the veins. Umbels 1–3cm across, 5–10-rayed; rays 0.8–2.5cm, minutely papillose pubescent at least at the ends, elongating slightly in fruit; bracts often absent or few, 1–2cm, falling early; umbellules densely flowered, 8–13mm across, pedicels 2–7.5mm; bracteoles as long as or slightly longer than the flowers, margins minutely papillate. Petals white to purple. Stylopodium dark purple; styles cream or tinged purple. Fruits brown with pale ridges when mature, 2–3 × 0.75mm.

**Bhutan:** S – Sankosh district (Daga La), C – Thimphu district (Nya Tso, Shodu) district, N – Upper Mo Chu district (Gangyuel Chu); **Sikkim:** Khangchengyao, Thanggu; **Chumbi:** Natu La to Champitang. Moist, rather open habitats, river banks, moorland, dwarf *Rhododendron* scrub, rocky areas, alpine turf, 3680–4900m. August–October.

**2. *S. bhutanica*** Watson

Very similar in flower and fruit structure to *S. dissecta*, but usually much less puberulent, and leaves larger with longer ultimate segments; plants 5–22cm tall from rootstock, slightly larger than *S. dissecta*; leaves 4–12 × 1.5–4cm, with long filiform segments, ultimate segments (5–)7–17mm; flowers white.

**Bhutan:** S – Sankosh district (Daga La), C – Thimphu district (Phajoding to Dongshola, Taluka), N – Upper Mo Chu district (Lingshi). Moist to wet habitats: rocky areas in grassland, underhangs, stone walls, 3850–4100m. September–October.

This Bhutanese endemic prefers damper habitats to *S. dissecta* and flowers somewhat later.

## 18. CHAMAESIUM Wolff

Glabrous biennial or perennial herbs, base often surrounded by papery leaf remains. Leaves pinnate; pinnae suborbicular to elliptic, shallowly lobed or

crenate. Umbels compound; bracts leaf-like; umbellules small, rays unequal; bracteoles in Bhutanese species leaf-like or linear. Calyx teeth minute triangular or obsolete. Petals obovate, incurved at apex. Stylopodium a flattened dome, dark purple, forming a characteristic thickened rim with the top of the ovary/fruit, rim wider than the ovary and young fruit, and about as wide as the mature fruit. Fruits oblong-ovoid, laterally compressed, mericarps subterete, characteristically 10-ribbed, ribs green, furrows brown.

1. Plants acaulous or with a short stem more than 5mm thick

1. **C. novem-jugum**

+ Plants 10–20cm tall, with slender stems less than 5cm thick

2. **C. viridiflorum**

1. **C. novem-jugum** (Clarke) Norman; *Trachydium novem-jugum* Clarke. Fig. 50a–c.

Subcaulous herbs, rarely with a short stem 0.5–1cm thick, 2–10cm tall; tap-root short and thick. Leaves mainly basal, shiny green above, 3–11 × 1.5–3.5cm (including petiole); leaflets in 3–5 pairs, ovate or suborbicular, 5–20 × 5–17mm, acute or rounded, base rounded, nearly sessile, margin minutely crenate-toothed. Umbels 7–20-rayed; rays 2–13cm, rather stout; bracts few, early deciduous; umbellules 13–25-flowered, 0.8–1.5cm across; pedicels 2–7mm; bracteoles 5–6mm, linear or 3-lobed with narrow segments. Petals green or tinged purple, c 1.5mm. Fruits 2.5–3 × 2–3mm, ribs in young fruit wavy.

**Bhutan:** C – Thimphu (Nya Tsho, Phajoding, Paga La to Lawgu) district, N – Upper Mo Chu (Chomo Lhari, Guile La, Laya, Pya La) and Upper Pho Chu (Chojo Dzong) districts; **Sikkim:** Kongra La, Phaklung, Thagia, Yumthang; **Chumbi:** Yak La. Moist or wet, semi-open habitats, rocky areas, moorland, Rhododendron scrub, 3050–4900m. July–September.

2. **C. viridiflorum** (Franchet) Shan; *Trachydium viridiflorum* Franchet, *T. affine* W.W.Smith.

Similar to *C. novem-jugum* but slender-stemmed (2–3mm thick), 6–28cm tall; leaves cauline, 4–12 × 1.2–2cm (including petiole); leaflets in 2–3 pairs, elliptic or ovate, c 10 × 5mm, obtusely shallowly lobed; umbels 4–6-rayed; rays slender, 1.5–3cm long; bracts narrowly pinnatisect, 1.5–2.5 × 0.7–1cm; umbellules c 1.5cm across; bracteoles pinnatisect, 7–10mm. Mature fruit unknown.

**Sikkim:** Ningbil (Chola Range). 4110–4265m. August.

## 19. BUPLEURUM L.

Annual or perennial, glabrous, often rather glaucous herbs. Leaves entire, usually at length parallel-veined. Umbels loosely compound, bracts and bracteoles leaf-like (or absent). Flowers yellow, sometimes tinged green or purple, shortly stalked. Calyx teeth absent. Petals obovate, emarginate. Stylopodium

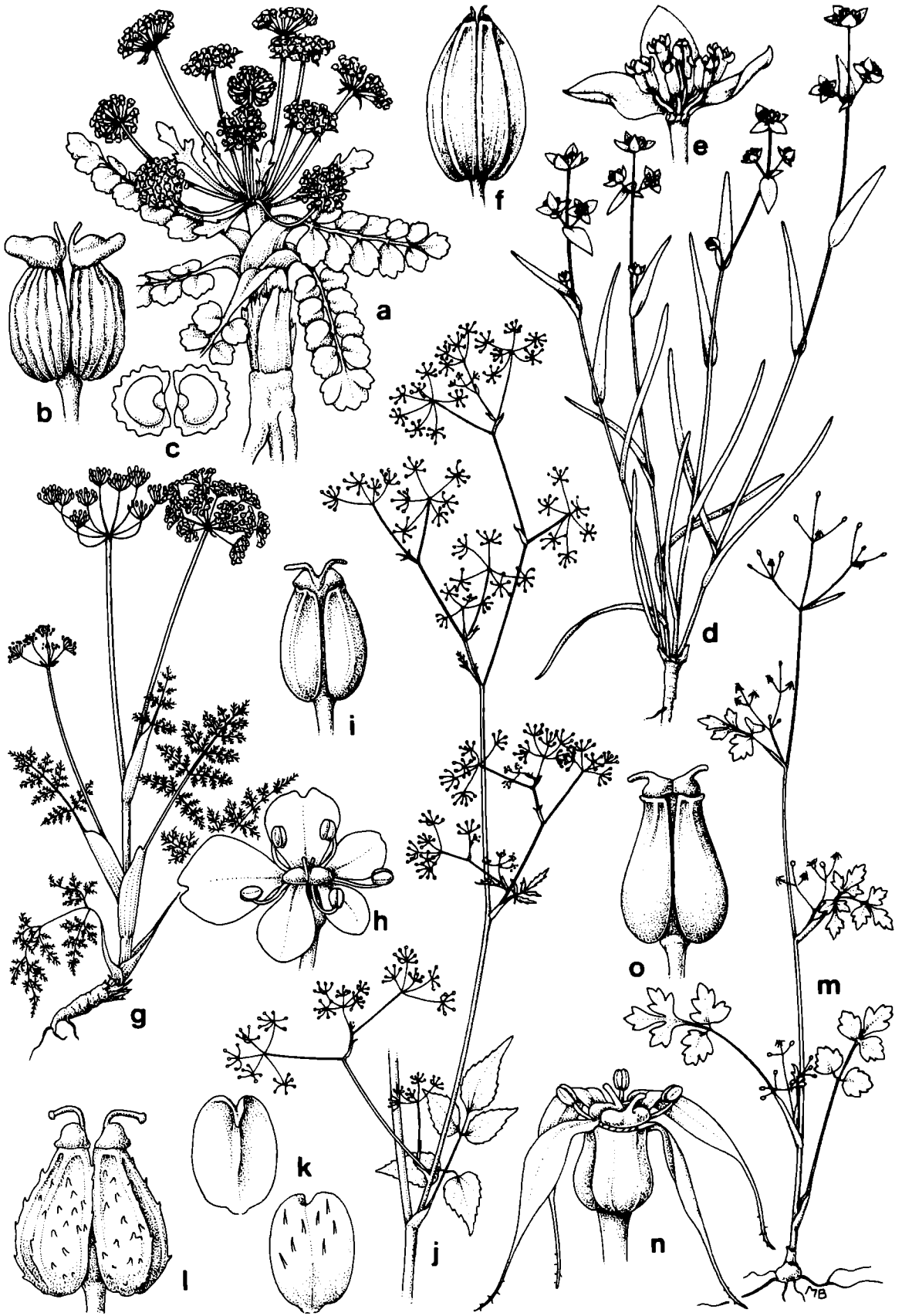
broadly conical. Fruits oblong or ovoid, slightly compressed laterally, mericarps subterete, somewhat prominently 5-ribbed.

A distinctive genus in which the specific limits are as yet not properly defined. Further work is needed covering the Sino-Himalayan representatives as a whole.

1. Annuals or short-lived perennials; inflorescences diffusely branched, rays very slender; flowers yellow-green; fruits ovoid, ribbed ..... **1. B. hamiltonii**
- + Perennials; inflorescences erect, rays slender to more robust; flowers yellow-green or purple; fruits oblong to ovoid, ribbed or winged ..... 2
2. Plants usually less than 40cm tall; stems numerous (more than 5) and often decumbent with a woody tap-root ..... 3
- + Mature plants more than 40cm tall; stems few, erect ..... 4
3. Bracteoles 4(-5), broadly elliptic-ovate; umbellules 1-4 per umbel  
**2. B. dalhousieanum**
- + Bracteoles 5-6, linear to linear-ovate; umbellules more than 5 per umbel  
**3. B. gracillimum**
4. Mid stem leaves ovate-elliptic to oblanceolate, more than 1.5cm wide, cuneate or rounded at base; umbellules numerous, usually more than 8 per umbel ..... **4. B. candollei**
- + Mid stem leaves narrower, usually less than 1.5cm wide, long attenuate at base; umbellules less than 8 per umbel ..... 5
5. Mid stem leaves expanded at base and clasping the stem; bracteoles numerous, more than 7 per umbellule, ovate, conspicuously longer than the purple flowers; fruits prominently winged ..... **5. B. himalayense**
- + Mid stem leaves attenuate at base; bracteoles usually less than 7 per umbellule, narrower than above and about as long as the yellow-green flowers; fruits with prominent ribs but not winged ..... 6
6. Leaves with broad whitish cartilaginous margin; bracteoles linear-lanceolate, about half as long as the flowers and shorter than the fruiting pedicels ..... **6. B. marginatum**
- + Margin of leaves not as above; bracteoles narrowly ovate, about as long as the flowers and longer than the fruiting pedicels ..... **7. B. falcatum**

FIG. 50. **Umbelliferae**. a-c, *Chamaesium novem-jugum*: a, habit ( $\times \frac{2}{3}$ ); b, fruit ( $\times 6$ ); c, cross-section of fruit ( $\times 6$ ). d-f, *Bupleurum dalhousieanum*: d, habit ( $\times \frac{1}{2}$ ); e, umbellule with one bracteole removed ( $\times 3$ ); f, fruit ( $\times 6$ ). g-i, *Sinocarum wolffianum*: g, habit ( $\times \frac{1}{2}$ ); h, flower ( $\times 8$ ); i, fruit ( $\times 8$ ). j-l, *Pimpinella urceolata*: j, habit ( $\times \frac{1}{3}$ ); k, petal, internal and external view ( $\times 14$ ); l, fruit ( $\times 14$ ). m-o, *Acronema tenerum*: m, habit ( $\times \frac{2}{3}$ ); n, flower ( $\times 14$ ); o, fruit ( $\times 14$ ). Drawn by M. Bates.





**1. *B. hamiltonii*** Balakrishnan; *B. tenue* D. Don.

Erect-stemmed annual to 75cm, often single-stemmed, woody at base and rather diffusely branched above, base of stem, leaf and bract margins often tinged red. Leaves linear-elliptic, 2–7 × 0.2–1.1cm, rounded at apex with a tiny micro, base cuneate to attenuate, sometimes finely brownish spotted. Umbellules very small, c 5mm across, 5–11-flowered, 2–5(–7) per umbel; bracts 2–3, small, unequal, narrowly elliptic, c 4 × 2mm; rays very slender; bracteoles 4–7(–10), narrowly elliptic, 2–4 × 1–1.5mm, acuminate, as long as or slightly longer than flowers. Petals yellow-green with a brown midrib on the reverse. Fruits ovoid, c 2 × 1.5mm, ribs whitish, prominent but not winged; fruiting pedicels shorter than bracteoles.

**Bhutan:** C – Punakha district (Wache). Open grassy slopes and rocky hillsides, 1000–2000m, July–September.

**2. *B. dalhousieanum*** (Clarke) Koso-Poljansky; *B. longicaule* DC. var. *dalhousieanum* Clarke. Fig. 50d–f.

Decumbent to erect perennial (5–)10–20(–35)cm tall, with several to many, sparingly-branched stems arising from a woody tap-root. Leaves membranous with obscure reticulate veining appearing parallel; basal and lower leaves linear to linear-oblongate, 2–8 × 0.15–0.4cm, obtuse-acute, long attenuate at base; middle leaves linear-lanceolate to lanceolate, (1–)2–6.5 × (0.2–)0.4–1cm, acute, base rounded or abruptly cuneate, semi-amplexicaul; uppermost leaves broadly lanceolate, 1–2.5(–4) × 0.4–0.6(–1)cm, acute, rounded to cordate at base and distinctly amplexicaul. Umbellules 4–6(–10)-flowered, 5–10mm across, 1–4 per umbel, rays somewhat unequal; bracts 2–3, unequal, the larger like the upper cauline leaves, 9–24 × 4–8mm; bracteoles 4(–5), broadly elliptic-ovate, 2.5–6 × 2–4mm, obtuse-acuminate, equal to or slightly longer than flowers. Petals dull blue to dark purple. Stylopodium dark purple-red. Fruits ovoid, 3–4 × 1.5–2.3mm; pedicels shorter than the fruit.

**Bhutan:** C – Punakha district (Tang Chu), N – Upper Bumthang Chu district (Dole La, Kantanang-Tsampa) and Upper Kulong Chu district (Shingbe); **Sikkim:** Chiya Bhanjang, Zongri, Meguthang, Nathang, Tsomgo, Yak La; **Chumbi?:** Lingter. Open hillsides, meadows, pathsides, etc., 3050–4600m. (May–)June–July.

Sometimes considered as just an altitude form of *B. longicaule*, but here treated as a morphologically distinct species.

*B. sikkimensis* Mukherjee is only reported from its type specimen (in fact probably collected in Chumbi). It is said to differ from *B. dalhousieanum* by its unwinged fruits, 3 vittae between the fruit ribs (4 on the commissural face) and obtuse leaves. It is not included here as no specimens have been seen.

**3. *B. gracillimum*** Klotzsch; *B. falcatum* L. var. *nigrocarpum* Jacquemont, *B. virgatum* Wall.

Slender tap-rooted perennial with many (usually more than 5) slender little-branched stems, prostrate to decumbent, or erect, up to 35(–60)cm long. Lower

leaves usually numerous and crowded, linear-oblongate, 1.5–3 × 0.15–0.3cm, obtuse-acute to -acuminate, base attenuate; stem leaves linear to lanceolate, 2–5(–6.5) × 0.15–0.3(–0.5)cm, acuminate, base cuneate to rounded, semi-amplexicaul; uppermost leaves sometimes wider. Flowers dark purple. Umbellules 5–10(–15)-flowered, 3.5–6mm across in flower, 2–5(–6) per umbel, primary rays slender. Bracts 1–3, lanceolate to lanceolate ovate, unequal, to 8 × 2.5mm; bracteoles 5–6, linear to linear-elliptic, 4–5 × 1mm, acute-acuminate, about as long as flowers. Fruits ovoid, c 3.5 × 2mm, vittae in 3 lines per furrow between the prominent ribs; pedicels shorter than the fruit.

**Bhutan:** C – Thimphu district (Barshong, Dakey Phungtso), N – Upper Mo Chu district (Laya, Lingshi La). Open areas, streamsides, tracks, etc., 2800–4000m. July–August.

#### 4. *B. candollei* DC.; *B. longicaule* auct. non DC.

Perennial with a few erect stems 75–130cm tall, usually sparingly branched, from a short, woody horizontal rhizome. Leaves very variable in shape and size, membranous with reticulate veining (sometimes obscure and appearing parallel), and a narrow cartilaginous margin; basal and lower leaves linear-oblongate(-spathulate), (3–)6–12 × (0.2–)0.5–1.5cm, obtuse-acute, attenuate at base, often withered at flowering; middle leaves ovate-elliptic to lanceolate or oblongate, (3–)5–10 × (0.8–)1.5–2.8cm, obtuse-acute, mucronate, attenuate to rounded at base, semi-amplexicaul, sometimes cordate-amplexicaul; uppermost leaves often ovate, (1.5–)2–4 × (0.6–)0.8–1.4cm, acute, rounded at base and amplexicaul. Umbellules (14–)15–20-flowered, 7–12(–15)mm across, (6–)8–15(–22) per umbel, rays somewhat unequal; bracts 2–3(–4), unequal, leaf-like, to 25 × 11mm; bracteoles usually 5, elliptic-ovate, 4–8 × 2.5–4mm, acute or obtuse-acuminate, equal to or slightly longer than flowers. Petals yellow or tipped purple, sometimes appearing dark blue or purple-black. Stylopodium dark purple-red. Fruits oblong-ellipsoid, 3.5–4.5 × 2mm.

**Bhutan:** C – Thimphu, Bumthang district (Bumthang, Gyetsa) and Mongar district (Sengor), N – Upper Mo Chu district (Lingshi); **Darjeeling:** Phullalong, Sandakphu; **Sikkim:** Lachen, Lachung, Phalut, Tari, Tsomgo; **Chumbi:** Bakcham, Chumbi, Yeum-chung. Common in open areas; grassy hillsides, streamsides, forest clearings, etc., 2300–4000m. June–August.

A problematic species needing further work, here treated as one variable entity. Several infraspecific taxa have been described but none is truly distinct. The elliptic-lanceolate leaf form characteristic of Wallich's type gathering (Wall. Cat. No. 552) intergrades across the geographic range of the species (NW India to Bhutan, Tibet and Myanmar) into specimens with broad amplexicaul bases, and narrowly lanceolate/oblongate leaves more reminiscent of elements of the Wallich (mixed) type collection of *B. longicaule* (Wall. Cat. No. 557). The parallel versus reticulate veining character, and number of veins are not reliable differentiators. The true identity of *B. longicaule* needs to be established. It may

prove to be conspecific with *B. candollei* and if so should be sunk under the latter name.

**5. *B. himalayense*** Klotzsch; *B. longicaule* DC. var. *himalayense* (Klotzsch) Clarke

Erect to decumbent perennial with a few, little-branched stems 18–60cm long, arising from a vertical to horizontal tap-root. Lower leaves narrowly oblanceolate, 3–8 × 0.15–0.35cm, apex acuminate to obtuse-acute, base long attenuate and semi-amplexicaule; stem leaves distinctively shaped, oblanceolate, 5–12 × 0.3–1cm, apex long acuminate, base auriculate rounded to subcordate, amplexicaule. Flowers dark purple. Umbellules 18–40-flowered, 10–17mm across, 3–5 per umbel; bracts 1–3, ovate acuminate, unequal, to 20 × 7mm; bracteoles (6–)7–8, ovate, 6–12 × 3–5mm, distinctly longer than the flowers, apex acute to shortly acuminate, base rounded. Fruits oblong, 3.5– × 1.5–mm, ribs prominently broadly winged; fruiting pedicels shorter than the bracteoles.

**Sikkim:** Lachen, Thanggu. Grassy slopes and forest clearings, 3300–4000m. July.

**6. *B. marginatum*** DC.; *B. falcatum* L. var. *marginatum* (DC.) Clarke.

Erect perennial with a few stout stems 60–75cm tall, arising from a woody horizontal rhizome; stems usually corymbosely branched towards the apex. Leaves linear-lanceolate or oblanceolate, 6–15 × 0.3–0.8cm, acuminate, base attenuate amplexicaul, whitish cartilaginous margin conspicuously wide. Flowers yellow. Umbellules 6–12-flowered, 5–10mm across, 4–8 per umbel; bracts 2–5, small, unequal, linear, c 4 × 1mm; bracteoles 4–5, lanceolate, 1.5–2.5 × 1mm, acuminate, about half as long as flowers. Fruits oblong-ovoid, 3–4 × 2–2.5mm, ribs prominent, whitish; pedicels distinctly longer than bracteoles in fruit.

**Bhutan:** C – Punakha district (Tang Chu) and Mongar district (Lhuntse);

**Sikkim:** Lachen; **Chumbi?:** Yam Dok Cho. Forest clearings and grassy hillsides, 1300–1850m. May–June.

**7. *B. falcatum*** L.

Perennial herb with erect, often shortly decumbent stems to 80cm tall. Leaves linear-oblanceolate, 4–11 × 0.2–0.4cm, apex acute, long attenuate at base, rather coarse textured with prominent parallel veins below. Umbellules small, 5–7mm across, 8–10-flowered, 5–7 per umbel; bracts 2–3, unequal, narrowly ovate-lanceolate, acuminate, to 5 × 1mm, prominently, strongly 3-veined below; rays slender; bracteoles similar to the bracts, as long as flowers. Petals yellow-green with brown midrib on the reverse. Fruits oblong, c 5 × 1mm, ribbed but not winged.

**Bhutan:** C – Thimphu district (Paya, Tsalimphe to Simo-Sampa) and Tashigang district (Tashi Yangtshi) districts, S – Upper Mo Chu district (Chusom). Dry stony hillsides and rough pasture, 2100m. July–August.

## 20. APIUM L.

Glabrous annuals or short-lived perennial herbs. Lower leaves pinnate, leaflets large, broadly ternately lobed; upper leaves small, ternate with narrowly obovate segments; petioles with membranous wings at base, particularly evident in upper stem leaves. Umbels compound, subsessile and often leaf-opposed, numerous in the top half of the stem; bracts and bracteoles absent. Calyx teeth obsolete. Petals white, obovate, acute with inflexed tip. Stylopodium subconical, styles short. Fruits ovoid to ellipsoid, mericarps prominently 3-ribbed.

1. **A. graveolens** L. Eng: *Celery*.

Erect to sprawling aromatic herb (smelling of celery when crushed), 30–80cm tall. Lower leaves to 16 × 4cm, leaflets 1.2–2.5 × 0.8–2.5cm; upper leaves 0.8–1.6cm long. Umbels 1–5-rayed, rays 0.8–2cm long; umbellules 10–16-flowered, c 0.8mm across. Petals 0.7mm. Fruits c 1.3 × 1mm.

**Bhutan:** C – Thimphu district (Gidakom). Wet ground, ditches, 2200–2800m. June.

Introduced as a vegetable crop.

## 21. TRACHYSPERMUM Link

Annuals or perennials, stems erect and corymbosely branched. Leaves 2–3-pinnate, ultimate segments filiform; petioles narrowly sheathing at base. Umbels compound, bracts and bracteoles linear. Calyx teeth obsolete. Petals white, obovate emarginate or acuminate and inflexed at apex. Stylopodium domed; styles reflexed in fruit. Fruits broadly ellipsoid, slightly compressed laterally, mericarps densely covered with fine short hairs or papillae, 5-ribbed, ribs scarcely prominent.

1. Stems, leaves and inflorescences puberulent; fruits densely so

1. **T. anethifolium**

+ Stems, leaves and inflorescences essentially glabrous; fruits minutely papillose ..... 2. **T. ammi**

1. **T. anethifolium** (D.Don) Wolff; *Carum anethifolium* (D.Don) Clarke.

Perennial, stems 40–75cm, whole plant densely puberulent. Leaves to 6.5cm, ultimate segments to 15 × 0.3mm. Umbels c 5cm across, 19–28-rayed; rays 1.3–3cm; bracts 5–8, linear-subulate, 5–7mm; umbellules 7–12mm across, 17–30-flowered; pedicels 0.2–5mm, unequal; bracteoles 8–10, linear, 2–3mm. Petals c 1.2 × 0.8mm, finely pubescent on the reverse. Fruits 1.2–1.5 × 1.2–1.5mm, densely puberulent.

**Bhutan:** C – Thimphu district (Thimphu), Punakha district (Chusom to Samtengang, Wangdu Phodrang) and Tashigang district (Tashigang). Dry, open grassy hillsides, 1050–2300m. October–November.

2. **T. ammi** (L.) Sprague; *Trachyspermum copticum* (L.) Link, *Carum copticum* Clarke.

Very similar to *T. anethifolium* but an essentially glabrous annual; umbels 2.5–5cm across, fewer (6–20)-rayed; rays 1–3cm; umbellules c 1cm across, c 20-flowered; pedicels 0.5–4mm; fruits densely covered in whitish minute papillae.

**Bhutan:** S – Phuntsholing district (Torsa River); **Sikkim:** Tista River. Moist shingle, 200–300m. May–June.

Extensively cultivated in S and SW Asia as a spice, presumed native to India.

## 22. CARUM L.

Glabrous biennials or short lived perennial herbs, with fusiform tuberous tap-roots. Leaves 2–3-pinnatisect, ultimate segments of lower leaves linear-lanceolate, of upper leaves linear-filiform; bases of petioles expanded, papery and sheathing the stem. Umbels compound, rather erect; bracts similar to the upper stem leaves; bracteoles linear, few or absent. Calyx teeth obsolete. Petals obovate with an incurved acuminate tip. Stylopodium domed. Fruits oblong-ellipsoid, slightly compressed laterally, glabrous; mericarps somewhat prominently 5-ribbed.

1. **C. carvi** L. Med: *Gonoid*, *Go-Shyod*, *Gonoet*; Eng: *Caraway*.

Stems erect or shortly decumbent, 15–45(–60)cm tall. Leaves 4–18 × 1–2.5(–5)cm; ultimate segments of lower leaves c 4 × 0.75mm, of upper leaves c 8 × 0.2mm. Umbels (3–)6–10-rayed; rays and pedicels characteristically unequal, lengthening in fruit up to 4 and 9cm respectively. Petals white or purplish-pink, with a brown midrib on the reverse. Fruits 3–4 × 1–2mm.

**Bhutan:** N – Upper Mo Chu district (Chebesa, Gangyul, Laya to Gasa Dzong) and Upper Kulong Chu district (Shingbe), C – Ha district (Ha) and Thimphu district (Barshong, Dodena); **Sikkim:** Lachen, Tangu, Thanggu; **Chumbi:** Lingshi La. Open areas, often around habitation, rough pasture, river banks, roadsides, etc., 2500–4150m. June–August.

A common plant, possibly native from Bhutan to W China.

## 23. SINOCARUM Shan & Pu

Slender or stout glabrous perennials; rhizome cylindrical or tuberous. Leaves 1–3-pinnatisect, ultimate segments narrow. Umbels few, compound, mainly terminal; bracts absent or few, linear; petioles sheathing at base. Flowers white. Calyx teeth minute, subulate-triangular or obsolete. Petals unequal, outer radiating and larger, obovate, spreading, usually rounded or slightly lobed. Stylopodium rounded. Fruits oblong, ovoid or ellipsoid, glabrous, mericarps inconspicuously 5-ribbed, usually deeply grooved on inner (commissural) face.

A complex genus where further study across the whole Sino-Himalayan region is desperately needed (282). See also *Pimpinella*, *Tongoloa* and *Acronema*.

1. Plants small, less than 6cm tall; rhizome cylindrical with a thickened tap-root; petiole bases broadly sheathing ..... 2
- + Plants usually more than 6cm tall, or the combination of rhizome and petiole sheaths not as above ..... 3
2. Plants very small, less than 3cm tall; rays less than 1cm long . **1. S. minus**
- + Plants usually more than 6cm tall; rays more than 2cm long .. **2. S. woodii**
3. Stems much-branched at base, forming clumps; calyx teeth minute, triangular ..... **3. S. longii**
- + Stems solitary or sparsely branched at base; calyx teeth obsolete ..... 4
4. Stems stout, 2–7mm thick; fruiting heads bent horizontally  
**4. S. clarkeanum**
- + Stems slender, usually less than 3mm thick; fruiting heads erect ..... 5
5. Umbels 3–4-rayed; umbellules 3–5-flowered; bracteoles absent  
**5. S. pauciradiatum**
- + Umbels more than 5-rayed; umbellules more than 6-flowered; bracteoles usually present (often falling early) ..... 6
6. Leaf sheaths very broad, more than 8mm wide; umbellules usually less than 10-flowered; fruits subglobose ..... **6. S. pulchellum**
- + Leaf sheaths narrower, less than 8mm wide; umbellules usually more than 10-flowered; fruits ovoid to oblong ..... 7
7. Rootstock an ovoid tuber with fibrous roots; leaves with segments more than 0.5mm broad and sheaths tapering at the apex; fruits ovoid  
**7. S. sikkimense**
- + Rootstock a short rhizome, usually with a main thickened root; leaf segments less than 0.5mm broad and sheaths usually rather auriculate at apex; fruits oblong-ovoid ..... **8. S. wolffianum**

### 1. *S. minus* Watson

Slender, diminutive, multi-stemmed perennial herb, 1–3cm tall from a short cylindrical vertical rhizome, c 3 × 15mm, or tap-root. Leaves basal and cauline, 1–2 × ternate, to 3 × 1cm (including petiole); leaflets ovate, to 4 × 4mm, deeply ternately lobed to pinnatifid, segments 3-lobed at apex, ultimate segments oblong-elliptic acute; petioles slender, to 2.5cm long, with broad sheathing bases c 4 × 3mm. Umbels held just above the leaves, 5–15mm across, 4–6-rayed; rays 1.5–5mm long, somewhat unequal; bracts 1–2, linear, 1–2mm long; umbellules 4–5-flowered, 3–6mm across; pedicels 0.5–2mm; bracteoles 0–3, linear, to 1.5mm. Calyx teeth obsolete. Petals dark purple or white flushed purple, ovate, acute, c 0.75 × 0.5mm. Stylopodium domed, dark purple; styles reflexed. Mature fruit not seen.

**Bhutan:** N – Upper Kulong Chhu district (Shingbe). Amongst rocks and boulders in alpine turf, 3800m. June.

Known only from single collections from East Nepal and East Bhutan (281).

## 2. *S. woodii* Watson

Short, single-stemmed, high altitude perennial, 2.5–6cm tall and 6–12cm across; stem 0.5–2cm long; rhizome cylindric, 3–7mm thick to 3cm long, usually vertical with a woody tap-root. Leaves 2–5, mainly basal, ovate in outline, to 4 × 2.5cm (including petiole); very finely and openly divided, 2–3-pinnate, the leaflets pinnatifid into linear-acute segments 0.2–0.5mm broad; petioles with conspicuous wide auriculate sheathing bases 1–2 × 0.5–1cm. Primary umbel solitary, terminal, almost sessile, 5–8-rayed; secondary lateral umbels 0–1, smaller and with fewer rays and pedicels; rays 2–6cm long, widely spreading and unequal, often down-curved in fruit; bracts absent; umbellules 8–12mm across, (7–)12–15-flowered; bracteoles 4–6, linear-lanceolate, 1–6mm long; pedicels 1.5–6mm long, somewhat unequal. Calyx teeth obsolete. Petals white, obovate, rounded to acute, to 2.4 × 1.3mm. Stylopodium conical-domed, dark purple; styles erect, spreading in fruit. Fruits oblong, c 2 × 1.5mm.

**Bhutan:** C – Thimphu district (Nya Tsho); **Sikkim:** Kaukola, Reshinangi, Torsa, Yeumthang. Short alpine turf and amongst rocks, 4000–4600m. August–October.

## 3. *S. longii* Watson

Tap-rooted perennial to 27cm tall, much branched from base, sometimes forming clumps; rhizome short and vertical to 2 × 0.5cm, clothed in leaf remains. Leaves mainly basal, biternate or pinnate, 10–24 × 2–4.5cm (including petiole); leaflets elliptic-ovate, to 1.2 × 1(–1.5)cm, deeply divided to pinnatifid, usually 3-lobed at apex; ultimate segments oblong acute, 2–5 × 1.2–3mm; petioles long and slender, to 9cm, with sheathing base to 15 × 8mm. Umbels 1.5–3cm across, 3–6-rayed, held above the leaves on long stout peduncles 10–24cm long; rays stout, very unequal, 0.5–4.5cm long, rather erect in flower, spreading in fruit; bracts 0–1, linear-lanceolate, 2–7mm, usually falling after flowering; umbellules 4–6mm across, 6–8-flowered; bracteoles 1–3(–5), linear, 1–1.5mm. Calyx teeth minute, triangular to obsolete. Petals elliptic-ovate, c 1.2 × 1mm, purple-black. Stylopodium flattened, dark-purple; styles erect in fruit. Fruits purplish, c 2.5 × 2mm, ovoid-oblong.

**Bhutan:** C – Thimphu district (between Phajoding and Dongsho La, Darkey Pang Tso) district; **Sikkim:** Zongri, Samiti Lake. Moist pasture or boggy moorland, around boulders and in rock crevices, 3700–4500m. July–August.

Endemic to Sikkim and Bhutan (281).

## 4. *S. clarkeanum* Mukherjee & Constance

Rather stout-stemmed, robust herb 5–35cm tall. Stems 2–7mm thick from a stout rhizome 1–3 × 0.7–1cm with woody tap-root. Leaves 2–3-pinnate or -ternate, to 25 × 7cm (including petiole); very finely and openly divided into



linear-acute segments 0.3–1mm wide, often 3-lobed at apex; sheathing petiole broad-based, 7–12mm across. Umbels 3.5–5.5cm across, 9–22-rayed; rays 1.5–6.5cm, almost equal, elongating and compacting in fruit, the fruiting head bending through almost 90°; bracts 0–2, linear-subulate, 1.5–7 × 0.2mm, falling early; umbellules (11–)15–25-flowered; pedicels 4–8mm; bracteoles 3–9, linear-subulate, 1–11mm. Calyx teeth obsolete. Petals white to suffused purple, obovate, to 2.2 × 1.3mm, apex acute, base clawed. Stylopodium domed, styles erect and spreading. Fruits oblong-ovoid, c 1.75 × 0.75mm.

**Darjeeling:** Singalelah; **Sikkim:** Meguthang; **Chumbi:** Pheonp. Open alpine turf, forest margins, 3300–4100m. August–September.

Nepalese specimens have finer leaf segments.

##### 5. *S. pauciradiatum* Shan & Pu

Delicate high altitude perennial 2–11cm tall. Rhizome slender, branching, to 3mm thick. Leaves few, mainly basal, ovate in outline, to 4 × 1cm (including petiole); usually ternate with the leaflets deeply 1–2 × ternately lobed or divided into oblong-elliptic segments c 1(–2)mm broad; petioles slender with a membranous sheathing base to 5 × 3mm. Umbels held just above the leaves, 8–14mm across, 3–4-rayed; rays 1–8mm, unequal; bract solitary, like the upper stem leaves, or bladeless, c 4mm long; umbellules 3–5-flowered; pedicels 0.5–2mm; bracteoles absent. Calyx teeth obsolete. Petals whitish-purple to darker, obovate, rounded, c 1.2 × 1mm. Stylopodium dark purple, somewhat domed; styles erect to spreading. Fruits ovoid-ellipsoid, c 1 × 0.75mm.

**Bhutan:** C – Sakden district (Orka La); N – Upper Mangde Chhu district (Changsethang). Well-drained open alpine turf, amongst stones, *Rhododendron* scrub, 3400–4900m. June–July.

##### 6. *S. pulchellum* Watson

Erect slender-stemmed herb 4–24cm tall. Tuber globose, 4–15mm thick; roots fibrous. Leaves 1–4, ovate in outline, 2.5–10 × 1.5–6cm, 2-pinnate; leaflets ovate to 14 × 11mm, usually 3-lobed into oblong-elliptic acute segments 0.75–1.5mm broad, pale below; petioles with characteristic broad sheathing bases 0.8–2.3 × 0.8–1.4cm. Umbels 2.5 × 4cm across, 5–12-rayed; rays 0.5–2cm, somewhat unequal, slender, becoming erect in fruit; bracts 2–3, linear, 1–4mm, falling early; umbellules 6–8mm across, 8–10(–12)-flowered; pedicels 1–2.5mm; bracteoles 1–5, linear-subulate, 0.5–2.2mm. Calyx teeth obsolete. Petals white, obovate, to 2 × 1.5mm. Stylopodium dark purple, domed; styles recurved. Fruits subglobose, c 1.5 × 1.75.

**Bhutan:** C – Tashigang district (Dong La); **Sikkim:** Kupup, Phedang. Marshy meadows, streamsides, mossy banks, 3700–4200m. July–August.

7. *S. sikkimense* (Mukherjee) Mukherjee & Constance; *Acronema sikkimense* Mukherjee, *Pimpinella acronemifolia* Clarke p.p., *Acronema acronemifolium* (Clarke) Wolff p.p.

Slender and erect little-branched herb (3–)7–40cm tall. Tuber globose, to

1cm thick, with fibrous roots; stem often suffused purple. Leaves oblong-ovate, 2–12 × 1–4cm (including petiole), openly 2-pinnate or -pinnatifid; leaflets ovate-elliptic to oblong, often trilobed into linear acute segments 1–6 × 0.5–1.5mm; petioles sheathed at base to 6mm broad (broadest in upper leaves), apex of sheath tapered into the petiole, usually suffused purple. Umbels 3–5cm across, (4–)6–10-rayed; rays slender, 0.7–3.5cm, unequal; bracts 0–(1), linear 2–7mm; umbellules c 8mm across, 7–15-flowered; pedicels 2–5mm, filiform, somewhat unequal; bracteoles (0–)3–5, linear, (1–)2–6mm. Calyx teeth obsolete. Petals white to purplish-red, obovate to lanceolate-elliptic, abruptly acute, to 1.7 × 1.2mm. Stylopodium dark purple, flat-domed; styles recurved. Fruits ovoid to subglobose, 1–1.5 × 1mm.

**Bhutan:** S – Sankosh district (Daga La); C – Thimphu district (Darkey Pang Tso, Dingtshola, Pumo La, Saga La, Talukah Gompah, Pha Tsho, Talukah La) and Tongsa district (Meru Samba); **Sikkim:** Chho La, Dobinda La, Kaukola, Muibardana, Tangkar La, Tsomgo Chho, Yampung; **Chumbi:** Dotag, Phari Dzong, Sham Dhu. Well-drained often rocky areas, scree bases, stream-sides, 3900–4500m. August–September.

**8. *S. wolffianum*** (Fedde) Mukherjee & Constance; *Acronema wolffianum* Fedde in Wolff. Fig. 50g–i.

Slender erect herb; stem single or little-branched, 5–28cm tall; rhizome short, to 20 × 8mm, occasionally bulbous but usually with a thickened root extending from it. Lower leaves to 20 × 4cm, 2-pinnate or -ternate; leaflets pinnatifid, very finely divided, the ultimate segments linear-acute, 1–3 × 0.2–0.5mm; petiole bases with sheath 5–9mm wide, mostly auriculate at apex (most evident in the middle leaves). Umbels 1–3(–5) per plant, 2.5–5cm across, 6–18-rayed; rays 1–3cm, unequal; bracts 0–2, linear-subulate, to 7mm, falling early; umbellules c 1cm across, 7–15-flowered; pedicels 1.5–3.5mm, unequal; bracteoles 3–6, linear-subulate, 1–2mm. Calyx teeth obsolete. Petals obovate, c 2 × 1mm white. Stylopodium purple, domed; styles reflexed in fruit. Fruits oblong to oblong-ovoid, 1.5–2.4 × 0.75–1.5mm.

**Bhutan:** C – Thimphu district (Dongsho La to Pajoding, Somana, Thimphu) and Tongsa district (Pele La); N – Upper Mo Chu district (Jari La, Laya and Pari La) and Upper Bumthang Chu district (Kopub); **Sikkim:** Belop, Zongri, Kang La, Nathong, Tackey King; **Chumbi:** Kupchee. Open areas in marshy meadows, stony areas, alpine turf, clearings in Fir forests, 3050–4600m. August–September.

## 24. PIMPINELLA L.

Biennial or perennial herbs with fusiform roots or thickened tap-root. Leaves simple, ternate or 1–3-pinnate; petioles narrowly winged at base. Umbels compound, bracts few or absent, bracteoles linear sometimes absent. Calyx teeth obsolete (except *P. sikkimensis*). Petals ovate or oblong, acute, incurved at apex

(except *P. tongloensis*). Stylopodium domed, styles spreading in fruit. Fruits ovoid or ellipsoid, slightly compressed laterally, mericarps somewhat obscurely 5-ribbed, ornamented with papillae or glabrous.

1. Leaves entire, ternate, biternate or simply pinnate ..... 2  
+ Leaves 2–3 × pinnately divided ..... 5
2. Stems up to 45cm; leaves mostly basal and simple, densely pubescent, uppermost often pinnatisect; bracteoles more than 4; fruits granular  
**1. *P. tibetica***  
+ Stems usually more than 45cm; leaves mostly cauline and compound, moderately pubescent to almost glabrous, uppermost rarely pinnatisect; bracteoles usually less than 4; fruits papillate or smooth ..... 3
3. Leaves glabrous excepting main veins; petals acute, flat; fruits ovoid, attenuate to apex, smooth ..... **2. *P. tongloensis***  
+ Leaves pubescent; petals with incurved apex; fruits papillate ..... 4
4. Leaves mostly pinnate, margins crenate-serrate; umbels less than 9-rayed,  
**3. *P. urceolata***  
+ Leaves mostly ternate, margin serrate; umbels more than (10-)15-rayed, rays stouter ..... **4. *P. diversifolia***
5. Ultimate leaf segments ovate-oblong, setulose-serrate .... **5. *P. sikkimensis***  
+ Ultimate leaf segments linear-lanceolate, entire or 3-fid ..... **6. *P. wallichii***

### 1. *P. tibetica* Wolff

Small, little branched, erect herb (6–)10–45cm tall; stem sparsely white pubescent below, denser above; inflorescence branches densely pubescent. Leaves dimorphic, mostly basal and simple, lower cauline leaves ternate, with similarly broad ovate leaflets, uppermost leaves often pinnatisect into linear-oblong or oblong-triangular acute segments; leaflets of lower leaves 1.1–4.2 × 1–3.7cm, apex acute, base cordate to truncate, margin crenate, densely pubescent below, slightly less so above; petioles 1.2–14cm, petiolules 0.1–1.5cm. Umbels mainly terminal, 3–5cm across, (8-)10–14-rayed; rays 13–23mm; bracts 1–5, linear, 6–16mm long; umbellules 6–8mm across, 10–18-flowered; pedicels 0.5–2.5mm; bracteoles 4–5, 2.5–4mm long, linear. Petals white or dark purple, c 1 × 0.5mm. Fruits c 1.7 × 1.5mm, ovoid-ellipsoid, densely covered in a granular minute papillae.

**Bhutan:** C – Ha district (Tare La) and Thimphu district (Barshong, Paro Valley, Pajoding, Shodug, Taka La); N – Upper Mo Chu district (Laya), Upper Pho Chu district (Lunana), Upper Bumthang Chu district (Tsampa) and Upper Kulong Chu district (Pangte La); **Sikkim:** Tangkar La; **Chumbi:** Champitang, Chumbi, Rinchingong, Yak La, Yatung. Open dry alpine turf, amongst shrubs, 3000–4100m. June–July(–August).

Many Bhutanese specimens have been misidentified as the southern Indian *P. candolleana* Wight & Arnott.

**2. *P. tongloensis*** Mukherjee; *P. diversifolia* DC. var. *alpina* Clarke

Erect plant (20–)40–60cm tall; stem often glabrous or sparsely pubescent with a line of white hairs; inflorescence branches densely strigose with white hairs. Leaves mainly trifoliolate (basal and uppermost sometimes simple), leaflets 1–6 × 0.8–5cm, triangular-ovate, apex acute, margin serrate (to biserrate), base (obtuse to) truncate to cordate, usually glabrous but strigose on the main veins above (sometimes also below); petiole 1–8cm, glabrous or with a line of hairs; petiolules 0.1–2cm. Umbels 3.5–5cm across, (6–)8–12-rayed; rays 8–19mm, unequal; bracts 0–1, lanceolate to 5mm, falling early; umbellules c 7mm across, 8–18-flowered; pedicels 0.2–6mm, unequal; bracteoles 1–4, linear-lanceolate, 1.5–2.5mm. Petals 1–1.5 × 0.6mm, ovate-acute, flat, white. Anthers white to suffused purple. Fruits 1.8–2.2 × 1.5–1.75, ovoid, attenuate to the tip, smooth.

**Darjeeling:** Labha, Rissisum, Tanglu. Dry areas in mixed forests, 2500–2800m. August(–September).

**3. *P. urceolata*** Banerji emend. Mukherjee. Fig. 50j–l.

Erect to ascending wiry perennial or biennial 45–100cm tall; stem slender, much branched, glabrous to moderately pubescent with white strigose hairs, inflorescence branches densely white pubescent. Leaves pinnate with 2–3 pairs of pinnae; leaflets of lower leaves ovate, 1.5–8 × 1–3.5cm, apex acuminate, margin crenate-serrate, base truncate to obtuse, moderately pubescent with white septate hairs below, less so above; petioles 3–7cm, petiolules to 2.5cm; upper leaves smaller (but still pinnate with 2 leaflets), leaflets much narrower to lanceolate (or linear), sometimes pinnately lobed, apex acuminate, margin serrate, base cuneate. Umbels 2–3.5cm across, 5–7(–8)-rayed; rays 0.6–2cm long, filiform, unequal; bracts 0–2, to 3mm, linear-subulate; umbellules c 5mm across, 7–11-flowered; pedicels short, 0.5–2.2mm (to 5mm in fruit), unequal; bracteoles (0–)1–4, linear-subulate, 0.75–2.5mm. Petals white to cream (rarely tinged purple), c 0.7 × 0.5mm, hairy on the reverse. Fruits c 1.5 × 1.3mm, ovoid-subglobose, covered with rounded to pointed papillae.

**Bhutan:** S – Chukka district (Chima Kothi); C – Thimphu district (Gida, Motithang, Simtokha Dzong, Thimphu), Punakha district (Chusom) and Tongsa district (Shamgong, Tashiling); N – Upper Mo Chu district (Mo Chu); **Darjeeling:** Rambhi, Simshibong; **Sikkim:** Chunthang, Hee, Heethlo. Open areas, dry grasslands and arid lands, 900–2600m. August–September(–October).

**4. *P. diversifolia*** DC.

Erect slender-stemmed perennial, laxly corymbosely branched above, 0.7–1m or more tall; stem variably pubescent but denser at base and below umbels; inflorescence branches densely pubescent. Leaves mainly trifoliolate (or lower leaves pinnate with 2 pairs of lateral leaflets); leaflets 1.5–7.5 × 1.3–5.5cm,

ovate, apex acute to acuminate, base cordate to truncate (-obtuse), margin serrate or biserrate, moderately pubescent below with jointed white hairs, less hairy above; petioles 1–10cm, petiolules 0.3–6cm, both moderate to sparsely pubescent. Inflorescences borne at top of plant, umbels 3–5cm across, (10–)15–24-rayed; rays 0.6–2cm, unequal; bracts 1, lanceolate sometimes with a leaf-like expanded apex, 0.5–1cm long; umbellules c 1.2cm across, 15–26-flowered; pedicels 0.5–8mm, very unequal; bracteoles 3–7, 1.5–5mm, linear, subulate. Petals cream to purple fringed cream, c 0.8 × 0.6mm, with a few white hairs on the reverse. Anthers dark purple, filaments cream. Fruits ovoid to subglobose, 1.2–1.6 × 1.2–1.6mm, densely covered in rounded papillae.

var. **diversifolia**

Plant without stolons; purple jointed hairs scattered but not dense; yielding good fruit.

**Bhutan:** C – Mongar (Dong La) district; **Sikkim:** Zongri, Lachung. 2700–4200m. August.

Apparently the less common variety in Bhutan.

var. **stolonifera** Handel-Mazzetti

Lower parts of stem densely to moderately pubescent with jointed long purple(-brown) hairs, mixed with shorter white simple hairs and becoming glabrous above; long, slender, flexuose stolons arising from the axils of the lower leaves, rooting and shooting at nodes (with simple leaves), sparsely hairy. Fruit set often rather poor.

**Bhutan:** S – Chukka (Bunakha, Bunakha to Chima Kothi) district; C – Thimphu (Dochong La, Motithang, Phajoding, Thimphu) district; **Darjeeling:** Darjeeling, Tanglu; **Sikkim:** Chija Bhanjang, Zongri, Tumbok. Moist mixed woodland, shaded pathsides, banks, etc., 2000–3500m. July–September.

**5. P. sikkimensis** Clarke; *Chaerophyllum reflexum* var. *orientalis* Clarke, *C. orientalis* (Clarke) Mukherjee non Boissier

Stems 30–120cm, erect to scandent, glabrous to scabrescent; stem and inflorescence branches sometimes purple-spotted. Leaves triangular-ovate in outline, to 25 × 17cm (including petiole), 2-pinnate; leaflets ovate-oblong, 5–18 × 3–12mm, setulose-serrate. Umbels c 2–4cm across in flower, (5–)9–15-rayed; rays 0.5–1.5cm, elongating and thickening to 7.5cm in fruit; bracts 1–6(–9), linear, 5–6mm, persistent; umbellules c 5mm across, 14–22-flowered, flowers male or hermaphrodite (only 5–12 fruiting); pedicels 1.5–4mm, elongating and thickening to 18mm in fruit; bracteoles 5–7, linear-subulate, to 2mm, persistent. Calyx teeth prominent, linear-lanceolate, 0.2–0.5mm, reflexed in fruit. Petals white to greenish-white. Infructescence lax with long rays and pedicels, umbellules with distinctive persistent remains of male flowers at base; fruits ovoid to ovoid-oblong, c 3–3.2 × 1.75–2mm, smooth, primary ridges moderately prominent.

**Darjeeling:** Ghumpahar, Rimbi Chhu; **Sikkim:** Heethlo, Lusing. Mixed forest, 1800–2500. August.

An immature Bhutanese specimen (Upper Kulong Chu district, Shingbe La, 10,000ft., Ludlow, Sherriff and Hicks, No 20815, 5 July 1949, **BM!**) may be this species.

**6. *P. wallichii* Clarke non *P. wallichiana* (Hohenacker) Gandhi**

Slender plant, 40–125cm, essentially glabrous apart from some minute scabrescence on the rays; stems erect, loosely corymose-branched. Leaves ovate in outline, to 25 × 22cm (including petiole), 3-pinnate or -pinnatifid, finely divided into linear-lanceolate ultimate segments, 1–2 × 2–6mm, often 3-lobed at apex, tips acute, margins scaberulous. Umbels numerous, terminal and lateral, 1.5–4cm across, 6–14-rayed; rays 0.8–2.5cm, somewhat unequal; bracts 0–1(–2), linear-subulate, to 5mm, falling early; umbellules 3–5mm across, 8–15-flowered; pedicels short, 0.5–5mm; bracteoles 1–3, linear-subulate, 1–5mm, as long as or overtopping the flowers, margins scaberulous. Petals white. Infructescence crowded; fruits ovoid to subglobose, 1.5–2 × 1.5–2mm, primary ribs prominent (pale when mature), the 2–3 ridges of vittae per furrow evident.

**Sikkim:** Hee, Heethlo, Kalej Khola. 1200–1850m. September.

## 25. TONGOLOA Wolff

Glabrous, erect, little-branched perennials from a woody tap-root. Leaves basal and cauline, broadly triangular in outline, finely 2–3-pinnate or -pinnatisect; petioles slender, tapering to a somewhat broad basal sheath (broadest in upper leaves). Umbels compound, rather lax, mainly terminal with a few smaller secondary laterals; bracts absent or few; bracteoles 3–15, linear-subulate. Calyx teeth minute to obsolete. Petals white to purple, obovate with rounded apex and distinct claw; flowers weakly irregular. Stylopodium low, domed; styles short, erect to spreading. Fruits scarcely compressed, ovate-oblong to subglobose, cordate at base, weakly 4–5 ribbed.

A poorly defined genus requiring further work. See also *Pimpinella*, *Sinocarum* and *Vicatia*.

1. Stems slender; ultimate segments of leaves oblong-acute, more than 1mm broad ..... **1. *T. gracilis***
- + Stems rather thicker; ultimate segments of leaves filiform-mucronate, less than 0.5mm broad ..... **2. *T. loloensis***

**1. *T. gracilis* Wolff; *Pimpinella tilia* Hiroe.**

Slender-stemmed herb (5–)13–40(–75)cm, from a slender tap-root covered in papery leaf remains at crown. Leaves 2–3-pinnate, to 17 × 5(–10)cm (including petiole); leaflets to 10 × 8mm, ovate in outline, 3–5-lobed; ultimate segments 2–6 × 1–1.5mm, oblong, acute; petioles of lower leaves long and slender, to

15cm (or more), sheathing base to 5mm broad. Umbels 2.5–4cm across, 5–7 (or more)-rayed on peduncles 4–10cm long; rays 0.3–3cm, almost equal; bracts solitary, lanceolate to ovate-lanceolate, 4–10mm long; umbellules 5–13mm across, (7–)10–15-flowered; pedicels 1.5–4mm; bracteoles 3–7, to 9mm, linear-subulate, often as long as or exceeding the flowers, margins often minutely scaberulous. Calyx teeth obsolete to minute-triangular. Petals dark purple to tipped white, c  $2 \times 1$ mm. Stylopodium dark purple with wavy margin, styles pale green, erect. Fruits (immature) rather oblong with conspicuous ribs.

**Bhutan:** N – Upper Mo Chu district (Laya). Alpine turf amongst low scrub, 4080m. September.

**2. *T. loloensis*** (Franchet) Wolff; *Carum loloense* Franchet, *Pimpinella loloensis* (Franchet) Boissieu, *Trachydium loloensis* (Franchet) Hiroe.

Erect herb 7–30 (or more) cm tall, from a short woody tap-root. Leaves 3–18  $\times$  1.5–4cm (including petiole), 2–3-pinnate or -pinnatifid into long linear-subulate segments; ultimate segments 2–8  $\times$  0.3–0.5mm, filiform with a mucronate tip; petiole with moderately sheathing base to 8mm broad in upper leaves. Umbels 3–8cm across, 8–15-rayed; rays 1–5, subequal; bracts 0–3, linear-subulate, to 5mm, falling early; umbellules 6–12mm across, 14–25-flowered; bracteoles numerous, (4–)8–15, subulate, to 6mm long, about equalling the flowers. Calyx teeth obsolete. Petals white or flushed pink, c  $1.5 \times 1$ mm. Stylopodium flattened, dark purple, domed; styles green, erect to divergent. Fruits ovoid, c  $2.5 \times 2$ mm, ribs moderately prominent.

**Bhutan:** S – Sankosh district (Daga La); C – Thimphu district (Taktsang Monastery). Alpine turf and amongst rocks, 3150–4100m. September–October.

## 26. ACRONEMA Edgeworth

Slender to robust, largely glabrous, perennial herbs; roots tuberous or rhizomatous. Leaves biternate or pinnately divided; upper stem leaves often with narrower segments than those below, glabrous or only the veins above or margins with hairs, often paler below; base of petiole narrowly sheathing the stem. Umbels compound, bracts and bracteoles absent or few, linear or lanceolate, often falling early; umbellules small. Calyx teeth obsolete. Petals ovate to lanceolate with a characteristic acute to acuminate or filiform apex. Stylopodium usually flattened or domed; styles erect to spreading. Fruits narrowly ovoid or subglobose and abruptly narrowed at apex, mericarps thinly 5-ribbed.

A critical genus of the Sino-Himalayan region, with several erroneous records based on misidentifications; literature records for *A. handelii* Wolff, *A. muscicolum* (Handel-Mazzetti) Handel-Mazzetti and *A. paniculatum* (Franchet) Wolff have not been substantiated. For blunter-petalled specimens compare with *Sinocarum*, which is often characterised by expanded petiole sheaths, a stouter rhizome and somewhat irregular flowers.

144. UMBELLIFERAE

1. Rootstock a thick elongate rhizome or tap-root; umbels usually many-rayed, rays more than 8; umbellules many-flowered, pedicels, more than 9, minutely puberulent; petals elliptic to obovate, apex acute ... **1. A. bellum**
  - + Rootstock a globose tuber or slender rhizome; umbels with fewer (less than 8) rays, and fewer pedicels (less than 8) both usually glabrous; petals ovate-acuminate to lanceolate with a filiform tip ..... 2
2. Leaflets with margin, main and secondary veins conspicuously scaberulous above; petals ovate (more than 0.7mm wide) with an acuminate tip; fruits subglobose ..... **2. A. nervosum**
  - + Leaflets glabrous or minutely scaberulous on margins and midrib only; petals lanceolate (more than 0.7mm wide) with tips acuminate to filiform; fruits narrow ovoid or subglobose ..... 3
3. Plants usually more than 25cm tall; petals creamy white with long densely pubescent filiform tips 2–3 × length of blade; mature fruits subglobose ..... **3. A. hookeri**
  - + Plants usually less than 25cm tall; petals white to purplish, acute to acuminate, but tips less than 2 × blade and at most minutely papillate; fruits subglobose to narrowly ovoid ..... 4
4. Plants usually less than 5cm tall; petals linear-subulate; fruits subglobose ..... **4. A. sichuanense**
  - + Plants more than 5cm tall; petals lanceolate; fruits ovoid-globose to narrowly ovoid ..... 5
5. Petals purplish with narrowly acuminate or shortly filiform, minutely papillate tips; fruits narrowly ovoid ..... **5. A. tenerum**
  - + Petals acute, glabrous; fruits ovoid-globose ..... **6. A. pseudotenerum**

**1. A. bellum** (Clarke) Mukherjee; *Pimpinella bella* Clarke

Stems 15–60(–90)cm tall, erect from a thickened tap-root or elongate rhizome; rhizome 1.5–3.5 × 0.6–1.5cm. Leaves often tufted at the base and cauline, pinnate, whitish or pale beneath, glabrous; lower leaves 6–25(–50) × 3–8(–13)cm (including petiole), sheathing base c 3mm broad (to 6mm in upper leaves); leaflets 0.5–5(–15) × 0.5–1.7(–3)cm, pinnate, pinnatisect or ternately divided into oblong to rounded segments; segments 3–7mm wide in lower leaves, margins serrate in apical half. Umbels terminal and lateral, 8–16-rayed, (2.5–)4–7(–13)cm across; rays elongating in fruit, 2.5–6cm; bracts absent or solitary, c 2.5cm, linear-lanceolate; umbellules 8–19-flowered, 1–2cm across; pedicels (4–)6–10mm, minutely papillose puberulent; bracteoles 0–5, linear c 6mm. Petals white, 1.5–2.5 × 0.6–1mm, elliptic to obovate, apex acute, distinctly clawed at base. Stylopodium purple-brown somewhat domed, styles erect to divergent. Fruits 2–3 × 0.75–1mm, narrowly ovoid.



**Bhutan:** C – Thimphu district (Daga La, Hongstu, Talukah La to Ginnekah, Thimphu); N – Upper Mo Chu district (Gangyuel); **Darjeeling:** Sandakphu, Singalelah; **Sikkim:** Bikbari, Kongra La, Lachen, Meguthang, Phalut, Prek Chhu, Thanggu, Thangkarphumoo, Thangshing. Among rocks and in turf, stream and pathsides in Fir or Cool Broad-leaved forests and *Rhododendron* scrub, 3000–4400m. July–September(–October).

## 2. *A. nervosum* Wolff

Small plants with a slender stem from a small rhizome; stems 12–30cm, erect, unbranched, the underground part very thin and easily detached from the rhizome; rhizome globose to oblong, 5–25 × 3–7mm. Leaves few, 1–2 basal and 1–2 cauline, ternate or pinnate, to 16 × 3cm (including the petiole); leaflets of basal leaves 0.5–2.5 × 0.4–1.7cm, ovate-elliptic, ternately lobed, sometimes deeply so, margin often serrately toothed in upper half; margins, midribs and secondary veins scaberulous above otherwise glabrous; upper leaves with narrower and more deeply cut segments; sheathing base of upper leaves very narrow, 1–2mm broad, almost absent in lower leaves. Primary umbel solitary and terminal, usually with just 1 smaller lateral secondary umbel close below; umbels 9–15mm across, 3–5-rayed; rays 3–6mm, elongating in fruit, slender and glabrous; bracts absent; umbellules 2–3mm across, 3–7-flowered; pedicels 2–3mm long, glabrous; bracteoles 2–3, linear, 1–2mm. Petals white to purple, 1.5–2 × 0.7–1mm, elliptic-ovate with a long acuminate apex, abruptly clawed at base, apex sometimes minutely papillose. Stylopodium cream to dark purple, flattened; styles erect. Fruits ovoid-globose, c 2 × 1.8mm.

**Bhutan:** C – Bumthang district (Dhur Chu); N – Upper Kulong Chu district (Me La) district; **Darjeeling?:** Jaktok; **Sikkim:** Tsomgo. Open turf and amongst moss on rocks in Fir forests, 3000–3700m. July–August

Endemic to the East Himalaya.

## 3. *A. hookeri* (Clarke) Wolff; *Pimpinella hookeri* Clarke

A rather robust erect, branching perennial (15–)25–110cm tall, from a small globose to oblong tuber; tuber to 6–12 × 4–8mm. Lower leaves pinnate then pinnate, or ternate, or 2-ternate; leaflets ovate, to 3 × 2cm, serrate to deeply lobed, glabrous or margins and main veins above minutely papillose; ultimate segments elliptic-ovate, obtuse-mucronate at the apex; upper leaves with fewer, narrower segments; sheathing base of leaves narrow, 1–2mm broad. Umbels usually concentrated in upper half of stem, forming a large lax group; umbels (2–)3–6-rayed; rays 8–18mm, slender; bracts and bracteoles 0–1, falling early, linear, c 2mm; umbellules 3–5-flowered; pedicels 3–13(–17)mm long, slender and rather weak. Petals creamy-white (occasionally purplish at base), lanceolate, to 4 × 0.3mm, with a long densely puberulent cuneate-filiform tip more than 2 × blade. Stylopodium flat-domed. Fruits ovoid to subglobose, c 1.5 × 1.2mm.

**Bhutan:** C – Thimphu district (Cheri, Dotena, Talukah La) and Bumthang district (Bumthang); N – Upper Kuru Chu district (Julu); **Sikkim:** Chungthang.

Lachen, Lachung, Samdong, Tankra; **Chumbi**: Jork, Punkabeeseemoo. On the ground in Spruce, mixed broad-leaved and *Rhododendron* forest, 2150–3650m. July–August.

Records from the area of the closely related *A. paniculatum* (Franchet) Wolff have proved to be referable to this species.

var. **graminifolium** (W.W.Smith) Wolff; *Pimpinella hookeri* Clarke var. *graminifolia* W.W.Smith, *Acronema graminifolium* (W.W.Smith) Liou & Shan.

Differs from the typical var. *hookeri* in having all the leaves pinnatisect into linear-lanceolate segments (1.5–)4–7 × 0.2–0.35cm.

**Bhutan**: C – Thimphu district (Barshong to Dolam Kencho, Talukah La); **Sikkim**: Samdong, Yakche (268) and Zemu Valley (268); **Chumbi**: Punkabeeseemoo, Rinchengang. Habitat as for var. *hookeri*, 2700–3600m. July–August

This narrow-leaved variety has been reported by several botanists to grow inter-mixed with the typical form.

#### 4. *A. sichuanense* Liou & Shan

A small high-altitude herb 1.5–5cm tall, from a small ovoid tuber up to 5mm thick. Leaves bi-ternate or ternate; leaflets ovate-elliptic, to 10 × 5mm, ternately incised or divided, glabrous; segments elliptic to narrowly so, linear in upper leaves, apex acute; sheathing petiole base rather broad, to 3mm wide. Umbels mainly solitary and terminal, 3–6-rayed; rays 1–2cm, glabrous; bracts absent; umbelules 4–10-flowered; bracteoles 2–4, linear, 0.5–2mm; pedicels 1–4mm, unequal, minutely scaberulous. Petals dark purple, linear-subulate, 1–2 × 0.2mm. Stylopodium dark purple, flattened; styles spreading to recurved. Fruits globose, c 1.5 × 1.5mm.

**Bhutan**: N – Upper Mo Chu district (Laya); **Sikkim**: Zemu/Temu La. Alpine turf, 3900–4900m. August–September.

The above description is based on Bhutanese specimens which are smaller than the Chinese. Chinese material is typically taller, 15–30cm, with respectively larger leaves.

#### 5. *A. tenerum* (DC.) Edgeworth; *Helosciadium tenerum* DC., *Pimpinella tenera* (DC.) Clarke, *Pimpinella tenera* var. *dissecta* Clarke. Fig. 50m–o.

Stems (5–)8–25(–35)cm, slender and erect, from a small globose tuber 4–6mm across. Leaves to 7 × 2cm (including petiole), pinnate with 3–7 ovate leaflets (upper stem leaves often ternate); leaflets ovate, entire to deeply ternately lobed, 5–13 × 4–9mm, acute, base truncate or narrowed, margins serrate, minutely papillose on margins and veins above; ultimate lobes ovate-elliptic; sheathing base of petiole rather narrow, c 1.5mm broad. Umbels 2–4(–6)-rayed, laxly branched to 3cm across, lateral umbels well developed in leaf axils along the whole stem; rays 6–13mm; bracts 0–1, lanceolate-linear, c 2mm, falling early; umbellules c 8mm across, laxly 3–4-flowered; pedicels 2–5mm, glabrous; bracteoles 3–5, narrowly ovate, 1–1.5mm. Petals purplish, narrowly lanceolate,

1–2mm, with a long acuminate to filiform apex minutely papillose at the tip. Stylopodium cream-green, flat-domed; styles spreading. Fruits narrowly ovoid, c 1.5 × 1mm.

**Bhutan:** C – Thimphu district (Darkey Pang Tso, Taluka La) and Bumthang district (Rudo La); **Darjeeling:** Singalelah; **Sikkim:** Zongri, Lachen, Lachung, Samdong. Often epiphytic in moss and leaf mould in Fir forest, 3050–3800m. July–August.

Sometimes misidentified as *A. muscicolum* (Handel-Mazzetti) Handel-Mazzetti (282).

#### 6. *A. pseudotenerum* Mukherjee

Very slender-stemmed herb; stems unbranched, erect, to 15cm tall, from a matted network of slender rhizomes; rhizomes to 30 × 2mm. Leaves basal and 1–3 cauline, pinnate with 5 leaflets or ternate; leaflets deeply ternately lobed to ternate; segments obovate to linear-lanceolate (uppermost leaves linear-subulate), 2–5 × 0.5–4mm, glabrous, wider leaflets toothed or lobed in upper half; sheathing bases rather conspicuous, 2.5–4mm broad to 10mm long in upper leaves. Primary umbel solitary and terminal, usually with just 1 smaller lateral secondary umbel close below; umbels to 3cm across, 4–6-rayed; rays 7–15mm, elongating in fruit, slender and glabrous; bracts absent; umbellules c 1cm across, 6–9-flowered; pedicels 2–3.5mm long, glabrous or minutely papillate; bracteoles 0–3, linear, to 3mm. Petals white or suffused purple, narrowly elliptic to lanceolate, 1.3–2.7 × 0.5mm, with an acuminate apex, clawed at base. Stylopodium purplish, flattened; styles erect to spreading. Fruits ovoid-globose, c 1 × 1mm.

**Sikkim:** Yume Samdong (268). Moss-covered boulders and logs in Fir and *Rhododendron* forest, 4200–5000m. June–August.

### 27. PTERNOPETALUM Franchet

Bhutanese representatives are essentially glabrous, slender little-branched annuals with short fusiform tap-roots. Leaves biternate or pinnatisect; petioles slender with ovate sheathing bases. Umbels compound, mainly terminal; rays somewhat unequal; bracts absent; umbellules 2–3-flowered; pedicels very short and conspicuously unequal; bracteoles present, linear. Calyx teeth minute, triangular. Petals white to purplish, ovate, acute spreading or incurved. Stylopodium domed. Fruits ovoid-ellipsoid, slightly compressed laterally, mericarps weakly ribbed, smooth.

1. Leaves biternate; leaflets serrate at apex; rays not filiform .. **1. P. radiatum**  
 + Leaves pinnate with (1–)2–4 pairs of leaflets; leaflets 3-lobed, often deeply so; rays filiform ..... **2. P. subalpinum**

**1. *P. radiatum*** (W.W.Smith) Mukherjee; *Pimpinella radiata* W.W.Smith, *Acronema radiatum* (W.W.Smith) Wolff, *Pternopetalum delicatulum* (Wolff) Handel-Mazzetti. Fig. 51l&m.

Stems 12–55cm. Leaves 2–8 × 1.5–4.5cm (including petiole), triangular-ovate in outline, biternate; ultimate segments 5–16 × 5–10(–15)mm, ovate-elliptic, apex acute, base cuneate, margin serrate in upper half, glabrous except margins and main veins with sparse stiff hairs; upper stem leaves narrower and more deeply incised; petioles 1.5–5cm. Umbels c 3cm across, mainly terminal with 0–2 smaller laterals, (5–)8–12(–14)-rayed; rays 0.5–2.5cm; umbellules 2–3-flowered; pedicels 0–2mm; bracteoles 1–2, 1–2mm. Petals greenish-white sometimes purple-margined. Stylopodium green; styles purple, recurved. Fruits 1.5–2 × 1.3–1.5mm.

**Bhutan:** C – Bumthang district (Lami Gompa) and Thimphu district (Dotena to Barshong, Hongsto); N – Upper Kuru Chu district (Julu); **Sikkim:** Yumthang. Damp shaded banks in Hemlock and Fir forests, 3100–3400m. June–July.

**2. *P. subalpinum*** Handel-Mazzetti

Delicate unbranched herb, 5–10(–20)cm tall. Leaves almost entirely basal, 3–8 × 0.6–1.5cm (including petiole), pinnate with (1–)2–4 pairs of leaflets; leaflets broadly ovate, 2.5–7 × 1.5–8mm, acutely 3-lobed, often deeply so, almost glabrous; petiole 3–5cm. Umbels entirely terminal, 5–10-rayed; rays 1.5–3.5cm, filiform, unequal; umbellules mostly 2-flowered; pedicels 0.2–2mm; bracteoles 2, 0.75–1.5mm. Petals white to purplish. Styles purple. Fruits c 1.5 × 0.75mm.

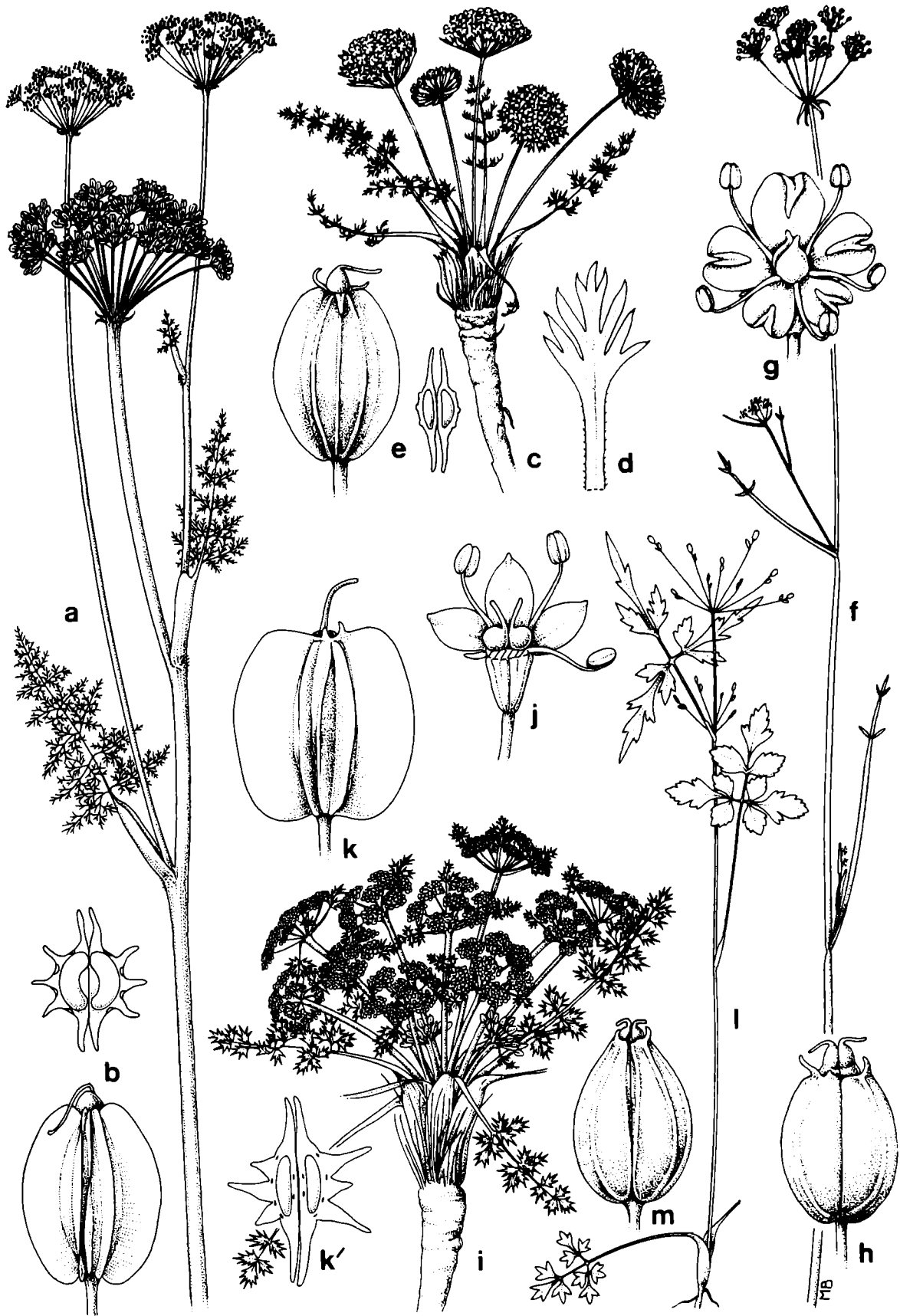
**Bhutan:** C – Tongsa district (Yuto La); N – Upper Mo Chu district (Kohina) and Upper Kulong Chu district (Lao); **Sikkim:** Tsoka to Jamlinghang. Shaded mossy banks and rocks in Fir forests, 3000–3550m. June–July.

Literature references to *P. tanakae* (Franchet & Savatier) Handel-Mazzetti occurring in Bhutan are based on a misidentified specimen of *P. subalpinum*.

## 28. OENANTHE L.

Rhizomatous or stoloniferous marshland perennials. Leaves 1–4 × pinnately divided, ultimate segments medium-sized or minute. Umbels compound; bracts absent or few; bracteoles several, linear. Calyx teeth small. Petals obovate, with an acute inflexed tip. Stylopodium conical, often hidden by calyx. Fruits ovoid-ellipsoid, glabrous, mericarps unequally ribbed, lateral pair of ribs broader and corky.

FIG. 51. **Umbelliferae.** a–b, *Selinum candollei*: a, habit (× 1/3); b, fruit and cross-section (× 4). c–e, *Cortia depressa*: c, habit (× 2/3); d, bracteole (× 4); e, fruit and cross-section (× 4). f–h, *Oenanthe hookeri*: f, habit (× 1/2); g, flower (× 8); h, immature fruit (× 8). i–k, *Cortiella hookeri*: i, habit (× 1/2); j, flower with 2 sepals, 2 petals and 2 stamens removed (× 6); k and k', fruit and cross-section (× 4). l–m, *Pternopetalum radiatum*: l, habit (× 2/3); m, fruit (× 10). Drawn by M. Bates.



1. Leaves simple or sparingly once-pinnate; rachis grass-like, segments filiform  
1. *O. hookeri*  
 + Leaves biternate or 2–4 × pinnately divided; segments otherwise ..... 2
2. Leaves biternate or bipinnate; segments medium-sized, elliptic  
2. *O. javanica*  
 + Leaves 3–4 × pinnately divided; ultimate segments numerous, minute, linear ..... 3. *O. thomsonii*

**1. *O. hookeri* Clarke.** Fig. 51f–h.

Stems fleshy, weakly erect, to 100cm long. Leaves 4–20cm, simple or sparingly once-pinnate; rachis grass-like, flattened, 2–3mm broad; segments up to 3 pairs, linear, 2–25 × 0.5mm, glabrous. Umbels rather few, 3–4cm across, 6–9-rayed; rays 1.5–3cm; bracteoles 2–3mm; umbellules 0.75–1cm across. Calyx teeth c 1mm. Petals white, sometimes tinged pink, obovate-spathulate, 1–1.25mm. Styles short, c 1mm. Fruits narrowly ellipsoid, c 2.5 × 1.5mm.

**Bhutan:** C – Ha district (Ha (117)), Thimphu district (Paro (117)), Sharna to Choidi Ponkey, Taba, Tashi Cho Dzong, Thimphu) and Bumthang district (Dhur Valley). Locally abundant in wet meadows and marshes, 2200–3000m. July–September.

**2. *O. javanica* (Blume) DC.; *O. stolonifera* (Roxb.) Clarke.**

A robust stoloniferous herb with erect stems 60–120cm, often rooting at lower nodes. Leaves up to 30cm long, biternate or bipinnate; segments ovate-acute, 2–5 × 0.75–2.5cm, base cuneate, margin serrate. Umbels large, 5–8cm across, 16–20-rayed; rays 2–3cm long; bracteoles c 4mm. Calyx teeth 0.5–1.5mm. Petals white or greenish-yellow, c 1.5mm. Styles as long as calyx teeth. Fruits ellipsoid, c 2.5 × 1.5mm.

**Bhutan:** S – Deothang district (Narfong (117)), C – Tongsa district (Tongsa) and Tashigang district (Tashigang); **Darjeeling:** Mahanadi (terai). Marshy ground, roadside ditches, 150–2600m. April–October.

**3. *O. thomsonii* Clarke**

A weak diffuse herb with stems 20–80cm. Leaves 3–15(–30)cm long, finely 3–4 × pinnately divaricately divided, ultimate segments linear, c 1.5 × 0.25mm. Umbels 3–5.5cm across, 3–9-rayed; peduncle 1–7cm; rays 1–2.5cm; bracteoles 2–3mm; umbellules 6–10mm across; pedicels 2–7mm. Calyx teeth 0.5–1mm. Petals white, 1.25–1.5mm long. Styles 0.75–1mm. Fruits ovoid, 2.5–3 × 2mm.

**Bhutan:** S – Chukka district (Gedu), C – Tongsa district (Chendebi) and Mongar district (Namning, Saling); **Darjeeling:** widespread; **Sikkim:** widespread. A locally common plant of marshy ground in wet broad leaved forest, roadside ditches, etc., 1000–2500m. April–August.

## 29. FOENICULUM Miller

Erect aromatic (anise-scented) perennial herbs. Leaves 2–4 × pinnately divided, ultimate segments linear, elongated; petiole broadly sheathing at base. Umbels compound, bracts and bracteoles absent. Calyx teeth obsolete. Petals yellow, ovate, inflexed at apex. Fruits ovoid-oblong to oblong; mericarps rounded dorsally, inner face flat or concave, ribs prominent, almost equal, furrows between ribs dark.

### 1. *F. vulgare* Miller. Eng: *Fennel*.

Stems up to 2m (or more), glaucous, clump-forming. Leaves up to 15cm, triangular-ovate in outline; ultimate segments 5–60 × 0.5mm; petiole 7–14cm. Umbels 15–40-rayed; rays 1–7cm, unequal; umbellules c 1.5cm across, 12–25-flowered; pedicels 2–10mm when mature. Petals 1.5–2 × 1.25mm. Fruits 4–10.5 × 1.5–2.5mm.

**Bhutan:** C – Tashigang district (Jhorsingang, 117). December–February.

Probably escaped from cultivation; leaves eaten as a vegetable and fruits used as a spice.

## 30. CORTIELLA Norman

Acaulous or shortly stemmed perennials, usually forming compact flat rosettes closely adpressed to the soil surface; vertical tap-root long and stout, crowns surrounded by fibrous leaf remains; leaf rachis and main veins, petioles and inflorescence branches stout, densely puberulent to almost glabrous. Leaves ovate-oblong in outline, pinnate; pinnae usually not disjunct on rachis, 2 × pinnatifid, ultimate segments linear-lanceolate. Umbels compound, main inflorescence usually sessile, laterals often stalked; bracts leaf-like; bracteoles linear-lanceolate or pinnatifid with linear segments. Calyx teeth linear-lanceolate, unequal. Petals narrowly obovate, base acuminate, apex acute, inflexed. Stylopodium domed, styles long, spreading in fruit. Fruits rectangular-ellipsoid to suborbicular in outline, truncate or more usually cordate at ends, mericarps dorsally compressed, white with 4 dark brown lines of vittae alternating with the 3 dorsal ribs; lateral ribs broadly winged, some of the dorsal ribs equally broadly winged or wings reduced to abortive structures at base of fruit; whole fruit characteristically asymmetric with one mericarp having the 2 outer dorsal ribs ornamented and the other only the centre rib, vittae apparent as brown lines.

1. Ultimate leaf segments less than 4mm long; styles (1.5–)2–3.5mm after flowering; wings on dorsal ribs of mericarp well developed, often convoluted and crowded obscuring vittae lines ..... **1. *C. hookeri***
- + Ultimate leaf segments usually more than 4mm long; styles 1.75–3mm after flowering; wings on dorsal ribs of mericarp poorly developed, often reduced to the lower half of the fruit or less ..... **2. *C. cortioides***

1. *C. hookeri* (Clarke) Norman; *Cortia hookeri* Clarke p.p., *C. cauwetmarciana* Farille & Malla, *C. glacialis* Bonner. Fig. 51i&k.

Plants 7–30cm across. Leaves 3–10 × 0.8–2cm (including petiole), ultimate segments 2–4 × 0.75mm. Peduncles of lateral umbels 2–10cm, crassicaul, 1.5–5mm thick; umbels 7–many-rayed; rays 1–7cm; umbellules 1–1.5cm across, pedicels 2–5mm. Calyx teeth linear-subulate, 0.3–1(–1.2)mm. Petals usually white, sometimes purplish, 1.5–2mm. Styles (1.5–)2–3.5mm after flowering. Fruits 3–5 × 3–5mm, occasionally tipped purple, wings on dorsal ribs of mericarp well developed equalling the laterals (1mm wide), often convoluted and crowded, obscuring dark vittae lines at maturity.

**Bhutan:** C – Tongsa district (Rinchen Chu, Takse La), N – Upper Mo Chu district (Laya, Yale La), Upper Pho Chu district (Kessa La), Upper Bumthang Chu district (Marlung) and Upper Kuru Chu district (Gong La); **Sikkim:** Dongkya La, Zongri, Khangchengyao, Lhonak, Naku La, Momay Samdong; **Chumbi:** Phari Dzong, Tang La. Alpine turf and particularly screes, 3950–5500m. June–September.

2. *C. cortioides* (Norman) Watson; *Selinum cortioides* Norman, *Cortia hookeri* Clarke p.p.

Plants 7–26cm across. Leaves 8–14 × 2–4cm (including petioles), ultimate segments (3–)4–13 × 0.75mm. Main umbel sessile on crown of plant, many-rayed; lateral secondary umbels on peduncles (sometimes crassicaul), to 10cm long, 1.2–2.5mm thick, fewer rayed; rays 0.8–4cm, somewhat shorter than leaves, spreading almost horizontally; umbellules 1.5cm across, pedicels 3–6mm; bracteoles often tipped purple-black. Calyx teeth 0.3–0.7(–1)mm. Petals white, occasionally tinged purple, 1–1.5 × 0.6–0.75mm. Styles 1.75–3mm after flowering. Fruits 4–5.5 × 4–5mm, 3 dorsal ribs prominent, some with reduced wings in the lower half (rarely more) or reduced to tiny abortive structures in the very lowest part.

**Bhutan:** C – Thimphu district (Dungtso La), N – Upper Mo Chu district (Lingshi La) and Upper Mangde Chu district (Gyophu La) and Upper Kuru Chu district (Narim Thang); **Sikkim:** Bikbari, Zongri, Ghora La, Goecha La, Jelep La, Khangchengyao Glacier, Kongra La, Lhonak, Phalut, Riago, Samiti Lake, Yale La, Yume Samdong; **Chumbi:** Kalaeree, Upper Khanghu. Screes, rocky slopes and free-draining sandy areas, 4000–5400m. (June–)July–September(–October).

### 31. CNIDIUM Cusson

Bhutanese species are essentially glabrous erect biennials or perennials; root-stock a short woody tap-root; stems solitary, unbranched (excepting the lateral umbel), purplish, base clothed in papery leaf remains. Leaves distantly 1–2-pinnate or pinnately lobed, almost entirely basal, the 1–2 stem leaves reduced, uppermost almost to a sheathing petiole; leaflets lanceolate-ovate,



margin regularly serrate and/or incised; petioles long and slender, abruptly and broadly sheathing at base. Umbels 1–2, compound, main terminal umbel solitary, usually subtended by a much smaller lateral with long slender peduncle; bracts linear-subulate, sometimes with a larger subtending leaf or leaf-like bract; bracteoles subulate. Calyx teeth minute, ovate-triangular, persistent in fruit. Petals dark purple, obovate, subequal. Stylopodium dark purple, domed; styles short, often reflexed in fruit. Fruits oblong-ellipsoid, dorsal and lateral ribs equally winged, wings somewhat corky; vittae small, one per furrow and 2 on the commissure.

**1. *C. bhutanicum* Watson; *C. atropurpureum* Watson**

Plants 35–85cm tall, essentially glabrous but with minute scabrescence on the leaf margins and main veins, around nodes and below umbels. Basal leaves 4–6, 25–40 × 7–18cm (including petiole), ovate in outline, mid green above, paler below; ultimate segments 1.8–5 × 0.5–3cm; petioles to 30cm, sheathing base 1.8–4 × 1.3–2.8cm, often purplish. Terminal umbel 7–16-rayed; rays subequal, 1.5–4.5cm, thickening and lengthening in fruit to 5cm or more, ribbed, glabrous or with sparse minute scabrescence on ribs; bracts 0–4, 1–1.3cm; umbellules 7–10mm across, c 20-flowered; pedicels 1.5–6mm; bracteoles 9–12, to 6mm long. Calyx teeth c 0.3mm. Petals dark purple with pale midrib above, c 1.7 × 1.2mm. Fruits 6–6.5 × 3–3.5mm; wings 0.5–0.75mm broad.

**Bhutan:** C – Ha district (Sage La to Ha) and Thimphu district (Gida Valley, Phajoding Monastery, Tataka Gompa to Tataka La). Scrubland, rough hill pasture and open Fir woodland, 3300–3800m. August–September.

Apparently endemic to W Bhutan (281, 282).

### 32. SELINUM L.

Dwarf or medium-sized perennial herbs. Leaves 3–4 × pinnately divided, triangular in outline; ultimate segments ovate or linear-lanceolate; glabrous above, often pubescent below. Umbels compound, rays numerous; bracts linear or sometimes pinnatifid. Calyx teeth small, linear, unequal. Petals obovate, emarginate, somewhat unequal. Fruits ovoid, usually greatly dorsally compressed, lateral ribs winged, dorsal ribs prominent to narrowly winged; vittae 1(–3) per dorsal furrow, 2–3 per lateral furrow, 4–6 on the commissural (inner) face.

A complex genus where large ranges of variation in morphology have clouded specific limits (see 282). The rather poor herbarium specimens on which early names have been based compound the problems. The situation in Bhutan has been greatly enlightened by detailed field observations and quality herbarium collections of John Wood. The Bhutan plants have been identified with the names *S. tenuifolium* and *S. candollei*, but the situation in Sikkim (and the rest of the Sino-Himalayan region) can only be provisional awaiting further work.

Non-fruiting specimens can be confused with *Ligusticum*, which usually has

hairs on the upper surface of the leaves and rather longer hairs around the nodes and base of umbel. Compare also with *Pleurospermum* and *Cortia*.

1. Sheathing bases of upper leaves conspicuously large, 6–10mm wide and as long as or longer than blade; bracteoles villous pubescent, strongly deflexed after flowering ..... **3. *S. papyraceum***
- + Sheathing bases of uppermost leaves narrower and shorter than above; bracteoles puberulent to glabrous, but not villous, deflexed (but not strongly) or not after flowering ..... 2
2. Stems slender, less than 5mm thick, densely puberulent; ultimate leaf segments or lobes broad, mainly more than 0.7mm wide .. **1. *S. wallichianum***
- + Stems stouter, usually more than 5mm thick, glabrous (only puberulent around nodes); ultimate leaf segments or lobes rather fine, less than 0.6mm wide ..... **2. *S. candollei***

**1. *S. wallichianum*** (DC.) Raizadae & Saxena; *S. tenuifolium* Clarke. Med: *Rabe, Tsed*.

Foetid herb 50–95(–120)cm tall, with a stout tap-root and erect or ascending stem, surrounded by fibrous leaf remains at base; stem 3–6mm thick, ridged, usually suffused purple, densely whitish puberulent (at least in upper parts), upper parts sparingly leafy. Leaves 3-pinnate, ultimate segments ovate-oblong, deeply pinnatifid, lobes acute, 0.8–1.2mm broad; basal leaves to 40 × 20cm (including petiole), usually finely pubescent on the rachis and veins beneath; petioles to 25cm long, with narrow sheathing base c 1.5cm broad (c 8mm broad in upper leaves). Main umbels 6–8cm across, 15–22(–30)-rayed; rays densely to moderately white papillose-puberulent, 2–3.5cm in flower, elongating to 5cm and ascending in fruit; bracts linear, occasionally forked, rarely pinnatifid, 0.8–2cm, falling early; umbellules c 1cm across; bracteoles linear-lanceolate to ovate-lanceolate, c 8 × 0.5–1.4mm, white margined with papillose to hispid pubescence or almost glabrous, recurved or not after flowering; pedicels 5–6mm, papillose-pubescent. Calyx teeth to 1mm. Petals white, c 1.5–2 × 1mm, somewhat unequal. Style 0.8mm. Fruits elliptic to circular in outline, 3–5 × 2.2–3.5mm; dorsal ribs prominent, scarcely winged, laterals with wing 0.5–0.7mm broad; lateral furrows 2-vittate, dorsal furrows 2-vittate, 4 vittae on commissural face.

**Bhutan:** C – Thimphu district (Barshong to Dotena, Darkey Pang Tso, Dechencholing to Begana, Motithang, Paro, Samakha, Serbitang, Talukah Gompah, Thimphu), N – Upper Mo Chu district (Laya, Zambuthang) and Upper Pho Chu district (Chojo Dzong); **Darjeeling:** Darjeeling, Suriel; **Sikkim:** Chija Bhanjang, Chola, Zongri, Lachen, Lachung, Pheonp, Samdong, Singalila, Yumthang; **Chumbi:** Chumbi. Open, well-drained rough grassland, yak pasture, tracksides, in coniferous forest clearings, scrubland, etc., 2300–4000m. July–September.

Common in eastern Bhutan, the roots used medicinally for treating coughs and colds.

The above description is based entirely on Bhutanese material. Finer-leaved specimens from Nepal and the W Himalaya have been attributed to var. *filicifolia* (Edgeworth) C.B. Clarke, but this has not been seen in Sikkim or Bhutan.

## 2. *S. candollei* DC. Fig. 51a&b.

Similar to *S. wallichianum*, but differing as follows. Plant more vigorous, usually 75–125cm tall, with stouter, more obviously hollow stem 6–15mm thick; stem mainly glabrous, only puberulent immediately below the umbels and around the leaf nodes, also suffused purple, but more often green. Leaves more finely and sparsely divided with ultimate segments or lobes narrower, lanceolate-acuminate, 0.4–0.6mm wide; petiole with a wider sheathing base to 2–3cm across. Main umbels many-rayed, 10–15(–22)cm across with 35–50 rays; rays elongating to 8.5cm in fruit and becoming erect, forming a dense fruiting head with concave sides at maturity; bracts and bracteoles more often forked and more densely pubescent, occasionally pinnatifid. Fruits 6–8 × 2.5–3mm usually oblong-elliptic in outline; lateral wings c 0.7mm wide, dorsal ribs narrowly winged; lateral furrows 1–3-vittate, dorsal furrows 1(–3)-vittate, 4–6 vittae on commissural face.

**Bhutan:** S – Sankosh district (Daga La), C – Thimphu district (Chiwdokha Gompa, Phajoding, Pumola, Talukah Gompah, Thimphu, Wang Chu Gorge); **Darjeeling:** Phullalong; **Sikkim:** Yak La. Lush, moist clearings in Fir forests, riverine gorges, rich yak pasture, around human settlement (nitrophile?), 3200–4000m. August–September.

Although morphologically rather similar to the more common *S. tenuifolium*, *S. candollei* has a clearly distinct habitat preference. Western Himalayan material appears to have leaves with broader segments and broader leaf sheaths.

## 3. *S. papyraceum* Clarke

Similar to *S. wallichianum*, but differing as follows: a rather slender plant with stems glabrous to minutely puberulent (particularly around nodes), 5–9mm thick at base, usually leafy to the base of the umbels. Leaves to 28 × 24cm in outline, often rather less pinnatifid, the ovate segments 3–6 × 2–3mm with a serrate margin, lobes acute, glabrous (sometimes puberulent around rachis nodes); petioles with a distinctive broad, puberulous sheathing base, those of the upper leaves particularly conspicuous, 6–12mm broad and rather longer than the blade. Main umbel 6–12cm across, 17–35-rayed; rays 2.5–5cm in flower, extending slightly in fruit, hispid pubescent/puberulent; pedicels hispid puberulent, 6–10mm long in fruit; bracts linear, 10–25mm long, sometimes forked at the end; bracteoles linear to linear-lanceolate, 5–10 × 0.5–1mm, hispid pubescent, strongly deflexed after flowering. Calyx teeth as long as stylopodium, c 0.5mm. Petals to 2 × 1.5mm. Fruits elliptic-oblong in outline with emarginate ends, 4–5 × 2.5–3.5mm; lateral wings 1–1.5mm broad, dorsal ribs narrowly winged.

**Darjeeling:** Rechi La, Tanglu; **Sikkim:** Chiya Bhanjang, Zongri. Mountain pasture?, 3000–3400m. August–October.

This unusual species has mainly been collected from the summit of Tanglu.

### 33. LIGUSTICUM L.

Medium-sized biennial or perennial herbs. Leaves 2–3(–4) × pinnately to ternately divided, triangular in outline; ultimate segments ovate or linear-lanceolate, pubescent above and below (at least on main veins) or whole plant essentially glabrous. Umbels compound, rays numerous; bracts and bracteoles linear to linear-lanceolate. Calyx teeth obsolete or small, triangular to narrowly so, unequal, rarely as long as stylopodium. Petals white, obovate, emarginate with inflexed tip, somewhat unequal. Stylopodium domed. Fruits ovoid or ellipsoid, greatly dorsally compressed, lateral ribs winged, dorsal ribs prominent to narrowly winged; vittae usually at least 2 per dorsal furrow, at least 3 per lateral furrow, 6 or more on the commisural (inner) face; vittae 2–3 in dorsal furrows, 3 in laterals and 6–8 on commisural face.

The generic limits between this and *Selinum* in the Sino-Himalayan region are indistinct, see notes under *Selinum*.

1. Stems and leaves puberulent; stems fibrous at base; calyx teeth present

1. **L. elatum**

+ Plant essentially glabrous; stems not fibrous at base; calyx teeth obsolete

2. **L. acuminatum**

1. **L. elatum** (Edgeworth) Clarke; *Cortia elata* Edgeworth.

Aromatic herb to 1m tall, with a stout tap-root and erect stem surrounded by fibrous leaf remains at base; stem 0.5–1cm thick, ridged, glabrous to minutely puberulent (at least in upper parts). Leaves 2–3-pinnate, ultimate segments ovate, 3–9 × 1.5–5mm, deeply pinnatifid to serrate, lobes obtuse-acute, puberulent on the main veins above and below; basal leaves rather less incised than the upper stem leaves; basal leaves to 40 × 26cm (including petiole); petioles to 15cm long, with narrow sheath running the full length of the petiole, upper leaves with sheath somewhat auriculate at junction with leaf blade. Main umbels 6–12cm across, 12–30-rayed; rays densely to moderately white puberulent, 2–3.5cm in flower, elongating to 6cm in fruit; bracts to 1.5cm, falling early; umbellules c 1cm across; bracteoles 3–5mm, white margined with papillose to hispid pubescence, recurved or not after flowering; pedicels 3–5mm, pubescence as for rays. Calyx teeth small, triangular, about half as long as stylopodium. Petals c 1.5–1mm. Style 0.7mm. Fruits elliptic in outline, c 5 × 4mm; dorsal ribs narrowly winged, laterals with wing c 0.7mm broad.

**Bhutan:** C – Thimphu district (Dochong La); **Darjeeling:** Sandakphu. Moist grassy clearings in open broad-leaved forest, 3100–3300m. September.

**2. *L. acuminatum*** Franchet; *Ligusticopsis acuminata* (Franchet) Leute

Ascending aromatic (celery-scented) perennials to 1m tall, whole plant essentially glabrous except inflorescence branches; stems often purplish, especially near the base, without fibrous leaf remains at base. Leaves c 3-pinnately or -ternately divided, 12–25 × 7–15cm (including petiole), triangular in outline; leaflets ovate-elliptic, 0.6–3.5 × 0.5–2cm, serrate to pinnatifid, apex of terminal leaflet acuminate. Umbels rather few, mainly terminal, 5–9cm across, 10–24-rayed; rays 2.5–5cm in flower; pedicels 2–9mm. Calyx teeth obsolete. Petals to 1.5 × 1mm. Styles 0.7mm, reflexed. Fruits c 5 × 4mm (from Chinese material), lateral wings c 1mm broad, dorsal ribs very narrowly winged.

**Bhutan:** C – Thimphu district (Barshong, Cheri, Thimphu). Semi-shaded areas, open woodlands, moist ground, 2500–3400m. August–September.

Previously thought to be a W China endemic; Chinese specimens have been recorded as up to 2m tall.

### 34. HAPLOSPHAERA Handel-Mazzetti

Stout erect perennials. Leaves 2-pinnate; leaflets pinnatisect; ultimate segments ovate, pinnatifid; petioles sheathing at base (broadly so in upper leaves). Umbels densely crowded into a compact-globose head, at first appearing simple, later more obviously compound; bracts absent. Calyx teeth inconspicuous. Petals ovate, inflexed. Fruits broadly obovoid, smooth, mericarps 5-angled in cross-section, ribs conspicuous.

**1. *H. himalayensis*** Ludlow

Plants up to 120cm, stem to 1.5cm thick, surrounded by leaf remains at the base; rootstock cylindrical, c 5 × 1–1.5cm. Leaves ovate-triangular in outline, 12–15 × 13–15cm; ultimate segments acute-dentate, mucronate; petioles 10–15cm. Umbels 1.5–2.5cm across; umbellules 5–18-flowered; pedicels 2–3mm, stout; bracteoles 4–8, linear-lanceolate c 6mm. Petals dark brown, acute, 1.5 × 1–1.25mm. Filaments greenish-white, anthers dull green. Fruits c 3 × 1.5mm, olive green.

**Bhutan:** N – Upper Kulong Chu district (Me La). On open hillside, 3900m. August.

### 35. CORTIA DC.

Acaulous ascending perennials, rarely adpressed-prostrate; crowns surrounded by fibrous leaf remains. Leaves oblong in outline, pinnate; pinnae ovate in outline, finely pinnatisect into small, linear-lanceolate segments; petioles narrowly winged at base. Umbels compound, usually sessile on crown of plant; rays lax, erect to ascending; bracts and bracteoles finely pinnatisect (bracteoles sometimes linear), slightly longer and fringing the umbellule. Calyx teeth linear-lanceolate, unequal. Petals obovate with an acute inflexed tip. Stylopodium

domed, styles short, spreading in fruit. Fruits oblong-ellipsoid, rounded to obtuse at ends, mericarps much compressed dorsally, dorsal ribs prominent, sometimes narrowly winged, lateral ones broadly winged.

1. **C. depressa** (D. Don) Norman; *Athamanta depressa* D. Don, *Cortia lindleyi* DC., *C. oreomyrrhiformis* Farille & Malla, *C. nepalensis* Norman. Med: *Bam-po*. Fig. 51c-e.

Leaf rachis and main veins, petioles and inflorescence branches densely puberulent to almost glabrous. Leaves 1.5–7(–15) × 0.75–2.5(–4) cm, pinnae 3–10 × 3–7 mm, often distjunctly spaced on rachis, pinnatisect into short fine linear lobes 1–8 × 0.3–0.75 mm. Peduncles 0–4(–13) cm long, stout, erect; umbels 3–6-rayed; rays (2.5–)4–15(–21) cm, slender; umbellules 1–1.5(–2.5) cm diameter, pedicels 2–10 mm; bracteoles 1.5–2 × pedicels. Calyx teeth linear-lanceolate, 0.5–1(–1.25) mm. Flowers slightly fragrant, petals white, purplish to deep purple-red, c 1.5 × 1 mm. Stylopodium pitted; styles 0.5–1.5 mm, little elongated in fruit. Fruits (3–)4–5 × 3–4 mm, lateral wings 0.75–1 mm broad, vittae not apparent from the outside.

**Bhutan:** C – Thimphu district (Barshong, Bimelang Tso–Dungtso La, Darkey Pang Tso, Ginnekah, Paya La, Phajudin, Pyemitangka–Bela La, Somana, Talukah Gompa) and Tongsa district (Thita Tso), N – Upper Mo Chu district (Laya), Upper Pho Chu district (Gyophu La) and Upper Kulong Chu district (Shingbe La); **Darjeeling:** Tosa; **Sikkim:** Bikbari, Cho La, Chomnagu, Kaukola, Khangchengyao, Lachen, Lampokri, Langnak La, Onglakthang, Sherabthang, Yak La, Yeumthang; **Chumbi:** Champitang, Chumbi, Galing, Yatung. Alpine turf and grass-covered rocks, amongst rocks, on free-draining hillsides or banks, etc., 3350–4900 m. (May–) July–August.

### 36. ANGELICA L.

Aromatic perennials usually tall and robust, but sometimes scrambling. Leaves 1–3-pinnate or -ternate, ultimate segments usually large and distant; petiole greatly to moderately winged at base. Umbels compound, rays and pedicels 10 to numerous; bracts few or none; bracteoles several, linear. Calyx teeth minute or obsolete. Petals obovate, emarginate. Stylopodium flat-domed, flanged at the margin (especially in young fruit). Fruits broadly ellipsoid to orbicular and notched at both ends, greatly dorsally compressed with lateral ribs broadly winged, mericarps with dark vittae lines between the five dorsal ribs.

1. Rather weak-stemmed almost glabrous plant, usually scrambling; umbels with slender rays 2–5.5 cm long ..... 1. **A. sikkimensis**
- + Large, sturdy erect plants; at least inflorescence branches pubescent; umbels with stout rays up to 15 cm ..... 2

2. Leaflets with distinct petiolule, glabrous below; petiole wings of upper leaves not greatly enlarged ..... **2. A. nubigena**  
 + Leaflets usually decurrent along leaf rachis, densely puberulent on the veins below; petiole wings of upper leaves greatly enlarged often 6–11cm broad  
**3. A. cyclocarpa**

**1. A. sikkimensis** (Clarke) Mukherjee; *Peucedanum sikkimense* Clarke. Fig. 52f&g.

Slender branched, glabrous diffuse herb, stems weakly erect or scrambling to 1–2m, plant often tinged purple. Leaves ovate in outline, distantly 2-pinnate, 18–40 × 8–25cm; ultimate segments ovate-lanceolate to lanceolate, acuminate, 6–30(–50) × 3–8(–12)mm, petiolulate, base cuneate, margins coarsely serrate; petiole only narrowly winged at base. Umbels very diffusely branched with 6–11(–16) spreading rays, to 15cm across; rays very slender, 2–5.5cm; bracts absent or 1–2, small and like the upper leaves; umbellules 1–1.5cm across, 7–13-flowered; bracteoles absent or 1–2, linear-lanceolate, 2–6mm; pedicels filiform, unequal, 3–8mm, elongating to 14mm in fruit. Calyx teeth minute, triangular, c 0.2mm. Petals white–purplish or dull yellow, 0.5–1mm. Fruits ellipsoid, 6–7.5 × 5–6mm, broadly (1.5–2mm) winged along both margins, dorsal ridges scarcely prominent, centre dark brown, wings and ridges paler.

**Bhutan:** S – Deothang district (Deothang to Wamrong), C – Ha district (Damthang) and Thimphu district (Chapcha to Confluence, Dechhenphu, Dotena, Paga, Paro, Thimphu); **Sikkim:** Kalej Khola, Lagyap, Lingdam, Rishi, Tsomgo. Coniferous and mixed deciduous forests, open hillsides, 1200–3300m. July–August(–September).

Apparently endemic to Sikkim and Bhutan.

**2. A. nubigena** (Clarke) Mukherjee; *Heracleum nubigenum* Clarke.

Plants with glabrous stout stems to 1–2m tall, thick rhizome long and tapering. Leaves broadly ovate in outline, 3-pinnate, lower leaves c 40 × 35cm; leaflets ovate, 2.5–7.5 × 1.4–4cm, often ternately lobed, margins serrate, lamina sparsely puberulent above especially on main veins, glabrous or almost so below, petiolulate; petioles winged but not greatly so. Primary umbels large, 17–32cm across, 30–50-rayed, overtopped by lateral umbels later in the season; peduncles increasing in pubescence towards flower head; rays stout, 5–15cm, densely pubescent; umbellules 15–30-flowered; pedicels 5–15mm, densely pubescent; bracteoles 4–10, linear, 5–12mm. Calyx teeth obsolete. Flowers pale yellow-green. Fruits orbicular, 5–8 × 5.5–7mm, notched at both ends, dorsal ridges broad, almost obscuring the dark vittae lines.

**Sikkim:** Chho La and Yak La. 3000–4200m. August?

The limits between this and the following species are unsatisfactory and need further study across the whole Sino-Himalayan region.

**3. *A. cyclocarpa*** (Norman) Cannon; *Archangelica cyclocarpa* Norman.

Similar to *A. nubigena*, but rather larger, to 3.5m tall and with conspicuous enlarged petiole wings on upper leaves; lower leaves to 1m; ultimate segments ovate-lanceolate or ternately-lobed, 4–15 × 2–6cm, base narrowed and often decurrent on rachis, margin coarsely serrate, lamina sparsely pubescent above, densely so on the veins below, rachis sparsely pubescent, denser around the nodes; petioles of upper leaves with very wide, pale wings (3–)6–11cm broad; fruits 5.5–7 × 5.5–6.5mm, dorsal ridges broad, almost obscuring the dark vittae lines.

**Bhutan:** C – Thimphu district (Dochong La); **Sikkim:** Lachen, Tenehungkar, Yumthang; **Chumbi:** Chumbi. Mixed forests and amongst shrubs in open areas, 2800–4000m. July–September.

**37. ANETHUM L.**

Aromatic glabrous annuals or short-lived perennials. Leaves 3–4 × pinnately-sect into linear segments; base of petioles narrowly sheathing. Umbels compound; bracts and bracteoles absent. Calyx teeth obsolete. Petals yellow, obovate, inflexed at apex. Stylopodium subconical; styles short, recurved in fruit. Fruits ovoid-ellipsoid, dorsally compressed, two lateral ribs broadest, almost winged, 3 dorsal ribs narrow.

**1. *A. graveolens* L.; *A. sowa* Roxb., *Peucedanum graveolens* (L.) Clarke.** Eng: *Dill*.

Stems erect up to 75cm. Leaves up to 20cm, segments up to 65 × 0.25mm. Umbels to 5cm across, 15–35-rayed; rays 3–5cm. Fruits c 3.5 × 2mm, brown, ribs pale.

**Bhutan:** S – Phuntsholing district (Torsa River). Streamside, 200–1200m. May.

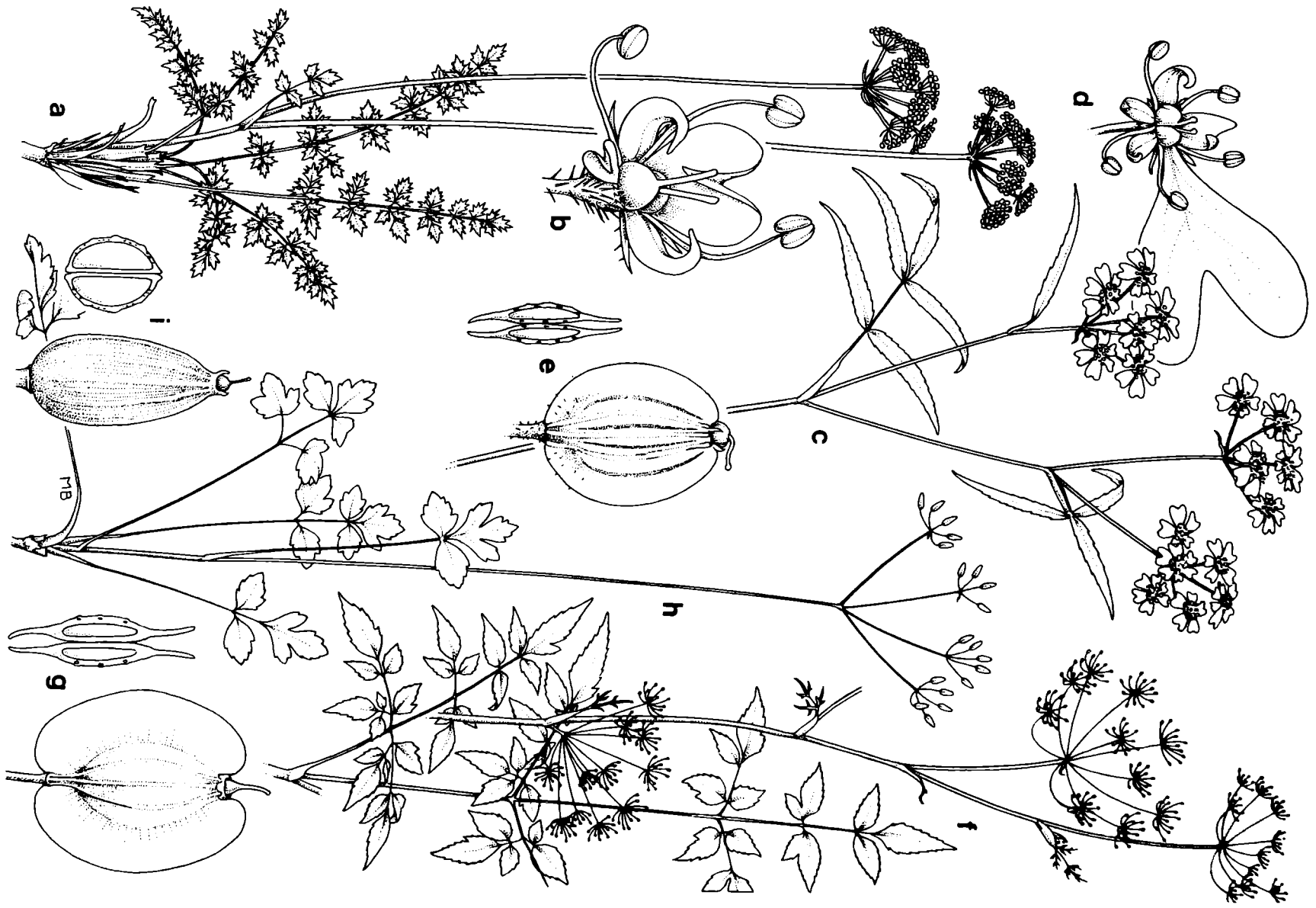
Widely cultivated for culinary and medicinal uses, sometimes escaping.

**38. LALLDHWOJIA Farille**

Delicate, erect perennial herbs, often suffused purple particularly above; stems short, glabrous or very sparsely hairy in the inflorescence branches, 3–5-leaved in lower half, usually naked above; rhizome long and slender. Leaves ternate or biternate; leaflets ovate in outline, 3-lobed, margins serrate; petiole slender, narrowly winged at base. Umbels compound, rays and flowers few; bracts absent; bracteoles few, very small and linear. Calyx teeth minute, triangular,

FIG. 52. **Umbelliferae.** a–b, *Semenovia millefolia*: a, habit (× ½); b, flower with 1 sepal, 1 petal and 2 stamens removed (× 8). c–e, *Heracleum sublineare*: c, habit (× ⅓); d, flower (× 3), e, fruit and cross-section (× 4); f–g, *Angelica sikkimensis*: f, habit (× ¼); g, fruit and cross-section (× 4). h–i, *Lalldhwojia acronemifolia*: h, habit (× ½); i, fruit and cross-section (× 6). Drawn by M. Bates.





persistent. Petals white or purplish, oblanceolate-elliptic, obtuse. Stylopodium domed. Fruits ovoid-ellipsoid, somewhat compressed dorsally, sparsely pubescent especially when young, lateral ribs very narrowly winged, mericarps convex on the back, dorsal ribs inconspicuous, each pair with 2–3(–5) fine brown vittae lines between them, mericarps with 4–5 vittae on the inner face.

1. **L. acronemifolia** (Wolff) Watson; *L. staintonii* Farille; *L. cooperi* Farille, *Peucedanum acronemifolium* Wolff. Fig. 52h&i.

Plants 10–45cm tall. Leaflets 1–3.5 × 1–3cm, sparsely pubescent above and below, sometimes glabrous below; petioles 4–14cm, winged at base for 1cm. Rays 3–5, (1–)2.5–6.5cm; bracteoles 1–3, 0.5–1mm; umbellules 2–6-flowered; pedicels 6–14mm. Calyx teeth 0.2–0.4mm. Petals 6–14mm. Fruits 3–4 × 1.5–2mm, vittae on dorsal side sometimes merging together.

**Bhutan:** C – Thimphu district (Dodena, Thimphu); **Sikkim:** Tsomgo and on Bhutanese border (near Kupup). Open coniferous forest and scrub, 3200–3700m. June–July.

### 39. HERACLEUM L.

Perennial herbs. Leaves 1–3 × pinnately or ternately divided, leaflets often lobed. Umbels compound, rays usually numerous, bracts absent, few, usually deciduous; bracteoles usually linear and deciduous, sometimes persistent. Calyx teeth small or obsolete. Petals obovate, emarginate or 2-lobed, outermost ones often longer and radiant. Fruits ellipsoid or orbicular, dorsally much compressed, dorsal ridges somewhat inconspicuous, with one or more dark lines (vittae) between each pair extending from top to below middle of mericarp, lateral ridges broadly winged; strengthening cells continuous around seed cavity and under ribs.

The Himalayan species are sometimes poorly defined and intermediate specimens are not uncommon. It is very probable that this is the result of hybridisation, a feature well documented for this genus elsewhere.

1. Leaves white tomentose beneath; leaflets rounded to sub-orbicular, obtuse
  1. **H. obtusifolium**
  - + Leaves pubescent but not white tomentose beneath; leaflets subacute, acute or acuminate ..... 2
2. Leaves moderately to densely covered in coarse hairs; flowers yellow
  2. **H. bhutanicum**
  - + Leaves hairy but not with coarse hairs; flowers white ..... 3
3. Plants slender, erect to ascending, less than 80cm tall ..... 4
  - + Plants stout, erect, usually more than 1m tall ..... 5

4. Petals of outer flowers greatly expanded; leaflets of middle and upper leaves linear, usually less than 0.8mm wide, glabrous above excepting the midrib, sparsely pubescent below, concentrated on the main veins **3. H. sublineare**  
 + Radiant petals not so greatly expanded; leaflets of middle and upper leaves ovate-lanceolate, usually more than 0.8mm wide, moderately hairy above and below ..... **4. H. wallichii**
5. Stems with coarse white hairs; calyx teeth absent; vittae on outer face extending to just below middle of main body of fruit  
**5. H. sphondylium** agg.  
 + Stems finely hairy but without coarse white hairs; calyx teeth present; vittae on outer face extending to the whole length of main body of fruit ..... 6
6. Flowers white; main umbels more than 30-rayed, distinctly overtopped by a pair of subtending secondary lateral umbels ..... **6. H. nepalense**  
 + Flowers yellowish-green; main umbels less than 25-rayed, not overtopped by the solitary subtending lateral umbel ..... **7. H. woodii**

**1. H. obtusifolium** DC.; *Tetrataenium obtusifolium* (DC.) Mandenova. Med: *Trucha, Tukar*.

Erect stout biennial(?), 30–150cm tall from a stout woody rootstock, plant finely pubescent; stem base surrounded by leaf remains. Leaves ternate or pinnate with 5 leaflets 10–45 × 5–25cm (including petiole); leaflets broadly ovate to suborbicular, 2.5–9.5 × 2–6cm, petiolulate, often 3-lobed, apex rounded, base obtuse to truncate, margin crenate to bluntly serrate, thinly pubescent above, densely white tomentose beneath; petioles 4–30cm, broadly sheathing in upper leaves. Umbels 3–5cm across, (12–)16–40-rayed; rays 2–5cm in flower, extending to 10cm in fruit, unequal; bracts 3–4, lanceolate, 0.5–2cm, falling early; umbellules 1–1.5cm across, 16–25-flowered; pedicels 3–6mm in flower, extending to 15mm in fruit; bracteoles 4–7, linear-lanceolate, 3–8mm. Calyx teeth triangular-acuminate, to 1mm, unequal. Petals white to pinkish, outer ones radiant to 6 × 7mm. Fruits obovoid, 8–10 × 5–7mm, 4 lines of vittae on outer face, 2 lines on inner face, minutely pubescent when young becoming glabrous at maturity.

**Bhutan:** C – Thimphu district (Chapcha, Chelai La, Confluence, Paro Dzong, Pumo La, Thimphu) and Punakha districts (Lobesa to Mendegong), **N** – Upper Mo Chu district (Zambuthang), Upper Pho Chu district (Lhedi) and Upper Bumthang Chu district (Pangotang); **Sikkim:** Chamgong, Lachen. Locally frequent on well-grazed short pasture in dry areas, 1500–4600m. April–September.

The relationship between this species and the more western Himalayan *H. candicans* DC. needs further study. The former has more rounded leaflets with crenate margins, the latter acute leaflets with serrate-dentate margin and slightly larger fruits (to 14 × 8mm). The depth of the divisions and separation of the leaflets used by some authors does not seem to hold. Two specimens from

Chumbi (Champitang to Yatung) may be *H. candicans* but are insufficient for a firm determination.

## 2. *H. bhutanicum* Watson

Erect to decumbent, branched perennial 35–100cm tall; stems moderately to sparsely covered in coarse, whitish, patent hairs, densest around the nodes. Leaves 1–2-pinnate, ovate-triangular in outline; ultimate segments ovate-lanceolate to narrowly ovate, 0.4–2.5 × 0.7–6.5cm, margin serrate, apex acute to acuminate, base cuneate, moderately to densely covered in coarse hairs; petiole 1.5–11cm, hairy, narrowly sheathing at base, sheath with two lanceolate lobes at apex. Umbels lateral, (6–)8–12-rayed; rays to 6cm, unequal, thickening in fruit, with scattered hairs; umbellules 12–20-flowered, 6–9mm across; pedicels to 13mm in fruit; bracteoles 3–4, lanceolate, to 5 × 1mm. Calyx teeth obsolete. Petals yellow, c 1 × 0.7mm, obovate with inflexed apex. Styles short. Fruits rounded to broadly elliptic, 5–10 × 5–8mm, wing 1.5–2mm broad; vittae 4 on outer surface, 2–4 on inner surface (sometimes obscured).

**Bhutan:** S – Chukka district (Awaka to Taktichu, Marichong). On disturbed open cliff banks in moist broad-leaved forest, 1000–1600m. July–October.

Endemic to Bhutan (281).

## 3. *H. sublineare* Clarke; *Tetrataenium sublineare* (C.B.Clarke) Farille, Cauwet & Malla. Fig. 52c–e.

Stems erect to ascending, slender, 20–45cm tall, sparsely hairy to glabrous except at nodes and below umbels; woody tap-root narrow. Leaves ternate to pinnate with 5 leaflets; leaflets of mid to upper stem leaves linear-lanceolate, 3–10 × 0.2–0.8cm (lower leaflets to 1.3cm wide), acuminate, base rounded, margin broadly serrate and slightly inrolled, essentially glabrous above, excepting the midrib, sparsely pubescent beneath especially on the main veins; petiole with expanded sheathing base (widest in upper leaves). Umbels 3–4.5cm across, 2–7-rayed; rays 1–4cm, ridged, pubescent with short pilose hairs and longer glandular hairs; bracts usually 1, linear-lanceolate, 3–4mm, falling early; umbellules 5–11-flowered; pedicels 2–5mm; bracteoles 3–5, linear-subulate, 3–8mm, dropping after flowering, persistent. Calyx teeth long-acuminate to 0.7mm, unequal; marginal petals white to pinkish, greatly expanded to triangular-obovate, radiant up to 6 × 10mm, bilobed. Stylopodium dark purple, domed, with pale thickening between mericarps evident in mature fruit. Fruits ellipsoid or orbicular, 5–5.5 × 4–5mm, marginal wings 0.5–1mm broad, 4–6 vittae on outer surface, 2 on inner face, sparsely pubescent becoming glabrous.

**Bhutan:** S – Sankosh district (Lawgu to Daga Chu); C – Ha district (Damthang to Sharithang), Thimphu district (Barshong, Darkey Pang Tso, Pajoding) and Bumthang district (Dhur Valley, Gortsam); **Darjeeling:** Phullalong, Sandakphu; **Sikkim:** Lachen, Lachung, Sherabthang, Thanggu, Yathang, Yumthang; **Chumbi:** Rinchengang. Dry to moist areas, bushy rocky

ground in upper reaches of Fir and *Rhododendron* forest, moraine gravel, 3100–4000m. July–October.

Some W Sikkimese (and Nepalese) specimens have hairier, broader and more closely serrate leaves and have been misidentified as *H. wallichii*.

**4. *H. wallichii* DC.; *Tetrataenium wallichii* (DC.) Mandenova.**

Plant (30–)40–80cm tall, almost glabrous except around the nodes and base of umbels. Leaves 1(–2)-pinnate with 3–5 leaflets (or more in lowest leaves); leaflets deeply 3-lobed (to almost ternate), lobes 1.5–7 × 1–3.7cm (terminal lobe largest), ovate-lanceolate to oblong-elliptic, acute to acuminate, base truncate-obtuse, margin densely mucro-serrate, not inrolled, moderately hairy above and less so below (apart from main veins and margin). Umbels 3–8cm across, (6–)9–30-rayed; rays 1.5–3.5cm in flower, elongating to 7cm in fruit, almost glabrous to puberulent; bracts 1–3, to 2cm, falling early; bracteoles 1–5, c 5mm. Petals white to purplish, outer petals moderately enlarged, to 2.5 × 2mm. Stylopodium as for *H. sublineare*. Fruits obovate, 7–10 × 6–8mm, 4 vittae on outer surface, 0–2 on inner face, wing to 3mm broad.

**Darjeeling:** Tanglu; **Sikkim:** Phalut, Singalila. 3000–3300m. July–August.

**5. *H. sphondylium* L. agg.**

Stout erect biennial or perennial 1–1.5m tall, whole plant rough hairy; stem with coarse white hairs especially in the lower parts, thickened bases leaving tubercles when falling. Lower leaves bipinnate or biternate (or ternately lobed), to 80 × 40cm; lobes 6–10 × 2–12cm, elliptic-oblong, apex acute to obtuse, margin serrate-dentate, hairy above and below; petiole with a broadly sheathing base; upper leaves smaller and less divided. Main umbels 7–10cm across in flower, (7–)16–20-rayed; rays 2–4cm in flower, elongating to 14cm in fruit; bracts 3–5, linear-subulate to 8mm long; umbellules 18–25-flowered; bracteoles 4–6, linear-subulate, to 6mm. Calyx teeth obsolete. Petals white, to 5 × 4mm. Young ovary coarsely hairy; stylopodium conical; styles 1.5–2mm. Fruits broadly ellipsoid, 6–9 × 5–7.5mm; vittae 4 on outer face, extending to just below the main body of the fruit, 2 on inner face (sometimes indistinct).

**Bhutan:** C – Ha district (Ha to Punda) and Thimphu district (Barshong, Guljekha, Serbithang, Thimphu); **Sikkim:** Lachen, Yume Samdong; **Chumbi:** Phomong. Hedgerows, streamsides, field borders, rough cultivation, 2100–3400m. May–July(–August).

**6. *H. nepalense* D. Don; *H. nepalense* D. Don var. *bivittatum* Clarke p.p., *Tetrataenium nepalense* (D. Don) Mandenova. Med: *Trunag*, *Tunak*.**

Tall stout erect biennial or perennial 1–2m tall (stunted specimens as small as 25cm), all parts densely bristly pubescent; stems purplish-brown, slightly foetid when crushed. Basal leaves large, to 45 × 35cm, pinnate with 5–7 pinnae (upper 3 sometimes confluent), ovate in outline, spreading horizontally when they first appear; pinnae deeply lobed into ovate-elliptic rounded segments 3–15

× 3.5–12cm. Upper leaves ternate to deeply ternately lobed; segments 3–23 × 1.7–6cm, narrowly elliptic, acute, base cuneate, margin serrate-dentate; petiole broadly winged. Primary terminal umbels very large (11–)15–30cm across, (25–)30–60 (or more) -rayed, distinctly over-topped by the smaller secondary lateral umbels, inflorescence branches 2 per node; rays to 8cm in flower, extending and thickening to 17cm in fruit; bracts 7–8, linear-lanceolate, 5–9mm, persistent; umbellules 1.5–2cm across, 30–40-flowered; pedicels 3–8mm in flower, thickening and elongating to 3.5cm in fruit, fruiting head lax with spreading rays; bracteoles 5–7, lanceolate, c 5 × 0.75mm. Calyx teeth minute, triangular-acuminate, c 0.5mm. Petals white, occasionally flushed pink, outer ones enlarged, radiant, bilobed, to 3 × 2.3mm. Young ovary densely puberulent. Stylopodium domed, with pale thickenings on the inner face in fruit; styles 1–1.2mm in maturing fruit. Fruits obovate to elliptic-obovate, 9–11(–17) × 7–10(–14)mm, smooth, wing 2.2–4mm wide, seed in upper half; vittae 2–4 in inner face.

**Bhutan:** S – Chukka district (Bunakha, Gedu) and Deothang (Khaling to Wamrong); C – Thimphu district (Barshong, Dochong La, Dotena, Hongtsho, Phajoding, Thimphu); N – Upper Mo Chu district (Gasa, Jari La, Laya, Zambuthang), Upper Pho Chu district (Lhedi) and Upper Bumthang Chu district (Kantanang, Shimitang); **Darjeeling:** Darjeeling; **Sikkim:** Chunthang, Kabi, Lachen, Lachung, Pheonp; **Chumbi:** Backchung, Chumbi, Yathong. Well-drained disturbed places, roadsides, cliff edges, etc., in Pine and Fir forest, 1750–4000m. (May–)June–August(–September).

7. **H. woodii** Watson; *H. nepalense* D.Don var. *bivittatum* Clarke p.p.

Similar to *H. nepalense* but a smaller less robust plant and generally less hairy. Stems 0.5–1m, 8–13cm thick at base, often suffused purple. Leaves rather few, often 1–2 basal and 1–2 cauline, internodes long. Lowest leaves pinnate with 5 ternately lobed or divided pinnae, to 50 × 25cm, oblong-ovate in outline, petiole to 11cm, slender, slightly winged at base. Upper leaves to 30 × 30cm, biternate, triangular-ovate in outline; leaflets ovate, rounded, shallow to deeply lobed, c 5–10 × 3–6cm; petioles broadly winged to auriculate, often purple. Central primary umbel 3–6cm in flower (to 10cm in fruit), 11–26-rayed, held above the subtending solitary secondary lateral umbel; rays to 6cm and sturdy in fruit, fruiting head compact, with erect often concave rays; umbellules (12–)16–25-flowered; pedicels to 13mm in fruit; bracteoles 3–4, lanceolate, to 5 × 1mm. Calyx teeth linear-lanceolate, to 1mm, unequal. Petals greenish-yellow or brownish-yellow, rarely whitish. Style long, (1.2–)1.7–3(–4)mm, erect in maturing fruit. Fruits elliptic to broadly elliptic-obovate, 6.5–10 × 6.5–8mm, wing 2–2.5mm broad; vittae 4 on outer surface, 2 on inner surface (sometimes obscured).

**Bhutan:** C – Thimphu district (Dungtshola, Hongtso, Pajoding, Saga La, Talukah Gompa); **Sikkim:** Zongri, Kangling, Thangshing, Yampung. Fir forest

and rocky slopes above treeline, scrubby alpine turf, grassy banks, 3900–4300m. July–September.

#### 40. TORDYLIOPSIS DC.

Slender, erect perennial herbs similar to *Heracleum*, forming small clumps; stems simple or sparsely branched, clothed in fibrous leaf remains at base, from a short stout branched rootstock. Leaves pinnate, oblong in outline; petioles slender, narrowly sheathing at base (broader in upper leaves). Umbels compound; rays and pedicels short, enveloped by numerous, large lanceolate-ovate bracts and bracteoles. Calyx teeth linear, unequal. Petals dimorphic as in *Heracleum*. Stylopodium domed, styles long. Fruits very similar to *Heracleum*, sparsely hairy when young, smooth at maturity; 4 unequal vittae on outer face extending more than half way down the fruit, 0–4 vittae on inner face, often abortive; strengthening cells beneath inner margin of lateral wings.

A monotypic genus of the Himalayas.

##### 1. *T. brunonis* DC.; *Heracleum brunonis* (DC.) Clarke.

Stems 20–60cm. Leaves mainly basal; leaflets 5–9, oblong-ovate, 2–3.5 × 1.5–3cm, acute, base rounded or truncate, sessile, margin irregularly serrate, softly pubescent, especially beneath; petioles 10–25cm. Umbels 4–6cm across, 4–10-rayed; rays 1.5–3cm, densely softly pubescent; bracts 4–6, lanceolate-acuminate, 15–30 × 2–5mm; umbellules 1.5–2cm across; bracteoles similar to bracts and overtopping flowers. Flowers greenish or purplish-white, outer petals to 7 × 4mm. Styles 3–4mm. Fruits ellipsoid, 6–7 × 5–6mm, marginal wings c 1mm broad.

**Bhutan:** C – Ha district (Tara La), Thimphu district (Barshong, Peglekecheram, Tataka Gumpa) and Tongsa district (Padima Tso, Tibdey La to Yuto La), N – Upper Mo Chu district (Zambuthang) and Upper Mangde Chu district (Goktang, Ju La); **Sikkim:** Kalep, Lachen, Thanggu; **Chumbi:** Dotag, Meerik La. Open hill slopes amongst shrubs, 3950–4400m. July–August.

#### 41. SEMENOVIA Regel & Herder

Dwarf perennial herbs with a stout tap-root; base of stem surrounded by fibrous leaf remains. Leaves mainly basal, pinnate, linear-oblong in outline; pinnae small, deeply lobed to pinnatifid. Umbels compound with distinct peduncles; bracts and bracteoles linear-lanceolate, entire. Calyx teeth small, linear-lanceolate. Petals broadly obovate; outer flowers in umbel somewhat zygomorphic, with larger, bilobed outer petal. Stylopodium a flattened dome. Fruits ellipsoid or obovoid, covered with dense, white, patent hairs, dorsally compressed, dorsal ridges scarcely prominent, with 1 or 2 broad dark lines between each pair extending from top of mericarp to near base, marginal ridges winged.

1. *S. millefolia* (Diels) Vinogradova & Kamelin; *Heracleum millefolium* Diels, Fig. 52a&b.

Whole plant white puberulent, some parts densely so. Leaves narrowly oblong in outline, 3–16 × 0.6–2.5cm; leaflets in 3–5 somewhat distant pairs, ovate-oblong in outline, 3–12 × 2–9mm. Peduncles 6–26cm long, erect or ascending, leafless or with one leaf near base. Umbels compact, 1.5–4cm across, 5–12-rayed; bracts 2–6mm; rays 0.5–1.5cm; umbellules 0.7–1.5cm across; bracteoles 3–5mm. Petals white, yellowish or purplish, outer ones up to 4.5 × 7mm. Calyx teeth c 0.75mm. Fruits (immature) c 4–5 × 3–4mm.

**Chumbi:** Dotag, Patong, Phari to Tuna. Open hillsides, 4000–4500m. July–August.

### Family 150. MYRSINACEAE

by D.G. Long & S.J. Rae

Trees, shrubs or woody climbers, often evergreen. Leaves alternate, simple, pinnately veined, exstipulate, often gland-dotted or with pellucid reticulations. Flowers in racemes, panicles, cymes, umbels or fascicles, small, bisexual or unisexual (then dioecious), actinomorphic, (4–)5-merous. Sepals united at base, sometimes (*Maesa*) adnate to ovary. Petals united at least at base, rotate or tubular. Stamens opposite petals, free or borne on corolla tube, rarely anthers united into a ring (*Amblyanthus*). Ovary superior or (*Maesa*) semi-inferior, 1-celled; style simple, stigma capitate, flattened or lobed; ovules 1–many, axile or free-central. Fruit a drupe, with fleshy exocarp and stony endocarp, or (*Maesa*) a many-seeded berry.

The record of *Sadiria solanifolia* Mez from Bhutan (220) is based on the type specimen collected in Arunachal Pradesh by Booth.

1. Ovary semi-inferior on pedicels with 2 bracteoles; fruit a many-seeded berry surrounded by fleshy calyx tube and crowned with persistent sepals

1. *Maesa*

- + Ovary superior, pedicels without bracteoles; fruit a 1-seeded drupe free from calyx ..... 2

2. Flowers in dense or lax fascicles (on very short scaly branchlets), in leaf axils or on old wood ..... 3

- + Flowers in terminal or axillary umbels, racemes or panicles on short to long peduncles ..... 5

3. Pedicels 10–14mm; petals acuminate 7–8mm, fruit c 10mm diameter

7. *Antistrophe*

- + Pedicels 1–8mm; petals obtuse or acute 2–3mm, fruit c 4mm diameter .. 4



4. Leaves acuminate, serrulate at least near apex; flowers on short slender pedicels 2–8mm; stigmas fimbriate ..... **2. Myrsine**  
 + + Leaves acute or bluntly pointed, entire; flowers subsessile on very short thick pedicels; stigma elongate, flattened, curved ..... **3. Rapanea**
5. Flowers in umbels on long slender unbranched peduncles clustered at ends of leafy shoots; petals emarginate; anthers united in a ring around style  
**6. Amblyanthus**  
 + Flowers in axillary and terminal racemes or panicles, or in umbels but these solitary or with conspicuous bracts; petals acute or obtuse, not emarginate; anthers free ..... 6
6. Flowers unisexual in axillary racemes or widely-branched terminal or axillary panicles with flowers arranged racemosely; petals 1.4–3mm  
**4. Embelia**  
 + Flowers bisexual in peduncled umbels or in terminal or axillary panicles with flowers  $\pm$  clustered on branches; petals 3–11mm ..... **5. Ardisia**

### 1. MAESA Forsskål

Shrubs or small trees. Leaves serrate or entire, often with pellucid reticulations. Dioecious; flowers in racemes or panicles, functionally unisexual, 5-merous; pedicels with 2 bracteoles at apex. Calyx tube adnate to ovary. Corolla tubular at base. Stamens adnate to corolla tube. Ovary semi-inferior; ovules many on globose central placenta; style simple, short, with capitate or lobed stigma. Fruit a  $\pm$  fleshy many-seeded berry, bearing remains of persistent style and sepals at apex.

Some species regularly produce dense deformed (galled) branched panicles.

1. Flowers in large panicles 6–25cm ..... 2  
 + Flowers in short sometimes branched racemes 1–6cm ..... 3
2. Leaves dentate or serrate, pubescent ..... **1. M. macrophylla**  
 + Leaves entire, glabrous ..... **2. M. ramentacea**
3. Leaves coriaceous, rugose above ..... **3. M. rugosa**  
 + Leaves membranous, smooth ..... 4
4. Leaves and young stems pubescent; leaves large, 10–30  $\times$  5.5–13cm  
**4. M. argentea**  
 + Leaves and young stems glabrous (or finely puberulous in *M. montana*): leaves mostly small, 7–16  $\times$  2–10cm ..... 5

- 5. Young shoots puberulous; leaves puberulous on midrib beneath, without translucent veins but minutely punctate; racemes short, mostly 1–2.5cm  
7. *M. montana*
- + Young shoots glabrous; leaves glabrous beneath with translucent elongate or reticulate minor veins; racemes often 2.5–6cm ..... 6
- 6. Leaves subentire to shallowly sinuate or serrulate; lateral veins spreading; minor veins conspicuously translucent and reticulate ..... 5. *M. chisia*
- + Leaves usually ± coarsely serrate; lateral veins ascending; minor veins inconspicuously translucent, elongate, not reticulate ..... 6. *M. indica*

**1. *M. macrophylla* (Wall.) A.DC.** Nep: *Bogote* (34).

Shrub 2–4m or small tree; branchlets softly pubescent. Leaves thin, broadly elliptic, ovate or obovate, 10–18 × 6–14cm, acute, obtuse or retuse, often apiculate, base rounded or shallowly cordate, margins dentate or serrate, softly pubescent beneath, sparsely above, minor veins slender, conspicuously translucent and reticulate; petiole 1.5–3.5cm. Flowers in large panicles 7–25cm, borne in leaf axils and on old wood, white or creamy; pedicels c 1.5mm. Sepals broadly ovate c 0.8mm. Corolla 2.5–3mm, lobes rounded. Berry globose 3–4mm.

**Bhutan:** S – Phuntsholing district (hills above Phuntsholing); **Darjeeling:** Birik, Kalimpong, Takdah, Sureil, Mongpu, etc.; **West Bengal Duars:** Buxa. Subtropical and Warm broad-leaved forests, 600–1700m. February–May.

**2. *M. ramentacea* (Roxb.) A.DC.**

Similar to *M. macrophylla* but a small tree 5–10m; branchlets glabrous; leaves thinly coriaceous, lanceolate, 9–18 × 2.5–7cm, acuminate, margins entire, glabrous, minor veins translucent but inconspicuous, elongate, parallel to lateral veins; petiole 0.8–1.5cm; panicles 6–14cm; corolla 1.5–2mm; berries c 2mm diameter.

**Assam Duars:** Durunga. Terai forests. December–March.

**3. *M. rugosa* Clarke**

Shrub 1–3.5m, branchlets minutely scaly when young. Leaves thick and rigid, ovate to lanceolate, 11–20 × 3–9.5cm, acuminate, base rounded or cuneate, margins subentire or serrulate, sparsely minutely scaly beneath when young, otherwise glabrous, minor veins not translucent; petioles 0.8–2cm. Flowers in branched puberulous axillary racemes 2.5–4cm; pedicels 1–2mm. Sepals ovate, c 1mm. Corolla white, 2.5–3mm. Fruit globose c 3mm.

**Bhutan:** S – Chukka, Gaylegphug and Deothang districts, C – Thimphu, Punakha and Tongsa districts; **Darjeeling:** Rississum; **Sikkim:** Gangtok, Rathong Chhu, Yoksam, Tista. Broad-leaved forests, 1500–2440m. November–March.

Specimens from Darjeeling, Sikkim and western Bhutan (var. **rugosa**) all have narrow lanceolate leaves; those from eastern Bhutan have broader, ovate leaves rounded at the base and have been distinguished as var. **griffithii** Clarke. Several specimens, however, are intermediate.

**4. *M. argentea* (Wall.) A.DC.**

Shrub or small tree to 8m, branchlets pubescent. Leaves membranous, pale beneath, ovate-elliptic, 10–30 × 5.5–13cm, acuminate, base cuneate, margins coarsely dentate, pubescent especially on midrib, more sparsely so above, minor veins translucent, elongate and parallel to main veins; petiole 2–4cm. Racemes branched, 3–5cm; pedicels 2–3mm. Sepals c 1.2mm. Corolla white, c 3mm. Berry subglobose, c 4mm diameter.

**Darjeeling:** Tangu. Cool broad-leaved forests, 2130–2440m. April.

**5. *M. chisia* D.Don. Nep: *Bilaune* (34). Fig. 53d–g.**

Shrub or more rarely a small tree 2–6m; branchlets glabrous. Leaves membranous, lanceolate or elliptic, 8–15 × 2.5–4.5cm, acuminate, base cuneate, margins subentire, sinuate or distantly and shallowly serrate, glabrous, minor veins reticulate, conspicuous and translucent; petioles 1–1.5cm. Racemes simple or branched, 2.5–6cm; pedicels 2–2.5mm. Sepals ovate c 1mm. Corolla white, c 2mm. Fruit globose, c 4mm diameter.

**Bhutan:** S – Phuntsholing, Sarbhang and Gaylegphug districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** Kurseong, Senchal, Takdah, Rungirun, Darjeeling; **Sikkim:** Gangtok, Dentam. Margins of Evergreen oak and Warm broad-leaved forests, often on rocky slopes and cliffs, 1250–2100m. February–May.

**6. *M. indica* (Roxb.) A.DC.; *M. elongata* (A.DC.) Mez, *M. indica* sensu F.B.I. p.p., ?*M. neocoriacea* Bennet. Dz: *Sechum Shing*; Nep: *Bilaune*, *Kanchirna*, *Phiksangme* (117).**

Similar to *M. chisia* but leaves thinly coriaceous, lanceolate, ovate or elliptic, 8–16 × 2.5–10cm, acute or acuminate, base cuneate to rounded, margins ± coarsely serrate, lateral veins ascending, minor veins conspicuous, translucent, elongate but not reticulate; racemes short, 1.5–4cm; pedicels 1–2mm; petals c 2.5mm.

**Bhutan:** S – Samchi, Phuntsholing, Chukka and Sarbhang districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** terai (Sukna, Sivoke) and foothills (Sureil, Sitong, Mongpu, Tukvar); **Sikkim:** Mamring, Rangpo. Subtropical (often secondary) and terai forests, 200–1250m. February–May.

Two forms of this common species occur, one with broadly ovate or elliptic acute leaves and one with lanceolate long acuminate leaves. *M. neocoriacea* Bennet (*M. coriacea* (A.DC.) Mez *hom. illeg.*) has been recorded from Darjeeling district but may be a synonym of *M. indica*.

**7. *M. montana* A.DC.; *M. castaneifolia* Mez, *M. indica* sensu F.B.I. p.p. non (Roxb.) A.DC. Nep: *Bilaune* (34).**

Similar to *M. chisia* and *M. indica* but branchlets puberulous; leaves thinly coriaceous, elliptic, 7–14 × 3–8cm, acuminate, base rounded or cuneate, margins shallowly sinuate-denticulate, midrib puberulous beneath, lateral veins

ascending, lamina minutely punctate-glandular but translucent minor veins absent; petiole 1–1.5cm; racemes puberulous 1–2.5cm; petals c 3mm.

**Bhutan:** S – Sarbhang district (Lam Pati) and Gaylegphug district (Thewar Khola); **Darjeeling:** Rambhi Chhu, Tista Valley, terai etc. Subtropical and terai forests, 300–410m. March–May.

## 2. MYRSINE L.

Shrubs or small trees. Leaves serrate, gland-dotted beneath. Dioecious; flowers in dense fascicles in leaf axils or on old wood, unisexual, 4–5-merous, pedicels ebracteolate. Calyx cup-shaped, lobed, gland-dotted. Petals free almost to base, gland-dotted. Stamens with short filaments attached to base of petals. Ovary superior, globose with short style and spreading fimbriate stigmas. Fruit a drupe, subtended by persistent calyx.

1. *M. semiserrata* Wall. Nep: *Palami*, *Phalame* (34), *Jhingni* (34). Fig. 53h–j.

Glabrous shrub or small tree 2–5m. Leaves thinly coriaceous, narrowly elliptic-lanceolate, 6–15 × 1.8–5.5cm, acuminate, base cuneate, margins serrulate at least near apex, with red pellucid gland dots beneath especially along margin; petiole 4–7mm. Flowers 5–15 in axillary fascicles 1–1.5cm diameter; pedicels 2–8mm. Calyx lobes triangular, 0.8–1mm. Petals creamy or reddish tinged, 2–3mm, obtuse, gland dotted. Stigma lobes 2–3, spreading. Drupes reddish, globose c 4mm, often with persistent style base.

**Bhutan:** S – Chukka and Gaylegphug districts, C – Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Kuru Chu district; **Darjeeling:** Tanglu, Senchal, Ghum, Dilpa to Garibans, Pasting, etc.; **Sikkim:** Yoksam to Bakkim (69). Evergreen oak and mixed broad-leaved forest, 1250–2460m. November–April.

A source of green dye (34).

## 3. RAPANEA Aublet

Similar to *Myrsine* but leaves entire; flowers sessile in dense clusters on short scaly branchlets on old wood; anthers sessile on petals; style very short, stigma elongate, flattened, curved, obscurely lobed at apex.

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FIG. 53. **Myrsinaceae.** a–c, *Embelia ribes*: a, flowering shoot (× 1/3); b, female flower (× 6); c, male flower (× 6). d–g, *Maesa chisia*: d, flowering shoot (× 1/3); e, male flower (× 4); f, female flower (× 4); g, fruit (× 4). h–j, *Myrsine semiserrata*: h, flowering shoot (× 1/2); i, male flower with one petal and stamen removed (× 5); j, female flower with one petal and stamen removed (× 5). k–l, *Rapanea capitellata*: k, male flower (× 3); l, female flower (× 3). m–o, *Ardisia macrocarpa*: m, flowering shoot (× 1/2); n, flower (× 2); o, fruit (× 2). Drawn by M. Bates.



**1. *R capitellata*** (Wall.) Mez; *Myrsine capitellata* Wall. Nep: *Kalachamp* (117), *Phalamkath* (34). Fig. 53k&l.

Glabrous shrub or small tree 6–15m. Leaves coriaceous, elliptic to narrowly obovate, 6–15 × 2.5–5.5cm, acute or bluntly pointed, base cuneate, margins entire, gland-dotted beneath especially on margin towards base; petiole c 1cm. Flowers in axillary fascicles, 5–10 flowered, whitish-pink; pedicels very short, thick. Calyx lobes triangular 1–1.2mm. Petals creamy or reddish tinged, oblong, 2–3mm, acute, gland-dotted. Fruit c 4mm, purple.

**Bhutan:** S – Chukka district (Marichong) and Gaylegphug district (Sham Khara), C – Punakha district (between Lobeysa and Tinleygang, Wangdu Phodrang) and Tashigang district (Jiri Chu); **Darjeeling:** Tista Valley (34). Warm broad-leaved forests, 1200–1900m. November–December.

Yields hard, durable timber (48).

#### 4. EMBELIA Burman

Shrubs, usually climbing, or small trees. Leaves entire or serrulate, pellucid gland-dotted. Dioecious; flowers in axillary or terminal racemes or panicles, unisexual, 4–5-merous; pedicels ebracteolate. Sepals free. Petals ± free. Stamens with short filaments attached to base of petals. Ovary superior, subglobose, style cylindrical with capitate stigma. Fruit a drupe subtended by persistent sepals.

*E. undulata* (Wall.) Mez has been reported from Sikkim but the specimens probably refer to *E. vestita*. Records of *E. nutans* Wall. from Bhutan are probably based on a mis-labelled Griffith specimen.

- |   |                              |
|---|------------------------------|
| 1. Flowers much-branched panicles .....   | 2                            |
| + Flowers in racemes, simple or rarely branched at base .....   | 3                            |
| 2. Leaf margins without raised red gland-dots; panicles terminal, puberulous, rarely subglabrous; flowering March–April ..... | 1. <i>E. ribes</i>           |
| + Leaf margins with raised red gland-dots; panicles axillary, rarely also terminal, subglabrous; flowering December .....     | 2. <i>E. floribunda</i>      |
| 3. Lateral veins not prominent beneath .....  | 4. <i>E. vestita</i>         |
| + Lateral veins prominent beneath .....   | 4                            |
| 4. Epiphytic or climbing shrub; leaves 11–20cm, reticulate above, glabrous beneath .....                                      | 3. <i>E. frondosa</i>        |
| + Erect shrub or tree; leaves 6–13cm, not reticulate above, red-brown pubescent beneath, at least on veins .....              | 5. <i>E. tsjeriam-cottam</i> |

**1. *E. ribes*** Burman. Fig. 53a–c.

Climbing shrub with glabrous warty stems. Leaves thinly coriaceous, elliptic-lanceolate, 8–12 × 3–4cm, acuminate, base cuneate or rounded, margins entire

but slightly recurved, glabrous, pellucid dots usually obscure except near margin, marginal raised gland-dots absent; petiole 5–8mm, winged. Flowers in large terminal puberulous (rarely subglabrous) panicles 10–25 × 7–15cm; pedicels 2–3mm. Sepals triangular, 0.5mm, puberulous. Petals whitish, ovate, c 1.4mm, puberulous outside. Style very short, stigma capitate. Fruit subglobose c 4mm diameter.

**Bhutan:** S – Phuntsholing, Sarbhang, Gaylegphug and Deothang districts, C – Tongsa district; **Darjeeling:** Birick, Mongpu; **Sikkim:** Rathong La to Temi (69), Gangtok (69). Subtropical and warm broad-leaved forests, 600–1850m. March–April.

Fruits are used as an anthelmintic (48).

## 2. *E. floribunda* Wall. Nep: *Chiuri Amla Lahara* (117).

Similar to *E. ribes* but leaves with more conspicuous pellucid dots and dashes, and with raised red gland-dots along margins; panicles axillary, sometimes also terminal, smaller, 7–15 × 6–10cm, glabrous or sparsely puberulous; pedicels 1–2mm.

**Bhutan:** C – Tongsa district (S of Shamgong); **Darjeeling:** Sureil, Rishep and Mamring; **Sikkim:** Barmiak. Warm broad-leaved forests, 1220–1850m. December.

Fruit edible (117).

## 3. *E. frondosa* (Gamble) Long; *E. gamblei* Clarke

Large epiphytic or climbing shrub. Leaves coriaceous, elliptic-oblong, 11–20 × 4–7cm, acute, base cuneate, margins entire, reticulate above, veins prominent beneath, glabrous; petiole 1.5–2cm. Flowers (4–)5-merous, in pubescent racemes, 3–6cm borne on old wood; pedicels 2–4mm. Sepals triangular c 1.5mm. Petals elliptic c 3mm. Anthers exerted on long filaments. Fruit globose, pinkish-red, c 4mm, with persistent style.

**Bhutan:** C – Tashigang district (Gamri Chu); **Darjeeling:** Darjeeling, Samara, Pachhim; **Sikkim:** Karponang. Mixed evergreen forest, 1500–2440m. May–August.

Leaves and fruit edible.

## 4. *E. vestita* Roxb.; *E. nagushia* D.Don non sensu F.B.I.

Similar to *E. frondosa* but leaves thinly coriaceous, 5–11 × 2.5–3.5cm, acuminate, margins serrate to almost entire, veins numerous, spreading, not prominent beneath; petiole 5–8mm; flowers 5-merous, sepals ovate c 0.7mm; petals elliptic, 1.5–2mm; fruit 5–8mm.

**Bhutan:** C – Punakha district (Rinchu, Tinlegang etc., 71); **Darjeeling:** Darjeeling, Takdah. Dry valleys, 1500–2000m. November–January.

Leaves and fruit edible.

**5. *E. tsjeriam-cottam* (Roemer & Schultes) A.DC.; *E. robusta* Roxb.** Nep: *Achal* (34).

Erect shrub or small tree to 15m; young branches pubescent. Leaves thinly coriaceous, elliptic-obovate, 6–13 × 4–7cm, acute or shortly acuminate, base cuneate, margins entire or serrulate near apex, glandular and reddish pubescent beneath, at least on veins, sparsely so above; petioles 0.5–1.5cm. Flowers 5-merous, in simple (rarely branched at base) axillary racemes, pubescent, 2–6cm; pedicels 2–4mm. Sepals triangular c 0.8mm, glandular. Petals elliptic, c 2.5mm, reflexed, glandular on inside. Fruit globose, c 4mm.

**Darjeeling:** terai and Tista valley. Dry subtropical and terai forests. June–August.

**5. ARDISIA Gaertner**

Shrubs. Leaves entire or crenate, often gland-dotted. Flowers bisexual in terminal or axillary panicles or peduncled umbels, 5-merous; pedicels ebracteolate. Sepals free, overlapping or not. Petals shortly united at base, obtuse or acute but not emarginate. Filaments short; anthers free, acute. Ovary superior, ovoid or subglobose; style elongate; stigma minute or capitate. Fruit a drupe subtended by persistent sepals.

- 1. Leaves elliptic or narrowly oblanceolate, 1–4cm wide (if wider then margins strongly crenate); sepals ovate or oblong-spathulate, scarcely overlapping 2
- + Leaves obovate or oblanceolate, 3–8cm wide, margins entire or weakly crenate; sepals suborbicular, distinctly overlapping 6
- 2. Leaf margins distinctly crenate; flowers in umbels or panicles 3
- + Leaf margins entire; flowers in panicles 5
- 3. Leaves thinly coriaceous, 14–22 × 4–6.5cm; flowers in short deflexed panicles **7. A. bhotanica**
- + Leaves thickly coriaceous, 7–14 × 1–4cm; flowers in ± erect umbels 4
- 4. Leaf margins with conspicuous marginal band of raised red gland-dots; sepals 3–3.5mm; petals 6–7mm; fruit c 10mm **1. A. macrocarpa**
- + Leaf margins with few marginal raised gland-dots not forming a distinct line; sepals c 1.2mm; petals c 4mm; fruit 6–8mm **2. A. crispa**
- 5. Leaves 20–30 × 5–8cm **3. A. colorata**
- + Leaves 7–19 × 2–4.5cm **4. A. thyriflora**
- 6. Bracts at base of pedicels 4–6mm, early deciduous; sepals 3–4mm, not enveloping fruit **5. A. solanacea**



- + Bracts at base of pedicels 15–25mm, subpersistent; sepals 11–12mm, enveloping fruit ..... **6. A. involucrata**

**1. A. macrocarpa** Wall. Dz: *Ressim*; Nep: *Damai Gera, Khalo Argale, Damai Phal* (34); Lepcha: *Dangpeyong-kung* (34). Fig. 53m–o.

Shrub 0.6–1.5m, glabrous, single-stemmed, branching near apex. Leaves coriaceous, elliptic or narrowly oblanceolate, 7–14 × 1–4cm, acute, base attenuate, margins undulate, with a line of raised gland-dots, glabrous and with scattered raised gland-dots beneath, lateral veins spreading, not prominent; petiole 3–8mm, winged. Flowers in umbels, each 2–5-flowered borne terminally and in upper axils on short peduncle 1–2cm at ends of leafy branches; pedicels 1–2cm; bracts ovate c 2mm, deciduous. Sepals oblong-spathulate 3–3.5mm, outside gland-dotted. Petals lanceolate 6–7mm, pinkish-white, gland-dotted. Style elongate c 5mm. Fruit globose c 1cm diameter, scarlet.

**Bhutan:** S – Chukka and Deothang districts, C – Punakha, Tongsa and Mongar districts; **Darjeeling:** Ghum, Rambhi, Takdah; **Sikkim:** Dentam to Pemayangtse (69). Evergreen oak and cool broad-leaved forests, 1600–2400m. May–July.

Flowers and fruits highly ornamental; fruits edible (34).

**2. A. crispa** (Thunberg) A.DC.; *A. undulata* Clarke

Similar to *A. macrocarpa* but leaf margins with scattered raised gland-dots not forming a distinct line; petiole 6–10mm; umbels usually on short peduncle; terminal umbel 5–8-flowered; sepals ovate c 1.2mm; petals c 4mm; fruit 6–8mm.

**Bhutan:** C – Ha district (Chungu Gompa), **Sikkim/Darjeeling:** locality unknown. Oak forest, 2130m. December–February.

**3. A. colorata** Roxb.

Shrub or small tree to 4m, glabrous. Leaves coriaceous, elliptic, 20–30 × 5–8cm, acute or shortly acuminate, base cuneate, margin entire; lateral veins spreading, inconspicuous; petioles stout, c 1cm. Flowers borne in terminal panicles up to 15 × 10cm; pedicels 2–3mm. Sepals ovate, c 1.4mm, gland-dotted. Petals c 3.5mm, pink. Fruit c 5mm, red.

**Bhutan:** locality unknown; **Darjeeling:** West Duars (Damdim). Terai forests. November–January.

**4. A. thyrsoflora** D. Don; *A. floribunda* Wall. non Roemer & Schultes, *A. neriifolia* A.DC. Nep: *Cheuri Pati*

Large shrub 3–5m. Leaves coriaceous, elliptic-oblanceolate, 7–19 × 2–4.5cm, acute or shortly acuminate, base cuneate, margins entire, not undulate, lateral veins obscure, gland dots minute, obscure; petiole 7–10mm. Flowers in panicles 5–10cm, borne terminally and in upper leaf axils, usually puberulous; pedicels 3–5mm. Sepals ovate, c 1.5mm, acute or subacute, gland-dotted. Petals pink or purple, ovate, c 3.5mm, gland-dotted. Fruit red, depressed globose, c 5mm diameter.

**Bhutan:** S – Samchi district (Samchi, 117) and Sarbhang district (Chirang road); **Darjeeling:** Badamtam, Lal, Tista valley and terai. Subtropical and terai forests, often along streams, 300–1200m. May–July.

*A. depressa* Clarke has been recorded from Sikkim (80), but is probably only a subspecies of *A. thyrsoiflora*, differing in its more slender pedicels 4–6mm and narrower acute sepals.

**5. *A. solanacea* Roxb.; *A. humilis* sensu F.B.I. non Vahl**

Shrub 2–6m, branches glabrous. Leaves coriaceous, obovate, 8–22 × 3–8cm, apiculate, base attenuate, margins entire or shallowly crenate, lateral veins somewhat prominent beneath, glabrous but with scattered minute gland dots beneath; petiole 4–10mm, winged. Flowers in axillary (rarely terminal) sub-umbellate racemes 4–6cm, 3–12-flowered; peduncle 3–8cm; pedicels stout, 2–4cm; bracts at base of pedicels 4–6mm, caducous. Sepals suborbicular, overlapping, 3–4mm, gland-dotted, persistent. Petals pink, broadly ovate 9–11mm, gland-dotted. Fruit crimson, globose, 9–11mm, not enclosed by persistent sepals.

**Bhutan:** S – Sarbhang district (Longa Khola) and Gaylegphug district (Lodrai Khola); **Darjeeling:** Peshok, Rississum, Sukna, Tista and Rangit valleys. Subtropical and terai forests, 300–1800m. April–July.

**6. *A. involucrata* Kurz; *Parardisia involucrata* (Kurz) Nayar & Giri. Nep: *Chumlani* (34); Lepcha: *Denyok* (34).**

Similar to *A. solanacea* but leaves narrowly obovate, 8–23 × 3–6cm; umbels 3–5-flowered, terminal and in leaf axils; bracts at base of pedicels obovate, 1.3–2(–3)cm, subpersistent; sepals large, 11–12mm; petals slightly shorter than sepals, 9–10mm; fruit 6–7mm, completely enclosed by persistent sepals.

**Bhutan:** S – Sarbhang district (Longa Khola near Phipsoo); **Darjeeling:** Jalapiguri, Pankhabari, Sivoke, Mongpu, Lal, Ryang, Sureil, Farseng. Subtropical and terai forests, 300–2400m. June–July.

**7. *A. bhotanica* Clarke; *Amblyanthopsis bhotanica* (Clarke) Mez**

Shrub; branches glabrous. Leaves thinly coriaceous, elliptic, 14–22 × 4–6.5cm, acuminate, base attenuate, margins strongly crenate, glabrous but with conspicuous scattered red glands beneath; petiole 1–1.5cm. Flowers in short deflexed axillary panicles 3–5cm long; pedicels 1–2mm. Sepals ovate, 3–3.5mm, rounded, gland-dotted. Petals oblong, c 4mm, rounded but not emarginate. Anthers subsessile on petals. Fruit globose, c 8mm diameter.

**Bhutan:** locality unknown; **Bengal Duars:** Buxa; **Darjeeling district(?):** Domphe Pokri. Warm broad-leaved forests, 1700m. May.

## 6. AMBLYANTHUS A.DC.

Similar to *Ardisia* but leaves ± membranous; flowers in umbels on long slender unbranched peduncles, peduncles several, clustered at ends of leafy

shoots; petals emarginate; stamens with rounded anthers united into a ring around style.

**1. *A. glandulosus* (Roxb.) A.DC.**

Small shrub. Leaves elliptic-lanceolate, 8–20 × 2.5–5cm, acuminate, base cuneate, margins with swollen glands; midrib prominent below; glabrous with scattered gland-dots below; petiole 6–10mm. Peduncles 3–10, 1.5–5cm long, each bearing an umbel of 5–10 flowers; pedicels 2–4mm. Sepals c 1.5mm, gland-dotted. Petals c 2.4mm, rounded, emarginate. Fruit red, globose, c 8mm, densely gland-dotted.

**Bhutan:** locality unknown. 1800–2430m (Assam).

Known only from unlocalised Griffith specimens which may be mis-labelled; otherwise restricted to Assam and Khasia.

**7. ANTISTROPHE A.DC.**

Small shrubs. Leaves subentire or crenulate. Flowers few in axillary fascicles on very short stalks, 5-merous, bisexual. Pedicels slender, ebracteolate. Calyx small, deeply lobed. Petals shortly united at base, lanceolate, acuminate. Anthers large, on short filaments. Ovary ovoid with long slender style; stigma minute. Fruit a berry.

**1. *A. oxyantha* (A.DC.) A.DC.; *A. oxyantha* var. *bhutanica* Nayar & Giri.**

Small shrub 1m; branchlets puberulous. Leaves membranous, elliptic-lanceolate, 9–15 × 3–6cm, shortly acuminate, base cuneate, margins subentire or crenulate, with scattered raised red gland-dots, glabrous or puberulous on veins beneath; petiole 5–17mm. Fascicles 2–3-flowered; pedicels slender, 10–14mm. Sepals triangular, 1.5–2mm, minutely puberulous. Petals white, lanceolate, 7–8mm, shiny and becoming reflexed. Berry c 1cm.

**Bhutan:** S – Samchi district (Tamangdhanra Forest); **Darjeeling:** Git Jhora W of Jaldakha, Lal, Lat Panchor (34). Subtropical and terai forests, 670–1500m. March, July.

**Family 151. PRIMULACEAE**

by E. Aitken, A.J.C. Grierson & D.G. Long

Herbs, usually rhizomatous, perennial or annual. Leaves simple, sometimes all radical or sometimes cauline, alternate or opposite, exstipulate. Flowers bisexual, regular, mostly 5-merous, sometimes 4–7-merous, small or medium-sized, sometimes axillary, solitary or in heads, umbels or in whorls sometimes aggregated into racemes or spikes, inflorescences often on peduncles (scapes); flowers monomorphic or dimorphic (pin- and thrum-flowers) with styles and

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stamens set at different levels. Calyx teeth connate or at least coherent at base. Corolla rotate with cylindrical basal tube and 5–7 patently spreading lobes or funnel-shaped with corolla tube and lobes more or less in line. Stamens as many as corolla lobes, adnate and opposite to them. Ovary superior, ovoid, globose or narrowly cylindric, unilocular, style short or elongate, stigma often capitate. Capsule 5–7-valved or upper part dehiscent as a cap or bursting irregularly. Seeds few to numerous, borne on a free central placenta, compressed and winged or peltate and convex beneath.

- 1. Corolla lobes imbricate in bud; leaves all radical; flowers on peduncles, solitary or few, or in umbels ..... 2
- + Corolla lobes contorted; leaves cauline; flowers axillary, solitary or in racemes ..... 5
  
- 2. Flowers 7-merous; capsule narrowly cylindric, dehiscent by apical cap  
**4. Bryocarpum**
- + Flowers usually 5-merous, sometimes 4–6-merous; capsule globose or ovoid, opening by valves or dehiscent irregularly ..... 3
  
- 3. Corolla zygomorphic, purple; seeds compressed, surrounded by a wing  
**2. Omphalogramma**
- + Corolla usually actinomorphic (or if zygomorphic then flowers not purple); seeds peltate, not winged ..... 4
  
- 4. Flowers monomorphic or dimorphic (with pin- and thrum-flowers); corolla rotate or funnel-shaped, mostly more than 10mm diameter (or if less, then funnel-shaped, rarely rotate), throat constricted or not ..... **1. Primula**
- + Flowers monomorphic; corolla rotate, limb not exceeding 10mm diameter, throat always constricted ..... **3. Androsace**
  
- 5. Flowers in racemes or heads, sometimes solitary; capsule ovoid or subglobose, 5-valved or bursting irregularly ..... **5. Lysimachia**
- + Flowers always solitary; capsule globose, upper half dehiscent as a cap  
**6. Anagallis**

**1. PRIMULA L.**

by A.J.C. Grierson & D.G. Long

Rhizomatous perennial herbs. Leaves all radical, often obovate, spatulate, rarely orbicular and petiolate, sometimes surrounded at base by oblong or rounded bud scales, sometimes dusted with yellow or whitish farina. Flowers on peduncles, solitary or few, or in heads, umbels or whorls, these sometimes superposed in candelabra, monomorphic or dimorphic (pin- and thrum-flowers)

with styles and stamens set at different levels in the corollas. Calyx tubular or funnel-shaped, teeth 5, sometimes farinose. Corolla usually rotate with cylindrical basal tube and 5 patently spreading lobes (with area around mouth of tube or 'eye' differently coloured), sometimes funnel-shaped, campanulate or saucer-shaped with corolla tube and lobes  $\pm$  in line. Stamens 5, included. Capsule globose or ovoid, 5-valved, sometimes dehiscent irregularly. Seeds  $\pm$  peltate, flattened dorsally, convex ventrally.

The first (preliminary) descriptions in this account were written by A.J.C. Grierson; the key to species was written later and the descriptions completely revised by D.G. Long.

Published reports of the following species by Halda (256) have not been substantiated and are probably erroneous: *P. aureata* Fletcher, *P. chungensis* Balfour f. & Ward, *P. erosa* Regel, *P. euosma* Craib, and *P. sinopurpurea* Hutchinson.

1. Bracts easily visible and prolonged below their insertion into a 1–3-toothed auricle 4–7mm; flowers weakly zygomorphic ..... **40. P. munroi**  
 + Bracts concealed or easily visible, but not prolonged more than 2mm below insertion; flowers usually actinomorphic ..... 2
  
2. Leaf lamina shallowly to deeply lobed, suborbicular or broadly ovate, less than 1.5  $\times$  as long as broad, non-decurrent on petiole ..... 3  
 + Leaf lamina not or rarely lobed, ovate or oblong, rarely suborbicular (in *P. gambeliana*, *P. pulchra* and *P. rotundifolia*), usually more than 1.5  $\times$  as long as broad, mostly regularly crenate or serrate, often decurrent on petiole ..... 7
  
3. Leaf lobes deep, to  $\frac{1}{3}$  lamina length, longer than broad ..... 4  
 + Leaf lobes shallow, to  $\frac{1}{6}$  lamina length, much broader than long ..... 5
  
4. Petioles sheathing at base; peduncles 3–11cm; corolla tube 4–7mm ..... **2. P. vaginata**  
 + Petioles not sheathing; peduncles 14–40cm; corolla tube 8–10mm ..... **3. P. geraniifolia**
  
5. Leaf lamina 5–12cm long and broad; umbels usually 2–3, superposed ..... **1. P. mollis**  
 + Leaf lamina 1–5cm long and broad; umbel solitary ..... 6
  
6. Leaves usually slightly broader than long, palmately 5-veined at base; corolla pink ..... **4. P. listeri**  
 + Leaves usually slightly longer than broad, pinnately veined throughout; corolla white or pale mauve ..... **5. P. filipes**

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- 7. Leaves pubescent with multicellular hairs, at least on midrib beneath or on margins (minutely puberulous in *P. atrodentata*, *P. denticulata*, *P. eburnea*, *P. stirtoniana*, *P. waddellii* and *P. walshii*) ..... 8
- + Leaves glabrous, although often farinose, (minutely glandular-papillate in *P. assamica*, *P. atrodentata*, *P. capitata*, *P. drummondiana* and *P. glomerata*) ..... 24
  
- 8. Leaf lamina broadly ovate, truncate or shallowly cordate at base, margin distantly and irregularly undulate or shallowly lobed ..... **5. P. filipes**
- + Leaf lamina spathulate, oblanceolate or elliptic, usually attenuate at base (truncate and narrowly decurrent in *P. chasmophila*), margin closely and usually regularly toothed or crenate (entire in *P. walshii*) ..... 9
  
- 9. Corolla with cylindrical tube and rotate limb with widely spreading lobes ( $\pm$  salverform); leaves mostly shallowly serrate (crenate in *P. sherriffae*), long attenuate at base without distinct petiole ..... 10
- + Corolla broadly funnel-shaped with tube gradually broadening upwards and lobes ascending or semi-spreading; leaves coarsely (often doubly) toothed, borne on distinct petiole ..... 19
  
- 10. Corolla tube long and slender, 1.8–4cm; limb 1.5–3cm diameter ..... **68. P. sherriffae**
- + Corolla tube short, 0.1–1.2cm; limb 0.3–1.5cm diameter ..... 11
  
- 11. Peduncles 0.1–1(–1.8)cm at flowering time, usually hidden amongst leaves, each bearing 1–4 flowers; dwarf herbs with leaves 0.8–2cm ..... 12
- + Peduncles (1.5–)3–35cm at flowering time, long exerted above leaves, each bearing 6–30 flowers (1–4 in *P. primulina*); small to robust herbs with leaves 1.5–20cm (0.8–1.8cm in *P. primulina*) ..... 14
  
- 12. Leaves entire; corolla limb 5–7mm diameter ..... **49. P. walshii**
- + Leaves toothed; corolla limb 13–15mm diameter ..... 13
  
- 13. Corolla lobes divided into 2 short teeth as broad as long **51. P. stirtoniana**
- + Corolla lobes divided into 2 linear teeth much longer than broad ..... **53. P. waddellii**
  
- 14. Leaves 0.8–1.8cm; heads 1–4-flowered; flowers with corolla tube 3–4mm ..... **48. P. primulina**
- + Leaves 1.5–20cm; heads (3–)6–30-flowered; flowers with corolla tube 5–12mm ..... 15
  
- 15. Flower heads with dome-like cap of bracts above the pendant flowers; corolla limb 3–6mm diameter ..... **62. P. bellidifolia**

- + Flowers heads without dome-like cap; bracts below erect and spreading flowers; corolla limb 7–15mm diameter ..... 16
- 16. Flowers 1–5 on distinct pedicels 3–6mm ..... **45. *P. assamica***
- + Flowers usually 10–many, sessile or on short pedicels 1–2mm ..... 17
- 17. Plants surrounded at base by persistent bud-scales; flower heads with marginal flowers pendant ..... **57. *P. denticulata***
- + Plants without persistent bud-scales at base (sometimes surrounded by dead leaves); flower heads with all flowers spreading or erect ..... 18
- 18. Plants without dead leaves at base; leaves pubescent .. **58. *P. erythrocarpa***
- + Plants surrounded at base by dead leaves; leaves minutely scabrid-puberulous or subglabrous ..... **59. *P. atrodentata***
- 19. Leaf lamina small, 0.5–1.5cm long; flowers 1–4 ..... 20
- + Leaf lamina large, 1.5–6.5cm long; flowers 4–12 (mostly 2–5 in *P. chasmophila*) ..... 21
- 20. Flowers 1–4 on peduncle 1.2–4.5cm; corolla purple, 3–4mm long, limb 4–5mm diameter ..... **63. *P. sapphirina***
- + Flowers 1(–2) on peduncle 4–13cm; corolla pale blue-violet, 18–26mm long, limb 25–35mm diameter ..... **69. *P. klattii***
- 21. Leaf base truncate and narrowly decurrent on petiole; flowers (1–)2–5, blue-violet ..... **70. *P. chasmophila***
- + Leaf base broadly attenuate and decurrent on petiole; flowers 4–12, blue, white or purple ..... 22
- 22. Peduncles glabrous; flowers purple ..... **71. *P. wattii***
- + Peduncles glandular-puberulous or white hairy; flowers blue or white .. 23
- 23. Peduncle bearing long white hairs ..... **66. *P. umbratilis***
- + Peduncle glandular-puberulous ..... **67. *P. eburnea***
- 24. All leaves with base of lamina abruptly narrowed, truncate or cordate, not decurrent on petiole ..... 25
- + All or some leaves with base of lamina gradually attenuate and decurrent on petiole (in Species 6–15 outer leaves sometimes truncate at base but inner leaves attenuate) ..... 34
- 25. Dwarf cushion- or mat-forming herb; leaf lamina 10–13mm, leathery, with revolute margins, strongly farinose beneath  
**56. *P. dryadifolia* subsp. *jonardunii***

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- + Small to large plants rarely forming dense mats or cushions; leaf lamina mostly 20mm or more, thin, with plane margins, farinose or efarinose beneath ..... 26
- 26. Flowers blue or purple ..... 27
- + Flowers yellow to white ..... 30
- 27. Leaf lamina 4–9cm long (–30cm in fruit), much longer than broad, acute; petiole broadly winged; flowers deep blue-violet ..... **19. P. griffithii**
- + Leaf lamina 1–11cm long, scarcely longer than broad, acute; petiole unwinged; flowers purple ..... 28
- 28. Leaves suborbicular, 3–10cm broad, farinose beneath .. **27. P. rotundifolia**
- + Leaves broadly ovate, 0.5–5cm broad, not farinose ..... 29
- 29. Scales of resting bud linear-oblong at flowering time, 1–7cm, efarinose; leaf base truncate or shallowly cordate, margin shallowly sinuate-crenate  
**16. P. pulchra**
- + Scales of resting bud ovate at flowering time, 0.5–1.5cm, farinose; leaf base strongly cordate, margin crenate-dentate ..... **26. P. gambeliana**
- 30. Plants with basal bud scales; leaves ovate ..... 31
- + Plants without basal bud scales; leaves usually oblong ..... 32
- 31. Bud scales and leaves efarinose; leaf margins dentate  
**20b. P. tanneri** subsp. **nepalensis**
- + Bud scales and sometimes lower leaf surface farinose; leaf margins crenate  
**26. P. gambeliana**
- 32. Leaves thick, subcoriaceous; flowers few; bracts linear-subulate, up to 1mm broad ..... **37. P. chumbiensis**
- + Leaves membranous; flowers usually 5 or more; bracts lanceolate, 2–3mm broad ..... 33
- 33. Corolla 13–20mm long, thinly farinose within ..... **38. P. reticulata**
- + Corolla 20–25mm long, densely farinose within ..... **39. P. alpicola**
- 34. Dwarf herbs with leaves 0.5–1.5(–3)cm; flowers on very short peduncles hidden by leaves, or if long-exserted then 1(–2) on slender peduncles 1.2–4.5cm (in *P. hookeri* peduncles greatly elongated in fruit) ..... 35
- + Usually medium to robust herbs (dwarf only in *P. caveana*, *P. glabra*, *P. pulchra* and *P. tibetica*), with leaves mostly 2–32cm; peduncles mostly well developed and 1–many-flowered (in *P. gracilipes*, *P. bracteosa*, *P. drummondiana* and related species peduncles short or absent at flowering but plants robust) ..... 47



35. Flowers semi-pendant; corolla funnel-shaped at base, scarcely tubular . 36  
+ Flowers erect; corolla tubular at base ..... 38
36. Corolla 9–14mm long, white ..... **65. *P. soldanelloides***  
+ Corolla 3–9mm long, mauve or bluish-purple ..... 37
37. Corolla 3–6mm long, bluish-purple ..... **63. *P. sapphirina***  
+ Corolla 8–9mm long, mauve with maroon eye ..... **64. *P. jigmediana***
38. Leaves farinose beneath ..... 39  
+ Leaves efarinose ..... 41
39. Flowers solitary, almost sessile ..... **54. *P. spathulifolia***  
+ Flowers solitary or several, on distinct peduncles 5–30mm ..... 40
40. Leaves entire; corolla limb 7–10mm diameter ..... **44. *P. concinna***  
+ Leaves strongly serrate; corolla limb 11–26mm diameter .... **55. *P. tenella***
41. Leaves entire; corolla pink ..... 42  
+ Leaves toothed; corolla blue to purplish ..... 43
42. Calyx and leaves completely glabrous ..... **42. *P. pumilio***  
+ Calyx and usually leaves glandular-puberulous ..... **49. *P. walshii***
43. Corolla limb 6–12mm diameter ..... 44  
+ Corolla limb 14–20mm diameter ..... 45
44. Rosette herb; leaves 10–30mm, many-toothed; corolla lobes entire  
**12. *P. hookeri***  
+ Cushion-forming herb; leaves 4–8mm, 5–6-toothed at apex; corolla lobes  
bifid ..... **50. *P. muscoides***
45. Corolla tube white pubescent outside ..... **52. *P. tenuiloba***  
+ Corolla tube glabrous outside ..... 46
46. Corolla lobes divided into 2 short teeth as broad as long **51. *P. stirtoniana***  
+ Corolla lobes divided into 2 linear teeth much longer than broad  
**53. *P. waddellii***
47. Leaves with irregular sharp spreading teeth; peduncle in flower absent or  
up to 4cm (–8cm in *P. bhutanica*), stout, usually shorter than pedicels  
(fructing peduncle up to 17cm in *P. irregularis*, *P. scapigera*, *P. bracteosa*  
and *P. bhutanica*); corolla blue, purple or pink, never yellow, lobes 3- or  
more toothed at apex (bilobed only in *P. drummondiana*) ..... 48

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- + Leaves mostly subentire to bluntly toothed (sharply irregularly serrate only in *P. tanneri*, *P. prenantha*, *P. xanthopa*, *P. glomerata* and *P. capitata*); peduncle in flower usually well developed, 5–45cm, longer than pedicels except in *P. tibetica* (peduncle sometimes less than 5cm in *P. pulchra*, *P. megalocarpa*, *P. caveana*, *P. tibetica*, *P. glabra* and *P. atrodentata*); corolla colour various, lobes bilobed or emarginate, sometimes rounded (3-notched only in *P. caveana* and *P. elongata*) ..... 56
  
- 48. Plant deciduous, with conspicuous winter resting bud; bud scales conspicuous at base of plant at flowering ..... 49
- + Plant evergreen, without winter resting bud; bud scales absent at base of plants at flowering ..... 50
  
- 49. Corolla lobes coarsely 3-toothed; calyx lobes acute, entire **13. P. bhutanica**
- + Corolla lobes shallowly crenate; calyx lobes obtuse, dentate .. **14. P. whitei**
  
- 50. Corolla lobes deeply bifid ..... **15. P. drummondiana**
- + Corolla lobes 3- or more toothed ..... 51
  
- 51. Flowers borne on pedicels amongst leaves of basal rosette, peduncle absent in flower and fruit ..... 52
- + Flowers borne on distinct peduncle (often very short in flower) which elongates in fruit ..... 54
  
- 52. Flowers 2–4 per plant, on short pedicels up to 1cm; corolla tube villous within, limb mauve to white, lobes ascending ..... **8. P. deuteronana**
- + Flowers 5–20 per plant, on longer pedicels 1–6cm; corolla tube glabrous within, limb pink, lobes spreading ..... 53
  
- 53. Plants with farina, at least on calyx ..... **6. P. gracilipes**
- + Plants without farina ..... **7. P. petiolaris**
  
- 54. Plants farinose especially on flower buds and young leaves; flowering peduncle up to 2cm, bearing 12–30 flowers; calyx not ribbed, lobes broadly ovate, bluntly pointed and 1–2-toothed ..... **11. P. irregularis**
- + Plants sparsely or not farinose; flowering peduncle 1–4cm bearing 3–17 flowers; calyx with prominent ribs, lobes lanceolate with acute to finely acuminate apex ..... 55
  
- 55. Plants usually sparsely farinose; calyx lobes acute; fruiting peduncles bearing leaf-like bracts amongst pedicels ..... **9. P. bracteosa**
- + Plants efarinose; calyx lobes with finely subulate-acuminate apex; fruiting peduncles without leaf-like bracts ..... **10. P. scapigera**

56. Flowers on distinct pedicels 5–100mm, 1–few or many in loose umbels; corolla colour various ..... 57  
 + Flowers subsessile or on short pedicels 1–3(–5)mm, 6–many in dense heads; corolla blue, mauve, purple or white, never yellow ..... 86
57. Flowering inflorescence a candelabra of 2 or more superposed umbels (sometimes only one umbel in small plants) ..... 58  
 + Flowering inflorescence a single umbel (in *P. elongata* often becoming a candelabra only in fruit) ..... 62
58. Corolla violet ..... **32. *P. ianthina***  
 + Corolla yellow ..... 59
59. Corolla tube 5–7mm, limb 6–8mm diameter ..... **34. *P. prenantha***  
 + Corolla tube 8–18mm, limb 10–18mm diameter ..... 60
60. Plants with winter resting buds and persistent bud scales present at flowering; pedicels 5–10mm ..... **25. *P. elongata***  
 + Plants with winter resting buds and persistent bud scales absent at flowering; pedicels 10–22mm ..... 61
61. Calyx farinose; calyx 3–4mm long and broad ..... **31. *P. smithiana***  
 + Calyx efarinose; calyx 7–8 × 4–5mm ..... **33. *P. cooperi***
62. Leaves fleshy, densely gland-pitted, with horny margins ..... 63  
 + Leaves thin, rarely thick (leathery in *P. chumbiensis*), without gland-pits or horny margin ..... 64
63. Corolla deep claret red, lobes entire or emarginate ..... **29. *P. kingii***  
 + Corolla yellow, white or purplish, lobes bilobed ..... **30. *P. dickieana***
64. Corolla yellow ..... 65  
 + Corolla white, creamy, pink, mauve, purple or blue ..... 70
65. Plants with winter resting buds and persistent bud scales present at flowering ..... 66  
 + Plants without winter resting buds and persistent bud scales at flowering ..... 69
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 + Whole plant efarinose ..... 68
67. Umbels 6–20-flowered; pedicels 10–20mm ..... **18. *P. strumosa***  
 + Umbels 5–10-flowered; pedicels mostly 5–10mm ..... **25. *P. elongata***

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68. Leaves mostly acute, with sharply pointed marginal teeth; corolla limb 1.5–2cm diameter ..... **20b. P. tanneri** subsp. **nepalensis**  
 + Leaves mostly obtuse, with cremate margins; corolla limb 2–3cm diameter **21. P. tsariensis**
69. Leaves thin, long attenuate at base; umbels usually > 10-flowered **35. P. sikkimensis**  
 + Leaves leathery, at least some truncate at base; umbels usually < 10-flowered **37. P. chumbiensis**
70. Flowers white or creamy ..... 71  
 + Flowers pink, mauve, purple or blue ..... 74
71. Plants without winter resting buds or persistent bud scales at flowering **35. P. sikkimensis**  
 + Plants with winter resting buds and persistent bud scales at flowering .. 72
72. Bracts leafy, subequalling pedicels ..... **23. P. megalocarpa**  
 + Bracts slender, not leafy, much shorter than pedicels ..... 73
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85. Leaves acute, sharply toothed; peduncles 8–23cm in flower; calyx lobes acute ..... **20a. *P. tanneri* subsp. *tanneri***  
 + Leaves obtuse, crenate; peduncles 3–10cm in flower; calyx lobes subacute ..... **21. *P. tsariensis***
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 + Leaves pubescent, rarely farinose beneath; corolla lobes 1–2mm long ..... **62. *P. bellidifolia***



La, Bhutan (45, 275) are erroneous and based on *Ludlow & Sherriff* 18740 which is *P. vaginata*.

### 3. *P. geraniifolia* Hook. f. Fig. 54b.

Similar to but larger than *P. vaginata*; leaves suborbicular in outline, 2.5–9.5cm diameter, base deeply cordate, sharply toothed and lobed up to  $\frac{1}{3}$  width, hairy, especially beneath; petiole 4–15mm,  $\pm$  shaggily pubescent, not sheathing at base; peduncle 14–40cm, pubescent, bearing an umbel (rarely 2 superposed umbels) of 2–7 flowers; pedicels 5–16mm; calyx reddish, campanulate, ribbed, 5–8mm, divided to middle into lanceolate teeth; corolla deep pink or red, tube 8–10mm, limb 10–15mm diameter, lobes emarginate; capsule  $\pm$  as long as calyx.

**Bhutan:** C – Ha, Thimphu, Punakha and Bumthang districts, N – Upper Mo Chu and Upper Mangde Chu districts; **Sikkim:** Lachung, Phusum, Dik Chu, Kanglasa, Karponang, Laghep, Changu, Kapup; **Chumbi:** Galing, Rinchenging, Gautsa, Yatung. In Fir forests, 2740–3660m. May–August.

### 4. *P. listeri* Hook. f.

Rhizomatous clump-forming herb; efarinose. Leaves suborbicular, 1–5  $\times$  1–5cm, obtuse, base cordate, lobes up to  $\frac{1}{3}$  width, palmately 5-veined at base, pubescent especially above; petiole 1.5–12cm, pubescent. Peduncle 2–6(–12)cm pubescent, bearing an umbel of 2–4 flowers; pedicels 3–10(–15)mm; bracts linear-lanceolate 3–7mm. Calyx widely campanulate, 5–8mm, pubescent, mouth 8–12mm broad when pressed, teeth short, acute. Corolla pink, tube 1–2  $\times$  as long as calyx, limb 10–15mm diameter, lobes obcordate, emarginate. Capsule subglobose included within calyx, dehiscing irregularly.

**Bhutan:** C – Ha, Tongsa, Bumthang, Mongar and Sakden districts, N – Upper Mo Chu district (Gasa); **Darjeeling:** Sandakphu, Tonglu; **Sikkim:** Tsoka, Kalipokhri, Karponang, Lodherma. On damp ground in Fir forests and under bamboo, 2440–3800m. April–June.

### 5. *P. filipes* Watt

Similar to *P. listeri* but leaves often broadly ovate, 1–5  $\times$  1–4.5cm, base rounded, truncate or cordate, margin undulate or shallowly lobed, denticulate, pinnately veined to base, reddish pubescent beneath; petiole 1–5cm, pubescent; peduncle 1.5–4.5(–10)cm, bearing a single umbel of 4–10 flowers; pedicels 10–20mm; calyx 4–7mm; corolla white to pale mauve with yellow eye, tube 2–3  $\times$  length of calyx, limb 10–12mm diameter.

**Bhutan:** S – Chukka and Deothang districts, C – Punakha, Mongar, Tashigang and Sakden districts. Shady cliffs and rocky slopes in warm broad-leaved forests, 1980–2740m. November–February.

### 6. *P. gracilipes* Craib; *P. scullyi* Craib. Fig. 54f&g.

Evergreen herb; winter buds and persistent bud scales absent. Leaves rugose,

at flowering oblanceolate, 3–6 × 1–2.5cm, obtuse, base attenuate, without petiole, margins finely irregularly spreading-denticulate, efarinose or sparsely farinose when young; leaves after flowering ovate-oblong, 4–11 × 2.5–4cm, obtuse or subacute, base truncate or subcordate, on long petiole 5–13cm. Flowers 5–20 borne amongst rosette leaves; peduncle absent; pedicels slender, 1–6cm; bracts linear-lanceolate, 5–15mm. Calyx campanulate, 5–9mm, farinose, divided to middle into oblong acute teeth. Corolla pinkish-purple with greenish-yellow eye, subrotate, tube c 2 × length of calyx, limb 1.5–2.5cm across, with obovate irregularly dentate lobes. Capsule subglobose, included within calyx, ripening at ground level on recurved pedicels.

**Bhutan:** C – Ha, Thimphu, Tongsa, Bumthang, Mongar, Tashigang and Sakden districts, N – Upper Mo Chu district; **Darjeeling:** Phallut and Singalela ridge; **Sikkim:** Chhurong Chu, Legship, Lachen, Yumthang, Karponang; **Chumbi:** Langrang, Yatung; **Arunachal Pradesh:** Nyam Jang Chu. On damp shady banks, streamsides, mossy rocks and in ravines, in *Abies/Rhododendron* forest or *Rhododendron* scrub, 1980–4720m. February–June.

The most frequent petiolarid *Primula* in Bhutan.

### 7. *P. petiolaris* Wall.

Similar to *P. gracilipes* but smaller and without farina; corolla limb c 1.5cm diameter.

**Darjeeling:** Phalut. On rocks. April–May.

Very closely allied to *P. gracilipes* which is probably conspecific, although the farinose plants from Bhutan are usually more robust and larger-flowered than the typical efarinose plants of *P. petiolaris* from Nepal. The name was formerly applied in a much broader sense (80) and old records from Bhutan refer mostly to *P. gracilipes*.

### 8. *P. deuteranana* Craib

Similar to *P. gracilipes* and *P. petiolaris* but sparsely farinose when young; flowers few, 2–4, on short pedicels up to 1cm which are hidden by leaves; corolla pale lilac with a yellow eye, tube 1.7–2.2cm densely pilose within, limb 1.2–3cm diameter with narrowly oblong ascending lobes, irregularly toothed or 3-lobed at apex.

**Sikkim:** Jongri, Nyegu La, Sirkia La. Open alpine slopes, 3960–4400m. May–August.

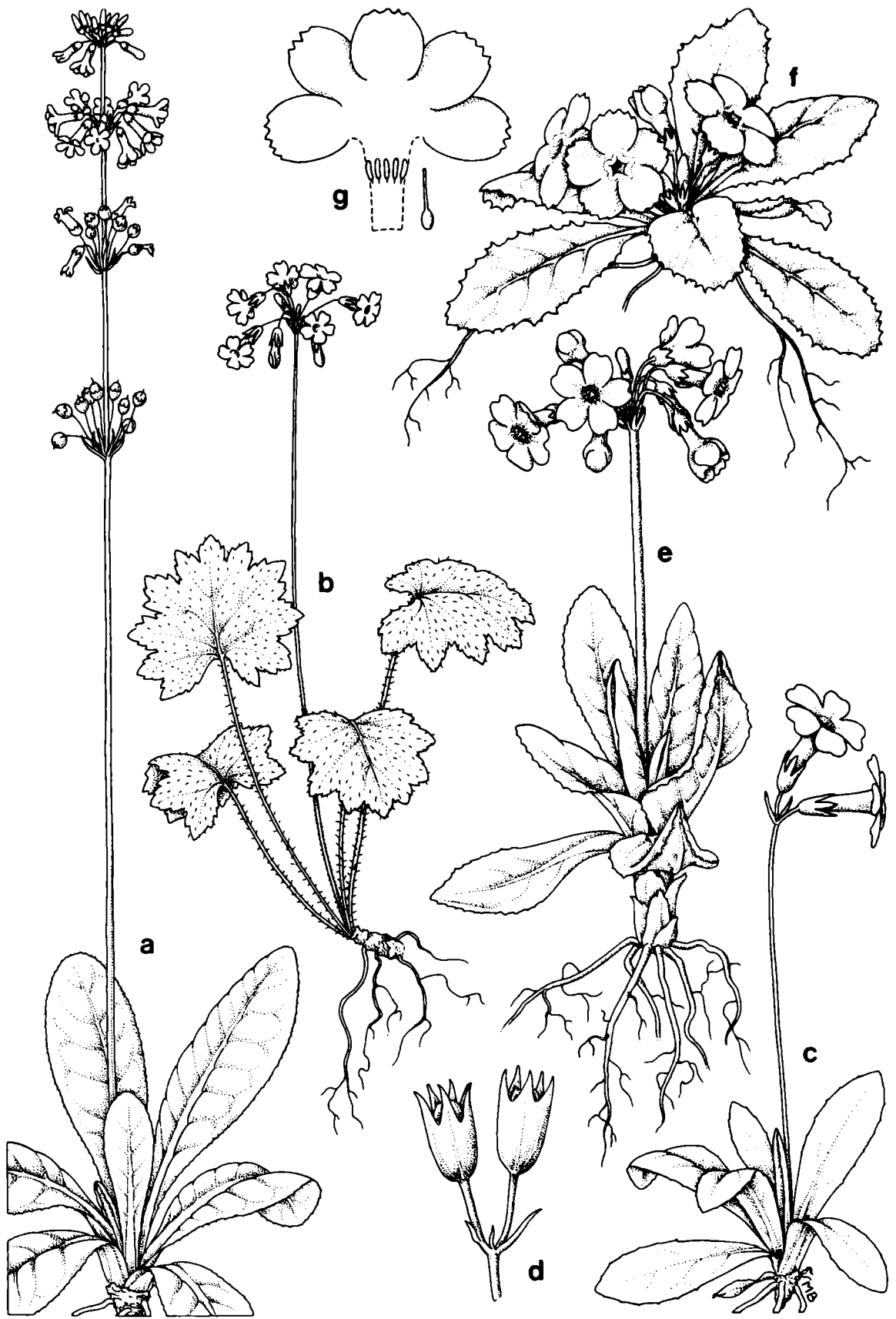
### 9. *P. bracteosa* Craib; *P. boothii* Craib

Evergreen sparsely farinose or efarinose plants; winter buds and persistent bud scales absent. Leaves at flowering rugose, spathulate or broadly obovate.

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FIG. 54. **Primulaceae.** a, *Primula smithiana*: plant in flower and fruit (× 1/3). b, *Primula geraniifolia*: habit (× 1/3). c–d, *Primula dickieana*: c, habit (× 2/3); d, fruit (× 1 1/2). e, *Primula calderiana*: habit (× 1/3). f–g, *Primula gracilipes*: f, habit (× 2/3); g, dissected flower (× 1). Drawn by M. Bates.





3–7 × 1.5–2.5cm, obtuse, base tapering into short broadly winged petiole, obtuse, margin denticulate, glabrous and efarinose or sparsely farinose on both surfaces. Leaves after flowering broadly ovate, 4–6 × 2.5–4.5cm, truncate or cordate at base with reddish narrowly winged petiole 3–8cm. Peduncle at flowering 1–4cm, sometimes sparsely farinose at apex, bearing a single umbel of 3–17 flowers; pedicels in flower 1.5–3.5cm; bracts linear-lanceolate 3–10mm, accompanied (in fruit only) by one or a few broadly ovate leafy bracts up to 2.5cm, on petioles 1.5–4cm. Calyx campanulate, keeled at base, 7–10mm, puberulous, farinose or not, cut to middle into entire, ovate-lanceolate teeth with prominent midrib. Corolla pink to magenta with greenish-yellow eye surrounded by white, tube 2–2.5 × length of calyx, limb 2–3cm, lobes broadly obovate, margin sinuous or trilobed. Capsule globose, dehiscent irregularly by a crumbling membrane.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa and Tashigang districts; **Sikkim:** Gangtok to Karponang; **Arunachal Pradesh:** Nyam Jang Chu. On mossy banks, steep slopes and damp rocky ravines in Hemlock/*Rhododendron* forest and among bamboo, 2130–3350m. February–May.

As suggested by Hara (71) *P. boothii* and *P. bracteosa* cannot be distinguished. The leafy bracts which have been used to characterise the latter species only appear in fruit.

**10. *P. scapigera* (Hook.f.) Craib; *P. petiolaris* Wall. var. *scapigera* Hook.f.**

Similar to *P. bracteosa* but plant efarinose; leaves smooth, pale green; pedicels 1.5–5cm, glandular; calyx 8–10mm, teeth long subulate-acuminate, reddish; fruiting peduncles without leafy bracts.

**Darjeeling:** Sandakphu, Tonglo, Garibans, Palmajua; **Sikkim:** Chhurong Chu and below Dzungri. Shady banks in *Abies/Rhododendron* forest, 2360–3000m. March–April.

Records from Bhutan (80, 256) have not been confirmed.

**11. *P. irregularis* Craib**

Similar to *P. bracteosa* and *P. scapigera* but plant strongly farinose, especially young leaves and flowers; leaves more leathery in texture, at flowering spatulate, up to 6 × 3cm, base tapering into broadly winged scarcely petiolate base, pale yellowish farinose; leaves at fruiting broadly ovate, 4–7 × 3–5cm, on petiole 3–7cm; peduncle at flowering up to 2cm (elongating to 17cm in fruit), bearing a farinose umbel of 12–30 flowers on pedicels 1.5–7cm; calyx tubular-campanulate, 8–12mm, farinose, not ribbed, cut to middle into ovate teeth, irregularly 3-toothed at apex; corolla waxy, pink, farinose, tube 2–2.5 × length of calyx, limb 1.5–3.5cm diameter, lobes obovate, shallowly dentate at apex; fruiting peduncles without leafy bracts.

**Sikkim:** Chia Bhanjang, Gowsar Chuli, Kanglasa, Nathu La. Rocky banks in *Abies/Rhododendron* forest, 3050–3960m. January–April.

**12. *P. hookeri* Watt; *P. vernicosa* Ward**

Dwarf deciduous efarinose herb, 2–3cm tall at flowering, with winter resting buds, and persistent ovate basal bud scales at flowering. Leaves at flowering oblong-spathulate, 1–3 × 0.6–0.8cm, obtuse, base attenuate into short winged petiole, sharply denticulate; leaves after flowering enlarging, oblanceolate, 4–9 × 2–3.5cm, with sharp irregular spreading teeth. Peduncle very short and invisible at first, bearing 1–4 flowers amongst leaves; pedicels less than 1cm; bracts minute, subulate. Calyx campanulate, 5–8mm, with short triangular entire or dentate teeth. Corolla white or violet, tube 1.5–2 × length of calyx, limb 8–12mm diameter, lobes entire or faintly emarginate. Fruiting peduncle stout, greatly elongated, 5–15cm, with short stout pedicels 5–10mm.

**Bhutan:** C – Tongsa district (Rinchen Chu) and Mongar district (Rudong La), N – Upper Bumthang Chu district (Chamka) and Upper Kulong Chu district (Shingbe, Me La); **Sikkim:** Lachen, Tholoong. Damp banks in *Abies/Rhododendron* forest, in *Rhododendron* scrub and on moraines, 3200–4720m. May–June.

Distinguished from *P. whitei* by its lack of a peduncle at flowering and its much smaller flowers.

**13. *P. bhutanica* Fletcher**

Deciduous herb with conspicuous winter resting bud. Bud scales persistent at flowering, ovate-oblong, 2–4 × 0.5–1cm. Leaves at flowering spathulate or oblanceolate, 2–10 × 1–1.5cm, obtuse or subacute, base attenuate into winged petiole, deeply denticulate, sparsely farinose, especially beneath but disappearing with age; after flowering leaves larger, 6–15(–20) × 1.5–5cm, with petiole 4–9cm. Peduncle 1–8cm in flower, up to 18cm in fruit, farinose near apex, bearing an umbel of 3–8 flowers; pedicels 2–4cm; bracts linear-lanceolate, 8–10mm. Calyx campanulate, 8–10mm, farinose, teeth lanceolate, acute, entire. Corolla bluish with a white eye, tube 2 × length of calyx, limb 2–3cm diameter, lobes obovate, usually 3-dentate.

**Bhutan:** C – Tashigang district (Dib La and Choling La) and Sakden district (Sakden), N – Upper Kulong Chu district (Lao). Under bamboo and rhododendrons, 3050–3650m. March.

Restricted to eastern Bhutan.

**14. *P. whitei* W.W. Smith**

Closely related to *P. bhutanica* but leaves after flowering more narrowly oblanceolate, with lamina decurrent to base of petiole; calyx lobes obtuse with 2–4-dentate apex; corolla lobes entire to crenate.

**Bhutan:** C – Punakha, Tongsa and Bumthang districts, N – Upper Kuru Chu district. Slopes under rhododendrons and conifers, 3050–4265m. March–May.

Restricted to the Black Mountains and northern central mountains of Bhutan. In east Bhutan it is replaced by the allied but rarer *P. bhutanica* (see above) which is probably no more than subspecifically distinct.

**15. *P. drummondiana*** Craib; *P. cunninghamii* Craib, *P. petiolaris* var. *stracheyi* Hook.f.

Evergreen herb; winter resting buds absent. Leaves at flowering oblanceolate or spatulate, 1.5–11 × 1–4cm, obtuse, base tapering to winged petiole, sharply and unequally spreading-denticulate, puberulous above, later glabrous, sparsely farinose at first, efarinose at maturity. Flowers numerous, borne amongst basal rosette leaves; peduncle absent; pedicels slender, 0.3–4cm, sparsely farinose, puberulous; bracts lanceolate 3–6mm. Calyx campanulate, 4–6mm, puberulous, farinose, divided  $\frac{1}{2}$ – $\frac{2}{3}$  into lanceolate teeth. Corolla pink or purplish with a brown spot at base of lobes, eye yellow, tube 2 × length of calyx, limb 10–15mm diameter, lobes obcordate, bifid. Capsule not seen.

**Sikkim:** Changu, Gnatong, Kanglasa, Karponang, Lingtoo, Sheraothang; **Chumbi:** Chumpithang. Open rocky and grassy banks, streamsides, 2440–3960m. September–February.

Similar to *P. gracilipes* and other ‘petiolarid’ species in habit and foliage, but flowers smaller and corolla lobes distinctly bifid.

**16. *P. pulchra*** Watt

Weak deciduous efarinose herb with winter resting bud; bud scales persistent at flowering, ovate-oblong, 1–7cm, membranous. Leaves oblong, 1–4 × 0.5–2cm, obtuse or subacute, base truncate or slightly cordate, margin sinuate-crenate, petiole slender, 3–13cm. Peduncle 2–12cm bearing an umbel of 1–4(–7) flowers; pedicels 0.5–4cm; bracts linear-lanceolate, 5–15mm. Calyx narrowly campanulate, 8–9mm, divided into lanceolate acute teeth in upper  $\frac{1}{3}$ . Corolla purplish, tube 9–13mm, limb 1.5–2.3cm diameter with bifid lobes. Capsule subglobose, included within calyx.

**Sikkim:** Jongri, Lachen, Tari; **Nepal/Sikkim border:** Meygo La and Kangla namo. On rocks. May–June.

A rare species endemic to Sikkim and adjacent East Nepal.

**17. *P. calderiana*** Balfour f. & Cooper; *P. diana*e Balfour f. & Cooper, *P. gammiana* Balfour f., *P. roylei* (Hook.f.) Balfour f. & W.W. Smith, *P. obtusifolia* Royle var. *roylei* Hook.f., *P. roylei* subsp. *diana*e (Balfour f. & Cooper) W.W. Smith & Forrest, *P. roylei* subsp. *calderiana* (Balfour f. & Cooper) W.W. Smith & Forrest. Fig. 54e.

Deciduous herb with winter resting bud. Bud scales persistent at flowering, ovate, yellow farinose. Leaves oblanceolate or spatulate, 5–30 × 1–6cm, obtuse to acute, base tapering to winged petiole, margin crenate-denticulate, weakly farinose beneath. Peduncle 7–28cm at flowering, farinose near apex, bearing an umbel of 5–25 flowers; pedicels 0.5–3.5cm, farinose; bracts lanceolate 5–10mm, farinose. Calyx campanulate, 5–10mm, cut to middle into lanceolate bluntish teeth, farinose. Corolla purple (white in forma *alba*), with yellow eye, tube 8–14mm, limb 1.5–3cm diameter, lobes obcordate, emarginate. Capsule globose, included within calyx.

**Bhutan:** C – Ha, Thimphu, Tongsa, Bumthang, Mongar and Sakden districts, N – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Sandakphu; **Sikkim:** widespread; **Chumbi:** Jelep La, Lingtoo. Clearings and streamsides in *Abies* forest, and in damp alpine meadows, 3000–4880m. May–August.

Two variants occur which are of minor taxonomic significance: forma **alba** (W.W. Smith) Hara with white flowers, from Sikkim (Changu) and Bhutan (Upper Bumthang Chu and Kulong Chu districts); var. **acaulescens** (Balfour f. & W.W. Smith) W.W. Smith & Fletcher which is a variant lacking a peduncle but with elongated pedicels 6–10cm, known only from SW Sikkim (between Sandakphu and Fahelungma).

**18. *P. strumosa*** Balfour f. & Cooper; *P. calderiana* subsp. *strumosa* (Balfour f. & Cooper) Richards

Similar to *P. calderiana* but corolla bright yellow, up to 3.5cm diameter.

**Bhutan:** C – Sakden district (Sakden), N – Upper Bumthang Chu district (Tsampa, Narim Thang and Waitang) and Upper Kuru Chu district (Po La); **Arunachal Pradesh:** Nyam Jang Chu. Damp clearings amongst *Abies* and *Rhododendron*, and marshy alpine meadows, 3650–4570m. April–August.

Sometimes treated as a subspecies of *P. calderiana* because it hybridises freely in cultivation. However in the wild this happens only where the two taxa (rarely) overlap. Normally they are quite distinct in flower colour and geography. The species is widespread in Nepal but curiously absent from Sikkim.

**19. *P. griffithii*** (Watt) Pax; *P. obtusifolia* Royle var. *griffithii* Watt

Similar to *P. calderiana* but at least some leaves ovate with truncate or subcordate base (others attenuate), 4–9 × 1–6cm at flowering, enlarging to 20–30 × 7–10cm at fruiting, apex sharply pointed, petiole broadly winged, margin coarsely spreading-denticulate; calyx 5–6mm, farinose, lobes broadly and bluntly triangular; corolla tube 9–11mm, limb 1.2–2.5cm diameter, deep blue violet (rarely purple) with golden eye, lobes emarginate.

**Bhutan:** C – Ha district (Damthang, Ha La, Saga La) and Thimphu district (Chelai La, Gunisawa, Bela La, Motithang, Pajoding, Taba, Dotena, Barshong); **Chumbi:** Lingmathang. In coniferous forests (*Abies*, *Tsuga*, *Picea* and *Pinus*) and *Rhododendron* scrub, in marshes and by streams, 2600–3800m. April–May.

A local endemic restricted to western Bhutan and the adjacent Chumbi valley, though quite frequent in the Paro and Thimphu valleys.

**20. *P. tanneri*** King

Efarinose herb with small winter resting buds. Bud scales persistent, ovate to oblong, 1.5–4.5cm long, obtuse or apiculate. Leaves dimorphic, at flowering mostly elliptic, 6–10 × 2.5–3.5cm, acute, base attenuate into winged petiole 3–5cm, margins spreading-denticulate; later leaves larger, ovate, 7–16 × 4–9cm, with truncate or cordate base, coarser marginal toothings and longer winged

petioles 8–17cm. Peduncle 8–23cm at flowering (–36cm in fruit), bearing an umbel of 6–12 flowers; pedicels 10–20mm; bracts narrow lanceolate 5–10mm. Calyx narrowly campanulate, 8–11mm, weakly constricted above ovary, split to below middle into lanceolate acuminate teeth. Corolla mauve or pale purple (yellow in subsp. *nepalensis*), with yellow eye; tube 10–15mm, limb 1.5–2cm diameter, lobes notched at apex. Capsule globose, enclosed within calyx.

Two subspecies occur:

a. subsp. **tanneri**

Flowers mauve or pale purple.

**Bhutan:** C – Ha district (Sele La), Thimphu district (Dotena, Barshong), Tongsa/Bumthang district (Yuto La), Mongar district (Donga La) and Tashigang district (ridge E of Tashigang); **Sikkim:** Chiya Bhanjang, Dzongri, Kanglasa, Fahelungma, Phalut and Singalela ridge; **Chumbi:** Yatung. Marshy clearings in *Picea* and *Abies* forests, rocks by streams and grassy alpine meadows, 2440–3650m. April–June.

Small forms can be confused with *Primula gambeliana* which differs in its smaller farinose resting buds and having all leaves cordate at base.

b. subsp. **nepalensis** (W.W. Smith) Richards; *Primula nepalensis* W.W. Smith

Flowers yellow.

**Bhutan:** C – Mongar/Tashigang districts (Donga La). Moist mossy ground in *Rhododendron* forest, 3500m. April–May.

Very close to yellow-flowered forms of *P. tsariensis* but differs in its acute leaves with sharp marginal teeth and smaller flowers up to 2cm diameter. *P. elongata* differs in its farina.

**21. *P. tsariensis*** W.W. Smith; *P. tanneri* subsp. *tsariensis* (W.W. Smith) Richards, *P. strumosa* var. *perlata* W.W. Smith & Fletcher

Similar to *P. tanneri* but leaves not dimorphic, all obovate-spathulate at flowering, obtuse at apex, attenuate at base, margins crenate; corolla larger, 2.5–3.5cm diameter with broad obovate lobes notched at apex, white, yellow, violet to dark purple.

**Bhutan:** C – Punakha district (Tang Chu, Ritang) and Tongsa district (Rinchen Chu valley at Lachu La, Omta Tso and Thita Tso). Damp alpine meadows and gullies, especially with late snow-lie, 4410–4875m. June–August.

Sometimes reduced to a subspecies of *P. tanneri* but distinct in its foliage characters. It grows at much higher altitudes than *P. tanneri*. The large flowers which are very variable in colour make this an extremely showy and attractive species.

**22. *P. macrophylla*** D. Don; *P. purpurea* Royle, *P. stuartii* Wall. var. *purpurea* (Royle) Watt

Robust herb with winter resting-buds and numerous persistent dead leaves. Bud scales 3–5cm, reddish, often farinose. Leaves oblanceolate, 5–14 × 1–3cm,

acute, base attenuate to winged petiole, margin finely crenate, slightly revolute, creamy or yellow farinose beneath, otherwise glabrous. Peduncle 9–20cm (–25cm in fruit), farinose above, carrying a single umbel of 3–12 flowers; bracts purplish, leafy, linear-lanceolate, 10–15mm,  $\pm$  equalling pedicels; pedicels 5–17mm in flower (up to 9cm in fruit), farinose. Calyx purple, 8–15mm, cylindrical, divided to  $\frac{2}{3}$  or  $\frac{3}{4}$  into linear-lanceolate teeth, acute or subacute, farinose chiefly within. Corolla deep lilac or rich purple, with darker purple eye, tube 12–18mm, limb 2–2.5cm diameter, lobes obovate, entire or slightly emarginate. Capsule cylindrical, 10–15mm, dehiscent by acute valves.

**Bhutan:** C – Thimphu and Tongsa districts, N – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Lhonak, Cho La, Lachung, Chemathang, Naku La, Koraphu Chu; **Chumbi:** Chomolhari, Chumegata. Damp alpine meadows, marshes and stream-sides, sometimes amongst dwarf *Rhododendron*, 3810–4880m. May–August.

**23. *P. megalocarpa*** Hara; *P. stuartii* Wall. var. *macrocarpa* Watt, *P. macrophylla* D. Don var. *macrocarpa* (Watt) W.W. Smith & Fletcher

Similar to *P. macrophylla* but a smaller plant; leaves 3–8 × 0.5–1.4cm at flowering, apex acute or obtuse; peduncles much shorter, 2.5–7cm in flower (–10cm in fruit); flowers 2–6 per umbel on pedicels up to 1cm usually exceeded by conspicuous bracts; calyx divided almost to base into oblanceolate lobes broadest near apex which is rounded or often retuse; corolla paler in colour, lilac or mauve (sometimes white in Nepal), limb 2.5–3cm diameter; lobes deeply emarginate; capsule 1.4–2.1mm with valves rounded at apex.

**Bhutan:** C – Thimphu and Tongsa districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Thangshing, Koraphu Chu, Thanka La, Tosa, Cho La, Cheumsangthang. Wet alpine cliffs and scree, rocky streamsides and by waterfalls, 3960–4880m. June–August.

*P. megalocarpa* is a recently described species but was formerly known as *P. macrophylla* var. *macrocarpa*; however the latter taxon was poorly defined and specimens so named can belong to either *P. macrophylla* or *P. megalocarpa*.

**24. *P. obliqua*** W.W. Smith; *P. stuartii* auct. p.p. non Wall.

Deciduous herb with large winter resting-buds. Bud scales persistent at flowering, ovate, 2–6cm, imbricate, reddish, often farinose. Leaves oblanceolate, 10–20 × 2–5cm, obtuse or subacute, base tapering into winged petiole, margin crenate-serrate or subentire. Peduncle 25–45cm in flower (–60cm in fruit), bearing a single umbel of 4–9 flowers; bracts subulate, up to 1cm; pedicels 1–3cm, densely farinose. Calyx campanulate, 7–12mm, divided at least to middle into oblong obtuse teeth, farinose. Corolla white or creamy, sometimes pinkish or orange in centre, tube 1–1.5cm, farinose within, limb 2–3cm diameter, lobes broadly obovate, deeply emarginate, 2 posterior lobes usually reflexed. Capsule usually longer than calyx.

**Bhutan:** C – Ha, Thimphu, Tongsa, Bumthang and Mongar districts, N – Upper Bumthang Chu and Upper Kuru Chu districts; **Sikkim:** Changu, Dzongri, Cho La, Chuurong Chu, Momay Samdong, Gnathong, Tari; **Chumbi:** Chumbithang. Moist alpine meadows and marshes, often amongst rhododendrons, 3200–4570m. June–August.

### 25. *P. elongata* Watt

Deciduous herb with persistent winter resting-buds. Bud scales oblong, 1.5–2 × 0.7cm, farinose. Leaves oblanceolate, 7–12 × 2–4cm, obtuse or subacute, base tapering to winged petiole (or sometimes, in Bhutan some leaves cordate or truncate at base), covered at first beneath by weak farina. Peduncle 20–30(–40)cm, farinose above, bearing a single (sometimes double) umbel of 5–10 flowers; pedicels 5–10mm (up to 5cm in fruit); bracts subulate, 2.5–5mm. Calyx tubular, 6–9mm, cut to middle into lanceolate teeth. Corolla zygomorphic, sulphur-yellow, tube 12–18mm, limb 1.6–2.6cm diameter, lobes obcordate, crenulate-toothed at apex. Capsule cylindrical, 1.5–2cm.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Changu, Yak La, Kapup, Gnathong, Sherabthang, Cho La and Zemu Valley; **Chumbi:** Chumpithang, Gautsa. Alpine screes, cliff-ledges and streamsides, amongst *Rhododendron*, and in *Abies/Rhododendron* forest, 3050–4720m. April–July.

Two variants occur in Bhutan: the typical widespread plant with the base of all leaves long attenuate, and a more local Bhutanese form with the young leaves cordate at the base but older leaves typical; this form is restricted to Punakha district (Ritang), Tongsa district (Black Mountain area and Rinchen Chu) and Upper Bumthang Chu district (Pangothang, Tsampa, Tolegang, Kantanang). This form has sometimes been misidentified as *P. barnardoana* W.W. Smith & Ward from SE Tibet which differs in having all its leaves cordate at the base.

*P. elongata*, *P. gambeliana* and *P. rotundifolia* are apparently closely related (though sometimes placed in different sections) in sharing the unusual character of ‘double umbels’; these appear as single umbels when in flower but contain a very short inconspicuous secondary peduncle bearing some of the flowers; this secondary peduncle elongates only in fruit to give a true candelabra. However this character is displayed only in more robust plants of all three species; small plants bear only a single umbel.

### 26. *P. gambeliana* Watt

Deciduous herb with winter resting bud. Bud scales strongly farinose but rest of plant efarinose. Leaves broadly ovate, 1–5 × 1–3cm in flower (to 11 × 6cm in fruit), acute, base cordate, margin crenate-serrate, glabrous on both surfaces; petiole 2–10cm in flower (–19cm in fruit), ± sheathing at base. Peduncle 5–20cm, bearing a single or double umbel with 3–11 flowers (secondary peduncle



when present elongating to 5cm in fruit); pedicels 4–10mm; bracts linear-lanceolate, 3–8mm. Calyx tubular, 6–8mm, deeply divided into linear acute lobes. Corolla purplish or violet with yellow eye, tube 11–16mm, limb 2–2.5cm diameter, lobes obcordate, irregularly denticulate at apex. Capsule cylindrical, 10–14mm.

**Bhutan:** C – Sakden district (Sakden, Merak, Orka La); **Darjeeling:** Sandakphu; **Sikkim:** Alookthang, Jamlinghang, Lachung, Jongri, Megu, Phedup and Singalila; **SE Tibet:** Cho La. On rocky mossy banks and shady cliff-ledges, mostly in *Abies/Rhododendron* forest, 3650–4570m. May–July.

Yellow-flowered plants from E Nepal (which could also occur in Sikkim) have been identified as *P. barnardoana* W.W. Smith & Ward (from SE Tibet), but the latter differs in having leaves farinose beneath and is closer to *P. elongata*; the Nepal plants are at present treated as a colour variant of *P. gambeliana* but are much more restricted geographically.

**27. *P. rotundifolia*** Wall.; *P. cardiophylla* Balfour f. & W.W. Smith, *P. cordifolia* Pax, *P. roxburghii* Balakrishnan *nom. superfl.*

Deciduous herb with resting buds. Basal scales farinose. Leaves broadly ovate or suborbicular, 3–10 × 3–10cm, obtuse, base deeply cordate, margin dentate, farinose beneath; petiole 5–20cm, ± sheathing at base. Peduncles 10–30cm, bearing a single or often double umbel of 2–16 flowers (secondary peduncle elongating to 7cm in fruit); pedicels 1–2(–3)cm, farinose; bracts subulate, 5–15mm. Calyx campanulate, 5–6mm, farinose, divided almost to base into linear subacute teeth. Corolla purplish with yellow eye, tube 1–1.5cm, limb c 1.5cm diameter, lobes entire or subcrenate. Capsule oblong, c 1cm.

**Darjeeling:** Sandakphu. Dry crevices and rock-ledges on cliffs, 3600–3960m. May–June.

**28. *P. caveana*** W.W. Smith; *P. cana* Balfour f. & Cave

Dwarf herb with persistent winter resting buds surrounded by withered leaf remains. Bud scales farinose. Leaves oblanceolate or obovate, 1.5–4 × 1–2cm, obtuse, base abruptly or gradually cuneate to ± slender petiole, margin denticulate, white farinose glandular beneath; petiole subequal or up to 3 × longer than lamina. Peduncle 3–12cm, bearing a single umbel of 1–9 sweetly fragrant flowers; bracts linear-lanceolate, 7–15mm; pedicels 1–2cm (up to 4cm in fruit), farinose. Calyx campanulate, 5–10mm, farinose, deeply divided cut into oblong subacute teeth. Corolla purple with yellow eye, tube 0.7–1.3cm, limb 1.2–1.7(–2.3)cm diameter, lobes entire or crenulate. Capsule ovoid-subglobose, included in calyx.

**Bhutan:** C – Tongsa district, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Lhonak, Lungnak La, Naku La; **Chumbi:** Chomolhari. Dry crevices and rock overhangs on cliffs and under boulders at high altitude, 3960–4880m. June–July.

**29. *P. kingii* Watt; *P. dickieana* Watt var. *gouldii* Fletcher, *P. gageana* Balfour f. & W.W. Smith**

Perennial efarinose herb with small winter resting-buds; bud scales oblong, 1–2cm. Leaves firm and fleshy, elliptic-oblong, 4–11 × 1–2cm including petiole, acute, base attenuate, margin horny, remotely denticulate, gland-pitted beneath. Peduncle 7–18cm (–29cm in fruit); umbel of 3–7(–12) flowers, ± pendant; bracts 3–10mm linear; pedicels 5–15mm puberulous. Calyx narrowly campanulate, 6–8mm, divided to middle into triangular teeth. Corolla dark claret to almost black, campanulate, 15–18mm long, lower tubular part as long as calyx, limb 13–17mm diameter, lobes oblong or elliptic, c 5mm, entire or emarginate. Capsule ovoid, 1–1.5 × length of calyx.

**Bhutan:** C – Ha district (Sharitang and Saga La), Bumthang district (Minling, Ura La, Tripte La) and Sakden district (Orka La); **Sikkim:** Joloong, Kapup, Nathong, Natu La and Sherabthang; **Chumbi:** Yatung, Rinchengang. Marshes and swampy ground in pastures and forest clearings, 3500–4265m. May–June.

One of the most horticulturally desirable alpinines of Bhutan on account of its exceptionally attractive flowers.

**30. *P. dickieana* Watt; *P. pantlingii* Watt. Fig. 54c&d.**

Similar to *P. kingii* but flowers fewer, mostly 1–6 on spreading pedicels 2–7mm (up to 25mm in fruit, then erect); calyx 8–10mm; corolla yellowish-white or purplish usually with a yellow or orange eye, c 2 × length of calyx, hairy within, limb 2–2.8cm diameter, lobes obovate-elliptic, bilobed.

**Bhutan:** C – Sakden district (Merak and Orka La), N – Upper Kuru Chu district (Singhi) and Upper Kulong Chu district (Shingbe, Lao and Me La); **Sikkim:** Eumtso La, Lachen, Thangu, Tsomgo. Boggy ground and marshes in alpine pastures and *Rhododendron* scrub, 3200–4260m. May–August.

The above description and distribution refer to the typical var. **dickieana**. Var. **aureostellata** (Balfour f. & Cooper) Fletcher (*P. aureostellata* Balfour f. & Cooper) is a vigorous variety, distinguished from var. *dickieana* by its taller peduncles 28–40cm, bearing white or pale yellow flowers with deeper yellow star-like centres. It is endemic to Bhutan, confined to the Bumthang/Mongar district divide (Kempe La and Rudong La, 3200–3800m).

**31. *P. smithiana* Craib. Fig. 54a.**

Perennial evergreen herb without winter resting buds. Leaves oblanceolate, 7–20 × 2–5cm including petiole, obtuse, base attenuate, glabrous, efarinose or sparsely farinose beneath, margins sharply denticulate. Peduncles 15–60cm, bearing 2–5 distant (rarely 1) umbels; nodes, pedicels, bracts and calyces farinose; bracts up to 10mm long; pedicels up to 2.2cm. Calyx campanulate, 3–4mm long and broad, strongly farinose, toothed in upper third. Corolla tube cylindrical, 8–10mm; limb yellow, 10–15mm diameter, lobes oblong to obovate, slightly emarginate. Capsule globose ± as long as calyx, dehiscent by 5 valves.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Mongar districts;

**Chumbi:** Rinchengong, Lingmuthang, Tungka La. Boggy places beside streams, 2440–3350m. April–June.

Surprisingly absent from Sikkim. Sometimes united with *P. prolifera* Wall. from Assam which differs in being efarinose, its more finely denticulate leaves and larger yellow flowers with tube up to 18mm and limb 18–20mm diameter.

**32. *P. ianthina* Balfour f. & Cave**

Similar to *P. smithiana* but leaves up to 25 × 7cm, glandular pitted especially on lower surface; calyx farinose, divided to halfway; corolla with broader violet limb 1.5–2cm diameter, lobes obcordate to rounded emarginate.

**Darjeeling:** between Sandakphu and Garibans; **Sikkim:** between Sandakphu and Phalut, Megu. In pastures and damp meadows, 3500–4265m. June–July.

Endemic to the Singalila ridge of western Darjeeling and Sikkim.

**33. *P. cooperi* Balfour f.**

Similar to *P. smithiana* but leaves more coarsely dentate, reputedly aromatic at flowering time; peduncle up to 30cm, with 1–2 umbels of flowers; calyx efarinose, tubular-campanulate 7–8 × 4–5mm, divided in upper 1/3 into triangular teeth; corolla yellow, tube c 10mm, limb to 17mm diameter, lobes surtund; capsule ± as long as calyx, dehiscing rather irregularly.

**Sikkim:** above Tong. Sandy streamsides, 3050m. July.

Endemic to Sikkim.

**34. *P. prenantha* Balfour f. & W.W. Smith**

Smaller than *P. smithiana* and its allies. Leaves oblong-obovate, 5–12 × 2–3cm including petiole, obtuse, base attenuate, margin denticulate, glabrous and efarinose. Peduncles up to 15cm (–20cm in fruit) sparsely farinose above, with 1–2 closely superposed umbels of flowers. Flowers 4–8 per umbel; pedicels up to 15mm; bracts linear 5–10mm. Calyx campanulate, 4.5–5mm long and broad, teeth short, tinged reddish. Corolla yellow, tube 5–7mm, limb 6–8mm diameter, lobes oblong, 2–2.5mm, retuse. Capsule subglobose, c 5mm diameter.

**Bhutan:** C – Bumthang/Mongar district (Rudong La), N – Upper Mangde Chu/Upper Bumthang Chu district (Ju La) and Upper Kuru Chu district (Singhi Dzong); **Sikkim:** Phedang and between Dzongri and Yoksam. Damp mossy banks and amongst rocks in *Abies/Rhododendron* forest, 2440–3650m. June–July.

**35. *P. sikkimensis* Hook. f. Med: *Shangshangdilbu*.**

Evergreen perennial herb without resting buds. Leaves oblanceolate, 4–32 × 1–5cm including petiole, apex obtuse, base long attenuate into distinct petiole, sometimes with some leaves more abruptly narrowed at base, margin finely dentate, glabrous, efarinose. Peduncle 10–50cm (–90cm in fruit), farinose at apex, bearing usually one umbel, rarely 2, flowers 3–20, fragrant; pedicels 2–8cm in flower, pendulous at first, later elongating, erect, farinose at apex; bracts

linear-lanceolate, 8–13mm, with distinct midrib. Calyx tubular, 7–12mm, farinose, divided to middle into lanceolate teeth with distinct midrib. Corolla campanulate, yellow, more rarely creamy or white, tube 1–2cm, limb 1–2cm diameter, lobes suberect, obcordate, entire or emarginate, farinose within. Capsule oblong, c 1cm, as long as or longer than calyx.

Three varieties occur but these appear to intergrade and are of doubtful taxonomic status (they may be habitat variants):

a. var. **sikkimensis**

Robust plants with long leaves 12–32 × 2–5cm; peduncle up to 50cm, flowers 6–20 per umbel; corolla yellow, 1.5–2cm diameter.

**Bhutan:** C – Thimphu, Tongsa, Bumthang, Mongar, Tashigang and Sakden districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Phallut; **Sikkim:** Dzungri, Bikbari, Nathu La, Sheraothang, Chamnago, Changu, etc.; **Chumbi:** Yatung, Chumbithang. Marshy ground beside streams, damp meadows, amongst scrub and in *Abies* forest, 2745–4420m. May–August.

b. var. **pudibunda** (W.W. Smith) W.W. Smith & Fletcher; *Primula pudibunda* W.W. Smith

Smaller than var. *sikkimensis* (possibly a high-altitude form), leaves 4–16 × 1–2cm, at least some more abruptly narrowed at the base; peduncle shorter, 10–33cm in flower, flowers 3–10 per umbel, corolla yellow, 1–1.5cm diameter.

**Bhutan:** C – Tongsa/Bumthang districts (Yuto La), N – Upper Mo Chu district (Yale La), Upper Bumthang Chu district (Pangotang) and Upper Kuru Chu district (Singhi Dzong); **Sikkim:** Lamteng to Thangu, Dobinda Pass, Eumtso Lake. Habitats as for var. *sikkimensis*, 3960–4880m. May–July.

c. var. **hopeana** (Balfour f. & Cooper) W.W. Smith & Fletcher; *Primula hopeana* Balfour f. & Cooper

Similar to var. *pudibunda* but corolla white or creamy, sometimes with a red tube.

**Bhutan:** C – Punakha district (Wangdu Phodrang, Tang Chu), Tongsa district (Dungshinggang) Sakden district (Orka La), N – Upper Mo Chu district (Kangla Karchu La), Upper Mangde Chu district (Saga La, Goktang La), Upper Bumthang Chu district (Ju La, Tolegang, Kantanang, Tsampa). Often in drier habitats than var. *sikkimensis*, in meadows, scrub, open hillsides and cliff-ledges. 3660–4730m.

Forms of *P. sikkimensis* with two umbels can be easily distinguished from *P. smithiana* by the longer efarinose calyx.

**36. P. waltonii** Balfour f.; *P. vinosa* Stapf

Similar to some forms of *P. sikkimensis* especially var. *hopeana* but corolla deep purplish.

**Bhutan:** C – Sakden district (Sakden); **Sikkim:** Singalila Ridge (Richards);

**Arunachal Pradesh:** Nyam Jang Chu (Marmang). Marshy ground, streamsides and in conifer forest, 3050–3650m. May–July.

This is a Tibetan plateau taxon which just reaches the *Flora of Bhutan* area; it is often mixed with yellow-flowered plants suggesting that it may hybridise freely with *P. sikkimensis*, or be a variety of that species.

### 37. *P. chumbiensis* W.W. Smith

Similar to *P. sikkimensis* especially the smaller varieties, but leaves  $\pm$  coriaceous, oblong-elliptic, 2–8  $\times$  1–5cm, obtuse, all  $\pm$  rounded at base, crenate-dentate, glabrous but minutely papillate beneath, lateral veins prominent; umbel of 1–9 flowers; pedicels 1.5–2cm in flower; corolla 1.5–2cm diameter, pale yellow, slightly farinose within.

**Bhutan:** C – Thimphu district (Barshong, Kumathang and Mem La), N – Upper Mo Chu district (Naha and Yale La); **Chumbi:** Chomolhari, Chumegata and Kalaeree. Sandy and gravelly river banks, 3800–4730m. May–August.

A local endemic species confined to W Bhutan and the Chumbi Valley.

### 38. *P. reticulata* Wall.

Similar to *P. sikkimensis* and *P. chumbiensis* but leaves membranous, ovate-oblong, 2.5–11  $\times$  1.5–3cm, obtuse, base shallowly cordate, margin  $\pm$  doubly crenate-denticulate, veins  $\pm$  prominent and minutely papillate beneath, petioles 2.5–11cm; peduncles 15–30cm, bearing an umbel of 2–8 flowers, sparsely farinose above; pedicels 1–3.5cm; bracts leafy, lanceolate, 10–15  $\times$  3–4mm; calyx 5–8mm sparsely farinose; corolla creamy or pale yellow, 13–20mm long, thinly farinose within.

**Bhutan:** C – Thimphu district (Barshong, Barshong to Shodu), N – Upper Mo Chu district; **Sikkim:** Changu, Megu, Kapup, Jongri, Nathu La, Tari, Dobinda Pass and Yak La. On mossy rocks, streamsides, in marshes and amongst ferns on open hillsides, 3500–4265m. May–August.

### 39. *P. alpicola* (W.W. Smith) Stapf

Evergreen perennial herb without resting buds. Leaves oblong-elliptic, 4–15  $\times$  2.5–6cm, obtuse, base abruptly contracted, rounded, margin finely crenate-denticulate, glabrous but minutely papillate beneath; petiole 4–9cm. Peduncle 17–35cm in flower, farinose at apex, bearing a single (rarely double) umbel of 8–13 flowers; bracts leafy, oblong, 12–17  $\times$  3–5mm. Calyx 7–8mm, farinose, divided to  $\frac{1}{3}$  into triangular teeth. Corolla yellow (in Bhutan), rather variable in size, tube 7–12mm, lobes ovate, 5–7mm, shallowly notched, densely farinose within. Capsule cylindric, 7–10mm.

**Bhutan:** C – Punakha district (Tang Chu) and Tongsa district (Rinchen Chu), N – Upper Mangde Chu district (Saga La) and Upper Bumthang Chu district (Kantanang). In damp clearings in *Abies/Rhododendron* forest, amongst dwarf rhododendrons and on open hillsides, often by streams, 3650–4100m. June–July.

**40. *P. munroi*** Lindley; *P. involucrata* Duby non Sweet. Fig. 55a&b.

Glabrous perennial herb. Leaves ovate or oblong 1–3.5 × 0.5–1cm, obtuse, base abruptly narrowed, entire or denticulate, efarinose; petiole winged, 2–6cm. Peduncle 10–30cm, bearing a single umbel of 2–6 nodding fragrant flowers; bracts oblong-lanceolate, upper part 6–10 × 1.5–4mm, prolonged below insertion into a broad 1–3-toothed auricle 4–7mm; pedicels slender, 1–2.5cm. Calyx tubular-campanulate, 5–7mm, divided in upper third into lanceolate teeth. Corolla usually white with yellow eye but sometimes pink tinged or purplish, ± zygomorphic, tube 8–12mm, limb 1–2.2cm diameter, lobes obcordate, deeply emarginate. Capsule oblong up to 7mm.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Bumthang and Sakden districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Kopup, Nathu La, Lhonak, Lam Pokhri, Lachen. Boggy ground and streamsides in open alpine meadows and amongst *Salix* and *Rhododendron* scrub, 3650–4570m. May–September.

The familiar name of *P. involucrata* Duby cannot be used for this species due to the existence of an earlier *P. involucrata* Sweet from Egypt.

Most collections from Sikkim and Bhutan belong to the typical subsp. **munroi** with white or pale pinkish-tinged flowers; three collections from Bhutan, Tongsa district (Tibdey La and Penge La) and Upper Bumthang Chu district (Kantanang), represent the more eastern subsp. **yargongensis** (Petitmengin) Long (*P. yargongensis* Petitmengin) with deep pinkish or mauve flowers. It is probably only a colour form.

**41. *P. tibetica*** Watt

Dwarf glabrous perennial herb. Leaves ovate-elliptic, 0.5–3 × 0.5–1.2cm, obtuse or subacute, base cuneate, margins entire, efarinose; petiole winged, 0.5–3.5cm. Peduncles 2–9(–20)cm, often hidden among leaves, bearing 1–12 flowers; bracts oblong, 4–8mm, ± acute, base saccate or shortly auricled; pedicels often longer than peduncles, 1.5–5.5cm. Calyx narrowly campanulate, 4–5mm, usually with 5 prominent dark purple ribs, divided to 1/3 into oblong obtuse teeth, tube saccate at base. Corolla pink with yellow eye, tube 4–5mm, limb 7–10mm diameter with obcordate deeply emarginate lobes. Capsule cylindrical, c 8mm.

**Bhutan:** N – Upper Mo Chu (Chebisa, Chumiten, Gangyuel, Pangte La); **Sikkim:** Lhonak, Lama Gongra, above Tangu; **Chumbi:** Phari, Lingmatang, Yatung to Gautsa. In damp grassy meadows and marshy river banks, 3600–4570m. May–September.

The specimen (*Ludlow* et al. 16277) from Pangte La was formerly wrongly

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FIG. 55. **Primulaceae.** a–b, *Primula munroi*: a, habit (× 2/3); b, fruit (× 1). c, *Primula capitata*: habit (× 1/3). d, *Primula soldanelloides*: habit (× 1 1/2). e, *Primula dryadifolia* subsp. *jonardunii*: habit (× 2/3). f–h, *Primula primulina*: f, habit (× 1); g, dissected corolla of thrum-eyed flower (× 2 1/2); h, dissected corolla of pin-eyed flower (× 2 1/2). i–j, *Omphalogramma ehwesiana*: i, habit (× 2/3); j, fruit (× 1). Drawn by M. Bates.



identified as *P. fasciculata* Balfour f. & Ward, a Chinese species.

**42. *P. pumilio*** Maximowicz; *P. pygmaeorum* Balfour f. & W.W. Smith

Similar to *P. tibetica* but a smaller compact herb; leaves spatulate, up to 1 × 0.5cm, with short broadly winged petiole; peduncle absent or up to 6mm, bearing up to 8 flowers; bracts ovate, 1–2mm, not saccate; pedicels 2–6mm; corolla limb 5–7mm diameter.

**Chumbi:** between Phari and Gyantse. Open marshy grassland, 4270m. May.

A Tibetan plateau species. Similar to *P. walshii* in habit but that species differs in its minutely pubescent leaves and calyx.

**43. *P. glabra*** Klatt; *P. genestieriana* Handel-Mazzetti

Glabrous rosette herb forming small clumps. Leaves spatulate, 1–3.5 × 0.4–1cm, subacute or obtuse, base tapering to winged petiole, margin sharply denticulate, usually glandular punctate beneath. Peduncle slender, 2–11cm, umbel of (2–)6–9(–12) flowers; bracts ovate to lanceolate, 1–2mm, ± pouched at base; pedicels 1–2(–5)mm. Calyx campanulate, 3–4mm, lobes rounded. Corolla blue or purplish, rarely white, with yellow eye, tube 3–4mm long, limb 4–7mm diameter with obovate deeply emarginate lobes. Capsule short, as long as calyx.

**Bhutan:** C – Ha, Thimphu, Punakha, Bumthang and Sakden districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Bikbari, Kopup, Ningbil, Dzongri, Rathong Chu, Yampung, Surkia La; **Chumbi:** Yatung. In clearings in dwarf *Rhododendron* and on open alpine peaty turf, mossy rocks and grass slopes, 3650–4510m. April–August.

**44. *P. concinna*** Watt

Dwarf cushion-forming or turf-forming plant up to 2.5cm tall. Leaves oblanceolate or obovate, 1–2.5 × 0.6cm including petiole, acute or subacute, base attenuate, margin entire or obscurely crenate, glabrous above, yellowish farinose beneath. Peduncle concealed among leaves, 5–10mm long, bearing an umbel of 1–5 fragrant flowers; bracts linear, 2–6mm; pedicels slender, 5–10mm. Calyx campanulate, 4–5mm, ± farinose, divided to middle into oblong subacute teeth. Corolla purplish or white with yellow eye, tube 4–5mm, limb rotate, 7–10mm diameter with obovate emarginate lobes. Capsule oblong, as long as calyx, dehiscing by valves.

**Bhutan:** C – Thimphu district (Tarka La) and Tongsa district (Changesthang), N – Upper Mo Chu district (Shingche La FEH 2, Kangla Karcha La), Upper Pho Chu district (Gaffoo La) and Upper Bumthang Chu district (Marlung and Champa); **Sikkim:** Kanglanomo Pass, Kinchin Jhow, Momay Samdong, Lhonak, Changu, E Rathong Glacier, Gora La, Naku La, Gocha La; **Chumbi:** Yatung, above Gautsa. In peaty turf in alpine meadows, rocks and stony slopes, often near water, 4265–4880m. June–July.



**45. *P. assamica* Fletcher**

Evergreen perennial herb with persistent withered leaf remains at base. Leaves oblanceolate, 1.8–4.5 × 0.5–1cm, obtuse, base attenuate into short winged petiole, white farinose beneath, minutely glandular-puberulous above. Peduncle 1.3–4cm (–8cm in fruit), bearing a single umbel of 1–5 flowers; bracts lanceolate, 5–10mm, glandular-puberulous; pedicels 3–6mm. Calyx 10–11mm, glandular puberulous, divided to  $\frac{2}{3}$  into lanceolate teeth. Corolla mauve with white eye, tube 9–10mm, limb rotate 1.3–1.6cm diameter. Fruit not seen.

**Bhutan:** C – Sakden district (Orka La), N – Upper Kulong Chu district (Lao). Damp cliff-ledges, 3550–4600m. May–June.

A poorly-known species probably related to *P. jaffreyana*, but also similar to forms of *P. atrodentata* which differs in its smaller sessile flowers.

**46. *P. jaffreyana* King; *P. lhasaensis* Balfour f. & W.W. Smith**

Perennial herb with persistent withered leaf remains at base. Leaves obovate-elliptic, 3–7 × 0.7–3.5cm, obtuse, base attenuate into petiole up to 4cm, glabrous but often white farinose beneath, margins serrate-dentate. Peduncle 5–20cm, bearing a single umbel of 6–20 flowers; bracts subulate 8–10mm; pedicels 0.6–2.5cm, farinose. Calyx cylindrical, 7–8mm, 5-ribbed, divided almost halfway into oblong lobes, farinose. Corolla mauve or violet with yellow eye, tube 12–15mm, limb rotate, 12–15mm diameter, lobes broadly obcordate. Capsule cylindrical, 8–10mm.

**Chumbi:** locality unknown. Dry scrubby slopes, typically amongst *Rhododendron* and evergreen oak scrub, 3660m. May–July.

The original description of this species gave Chumbi as the locality; however the type specimen is labelled only ‘Tibet’ and its precise provenance is uncertain.

**47. *P. xanthopa* Balfour f. & Cooper**

Perennial herb with slender rhizomes bearing withered leaf remains. Leaves obovate, 1–3.5 × 1–2cm, apex rounded, margin coarsely sharply toothed, base narrowed to a slender petiole up to 5cm long, glabrous and efarinose above, thickly golden farinose beneath. Peduncle slender, 5–10cm, farinose near apex, bearing 1–3 flowers; bracts elliptic-lanceolate, up to 7 × 2mm; pedicels 7–11mm. Calyx campanulate, 4–6mm, farinose, deeply cut into acute lobes. Corolla purplish with a yellow eye, tube c 1cm, limb 1–1.5cm diameter with obovate emarginate lobes. Capsule oblong, c 5mm.

**Bhutan:** C – Mongar/Tashigang district (Donga La). On moist shady mossy rocks and cliff-ledges, 3650–3800m. July–August.

A very local Bhutanese endemic known only from this single locality where it was discovered by R.E. Cooper.

**48. *P. primulina* (Sprengel) Hara; *P. pusilla* Wall. non Goldie. Fig. 55f–h.**

Dwarf herb often forming extensive patches. Leaves forming a basal rosette surrounded by dead leaves. Leaves spatulate to oblanceolate, 0.8–1.8 ×

0.3–0.5cm, acute, base attenuate, margin pinnatifid-dentate, efarinose, scabrid-pubescent on both surfaces. Peduncle slender, 1.5–7cm, sparsely farinose above, bearing a head of (1–)2–5 subsessile flowers; bracts linear-lanceolate, c 4mm. Calyx campanulate, 3–5mm, divided to middle into triangular teeth, finely puberulous or white farinose. Corolla purplish, rarely white, tube 5–6mm, whitish puberulous externally, throat occluded by a dense tuft of white hairs, limb 8–10mm diameter, lobes obcordate, emarginate. Capsule ovoid,  $\pm$  as long as calyx.

**Bhutan:** C – Ha, Thimphu, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kuru Chu districts; **Sikkim:** Changu, Nathu La, Jongri, Lachen, Zelep La, Bikbari, Lungnak La, Phaklung, etc.; **Chumbi:** Yatung, Phari, Chomolhari. Peaty hummocks and grassy banks in alpine meadows, on marshy valley floor or on cliffs and rocky slopes, 3860–4920m. June–September.

#### 49. *P. walshii* Craib

Dwarf rosette herb. Leaves oblanceolate, 8–12 × 3–6mm, acute, base cuneate, entire or obscurely serrate at apex, glandular puberulous on each side, efarinose; petiole 2–4mm, winged. Peduncle at flowering time 3–6mm, hidden among leaves, in fruit up to 3cm, bearing 1–4 flowers; bracts 2mm, ovate or lanceolate, broadly clasping at base forming a cup shaped involucre, pedicels 1–4mm. Calyx tubular, 4–5mm, glandular pubescent divided to half into lanceolate teeth. Corolla pink or pale mauve with yellow or white eye, tube 3–5mm, without hairs in throat, limb rotate, 7–8mm diameter, lobes broadly obovate, deeply emarginate. Capsule oblong, 7–8mm.

**Bhutan:** C – Thimphu district (Tremo La), N – Upper Mo Chu district (Laya, Lingshi, Shingche La, Yale La and Pangte La) and Upper Bumthang Chu (Waitang); **SE Tibet:** between Me La and Cho La; **Sikkim:** Samiti Lake, Chemathang, Changu; **Chumbi:** Phari. Open alpine grassy slopes among boulders, sometimes amongst dwarf *Rhododendron* and Juniper, 3960–4570m. May–July.

#### 50. *P. muscoides* Watt

Dense dwarf cushion-forming herb with elongate slender wiry stems 2–6cm. Leaves somewhat leathery, narrowly obtriangular, up to 10 × 5mm, apex rounded or almost truncate with 3–5 blunt teeth, margins otherwise entire, base  $\pm$  sessile, glabrous, efarinose. Flowers solitary, peduncle absent at flowering time, 1–2cm at fruiting time; pedicels less than 1mm, farinose. Calyx campanulate, 2–3mm, divided to middle into triangular teeth, farinose on both surfaces. Corolla lilac-purplish with yellow or white eye, tube 5–6mm, pubescent in throat, lobes ascending, narrowly oblong, c 3mm, shortly bifid. Capsule globose, c 3mm diameter.

**Bhutan:** C – Tongsa district (Thampe La), N – Upper Pho Chu district (Chojo Dzong), Upper Mangde Chu district (Changsethang), Upper Bumthang Chu

district (Marlung), Upper Kuru Chu district (Narim Thang) and Upper Kulong Chu district (Shingbe); **Sikkim:** Kankola, Gocha La, Dobina La, Eumtso La, Chakung Chu, Changu, Cho La, Ritampoo, Tangu and Sherabthang. On cliff-edges and sandy ground amongst boulders, 4265–4875m. June–August.

A very distinctive species in its cushion habit and obtriangular leaves glabrous and toothed only at apex.

### 51. *P. stirtoniana* Watt

Dwarf densely tufted plant, efarinose. Leaves spatulate, 6–20 × 4–7mm, obtuse, base tapered to winged petiole, sharply denticulate or serrulate especially in upper part, minutely scabrid-puberulous on both surfaces. Flowers solitary on short peduncles up to 2mm. Calyx concealed among leaves, campanulate, 6–7mm, divided to middle into lanceolate puberulous teeth. Corolla bluish or pinkish-purple with white eye, tube 9–11mm, throat bearing a few white hairs, limb subrotate with somewhat ascending lobes, 1.4–1.7cm diameter, lobes obcordate, 5mm, ± as broad as long, emarginate. Capsule not seen.

**Bhutan:** C – Tongsa district (Black Mountain); **Sikkim:** Kanglanama La, Surkia La, Nyegala and Peykiong La. Among moss on cliff-face, 4265–4400m. May–July.

### 52. *P. tenuiloba* (Watt) Pax; *P. muscoides* Watt var. *tenuiloba* Watt, *P. indobella* Balfour f. & W.W. Smith

Similar to *P. stirtoniana* but leaves glabrous; peduncle slender, 5–15mm; calyx 4.5–6mm; corolla deep blue with white eye, sometimes all white, tube up to 6–8mm, white villous outside, limb 1.5–1.8cm diameter, lobes ascending, deeply obcordate, divided into 2 linear teeth longer than broad.

**Bhutan:** N – Upper Mo Chu district (Kangla Karchu La, Phile La), Upper Mangde Chu district (Changsethang), Upper Bumthang Chu district (Dole La, Pangotang and Waitang), Upper Kuru Chu district (Gong La, Narim Thang) and Upper Kulong Chu district (Me La); **Sikkim:** Megu, Sherabthang, Lhonak, Zemu valley, Gocha La, Thangshing, Yakla, Tosa, Sebu La, etc. On alpine hillsides, rocky mossy banks and cliff-ledges, 4100–5040m. June–August.

*P. indobella* was described as originating from Bhutan but is based on a J.C. White collection from Tibet.

### 53. *P. waddellii* Balfour f. & W.W. Smith

Similar to *P. stirtoniana* and *P. tenuiloba* but leaves smaller, up to 10 × 4mm, puberulous on both surfaces; peduncle up to 3mm with a minute bract at base of calyx; corolla pinkish-purple with white eye, tube glabrous outside, white pubescent within, lobes narrowly obovate, deeply bifid into 2 linear teeth longer than broad.

**Bhutan:** C – Thimphu district (Tremo La) and Tongsa district (Black Mountain), N – Upper Mo Chu district (Kangla Karchu La, Yale La, Pangte La), Upper Pho Chu (Gyophu La) and Upper Bumthang Chu district (Dole

La, Pangothang, Marlung); **Chumbi**: below Ghora La. In peaty turf on open alpine slopes, 4265–4270m. May–July.

**54. *P. spathulifolia*** Craib; *P. minutissima* Duby var. *spathulata* Hook.f., *P. melichlora* Balfour f. & W.W. Smith

Dwarf tufted yellowish farinose plants with slender woody rhizome. Leaves obovate or oblanceolate, 10–25 × 45–11mm, subacute or obtuse, base tapering to winged petiole, entire or dentate in upper half, farinose on both surfaces, especially beneath, otherwise glabrous. Flowers solitary on short peduncle 3–6mm, farinose. Calyx narrowly campanulate, 6–7mm, teeth lanceolate half as long. Corolla purplish with yellow or white eye, tube 9–10mm, glabrous outside and in throat, limb 1.5–2cm diameter, lobes obcordate with teeth ± as broad as long.

**Sikkim**: Sebu La, near Lachung, Namdee and Tosa. Open hillsides and exposed rock-faces, 3050–4400m. May–August.

**55. *P. tenella*** Hook.f.

Dwarf white farinose plants with or without slender spreading leafless stolons. Leaves obovate or oblanceolate, 0.5–2 × 0.3–0.8cm, acute, base cuneate to winged petiole 0.4–4cm, denticulate or serrulate, white farinose especially above. Peduncle slender, 0.5–6cm, usually bearing a single flower, farinose, with or without 1–2 small bracts below calyx. Calyx campanulate, 4–9mm, divided deeply into lanceolate teeth. Corolla bluish with white eye, tube 7–15mm, white pubescent within, limb 1.1–2.6cm diameter, lobes obcordate, emarginate. Capsule subglobose or cylindric, ± as long as calyx.

Two varieties are recognised; these vary in flower size, presence or absence of bracts and presence or absence of stolons; these differences do not always correlate.

a. var. **tenella** Hook. f.

Stolons absent; peduncle 1–6cm; lanceolate bract 2–5mm usually present at base of calyx; calyx 5.5–9mm; corolla tube 11–15mm, limb 1.2–2.6cm diameter.

**Bhutan**: C – Ha district (between Tremo La and Ha), Thimphu district (Pumo La) and Punakha district (Tang Chu), N – Upper Mo Chu district (Lingshi and Jari La); **Chumbi**: Phari. In moss on damp cliff-faces, 3960–4570m. May–September.

b. var. **flagellaris** (W.W. Smith) Richards; *P. flagellaris* W.W. Smith

Similar to var. *tenella* but a smaller plant; stolons present, naked but giving rise to new plants at apex; peduncle 0.5–1.5cm, usually ebracteate; calyx 4–5mm; corolla tube 7–8mm, limb 11–14mm diameter.

**Bhutan**: C – Punakha district (Tang Chu) and Tongsa district (Chendebi); **Sikkim**: above Zemu Valley towards Lachen. On mossy cliff-ledges, 2440–4400m. May–July.

**56. *P. dryadifolia*** Franchet subsp. *jonardunii* (W.W. Smith) Chen & Hu; *P. jonardunii* W.W. Smith, *P. oreina* Balfour f. & Cooper. Fig. 55e.

Evergreen herb forming dense mats, with slender woody rhizomes below clothed in dead leaves. Leaves coriaceous, ovate-elliptic, 10–13 × 4–7mm including petiole, obtuse, base rounded to broad sheathing petiole 3–6mm, margins crenate but with crenulations reflexed so margin appears entire, glabrous above, yellowish farinose beneath. Peduncles 5–10(–20)mm, farinose, flowers solitary, rarely 2; bracts ovate, 4–7 × 3–5mm, acute or rounded, farinose, pouched and closely subtending flower. Calyx dark red, campanulate, 5–9mm, farinose, divided to middle into rounded elliptic lobes. Corolla crimson with dark purple or white eye, tube 6–10mm, hairy in throat, limb 1.0–2.3cm diameter, with obcordate, deeply bilobed lobes. Capsule ± as long as calyx.

**Bhutan:** N – Upper Bumthang Chu district (Marlung), Upper Kuru Chu district (Bod La, Singhi, Narim Thang), Upper Kulong Chu district (Me La). Mossy cliffs and steep rocky slopes, 3950–4730m. June–August.

**57. *P. denticulata*** J.E. Smith; *P. aequalis* Craib, *P. platycrana* Craib. Dz: *Doched Metog*; Tongsa: *Gurgur Metog*; Nep: *Simphul*; Eng: *Drumstick Primrose*

Deciduous herb with winter buds and persistent bud scales at flowering; scales broadly ovate, 1.5–4 × 1–2cm. Leaves oblong-ob lanceolate 5–20(–30) × 1.5–5cm including petiole, obtuse, base attenuate, margin denticulate, glabrous or finely pubescent above, rarely farinose beneath. Peduncle 7–25cm (–45cm in fruit), glabrous or pubescent, efarinose or farinose in upper parts, bearing numerous ± sessile spreading and erect flowers in a compact globose head; bracts lanceolate, 5–10mm, acuminate, base rounded or auricled, farinose. Calyx tubular-campanulate, 5–10mm, farinose, cut to middle into oblong lanceolate teeth, purplish at apex. Corolla purplish or white with yellow eye; tube 7–10mm, limb 10–15mm diameter, lobes bilobed. Capsule oblong to subglobose included within calyx.

**Bhutan:** S – Chukka district (Chimakothi), C – Ha, Thimphu, Punakha, Tongsa, Tashigang and Sakden districts; **Darjeeling:** Sandakphu, Phallut; **Sikkim:** Dzungri, Chunthang, Yumthang, Lachen, Lachung, Fabelungma; **Chumbi:** Yatung, Chumpitang. Open damp meadows and flushes, marshy clearings in Oak, Pine and Spruce forests, 1525–4110m. February–June.

Often eaten by cattle.

**58. *P. erythrocarpa*** Craib

Very close to *P. denticulata* but evergreen; winter buds and persistent bud scales absent; leaves conspicuously pubescent above and on veins beneath, margins ciliate; corolla blue-violet with orange eye.

**Bhutan:** S – Chukka distinct (near Chukka), C – Thimphu district (common in Thimphu and Paro valleys), Tongsa district (Chendebi) and Bumthang district (Byakar Dzong); **Arunachal Pradesh:** Nyam Jang Chu. Open damp meadows, streamsides and flushes, 1830–3050m. December–June.

**59. *P. atrodentata*** W.W. Smith; *P. orestora* Craib & Cooper

Similar to *P. denticulata* but a much smaller plant; evergreen, winter buds and persistent bud scales absent though base of plant often surrounded by dead leaves; leaves spatulate, 1.5–5 × 0.5–1.5cm, ± scabrid above with minute glandular hairs; peduncle 2.5–12cm (–30cm in fruit), farinose especially above; flower heads held erect; calyx 5–7mm, farinose, divided to middle into lanceolate teeth usually purplish-tipped; corolla mauve with white eye, sometimes pink or white; tube 7–10mm, limb 7–15mm diameter, lobes deeply bilobed.

**Bhutan:** C – Thimphu district (Gunisawa and Paro), Tongsa district (Dungshinggang and Yuto La), N – Upper Mo Chu district (Lingshi), Upper Bumthang Chu district (Champa and Pangotang), Upper Kuru Chu district (Narim Thang) and Upper Kulong Chu (Me La); **Sikkim:** Lachen, Lhonak valley, Thangu, Thangchung La; **Chumbi:** Phari plain. On open grassy pastures, cliffs and rocky slopes, 3650–4870m. May–July.

**60. *P. glomerata*** Pax; *P. crispa* Balfour f. & W.W. Smith

Similar to *P. denticulata* but semi-evergreen, winter buds and persistent bud scales absent; leaves smaller, narrowly spatulate, 5–11 × 1.5–2cm, glabrous or minutely puberulous on margins above, efarinose or rarely white farinose beneath; peduncle slender, 18–29cm, curved at apex with flower heads held horizontally; bracts clustered below head, lanceolate, c 8 × 2mm, blackish-purple; flowers deep purple.

**Sikkim:** Tanka La, Lachung, Bikbari and Dzongri; **Chumbi:** W of Yatung. Grassy meadows and clearings in scrub, 3650–4570m. July–September.

**61. *P. capitata*** Hook. f. Fig. 55c.

Herb without winter buds or persistent bud scales. Leaves oblanceolate, very variable in size, 3–18 × 1–3.5cm, acute or obtuse, base attenuate, margin denticulate, green glabrous above, white to yellowish farinose or efarinose beneath, midrib and lateral veins impressed, rugose. Peduncle 6–45cm, farinose, especially above, bearing a head of numerous pendant flowers, each flower subtended by an oblong blackish bract 6–8 × 3–4mm, upper bracts subtending sterile reduced flowers which do not open, forming a dome-shaped cap on flower head. Calyx campanulate, 5–8mm, farinose, deeply cut into acute or obtuse purplish teeth. Corolla purple with a yellow eye, tube 8–10mm, limb 7–10mm diameter, lobes obcordate emarginate. Capsule subglobose, 5–7mm.

Four subspecies are recognised:

a. subsp. **capitata**; *P. mooreana* Balfour f. & W.W. Smith, *P. capitata* subsp. *mooreana* (Balfour f. & W.W. Smith) W.W. Smith & Forrest

Plants small to moderately robust; leaves obtuse or subacute, strongly white farinose beneath, margins shallowly denticulate.

**Bhutan:** C – Thimphu, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Chemathang, Lachen, Thangu, Lhonakh, Samiti Lake, Bikbari,

Yeumtang, Dzongri, Yume Samdong; **Chumbi**: Phari, Gautsa, Chaerlung, Chomolhari. Alpine meadows and yak pastures, streamsides, clearings in Juniper scrub, 2740–4720m. June–August.

Subsp. *mooreana* represents a robust form of subsp. *capitata*, but there is no clear discontinuity.

b. subsp. **crispata** (Balfour f. & W.W. Smith) W.W. Smith & Forrest; *P. crispata* Balfour f. & W.W. Smith

Leaves usually large, obtuse, efarinose beneath.

**Bhutan**: C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Tashigang districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim**: Yampung, Changu, above lachen, Kanglasa, Yak La, Karponang; **Chumbi**: Yatung. Open grassy areas and clearings in *Abies/Rhododendron* forest and Juniper scrub, 2440–4720m. July–November

Differs from subsp. *capitata* strikingly in its autumn flowering.

c. subsp. **craibeana** (Balfour f. & W.W. Smith) W.W. Smith & Forrest; *P. craibeana* Balfour f. & W.W. Smith

Leaves narrowly spatulate, up to 1.5cm broad, covered beneath with yellow farina, margins more regularly and deeply denticulate.

**Sikkim**: Sheraothang, Changu, Cho La, Lachung, Chaethanglaka; **Chumbi**: Sundung. Damp screes and rocky streamsides, 2740–3960m. August–September.

d. subsp. **lacteocapitata** (Balfour f. & W.W. Smith) W.W. Smith & Forrest; *P. lacteocapitata* Balfour f. & W.W. Smith

Similar to subsp. *craibeana* but leaves sharply pointed, with cream-coloured farina on lower surface and bright red bases to petioles.

**Sikkim**: Yume Samdong, Lachen, Lungnak La to Thango; **Chumbi**: Natu La to Champitang. Damp screes and rocky streamsides, 2750–3950m. August.

**62. P. bellidifolia** Hook. f.; *P. adenantha* Balfour f. & Cooper, *P. atricapilla* Balfour f. & Cooper, *P. menziesiana* Balfour f. & W.W. Smith, *P. micropetala* Balfour f. & Cooper

Short-lived perennial; winter buds absent. Leaves oblanceolate, 4–15 × 1–2.5cm, obtuse, base narrowed to winged petiole, crenate-serrate, pubescent on both surfaces, sometimes white farinose beneath. Peduncle 10–35cm, puberulous, farinose at apex bearing a dome-shaped spike of 7–15 pendant sessile flowers; bracts rounded, c 3 × 3mm, blackish with white pubescent margins, forming a cap on top of spike. Calyx campanulate, c 5mm, usually white farinose, deeply unequally cut into oblong-elliptic obtuse teeth. Corolla violet or purplish, tube 5–10mm, lobes 1–2mm, emarginate. Capsule ovoid, longer than calyx.

**Bhutan**: C – Ha, Thimphu, Tongsa and Sakden districts, N – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim**: Yak La and above Changu; **Chumbi**: Dotha, Chomolhari. Under overhanging rocks and dry ledges of cliffs, 3650–4570m. June–July.

**63. *P. sapphirina* Hook. f. & Thomson**

Short-lived dwarf efarinose perennial herb. Leaves oblanceolate, 5–10 × 2–5mm, obtuse, base attenuate, margin pinnatifid-dentate, with scattered white hairs on midrib beneath or almost glabrous. Peduncle slender, 1.2–4.5cm, minutely glandular, bearing 1–2(–4) sessile, semi-pendant flowers; bracts lanceolate, 1–2mm. Calyx blackish-purple, 2–3mm, divided to middle into acute teeth. Corolla bluish-purple or lilac, funnel-shaped, 3–6mm long, limb 4–6mm diameter, lobes c 2mm long. Capsule subglobose, included within calyx.

**Bhutan:** C – Thimphu, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kuru Chu districts; **Sikkim:** Changu, Kapup, Cho La, Gnathong, Dzongri, Lam Pokhri, Chaunrikhiang, Yampung, Lasha Chhu; **Chumbi:** Nathu La, Yatung. On grassy turf on alpine hillsides, on rock-ledges and amongst *Rhododendron*, 3800–4680m. June–August.

**64. *P. jigmediana* W.W. Smith**

Similar to *P. sapphirina* but leaves glabrous; flowers always solitary on peduncles 1.5–4cm; corolla 8–9mm long, limb 10–12mm diameter, lobes 4–4.5mm long.

**Bhutan:** N – Upper Kulong Chu district (Shingbe, Me La). In moss on wet cliffs, 3800–4265m. June–August.

Endemic to this single locality in Bhutan.

**65. *P. soldanelloides* Watt. Fig. 55d.**

Dwarf perennial efarinose herb. Leaf lamina elliptic, 8–15 × 2–5mm, subacute, base attenuate, margin deeply pinnatifid-dentate, glabrous; petiole 5–15mm. Peduncles 1.5–4.5cm, ebracteate, bearing a solitary pendant flower. Calyx dark purple, c 4.5mm, campanulate, divided to middle into acute teeth. Corolla white, broadly funnel-shaped, 9–14mm long, limb 12–15mm diameter, lobes oblong, 3–5mm, entire or emarginate.

**Bhutan:** C – Tongsa district (Changesthang), N – Upper Mo Chu district (Kangla Karchu La), Upper Bumthang Chu district (Pangotang, Marlung and Champa) and Upper Kulong Chu district (Me La); **Sikkim:** Changu, Lam Pokhri and Patang. On open mossy cliff-faces and wet rocks by waterfalls, 4100–4730m. June–August.

**66. *P. umbratilis* Balfour f. & Cooper; *P. metria* Balfour f. & Cooper**

Efarinose rosette herb. Leaf lamina oblong-elliptic, 1.5–7 × 1–3cm, obtuse, base attenuate, margin coarsely crenate-dentate, silvery-white pubescent on both surfaces; petiole 1–8cm. Peduncle 5–16cm, spreading white pubescent, efarinose, bearing a head of 4–10 sessile pendant fragrant flowers; bracts narrow, c 3mm long. Calyx 4–6mm, sparsely farinose within, divided to middle into oblong-ovate teeth. Corolla blue, purplish or white, funnel-shaped, 12–16mm long, glabrous, limb 10–17mm diameter, lobes rounded, c 4mm, emarginate.



**Bhutan:** C – Punakha, Tongsa and Bumthang districts, N – Upper Mangde Chu and Upper Bumthang Chu districts. Cliff-ledges and under rocks on very steep hillsides and in gorges, 3650–4720m. June–September.

Endemic to Bhutan where two distinct varieties occur:

a. var. **umbratilis** with smaller blue or purplish flowers, known from Tongsa, Bumthang, Upper Mangde Chu and Upper Bumthang Chu districts.

b. var. **alba** Fletcher with larger white flowers, known from Punakha, Tongsa, Upper Mangde Chu and Upper Bumthang Chu districts.

**67. *P. eburnea*** Balfour f. & Cooper; *P. harroviana* Balfour f. & Cooper

Similar to *P. umbratilis* var. *alba*, but leaves more shallowly dentate, minutely puberulous on both surfaces; peduncles glandular-puberulous but without spreading white hairs, bearing a head of 6–12 flowers; bracts lanceolate, 5–6mm; calyx 7–8mm, lobes oblong, denticulate; corolla always white.

**Bhutan:** N – Upper Kuru Chu district (Narim Thang and Singhi Dzong). Under overhanging rocks, 4265–4880m. July–August.

A very rare species restricted to E Bhutan and adjacent SE Tibet.

**68. *P. sherriffae*** W.W. Smith

Perennial rosette herb. Leaves oblanceolate 6–17 × 2.5–5cm obtuse, base narrowed to winged petiole, entire or irregularly shallowly toothed, white pubescent especially beneath, efarinose. Peduncle 4–10cm, glabrous, sparsely farinose above, bearing a head of 1–8 suberect or horizontal flowers. Calyx cup-shaped, 8–10mm, divided in upper 1/3 into ovate teeth, farinose especially within. Corolla purplish with white centre, salverform, tube slender, slightly curved, 3.5–4cm, farinose above (especially in bud), limb rotate, 2–3cm diameter, lobes rounded, c 1cm. Capsule globose 7–8mm diameter.

**Bhutan:** S – Deothang district (Chunkar). In wet moss on overhanging cliffs in shade, 1525–1980m. June.

An extremely distinctive species on account of its ± horizontal salverform flowers. Endemic to Bhutan. The above description refers to the typical var. **sherriffae**.

b. var. **ludlowii** (W.W. Smith) Richards; *P. ludlowii* W.W. Smith

Similar to but smaller than var. *sherriffae*; flowers solitary or paired; corolla tube c 1.8cm, limb c 1.5cm diameter, lobes rounded, 5mm.

**Bhutan:** S – Deothang district (Chungkar). In wet moss on shady overhanging rock-face, 1525m. June.

Endemic to Bhutan; probably a depauperate variant of *P. sherriffae* confined to the same single locality.

**69. *P. klattii*** Balakrishnan; *P. uniflora* Klatt non Gmelin

Dwarf efarinose herb. Leaf lamina elliptic or oblong, 6–15 × 4–7mm, acute,

base cuneate, margin crenate to incised-dentate, white pubescent on both surfaces; petiole 5–20mm. Peduncle 4–13cm, glabrous, bearing a solitary (rarely 2)  $\pm$  horizontal flower; bract ovate, minute. Calyx reddish, campanulate, 6–7mm, teeth oblong, c 4mm, apiculate, farinose within. Corolla blue-violet, broadly funnel-shaped, 1.8–2.6cm long, limb saucer-shaped, 2.5–3.5cm diameter, farinose within; lobes oblong, coarsely crenate at apex.

**Bhutan:** C – Tongsa district (Omta Tso, Thita Tso and Rinchen Chu); **Sikkim:** Chakung Chu and Tanka La; **Chumbi.** Alpine meadows, on steep open banks, 3960–4720m. July–August.

Easily recognised by its disproportionately large, solitary, rarely paired, flowers.

### 70. *P. chasmophila* Hutchinson

Perennial tufted efarinose herb with woody rhizome and persistent withered leaf remains. Leaves at flowering ovate-oblong, 1.5–4 × 1–2.5cm, obtuse, base truncate but narrowly decurrent on petiole, margins pinnatifid or coarsely crenate, efarinose, puberulous; petiole 2.5–6cm. Peduncle 5–12cm, puberulous, bearing a head of (1–)2–5 sessile semi-pendant flowers; bracts lanceolate, 2–3mm. Calyx campanulate, 5–6mm, puberulous, divided to middle into oblong teeth, entire or dentate at apex. Corolla blue-violet, funnel-shaped, 1.6–2.2cm long, limb 1.7–2.7cm diameter, lobes obovate, 6–9mm long, bifid.

**Bhutan:** C – Punakha district (SE of Wangdu Phodrang) and Tongsa district (Dungshinggang). On grass ledges and peaty rock crevices of very steep cliffs, 4265–4880m. June.

Endemic to Bhutan.

### 71. *P. wattii* Watt

Similar to *P. chasmophila* but leaves 2.5–6 × 1–2.5cm, obtuse, base broadly attenuate, margin coarsely dentate, with long white hairs on both surfaces; peduncle 7–13cm in flower, up to 20cm in fruit, glabrous, bearing a head of 5–10 flowers; calyx 7–9mm; corolla purple, 1.3–1.8cm long, limb 1.3–1.5cm broad, with white farinose throat, lobes oblong, 4–5mm long, irregularly toothed or fringed.

**Bhutan:** N – Upper Kulong Chu district (Shingbe); **Sikkim:** Changu and Chola. On open grassy alpine hillsides, 3800–4400m. June–August.

## 2. OMPHALOGRAMMA Franchet

by E. Aitken

Perennial herbs with stout rhizome. Leaves simple, basal, involute, glabrous or hairy, surrounded at base by oblong bud scales. Peduncle densely pubescent, without bracts. Flowers solitary, 5-merous. Calyx deeply divided. Corolla zygo-

morphic, funnel-shaped. Stamens inserted near middle of corolla tube. Capsule oblong, dehiscent by valves; seeds compressed, surrounded by a wing.

*Omphalogramma* is sometimes treated as a subgenus of *Primula*.

**1. *O. elwesiana*** (Watt) Franchet; *Primula elwesiana* Watt. Fig. 55i&j.

Leaves oblanceolate, 4–13 × 1.5–3cm, acute or obtuse, base narrowed to broad winged petiole, margin entire to denticulate. Peduncles 8–15cm (–35cm in fruit), indumentum reddish. Calyx 7–10mm, pubescent; lobes lanceolate. Corolla pale or deep purple, pubescent; tube 2.5–3cm; lobes oblong, 1–1.5 × 0.7–1cm, toothed or emarginate. Filaments 4mm; anthers narrowly lanceolate, 3–4mm. Capsule 1–1.5cm.

**Bhutan:** N – Upper Kuru Chu/Kulong Chu district (Pang La); **Sikkim:** Nathang, Tsomgo, Chho La and Sherabthang; **Chumbi.** Open marshy places, 3350–4260m. June–July.

### 3. ANDROSACE L.

by E. Aitken

Perennial or annual herbs, usually small, sometimes stoloniferous or cushion-forming. Leaves sometimes dimorphic\*, rosulate at rhizome apex, or in dense clusters on columnar stems. Flowers usually 5-merous, rarely 6–8-merous, solitary or in umbels, small, pink, white or purplish, pedicellate or sessile. Calyx campanulate, divided to middle or near base, densely or sparsely pubescent. Corolla salver-shaped with short tube ± as long as calyx, annulate, or with folds opposite lobes forming the eye; limb flattened, with oblong or obovate lobes. Stamens 5, subsessile, included in corolla tube. Ovary subglobose, style short. Capsule ovoid or globose, 5-valved.

\*Winter leaves in tight clusters, sometimes elongating in summer (as in *A. lehmannii*), or with completely different, larger leaves developing in summer (as in *A. strigillosa*).

1. Plants forming cushions or mats; leaves sessile, imbricate, in tight clusters (rosettes) ..... 2
- + Plants forming clumps or spreading loosely with stolons; mature leaves petiolate, (indistinct in *A. graminifolia*) or if not obviously petiolate then linear with thickened margins, in loose rosettes ..... 11
2. Flowers sessile, or nearly so ..... 3
- + Flowers pedicellate (or solitary on short peduncle in *A. selago*) ..... 6
3. Summer leaves with long acuminate apex ..... **5. *A. lehmannii***
- + Summer leaves with short obtuse or rounded apex ..... 4

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4. Old leaves in globular clumps at base of rosettes; leaves with spreading hairs, mainly on margins ..... **12. A. delavayi**  
 + Old leaves in long imbricate columns at base of rosettes; leaves silvery, densely woolly on both surfaces ..... 5
5. Leaves thickly woolly, hairs soft, almost obscuring leaf apex; flowers rose-red with yellow eye ..... **11. A. hemisphaerica**  
 + Hairs straight, adpressed; flowers white with yellow or green eye  
**14. A. tapete**
6. Summer leaves sharply pointed ..... 7  
 + Summer leaves with short, obtuse, rounded, or subacute apex (sometimes acute in *A. ludlowiana*) ..... 8
7. Summer leaf clusters  $\pm$  rounded, with incurved tips; leaves with long, white, villous margins and apex; stems hirsute ..... **10. A. globifera**  
 + Summer leaf clusters spiky; leaves with spreading tips bearing indistinct tuft of short white cilia at apex, later becoming glabrous; stems glabrous  
**15. A. lehmannii**
8. Apex of leaves blunt, incurved; flowers on peduncles, with apical bracts closely subtending calyx ..... 9  
 + Apex of leaves broadly rounded or subacute; bracts at base of pedicel, distant from calyx ..... 10
9. Flowers 2–6, in umbels; bracts 3–6, linear, sometimes obscuring calyx  
**9. A. zambalensis**  
 + Flowers solitary, occasionally 2; bracts 1 or 2, lanceolate, as long as, but not obscuring calyx ..... **13. A. selago**
10. Leaves ciliate only on margins and apex; apex broadly rounded; pedicels 1–2mm; flowers 1 or 2 ..... **12. A. delavayi**  
 + Leaves ciliate on both surfaces; apex rounded or subacute; pedicels 5–8mm; flowers solitary or in 2–4-flowered umbels ..... **16. A. ludlowiana**
11. Plants without stolons or runners; rootstock thick, woody; leaves oblanceolate or linear ..... 12  
 + Plants without woody rootstock, sometimes with runners or stolons; leaves obovate, ovate, elliptic or suborbicular ..... 13
12. Peduncles 9–40cm; spring leaves oblanceolate, 3.5–13cm including long narrow petiole ..... **5. A. strigillosa**  
 + Peduncles 7–10(–30)mm; spring leaves linear, 0.6–2cm, with indistinct, short, winged petiole ..... **6. A. graminifolia**

13. Leaves obovate, ovate, elliptic, or oblanceolate, entire ..... 14  
 + Leaves suborbicular or broadly ovate, lobed, divided or crenate ..... 15
14. Runners and scapes densely brownish pilose; spring leaves oblanceolate, with broad petiole ..... **7. A. sarmentosa**  
 + Runners and scapes sparsely whitish pilose; spring leaves obovate, ovate or elliptic, with narrow petiole ..... **8. A. hookeriana**
15. Flowers in spreading umbels on long pedicels; calyx divided almost to base ..... **4. A. umbellata**  
 + Flowers in dense umbels on short pedicels; calyx campanulate, divided to middle or above ..... 16
16. Leaves shallowly lobed; umbels 15–30-flowered ..... **3. A. henryi**  
 + Leaves deeply lobed; umbels 3–10(–25)-flowered ..... 17
17. Leaves 0.7–6cm diameter, whitish pubescent; corolla pink or white, lobes 2–3mm, limb 5–8mm diameter ..... **1. A. geraniifolia**  
 + Leaves 1–2cm diameter, brownish pubescent; corolla dark purplish, lobes 1.5–2mm, limb 2–3.5mm diameter ..... **2. A. croftii**

**1. A. geraniifolia** Watt; *A. rhizomatosa* Handel-Mazzetti, *A. rhizomatosa* var. *major* Handel-Mazzetti, *A. geraniifolia* Watt var. *hookeriana* Knuth, *A. geraniiifolia* Watt var. *setosa* Knuth p.p.(Chumbi specimen), *Primula rhizomatosa* (Handel-Mazzetti) Bennet and Raizada, *P. rhizomatosa* var. *major* (Handel-Mazzetti) Bennet and Raizada. Fig. 56c.

Decumbent perennial with slender rhizome, sometimes stoloniferous. Leaves suborbicular, 0.7–3.5(–6)cm diameter, divided to middle into 5–6 lobes, each with 3–5 apical teeth, white hirsute on both surfaces; petioles 1.5–10(–14)cm, densely white pubescent. Peduncles 1 to several per rosette, (3–)8–25cm (–35cm in fruit), densely pubescent; umbels 4–10(–25)-flowered, sometimes bearing a small leafy rosette which develops into a new plant when the peduncle becomes horizontal in fruit, and the umbel rests on the ground. Bracts linear or lanceolate, 1–4mm; pedicels 3–20mm. Calyx campanulate, 2–4mm, pubescent; teeth acute, ± equal to tube. Corolla pink or white with yellow eye; limb 4–8mm diameter; lobes oblong or obovate, 2–3 × 1.5–2.5mm, entire. Capsule globose, c 2.5mm.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Mongar districts, N – Upper Mangde Chu/Upper Bumthang Chu and Upper Kuru Chu districts; **Sikkim:** Tsomgo to Kupup, Lachen, Lhonak, Lachung; **Chumbi:** Yatung, Peygoong-la. On shaded banks in coniferous forests and on open mountain grassy slopes, 2130–4270m. April–July.

The typical form of *A. geraniifolia* has a weak rhizome, and the leaves are divided into broad, rounded, bluntly toothed lobes. There are often obvious

stolons, developing either from the base of the plant or from small leafy rosettes on mature umbels. These are mostly woodland plants.

In Nepal and Central Bhutan, two other forms occur, which have been treated as varieties of *A. rhizomatosa*. These differ in the rhizome being more obviously developed and the leaves more deeply divided into narrower lobes with acute teeth. There appear to be no stolons developing from the umbels. These plants are mostly from alpine areas.

However, characters such as rhizome development, the presence or absence of stolons, plant size and hairiness of the leaves and calyx lobes, are all very variable in this group and require further study. Therefore they are retained at present as *A. geraniifolia* in a broad sense.

Records of *A. rotundifolia* Hardwicke from Bhutan (73, 167) appear to be errors and probably refer to *A. geraniifolia*.

## 2. *A. croftii* Watt

Similar to *A. geraniifolia* but smaller; leaves 1–2cm diameter, sometimes not as hirsute as *A. geraniifolia*; petioles up to 3cm; peduncles 2–6cm, densely silvery pubescent; umbels 3–8-flowered; flowers subsessile, pedicels 1mm or less; corolla dusky wine-red. New plants developing from fruiting umbels as in *A. geraniifolia*.

**Sikkim:** Singalila, Megu, Migothang, Nathang and Yampung. 3650–3960m. May–July.

## 3. *A. henryi* Oliver

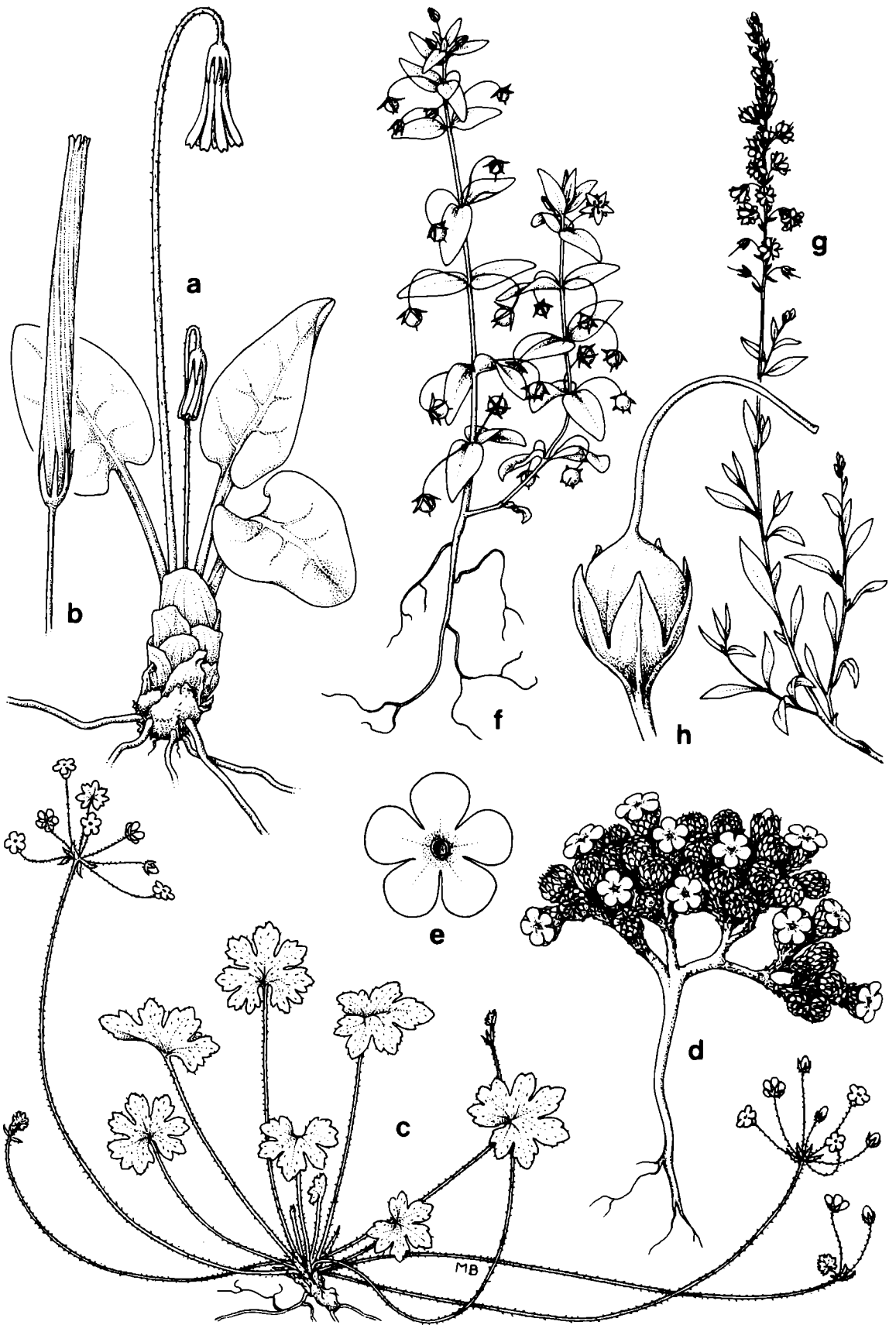
Perennial without stolons. Leaves shallowly crenately lobed, suborbicular, 1.5–6 × 2–6cm, petioles 3–10cm; umbels 15–30-flowered; peduncles 1 or several per rosette, 10–23cm, pedicels up to 15mm; bracts linear, 4 × 0.5mm. Calyx 2.5–5mm, sparsely ciliate; teeth acute; corolla pink or white, eye greenish; limb 4–7mm diameter, lobes obcordate, 1–2 × 1.5–2.5mm.

**Bhutan:** C – Mongar district (Saleng), N – Upper Kuru Chu district (Shambling) and Upper Kulong Chu district (Lao and Tobrang). In dense forests by streams, 2440–2890m. May.

## 4. *A. umbellata* (Loureiro) Merrill; *A. saxifragifolia* Bunge, *A. rotundifolia* auct. non Hardwicke

Annual herb. Leaves broadly ovate or suborbicular, 1–2.2 × 1–2.2cm, obtuse, base cordate or truncate, margin crenate, pubescent on both surfaces; petiole 0.5 to 3cm. Peduncles 2 to several per rosette, in flower 3–4cm, sparsely ciliate, (in fruit 5–12cm); umbels 5–9-flowered; pedicels 2–5mm in flower, (2.5–3cm in fruit); bracts linear, 3mm. Calyx 2.5–4mm, sparsely ciliate, divided almost to base; teeth ovate to elliptic, 2–3 × 1–1.5mm, acute, spreading in fruit. Corolla

FIG. 56. **Primulaceae.** a–b, *Bryocarpum himalaicum*: a, habit (× 1/2); b, capsule after dehiscent (× 2/3). c, *Androsace geraniifolia*: habit (× 1/3). d–e, *Androsace tapete*: d, habit (× 1); e, flower (× 4). f, *Anagallis arvensis*: fruiting habit (× 2/3). g–h, *Lysimachia lobelioides*: g, habit (× 1/3); h, capsule (× 10). Drawn by M. Bates.



white, limb 3–4mm diameter; lobes ovate to oblong, entire. Capsule subglobose, 3mm diameter.

**West Bengal Duars:** Torsa terai, Hurkapara. Damp shady rocks and banks, 600–1220m. January–February.

There is an unlocalised Hooker specimen labelled ‘Sikkim’ which is probably from the Darjeeling terai.

**5. *A. strigillosa*** Franchet; *A. sarmentosa* Wall. var. *grandifolia* Hook.f. *Med. Gatig.*

Clump-forming, with slender or stout woody rhizome, bearing numerous withered leaf remains; bud scales ovate, c  $1 \times 5$ cm, brown, ciliate. Leaves dimorphic; winter leaves numerous, in tight rosette, linear,  $3\text{--}12 \times 1\text{--}1.5$ mm, acute, entire, pubescent on both surfaces; summer leaves oblanceolate,  $2.5\text{--}8 \times 0.7\text{--}2.5$ cm, obtuse, base long attenuate, petiole 1–7cm, margin entire, pubescent. Peduncles 1 per rosette, 9–40cm, sparsely pubescent; umbels 3–20-flowered; pedicels up to 1.5cm in flower (to 4cm in fruit), pubescent; bracts lanceolate, c 5mm. Calyx 3–4.5mm, divided to middle or above, sparsely ciliate, more densely so on margins; teeth obovate, obtuse or rounded. Corolla deep rose pink, darker beneath, with yellow or dark red eye, in Nepal often white, purplish on reverse; limb 5–8mm diameter; lobes obovate,  $2\text{--}3 \times 1\text{--}3(4)$ mm, entire. Capsule ovoid, 5–6mm.

**Bhutan:** C – Ha, Thimphu and Bumthang districts, N – Upper Mo Chu and Upper Bumthang Chu districts; **Sikkim:** Thanggu and Lasha Chhu; **Chumbi.** On screes with shrubs, 3200–4570m. May–July(–September).

**6. *A. graminifolia*** Fischer

Similar to *A. strigillosa* in habit, but plants dwarf. Leaves not dimorphic, linear,  $6\text{--}13(22) \times 1\text{--}1.5(2)$ mm, acute, glabrous, margins and midrib thickened, base narrowing abruptly and widening to a winged, pubescent petiole. Peduncles 7–10(–30)mm, bearing umbels of 4–7 flowers; bracts unequal, elliptic to oblanceolate,  $3\text{--}5 \times 1\text{--}2$ mm, pubescent, margins thickened; pedicels 1–2mm. Calyx 2.5–3mm, pubescent; teeth acute. Corolla pink with orange eye; limb 4–6mm, diameter; lobes obovate,  $2 \times 2$ mm, entire. Capsule (not seen) ellipsoid, obtuse.

**Chumbi:** Phari. Open grassy hillsides, 4270m (3660–5000m in Tibet). August.

**7. *A. sarmentosa*** Wall. Nep: *Nita*, *Nitaha*

Stoloniferous, tufted perennial. Leaves dimorphic, covered in long silky adpressed white hairs; winter rosette leaves sessile, elliptic or oblanceolate,  $5\text{--}7(10 \text{ in Nepal}) \times 1.5\text{--}2(3)$ mm, acute, spreading; spring leaves narrowly elliptic or oblanceolate,  $12\text{--}20(30) \times 3\text{--}4$ mm, acute or rounded, erect, base narrowing to a broad petiole, 2–5mm. New leaf rosettes produced from axils of summer leaves, on long runners 20–50mm, brownish pilose, young leaves elliptic,  $3\text{--}6 \times 1.5\text{--}3$ mm (to  $25 \times 7$ mm in Nepal), acute. Peduncles 1 per



rosette, up to 8cm(–12cm) brownish pilose; bracts linear, 3–4 × 0.5–1mm, bearing umbels of 8–12 flowers. Pedicels 5–7(–10)mm. Calyx 2–2.5mm, slightly glandular, sparsely pubescent, more densely on margins; teeth acute or rounded. Corolla rose-pink with greenish-yellow eye; limb 5–7mm diameter; lobes obovate, 2–3 × 1.5–2mm, rounded, entire. Fruit not seen.

Darjeeling: Tanglu. Banks and paths in forest or alpine meadows, 2740–3700m. June.

**8. *A. hookeriana* Klatt; *Primula hookeriana* (Klatt) Bennet & Raizada**

Stoloniferous herb, forming clumps. Leaves obovate, ovate or elliptic, almost spatulate, 4–10 × 2–7mm, acute, obtuse or emarginate, base rounded or attenuate to petiole up to 1.5cm, margins entire, sparsely pubescent on both surfaces. Flowers in umbels of 2–10, peduncles 1 per rosette, 1.5–7cm, sparsely pubescent; bracts linear, c 5 × 1mm, pedicels up to 5mm. Calyx 2–3mm, sparsely pubescent, more densely on margins; teeth acute or rounded. Corolla pink with green, orange or dark red eye; limb 4–7mm diameter; lobes obovate, entire. Capsule ovoid, 2–3mm.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Sakden districts, N – Upper Bumthang Chu district; **Sikkim:** Thangchung La, Thangu, Zongri, Thomphyak Chhu, Torsa, Jelep La, Chakung Chhu, Lasha Chhu, Lhonak, and below Yume Samdong; **Chumbi.** On open grassy hillsides, 3350–4900m. June–August.

**9. *A. zambalensis* (Petitmengin) Handel-Mazzetti; *A. villosa* L. var. *zambalensis* Petitmengin, *A. coronata* (Watt) Handel-Mazzetti, *A. chamaejasme* Host var. *coronata* Watt**

Cushions spreading up to 10cm, with subglobose or shortly columnar rhizomes (5–6mm diameter) bearing persistent withered and current leaves, tightly imbricate. Leaves oblanceolate, 3–3.5 × 1mm, acute, entire, pubescent on both surfaces, base attenuate. Flowers in umbels of 2–6; peduncles 1 per rosette, 0.7–1cm; pedicels (sometimes obsolete) up to 2mm; bracts linear, 3–6mm, densely pubescent, often obscuring calyx. Calyx 2–3mm; teeth acute. Corolla pink or white, eye dark pink; limb 4–6.5mm diameter; lobes obovate, 2–3 × 1.5–2mm, entire. Fruit not seen.

**Sikkim:** Lhonak, Chakung La and Khora Phu Chu; **Chumbi:** Phari, Yatung and between Kongra La and Tawa Dzong. Among rocks and damp gravelly meadows, 4570–4880m. July–August.

**10. *A. globifera* Duby; *Primula globifera* (Duby) Bennet & Raizada, *Androsace poissonii* Knuth p.p.**

Cushions 20–60cm diameter. Rosettes globose, 8–12mm diameter. Leaves elliptic, 3–5 × 1–1.5mm, acute, entire, covered on both surfaces with white, straight hairs c 1mm, denser on undersides and at apex. Flowers 1 or 2 per rosette, peduncles very short; pedicels 0.2–1cm, pubescent. Calyx 2–2.5mm,

sparsely pubescent, more on margins; teeth acute. Corolla lilac or white with yellow eye; limb 4–5.5mm diameter; lobes obovate, c 2.5mm. Capsule oblong, c 2.5mm.

**Bhutan:** C – Thimphu and Tongsa districts, N – Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Ningbil, Yampung, Singalila Range, Tsomgo, Natu La. Among stones on open grassy hillsides, 3960–4720m. June–August.

The Sikkim syntype (*Watt 5422*) of *A. poissonii* Knuth belongs to *A. globifera* but the two North-west Himalayan syntypes (*Duthie 712, 713*) belong to *A. delavayi* Franchet.

**11. *A. hemisphaerica*** Ludlow; *Primula hemisphaerica* (Ludlow) Bennet & Raizada

Densely caespitose, cushions 8–14cm diameter, rhizomes columnar, c 7mm diameter, formed from many tightly imbricate dead and living leaves. Leaves oblanceolate, c 3 × 1mm, obtuse or subacute, base narrowed, densely covered on both sides near apex with straight silvery woolly hairs c 1.5mm. Flowers solitary, 1 per rosette, sessile, usually 5-merous, (sometimes 6–8-merous). Calyx 3mm, densely villous; teeth linear. Corolla rose-red with yellow eye; limb 8–10mm; lobes obovate, 1.5–3 × 1.5–2mm. Fruit not seen.

**Bhutan:** N – Upper Pho Chu district (Gaffoo La) and Upper Bumthang Chu district (Marlung and Waitang). On sandy screes and open grassy slopes, 4410–4730m. June–July.

Endemic to Bhutan.

**12. *A. delavayi*** Franchet; *A. poissonii* Knuth p.p.

Similar in habit to *A. hemisphaerica* and *A. globifera*, but rosettes subglobose, c 6mm diameter; leaves spatulate, c 3 × 1mm, apex broadly rounded, ± glabrous on both surfaces, base attenuate, margins entire and ciliate with straight white hairs up to 1mm; flowers 1 or 2 per rosette, axillary, sometimes appearing sessile, pedicels 1–2mm; calyx c 2.5mm, ciliate, sometimes only on margins, teeth obtuse; corolla pink with yellow eye, surrounded by a ring of purplish-red, limb 4–5mm diameter, lobes obovate, 2–3 × 3mm, entire or shallowly emarginate. Fruit not seen.

**Sikkim:** Khora Phu Chu above Chaunrikhiang, Naku Chhu and W of Rathong Glacier. Moraines. 4560–4730m. (July) August.

**13. *A. selago*** Klatt

Rounded cushions to 6cm; old stems columnar, 3–5mm diameter, with numerous, persistent, imbricate leaves. Leaves varied within the same rosette, obovate, lanceolate and spatulate, 2–4 × 0.5–1.5mm, acute or subacute, incurved, ciliate on upper surface, glabrous beneath, sometimes ciliate on both surfaces, densely ciliate at apex with straight whitish hairs c 0.8mm. Peduncles 1.5–4(–15)mm, 1 per rosette; flowers solitary, rarely 2; bracts lanceolate or

ovate,  $2 \times 0.5\text{--}1\text{mm}$ , closely subtending calyx. Calyx  $2\text{--}3\text{mm}$ , densely villous; teeth acute. Corolla pink or purplish with yellow eye; limb  $4\text{--}6\text{mm}$  diameter; lobes obovate,  $1.5\text{--}2 \times 1\text{--}3\text{mm}$ , entire. Capsule ellipsoid,  $c 2 \times 1\text{mm}$ .

**Bhutan:** C – Thimphu district, N – Upper Mo Chu and Upper Bumthang Chu districts; **Sikkim:** Temu La, Lhonak, Lugnak La, Giaogang, Kongra La, Samdong; **Chumbi:** Dotha, Trakkarpa to Phari. Habitat not certain, 3960–4880m. May–July.

**14. *A. tapete*** Maximowicz; *A. sessiliflora* Turrill, *A. selago* auct. non Klatt, *Primula sessiliflora* (Turrill) Bennet & Raizada. Fig. 56d&e.

Similar to *A. selago* in size and habit, but flowers sessile, 1 per rosette, white with yellow or green eye.

**Bhutan:** N – Upper Mo Chu and Upper Bumthang Chu districts; **Sikkim:** Lugnak La, Peyking La, Kangchenyao, Sebu La; **Chumbi:** Phari to Tremo La and Tuna. Grassy hillsides, rock-faces and screes, 3960–4570(–5180)m. May–July.

*A. selago* and *A. tapete* are variable species which appear to intergrade. Further research is needed on their distinction. Treatment as varieties may be more appropriate.

**15. *A. lehmannii*** Duby; *A. nepalensis* Derganc

Forming dense mats  $2\text{--}6\text{cm}$ . Stems glabrous. Rosettes spiky, leaves flexuose, spreading, linear-lanceolate,  $2.5\text{--}6 \times 1\text{--}1.5\text{mm}$ , acuminate, incurved in winter, erect and elongating in summer, sparsely pubescent along margins, apex with small tuft of thickened hairs, later becoming glabrous. Pedicels 1-flowered, up to  $3\text{mm}$  (– $8\text{mm}$  in Nepal), sparsely pubescent, several per rosette, in axils of spring leaves. Calyx  $c 2.5\text{mm}$ , sparsely ciliate, more densely ciliate on margins; teeth acute. Corolla white or pink with yellow-green eye, turning pink; limb  $3\text{--}6\text{mm}$  diameter; lobes obovate,  $1.5\text{--}2 \times 1.5\text{--}2\text{mm}$ , entire or emarginate. Capsule ovoid,  $2\text{--}3 \times 1\text{mm}$ .

**Sikkim:** Chemathang, Zongri, Sukia La, Yampung, Zemu Valley, Bikbari, Samiti Lake. Open grassy hillsides, 3900–4570m. June–September.

**16. *A. ludlowiana*** Handel-Mazzetti; *Primula ludlowiana* (Handel-Mazzetti) Bennet & Raizada

Forming loose cushions up to  $10\text{cm}$  in diameter; internodes between rosettes sparsely pubescent,  $5\text{--}20\text{mm}$ . Leaves ovate, elliptic or oblanceolate,  $1.5\text{--}5 \times 1\text{--}3\text{mm}$ , acute or obtuse, pubescent on both surfaces and longer near apex. Flowering habit very variable, flowers solitary or in umbels of up to 7; peduncles sometimes absent, or  $2\text{--}3$  per rosette, up to  $10\text{mm}$ , pubescent; bracts  $c 2\text{mm}$ ; pedicels  $5\text{--}8\text{mm}$ . Calyx  $1\text{--}3\text{mm}$ , pubescent; teeth acute. Corolla pink with greenish-yellow eye; limb  $6\text{--}8\text{mm}$  diameter; lobes obovate,  $2.5\text{--}3 \times 2.5\text{--}3\text{mm}$ , entire. Fruit not seen.

**Bhutan:** C – Punakha district (Maru) and Tongsa district (Rinchen Chu), N

– Upper Mangde/Bumthang Chu district (Goktang La). On cliff-ledges and very steep open hillsides, 3590–4720m. June–July. Endemic to Bhutan.

#### 4. BRYOCARPUM Hook.f. & Thomson

by E. Aitken

Perennial. Leaves basal, simple, entire, petiolate, with bud scales at base. Peduncles slender, sparsely pubescent and glandular. Flowers 7-merous, solitary, nodding. Calyx divided almost to base. Corolla tube almost as long as whole calyx; lobes elongate, slightly spreading. Stamens attached half-way up corolla tube; anthers acuminate. Ovary oblong; style slender. Capsule narrowly cylindrical, dehiscent by apical cap.

##### 1. *B. himalaicum* Hook. f. & Thomson. Dz: *Dum*; Tongsa: *Krapala*. Fig. 56a&b.

Bud scales oblong, at first 1–1.5 × 1cm, later up to 6.5 × 2cm, apex rounded. Leaves oblong to ovate, (2–)4.5–10 × (1–)1.5–5cm, acute or obtuse, base cordate, sparsely pubescent above, minutely blackish glandular beneath; petiole up to 6cm, winged. Peduncles up to 30cm. Calyx 7–12mm, sparsely glandular; teeth narrowly lanceolate. Corolla yellow, tube 5–12mm; lobes elongate-oblong, bidentate, 7–16 × 1.5–3mm. Filaments c 1mm; anthers 3–5mm. Capsule 5–7.5 × 0.2–0.5cm, apex ± toothed after dehiscent; seeds ovoid, 2–2.5 × 1mm, brown.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa, Bumthang, Mongar and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Sikkim:** Singalila, Ningbil, Thangu, Zemu Chhu, etc. Coniferous woodlands, 2740–4260m. April–June.

Apart from a few localities in SE Tibet and E Nepal, this species is confined to Bhutan and Sikkim where it is relatively common.

#### 5. LYSIMACHIA L.

by E. Aitken

Annual or perennial, erect or decumbent herbs. Leaves simple, entire, alternate or opposite, sometimes on the same plant, base attenuate, often extending along winged petiole. Flowers borne singly in leaf axils, or in racemes or terminal clusters, usually 5-merous, occasionally 4–6-merous. Calyx divided almost to base. Corolla rotate or funnel-shaped, lobes connate below middle. Stamens attached at base of corolla lobes, included or sometimes exerted; anthers dehiscent by slits, rarely pores. Capsule ovoid or subglobose, 5-valved or bursting irregularly, many-seeded.



**Bhutan:** S – Gaylegphug district, C – Punakha district (Pele La) and Tongsa district (Yuto La), N – Upper Bumthang Chu district (Shimitang) and Upper Kulong Chu district (Lao); **Darjeeling:** Batasia to Palmajua, Rinchingpong, Sandakhphu and Tanglu; **Sikkim:** Megu, Singalila Range, Lachen, Lagyap and Chiya Bhanjang; **Chumbi.** Tracksides in forests, (1500–)2740–4265m. March–July.

## 2. *L. chenopodioides* Watt

Stems 10–40cm, usually much branched from base, glabrous or puberulous. Leaves alternate, sometimes almost opposite, elliptic-lanceolate, 1–3 × 0.4–1cm, acuminate, minutely gland-dotted, base attenuate on winged petiole, 10–15mm. Flowers borne singly in leaf axils, sessile, or pedicels up to 4 (occasionally 7)mm, forming a loose leafy raceme along stems. Calyx c 4mm, teeth linear-lanceolate, acuminate, with reddish glandular streaks. Corolla pale pink or white, 4–4.5mm long; lobes spatulate, each with 3–4 glandular streaks. Stamens included. Capsule globose, c 3mm diameter, 5-valved.

**Bhutan:** S – Deothang district (Khaling), C – Thimphu district (Pangri Zampa, Paro and Tsalimaphe), Punakha district (Samtenang and Shenganga) and Bumthang district (Tangphomrong). Ditch sides and paddy-fields, 1800–2600m. April–August.

## 3. *L. decurrens* Forster f.; *L. javanica* Blume, *L. multiflora* Duby

Stems erect, 50–70cm, narrowly winged, glabrous. Leaves opposite and alternate on same plant, elliptic, 3–9 × 1–3cm, glabrous, with scattered, blackish glandular spots and streaks; base attenuate and narrowly decurrent on winged petiole 10–30mm. Flowers in slender leafless racemes; pedicels 5–10mm. Calyx 3–4mm, teeth lanceolate with 4 reddish glandular streaks. Corolla white, 3–4mm long; lobes spatulate, usually without glandular streaks. Stamens 2 short, 3 longer, exerted from corolla mouth. Capsule subglobose, 3–4mm diameter, dehiscent irregularly.

**Bhutan:** S – Chukka district (Raidak Valley) and Deothang district (Diu Ri river), C – Mongar district (Bagha La and Zimgang) and Tashigang district (Thriming); **Darjeeling;** **Sikkim:** Tista Valley. Footpaths and gravelly stream-sides, 270–1800(–2430)m. May, June.

## 4. *L. lobelioides* Wall.; *L. secunda* D. Don. Fig. 56g&h.

Stems decumbent or ascending, 10–30(–45)cm, glabrous. Leaves opposite or alternate, elliptic to lanceolate, 0.8–2 × 0.5–1cm, acute, base attenuate and decurrent on winged petiole up to 10mm, glabrous, with scattered, glandular spots, mostly near margins. Flowers in slender racemes; 5- or 6-merous; pedicels up to 10mm. Calyx 2.5–3mm, teeth lanceolate, glandular-streaked. Corolla white or pink, 4–6mm long; lobes oblanceolate, apparently without glands. Stamens included at first, becoming exerted. Capsule subglobose, c 1.5–2mm diameter, 5-valved.

**Bhutan:** C – Thimphu and Punakha districts, N – Upper Mo Chu district. Damp flushes and streamsides, 910–3660m. May–July.

The record of *L. obovata* Hook.f. from Dochu La (71) is based on an immature specimen of this species.

**5. *L. evalvis* Wall.**

Stems erect or creeping, up to 75cm, glabrous. Leaves alternate, broadly ovate to elliptic, 2–7.5 × 1–3.5cm, acuminate, glabrous, apparently without glands, intramarginal vein present, base abruptly attenuate; petiole up to 20mm, narrowly winged. Flowers solitary, axillary, on pedicels 15–40cm, forming loose, leafy racemes. Calyx 6–12mm, teeth ovate or lanceolate, acuminate, eglandular. Corolla yellow, 8–11(–15)mm long; lobes lanceolate or elliptic, acute, eglandular. Stamens included; anthers larger than other species, c 5mm, forming a loose cone, dehiscent by apical pores; filaments very short. Capsule subglobose, 4–8mm, diameter, bursting irregularly.

**Bhutan:** S – Phuntsholing district (Kamji), Chukka district and Deothang district (Narfong, 117); **Darjeeling;** **Sikkim:** Zongri, Tolung valley, Lachen. On wet mossy rocks at margins of forest, 920–2440m. May–July.

**6. *L. alternifolia* Wall.; *L. tetragona* D.Don, *L. glandulosa* Edgeworth**

Stems erect or creeping, up to 40cm, ridged, sparsely pubescent. Leaves alternate, narrowly elliptic to lanceolate, 1.5–4.5 × 0.7–2cm, acuminate, scattered coarse pubescence on both surfaces, minutely glandular, base attenuate to winged petiole up to 7mm. Flowers solitary, axillary, on pedicels 10–20mm, forming loose, leafy racemes. Calyx 5–6mm, teeth lanceolate, acuminate, scattered with minute reddish glands. Corolla yellow, 4.5–5mm long; lobes obovate, with minute reddish glands. Stamens included. Capsule subglobose, c 4mm diameter, 5-valved.

**Bhutan:** S – Chukka district (Marichong), C – Tongsa district (Tongsa to Changkha); **Darjeeling:** Tukvar; **Sikkim:** Thinglen, Kalej Khola, Rishi, Rathong Chhu Valley. On mossy rocks, 1060–1250m. July–August.

**7. *L. laxa* Baudo; *L. ramosa* Duby**

Similar to *L. alternifolia*, but stems to 60cm, ± erect; leaves elliptic to lanceolate, 2–7 × 0.6–2cm, acuminate, thinly puberulous on upper surface, glabrous beneath, without glands; petiole up to 10mm; pedicels 20–40mm; calyx 3–4mm, teeth ovate, without glands; corolla 5–8mm long, lobes oblong, without glands; capsule c 5mm diameter.

**Bhutan:** S – Deothang district (Narfong, 117); **Darjeeling:** Pankhabari; **Sikkim:** Gangtok, Namchi, Rungbee and Sitong. Ditch sides, 1520–2440m. June–September.

**8. *L. japonica* Thunberg; *L. debilis* Wall.**

Stems decumbent or prostrate, up to 35cm, puberulous, often rooting at

nodes. Leaves opposite, ovate, 1–3.5 × 0.5–2.2cm, acute, with thin intramarginal vein and scattered glandular dots, thinly or densely puberulous on both surfaces, base rounded to narrowly winged petiole, 3–10mm. Flowers terminal and in axillary pairs; pedicels 2–8mm, strongly deflexed in fruit. Calyx 4–10mm, densely ciliate; teeth linear-lanceolate. Corolla yellow, 6–12mm long, usually gland-dotted; lobes ovate, acute. Stamens included. Capsule 4–5mm diameter, 5-valved.

**Bhutan:** S – Chukka district (Chukka); **Darjeeling:** Lebung and Mongpu. Shady banks and damp ground in forest, 1970–2130m. June–August.

*L. japonica* is treated here in a broad sense including *L. debilis*. The two have sometimes been treated as separate taxa (69).

### 9. *L. congestiflora* Hemsley

Similar to *L. japonica* but stems and leaves less densely puberulous; flowers 3–5, clustered only at apex of branches; surrounded by whorls of upper leaves; pedicels 1–3mm, erect in fruit; corolla 7–10mm long.

**Bhutan:** S – Chukka district, C – Tongsa district, N – Upper Kuru Chu district (Between Denchung and Julu); **Darjeeling:** Kurseong, Sonada, Lebung, Senchal; **Sikkim:** Chunthang. In damp places in forest, 1060–2130m. June–July.

In the past often misidentified as *L. japonica* or *L. debilis*.

### 10. *L. ferruginea* Edgeworth; *L. deltoidea* auct. non Wight

Similar to *L. japonica* but softly hirsute (often reddish) throughout; leaves smaller, 0.8–2.5(–3) × 0.6–1.5cm, acute to obtuse, somewhat thicker in texture; flowers axillary; pedicels longer, 5–10(–15)mm in flower, (elongating up to 20mm in fruit), often deflexed; flowers smaller, calyx 3–6mm, corolla 3–6mm.

**Bhutan:** C – Thimphu district (Tsalimape, Paro Valley, Sharna to Chiodi Ponkay), Punakha district (Samtengang to Chusom) Bumthang district (Bumthang) and Tashigang district (Kanglung); Bhutan/Assam frontier, Orka La; **Darjeeling:** Basti (?Bhotia Basti). In sandy soil in oak forests or grassy hillsides, 1820–2890m. June–August.

Specimens from the Himalaya and northern India identified as the southern Indian *L. deltoidea* Wight mostly belong to this species.

## 6. ANAGALLIS L.

by E. Aitken

Erect or decumbent annual herbs. Leaves opposite or alternate, entire, sessile. Flowers 5-merous, solitary, axillary, without bracts. Calyx deeply toothed. Corolla red or blue, shallowly campanulate. Filaments villous. Ovary globose; style filiform. Capsule globose, upper half dehiscent as a cap.



1. *A. arvensis* L. Fig. 56f. Eng: *Pimpernel*.

Stems square in section, 6–20(–45)cm, glabrous. Leaves opposite, occasionally in whorls of 3, ovate, 0.7–2(–3.5) × 0.3–1(–1.5)cm, acute, base rounded or slightly cordate, glabrous, gland-dotted beneath. Peduncles 1–2(–3)cm, erect at first, later decurved. Calyx 4–5mm, teeth lanceolate. Corolla blue (in Bhutan specimens), lobes obovate, 4–5 × 3–4mm, margins erose, minutely glandular-ciliate. Filaments 2–2.5mm. Capsule 4–5mm diameter; seeds suborbicular, c 1mm, ± compressed.

**Bhutan:** S – Phuntsholing district (Torsa river), C – Punakha district (near Wangdi Phodrang). On damp shingle, 200–1200m. February–March.

A minor weed of crops (272).

*A. arvensis* is treated here in a broad sense which includes both red- and blue-flowered variants. In *Flora of Pakistan* (271) this species has been divided into var. *arvensis*, a higher altitude plant with orange-red or scarlet flowers, and var. *coerulea* (L.) Gouan, a lower altitude plant with blue flowers which seems to conform to the Bhutanese specimens. However, in some European floras flower colour is not considered to be a reliable character and the status of these colour forms in the Himalaya requires further study.

## Family 152. PLUMBAGINACEAE

by S.J. Rae & E. Aitken

Herbs or subshrubs. Leaves alternate, pinnately veined, exstipulate. Flowers in terminal racemes or capitate heads, bisexual, actinomorphic; bracts often scarious-margined, sometimes sheathing flowers; bracteoles 2. Calyx tubular, 5-lobed. Corolla with long slender tube and 5 spreading lobes. Stamens 5, opposite corolla lobes, free or adnate to the corolla tube. Ovary superior, 1-celled; style 1, divided into 5 stigmas; ovule 1, basal. Fruit a capsule, shed within persistent calyx, seeds cylindrical or ovoid.

- |  |                        |
|--|------------------------|
| 1. Annual herb; stems spiny; corolla lobes short, acute .....  | <b>2. Plumbagella</b>  |
| + Perennial subshrubs; stems ridged, glandular or hirsute; corolla lobes large, obovate .....          | 2                      |
| 2. Flowers in racemes; calyx glandular; stamens free .....   | <b>1. Plumbago</b>     |
| + Flowers in capitate heads; calyx ciliate, eglandular; stamens adnate to middle of corolla tube ..... | <b>3. Ceratostigma</b> |

### 1. PLUMBAGO L.

Perennial subshrubs; stems shallowly ribbed, glandular on upper parts. Flowers in slender terminal branching racemes; bracts and bracteoles much

shorter than calyx. Calyx covered with stalked glands; lobes very short. Stamens free from corolla tube.

1. Rachis of inflorescence and bracts glandular-warted; corolla white

1. *P. zeylanica*

+ Rachis of inflorescence and bracts eglandular, smooth; corolla red

2. *P. indica*

1. *P. zeylanica* L. Fig. 57d.

Scrambling bushy subshrub to 0.3–2m. Leaves ovate, 3–10 × 1.5–7cm, acute, margins entire, base attenuate, glabrous; petioles 0.5–2cm, narrowly winged above, broadly auriculate at base. Racemes many-flowered, glandular, 8–15cm. Bracts leaf-like, glandular. Calyx tube 11–13mm, densely covered with stalked and sessile glands; lobes triangular, c 1mm. Corolla white, tube 2–3cm; lobes obovate, 3–5mm. Capsule narrowly ellipsoid 4–5mm.

**Darjeeling:** Pankhabari, Gurubatan; **Sikkim:** Rangpo. Dry banks and wasteground, 610–853m. September–December.

2. *P. indica* L.; *P. rosea* L.

Similar to *P. zeylanica* but leaves often larger, 7–17 × 3–9cm; racemes longer, 10–30cm; rachis of inflorescence and bracts eglandular, smooth; corolla red, tube 2–4cm; lobes 8–10mm.

**Darjeeling:** Jalpaiguri Duars (Rekti Forest). On gravelly soil, 610m. January–February.

## 2. PLUMBAGELLA Spach

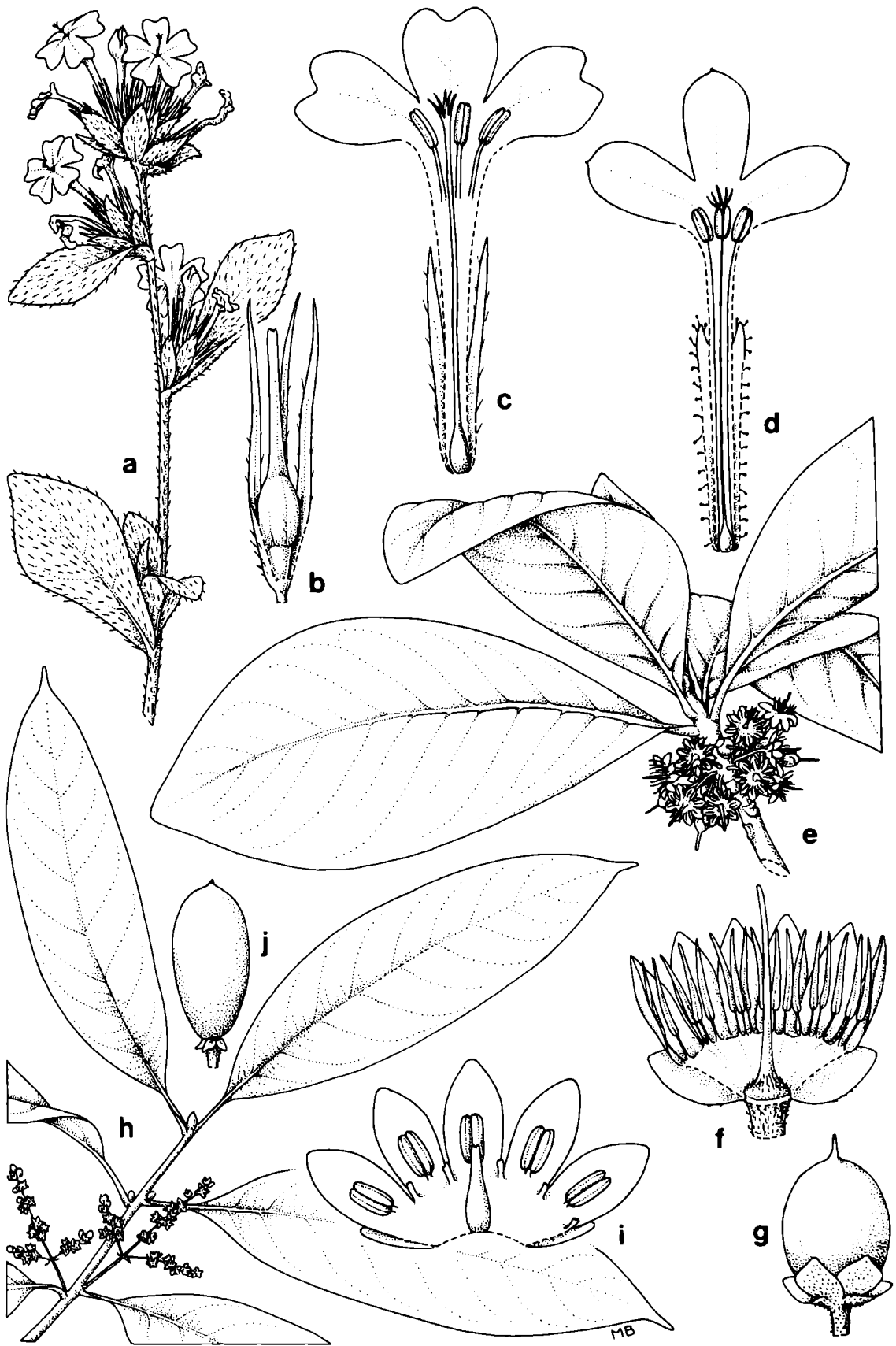
Annual herbs; stems ridged, spiny. Flowers sessile, in dense axillary and terminal subcapitate heads, sheathed by upper leaves and partially hidden by ovate bracts. Calyx winged; lobes ± as long as tube; stalked glands or tubercles only on margins of lobes. Corolla tubular, slightly longer than calyx; lobes short, acute. Stamens free from corolla tube.

1. *P. micrantha* (Ledebour) Spach var. **himalaica** W.W. Smith

Dwarf herb; stems 5–10cm, branching from base. Basal leaves elliptic to lanceolate, 2.5–5 × 0.6–1.5cm, apex acute, base narrowing to broad petiole; upper leaves linear-lanceolate, 2–4 × 0.4–0.6cm, glabrous, base semi-amplexicaul or auricular, margins denticulate. Bracts 4–9 × 3–5mm, margins entire. Calyx tube 1.5–2mm; lobes lanceolate, 1.5–2mm, acuminate, margins

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FIG. 57. **Plumbaginaceae**, **Sapotaceae** and **Sarcospermataceae**. **Plumbaginaceae**. a–c, *Ceratostigma griffithii*: a, flowering shoot (× 2/3); b, fruit (× 4); c, half-flower (× 3). d, *Plumbago zeylanica*: half-flower (× 2 1/2). **Sapotaceae**. e–g, *Diploknema butyracea*: e, flowering shoot (× 1/3); f, half-flower (× 1 1/2); g, fruit (× 2/3). **Sarcospermataceae**. h–j, *Sarcosperma arboreum*: h, flowering shoot (× 1/3); i, dissected corolla (× 4); j, fruit (× 2/3). Drawn by M. Bates.



with thick stalked glands. Corolla tube 3–3.5mm; lobes blue, 0.5–1mm. Capsule ovoid, 1.5–2mm.

**Chumbi:** Chugya. Alpine meadows, 4570m. July–August.

The Chumbi plant described above is a dwarf variant of the typical var. **micrantha** which is not recorded from Bhutan or Sikkim but does occur in Tibet, China (Kansu Province) and the Altai Mountains, in grassland, 1750–3660m. It is a much larger plant than var. **himalaica**: 25–30cm tall or more, with upper leaves 3–7 × 0.7–1.5cm and flowers in longer racemes.

### 3. CERATOSTIGMA Bunge

Perennial subshrubs; stems hirsute. Flowers in rounded terminal and axillary heads; bracts and bracteoles sheathing and partly concealing calyx. Calyx hairy, eglandular; tube short. Stamens adnate to middle of corolla tube.

#### 1. *C. griffithii* Clarke. Fig. 57a–c.

Bushy subshrub 0.5–1.5m; young shoots brownish-hirsute. Leaves obovate-spathulate, 1–8 × 0.7–4cm, acute, base attenuate, margins red, both surfaces ciliate; subsessile. Heads many-flowered, 1.5–3 × 1.5–2cm. Bracts leaf-like, tinged red, ciliate. Calyx ciliate, tube 2–3mm; lobes subulate 7–8mm. Corolla tube 1–1.5cm, pale pink; lobes deep blue, sometimes white, obovate c 5mm, apex truncate, mucronate. Capsule ellipsoid, 3–5mm.

**Bhutan:** C–Thimphu district (common in Paro Chu and Thimphu Chu valleys S to Kyapcha) and Punakha district (Khelekha). Amongst scrub on dry hillsides, 2130–2400m. June–October.

Valued as an ornamental shrub for its bright blue flowers; white-flowered plants are rare.

### Family 153. SAPOTACEAE

by D.G. Long & S.J. Rae

Evergreen trees rarely shrubs, producing white latex. Leaves coriaceous, simple, alternate, sometimes crowded towards apex (*Diploknema*), pinnately veined, entire; stipules caducous. Flowers bisexual, actinomorphic, in axillary fascicles or solitary. Sepals free, 4–8 in 2 whorls. Petals fused at base, 1–2 × as many as sepals. Stamens epipetalous, equal in number to and opposite the corolla lobes or more numerous; staminodes absent or present, alternating with stamens. Ovary superior 2–12-celled; style simple; ovules 1 per cell, axile or basal. Fruit a 1–8-seeded berry.

*Sideroxylon gamblei* Clarke is a synonym of *Platea latifolia* Blume (Icacinaceae).

1. Lateral veins numerous, obscure; calyx 8-lobed; petals 8, each deeply 3-lobed  
**2. Mimusops**
- + Lateral veins few, prominent beneath; calyx 5-lobed; petals 5, unlobed .. **2**
2. Leaves aggregated on young growth; petals 8–10; stamens many, staminodes absent ..... **1. Diploknema**
- + Leaves distant; petals 5; stamens 5 alternating with 5 staminodes  
**3. Xantolis**

### 1. DIPLOKNEMA Pierre

Trees. Leaves crowded towards branch ends; lateral veins prominent beneath. Flowers in fascicles in axils of fallen leaves, crowded below existing leaves. Sepals 5, outer 2 larger. Corolla of 8–10 lobes. Stamens c 40 inserted at base of corolla lobes; staminodes absent. Ovary 6–9-celled. Fruit 1–3-seeded.

**1. D. butyracea** (Roxb.) H.J. Lam; *Bassia butyracea* Roxb., *Aesandra butyracea* (Roxb.) Baehni. Dz: *Yega Shi*; Sha: *Pin-shing*; Nep: *Chiwari* (34), *Chiuri*. Fig. 57e–g.

Tree 20–30m. Young shoots pubescent. Leaves thinly coriaceous, obovate, 18–35 × 9–16cm, obtuse or acute, base cuneate, pubescent to subglabrous beneath; petiole 2–3.5cm, pubescent; stipules triangular, c 2mm, early caducous. Flowers 1–6 per axil, fragrant; pedicels 2–3.5cm, tomentose. Sepals ovate 6–9mm, brownish tomentose. Corolla white, 10–15mm, lobes 6–8mm. Fruit ovoid-ellipsoid, 2.5–3.5 × 2cm, fleshy, 1–3-seeded.

**Bhutan:** S – Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Tongsa, Mongar and Tashigang districts; **Darjeeling:** Darjeeling, Tista and Rangit Valleys, Badamtam, Kali Khola, Mongpu, Pomong, Mikhola, Balasun, etc.; **Arunachal Pradesh:** Nyam Jang Chu. Subtropical and warm broad-leaved forests, 820–1370m. July–December.

Fruit edible and yielding useful oil (117); bark used as fish poison (48).

### 2. MIMUSOPS L.

Trees. Leaves alternate, not aggregated; lateral veins numerous, obscure. Flowers in axillary fascicles. Sepals 8, in 2 whorls. Corolla of 8 petals, each deeply divided into 3 segments. Stamens 8, alternating with 8 staminodes, inserted at base of corolla. Ovary usually 8-celled. Fruit 1–2-seeded.

#### 1. *M. elengi* L.

Tree to 20m, branchlets glabrous. Leaves coriaceous, elliptic, 6.5–15 × 3.5–6.5cm, shortly and bluntly acuminate, base cuneate, glabrous, midrib prominent beneath, lateral veins numerous, parallel, not prominent; petiole 1–2.5cm. Flowers solitary or in fascicles of 2–6 in leaf axils, sweet-smelling; pedicels

6–12mm, tomentose. Sepals triangular, 5–9mm, tomentose. Corolla lobes c 6mm, each divided into 3 lanceolate segments. Fruit globose, 1.5–2.5 × 1.5–2cm.

**Bhutan:** S – Samchi district (Samchi); **Assam:** terai at Banesar near Cooch Behar; **Darjeeling:** Darjeeling; Cultivated in gardens, 180–500m. January–December.

Timber durable and useful (48); bark used medicinally (48).

### 3. XANTOLIS Rafinesque

Trees or shrubs, often spiny. Leaves alternate, not aggregated; lateral veins prominent beneath. Flowers solitary or clustered in axils. Sepals 5. Corolla 5-lobed. Stamens 5, inserted at base of corolla lobes, alternating with 5 petaloid staminodes. Ovary 5-celled. Fruit 1–2-seeded.

#### 1. *X. hookeri* (Clarke) van Royen; *Sideroxylon hookeri* Clarke

Tree to 12m, spiny (34), stems red-brown tomentose when young. Leaves membranous, elliptic, 11–19 × 4–6cm, long acuminate, base cuneate, lateral veins 10–17 on each side, prominent beneath, red-brown tomentose beneath when young, becoming ± glabrous; petiole 1–2cm. Flowers solitary or 2–5 in clusters, pedicels, 5–9mm, sericeous. Sepals ovate, 2.5–4.5 × 1.5–3.5mm, subobtusate, sericeous. Corolla lobes ovate-lanceolate, 7–9 × 2.5–3.5mm, lacerate at base. Stamens 6–7mm, staminodes lanceolate or linear, 6–7 × 1–2mm. Ovary ferruginous hirsute, 10–15mm. Fruit unknown.

**Bhutan:** S – Deothang district (Deothang); **Darjeeling:** below Lebong. Warm broad-leaved forests, 850–1300m. March–April.

A rare and poorly known species.

## Family 154. SARCOSPERMATACEAE

by D.G. Long

Evergreen trees. Leaves subopposite, pinnately veined, with axillary pits (domatia), entire, exstipulate. Flowers bisexual, actinomorphic, in axillary racemes or racemosely branched panicles. Sepals 5, free. Corolla shortly tubular at base, 5-lobed. Stamens 5, epipetalous, alternating with 5 staminodes. Ovary superior, 1–2-celled; style simple, short, ovules 1 per cell, basal. Fruit a 1–2-seeded drupe.

### 1. SARCOSPERMA Hook.f.

Description as for Sarcospermataceae.

#### 1. *S. arboreum* Hook.f. Nep: *Kalikath* (34). Fig. 57h–j.

Glabrous tree to c 15m. Leaves coriaceous, oblong, 10–29 × 4–9cm, sharply

acuminate, base cuneate, veins prominent beneath and with domatia in axils, glabrous; petioles 1.5–3cm. Flowers sweet-smelling, clustered in axillary racemes which usually branch to form broad panicles 4–13 × 2–15cm; pedicels 1–2mm. Sepals ovate, 3mm, appressed pubescent, persistent. Petals yellowish-white, ovate, 4mm. Fruit ellipsoid, c 2.5 × 1.5cm.

Bhutan: S – Gaylegphug district (Rang Khola NE of Surey), C – Tongsa district (N of Shamgong); **Darjeeling:** Badamtam, Lal, Kalimpong, Kurseong, Dumsong, Darjeeling; **West Bengal Duars:** Buxa. Warm broad-leaved forests, 915–1325m. December–March.

Vegetatively has been confused with *Cryptocarya amygdalina* Nees (Lauraceae) and *Bhesa robusta* (Roxb.) Ding Hou (Celastraceae), but differs from both in its domatia in vein axils.

Foliage used as fodder (34).

## Family 155. EBENACEAE

D.G.Long & S.J. Rae

Trees or shrubs. Leaves simple, alternate, pinnately veined, entire, exstipulate. Dioecious, rarely monoecious; flowers axillary, solitary or in cymes, actinomorphic, functionally unisexual, rarely bisexual. Calyx 4(–5)-lobed. Corolla tubular at base, 4(–5)-lobed. Male flowers with stamens 2–4 × number of corolla lobes; filaments free or united in pairs, attached towards base of corolla; pistillode small. Female flowers with staminodes (rarely with fertile stamens); ovary superior, 3–8-celled, each cell with 1 or 2 ovules; style 3–8-branched. Fruit a succulent berry, several-seeded, with persistent calyx.

### 1. DIOSPYROS L.

Description as for Ebenaceae.

1. Corolla densely sericeous externally; fruiting calyx with sericeous lobes with reflexed margins ..... **1. D. lanceifolia**
- + Corolla glabrous or thinly pubescent externally; fruiting calyx with glabrous or pubescent lobes with plane margins ..... 2
2. Male flowers 2–3, subsessile in axillary fascicles; female flowers and fruit sessile; ripe fruit 1.5–2cm long ..... **4. D. lotus**
- + Male flowers 3–6 in short axillary cymes; female flowers and fruit on peduncle 5–15mm; ripe fruit 3–6cm long ..... 3
3. Leaves coriaceous, oblong, rounded at base; ripe fruit ovoid, 3–5 × 2.2–4cm  
**2. D. malabarica**

- + Leaves thinly coriaceous or membranous, obovate-elliptic, ripe fruit subglobose, 5–6cm diameter ..... 3. *D. kaki*

**1. *D. lanceifolia* Roxb.** Fig. 58a–d.

Tree 5–15m; branchlets appressed sericeous when young, soon becoming glabrous. Leaves thinly coriaceous, oblong-elliptic, 6–14 × 2.5–5cm, acute or shortly acuminate with blunt tip, base cuneate, sparsely sericeous beneath when young, becoming glabrous, lateral veins weakly prominent above, obscure beneath; petiole 4–7mm. Male flowers usually 3 in short axillary cymes on peduncle 2–7mm; calyx 3.5–4mm, shortly 4-lobed, sericeous; corolla sericeous externally, tube 5–7mm, lobes c 2mm, spreading; stamens 16–18. Female flowers solitary, axillary, sessile; calyx deeply 4-lobed, lobes 7–10mm, with reflexed margins; corolla thick, sericeous externally, tube 7–8mm, lobes 3–3.5mm, spreading; staminodes 8–12; ovary subglobose, sericeous; style shortly columnar, 6–8-lobed. Fruit subglobose, 2.5–3cm diameter, sericeous, becoming glabrous, subtended by enlarged calyx c 2.2cm diameter, with thick sericeous lobes with reflexed margins.

**Darjeeling:** Tista, Farseng, Mongpu and Lat Panchor. Subtropical forests, 610–1220m. April–May.

Typical *D. lanceifolia* specimens from Assam differ from the Darjeeling material in their more lanceolate leaves and more prominent lateral veins; the two may represent distinct subspecies but require better material from Darjeeling and more detailed study.

**2. *D. malabarica* (Desrousseau) Kosteletsky; *D. embryopteris* Persoon, *D. peregrina* auct. non (Gaertner) Guerke**

Tree 6–15m; branchlets glabrous. Leaves coriaceous, oblong, 9–19 × 3–7cm, acute to obtuse, base rounded, glabrous, veins strongly ascending, reticulate above; petiole stout, 1–1.5cm. Male flowers 4–6 in short axillary cymes 1–2cm; calyx cup-shaped, tube short, lobes 4, 4–5mm, pubescent; corolla campanulate, yellowish, tube c 6mm, lobes rounded, c 4mm; stamens 30–40. Female (or sometimes bisexual) flowers solitary or few in axillary cymes; calyx lobes 7–10mm, pubescent; corolla tube c 9mm, lobes c 5mm; staminodes (or sometimes fertile stamens) up to 30; ovary ovoid, style 4-lobed. Fruit reddish, ovoid, 3–5 × 2.2–4cm, pubescent when young; fruiting calyx erect, lobes cordate at base.

**Darjeeling:** Mahanadi. Swampy places and river banks in terai, 500–1500m. May.

Sometimes cultivated for its edible fruit.

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FIG. 58. **Ebenaceae, Styracaceae and Symplocaceae.** **Ebenaceae.** a–d, *Diospyros lanceifolia*: a, male flowering shoot (× 1/3); b, male half flower (× 3); c, female half flower (× 3); d, fruit (× 2/3). **Styracaceae.** e–g, *Styrax grandiflorus*: e, flowering shoot (× 1/2); f, dissected flower (× 1); g, fruit (× 1). **Symplocaceae.** h–i, *Symplocos paniculata*: h, flowering shoot (× 1/2); i, half flower (× 5). j–k, *Symplocos lucida*: j, flowering shoot (× 1/3); k, fruit (× 2/3). Drawn by M. Bates.





**3. *D. kaki*** Thunberg. Dz: *Anday*; Eng: *Chinese Persimmon*, *Chinese Date Plum*.

Tree 6–10m; branchlets pubescent when young. Leaves thinly coriaceous or membranous, obovate-elliptic, 9–16 × 5–9cm, shortly acuminate or bluntly apiculate, base cuneate or attenuate, pubescent beneath, especially on veins, lateral veins 4–6 on each side, prominent beneath, minor veins reticulate beneath; petioles 1–2cm. Male flowers yellow, in short usually 3-flowered axillary cymes on slender peduncle 5–7mm; calyx cup-shaped, 6–9mm, pubescent externally, including short tube c 2mm, lobes 4, oblong; corolla 8–10mm, 4-lobed to half-way, pubescent; stamens 16 in slightly unequal pairs. Female flowers solitary on axillary peduncle 5–15mm; calyx 16–18mm, with 4 thick ovate lobes 10–15mm, pubescent externally; corolla 12–15mm, including tube 4–5mm, lobes spreading, pubescent; staminodes 8; ovary hairy; style 4-lobed. Fruit orange-red or yellow, globose, 5–6cm, glabrous, 3–8-seeded; persistent calyx c 4.5cm diameter, glabrous.

**Bhutan:** C – Punakha district (Punakha, Nalanda, Rinchu to Mishichen and Samtengang to Choojom), N – Upper Mo Chu district (Kencho). Cultivated in villages, 1400–2000m. May–July.

Native of Japan, cultivated for its edible fruit.

**4. *D. lotus*** L. Dz, Med: *Gundum Nakpo*; Sha: *Amldebu*; Eng: *Date plum*.

Similar to *D. kaki* but leaves ovate-elliptic, 6–10 × 3–5cm, usually sharply acuminate, base rounded to cuneate; male flowers 2–3 per axil, subsessile; calyx 3.5–4mm, with short triangular lobes c 1.5mm, almost glabrous; corolla pink, 5–6mm, with lobes 2–2.5mm, sparsely puberulous; female flowers solitary, sessile in axils; calyx lobes 5–6mm, glabrous; corolla c 7mm, 4-lobed half-way; fruit pale orange or yellow, 1.5–2cm diameter, subtended by persistent calyx 2–2.5cm diameter.

**Bhutan:** C – Thimphu district (Paro) and Punakha district (Norbugang and Bhotokha to Rinchu), N – Upper Mo Chu district (Tamji, Kencho); **Darjeeling:** terai (34). Cultivated, 300–2500m. May–June.

Fruit edible, flesh astringent. Records of *D. montana* Roxb. from Darjeeling district (34) have not been confirmed, and may refer to this species. A more southern species, *D. montana* is a smaller, often spiny tree, with smaller oblong, membranous leaves 4–8 × 1.2–3.5cm, male flowers in slender cymes and smaller, distinctly peduncled female flowers and fruit.

**Family 156. STYRACACEAE**

by D.G. Long

Trees, often with stellate indumentum. Leaves simple, alternate, pinnately veined, exstipulate. Flowers in axillary fascicles or terminal racemes, rarely solitary, actinomorphic, bisexual. Calyx campanulate, minutely 4–5-lobed.

Corolla shortly tubular at base, 4–7-lobed. Stamens equal in number to corolla lobes and alternating with them, or twice as many, filaments adnate to corolla or united into a tube. Ovary superior or inferior, 3–5-celled, ovules 1 to several per cell, axile; style slender, minutely 3–5-lobed. Fruit a capsule with persistent calyx.

### 1. STYRAX L.

Description as for Styracaceae.

1. Flowers 2–5 in axillary fascicles or many in terminal leafless racemes; calyx 4–5mm; corolla 10–13mm ..... 1. *S. serrulatus*  
 + Flowers 1(–2) per axil or 2–3 in short terminal racemes; calyx 6–8mm; corolla 16–23mm ..... 2. *S. grandiflorus*

1. *S. serrulatus* Roxb.; *S. serrulatus* var. *agrestis* Clarke. Nep: *Khari* (34); Lepcha: *Chamo-kung* (34).

Shrub or tree to 15m. Leaves ovate-elliptic, 5–15 × 3–5.5cm, acuminate, base cuneate or rounded, margin sharply serrulate in upper half, glabrous or sparsely stellate beneath; petiole 4–6mm. Flowers fragrant, 2–5 in axillary fascicles or many in terminal leafless racemes 3–7cm. Calyx tube campanulate, 4–5mm including minute teeth, stellate tomentose. Corolla white, 10–13mm, including lanceolate lobes 7–9mm. Capsule broadly ellipsoid, 10–12 × 6–8mm, 1–4-seeded, surrounded at base by persistent calyx tube.

**Bhutan:** S – Chukka district (Marichong), Sarbhang district (Phipsoo Khola) and Gaylephug district (Nabzi); **Darjeeling:** Kurseong, Dikchu, Darjeeling, Sivok, Mongpu, Lal, Jalpaiguri, Kalimpong, Pankhabari, Kurseong, Mal, Pedong. Subtropical and terai forests, sometimes with Sal, 280–1550m. March–May.

Used to make poles for prayer flags (34).

In this and the following species specimens with enlarged galled flower buds are occasionally seen.

2. *S. grandiflorus* Griff.; *S. hookeri* Clarke. Nep: *Khari* (34); Lepcha: *Chamo-kung* (34). Fig. 58e–g.

Similar to *S. serrulatus* but leaves ovate, somewhat longer, 8–16cm, often stellate on midrib and veins on both surfaces; flowers 1(–2) per axil or 2–3 in short terminal racemes; calyx tube 6–8mm; corolla 16–23mm, including spatulate lobes 12–19mm; capsule c 2 × 1.3cm.

**Bhutan:** C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Kuru Chu district (Denchung); **Darjeeling:** Senchal, Bhotia Basti, Tiger Hill, Darjeeling, Sonada, Ghumpahar, Mahaldiram; **Sikkim:** Roro Chhu near Gangtok. Evergreen oak and cool broad-leaved forests, 1700–2500m. April–June.

**Family 157. SYMPLOCACEAE**

by D.G. Long

Trees or shrubs, evergreen, rarely deciduous. Leaves simple, alternate, pinnately veined, exstipulate. Flowers axillary or terminal, solitary or in spikes, racemes, panicles or fascicles, actinomorphic, bisexual or functionally unisexual. Sepals 5, united at base. Corolla of 3–11 lobes, shortly united at base. Stamens 20–many, free or variously united, inserted on corolla. Ovary inferior or semi-inferior, 2–5-celled, ovules 2–4 per cell, axile; style slender; stigma capitate or lobed. Fruit a 1–3-seeded drupe or berry, bearing persistent calyx at apex.

**1. SYMPLOCOS Jacquin**

Description as for Symplocaceae.

1. Leaves deciduous, broadly elliptic to obovate; flowers in lax terminal panicles ..... **1. S. paniculata**
- + Leaves evergreen, usually narrowly elliptic; flowers in simple or branched axillary racemes or spikes, or axillary fascicles ..... 2
2. Midrib prominent on upper leaf surface ..... **2. S. lucida**
- + Midrib impressed on upper leaf surface ..... 3
3. Flowers in dense axillary fascicles or branched spikes ..... 4
- + Flowers in simple spikes or racemes ..... 5
4. Flowers in dense axillary fascicles ..... **3. S. glomerata**
- + Flowers in elongate branched spikes ..... **4. S. cochinchinensis**
5. Leaves membranous or thinly coriaceous, long-acuminate, often caudate; margins serrulate almost to base; calyx pubescent ..... **5. S. ramosissima**
- + Leaves thick and rigid, obtuse, subacute, acute or acuminate, rarely caudate; margins entire (rarely crenate), or serrulate only towards apex; calyx usually glabrous ..... 6
6. Branchlets stout; leaves sharply and often abruptly acuminate, usually serrulate towards apex; flowers and fruit on distinct pedicels 2–10mm ..... 7
- + Branchlets slender; leaves gradually acuminate to acute, subacute or obtuse, entire, crenate or variably serrulate; flowers and fruit subsessile or on short pedicels 1–4mm ..... 8
7. Terminal buds large, 18–22mm, glabrous externally; lateral veins 9–16 pairs; racemes 4–10cm; stamens 40–50 ..... **6. S. dryophila**

- + Terminal buds small, 5–6mm, outermost scales pubescent at base; lateral veins 5–8 pairs; racemes 3–5cm; stamens 20–30 ..... 7. **S. sumuntia**
8. Branchlets glabrous; leaf apex acute or gradually acuminate, margins entire or obscurely serrulate towards apex; racemes 1–3cm; stamens 30–35  
**8. S. pyrifolia**
- + Branchlets pubescent; leaf apex obtuse, subacute or acute, margins crenate to subentire; racemes 3–10cm; stamens 80–100 ..... 9. **S. racemosa**

1. **S. paniculata** (Thunberg) Miquel; *S. chinensis* (Loureiro) Druce, *S. crataegioides* D. Don. Dz: *Pangtse Shing*. Fig. 58h&i.

Tree or shrub 3–10m, glabrous or pubescent; terminal buds inconspicuous. Leaves membranous or thinly coriaceous, broadly elliptic, obovate or ovate, 4–8(–11) × 2–4.5(–6)cm, apiculate, acute or acuminate, base rounded, margins regularly serrulate or ciliate, glabrous above, pubescent on veins beneath; petiole 5–11mm. Flowers probably functionally unisexual, in terminal panicles 3–9cm on lateral shoots; bracts linear, 1–2mm, caducous, bracteoles minute, caducous. Calyx tube 1.5–1.7mm, glabrous or sparsely pubescent, lobes green, 1.2–1.6mm, ovate-triangular. Corolla lobes white, obovate, 4–5mm. Stamens 30–40. Style 2–4mm, slender. Fruit black, ovoid-subglobose, c 8 × 6mm, usually 1-seeded.

**Bhutan:** S – Chukka district, C – Ha, Thimphu, Punakha and Bumthang districts, N – Upper Mo Chu district. In Blue Pine forest and amongst shrubs on river banks. 1600–2850m. April–June.

A frequent species in W Bhutan yet curiously absent from Sikkim and Darjeeling. Leaves and bark used to make yellow dye (48); seeds yield edible oil.

2. **S. lucida** (Thunberg) Siebold & Zuccarini; *S. theifolia* D. Don, *S. phyllocalyx* Clarke. Dz: *Dom Shi*, *Khyapshing*. Nep: *Kharane*, *Lekh Kharane* (34), *Kharney Gach* (117). Fig. 58j&k.

Evergreen tree or shrub 4–10m, glabrous; terminal buds conspicuous, 7–13mm. Leaves thick, (yellow when dry), elliptic–lanceolate, 6–16 × 2–4.5cm, acuminate, base cuneate, margins shallowly crenate-serrate or subentire, glabrous on both surfaces, midrib prominent above; petiole 8–15mm. Flowers white or creamy, subsessile in dense spikes 1–4cm, branched near base; peduncle puberulous; bracts rounded, 2.5–3mm, ciliate. Calyx lobes rounded, 0.8–2mm, ciliate. Corolla lobes 3–4mm. Stamens many. Fruit ellipsoid, c 10 × 6mm, 2-seeded.

**Bhutan:** S – Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Kuru Chu district; **Darjeeling:** Tanglu, Manibhanjan, Sureil, Jorpokhri, Rambhi Chhu, Ramman, Dumsong; **Sikkim:** Bakhim, Zongri, Chhokha. Evergreen oak and warm broad-leaved forests, 900–2300m. April–June, October, November.

Leaves used to make yellow dye. Heartwood red, similar to *Daphniphyllum himalaense*; wood of both species is ground into a paste for use in Hindu religious ceremonies and for caste marks (34).

**3. *S. glomerata* Clarke.** Nep: *Kholme* (34), *Kalokrhani*.

Evergreen tree or shrub 3–10m, glabrous; terminal buds small. Leaves coriaceous, oblong-elliptic, 7–18 × 2–5cm, acuminate, base cuneate, margins serrulate, glabrous on both surfaces, midrib impressed above; petiole 9–18mm. Flowers white or pale yellow, sessile, in dense axillary fascicles 1–2cm diameter; bracts densely arranged, rounded, 1–3mm, pubescent. Calyx lobes suborbicular, 2–2.5mm, margins ciliate. Corolla lobes 5–7 × 3–4mm. Stamens many. Style slender; stigma capitate. Fruit cylindrical, 8–10 × 3–5mm, 1(–3)-seeded.

**Bhutan:** S – Chukka district, C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** Ghum, Sonada, Budhwari, Bhotia Basti, Rimbik, Senchal; **Sikkim:** Chunthang, Gangtok, Pemayangtse, Rathong Chhu, Phusum. Evergreen oak and cool mixed broad-leaved forests, 1830–2740m. March–May.

Wood used for fenceposts.

**4. *S. cochinchinensis* (Loureiro) S. Moore; *S. spicata* Roxb.** Nep: *Kholme* (34), *Kharane*.

Evergreen tree to 15m, branchlets glabrous or pubescent; terminal buds large, 7–11mm. Leaves coriaceous, elliptic, 12–25 × 4–7cm, acuminate, base cuneate, margins serrulate or crenulate, glabrous on both surfaces or pubescent beneath; petiole 7–18mm. Flowers white, sessile, in elongate glabrous or pubescent branched spikes 2–7cm; bracts ovate, 2–2.5mm, pubescent. Calyx tube 1–2mm; lobes rounded c 1mm, glabrous or pubescent. Corolla lobes oblong, 3–3.5mm. Fruit subglobose, c 7 × 7mm, 1-seeded, crowned by persistent incurved calyx lobes.

Two subspecies occur:

a. subsp. ***cochinchinensis***

Spikes usually pubescent; calyx lobes hairy, usually enlarged in fruit, forming a conical pubescent beak.

**Darjeeling:** Phara Dhara and Darjeeling. Subtropical forests, 1160m. November–January.

b. subsp. ***aurina* (Retzius) Noteboom**

Spikes glabrous; calyx lobes glabrous with ciliate margins, in fruit scarcely enlarged, forming a low glabrous crown.

**Bhutan:** locality unknown; **Darjeeling:** Siliguri, Rishap, Belakoba, Dhupgari, Lebong, Jalpaiguri, Sukna and Sureil; **West Bengal Duars:** Buxa. Subtropical and terai forests, 200–1220m. October–February.

The record for Bhutan is based on an unlocalised Griffith specimen.

**5. *S. ramosissima* G. Don.** Nep: *Kharane* (34).

Shrub to 5m or small tree 6–10m; branchlets slender, glabrous; terminal buds small, 4–6mm. Leaves membranous or thinly coriaceous, elliptic-lanceolate, 7–13 × 2–4.5cm, long acuminate, often caudate, base cuneate, margins serrulate

almost to base, glabrous and glossy above, glabrous or sparsely pubescent on midrib beneath; petiole 6–12mm. Flowers creamy white, on short pedicels 1–2mm, in short, simple axillary racemes 1–2.5cm; peduncle sparsely pubescent; bracts lanceolate, c 2mm, caducous. Calyx tube c 1mm, pubescent, lobes rounded, c 1mm, ciliate. Corolla lobes obovate, 4–5 × 2mm. Stamens many. Fruit ovoid-ellipsoid, 7–10 × 5mm, 1-seeded.

**Bhutan:** S – Chukka district, C – Thimphu, Punakha, Tongsa and Tashigang districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling:** Birch Hill, Sonada, Darjeeling, Baghora, Bhotia Basti, Kurseong, Lebong, Ghum to Sukia Pokhri; **Sikkim:** Pemayangtse, Gangtok, Dentam, Yoksam to Bakhim, Prek Chhu. Cool broad-leaved and evergreen oak forests, sometimes in scrub on open hillsides, 1600–2560m. May–July.

**6. *S. dryophila*** Clarke. Nep: *Kharane* (34).

Tree or shrub 3–10m; branchlets stout, glabrous; terminal buds large, 1.8–2.2cm, glabrous outside. Leaves coriaceous, oblanceolate to elliptic, 10–21 × 3–5.5cm, abruptly acuminate, base cuneate, margins entire or serrulate towards apex, glabrous, lateral veins 9–16 pairs, midrib impressed above; petiole 10–20mm, stout. Flowers white or creamy, in simple racemes 4–10cm; peduncle appressed hairy; bracts elliptic, 2–5mm; pedicels 2–4mm, pubescent. Calyx glabrous, tube 1–2mm, lobes triangular, 1–1.5mm. Corolla lobes oblong, 5–6mm. Stamens 40–50. Disk hairy. Style 3–6mm. Fruit ellipsoid, 5–12 × 3–7mm, 1-seeded, smooth.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** Budhwari, Tanglu, Rammam to Phalut, Pul Bazar, Dumsong; **Sikkim:** S of Dentam. Evergreen broad-leaved forests, 2100–3550m. April–July.

**7. *S. sumuntia*** D. Don; *S. caudata* G. Don. Dz: *Dumbu Shing*; Nep: *Aule Kharane* (34).

Similar to *S. dryophila* but terminal buds small, 5–6mm, outer scales hairy at base; leaves smaller, 8–11 × 3–5cm, margins serrulate in upper half, lateral veins distant, 5–8 pairs; petiole 8–15mm; racemes 3–5cm, peduncle glabrous or pubescent; calyx lobes 0.5–1mm; corolla lobes 3.5–5mm; stamens 20–30; disk glabrous.

**Bhutan:** S – Chukka district (Chimakothi), C – Punakha district (Punakha); **Darjeeling:** Jorbangala, Geddapahar and Rungirun. Evergreen oak forest, 900–2220m. April.

**8. *S. pyrifolia*** G. Don

Shrub or small tree to 5m; branchlets slender, glabrous; terminal buds slender, 1–1.5cm, glabrous externally. Leaves coriaceous (sometimes thinly), elliptic, 9–17 × 2.5–5cm, acute or gradually acuminate, base attenuate, margin entire or obscurely serrulate towards apex, glabrous, lateral veins 7–10 pairs; petiole

1–2cm. Flowers white in short simple racemes 1–3cm; peduncle pubescent; bracts concave, 5–7mm, caducous; bracteoles 2–3mm; pedicels 1–3mm, pubescent. Calyx tube 0.8–1mm, glabrous; lobes ovate, c 1mm, pubescent externally. Corolla lobes 3.5–4mm. Stamens 30–35. Fruit ellipsoid, 7–10 × 5mm, 1–3-seeded.

**Bhutan:** S – Chukka district (Chukka); **Darjeeling:** Namchi, Dumsong, Darjeeling. Warm broad-leaved forests, 1220–2130m. April, October.

**9. *S. racemosa* Roxb.; *S. racemosa* var. *composita* Kurz.** Nep: *Chumlane* (34); Lepcha: *Singan* (34).

Tree or shrub 5–10m, branchlets slender, pubescent; terminal buds small, 4–5mm, pubescent. Leaves coriaceous, elliptic, 4–15 × 1.5–5cm, obtuse, subacute or acute, base rounded or cuneate, margins crenate to subentire, glabrous above, sparsely hairy on midrib beneath, midrib impressed above, lateral veins 5–9 pairs; petiole 5–7(–10)mm. Flowers white, in simple axillary racemes 3–10cm; peduncle tomentose or pubescent; bracts ovate-triangular, 3–4mm; pedicels 0.5–2mm. Calyx ± glabrous, tube 1.2mm, lobes ovate, 1.5–2.2mm. Corolla lobes 4–5mm. Stamens 80–100. Fruit cylindrical-ellipsoid, 5–8mm, 1-seeded.

**Darjeeling:** Dalka Jhar, Jalpaiguri, Pankhabari and Siliguri. Terai forests, 100–300m. November–December.

Bark and leaves used for dyeing (34, 48, 126).

Specimens reported from Bhutan (117) have not been available for study.

## Family 158. OLEACEAE

by M.F. Watson

Trees or shrubs, occasionally lianes. Leaves opposite, rarely alternate, simple, trifoliate or pinnate, peltate glands present on undersurface; stipules usually absent. Flowers bisexual (unisexual in *Fraxinus*), actinomorphic, in axillary or terminal inflorescences. Calyx 4-lobed (sometimes 4–5-lobed, as in *Jasminum*), rarely absent. Petals united into a tube, typically 4-(occasionally 6–12)-lobed, sometimes deeply so, rarely absent, imbricate in bud. Stamens 2, epipetalous, anthers 2-celled, introrse, with longitudinal dehiscence. Pistil 1, ovary superior, of 2 fused carpels with axile placentation; ovules usually 2 per locule (4–10 in *Forsythia*), anatropous. Style 1 or none; stigmas 1–2. Fruit a berry, drupe, loculicidal capsule or samara.

- |   |                           |
|---|---------------------------|
| 1. Leaves pinnate .....   | 2                         |
| + Leaves simple or trifoliate .....   | 3                         |
| 2. Scandent to erect shrubs; flowers in few-flowered cymose inflorescences; fruit a drupe ..... | <b>1. <i>Jasminum</i></b> |



- + Trees with many-flowered panicles; fruit a samara ..... **3. Fraxinus**
- 3. Scandent climbers to erect shrubs, rarely self-supporting ..... 4
- + Shrubs to small trees, self-supporting ..... 5
- 4. Climbers or small shrubs; leaves simple, trifoliolate or pinnate, small (less than 10 × 4cm); flowers conspicuous, often scented ..... **1. Jasminum**
- + Climbers; leaves simple, large (more than 10 × 4cm); flowers inconspicuous, scentless ..... **8. Myxopyrum**
- 5. Small, sparingly branched shrubs; flowers yellow, flowering before leaf expansion; fruit a capsule ..... **2. Forsythia**
- + Medium sized shrubs to small trees; flowers not as above; fruit a drupe . 6
- 6. Flowers in fascicles or very short racemes ..... **4. Osmanthus**
- + Flowers in panicles ..... 7
- 7. Panicles terminal; petals fused into a tube ..... **7. Ligustrum**
- + Panicles axillary; petals fused into a tube or not, or absent ..... 8
- 8. Petals fused into a tube only at base, or in pairs ..... **5. Chionanthus**
- + Petals fused into a distinct tube or absent ..... **6. Olea**

### 1. JASMINUM L.

Scandent or erect shrubs; Bhutanese species evergreen. Leaves simple, 3-foliolate or pinnate with a terminal leaflet, alternate or more commonly opposite. Inflorescence a 2- or 3-chotomous cyme, sometimes contracted (flowers rarely solitary) axillary or terminal; bracts and bracteoles small, linear or ovate. Flowers often scented. Calyx 4–9-fid, sepals fused into a funnel-shaped tube, teeth long, setaceous, short or absent. Corolla fused into a narrow tube with 4–10 patent, spreading lobes, corolla white, pink or yellow. Stamens subsessile, included at apex of corolla tube. Stigmas 2, linear, on a cylindric style elongating up the corolla tube after anthesis. Fruit a drupe, borne in pairs or solitary by supression.

- 1. Leaves opposite ..... 2
- + Leaves alternate ..... 15
- 2. Leaves simple ..... 3
- + Leaves compound, trifoliolate or pinnate ..... 10
- 3. Calyx glabrous, or only sparsely pubescent ..... 4
- + Calyx distinctly hairy, particularly the teeth ..... 8

158. OLEACEAE

- 4. Leaves membranous; calyx teeth long, 10–16mm ..... **1. J. nervosum**
- + Leaves coriaceous; calyx teeth short, less than 7mm ..... 5
  
- 5. Leaves lanceolate, usually less than 25mm wide; bracts subtending main cyme branches large, leaf-like ..... **2. J. laurifolium**
- + Leaves elliptic to ovate-lanceolate, usually more than 25mm wide; all bracts small and linear ..... 6
  
- 6. Leaves more than 10 × 5cm; older stems with corky bark  
**15. J. sp. aff. sempervirens**
- + Leaves less than 10 × 5cm; older stems not corky ..... 7
  
- 7. Calyx teeth very short; less than 0.7mm; petioles more or less glabrous; cyme side branches often suppressed; fruit ellipsoid ..... **3. J. nepalense**
- + Calyx teeth longer, 1–6mm; petioles hirsute, rarely glabrous; cyme branches usually present; fruit spherical ..... **4. J. ritchiei**
  
- 8. Calyx teeth short, less than 5mm (–10mm in fruit), reflexed to spreading  
**5. J. scandens**
- + Calyx teeth longer, 6–13mm, not as above ..... 9
  
- 9. Corolla conspicuously double; leaves large, 3–12 × 2.5–7cm, elliptic to ovate ..... **6. J. sambac**
- + Corolla not double, 5–6-lobed; leaves smaller, 2.8–8.5 × 1.7–3.5cm, ovate-lanceolate ..... **7. J. elongatum**
  
- 10. Leaves trifoliolate ..... 11
- + Leaves pinnate with 5–13 leaflets ..... 13
  
- 11. Leaves 3–5-foliolate; lateral leaflets subsessile with petiolules less than 2mm, terminal leaflet considerably larger than the laterals; leaflets distinctly 5-nerved ..... **8. J. dispersum**
- + Leaves always 3-foliolate; lateral leaflets with petiolules usually more than 2mm, terminal leaflet larger than the laterals but not considerably so; leaflets pinnately veined ..... 12
  
- 12. Leaflets leathery; petiolules of lateral leaflets 9–25mm; inflorescence branches thick and robust ..... **9. J. lanceolarium**
- + Leaflets not leathery; petiolules of lateral leaflets 1–6mm; inflorescence branches slender ..... **10. J. caudatum**
  
- 13. Leaflets 5 (or 3); calyx lobes less than 2mm long ..... **8. J. dispersum**
- + Leaflets (5–)7–13; calyx lobes more than 4mm long ..... 14

14. Inflorescence cymose; pedicels of later flowers exceeding the earlier (central) ones in a cyme; corolla lobes  $8-18 \times 5-9\text{mm}$  ..... **11. *J. grandiflorum***  
 + Inflorescence sub-umbellate; pedicels all about the same length; corolla lobes  $9-12 \times 5-8\text{mm}$  ..... **12. *J. officinale***
15. Leaflets 5 or more (rarely 1-3); inflorescence 3-9-flowered, umbellate or sub-umbellate ..... **13. *J. humile***  
 + Leaflets 1-3 (rarely 5); inflorescence 30-50-flowered, corymbose to paniculate ..... **14. *J. subhumile***

**1. *J. nervosum*** Loureiro; *J. anastomosans* Wall. Fig. 59d.

Twining shrub 3-10m tall; young stems, petioles and inflorescence branches covered in minute hairs scarcely visible to the naked eye. Leaves opposite, simple, ovate to ovate-lanceolate,  $3.5-8 \times 1.4-3.5\text{cm}$ , apex acuminate to acute, base truncate to cuneate, glabrous, with 3 main veins; petioles 1-7mm. Inflorescence a 1-5-flowered, terminal or axillary cyme; peduncle 0-3mm; pedicels 1-6mm; bracts subtending main cyme division leaf-like, to  $35 \times 10\text{mm}$ . Calyx glabrous, sometimes sparsely minutely hairy, teeth 6-7, 10-16mm long, setaceous. Corolla tube 14-24mm long at anthesis; lobes 6-7,  $13-20 \times 1.5-2.5\text{mm}$ . Fruit ellipsoid, 10-18mm long.

**Bhutan:** S - Sarbhang district (near Lao Pani); **Darjeeling:** Daling. Open situations in subtropical and terai forests, 400-610m. March-July.

**2. *J. laurifolium*** Roxb.

Climbing, twining shrub 2-5m tall or more, glabrous throughout; stems angular. Leaves opposite, simple, lanceolate-elliptic to lanceolate,  $3.4-11.5 \times 1.6-2.7\text{mm}$ , apex acuminate, base obtuse to attenuate, coriaceous with 3 main nerves; petioles 3-8mm. Inflorescences terminal or on long axillary peduncles, of 3-5-flowered lax cymes; peduncle 10-42mm; pedicels 4-21mm; bracts subtending main cyme branches enlarged and leaf-like, to  $45 \times 12\text{mm}$ . Flowers very to faintly fragrant, white with red tube, buds dark red. Calyx teeth 5-6, setaceous but rather short, 2.5-4mm long, sometimes recurved. Corolla tube 15-23(-38)mm long at anthesis; lobes 9-11,  $15-20 \times 1.5-3\text{mm}$ . Fruit (not seen) black, globose, c 6mm long, borne singly or in pairs (80).

**Bhutan:** C - Tongsa district (Byiti Sam, below Pertimi and Tintibi Bridge, Jirgang Chu valley), Mongar district (Lhuntse Dzong) and Tashigang district (Dangma Chu). Climber on shrubs and trees in varied habitats from dense wet evergreen forest to dry forests, 750-1500m. March-May.

A variable species, and commonly introduced into cultivation.

**3. *J. nepalense*** Sprengel; *J. glandulosum* DC.

Scandent shrub with glabrous stems. Leaves opposite, simple, elliptic to ovate-lanceolate,  $5-10 \times 1.7-4.5\text{cm}$ , apex acuminate, base obtuse to truncate, glabrous, somewhat coriaceous; petiole 3-8mm, glabrous to minutely hairy.

Inflorescence a slender, axillary or terminal, 1–3-flowered lax cyme; much reduced through suppression of side branches to single ‘pedicel’ with a terminal flower and usually two pairs of linear bracteoles along its length, sometimes 2 side branches of the cyme develop. Pedicel length (last bracteole pair to flower) 8–15mm. Flowers sweet scented, white, fading cream. Calyx with very short, narrow teeth, less than 0.7mm long. Corolla tube 20–30mm long at anthesis; lobes 5–8, 10–15 × 1.5–3mm. Fruit, elongate-ellipsoid, blue-black, c 16 × 10mm.

**Bhutan:** S – Chukka district (Raidak Valley), C – Punakha district (Lobesa-Mendegong) N – Upper Mo Chu district (Kencho); **Darjeeling:** Kurseong, Rangnu, Mongpu, Pankhabari and Sureil. Subtropical forests (lower and upper hill forests), 100–2000m. July–September.

#### 4. *J. ritchiei* Clarke

Similar to *J. nepalense* but differing in pubescence and floral characters; petioles, inflorescence branches and pedicels (just below flower) hirsute, sometimes sparsely so; inflorescence a lax cyme with slender branches, 3(–9)-flowered, occasionally fewer; pedicels long, (6–)10–25mm; calyx teeth setaceous, 1–6mm; fruit spherical, 6–9mm long.

No Bhutanese material seen, but widespread in Western Ghats and Nepal and could occur in Bhutan.

#### 5. *J. scandens* Vahl. Nep: *Hara Lahara* (34).

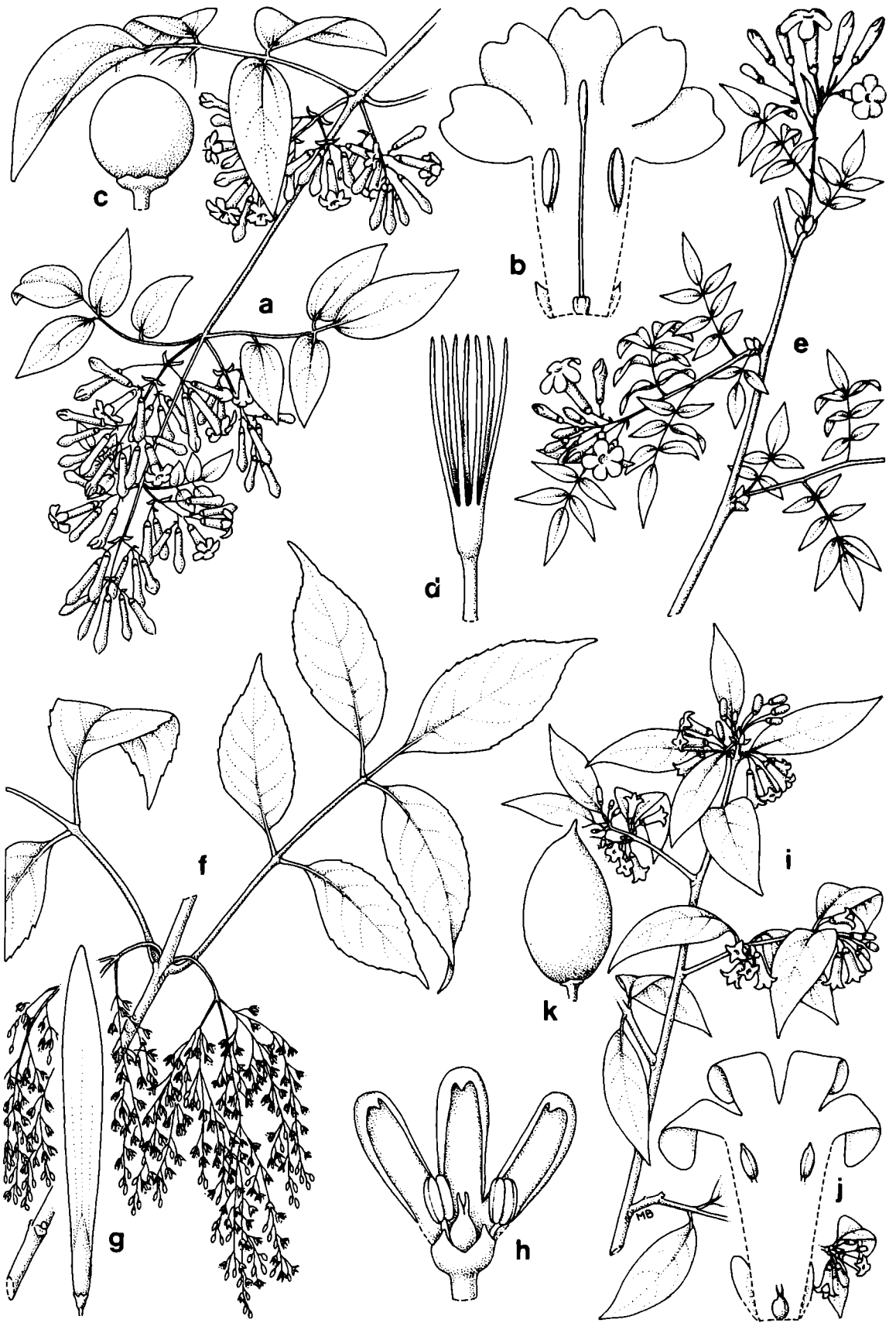
Large climbing shrub; young stems minutely hirsute. Leaves opposite, simple, ovate-lanceolate, 58–110 × 56–32mm, apex acuminate, base broadly cordate to rounded, somewhat coriaceous, glabrous except for a line of short hairs along the midrib (above and below); petiole 2–8mm. Inflorescence a 1-flowered, axillary or terminal (on short axillary branches), contracted cyme; peduncle 0–10mm long; pedicels 0–1.5mm. Flowers very sweetly scented, white, sometimes flushed pink. Calyx densely covered in short hairs, lobes 6–7, short and setaceous, 1.5–5(–10)mm long, recurved in flower and fruit. Corolla tube 17–23mm long at anthesis, lobes 6–7, 12–16 × 1.5–2.5mm. Fruit ellipsoid, ripening black. 6–13mm long, single or often paired.

**Darjeeling:** Sukna, Jalpaiguri and Dhupgari. Subtropical, terai forests, 100–500m. December–March.

An atypical specimen from Samchi district, Bhutan (Khagra valley near Gokti) is doubtfully referred either to this species or a wild form of *J. sambac*.

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FIG. 59. **Oleaceae.** a–c, *Jasminum dispernum*: a, flowering shoot (× 1/3); b, flower dissected (× 2); c, fruit (× 1 1/2). d, *Jasminum nervosum*: calyx (× 2). e, *Jasminum humile*: flowering shoot (× 1/2). f–g, *Fraxinus floribunda*: f, flowering shoot (× 1/3); g, fruit (× 2). h, *Chionanthus ramiflorus*: flower with 1 petal removed (× 5). i–k, *Osmanthus suavis*: i, flowering shoot (× 1/3); j, dissected flower (× 2); k, fruit (× 2). Drawn by M. Bates.



**6. *J. sambac* (L.) Aiton.** Eng: *Arabian Jasmine*.

Large scandent shrub; young branches, petioles and inflorescence branches densely pubescent. Leaves opposite, simple and large, elliptic to ovate, 30–120 × 25–70mm, apex acute to acuminate, mucronate, base truncate to cuneate, glabrous except for hairy midrib (as *J. scandens*). Inflorescence a terminal, usually a 3-flowered (more in some cultivars), contracted cyme; peduncle c 3mm long, pedicels 4–12mm. Flowers fragrant, usually double, white. Calyx puberulent, sometimes sparsely so, teeth long, setaceous, 7–11mm. Corolla tube 10–15mm at anthesis; lobes numerous, 17–27 × 5–8mm. Fruit (not seen) black, c 15mm long, solitary or paired (80).

**Bhutan:** S – Phuntsholing district (cultivated at Phuntsholing), C – Tashigang district (cultivated at Tashigang). Only known from cultivated material, 250–1350m. April–June.

This species has long been cultivated in tropical countries. Its native source is unknown (but see note above under *J. scandens*). The buds are used to flavour Jasmine tea in China.

**7. *J. elongatum* (Bergius) Willdenow;** *J. amplexicaule* G. Don, *J. undulatum* sensu Clarke non (L.) Willdenow. Nep: *Maidal*, *Sanumaidal* (Cowan specimen).

Climbing shrub, forming large bush to 3m tall. Younger stems, petioles and inflorescence branches covered in a dense yellow-brown pubescence. Leaves opposite, simple, ovate-lanceolate, (13–)28–55(–80) × (7–)17–28(–35)mm, apex abruptly acuminate to acuminate, base truncate to cuneate (sometimes slightly caudate), somewhat coriaceous and shiny, glabrous except for a characteristic line of short hairs along the midrib (above and below) and some marginal hairs; petiole 1–6mm. Inflorescence a terminal contracted cyme of 3–9 flowers; peduncle 2–12mm, pedicels 1–5mm. Flowers not, or only slightly, fragrant, white with a pale green tube. Calyx hairy to very hairy (particularly on the teeth), teeth 5–8, setaceous, 6–13mm. Corolla tube 10–23mm long at anthesis. lobes 5–8, 11–16 × 2.5–5mm. Fruit globose to ellipsoid, green ripening black, 5–12mm long, often paired.

**Bhutan:** S – Samchi, Chukka and Deothang districts, C – Tongsa district; **Darjeeling:** Kalimpong, Ryang Chu, Badamtam, Tista, Sivok, Sureil, Kalabari, Birik, etc. Climber on trees in subtropical terai forest, often in partially cleared areas, 600–1800m. June–November.

*J. multiflorum* (Burman f.) Andrews (syn. *J. hirsutum* (L.) Willdenow, *J. pubescens* (Retzius) Willdenow, *J. gracillimum* Hook., *Nyctanthes pubescens* Retzius) has been reported from the Himalaya (80) but all the specimens seen of this species from the *Flora of Bhutan* area appear to be misidentified and are *J. elongatum*. The former species is described from Peninsular India and China, and widely cultivated in the West since the end of the 18th century. It has significantly larger leaves and flowers than *J. elongatum*, and the leaves have a distinctly cordate base and are more hairy. *J. multiflorum* has sweet-scented flowers. Both these species have apparently similar habitats and altitudinal ranges.

**8. *J. dispernum*** Wall. Nep: *Hare Lahara, Charpate Lahara* (34). Fig. 59a–c.

Robust, twining creeper 2–3m tall. Leaves opposite, pinnate with 3–5 leaflets. Petioles 10–35mm long, curved; petiolule of terminal leaflet 8–20mm long, laterals 0–1.5mm. Leaflets ovate to ovate-lanceolate, apex acute to acuminate, base caudate to truncate or obtuse, glabrous, distinctly 5-nerved at base; terminal leaflet large, 40–120 × 18–75mm, lateral leaflets smaller, 17–70 × 8–38mm. Inflorescence a 9–many-flowered cyme, often paired in opposite leaf axils; peduncle 1–3cm long; pedicels 4–7mm. Flowers sweet-scented, white, sometimes with a pink tube, pink in bud. Calyx glabrous, teeth small and triangular or almost absent, less than 0.5mm long. Corolla tube 9–13mm long at anthesis; lobes 5, 7–9 × 5–7mm. Fruit globose, dark purplish-black, 8–9mm long, often in pairs.

**Bhutan:** S – Samchi (117), Phuntsholing (117), Chukka and Gaylegphung districts, C – Punakha, Tongsa and Tashigang (117) districts; **Darjeeling:** Darjeeling, Senchal, Tanglu, Lopchu, Rississum, Lebong; **Sikkim:** Sosing, Yoksam, Penlang La. Climber on shrubs and trees in moist mixed and broad-leaved forests, 1000–2700m. April–May.

This native Himalayan Jasmine has on several occasions been introduced into cultivation in Great Britain and North America.

**9. *J. lanceolarium*** Roxb.; *J. paniculatum* Roxb., *J. pachyphyllum* Hemsley.

Robust, large, climbing shrub. Leaves opposite, trifoliate. Leaflets elliptic to elliptic-lanceolate, apex acuminate, base cuneate to obtuse, glabrous and coriaceous; terminal leaflet 70–155 × 30–55mm, lateral leaflets 48–120 × 30–48mm; petiole 20–35mm, curved, petiolule of terminal leaflet 20–38mm, the laterals 9–25mm. Inflorescence a large, many-flowered terminal cyme; peduncles and inflorescence branches 10–40mm long and rather thick; pedicels short, 1–4mm. Flowers very fragrant, white. Calyx sparsely, minutely hirsute to glabrous, teeth very broadly triangular, minute, less than 0.5mm long. Corolla tube 15–30mm at anthesis; lobes 5, 8–13 × 4–5.5mm. Fruit not seen, ovoid-globose, 10–15mm long (80).

**Bhutan:** C – Punakha district (between Rinchu and Mishichen), Shamgong district (Shamgong) and Mongar district (between Shersing Thang and Namning). Climbing on trees and shrubs in wet broad-leaved and mixed forests, 1300–2100m. May–June.

**10. *J. caudatum*** Lindley. Nep: *Kagaji Phul*.

Large twining or sprawling climber to 3m tall. Leaves opposite, (1–)3-foliate, veins pinnate, indistinct. Leaflets ovate-lanceolate, apex acuminate to acute, base obtuse to cuneate, glabrous but not coriaceous; terminal leaflet large, 45–95 × 17–30mm; lateral leaflets smaller, 30–55 × 9–20mm; petiole 10–19mm, recurved, petiolules of lateral leaflets 1–6mm, terminal petiolule 6–18mm. Inflorescence a terminal or axillary cyme, wide-spreading with 3–many flowers; peduncle and pedicels slender, 5–18mm. Flowers large, sweet-scented, white.

Calyx glabrous, teeth minute, narrowly triangular, less than 0.5mm long. Corolla tube long and narrow, 14–30mm long at anthesis, lobes 5–7, 10–13 × 3–5mm. Fruit large, ovoid, ripening black, c 16mm long, often paired.

**Bhutan:** S – Samchi (117), Sarbhang, Gaylegphug (117) and Deothang districts; **Darjeeling:** Birik, Sivok, Lal, Pankhashari. Climbing on shrubs and trees in subtropical terai forest, 400–1200m. June–November.

**11. *J. grandiflorum* L.; *J. officinale* L. var. *grandiflorum* (L.) Stokes, *J. officinale* L. forma *grandiflorum* (L.) Kobuski.**

Robust, almost self-supporting, scrambling shrub to 3m tall. Leaves opposite, pinnate with (5–)7–13 subsessile leaflets; petiole 7–15(–25)mm long. Leaflets very variable, apex acute, base obtuse to cuneate; terminal leaflet 15–40 × 5–12mm, lateral leaflets 14–25 × 4–11mm, hirsute to glabrous. Inflorescence a widely branching, 3–many-flowered cyme, flowers rarely solitary; peduncle 15–40mm long; pedicels 6–20mm, those of later flowers in a cyme longer than earlier ones. Calyx glabrous (in Bhutanese material), teeth 5, setaceous, 4–7mm long. Flowers sweet-scented, white, sometimes flushed purple-red, especially in bud. Corolla tube 14–22mm long at anthesis; lobes 5, 8–18 × 5–9mm. Fruit globose, glossy-black, 5–9mm long, paired.

**Bhutan:** C – Punakha district (Kyebaka-Samtengang, Samtengang-Wangdu Phodrang, Punakha, Lobeysa, Toiberong Chu) and Tashigang district (Tashigong Dzong, Cha Zam). Dry, rocky areas in hot valleys, roadsides, 1050–1450m. June–October.

Widely grown as a cultivated plant throughout warm temperate and subtropical regions of the world. Used as a source of ‘Oil of Jasmine’ for perfume.

**12. *J. officinale* L.**

Similar to *J. grandiflorum* but inflorescence sub-umbellate with all pedicels of about equal length. Leaves pinnate with 3–5 subsessile leaflets, shape and pubescence very variable. Inflorescence (1–)3–many-flowered, peduncle 1–11mm long, pedicels 5–15mm. Calyx glabrous to hirsute, teeth 5–7mm long. Corolla tube 13–17mm long at anthesis; lobes 5, 9–12 × 5–8mm. Fruit not seen.

**Bhutan:** C – Ha district (Saka-La to Ha) and Thimphu district (Kyapcha, Motithang). Climbing on shrubs, 2100–2800m. July.

Also a widely cultivated species, and much confused with *J. grandiflorum*. Although the two species are both very variable, and many leaf and flower characters intergrade, intermediate specimens may be distinguished by the form of the inflorescence.

**13. *J. humile* L.; *J. pubigerum* D. Don, *J. revolutum* Sims, *J. wallichianum* Lindley.** Hindi: *Pili cameli*. Fig. 59e.

Large bushy shrub 1.5–5m tall. Leaves alternate, pinnate with 2–4 pairs and one terminal leaflet; petiole 4–25mm. Leaflets ovate-lanceolate to elliptic, apex acute to attenuate, base obtuse to cuneate, minutely hirsute to glabrous, margins



often revolute; terminal leaflet (10-)15-48 × (3-)6-11mm, lateral leaflets slightly smaller, (7-)11-24 × (2-)4-10mm. Inflorescence a 3-9-flowered contracted cyme, axillary, or more often terminal; peduncle 1-10mm long; pedicels 5-18mm. Flowers sweet-scented, bright golden yellow, rarely white. Calyx minutely hirsute, teeth 5, small, triangular to almost absent, 0.1-1mm long. Corolla tube 10-14mm long at anthesis; lobes 5, 5-8 × 4-6mm. Fruit ripening black, ovoid, 5-9mm long, solitary or paired.

**Bhutan:** C - Ha, Thimphu, Tongsa and Bumthang districts, N - Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** Darjeeling; **Sikkim:** Lachung, Phusum, Lhonak; **Chumbi:** no locality. Common in scrub vegetation and open forests on dry hill slopes, forest edges and field margins, 1500-3700m. May-July.

This widespread taxon exhibits a large range of morphological variation across its range and has been variously subdivided taxonomically. As all the characters intergrade it is best considered as a very variable species. It has been introduced into cultivation on several occasions, and is widely grown. One Bhutanese specimen seen has been infected by a gall.

**14. *J. subhumile*** W.W. Smith; *J. heterophyllum* Roxb., *J. diversifolium* Kobuski var. *subhumile* (W.W. Smith) Kobuski.

Large bushy shrub 1-4m tall or more; young stems, petioles and inflorescence branches covered in a dense white pubescence. Leaves alternate, 1-3-foliolate, leaflets subsessile; petioles 15-45mm long, petiolules of lateral leaflets 0-4mm, terminal petiolule 4-15mm. Leaflets ovate to ovate-lanceolate, 35-140 × 15-70mm, apex acute to acuminate, deflexed, base obtuse to broadly cuneate, or subcordate, somewhat coriaceous, glabrous above, very sparsely pilose below. Inflorescence a terminal 40-50-flowered, bracteate cyme; pedicels 3-7mm long. Flowers sweet-scented, deep golden-yellow. Calyx hirsute, teeth 5, triangular, minute to almost absent, less than 1mm long. Corolla tube 9-11mm long at anthesis; lobes 5, 5-8 × 4-5.5mm. Fruit ripening black, ovoid-spherical, 6-12mm long, borne singly.

**Darjeeling:** locality unknown (34). Open habitats in moist lower to middle hill forests, 1000-2700m. April-May.

Widely distributed through Nepal, Assam, Tibet, Burma and W. China, but no material from the Flora area has been seen. *J. humile* is a warm temperate species, whereas *J. subhumile* is subtropical, growing at lower altitudes.

**15. *J. aff. sempervirens*** Kerr

Twining shrub, with terete stems becoming thick and corky with age. Leaves opposite, simple, elliptic, 10-14 × 5.5-7.5cm, apex abruptly acuminate, base cuneate to widely so, margin entire, glabrous except midrib above and veins below. Inflorescence a terminal cyme. Calyx glabrous with minute teeth, tube c 2mm long. Fruit paired or solitary, c 24 × 12mm.

**Bhutan:** S - Sarbhang district (Lam Pati). Subtropical terai forest, 410m.

Only a single fruiting collection of this distinctive *Jasminum* species has been

seen. It appears to have affinities with tropical Indo-Chinese species (especially *J. sempervirens* Kerr), but without flowering material accurate determination or full description is impossible.

## 2. FORSYTHIA Vahl

Sparingly branched shrubs with long, ascending, flexuose branches; stem 4-angled, flowering before full leaf expansion. Leaves opposite, simple or trifoliate, usually serrate. Flowers in opposite axillary clusters of 1–2(–3) yellow flowers, pedicels subtended by numerous membranous bracts. Sepals 4, fused at base. Corolla tube short with 4 spreading lobes. Stamens long, attached to base of corolla tube. Stigma with 2 globose lobes. Fruit a loculicidal capsule.

### 1. *F. aff. intermedia* Zabel

Shrub to 1.5m. Leaves apparently simple, narrowly elliptic, serrate. Pedicels 2–4mm, often hidden by bracts. Calyx lobes ovate-triangular, 4–5mm long. Corolla tube 4–8mm; lobes 6–14mm long. Filaments c 4mm long. Style c 1mm. Fruit not seen.

**Bhutan:** C – Thimphu district (Thimphu). Cultivated, 2380m. April.

Only one Bhutanese specimen has been seen. This is in full flower, hence the leaves are not fully expanded, and the material is insufficient for accurate determination. Furthermore, wild Chinese specimens appear to have been dubiously identified as the Japanese *F. suspensa* (Thunberg) Vahl. This species often has trifoliate, coarsely serrate leaves, very different from the Chinese plants with simple, less serrate leaves.

## 3. FRAXINUS L.

Trees with opposite, unequally pinnate leaves. Inflorescence a large panicle, racemose or subfascicled, terminal or on shortened axillary branches, bracts and bracteoles caducous. Flowers small, polygamous or dioecious, buds blackened. Calyx small, 4-toothed or absent. Petals absent or 2–4, free or connate in pairs. Stamens attached at base of petals; filaments short or long. Stigma 2-lobed. Fruit a winged samara, 1-seeded.

- 1. Leaflets with slender petiolules; rachis glabrous ..... **1. *F. floribunda***
- + Leaflets subsessile; rachis densely red-brown pubescent at base of petiolules  
**2. *F. paxiana* var. *sikkimensis***

### **1. *F. floribunda*** Wall. Fig. 59f&g.

Large tree to 20m tall. Leaves with 3–4 pairs of leaflets; leaflets ovate to elliptic-lanceolate, 7–15 × 2.5–6cm, apex narrowly acuminate, base obtuse to cuneate, margin serrate, glabrous, veins pilose below; petiole 3–11cm, petiolules

6–15mm, glabrous or nearly so, as is the rachis. Pedicels glabrous. Flowers pink or white in pendulous panicles. Calyx teeth triangular. Corolla lobes 2.5–3.5 × 0.8–1.2mm. Samara spathulate, 20–27 × 3.5–6mm.

**Bhutan:** S – Phuntsholing district (below Kamji), C – Punakha district (Tang Chu, Rinchu–Mishichen) and Tongsa district (Chendebi); **Darjeeling:** Mongpu. Warm, dry, broad-leaved forests, 900–2800m. April.

Timber hard, valuable (48).

**2. F. paxiana** Lingelsheim var. **sikkimensis** Lingelsheim; *F. suaveolens* W.W. Smith. Nep: *Lankuri* (34), Lep: *Paizhu* (34).

Large tree similar to *F. floribunda*, differing in the following characters. Buds often red-brown tomentose. Leaves with (1–)3 pairs of leaflets; leaflets broadly lanceolate, 8–21 × 2.5–6.5cm, apex long-acute to acuminate, base broadly cuneate to rounded, margin crenate-denticulate; petiole to 10cm long, almost glabrous to red-brown hairy; petiolule of terminal leaflet 5–15mm, lateral petiolules 1–2mm (leaflets subsessile) and densely red-brown hairy, rachis otherwise sparsely hairy. Flowers cream, sometimes flushed green. Samara linear-spathulate, tip emarginate, 20–35 × 3–4mm.

**Bhutan:** C – Thimphu district (Hinglai La, Barshong) and Bumthang district (Shabjetang); **Darjeeling:** Labha (34), Melli (34); **Sikkim:** Lachen. In open temperate mixed forests, 2750–3500m. May–June.

#### 4. OSMANTHUS Loureiro

Evergreen shrubs or small trees, branches glabrous, ribbed and lenticellate, bark present on older stems. Leaves opposite, simple, rather coriaceous, usually glabrous, shiny dark green above, paler below. Inflorescences of axillary or terminal fascicles or very short racemes, basal bracts fused, sometimes deciduous. Flowers usually fragrant. Calyx 4-toothed or -lobed. Corolla lobes 4, obtuse. Stamens subsessile on the corolla tube. Style short or cylindrical, 2-lobed or nearly entire. Fruit a drupe, ellipsoid to ovoid, borne singly.

The two Bhutanese representatives of this genus have both been widely introduced into cultivation.

1. Leaf margin entire (rarely serrate); corolla tube less than 2mm long

1. **O. fragrans**

+ Leaf margin serrate to crenulate; corolla tube more than 4mm long

2. **O. suavis**

**1. O. fragrans** (Murray) Loureiro

Shrub or small tree 2–12m tall or more. Leaves elliptic-lanceolate to lanceolate, 50–140 × 17–55mm, apex abruptly acuminate to acuminate-acute, base attenuate to obtuse, margins entire (occasionally serrate), glabrous. Inflorescence of 1–9-flowered axillary fascicles, usually 2 per axil. Flowers very sweet scented,

white to pale yellow (to orange in cultivated specimens). Calyx small, tube less than 1mm long; teeth minute, irregular. Corolla tube short, 0.8–1.5mm; lobes 1.5–3mm long. Stigma bilobed. Fruit dark purple, 15–22mm long.

**Darjeeling:** Suriel, Rishap, Darjeeling, Tanglu, Ghumpahar. Moist shady ravines in forests, Upper Hill Forest, 900–3050m. September–October.

Himalayan material tends to have large leaves, and has been distinguished as *O. fragrans* var. *longifolius* (DC.) Hara. However, the variation in leaf size is continuous across the range of the species. In China the flowers are used to flavour tea.

**2. *O. suavis* Clarke.** Dz: *Chhatshe Kam*; Nep: *Silingi* (34). Fig. 59i–k.

Shrub or small tree 2–10m tall. Leaves lanceolate to lanceolate-ovate, 30–70 × 11–32mm, apex acute to acuminate, base attenuate to cuneate, margins shallowly crenate to serrate, sometimes sharply so, glabrous except for a line of hairs down the midrib. Inflorescence a 3–5(–9)-flowered axillary or terminal fascicle, usually 1 per axil. Flowers very fragrant to slightly so, white to cream. Calyx tube 3–4mm long; teeth 1–2mm, pale green, often tinged purple. Corolla tube long, 4–9mm; lobes 2.5–3.5 × 1.5–2mm. Stigma subentire. Fruit blue-black, 5–12mm long.

**Bhutan:** C – Ha to Mongar districts, N – Upper Mo Chu district (69); **Darjeeling:** Tanglu, Phalut, Ramman, Kalipokhri; **Sikkim:** Gangtok to Phusum, Chiya Bhanjang. In a variety of sub-alpine habitats, *Rhododendron* forests, dry forests, open hillsides, 2400–3700m. April–June.

Wood very hard.

## 5. CHIONANTHUS L.

Shrubs or small trees, glabrous or nearly so throughout; bark pale grey. Leaves simple, opposite, entire. Inflorescence a dense axillary, compound panicle, bracts minute. Calyx small, 4-lobed. Petals 4, small, only fused at base. Filaments short. Style short; stigma entire to obscurely 2-lobed. Fruit an ellipsoid drupe.

Differs from *Olea* in not having a distinct tubular corolla.

**1. *C. ramiflorus* Roxb;** *Linociera macrophylla* DC. Nep: *Barkunle* (Cowan specimen). Fig. 59h.

Leaves large, oblong-elliptic to obovate, 14–32 × 6–12cm, apex acute to shortly acuminate, base attenuate to cuneate, coriaceous; petiole long, 15–35mm. Flowers pink. Calyx lobes 0.5–1mm. Petals c 2mm long. Fruit (not seen) elongate-ellipsoid, c 15mm long, on greatly thickened pedicels (80).

**Darjeeling:** Jalpaiguri Duars, Mal Forest, Sivok, Lish Block. Subtropical evergreen and terai forests, 300–600m. February–March.

A specimen (*Griffith* 954) of *C. cf. terniflora* Griff. is labelled 'Bhutan' but is more likely to have been collected in Assam or Burma.

## 6. OLEA L.

Medium sized to large trees; branches usually glabrous, bark lenticellate. Leaves opposite, simple, coriaceous, elliptic to lanceolate, glabrous but covered in minute scales; margins entire or toothed. Inflorescence a terminal or axillary many-flowered panicle. Flowers small, bisexual or polygamous. Calyx small, irregularly 4-toothed or -lobed. Corolla tube very short, lobes 4, valvate or absent. Stamens subsessile on the corolla tube. Style short, stigma entire or shortly 2-lobed. Fruit a drupe, ellipsoid to globose.

1. Leaves ovate-lanceolate to elliptic-lanceolate; petiole more than 1cm long; stigma entire ..... 1. **O. dioica**  
 + Leaves lanceolate to narrowly elliptic; petiole less than 1cm long; stigma shortly 2-lobed ..... 2. **O. gamblei**

1. **O. dioica** Roxb. Nep: *Kalo Kymuna*, Lepcha: *Timburnyok* (34). Fig. 60a–c.

A medium-sized monoecious tree. Leaves ovate-lanceolate to elliptic-lanceolate, 50–170 × 30–70mm, apex acute to abruptly acuminate, base obtuse to cuneate, margin toothed or serrate; petiole 10–15mm. Male inflorescences larger and more dense than those with bisexual flowers. Corolla present only in male flowers, ?cream. Stigma entire. Fruit 10–13mm long, globose-ellipsoid.

**Darjeeling:** Jalpaiguri Duars, Dalka Jhar, Kumai Duars; **Sikkim** (135). Wet mixed plains forest, terai and lower hill forests, altitude not recorded. November–March.

The fruit is eaten and pickled, the wood is used for agricultural implements and the bark is used to reduce fevers.

2. **O. gamblei** Clarke

A tree similar to *O. dioica* but leaves lanceolate to lanceolate-elliptic, 75–120 × 14–42mm, apex long acuminate to acute, base obtuse to cuneate, margin entire; petiole 4–8mm; corolla absent in all flowers; stigma shortly bifid; fruit 20mm long, ellipsoid.

**Darjeeling:** Nimbong, Pankhabari, Sureil to Labdah, Tista; **Sikkim:** not confirmed and probably based on Darjeeling specimens (280). Lower hill forest, 300–1500m. August

Fruit edible, sweet (34). This species is considered threatened and has been given the conservation status 'Rare' (280).

## 7. LIGUSTRUM L.

Shrubs to medium-sized trees; branches lenticellate. Leaves opposite, simple, somewhat coriaceous. Inflorescence a large, many-flowered terminal panicle;

pedicels short with flowers often in subsessile clusters on the inflorescence branches. Flowers small, white or cream, sweet-scented. Calyx c 1mm long, tube truncate or minutely 4-toothed. Stamens attached to corolla tube, anthers shortly exerted with long filaments. Style short, stigma entire or slightly 2-lobed. Fruit a 1–3-seeded drupe.

1. Inflorescence branches densely pubescent; leaves elliptic to ovate, usually less than 7cm long ..... **1. *L. confusum***
- + Inflorescence branches glabrous; leaves ovate to lanceolate, usually more than 7cm long ..... **2. *L. compactum***

**1. *L. confusum*** Decaisne; *L. indicum* auct. p.p. non (Loureiro) Merrill, *L. nepalense* auct. p.p. non Wall. Dz: *Jangtse Shing*; Nep: *Goomgacha*. Fig. 60e&f.

Shrub or small tree, 3–10m tall; branches rather densely lenticellate, younger parts and inflorescence branches densely white pubescent. Leaves variable in shape and form, elliptic to elliptic-lanceolate to ovate, (10–)20–65(–80) × (7–)11–25(–35)mm, apex acuminate to acute, bases obtuse to cuneate, glabrous and shiny above, glabrous to hirsute below, particularly around the midrib. Panicle branches ascending; pedicels 0.5–1mm in flower. Bracts and bracteoles present, the lower ones often large and leaf-like, decreasing up the panicle to small and linear, caducous, often lost before flowers open. Corolla tube 3–5mm long; lobes spreading, 2–3mm long. Fruit blue-purple, ovoid, 4–5mm long.

**Bhutan:** C – Thimphu to Tashigang districts, N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Darjeeling, Rithu, Tanglu, Manibhanjan; **Sikkim:** Dentam, Gyreegong, Singhik. Oak and *Rhododendron* forest, mixed wet forests, and open scrub vegetation, 1200–3050m. April–July.

Leaves used as a diuretic. This species has been confused with two others not known from our area: *L. indicum* (Loureiro) Merrill which is a synonym of *L. sinense* Loureiro, restricted to China and Indo-china and *L. nepalense* Wall. from NW Himalaya and Nepal. The former differs in having the corolla tube shorter than the lobes and the latter differs in its inflorescence branches spreading at right angles and almost sessile flowers.

**2. *L. compactum*** (G. Don) Brandis. Dz: *Huyina Shing* and *Him Si* (Bedi specimen).

Shrub or small tree similar to *L. indicum*; branches often rather less lenticellate. Leaves ovate-lanceolate to lanceolate, 70–110(–130) × 18–28(–45)mm, apex

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FIG. 60. **Oleaceae, Loganiaceae, Strychnaceae and Gentianaceae.** **Oleaceae.** a–c, *Olea dioica*: a, flowering shoot (× 2/3); b, flower with 1 petal removed (× 6); c, fruit (× 2). d, *Myxopyrum smilacifolium*: flowering shoot (× 1/3). e–f, *Ligustrum confusum*: e, flowering shoot (× 1/4); f, flower with one petal removed (× 4). **Loganiaceae.** g–i, *Mitreola petiolata*: g, flowering plant (× 1/2); h, dissected flower (× 10); i, fruit (× 6). **Strychnaceae.** j–k, *Gardneria angustifolia*: j, flowering shoot (× 1/2); k, dissected flower (× 2). **Gentianaceae.** l–n, *Fagraea obovata*: l, flowering shoot (× 1/2); m, half flower (× 2/3); n, fruit (× 1/3). Drawn by M. Bates.



acute, base obtuse to cuneate, veins pale when viewed from above. Inflorescence branches glabrous. Fruit globose to ellipsoid, often curved, 5–8mm long

**Bhutan:** C – Thimphu district (Paga, Paro, Pyemitangka, Thimphu and Tsalimaphé) and Bumthang district (Khak Thang). Open areas in mixed pine and broad-leaved woodland, 2200–2800m. June–July.

The often cultivated Chinese native *L. lucidum* Aiton has been recorded from the area but no material seen has proved to be this species. The taxon is doubtfully distinct from *L. compactum*, apparently only differing in its ovate-lanceolate leaf shape and the presence of inflorescence bracts. These characters are not reliable.

## 8. MYXOPYRUM L.

Evergreen climbing shrubs or lianas, with 4-angled stems becoming terete with age. Leaves opposite, large, simple. Inflorescence a many-flowered terminal or axillary panicle. Flowers small, yellow. Sepals 4, fused at base into a short tube. Corolla tube short, 4-lobed. Stamens subsessile on corolla tube. Stigma subsessile, 2-lobed. Fruit a berry.

### 1. *M. smilacifolium* Blume. Fig. 60d.

Leaves elliptic-oblong to ovate, 10–26 × 4.5–9cm, apex shortly acuminate, base cuneate-rounded, margin entire or serrate, almost glabrous, subcoriaceous, prominently 3-nerved; petiole 5–15mm, thickened. Inflorescence large, to 22cm long; pedicels subsessile. Sepal lobes ovate-acute, less than 1mm long. Corolla tube 1–1.5mm; lobes 0.5–2.5mm, recurved. Fruit globose, 5–10mm long.

**Darjeeling:** terai (80); all specimens unlocalised. Evergreen terai forest, 700–1000m. Flowering time unknown.

## Family 159. LOGANIACEAE

by D.G. Long

Annual or perennial herbs. Leaves opposite, simple, entire, pinnately veined, stipulate; stipules minute, free or united. Flowers actinomorphic, bisexual, borne on 1 side of branches of terminal and axillary dichasial cymes, 5-merous. Calyx deeply lobed. Corolla urn-shaped, tubular in lower half, lobes erect. Stamens included, borne on corolla tube opposite calyx lobes. Ovary semi-inferior, 2-celled; ovules many. Fruit a 2-lobed capsule.

Loganiaceae is defined here in a narrow sense, with the following genera, traditionally placed in it, transferred to other families: *Buddleja* to Buddlejaceae, *Gardneria* to Strychnaceae and *Fagraea* to Gentianaceae.



## 1. MITREOLA L.

Description as for Loganiaceae.

1. Perennial herb; stems creeping at base; cymes with short spreading branches; flowers c 3mm long ..... **1. M. pedicellata**  
 + Annual herb; stems erect; cymes with long ascending branches; flowers c 1.5mm long ..... **2. M. petiolata**

**1. M. pedicellata** Bentham; *Cynoctonum pedicellatum* (Bentham) Robinson, *Paraophiorrhiza khasiana* Clarke

Perennial decumbent herb; stems creeping at base, puberulous, weakly 4-ribbed; leafy shoots ascending, 10–30cm, pubescent. Leaves in subequal pairs, ovate to elliptic, 1–4(–7) × 0.8–2.5(–4)cm, subacute to acuminate, base rounded or attenuate, pubescent on both surfaces; petiole 4–10mm; stipules free, subulate, 1–1.5mm. Cymes terminal and axillary, 2–5cm long and broad, with short spreading branches, pubescent. Flowers white. Calyx 1.2–1.5mm; lobes triangular, 0.8–1mm. Corolla c 3mm, pilose within tube; lobes ovate, 1.5–1.8mm. Capsule compressed, 2–3mm, pubescent, rugose, with 2 divergent not incurved lobes.

**Bhutan:** S – Deothang district (Chunkar); **Darjeeling:** Tista River near Tumlong. On shady cliffs and wet rocks, 1220m. February–May.

**2. M. petiolata** (Gmelin) Torrey & Gray; *Cynoctonum oldenlandioides* (DC.) Robinson. Fig. 60g–i.

Similar to *M. pedicellata* but a more erect, annual herb 10–50cm; stems glabrous; leaves subglabrous but pubescent along margins; stipules united into an interpetiolar sheath c 1mm high; cymes 7–20cm long, glabrous, with long, often curved ascending branches; calyx c 1.5mm; corolla c 1.4mm; capsule with 2 often incurved horns.

**Darjeeling:** Sukna. Terai forests. September–November.

## Family 159a. STRYCHNACEAE

by D.G. Long

Large climbing shrubs. Leaves opposite, simple, entire, pinnately veined, stipulate, stipules reduced to an interpetiolar rim. Flowers solitary, axillary, 4-merous, actinomorphic, bisexual. Calyx small, deeply lobed. Corolla rotate-campanulate, with very short tube and thick lobes. Stamens large, borne on corolla tube opposite calyx lobes, shortly exerted. Ovary superior, 2-celled; ovule 1 per cell, placentation axile. Fruit a 1-seeded berry.

## 1. GARDNERIA Wall.

Description as for Strychnaceae.

1. **G. angustifolia** Wall.; *Pseudogardneria angustifolia* (Wall.) Raciborski. Fig. 60j&k.

Extensive climber; glabrous throughout. Leaves lanceolate, 4–9 × 1–3cm, acuminate, base cuneate; petiole 6–10mm. Pedicels slender, 1–2cm, deflexed. Calyx 1.2–1.4mm, lobes rounded, ciliate. Corolla white or cream, sometimes pinkish, becoming black when dry, 7–9mm, lobed almost to base, lobes thick, ovate, recurved, villous within. Ovary glabrous, with slender style 2–4mm. Berry yellow when young, becoming scarlet then black when ripe, compressed-globose, c 10 × 8mm, with 1 compressed round seed.

**Bhutan:** C – Tongsa district (Rukubi to Neylong) and Mongar district (Reb La); **Darjeeling:** Mahaldiram, Jalapahar, Pankhashari ridge. In forests, 1830–3100m. June–July.

## Family 160. GENTIANACEAE

by E. Aitken

Annual or perennial herbs (trees or shrubs in *Fagraea*), erect, twining or sometimes saprophytic, usually glabrous. Leaves opposite, rarely alternate, simple, entire, palmately veined from base or pinnately veined, exstipulate. Flowers solitary or in panicles, cymes or umbels, bisexual (unisexual in *Veratrilla*), actinomorphic. Calyx and corolla tubular, 4–5-lobed, sometimes divided almost to base. Stamens 4–5, borne within corolla tube, alternating with corolla lobes; anthers dehiscing by slits, rarely pores. Ovary superior, 1–2-celled, bearing nectaries at base; ovules many, parietal; style linear or absent, stigma capitate or bilobed. Fruit a capsule or berry.

- |   |                        |
|---|------------------------|
| 1. Small epiphytic trees or shrubs .....  | 1. <b>Fagraea</b>      |
| + Erect, decumbent or climbing herbs .....  | 2                      |
| 2. Plants annual; leaves scale-like .....   | 3                      |
| + Plants annual or perennial; leaves not scale-like .....   | 4                      |
| 3. Flowers in loose cymes; corolla tubular, constricted at base of lobes; plant not saprophytic ..... | 3. <b>Sebaea</b>       |
| + Flowers solitary; corolla tube very short; plant saprophytic  |                        |
|   | 4. <b>Cotylanthera</b> |
| 4. Plants twining .....   | 5                      |
| + Plants erect, ascending or decumbent .....  | 6                      |

5. Flowers blue, purple or violet; filaments straight, winged; prominent glands present at base of stipe of ovary ..... **6. Crawfordia**  
+ Flowers white or greenish-white, filaments curved at apex, not winged; base of stipe of ovary enclosed by a collar-like disc ..... **7. Tripterispermum**
6. Corolla with plicae ..... **15. Gentiana**  
+ Corolla without plicae ..... 7
7. Corolla with long spurs ..... **8. Halenia**  
+ Corolla without spurs ..... 8
8. Throat of corolla tube fimbriate with thick white hairs .... **11. Gentianella**  
+ Throat of corolla tube glabrous, (sometimes bearing fimbriate glands on base of lobes in *Swertia*) ..... 9
9. Corolla lobes longer than tube ..... 10  
+ Corolla lobes shorter than or  $\pm$  equal to tube ..... 15
10. Corolla lobes 2cm or more long, yellow, green or red ..... 11  
+ Corolla lobes less than 2cm, mostly white, blue or purple, sometimes greenish or reddish in *Swertia* ..... 12
11. Corolla tube campanulate, 15–30mm, lobes without glands **9. Megacodon**  
+ Corolla tube 0.5–3mm, lobes with large glands ..... **14. Swertia**
12. Calyx winged ..... **2. Exacum**  
+ Calyx unwinged ..... 13
13. Glands large, paired and  $\pm$  united, cushion-shaped, glabrous; flowers functionally unisexual ..... **13. Veratrilla**  
+ Glands single or paired, disc-shaped or pouched, glabrous or with flaps or fimbriae (sometimes not obvious); flowers bisexual ..... 14
14. Ovary orange-yellow, oblong-ellipsoid; style absent; stigmas decurrent on ovary as two narrow bands; glands on corolla sometimes not prominent  
**12. Lomatogonium**  
+ Ovary not orange-yellow, shape various; stigmas capitate or sessile, not decurrent on ovary; glands on corolla always prominent ..... **14. Swertia**
15. Filaments attached  $\pm$  halfway up corolla tube ..... **11. Gentianella**  
+ Filaments attached at or near apex of corolla tube ..... 16
16. Calyx tubular; corolla tube narrowing abruptly at apex ..... **5. Canscora**  
+ Calyx deeply divided; corolla tube not narrowing abruptly **10. Jaeschkea**

## 1. FAGRAEA Thunberg

Trees or shrubs, often epiphytic and *Ficus*-like. Leaves coriaceous; petioles expanded at base; stipules reduced to an interpetiolar rim. Flowers few, in terminal cymes, 5-merous, large. Calyx deeply divided into thick imbricate lobes. Corolla funnel-shaped with long narrow tube and spreading lobes. Stamens exserted. Ovary superior; ovules numerous. Fruit a many-seeded berry.

1. *F. obovata* Wall. Fig. 601-n

Epiphytic shrub, often becoming tree-like, to 10m, glabrous throughout. Leaves coriaceous, obovate or obovate-elliptic, 9–19 × 5–8cm, abruptly bluntly apiculate, base attenuate; petiole stout, 1.5–3cm, expanded at base. Cymes erect, 6–12cm, 2–6-flowered. Pedicels stout, 5–18mm. Calyx tube 10–15mm; lobes broadly rounded, 10–12mm. Corolla creamy or pinkish, tube 3.5–4.5cm; limb to 7cm diameter; lobes elliptic, obtuse. Style slender, 4–5cm. Fruit broadly ovoid, c 3.5 × 3cm.

**Darjeeling:** Darjeeling, Dumsong and Jalpaiguri. Subtropical and terai forests, 200–600m. May–June.

## 2. EXACUM L.

Erect annuals. Stems terete or 4-angled. Flowers in leafy panicles composed of terminal and axillary cymes, 4-merous. Calyx deeply lobed almost to base, winged, lobes overlapping. Corolla rotate, tube shorter than lobes, constricted at apex; lobes blue or violet. Filaments attached at apex of corolla tube; anthers basifixed, dehiscing by apical pores. Ovary subglobose; style filiform; stigma subcapitate. Fruit an ovoid capsule, 2-valved.

1. Stems 4-angled, winged; calyx lobes with 3 wings; anthers straight, 4–6mm

1. *E. hamiltonii*

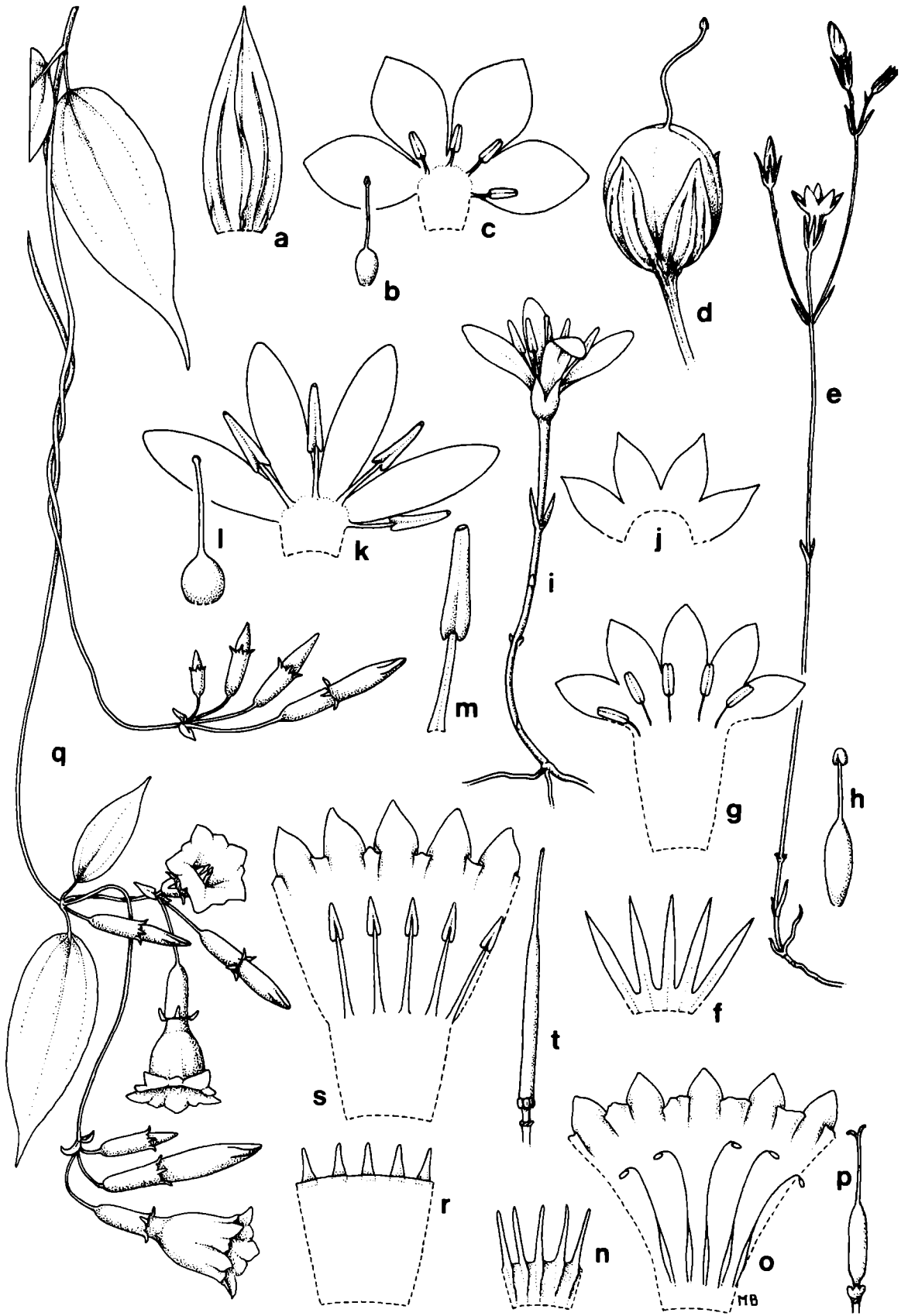
+ Stems terete; calyx lobes with one wing; anthers curved, 8–10mm

2. *E. teres*

1. *E. hamiltonii* G. Don; *E. tetragonum* sensu F.B.I. p.p. non Roxb. Dz: *Geethri-Metok*. Fig. 61a–d.

Little-branched herb 13–48cm. Stems 4-angled. Leaves membranous, lanceolate-elliptic, 1.5–6 × 0.5–1.5cm, acute or subacute, sessile and half sheathing

FIG. 61. **Gentianaceae.** a–d, *Exacum hamiltonii*: a, exterior of calyx lobe (× 3); b, ovary and style (× 1); c, corolla (× 1); d, fruit (× 2). e–h, *Sebaea microphylla*: e, habit (× 1); f, calyx (× 3); g, corolla (× 3); h, ovary and style (× 3). i–m, *Cotylanthera paucisquama*: i, habit (× 1); j, calyx (× 2); k, corolla (× 2); l, ovary and style (× 2); m, anther showing apical pore (× 4). n–p, *Tripterospermum volubile* subsp. *volubile*: n, calyx exterior (× 1); o, corolla (× 1); p, ovary and style (× 1). q–t, *Crawfordia speciosa*: q, flowering shoot (× ½); r, calyx interior (× 1); s, corolla (× 1); t, ovary and style (× 1). Drawn by M. Bates.



stem at base. Pedicels 8–20mm. Calyx tube 2–4mm; lobes ovate-lanceolate, 5–8 × 3–4mm, acuminate, 3-winged. Corolla tube 4–7mm; lobes deep blue-violet, broadly elliptic, 5–16 × 4–10mm, spreading. Anthers 5–6mm, straight. Ovary 4 × 3mm; style 7–10mm. Capsule 5–8 × 4–6mm.

**Bhutan:** C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Dalka Jhar (terai), Tista and Siliguri; **Sikkim:** Rangit Valley. Open grassy hillsides and amongst Chir pine, 1220–1830m. July–November.

Records of *E. tetragonum* Roxb. from Bhutan (117) probably refer to this species.

## 2. *E. teres* Wall.

Little-branched herb 49–70cm. Stems terete near base, only slightly ridged above. Leaves membranous, lanceolate, 1.5–17 × 0.3–2.5cm, acute, narrowed but not sheathing at base. Pedicels 3–13mm. Calyx tube 0–1mm; lobes unequal, elliptic to ovate, 6–7 × 3–4mm, acuminate, 1-winged. Corolla tube 3–5mm; lobes blue, elliptic, 8–13 × 3–6mm, spreading and folding back over calyx in young fruit. Filaments 2mm; anthers 8–10mm, curved. Ovary 3 × 2mm; style 10–13mm. Capsule 8–10 × 6–8mm.

**Bhutan:** S – Samchi district (Chamarchi), Phuntsholing district (Phuntsholing) and Deothang district (Deothang); **Darjeeling:** Rangit, Tista valley, Jalpaiguri etc.; **Sikkim:** S. of Gangtok; **Assam-Bhutan border:** Mangaldai. Open slopes and on shingle by rivers, 240–1220m. September–February.

The Griffith specimen reported from Bhutan (80) is in fact from Assam.

## 3. SEBAEA R. Brown

Annual, biennial or perennial, erect to procumbent, simple or branched herbs. Stems slender, 4-angled. Leaves reduced and scale-like or well developed. Flowers 4–5-merous, solitary, terminal or in loose cymes or corymbs. Calyx divided almost to base. Corolla tube constricted at apex. Style slender, exerted or included; stigma ± capitate or bilobed. Fruit a capsule.

1. *S. microphylla* (Edgeworth) Knoblauch; *S. khasiana* Clarke, *Cicendia microphylla* Edgeworth, *Erythraea microphylla* (Edgeworth) Benth. Fig. 61e–h.

Slender annual 5–18cm. Stems 4-angled. Leaves scale-like, linear-lanceolate, 2–3 × 0.5mm or less, apiculate, sessile. Flowers 5-merous in loose terminal cyme. Pedicels 2.5–5mm. Calyx tube 0.5–1mm, lobes narrowly lanceolate, 4–5.5 × 0.5–1mm, subulate, apiculate, keeled. Corolla golden yellow, tube 4–6mm, lobes elliptic to ovate-lanceolate, 3–5 × 1–2mm, acuminate, contorted in bud. Filaments 1mm, attached at base of corolla lobes; anthers oblong, 1mm. Ovary ellipsoid, sessile; style 2mm; stigma capitate. Capsule ellipsoid, 4–5 × 1–2mm, sessile, included in corolla.

**Bhutan:** C – Punakha district (near Chuzomsa). In grass, 1200m. September–October.

This collection (by John Wood) represents the first record of this genus from the East Himalaya.

#### 4. COTYLANTHERA Blume

Small, delicate, white saprophytic herbs. Stems erect, simple, fleshy, quadrangular. Leaves opposite, distant, membranous, scale-like. Flowers terminal, solitary, 4-merous. Calyx lobes free to base. Corolla tube short; lobes blue, mauve or white. Anthers dehiscent by an apical pore. Ovary 2-celled; style simple; stigma capitate. Capsule globose.

1. **C. paucisquama** Clarke; *C. yunnanensis* W.W. Smith. Fig. 61i-m.

Plants up to 15cm. Leaves ovate, 1-4 × 0.5-2mm, acuminate, sessile. Flowering stems 4-9(-15)cm. Calyx lobes white, ovate, 5-6 × 3-4mm, with single mid-vein, acuminate. Corolla tube 2-3mm; lobes dark blue, mauve or white, oblanceolate, 8-12 × 2-4mm, obtuse. Filaments 4-5mm; anthers 3.5-5.5mm, sagittate, slightly curved. Style 5-10mm, thickened towards base. Fruit not seen.

**Darjeeling:** Budhwari; **Sikkim:** locality unknown. In shady broad-leaved forest, 1829-2438m. July-October.

*C. caerulea* Lace has been reported from Bhutan (135), but no specimen has been located; it is similar to *C. paucisquama* but smaller, up to 9cm; calyx lobes deltoid, 3-5 × 2-3mm, corolla pale blue, tube 1-2mm; lobes oblong, 3-6 × 1-1.5mm; filaments 1.5-2.5mm; anthers oblong, 1.2-1.8mm, truncate; style filiform, 2.5-3mm, not thickened at base.

#### 5. CANSCORA Lamarck

Erect annuals. Stems 4-ribbed or winged. Flowers in loose terminal and axillary cymes, 4-merous. Calyx tubular, ribbed or winged, shortly lobed. Corolla tube cylindrical, narrowed at apex; lobes unequal, pink or white. Stamens attached near top of corolla tube, 1 larger, fertile, above the others, 3 smaller, sometimes infertile. Ovary 1-celled; style filiform; stigma bilobed. Capsule cylindrical, 2-valved, enclosed by persistent calyx.

1. Stems and calyx ribbed, unwinged ..... 1. **C. diffusa**  
 + Stems and calyx winged ..... 2. **C. decussata**

1. **C. diffusa** (Vahl) Roemer & Schultes

Plants 11.5-28cm tall, diffusely branched. Stems slender, quadrangular. Leaves membranous, broadly ovate, 1-4.5 × 0.5-2.3cm, acute, sessile, base rounded or attenuate, lower leaves with petioles 1-5mm. Pedicels 4-10mm. Bracts broadly ovate, 3-12 × 1-8mm, rounded or subcordate at base. Calyx

tube 3–7mm, ribbed; lobes linear-lanceolate, 1–2mm. Corolla tube 4–7mm, lobes pink or white, ovate, 2–3 × 2–2.5mm, obtuse. Uppermost stamen c 2.5mm, lower 3 c 1.5mm. Style 2.5–3mm. Capsule 3–7 × 1–1.5mm.

**Bhutan:** Locality unknown (80). Shady moist banks of paddy-fields and ditches, (150–)305–760(–1220)m. May–November.

**2. *C. decussata* Roemer & Schultes; *Exacum alatum* Roth**

Similar to *C. diffusa* but stems thicker and winged; leaves ovate-lanceolate; flowers larger; calyx tube 8–10mm, winged, lobes lanceolate, 1.5–2 × 1mm; corolla tube 9–10mm, lobes obovate, 4–5 × 2–4mm.

**Darjeeling:** terai at Bamon Pokri. Habitat and altitude not recorded. September–October.

## 6. CRAWFURDIA Wall.

Twining perennials, stems terete, spirally twisted. Leaves membranous or coriaceous, glabrous or glandular, 3–5-veined from base. Flowers in axillary or terminal cymes, pendulous, 5-merous. Calyx tubular. Corolla tubular, blue, mauve, violet or pink, plicate. Stamens symmetrical, equal, straight; filaments attached near middle of corolla tube, winged, widening towards base. Nectary glands at base of ovary naked. Style linear; stigma 2-lobed. Fruit an ellipsoid capsule, sometimes protruding from corolla on elongated stipe.

- 1. Calyx tube terete; lobes linear or lanceolate ..... 3
- + Calyx tube distinctly 5-ribbed; lobes ovate ..... 2
  
- 2. Calyx lobes lanceolate, reflexed, 1–4mm long, attached below rim of calyx tube ..... **1. *C. speciosa***
- + Calyx lobes linear, not reflexed, 4–7mm long, attached on rim of calyx tube ..... **2. *C. puberula***
  
- 3. Calyx lobes broadly ovate, leaf-like, 4–7mm broad; corolla lobes ovate, 6–10mm long ..... **3. *C. campanulacea***
- + Calyx lobes ovate-spathulate, 1–2mm broad; corolla lobes lanceolate, 8–14mm long ..... **4. *C. angustata***

**1. *C. speciosa* Wall.; *C. wardii* Marquand. Fig. 61q–t.**

Leaves membranous, glabrous, elliptic to ovate, 3–11 × 0.8–6cm, acuminate, base attenuate or rounded, almost cordate, margins minutely denticulate, glandular; petioles 0.5–1.2cm, glandular. Pedicels 0.5–14.5cm. Calyx tube truncate, 10–15mm, lobes lanceolate, 1–4 × 0.5–2mm, acute, reflexed, attached below rim of tube. Corolla blue or mauve, tube campanulate, 15–40mm; lobes triangular, 4–6 × 2–6mm, acuminate. Stamens 13–17mm, attached at middle



of corolla tube. Ovary ellipsoid, 20–23mm; style 7–10mm; stigma 1.5–3mm. Fruit ellipsoid, 25–30 × 6–10mm; stipe elongating to 20–30mm.

**Bhutan:** C – Punakha, Tongsa, Bumthang and Tashigang districts; N – Upper Mo Chu district (Gasa) and Upper Kulong Chu district (Tobrang); **Darjeeling:** Sandakphu and Pankhabari; **Sikkim:** Tanglu, Zongri to Onglakthang, Phusum; Nathang, Yak La. Climbing over shrubs by paths and over bamboo in forest clearings, 2134–3810(–4572)m. September–November.

## 2. *C. puberula* Clarke. Sha: *Dorji Ru*

Similar to *C. speciosa* but leaves narrowly elliptic to lanceolate, 1.5–5.5 × 0.5–1.5cm, glandular-pubescent on upper surface; petioles 0.2–0.4cm; flowers solitary or in pairs; pedicels 0.7–2cm; calyx tube 8–12mm, lobes linear-lanceolate, 4–7 × 0.5–1mm, erect, inserted on rim of tube; corolla pale purple, tube 23–35mm, lobes broadly ovate, 2–3 × 3–4mm, obtuse; stamens 15–20mm; ovary ellipsoid, 10–25mm; stipe 7–15mm; style 5–7mm; stigma 0.5–1.5mm; fruit 16–18 × 6–8mm.

**Bhutan:** N – Upper Mo Chu district (between Gasa and Pari La); **Sikkim:** Yak La. On shrubs in mossy Juniper forest, 2743–3225m. September–October.

## 3. *C. campanulacea* Clarke; *C. bulleyana* Forrest, *C. speciosa* Clarke p.p. non Wall. Sha: *Dorji Ru*.

Leaves more coriaceous than *C. speciosa*, narrowly elliptic, 4.5–9 × 1.7–3.5cm, acuminate, base rounded or attenuate, margins minutely denticulate, glandular; petioles 0.7–1.5cm. Pedicels 1.5–10cm. Calyx tube 10–20mm, ridged, sometimes narrowed at apex, lobes ovate, 5–10 × 4–7mm, acuminate, leaf-like, reflexed. Corolla bluish mauve or violet, tube 20–50mm; lobes ovate, 6–9 × 4–5mm, acuminate. Stamens 10–30mm. Ovary ellipsoid, 10–18 × 2–3mm; stipe 2–20mm; style 2–10mm; stigma 0.5–2mm. Fruit not seen.

**Bhutan:** S – Deothang district (Naningphu), C – Tashigang district (Gamri Chu, Yonpu La). In dense jungle, creeping on shrubs, 1891–3353m. November.

## 4. *C. angustata* Clarke; *C. trailliana* Forrest, *Gentiana heleni* Marquand

Leaves slightly coriaceous, glabrous, elliptic to lanceolate, 2–5.5 × 0.6–1.7cm, acuminate, margin entire, base rounded, petioles 4–8mm. Flowers solitary or in pairs. Pedicels 1–7cm. Calyx tube 15–20mm, ribbed, narrowed at apex; lobes ovate or spatulate, 2.5–4 × 1–2mm, acute. Corolla tube 30–50mm; lobes lanceolate, 8–14 × 3–6mm, acuminate, plicae larger than *C. speciosa*. Stamens 10–15mm, Ovary narrowly ellipsoid, 14–20 × 2–3mm; style 20mm; stigma c 3mm. Fruit not seen.

**Bhutan:** C – Tongsa district (near Kasala, between Tongsa and Shemgang). Damp grassy slopes, 1524–1600m. November–February.

7. **TRIPTEROSPERMUM** Blume

Similar to *Crawfurdia* but corolla greenish-yellow or white; stamens asymmetric; filaments attached below middle of corolla tube, unequal, curved backwards near apex; nectary glands enclosed in a collar-like disc; fruit a capsule or berry.

1. Calyx winged; fruit a red berry ..... **1. T. volubile**  
 + Calyx ribbed, not winged; fruit a black berry ..... **2. T. nigrobaccatum**

**1. T. volubile** (D. Don) Hara

Stems terete, glabrous. Leaves lanceolate to ovate, 1.5–9.5 × 0.5–3cm, acuminate, base rounded or cordate, margin slightly denticulate or sinuate; petiole 2–15(–25)mm. Pedicels 1–5mm. Calyx tube winged, 4–12mm; lobes linear, 6–15(–18) × 0.5–1mm, acuminate, attached below margin of tube. Corolla greenish yellow or white, sometimes faintly marked purple, tube 15–35mm; lobes ovate, 2–5 × 3–4mm, acuminate. Filaments 8–20(–25)mm; anthers c 1mm. Ovary narrowly cylindrical, 9–15 × 1.5–3mm, stipe 2–8mm; basal part of style 1.5–10mm, bifid, branches 1–5mm, often coiled (specimens with immature flowers often have an unbranched style). Fruit an ellipsoid red berry, 17–28 × 7–13mm; stipe elongating to 8–27mm; ripe fruit partially or completely exerted from persistent corolla.

Two subspecies occur:

a. subsp. **volubile**; *T. luteoviride* (Clarke) Murata, *Crawfurdia japonica* Siebold & Zuccarini var. *luteoviridis* (Clarke) Clarke, *C. affinis* Clarke non Wall., *C. luteoviridis* Clarke, *Gentiana volubilis* D. Don, *G. luteoviridis* (Clarke) Marquand, *G. confusa* Marquand. Fig. 61n–p.

Leaves lanceolate, 1.5–9.5 × 0.6–2(–3)cm. Calyx tube 4–10mm; lobes 6–15mm. Corolla tube 15–28mm; lobes 2–5 × 3–4mm. Filaments 8–15mm. Stipe of ovary 2–5mm; style usually shortly bifid, basal part 4–10mm, branches 1–4mm. Stipe elongating to 8–14mm; ripe fruit exerted up to 50% from corolla.

**Bhutan:** C – Ha district (Saga La), Tongsa district (Chendebi), Mongar district (East side of Kori La) and Tashigang district (Bailfa); **Darjeeling:** Rimbi Chhu, Kurseong, Tanglu, Senchal, Ghum; **Sikkim:** Bakkhim, Chhokha, Lachung, Fambong Lho. On shrubs and on banks in forest, 1525–3200m. June–October (fr. November).

b. subsp. **longipes** Aitken & Long

Differs from subsp. *volubile* in having lanceolate to ovate leaves, 2–9 × 1–3cm; calyx tube 8–12mm, lobes 7–14(–18)mm; corolla yellowish or white, tube 25–35mm; filaments 15–20(–25)mm; stipe of ovary 4–8mm; style usually bifid to near middle, basal part 2–4mm, branches 3–5mm; fruit 17–25 × 7–12mm; stipe elongating to 15–27mm; ripe fruit almost completely exerted from corolla.

**Darjeeling:** Sureil, Rimbi Chhu, Pankhashari Ridge, Tanglu, Senchal. Ecology not known, 1525–2440(–2745)m. July–October (fr. November).

## 2. *T. nigrobaccatum* Hara

Similar to *T. volubile* but leaves generally smaller, 2.5–5.5(–8) × 0.6–1.5cm; calyx tube ribbed, not winged, 5–6mm, lobes 5–8 × 0.5–1mm; corolla creamy white or pale greenish white, streaked purple, tube 16–26mm, lobes 2–4 × 3–4mm; filaments 9–12mm; ovary 6–17 × 1–4mm; stipe 2–3mm; style bifid near apex, basal part 3–5mm, branches 1.5–3(–4)mm; fruit a black berry, 10–15 × 5–6mm; stipe elongating to 6–10mm; fruit enclosed by corolla or slightly exserted.

**Bhutan:** C – Thimphu district (Dochong La), N – Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Manibhanjan; **Sikkim:** Kalipokhri. On banks in forest and in scrub on open hillsides, 2440–3080m. August–September (fr. October).

## 8. *HALENIA* Borkhausen

Annual, biennial or perennial erect herbs. Stems quadrangular, branched in upper part, sometimes narrowly winged. Leaves membranous, upper mostly sessile, lower with short petiole. Flowers in axillary cymes, forming a loose terminal panicle, 4-merous. Bracts leaf-like, sessile. Calyx divided almost to base. Corolla mauve, blue or white, tube campanulate, spurred at the base of each lobe. Stamens attached at apex of corolla tube. Ovary 1-celled; style short, cylindrical; stigma bilobed, oblong, lobes reflexed. Fruit a sessile, ovoid capsule; carpels separating nearly to the base.

### 1. *H. elliptica* D. Don; *Swertia centrostemma* Wall. Med: *Chaktig*. Fig. 64a&b.

Erect annual to 90cm. Leaves elliptic or ovate, 0.7–5.5 × 0.4–1.5cm, acute, sometimes obtuse, 3–5-veined, upper leaves mainly sessile; petiole of lower leaves 0.5–1cm. Bracts ovate-elliptic, 0.5–4.8 × 0.2–1.5cm, acute or rounded. Pedicels 0.5–4cm. Calyx tube 0.5–1.5mm; lobes elliptic or ovate, 2–6 × 0.5–2mm, acute, sometimes mucronate, often unequal in width. Corolla tube 1–3mm; lobes ovate, 4–6 × 2–4.5mm, apex mucronate, spurs 2.5–8mm. Filaments 1–4mm, thickened towards base; anthers ovate, obtuse. Ovary ovoid-ellipsoid, 3–6 × 2–4mm; style short, 0.5–2.5mm. Capsule ovoid-ellipsoid, 7–9 × 3–5mm, enclosed by persistent calyx and corolla.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa, Bumthang and Tashigang districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu, and Upper Kulong Chu districts; **Sikkim:** Thanggu, Lachung, Lachen, Gocha La, Zemu Chhu. On open hillsides, on sandy peat, coarse turf, in forest clearings, below cliffs and on marshy ground at roadside, 1829–4877m. May–September.

### 9. MEGACODON (Hemsley) H. Smith

Erect perennial. Stems robust, hollow, unbranched, sometimes ridged. Leaves 5–7-veined from base; upper sessile, amplexicaul, lower petioled, margins entire. Bracts leaf-like, sessile. Flowers large, in axillary and terminal few-flowered cymes, 5-merous. Calyx tube campanulate, shorter than lobes. Corolla greenish yellow, broadly campanulate. Ovary 1-celled; style filiform, slightly longer than stamens; stigma ovate, 2-lobed. Fruit an ellipsoid capsule.

#### 1. *M. stylophorus* (Clarke) H. Smith; *Gentiana stylophora* Clarke. Fig. 62e&f.

Perennial herb to 2m tall. Leaves broadly elliptic or ovate, 10–26 × 4–13.5cm, acute; petioles on lower leaves 1–3cm. Calyx tube 0.6–1.6cm; lobes lanceolate, 1.2–2.5 × 0.6–1.5cm. Corolla tube 1.5–3cm; lobes ovate, 2.5–5 × 1.5–3cm. Filaments 1–1.5cm, attached halfway up corolla tube; anthers oblong, 1–1.2 × 0.2–0.3cm. Ovary 1–1.5 × 0.2–0.5cm; style 0.8–1.5cm; stigma 2–3 × 1.5–2mm. Fruit 4 × 1cm, splitting in half when mature.

**Bhutan:** C – Thimphu, Bumthang, Mongar, Tashigang and Sakden districts. **N** – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Pheonp, Chhurong Chhu, Tsomgo, Gopethang, Chomnagu and Cheumsangthang; **Chumbi:** Trakarpo and Yatung. Grassy hill-sides and meadows and in Fir and *Rhododendron* forest, 3048–4267m, June–August.

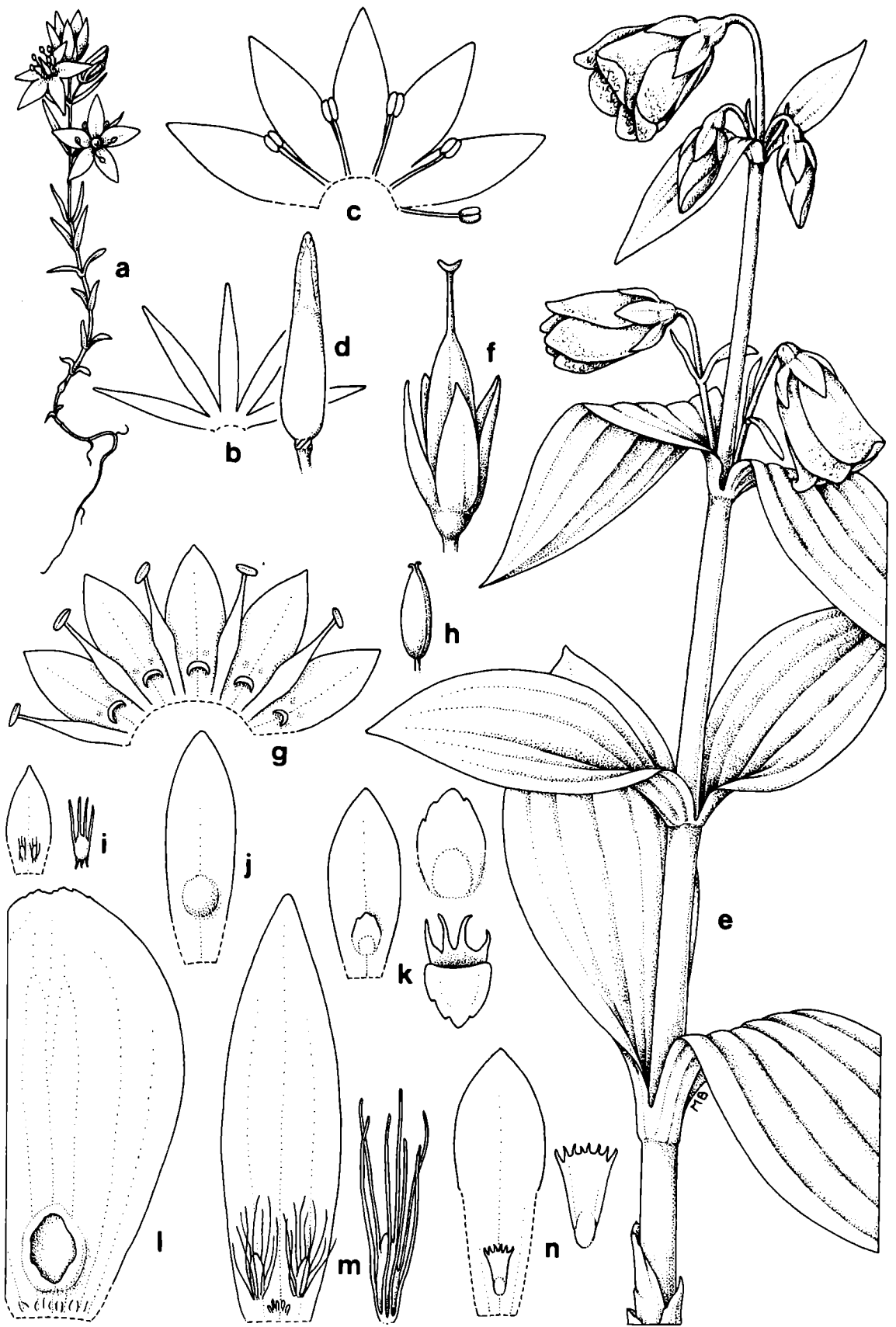
### 10. JAESCHKEA Kurz

Annual, erect or decumbent herbs. Stems branched, quadrangular, glabrous. Flowers (4?–)5-merous, in panicles, cymes or terminal, solitary. Calyx divided almost to base. Corolla pale blue, pink or violet, tubular, subcampanulate; tube longer than lobes, with paired nectaries at base. Filaments attached at apex of corolla tube. Ovary 1-celled, sessile or with short stalk; style short; stigma bilobed, papillose, revolute. Fruit a narrowly ellipsoid capsule, dehiscing into two valves.

#### 1. *J. microsperma* Clarke; ?*Parajaeschkea smithii* Burkill, *Jaeschkea smithii* (Burkill) Sunita

Decumbent annual, 1.5–8cm, diffusely branched from base. Leaves narrowly obovate to oblanceolate, 3–5(–10) × 1–3mm, apex rounded or subacute, sessile. Flowers solitary, terminal or in few-flowered cymes; peduncles 5–10(–25)mm.

FIG. 62. **Gentianaceae.** a–d, *Lomatogonium sikkimense*: a, habit (× 1); b, calyx (× 3); c, corolla (× 1); d, ovary, showing decurrent stigma (× 6). e–f, *Megacodon stylophorus*: e, flowering stem (× ¼); f, fruit (× ½). g–h, *Swertia paniculata*: g, corolla (× 3); h, ovary (× 3). i–n, *Swertia*: corolla lobes (all × 1) and details of glands (all × 6): i, *S. macrosperma*; j, *S. cordata*; k, *S. angustifolia*, with open and closed gland; l, *S. hookeri*; m, *S. cuneata*; n, *S. teres*. Drawn by M. Bates.



Calyx tube 0.5–1mm; lobes oblong or oblanceolate, unequal, 4–6 × 1–2mm, acute or rounded. Corolla blue-purple (Chinese specimens), tube 4–6mm; lobes obovate, 2–3 × 1.5–2mm, cuspidate, sometimes overlapping, margins serrulate. Filaments 0.5–2mm; anthers 0.5–1.5mm. Ovary narrowly ellipsoid, 6–7 × 1.5–2mm; style 0.5–1mm; stigma 0.5–1mm. Capsule 7–8 × 1–2mm.

**Sikkim:** Samdong, Gurudongmar; **Sikkim/Chumbi** border: Chalung La. Alpine slopes, 3350–5180m. August.

*Parajaeschkea smithii* Burkill appears to be a synonym, but no material has been available for study.

## 11. GENTIANELLA Moench

Decumbent, ascending or erect annuals, biennials or perennials. Stems lax or profusely branched. Basal leaves sometimes forming a rosette; stem leaves opposite. Flowers 4–5(–7)-merous, terminal, solitary or in loose cymes. Calyx tubular or deeply divided; lobes equal, unequal or distichous. Corolla without plicae, blue, mauve, purple, yellow or pink; tube with nectaries at base; throat naked or fimbriate. Filaments attached at, or slightly above, middle of corolla tube; anthers dorsifixed. Ovary sessile or with short stipe; style short or absent; stigma bilobed. Fruit a capsule, not protruding from corolla.

*Comastoma* (Wettstein) Toyokuni, *Aliopsis* Omer & Qaiser and *Gentianopsis* Ma which have been given generic status in some studies are treated here as synonyms of *Gentianella*. On examining a broad range of material, there seem to be insufficiently strong diagnostic features to warrant their treatment as separate genera.

- |  |                             |
|--|-----------------------------|
| 1. Corolla throat fimbriate .....  | 2                           |
| + Corolla throat naked .....   | 5                           |
| 2. Calyx lobes lanceolate, 9–12mm, acuminate .....   | <b>2. G. falcata</b>        |
| + Calyx lobes ovate or elliptic, 2–7mm, acute .....  | 3                           |
| 3. Leaves elliptic to lanceolate, occasionally ovate; calyx much less than half length of corolla .....                | <b>1. G. pedunculata</b>    |
| + Leaves elliptic, ovate or spatulate; calyx half or more length of corolla  | 4                           |
| 4. Plants dwarf or decumbent, with curved stems; leaves spatulate or obovate; corolla mostly less than 2 × calyx ..... | <b>4. G. urnigera</b>       |
| + Plants with weak, ± erect, flexuose stems; leaves elliptic to ovate; corolla mostly more than 2 × calyx .....        | <b>3. G. stellariifolia</b> |
| 5. Calyx lobes equal .....   | <b>7. G. pygmaea</b>        |
| + Calyx lobes unequal .....  | 6                           |
| 6. Flowers 4-merous; calyx lobes in unequal pairs .....  | 7                           |

- + Flowers 5–7-merous; calyx lobes slightly unequal ..... 8
- 7. Flowers solitary, on long peduncles 5–20cm; corolla tube 25–35mm  
**8. *G. paludosa***
- + Flowers in loose cymes, on short peduncles 0.5–2cm; corolla tube 15–20mm  
**9. *G. contorta***
- 8. Flowers in dense cymes; pedicels 0–1mm; calyx lobes cuspidate  
**5. *G. griersonii***
- + Flowers in lax cymes; pedicels 6–27mm; calyx lobes acute .... **6. *G. azurea***

**1. *G. pedunculata*** (D. Don) H. Smith; *Comastoma pedunculatum* (D. Don) Holub, *Eurythalia pedunculata* D. Don, *Gentiana pedunculata* (D. Don) Royle, *Gentiana tenella* sensu F.B.I. non Rottboell. Fig. 64c–e.

Erect or ascending annual, 3–20cm; stems branching from base and often further up. Leaves elliptic to lanceolate, occasionally ovate, 5–20 × 2–10mm, acute or rounded, sessile. Flowers 5-merous, peduncles 12–85mm. Calyx tube 0.5–1mm; lobes unequal, ovate to narrowly elliptic, 3–7 × 1–3mm, acute. Corolla slaty blue, violet or pale lilac spotted purple; tube 5–12mm; lobes elliptic, 4–7 × 2–4mm, rounded; throat fimbriate. Filaments 3–6mm; anthers c 1mm. Ovary narrowly ellipsoid, 4–8 × 1–2mm, sessile. Capsule narrowly ellipsoid, 10–14 × 3–4mm.

**Bhutan:** C – Punakha district, N – Upper Mo Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Chhophtha, above Thanggu. On grassy, gravelly slopes and dryish sunny banks, 3656–4300m. July–October.

**2. *G. falcata*** (Karelin & Kirilow) H. Smith; *Gentiana falcata* Karelin & Kirilow, *Gentiana tenella* Rottboell var. *falcata* Karelin & Kirilow, *Comastoma falcatum* (Karelin & Kirilow) Toyokuni

Ascending annual, 14–23cm tall; stems branching from or near base. Leaves mainly on lower part of stems, elliptic, 7–20 × 2–5mm, acute, upper leaves sessile, lower leaves with broad petiole. Flowers 5-merous, solitary. Peduncles 5–14cm. Calyx tube 1–2mm; lobes unequal, lanceolate, 9–11 × 2–5mm, apex acuminate, often curved. Corolla slaty blue-violet; tube 8–16mm; lobes oblong or elliptic, 4–8 × 2–3mm, obtuse; throat fimbriate. Filaments 5mm; anthers 1–1.5mm. Ovary narrowly ellipsoid, 11 × 3mm, sessile. Fruit not seen.

**Chumbi:** Phari. In alpine meadows in dry areas, 4420m. August–September.

**3. *G. stellariifolia*** (Forbes & Hemsley) H. Smith; *Gentianella tenella* (Rottboell) Borner var. *sikkimensis* (Clarke) Sunita, *Gentiana tenella* Rottboell var. *sikkimensis* Clarke, *Gentiana stellariifolia* Forbes & Hemsley, *Comastoma stellariifolium* (Forbes & Hemsley) Holub.

Ascending or erect weak-stemmed annual; stems (2.5–)4–10(–14)cm. Leaves elliptic to ovate, 2–12 × 1–4mm, rounded or acute, basal leaves often with

broad petiole, stem leaves sessile. Flowers 4- or 5-merous, on long peduncles 7–50mm. Calyx tube c 1mm; lobes unequal, elliptic to ovate, 2–4 × 1–2mm, acute. Corolla blue, (or dark red on Chumbi specimen) tube 3–6mm; lobes elliptic, 3–5 × 1.5–3mm, acute or rounded; throat fimbriate. Filaments 3–5mm; anthers 0.5–1mm. Ovary ellipsoid, 2–10 × 0.5–2mm, sessile. Capsule narrowly ellipsoid, 9–10 × 2–2.5mm.

**Bhutan:** C – Punakha/Tongsa district (locality unknown); **Sikkim:** Sherabthang, Samdong, Thanggu, Yumthang; **Chumbi.** On peaty turf, scree and mossy stones, 3962–4267m. July–September.

#### 4. *G. urnigera* Aitken & Long

Decumbent, often dwarf, annual. Stems 1.5–5(–9)cm long, diffusely branched from base. Leaves spatulate or obovate, 4–10 × 2–4mm, including broad petiole, apex rounded, base attenuate or narrowing abruptly; stem leaves sometimes ± sessile. Flowers 4- or 5-merous, solitary, terminal; peduncles 3–20(–50)mm. Calyx tube 0.5–2mm; lobes unequal, ovate or lanceolate, 3–5 × 1–3mm, rounded or acute. Corolla slaty blue or deep blue-violet; tube 3–6(–7)mm; lobes oblong or ovate, 2–4(–5) × 1.5–2mm, rounded or subacute; throat fimbriate. Filaments 1–2mm; anthers 0.5–1mm. Ovary ovoid, 3–3.5 × 1–2mm, sessile. Capsule ellipsoid, 5–6 × 2–2.5mm.

**Bhutan:** C – Tongsa district (Rinchen Chu), N – Upper Kulong Chu district (Me La); **Sikkim:** Yumthang, Thanggu, Kankola. Alpine pastures, grassy slopes and open stony ground, 4270–4720m. August–September(–October).

One collection (*Ludlow, Sherriff and Hicks* 21135) from N.E. Bhutan (Me La), is a much larger plant, but with the same characteristics as the typical plants. When material becomes available for a more extensive study, it may merit treatment as a variety, but for the present it is not being considered separately (246).

#### 5. *G. griersonii* Aitken & Long

Erect, branched annual, 2.5–6cm. Stems densely glandular-pubescent, often leafless on lower part, unbranched or with 1–4 slender branches from lower part. Rosette leaves absent; lower stem leaves orbicular or reniform, 2–5 × 2–5mm, rounded, margin scabrous, petiole narrow, 1.5–6mm; upper stem leaves spatulate, 3–8 × 2–3mm, including winged petiole 1–2mm, petiole bases of leaf pairs shortly connate; leaf apex cuspidate. Flowers 5–7-merous, in dense corymbose cymes, 1–2cm broad, occasionally solitary on depauperate plants. Bracts leaf-like. Pedicels 0–1mm. Calyx scabrous, tube 2–4mm; lobes erect with spreading tips, elliptic, 2–4 × 1–1.5mm, unequal in width, cuspidate. Corolla pale pink or mauve; tube 3–6mm; lobes spreading, obovate, 2.5–5 × 1–3mm, mucronate, throat naked. Filaments 2–3mm, attached below middle of corolla tube; anthers 0.5–1mm. Ovary ovoid, 3–4 × 1.5–2mm; stipe 0.5–1mm; style 1–3mm. Fruit not seen.

**Bhutan:** C – Thimphu district (Shodu) and Tongsa district (Chendebi), N –



Upper Mo Chu district (Lingshi Dzong). On mossy boulders on cliffs, 2590–3960m. October.

Endemic to Bhutan (245). Similar to *G. gentianoides* (Franchet) H. Smith from Yunnan, but a smaller plant, with narrower stem leaves not obscuring flowers; inflorescence corymbose rather than paniculate and calyx not so deeply divided.

**6. *G. azurea*** (Bunge) Holub; *Gentiana azurea* Bunge

Decumbent annual 3–6cm. Stems ridged, slightly scabrous. Leaves membranous, elliptic, 3–10 × 1–4mm, acute, sessile. Flowers 5-merous. Pedicels 6–27mm. Calyx tube 1–2mm; lobes unequal, lanceolate, 3–4 × 0.5–1mm, acute. Corolla tube 3–5mm; lobes ovate-elliptic, 2.5–4 × 1.5–2mm, acute, throat naked. Filaments 4–6mm; anthers c 1mm. Ovary ellipsoid, 4 × 1mm; style 1–2mm. Fruit not seen.

**Bhutan:** N – Upper Kulong Chu district (Between Me La and Cho La). Open stony hillsides, 4115m. August.

**7. *G. pygmaea*** (Regel & Schmalhausen) H. Smith; *Gentianella thomsonii* (Clarke) Bhattacharyya & Sunita, *Gentiana pygmaea* Regel & Schmalhausen non Clarke, *Gentiana thomsonii* Clarke, *Aliopsis pygmaea* (Regel & Schmalhausen) Omer & Qaiser.

Erect dwarf annual, 1.5–3.5cm, branching mainly from base. Leaves oblanceolate or spatulate, 4–6 × 0.5–1.5mm, including broad petiole, apex rounded or obtuse, margins entire, bases attenuate. Peduncles, 4–15mm. Flowers 4-merous, solitary or in axillary cymes. Calyx divided almost to base; tube 0.5–1mm; lobes ± equal, obovate or spatulate, 1.5–3 × 0.75–1mm, obtuse. Corolla red, yellow or wine-rose, throat naked; tube 2.5–3mm; lobes oblong, 1.5–2 × 1–1.95mm, rounded. (Pairs of interstaminal glands conspicuous on Tibetan specimens but not on Sichuan specimen.) Filaments filiform, 0.5–1mm; anthers ovate, less than 0.5mm. Ovary narrowly ovoid, sessile, 2 × 1mm; style 0–0.5mm. Capsule sessile or with short stipe, ovoid, 4 × 1.5mm.

**Sikkim:** Lhonak. Moist shady places, 4877–5227m. August–September.

**8. *G. paludosa*** (Hooker) H. Smith; *Gentiana detonsa* Rottboell var. *paludosa* Hooker, *Gentiana detonsa* Rottboell var. *stracheyi* Clarke, *Gentianopsis paludosa* (Hooker) Ma. Fig. 64f–h.

Erect biennial 10–50cm; stems simple, rarely branched. Leaves membranous, elliptic-lanceolate, 1.2–5 × 0.4–1cm, rounded or acute, sessile. Flowers 4-merous, solitary, terminal; peduncles 5–20cm. Calyx tube 13–18mm; lobes distichous in unequal pairs, ovate or lanceolate, 6–11 × 1–7mm, acute or acuminate. Corolla slaty blue or pale purple; tube 25–35mm; lobes oblong or spatulate, 8–18 × 3–5mm, rounded or obtuse, bases often with fimbriate margins; throat naked. Filaments 5–10mm; anthers ellipsoid, 1.5–2mm. Ovary oblong-ellipsoid, 25–35mm; stipe 5–10mm. Capsule cylindrical, 3.5–5cm.

**Bhutan:** S – Chukka district, C – Ha, Thimphu and Bumthang districts, N – Upper Kuru Chu, Upper Mo Chu and Upper Bumthang Chu districts; **Sikkim:** Lhonakh, Naku La, Chaerlung; **Chumbi.** On open plain amidst small bushes and peaty turf, (396?) 3658–4877m. July–September.

**9. *G. contorta*** (Royle) H. Smith; *Gentiana contorta* Royle, *Gentianopsis contorta* (Royle) Ma

Similar to *G. paludosa* but smaller, more densely branched plant, 14–24cm; basal leaves absent; flowers terminal and axillary, in loose cymes; peduncles 0.5–2cm; corolla tube cream, 15–20mm; lobes pale blue, oblong, 7–8 × 2–3mm, without fimbriate margins at base; (lobes supposedly contorted in bud rather than imbricate as in *G. paludosa*) ovary narrowly oblong, 10–15mm; fruit not seen.

**Chumbi:** Upper Chumbi Valley. On dry slopes in forest and shady moist places, 3048–3658m. September–October.

## 12. LOMATOGONIUM A. Braun

Erect or decumbent branched annuals. Stems solitary or tufted, quadrangular. Leaves sessile or with broad petiole. Flowers in axillary or terminal cymes or solitary, terminal, on long peduncles, 4–5-merous. Calyx tube very short. Corolla pale blue, lilac or white; tube very short; base with pairs of fimbriate glands, not always obvious in some species. Filaments linear; anthers ovate-oblong, globose, minute or sometimes nearly equal to filaments. Ovary oblong-ellipsoid, flattened, sessile, 1-celled, orange-yellow; style absent; stigma decurrent on ovary as 2 narrow bands.

1. Flowers in loose or dense cymes (little-branched in *L. himalayense*); pedicels short, axillary on leafy stems ..... 2
- + Flowers usually solitary; pedicels elongate, terminal on slender leafy stems, rarely axillary ..... 4
  
2. Leaves lanceolate or linear with reflexed or revolute margins ..... **4. *L. sikkimense***
- + Leaves ovate or elliptic, margin not reflexed or very weakly so ..... 3
  
3. Stems weak, diffusely branched; calyx lobes spatulate, 2.5–4mm; corolla lobes ovate, 4–8mm ..... **2. *L. chumbicum***
- + Stems erect, simple or branched; calyx lobes elliptic or linear, 5–11mm; corolla lobes elliptic or oblong, 8–15mm ..... **3. *L. himalayense***

4. Stems much-branched near base; corolla lobes ovate or elliptic, 6–10mm  
**1. L. brachyantherum**  
 + Stems little-branched near base; corolla lobes obovate, 8–16mm  
**5. L. stapfii**

**1. L. brachyantherum** (Clarke) Fernald; *Pleurogyne brachyanthera* Clarke, *P. diffusa* Maximowicz, *Swertia brachyanthera* (Clarke) Knoblauch, *S. lloydoides* Burkill, *L. lloydoides* (Burkill) Hara, Chater & Williams, *L. diffusum* (Maximowicz) Fernald, *Pleurogynella brachyanthera* (Clarke) Ikonnikov, *P. diffusa* (Maximowicz) Ikonnikov

Decumbent or ascending annual to 14cm. Stems branching from near base. Basal leaves ovate-elliptic, sometimes spatulate, 6–15 × 1.5–3mm, including broad petiole, stem leaves elliptic, 4–7 × 1.5–3mm acute, sessile or with broad petiole, margins entire. Flowers 5-merous (sometimes 4-merous in W. Tibet (80)) solitary, terminal, on long pedicels 10–60mm. Calyx tube 0.5–1mm; lobes elliptic or lanceolate, unequal, 4–6 × 1–2mm, acute. Corolla lilac or pale blue; tube 1–2mm; lobes ovate or elliptic, 6–10 × 2.5–4mm, acute, fimbriate double glands or flaps at base sometimes very prominent. Filaments filiform, winged, 3–4mm; anthers c 1mm. Ovary cylindrical, 7–9 × 1–1.5mm, including decurrent stigma 1.5–2mm.

**Bhutan:** C – Tongsa district (Chendebi to Dungshinggang); **Sikkim:** Gocha La; **Chumbi:** Dotag. Amongst small shrubs on dry hillsides, 3800–4300m. August–September.

*L. brachyantherum* as treated here may include more than one entity and requires further study throughout the Himalaya.

**2. L. chumbicum** (Burkill) H. Smith; *Swertia chumbica* Burkill

Decumbent annual, diffusely branched above base. Stems up to 25cm long. Leaves ovate or elliptic, (2–)3–14 × 1–7mm, rounded or acute, sessile, margins weakly reflexed when dry. Flowers 5-merous, in very loose cymes, pedicels 8–30mm. Calyx tube 1–1.5mm; lobes spatulate, (2–)2.5–4 × 1–1.5mm, acute. Corolla pale or slaty blue; tube 1–1.5mm; lobes ovate, 4–8 × 1.5–3mm, acute, with fimbriate nectaries at base. Filaments 2.5–3mm; anthers oblong, 0.75–1.5mm. Ovary ellipsoid, 2–4 × 1–1.5mm; stigma less than 0.5mm. Fruit ellipsoid or ovoid, 4–6 × 1–3mm.

**Bhutan:** C – Bumthang district, N – Upper Pho Chu, Upper Kuru Chu and Upper Bumthang Chu districts; **Sikkim:** Thangu, Lhonak; **Chumbi:** Dotag, Tah-loom (Talung?). Open grassy slopes and beside footpaths, 3290–4420m. August–October.

**3. L. himalayense** (Klotzsch) Aitken; *L. carinthiacum* auct. non (Wulfen) Reichenbach, *Pleurogyne himalayensis* Klotzsch

Erect or ascending branched annual 6–28cm tall. Leaves ovate, 4–20 × 2–8mm, acute or rounded, sessile, margins scabrous. Flowers 5-merous, in loose

terminal few-flowered cymes, rarely solitary; pedicels 10–60cm. Calyx tube 1–2mm; lobes elliptic or linear-lanceolate, 5–11 × 1.5–3mm, acute. Corolla light or slaty blue, sometimes tinged green; tube 1–2mm; lobes elliptic or oblong, 8–15 × 3–8mm, obtuse or acute. Filaments 4–7mm; anthers oblong, 2–3mm. Ovary linear, 8–12 × 1–2mm, including stigma. Fruit not seen.

**Bhutan:** N – Upper Mo Chu district (Laya), Upper Mangde Chu district (Passu Sefu), Upper Bumthang Chu district (Lhabja, Tolegang) and Upper Kulong Chu district (Me La); **Sikkim:** Bikbari. Grassy, rocky valley beds, open damp places, swampy grassland, 3962–4420m. September–October.

The name *L. carinthiacum* (Wulfen) Reichenbach has been widely used for this plant in the East Himalaya. European *L. carinthiacum* is a much smaller plant with little or no branching on upper stems, smaller, narrower leaves and often shorter, broader calyx lobes (246).

Some of the specimens assigned here to *L. himalayense* from Bhutan and many similar ones from West China have been placed under *L. macranthum* (Diels & Gilg) Fernald by Ho & Pringle (257). This species was described from Gansu province in North China and further study is needed to determine whether this name can be reduced to synonymy.

**4. *L. sikkimense* (Burkill) H. Smith; *Swertia sikkimensis* Burkill.** Fig. 62a–d.

Erect annual 3–19cm tall. Stems branching from base and above. Leaves glandular, sometimes whorled or clustered, lanceolate to linear, 4–15mm (–25mm on basal leaves) × 1–3.5mm, acute, sessile, margins reflexed or revolute. Flowers 5-merous, in dense terminal and axillary cymes. Bracts 4–21 × 0.5–2mm, sometimes in a whorl below inflorescence. Pedicels 1–15mm. Calyx tube 1–2mm; lobes linear, 3–6 × 0.75–1mm, acute. Corolla tube 1–2mm; lobes ovate-elliptic, 6–8 × 3–4mm, apex acute, with small indistinct pairs of glands at base. Filaments 3–4mm; anthers 1–1.5mm. Ovary narrowly ellipsoid, 3–5 × 0.75–1mm; stigma c 1mm. Fruit narrowly ellipsoid, 6 × 1mm.

**Bhutan:** C – Ha and Thimphu districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Sikkim:** Giaogang, Gyemo Chen, Chumbithang, Soe, Zongri. Grassy open hillsides, 3658–4572m. September–October.

**5. *L. stapfii* (Burkill) H. Smith; *Swertia stapfii* Burkill.**

Erect annual 7–11cm tall. Stems little-branched near base. Leaves ovate or spatulate, 5–10 × 3–5mm, acute or obtuse, sessile or narrowing at base to broad petiole. Flowers 5-merous, solitary or rarely 2, terminal; bracts 5–13 × 3–4mm; pedicels 8–40cm. Calyx tube 1–2mm; lobes unequal, lanceolate to narrowly elliptic, 5–6 × 1–2mm, acute or rounded. Corolla blue-violet; tube 3–6mm, pairs of nectaries at base with long fimbriae; lobes obovate, 8–16 × 5–10mm, subacute. Filaments 8–11mm; anthers 2–3mm. Ovary very narrowly oblong, 10–17 × 1–3mm; stigma 1–2mm. Fruit 12–20 × 3mm.

**Bhutan:** C – Thimphu district (Naro) and Sakden district (Nyuksung La), N

– Upper Mo Chu district (Nelli La). In peaty turf over sand and on bare open hillsides between dwarf rhododendrons, 4115–4600m. September–October.

### 13. VERATRILLA (Baillon) Franchet

Erect glabrous perennials. Stems angled or slightly winged. Basal leaves rosulate, often with long petiole, cauline leaves opposite, sessile, 3–5-veined. Flowers unisexual, in panicles of axillary and terminal racemes, 4-merous (although 5-merous plants have been recorded). Male plants with many flowers in tight sessile clusters; female plants with fewer-flowered, more elongated racemes. Stamens attached near apex of corolla tube. Stigma bilobed; style absent. Fruit an ovoid, sessile capsule.

1. *V. baillonii* Franchet; *V. burkilliana* (W.W. Smith) H. Smith, *Swertia burkilliana* W.W. Smith, *S. mekongensis* Balfour f. & Forrest. Fig. 64i–k.

Plants 7–48cm tall. Leaves membranous, elliptic; basal leaves 2.5–11 × 0.8–2.8cm, base attenuate, petioles 1–14cm; stem leaves 3–6 × 1.2–2cm, acute or obtuse. Male panicles (2–)7–18cm; female panicles 17–28cm. Bracts elliptic, 0.7–5 × 0.2–1.3cm. Calyx tube 1–2mm; lobes lanceolate, 1–3 × 0.5–2mm, acute. Corolla dull greenish purple or blue marked with green, tube 2–4mm; lobes ovate, 4–5 × 2–3.5mm, obtuse. Filaments linear, 1.5–2mm; anthers oblong, c 1mm. Ovary ovoid, 1.5–2mm; stigma c 0.5mm. Capsule ovoid, 8–14 × 5–9mm.

**Bhutan:** C – Mongar district (Pung La); **Bhutan/Assam frontier:** Orka La; **Sikkim:** Tsomgo, Sherabthang, Fiyengong. In open marshy places, among turf on lake edges, 3658–3962m. July–August.

*V. burkilliana* and *V. baillonii* are generally regarded as distinct species. In the most recent treatment by Ho & Pringle (257), they differ primarily in stature, corolla gland colour and seed coating. The specimens from our area appear to intergrade in many characters and therefore are treated as one species. *V. burkilliana* is the species cited as occurring in Bhutan and Sikkim.

### 14. SWERTIA L.

Annual, biennial or perennial, erect or decumbent herbs. Stems terete, angled or winged. Leaves opposite, whorled, rosulate or alternate, sessile or petiolate. Flowers pedicellate, 4- or 5- (6-?) merous, in leafy panicles of axillary and terminal clusters. Bracts leaf-like, opposite, sessile. Calyx deeply lobed. Corolla rotate, tube very short; lobes with 1 or 2 nectariferous glands or pits, naked or nearly covered by a scale or flaps, glabrous, fringed or fimbriate. Stamens as many as corolla lobes, attached at base of corolla lobe sinuses, sometimes surrounded by long hairs. Ovary 1-celled, sessile or sometimes with short stipe. Style slender or absent; stigma bilobed. Fruit a capsule, enclosed by persistent calyx and corolla, ovoid, oblong or flattened, dehiscent into 2 valves.

160. GENTIANACEAE

- 1. Flowers 5-merous (occasionally 4-merous in *S. macrosperma*) ..... 2
- + Flowers 4-merous ..... 11
  
- 2. Calyx tube campanulate, ciliate on outer surface ..... **6. S. teres**
- + Calyx tube divided almost to base, glabrous ..... 3
  
- 3. Corolla lobes usually less than 6mm ..... 4
- + Corolla lobes more than 6mm ..... 6
  
- 4. Leaves ovate; corolla white with 2 small, fimbriate glands  
**5. S. macrosperma**
- + Leaves lanceolate; corolla white or pale blue with purple band and 1  
 horseshoe-shaped, glabrous gland ..... 5
  
- 5. Calyx lobes 2.5–4mm; filaments forming short tube at base ... **1. S. ciliata**
- + Calyx lobes 4–9mm; filaments free ..... **2. S. paniculata**
  
- 6. Stem leaves broadly ovate, bases cordate, amplexicaul; with 1 gland on each  
 corolla lobe ..... **3. S. cordata**
- + Stem leaves otherwise; with 2 glands on each corolla lobe ..... 7
  
- 7. Corolla glands naked, viscous, green ..... **4. S. bimaculata**
- + Corolla glands fimbriate ..... 8
  
- 8. Stems slender; basal leaves 0.6–1cm wide ..... 9
- + Stems stout; basal leaves 2–7cm wide ..... 10
  
- 9. Corolla lobes 7–15mm long, blue or dull purple; glands narrow, oblong  
**12. S. cuneata**
- + Corolla lobes 14–22mm long, white; glands round, saccate  
**13. S. younghusbandii**
  
- 10. Panicles dense; basal leaves 5–7cm wide; corolla glands flat, not saccate  
**10. S. speciosa**
- + Panicles elongate; basal leaves 3–4.5cm broad; corolla glands saccate  
**11. S. wardii**
  
- 11. Plants with no main stem; flowers on numerous long peduncles  
**14. S. multicaulis**
- + Plants with long main stem; flowers in panicles or cymes ..... 12
  
- 12. Stems pentangular, grooved, winged ..... **16. S. staintonii**
- + Stems quadrangular or terete ..... 13
  
- 13. Stems slender; corolla usually not more than 10mm ..... 14

- + Stems robust; corolla usually more than 10mm ..... 17
- 14. Plant with basal rosette of leaves; calyx lobes broadly ovate **15. S. ramosa**
- + Plant without basal rosette of leaves; calyx lobes linear or lanceolate .. 15
- 15. Calyx lobes shorter than corolla; glands in pairs, flat, fimbriate  
**7. S. chirayita**
- + Calyx lobes longer than or  $\pm$  equal to corolla; glands single, with fimbriate flap ..... 16
- 16. Leaves elliptic; calyx 1.5–2 times as long as corolla ..... **8. S. nervosa**
- + Leaves lanceolate to linear, rarely elliptic; calyx slightly longer than or  $\pm$  equal to corolla ..... **9. S. angustifolia**
- 17. Margins of calyx lobes entire or undulate ..... 18
- + Margins of calyx lobes lacinulate or erose ..... 21
- 18. Calyx lobes elliptic or lanceolate, not overlapping ..... **17. S. hookeri**
- + Calyx lobes broadly ovate, overlapping ..... 19
- 19. Corolla lobes 20–30mm long; gland round with membranous, dentate margin; long hairs at base of calyx ..... **20. S. grandiflora**
- + Corolla lobes 11–20mm; gland triangular, naked or elliptic, fimbriate; no hairs at base of calyx ..... 20
- 20. Flowers on long pedicels in loose panicles; gland elliptic or rhombic, fimbriate ..... **18. S. pseudohookeri**
- + Flowers in congested cymes; gland triangular, naked ..... **19. S. virescens**
- 21. Gland orbicular with fimbriate margin; anthers with claw-like connective at apex ..... **21. S. crossoloma**
- + Gland orbicular or slightly pointed, with membranous dentate margin; anthers without claw at apex ..... 22
- 22. Flowers on ascending, curving branches from main stem; gland orbicular or pointed, sometimes fimbriate at base ..... **22. S. candelabrum**
- + Flowers in whorls on main stem; gland orbicular, not fimbriate  
**23. S. assamensis**

**1. S. ciliata** (G. Don) Burt; *S. purpurascens* Clarke non D. Don, *S. purpurascens* Clarke var. *ramosa* Burkill, *S. pedicellata* Banerji, *Ophelia ciliata* G. Don.

Erect annual 30–59cm. Stems quadrangular, branched or simple, slightly winged, with short glandular hairs. Leaves elliptic-lanceolate, 1.5–2.5 × 0.4–0.7cm, acute, sessile. Flowers 5-merous, in loose panicles; bracts lanceolate,

4–15 × 0.5–2mm, acute; pedicels 4–7mm. Calyx tube c 0.5mm; lobes slightly unequal, lanceolate, 2.5–4 × 0.5–1mm, acuminate. Corolla tube 1–1.5mm; lobes pale blue or bluish white, with purple band above gland, elliptic-ovate, 3–5 × 1.5–3mm, mucronate. Gland 1 per lobe, horseshoe-shaped. Filaments widening towards base, 2–4mm, connate in short tube c 1mm; anthers ovate, c 1mm. Ovary ovoid, 2–3 × 1–1.5mm, stipe c 1mm; style 1–2mm. Capsule ovoid, 5–6 × 2–3mm.

**Darjeeling:** Senchal and Jorpokhri. Open grassy places, 2440–2700m. August–September.

**2. *S. paniculata*** Wall.; *S. dilatata* Clarke, *S. griffithii* Clarke, *Ophelia paniculata* (Wall.) D. Don. Fig. 62g&h.

Similar to *S. ciliata* but generally a larger plant, stems glabrous, leaf nodes sometimes ciliate. Leaves linear-lanceolate, 1.7–6 × 0.4–1cm. Bracts linear, 13–40 × 1–2mm, acuminate, pedicels 2–12mm. Calyx tube 1–1.2mm; lobes 4–9 × 1–2mm, margins often ciliate. Corolla tube 2–2.5mm; lobes elliptic, 5–6 × 2–3mm, acuminate, white with purple band; gland as *S. ciliata*. Filaments free, 4–6mm. Ovary ellipsoid, 3–4 × 1–3mm; style 0.5–2mm. Capsule ellipsoid, 7–13 × 2–4mm.

**Bhutan:** C – Thimphu district (Tsalimaphe); **Darjeeling:** Chiya Bhanjang, Darjeeling, Senchal and Kurseong; **Sikkim:** Zongri. Edges of swamps, 2130–3350m. July–October.

**3. *S. cordata*** (G. Don) Clarke; *Ophelia cordata* G. Don, *O. chirayta* G. Don, *O. cordata* var. *laxa* Grisebach. Med: *Chagtickarpo*. Fig. 62j.

Erect annual to 60cm. Stems quadrangular. Leaves opposite, sometimes in whorls of 3, ovate, 0.7–2.5 × 0.3–1.4cm, acute or rounded, base cordate, amplexicaul. Flowers 5-merous, in panicles; bracts ovate, 5–18 × 1–9mm; pedicels 1–13mm. Calyx lobes free almost to base, elliptic to lanceolate, 5–8 × 1–3mm, acuminate. Corolla lobes white flecked purple, elliptic 6–11 × 1.5–3mm, acute; gland 1 per lobe, yellow, viscous, circular. Filaments filiform, 2–6mm, joined at base; anthers c 1mm. Ovary ellipsoid, 3–5 × 1–2mm; style 1–2mm. Fruit not seen.

**Bhutan:** S – Deothang district (Wamrong), N – Upper Mo Chu district (Pang La); **Sikkim/Darjeeling:** locality unknown. On open hillsides, 3050m. August–September.

**4. *S. bimaculata*** (Siebold & Zuccarini) Clarke; *Ophelia bimaculata* Siebold & Zuccarini. Nep: *Chirata*.

Annual or biennial to 70cm. Stems terete or quadrangular, slightly winged above. Leaves broadly elliptic or ovate, 2.5–12 × 1–4.5cm, acute or apiculate, base narrowing to broad petiole 0.5–6cm. Flowers in panicles made up of corymbs; bracts 10–25 × 3–10mm; pedicels 10–25mm. Calyx tube 1–1.5mm; lobes unequal, spatulate, 1–8 × 0.5–1mm, acuminate. Corolla tube 1–1.5mm;



lobes white or greenish yellow, spotted dark purple or black, elliptic or obovate, 6–12 × 3–6mm; glands 2 per lobe, greenish, viscous, orbicular. Filaments filiform, 3–5mm; anthers 1–2mm. Ovary ellipsoid-ovoid, 5–13 × 1.5–4mm; style absent. Capsule ellipsoid, 10–15 × 4–6mm.

**Bhutan:** S – Chukka district, C – Tongsa, Punakha and Tashigang districts, N – Upper Mo Chu district; **Darjeeling:** Ghum, Sukiapokhri and Senchal; **Sikkim:** Yoksam. On sandy loam in evergreen oak forest, 1520–3660m. (February?) July–October.

*S. plantaginifolia* Griff., from Punakha, may be a synonym of *S. bimaculata*, but no type material could be located.

**5. *S. macrosperma* (Clarke) Clarke; *Ophelia macrosperma* Clarke. Fig. 62i.**

Annual or biennial to 70cm. Stems quadrangular. Leaves ovate, 1.2–4 × 0.5–2cm, sessile. Flowers 5-merous, sometimes 4-merous, in panicles; bracts ovate, 5–20 × 2–8mm, acuminate; pedicels 5–18mm. Calyx tube 0.5mm or less, base with hairs on inner surface; lobes elliptic-lanceolate, 1.5–2.5 × 0.5–1mm, acuminate. Corolla tube c 0.5mm; lobes white, ovate or elliptic, 2.5–4 × 1.5–2mm, acuminate; glands 2 per lobe, oval, fimbriate. Filaments linear, 1.5–2.5mm, with hairs at base; anthers c 0.5mm. Ovary ovoid, 2–3 × 1.5–2mm; style stout, c 0.5mm. Capsule ovoid, 5–6 × 3–4mm.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Bumthang and Mongar districts, N – Upper Mo Chu district. Damp clearings in *Rhododendron* and *Tsuga* forests, 2130–3080m. August–September.

**6. *S. teres* (G. Don) J. Shah; *S. racemosa* (Grisebach) Clarke, *Kingdonwardia codonopsidoides* Marquand, *Ophelia teres* G. Don, *O. racemosa* Grisebach, *O. purpurascens* D. Don, non Clarke. Fig. 62n.**

Annual 5–50cm. Stems angled on upper part, slightly ridged or terete on lower part. Leaves narrowly ovate or lanceolate, 1–5 × 0.2–0.8cm, acute, sessile, ciliate or only with ciliate margin. Flowers 5-merous, in panicles; bracts lanceolate, 10–25 × 2–4mm; pedicels 2–15mm. Calyx tube campanulate, 2.5–5mm, densely ciliate on outer surface; lobes unequal, triangular or ovate, 2–10 × 1–3mm, acute. Corolla sometimes glandular-pubescent outside, tube campanulate, 2–6mm; lobes white, pale blue, occasionally pale pink, ovate, 4–7 × 2–4mm, acute or mucronate, margins ciliate; gland small, circular, outer rim with fimbriae in 2 tufts or a single band above, variable, sometimes indistinct. Filaments 2–4mm, widening towards base, forming tube 0.5–1mm; anthers c 1mm. Ovary narrowly ovoid, 4–11 × 1–3mm; style slender, 1–2mm. Capsule ovoid, 8–11 × 3–4mm.

**Bhutan:** C – Thimphu district (Shodu), N – Upper Mo Chu district (Lingshi and Chumolhari) and Upper Bumthang Chu district (Tolegang, Kopub, Waitang, Lhabja); **Sikkim:** Kangling, Tsomgo. In ravines and sandy banks on steep hillsides, 3350–4270m. September–November.

This species has a very wide range of variability in the shape, length and

degree of ciliation of the leaves, the length of the calyx lobes and the shape of the gland on the corolla lobe. The extreme forms seem to be connected by intermediates.

**7. *S. chirayita* (Roxb.) Karsten; *S. tongluensis* Burkill, *Gentiana chirayita* Roxb.** Sanskrit: *Chirata*, Beng: *Chireta*, *Chirayta*; Eng: *Chiretta*.

Annual or biennial to 90cm. Stems terete or quadrangular, sometimes slightly winged. Leaves glabrous, ovate or elliptic, 1.6–8 × 0.3–2.7cm, sessile. Flowers 4-merous, in numerous small clusters on branches of panicles; bracts 8–23 × 1–6mm; pedicels 3–8mm. Calyx tube 0.5–1.5mm, sometimes fimbriate; lobes linear-lanceolate, 3–4 × 0.5–1mm, acute or acuminate. Corolla tube 1–2mm; lobes greenish yellow, ovate, 4–5 × 2–3mm, acuminate; glands 2 per lobe, large, oval or oblong, fimbriate. Filaments free, linear, 1.5–3mm; anthers c 1mm. Ovary ovoid, 2–3 × 1.5–2mm, with short stipe c 0.5mm; style 0.5–1mm. Capsule ovoid, 4–9 × 2.5–3mm.

**Bhutan:** S – Deothang district (Rydang); **Darjeeling:** Ghum, Senchal, Sandakphu, Rungbool, Kalipokhri and Tanglu. On steep banks, 2130–2740m. September–November (March).

Dried plants used medicinally (126). Some specimens from Darjeeling district (Tanglu) have more strongly winged stems and more elongate capsules and have been distinguished as *S. tongluensis* Burkill.

**8. *S. nervosa* (G. Don) Clarke; *Ophelia nervosa* (G. Don) Grisebach, *Agathotes nervosa* G. Don**

Annual to 60cm. Stems quadrangular, winged. Leaves elliptic to lanceolate, 3–5 × 0.4–1.2cm, acute, base attenuate, almost petioled on basal leaves. Flowers 4-merous, in panicles made up of cymes; bracts linear or lanceolate, 12–22 × 1–3(–6)mm; pedicels 3–12mm. Calyx tube 0.5–1mm; lobes linear, 7–10(–22) × 1–2(–3)mm, often much longer than corolla, apex acute. Corolla tube 1–2mm; lobes green or whitish with purple markings, elliptic-ovate, 5–7(–9) × 2–3mm, acuminate; gland 1 per lobe, with pocket-like flap, fimbriate at apex. Filaments linear, widening at base, ± free, 2–4mm; anthers c 1mm. Ovary ovoid, 3–4.5mm × 1.5–2.5mm; style stout, 0.5mm or less. Capsule ovoid, 5–7 × 3.5–4mm.

**Bhutan:** C – Thimphu district (Thimphu, Taba and Paro (117)), Punakha district (117); **Darjeeling:** Senchal, Darjeeling, Ghum, **Sikkim:** Lachung, Kalej Khola, Rishi, Rangit. Roadsides, 2350–2440m. August–November.

**9. *S. angustifolia* D. Don; *Ophelia angustifolia* (D. Don) G. Don.** Darjeeling: *Chirathi*. Fig. 62k.

Similar to *S. nervosa* but leaves narrower, lanceolate to linear, rarely elliptic, 1–4 × 0.1–7cm; calyx lobes linear-lanceolate, 3–8 × 1–2mm, acute, ± equaling, rarely longer than corolla; corolla lobes white, bluish white, spotted blue or black, elliptic to oblong, 6–8 × 2.5–4mm, acute or obtuse; gland similar to

*S. nervosa*, but flap sometimes not fimbriate; ovary narrowly ellipsoid,  $3.7 \times 0.5$ – $2.5$ mm. Fruit not seen.

**Bhutan:** C – Thimphu, Punakha, Tongsa and Tashigang districts; **Darjeeling:** Pul Bazar to Rishi, Darjeeling, Siliguri, Nahsarbari terai; **Sikkim:** Ramman, Great Rangit Valley. Open grassy meadows, 200–1830(–2440)m. September–November.

Although a variable species throughout its range, the material from our area is relatively uniform in having calyx and corolla subequal and corolla white or pale blue with darker spots. This has been segregated as var. *pulchella* (D. Don) Burkill (*Ophelia pulchella* D. Don, *Ophelia porrigens* G. Don). *S. angustifolia* var. *angustifolia*, with calyx lobes longer than corolla, occurs in East Nepal and could occur in Sikkim and Bhutan but no material has been seen.

**10. *S. speciosa*** D. Don; *S. perfoliata* G. Don, *S. rex* Clarke, *S. speciosa* var. *perfoliata* (G. Don) Clarke, *S. speciosa* var. *lacei* Burkill, *S. kingii* Hook. f.

Perennial to 98cm. Stems hollow, cylindrical or square, unbranched. Basal leaves elliptic to spatulate,  $(12\text{--})19$ – $25$ (– $40$ )  $\times$   $5$ – $7$ cm, including broad petiole  $8$ – $11$ cm; stem leaves elliptic to lanceolate,  $4.5$ – $17$   $\times$   $1$ – $5$ cm, acute, bases sheathing the stem. Flowers 5-merous, in a panicle made up of cymes. Bracts lanceolate,  $2$ – $2.5$   $\times$   $0.3$ – $0.5$ cm. Calyx lobes lanceolate or ovate,  $8$ – $18$   $\times$   $2$ – $6$ mm, acuminate, sometimes with long hairs on inner surface at base. Corolla tube  $3$ – $5$ mm; lobes whitish, yellowish green or blue-green, sometimes veined purple, elliptic or obovate,  $8$ – $20$   $\times$   $3$ – $9$ mm, rounded; glands 2 per lobe, oval, with long fimbriae, flat or sometimes with raised margin. Filaments filiform,  $(3\text{--})5$ – $9$ mm, often with hairs at the base; anthers  $2$ – $3$ mm. Ovary ovoid or obovoid,  $6$ – $10$   $\times$   $2$ – $3$ mm; style absent. Capsule ovoid,  $12$ – $22$   $\times$   $5$ – $8$ mm.

**Sikkim:** Tsomgo, Ningbil, Meguthang, Tumbok, Singalila; **Chumbi:** Yatung. In peaty meadows, 3353–4267m. August–November.

The Bhutan reports of *S. kingii* and *S. speciosa* (73) refer to *S. wardii*.

**11. *S. wardii*** Marquand

Perennial to 60cm. Stems robust, unbranched, cylindrical. Basal leaves lanceolate,  $6$ – $14$   $\times$   $3$ – $4.5$ cm, acute, with broad petiole  $6$ – $12$ cm; stem leaves narrowly elliptic or lanceolate,  $9$ – $17$   $\times$   $2.5$ – $4.5$ cm, acute, sessile, semi-amplexicaul or attenuate. Flowers 5-merous, in elongated panicle of cymes; bracts elliptic,  $2$ – $5$   $\times$   $0.5$ – $1$ cm, acute; bracteoles lanceolate,  $1$ – $1.8$   $\times$   $0.2$ – $0.4$ cm, acuminate. Calyx tube  $1$ – $1.5$ mm, with short hairs on inner surface of base; lobes elliptic-lanceolate, slightly unequal,  $8$ – $17$   $\times$   $1$ – $6$ mm, apex acuminate. Corolla tube  $2$ – $3$ mm; lobes pale blue, ovate-oblong,  $13$ – $19$   $\times$   $5$ – $7$ mm, rounded; glands 2, oval, saccate, with long fimbriae. Filaments  $8$ – $10$ mm, widening at base; anthers  $2$ – $3$ mm. Ovary ellipsoid,  $8$ – $10$   $\times$   $3$ – $4$ mm; style absent. Capsule ellipsoid,  $16$ – $20$   $\times$   $5$ – $7$ mm.

**Bhutan:** N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Onglakthang and Yampung; **Chumbi.**

On shady ground by streams and damp stony grassy valley beds, 3800–4570m. July–September.

**12. *S. cuneata*** D. Don; *S. glycanthera* (Royle) G. Don *nom. nud.*, ?*S. hugelii* Grisebach. Fig. 62m.

Perennial 10–40cm. Stems quadrangular. Basal leaves whorled, spatulate or narrowly ovate, 2–6.5 × 0.6–1.3cm; rounded or acute, base attenuate, petioles 1.2–4cm, stem leaves spatulate or narrowly oblong, 2–4.5 × 0.4–1.4cm, acute, subsessile or sessile. Flowers 5-merous, in a lax panicle of cymes; bracts linear or narrowly oblong, 1.3–2.2 × 0.2–0.3cm; pedicels 0.5–6cm. Calyx tube c 1mm; lobes spatulate, unequal, 4–8 × 1–2.5mm, acute or acuminate. Corolla tube 1–2mm, with thick hairs at base; lobes blue or dull purple, narrowly elliptic or ovate 7–15 × 2–5mm; glands 2 per lobe, narrow, oblong, fimbriate. Filaments linear, 3–8mm; anthers 2–3mm. Ovary narrowly ellipsoid, 6–12 × 2–2.5mm; style absent. Capsule narrowly ellipsoid, 12–16 × 3–4mm.

**Sikkim:** Zongri, Yampung, Yumthang, Nathang, Giaogang, Thanggu; **Chumbi:** Merug La. Open spaces or moist peaty soil in deep shade under *Rhododendron*, (1980–)3658–4572m. August–October.

Some plants from Chumbi are smaller (to 15cm) with only 1–2 flowers, sepals deflexed, petals larger, 15–20mm and similar to *S. younghusbandii* in habit.

**13. *S. younghusbandii*** Burkill

Similar to *S. cuneata* but 6–22cm tall; leaves linear-lanceolate, basal leaves 1.5–3(–4.5) × 0.2–0.7(–1cm), petiole 0.7–1cm, stem leaves 1.5–3 × 0.2–0.5cm; flowers solitary or in a few-flowered cyme; peduncles 2.5–6cm; calyx lobes narrowly lanceolate, 10–15 × 1–2mm, acuminate; corolla with finer hairs at base than *S. cuneata*, lobes white, oblong or narrowly elliptic, 14–22 × 5–6mm, apex rounded, glands round, saccate, fimbriate; filaments 8–10mm; ovary ellipsoid, 7–8 × 2–3mm. Fruit not seen.

**Sikkim:** Lhonak; **Chumbi:** Tawa Dzong. On grassy hillsides, 4570–5030(–5180)m. August–September.

**14. *S. multicaulis*** D. Don; *S. multicaulis* D. Don var. *umbellifera* Ho & Liu.

Stemless perennial 4–18cm, with fleshy tap root. Leaves all basal, rosulate, narrowly oblong, linear or spatulate, 1.5–8.5 × 0.2–1cm, acute or rounded, almost petiolate. Flowers 4-merous, in loose cymes on many long peduncles 1.5–8cm, arising from basal caudex. Bracts lanceolate, 9–35 × 1–5mm, acuminate. Calyx divided to base; lobes unequal, oblong to elliptic, 5–9 × 1–3mm, acute. Corolla tube 0.5–1.5mm; lobes slaty blue or deep purple, oblong-elliptic, 7–13 × 3–6mm, obtuse or acute; gland 1 per lobe, rhomboid or suborbicular, with fimbriate edges. Filaments linear, 3–8mm, with hairs at base; anthers 1–2mm. Ovary narrowly ovoid, 5–15 × 1–5mm; style absent. Capsule ovoid, 10–14mm × 5mm.

**Bhutan:** C – Thimphu, Tongsa and Mongar districts, N – Upper Mo Chu.

Upper Pho Chu, Upper Mangde Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim**: Lhonak, Yak La, Koling, Meguthang, Naku La, Sherabthang, Bikbari, Kanko La, Yampung, Chho La, Jelep La, Yumthang, Lugnak La, Goichang; **Chumbi**: Yatung, Phari to Temo La. Among grass and stony peaty soil on hill slopes, 3660–5030(–5180)m. July–October.

**15. *S. ramosa*** W.W. Smith

Erect perennial 14–26cm. Stems cylindrical. Basal leaves rosulate, spatulate, 2–11 × 0.8–2.3cm, including broad petiole 1–4cm, apex rounded or acute, stem leaves opposite, ovate or spatulate, 4.5–6 × 1.5–2.2cm, including petiole 1–2cm, apex rounded or acute, base attenuate or rounded. Flowers 4-merous, in widely spaced dense cymes. Bracts ovate or spatulate, 2–4.2 × 1–2.3cm, rounded or acute, base almost petiolate. Calyx divided almost to base; lobes broadly ovate, 9–11 × 4–6mm, acute. Corolla tube c 1mm; lobes greenish yellow or bluish white, ovate, 6–8 × 4–5mm acute; gland 1 per lobe, oval, saccate, densely fimbriate. Filaments linear, 4–4.5mm, anthers 1.5–2mm. Ovary ovoid, 4–8 × 2.2.5mm; style c 0.5mm or less. Capsule ovoid, c 10 × 3mm.

**Bhutan**: C – Bumthang/Mongar districts (Rudong La); **Sikkim**: Phusum. In forest, in moist sand, 2740–3660m. June–July.

**16. *S. staintonii*** H. Smith

Perennial 25–50cm. Stems unbranched, pentangular, deeply grooved, ciliate, winged. Leaves slightly glandular, basal leaves rosulate, spatulate, 6–10 × 1–2cm, acute, including broad petiole 2–5cm; stem leaves whorled, elliptic, 6–7.5 × 1.5–2mm, acute, including broad petiole 1.5–2cm, margins lacinulate. Flowers 4-merous, in a panicle made up of cymes. Bracts elliptic, 2.5–3.5 × 1–1.5cm, acute, sessile; pedicels 1.6–3.5cm, sometimes lacinulate and winged. Calyx lobes almost free to base, ovate, 10–13 × 4–6mm, acute, margins lacinulate. Corolla tube 1.5–2mm; lobes pink or white, broadly ovate, 12–17 × 7–10mm, rounded, margin eroded; gland 1 per lobe, naked, pear-shaped. Filaments linear, 5–10mm; anthers elliptic, c 3mm. Ovary ovoid, 8–10 × 2–3mm; style 1.5–2mm. Capsule ovoid, 8–18mm.

**Bhutan**: C – Thimphu district (Barshong). In alpine turf and peaty gravel, 3810–3960m. June–July.

**17. *S. hookeri*** Clarke. Fig. 621.

Perennial to 150cm. Stems hollow, unbranched, cylindrical or angular. Leaves in whorls of 3–8, glabrous, spatulate, elliptic, basal leaves 9–24 × 2–5cm, including broad petiole 4–8mm, lower part of margins lacinulate, stem leaves 3–13 × 1–4cm, acute, sessile. Flowers 4-merous, in a panicle made up of whorls. Bracts lanceolate, 2–3 × 0.7–1cm, acute; pedicels 2–10.5cm. Calyx tube 0.5–1mm, with hairs on inner surface at base; lobes unequal, elliptic to lanceolate, 7–13 × 2–6mm, acuminate. Corolla tube 2mm, with hairs at base; lobes reddish purple or bronze-red, ovate-oblong, 10–18 × 6–10mm, apex rounded;

gland 1 per lobe, orbicular or ovate, margins slightly dentate. Filaments linear, 7–9mm; anthers 2–3mm. Ovary ovoid, 5–11 × 2–6mm; style c 1mm. Capsule ovoid, 13–18 × 7–9mm.

**Bhutan:** C – Thimphu and Sakden districts, N – Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Yumthang, Namgaythang, Phedup, Tsomgo, Meguthang, Kanglasa, North Chakung and below Lam Pokhri. On peaty hillsides, 3050–4270m. July–September.

### 18. *S. pseudohookeri* H. Smith

Similar to *S. hookeri* but 28–60cm tall; stems terete; basal leaves rosulate, spathulate to ovate, 5–8 × 1–2.5cm, margins entire, base attenuate to broad petiole 2.5–7mm; stem leaves opposite or whorled, ovate to oblong-ovate, 4–6 × 1–2cm, entire, acute or obtuse; calyx lobes broadly ovate or triangular, 4–10 × 3–6mm, acute or obtuse, overlapping, without hairs at base, margins entire, undulate; corolla tube 1–2mm, lobes greenish white with purple lines, obovate to obcuneate, 10–15 × 8–10mm, margins entire or eroded; gland elliptic or rhombic, fimbriate; capsule ovoid, 12–15mm × 5–6mm.

**Bhutan:** C – Bumthang district (Kaemphu) and Tongsa district (Tibdey La), N – Upper Mangde Chu and Bumthang Chu districts. On open grassy hillsides and in ravines, 4000–4400m. June–September.

Endemic to Bhutan.

### 19. *S. virescens* H. Smith

Perennial 8–20cm. Stems unbranched, terete above, quadrangular in basal part. Basal leaves rosulate, spathulate to ovate-spathulate, 4–10 × 1.5–3cm, including broad petiole 2.5–3cm, apex obtuse or rounded; stem leaves 3–6, whorled, oblong-ovate to ovate, 2–5 × 1.5–3cm, obtuse or rounded. Flowers 4-merous, in congested cymes forming a panicle. Calyx lobes ± free, ovate, 5–10 × 4–8mm, margins entire, undulate, overlapping at base. Corolla yellowish green or white with purple veins; tube 1–2mm; lobes elliptic to obovate, 15–20 × 5–10mm, entire or eroded; gland 1 per lobe, irregularly circular or triangular, naked. Filaments 7–8mm; anthers 0.5–1mm. Ovary narrowly ellipsoid, 5–8mm; style 2–3mm. Capsule not seen (12–16mm from description).

**Bhutan:** N – Upper Bumthang Chu district (Tsampa, Pangothang). On open hillsides, 3000–4400m. July–August.

### 20. *S. grandiflora* H. Smith

Perennial to 60cm. Stem cylindrical, unbranched. Basal leaves rosulate, elliptic-oblong to ovate-spathulate, 16–18 × 4–6cm, entire, acute; stem leaves 3–6 per node, ovate to oblong-ovate, 8–9.5 × 4–6cm, acute. Flowers 4-merous, in panicles. Calyx lobes ± free, overlapping, broadly ovate, 15–20 × 10–15mm, obtuse or shortly acute, with long, filiform black hairs on inner surface at base, margins entire, undulate. Corolla tube 1–2mm; striped dull red and green; lobes elliptic to obovate, 20–30 × 10–15mm; glands 1 per lobe, orbicular, with

membranous dentate margin. Filaments 8–10mm; anthers ovate-oblong, obtuse. Ovary ovoid, 10–14mm × 3–5mm; style absent. Capsule ellipsoid, 20–25 × 10mm.

**Bhutan:** N – Upper Kulong Chu district (Shingbe, Me La). Open grassy hillsides above treeline, very common, 4000–4300m. June–October.

Endemic to East Bhutan.

### 21. *S. crossoloma* H. Smith

Similar to *S. grandiflora* but smaller, up to 22cm tall; stem ciliate, terete above but quadrangular at base; basal leaves 12–16 × 1–2cm, acute or obtuse, margins lacinulate; stem leaves whorled, 3–6 × 1–2cm; calyx lobes overlapping, 6–8 × 2.5–3mm, acute, lacinulate, glabrous; corolla pale creamy green, striped blue at base, lobes ovate, 18–20 × 5–10mm, lacinulate, gland fimbriate; anthers 2–2.5mm, with prolonged, often claw-like connective; ovary narrowly ovoid, 5–6 × 2–3mm; style c 1mm. Fruit not seen.

**Bhutan:** N – Upper Kulong Chu district (Me La). Open grassy hillsides, 4300m. Fl. & fr. July–August.

Endemic to Bhutan, known only from the type specimen.

### 22. *S. candelabrum* H. Smith

Similar to *S. grandiflora* and *S. crossoloma* but up to 40cm tall; stem cylindrical, slightly ridged; basal leaves 8–16 × 2–2.5cm, acute, margins finely lacinulate; stem leaves whorled or opposite, elliptic, (2–)4.5–11 × 1–3cm, acute, finely lacinulate; flowers in cymes on curving, ascending branches; bracts elliptic or ovate, 1.5–2.5 × 0.7–1cm, acute, whorled, finely lacinulate; calyx lobes unequal, elliptic to cuneate, 7–13 × 2–9mm; corolla bluish white or greenish yellow tinged purple, tube 2–4mm; lobes broadly obovate, 18–23 × 8–18mm, gland sometimes slightly pointed at apex, with membranous, dentate, incurved margin, sometimes more fimbriate on lower edge; style 1–4mm; capsule ovoid, 1.7–2.3 × 0.5–1cm.

**Bhutan:** C – Sakden district (Nyuksang La and Merak). On open hillsides among *Rhododendron* scrub, 3660–4800m. June–September.

A rare and poorly known species. The Bhutan collections are only tentatively referred to as this species, as the flowers are more numerous and larger than those of the type from Nepal.

### 23. *S. assamensis* H. Smith

Perennial 25–30cm. Stems unbranched, cylindrical, lineolate. Basal leaves rosulate, elliptic to ovate-spathulate, 6–10 × 1.8–2.5cm including broad petiole 3–5cm, apex obtuse, margin lacinulate; stem leaves or bracts elliptic to ovate, 2–5 × 0.6–1.5cm, sessile. Flowers 4-merous, in a panicle of congested whorls. Pedicels 0.5–2cm. Calyx lobes broadly ovate, 5–12 × 7–10mm, acute, lacinulate, overlapping. Corolla yellow striped red, tube 0.5–1mm; lobes broadly obovate

to cuneate, 15–25 × 10–18mm, acute; gland 1 per lobe, orbicular, with membranous dentate rim. Filaments 8–9mm; anthers 2–3mm. Ovary ovoid, 8–10 × 2–3mm; style 1–2mm. Fruit not seen.

**Assam/Bhutan frontier:** Orka La. In alpine pastures, 3350–3960m. June–July.

## 15. GENTIANA L.

Annual, biennial or perennial herbs. Roots slender, fibrous, branched or a single stout tap-root or rhizomes, often with runners or stolons. Stems erect, decumbent or prostrate, sometimes absent, leafy or naked, terete, quadrangular or bicanaliculate. Leaves membranous or coriaceous, sessile or petiolate, with translucent or cartilaginous, entire, glandular, denticulate or wrinkled margins, bases attenuate or with broad, flattened petioles, often connate in scabrous tubes. Flowers 5-merous (except *G. infelix* and *G. pluviarum* which are occasionally 4-merous and *G. doxiongshangensis* which is occasionally 6-merous) in paniculate, umbellate or capitate cymes or solitary, axillary and terminal. Bracts foliaceous, sessile or petiolate. Calyx tubular, terete, keeled, glabrous or scabrous, sometimes with conspicuous intracalycular membrane. Corolla tubular, naked or fimbriate in throat, lobes ovate, oblong, elliptic or triangular; plicae small or nearly equal to lobes. Stamens attached to middle or lower half of corolla tube. Ovary sessile, subsessile or stalked, glands or nectaries at base; apex of fruit entire, winged, crested or denticulate; style absent or slender; stigma 2-lobed, papillose. Capsule included or protruding from corolla on long stipe.

The following species have been recorded from Bhutan or Sikkim but are not confirmed: *G. amplicrater* Burkill, *G. argentea* Royle, *G. cuneibarba* H. Smith, *G. faucipilosa* H. Smith, *G. huxleyi* Kusnezow, *G. listeri* Burkill, *G. longipetiolata* Kusnezow, *G. stellata* Turrill and *G. tetrasticha* Marquand.

1. Plants perennial (dwarf or delicate species may be mistaken for annuals if there are no roots present) ..... 2  
+ Plants annual or biennial ..... 29
2. Largest leaves 1–6.5cm broad; calyx deeply split on one side, ± unlobed or lobes very narrow, subulate ..... 3  
+ Largest leaves up to 1cm broad; calyx divided into (4)5 subequal lobes 4
3. Basal leaves and largest stem leaves 10.5–26 × 3.5–6.5cm; floral bracts 4–12cm long; calyx lobes almost absent, c 1mm or less ..... **6. G. tibetica**  
+ Basal leaves 5–50 × 1–3.5cm; floral bracts 1.5–3(–6)cm long; calyx lobes subulate (narrowly triangular) 0.5–2mm, 2 lobes often longer than the others  
**7. G. robusta**



4. Corolla tube 5–20mm; flowers 1–2, terminal ..... 5  
+ Corolla tube mostly longer than 20mm, or if shorter, flowers  $\pm$  clustered (*G. sikkimensis*), or upper leaves closely overlapping, retuse (*G. emodi*) 11
5. Plants with numerous slender fibrous roots ..... 6  
+ Plants with single tap-root or thickened, fleshy roots ..... 7
6. Flowering stems elongate, numerous; base of corolla cream with darker veins, lobes blue or purple ..... **8. G. meiantha**  
+ Flowering stems very short, solitary; corolla uniformly deep blue  
**23. G. tubiflora**
7. Flowering stems with internodes usually longer than leaves ..... 8  
+ Flowering stems with internodes usually shorter than leaves ..... 9
8. Corolla tube 15–20mm, cream or greenish with purple lines **1. G. hicksii**  
+ Corolla tube 12–15mm, uniformly blue ..... **2. G. doxiongshangensis**
9. Plants with fleshy roots and stolons; calyx lobes lanceolate, acuminate  
**3. G. loueirii**  
+ Plants with woody tap-root, without stolons; calyx lobes ovate or elliptic, acute ..... 10
10. Corolla tube 12–14mm, c 3 times as long as calyx tube .... **4. G. leucantha**  
+ Corolla tube 5–9mm, c 2 times as long as calyx tube ..... **5. G. infelix**
11. Calyx lobes obovate, apex broadly truncate, often retuse ..... 12  
+ Calyx lobes lanceolate or ovate, apex acute to obtuse ..... 14
12. Leaves and calyx lobes with lacerulate (minutely toothed) membranous margin ..... **27. G. lacerulata**  
+ Leaves and calyx lobes with smooth or minutely roughened (never toothed) margins ..... 13
13. Thickened margin of leaves and calyx lobes broad, white, minutely roughened; corolla with broad, dark reddish-purple bands ..... **25. G. emodi**  
+ Thickened margin of leaves and calyx lobes narrow, smooth; corolla white or bluish with narrow dark purple lines ..... **26. G. urnula**
14. Flowering shoots all 1-flowered, leaves mostly 0.5–2(–3)cm ..... 15  
+ Flowering shoots mostly with 2–8  $\pm$  clustered flowers, or if 1–2-flowered, then leaves mostly 3–10cm long ..... 26

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15. Leaves linear to lanceolate, 2–5mm broad, or ovate to obovate, 2–4mm broad ..... 16  
 + Leaves broadly ovate to obovate or spatulate, 4–20mm broad ..... 24
16. Plants with basal rosette and 1(–2) ± erect flowering shoots ..... 17  
 + Plants with or without basal rosette with 2–20 spreading ± decumbent flowering shoots ..... 18
17. Leaves linear-lanceolate, 15–30mm long; calyx lobes bluntly pointed  
**17. G. himalayensis**  
 + Leaves spatulate, 3–8mm long; calyx lobes sharply mucronate  
**23. G. tubiflora**
18. Calyx lobes suborbicular, strongly constricted at base ... **22. G. gilvostriata**  
 + Calyx lobes linear or lanceolate, not constricted at base ..... 19
19. Plants with distinct basal rosette of linear leaves, often longer than cauline leaves ..... 20  
 + Plants without distinct basal rosette of elongated leaves, but often with a cluster of bud-like shoots with very small leaves ..... 22
20. Corolla when open narrowly funnel-shaped, gradually tapering throughout  
**9. G. veitchiorum**  
 + Corolla when open ± campanulate, ± suddenly contracted into narrow base ..... 21
21. Corolla tube 23–35(–40)mm; lobes 2–5mm ..... **10. G. ornata**  
 + Corolla tube 40–47mm; lobes 4.5–6mm ..... **11. G. nyalamensis**
22. Corolla narrowly tubular ..... **12. G. prolata**  
 + Corolla broadly funnel-shaped ..... 23
23. Upper leaves linear-lanceolate, 1–2mm broad; plicae 1.5–2mm  
**13. G. oreodoxa**  
 + Upper leaves elliptic, 2–3mm broad; plicae to 1mm ..... **14. G. obconica**
24. Leaf apex acute, occasionally rounded, with distinct translucent, glandular-dentate margins ..... **24. G. depressa**  
 + Leaf apex rounded or retuse, without translucent glandular-dentate margins  
25
25. Upper leaves obscuring calyx ..... **18. G. phyllocalyx**  
 + Upper leaves not obscuring calyx ..... **19. G. venusta**
26. Corolla white or cream ..... **15. G. algida**

- + Corolla blue ..... 27
- 27. Leaves linear-lanceolate ..... **16. G. nubigena**
- + Leaves elliptic or ovate ..... 28
- 28. Stems  $\pm$  erect; upper cauline leaves subtending flowers; leaves on lateral rosettes lanceolate with long petioles ..... **20. G. elwesii**
- + Stems curved, decumbent; upper cauline leaves surrounding and sometimes covering flowers; leaves on lateral rosettes ovate or obovate, with short petioles ..... **21. G. sikkimensis**
- 29. Flowers in dense terminal heads, occasionally with axillary clusters; lower stem without leaves (sometimes leafy in *G. albicalyx*), very thin, root-like ..... 30
- + Flowers solitary or in cymes; lower stem with leaves ..... 33
- 30. Flower heads not subtended by large rosette leaves ..... 31
- + Flower heads subtended by large rosette leaves ..... 32
- 31. Leaves orbicular or broadly ovate, not recurved ..... **44. G. albicalyx**
- + Leaves ovate or elliptic, recurved ..... **41. G. marginata**
- 32. Rosette leaves 4; flowering time August–October ..... **43. G. cephalodes**
- + Rosette leaves numerous, imbricate; flowering time April–June, rarely October ..... **42. G. capitata**
- 33. Corolla throat fimbriate within ..... **45. G. wangchukii**
- + Corolla throat not fimbriate within ..... 34
- 34. Calyx lobes linear or lanceolate (sometimes ovate in *G. simulatrix*) ..... 35
- + Calyx lobes ovate or orbicular (sometimes almost lanceolate in *G. pedicellata*) ..... 42
- 35. Calyx much longer than corolla ..... **28. G. pluviarum**
- + Calyx shorter than corolla ..... 36
- 36. Leaves membranous, soft or spreading; basal leaves large, forming conspicuous rosette ..... 37
- + Leaves stiff, erect, imbricate (sometimes spreading in *G. karelinii*); basal leaves usually small, forming inconspicuous rosette ..... 39
- 37. Stems weak, 4–15cm long; plicae 1–2mm, fimbriate or asymmetrical ... 38
- + Stems  $\pm$  erect, 2–8cm; plicae 0.5–1.5mm, undulate or bidentate  
**31. G. maeulchanensis**

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38. Plicae lacinulate; style 0.5–1mm ..... **29. G. recurvata**  
 + Plicae asymmetrical, often auriculate; style less than 0.5mm . **30. G. prainii**
39. Flowering (December) February–July ..... 40  
 + Flowering August–October ..... 41
40. Stems branching from base, smooth; corolla tube 7–8mm  
**34. G. micantiformis**  
 + Stems papillose; branching above base; corolla tube 5–7mm  
**35. G. simulatrix**
41. Stem leaves linear-lanceolate, margins prominently translucent  
**32. G. micans**  
 + Stem leaves elliptic to spatulate, margins not prominently translucent  
**33. G. karelinii**
42. Stems ± smooth; leaves soft and widely spreading from base, smooth  
**40. G. glabriuscula**  
 + Stems glandular-papillose; leaves ± rigid, spreading from base or recurved, glandular-papillose, at least on margin ..... 43
43. Plants branching mostly above the base (forming leafy cymes); flowers on short leafy branches; calyx lobes and stem leaves not or weakly bordered  
44  
 + Plants branching mostly at base; flowers on elongate leafy branches; calyx lobes and stem leaves strongly bordered ..... 45
44. Leaves narrowly elliptic or lanceolate, papillose and ciliate-margined; calyx lobes ovate to lanceolate, not constricted at base ..... **36. G. pedicellata**  
 + Leaves ovate, almost smooth; calyx lobes suborbicular, strongly constricted at base ..... **37. G. vernayi**
45. Calyx lobes ovate with spreading tips; leaves ovate, finely papillose throughout, especially above ..... **38. G. bryoides**  
 + Calyx lobes orbicular with tips often deflexed; leaves broadly ovate or suborbicular, ± smooth except towards base ..... **39. G. crassuloides**

**1. G. hicksii** Ho & Liu

Decumbent perennial to 8cm, with fleshy tap-root. Leaves membranous, basal leaves linear, 15–40 × 2–4mm; stem leaves narrowly elliptic, 8–10 × 2–3mm, acute, margin entire, bases forming tube 0.5–2mm. Flowers terminal, solitary or in pairs. Calyx tube 4–5mm; lobes linear, 3–4 × 0.5mm, apex rounded. Corolla cream, striped green and purple; tube 15–20mm; lobes ovate, 8–12 × 3–5mm, apex rounded or acute; plicae narrowly triangular, 2.5 × 1mm, acute, irregular,

± bifid. Filaments attached less than halfway up corolla tube, 5–12mm; anthers 2mm. Ovary narrowly ellipsoid, 8–15 × 2mm; style 3–9mm. Capsule not seen.

**Bhutan:** N – Upper Kuru Chu/ Kulong Chu district (Pang La). Open wet slopes, 3960–4000m. September.

## 2. *G. doxiongshangensis* Ho

Perennial, with thick, fleshy roots. Flowering stems 6–14cm, arising from beside rosettes of basal leaves, decumbent at base, becoming erect, thinner, glabrous. Leaves slightly glandular, basal leaves lanceolate or narrowly elliptic, 8–35 × 2–5mm, obtuse or rounded, base attenuate to petiole; stem leaves elliptic, 5–10 × 2–4mm, sessile, margins slightly dentate, mid-vein prominent. Flowers 5(6)-merous, solitary, terminal. Calyx tube campanulate, 4–6mm; lobes lanceolate or narrowly triangular, 1–2 × 0.5–1mm, acute, margins smooth. Corolla deep blue, paler within; tube campanulate, 12–15mm; lobes ovate, 2–3 × 1.5–3mm, obtuse or rounded; plicae pale blue or white, irregularly triangular, auricular (on one side of corolla lobe), 0.5–1 × 0.5mm or less, margin entire. Filaments 4–7mm, winged, attached less than halfway up corolla tube; anthers 1.5–2mm. Ovary linear-ellipsoid, 6–11 × 1–2mm; style 0.5–1mm. Capsule narrowly ellipsoid, 13–15mm, not protruding from corolla.

**Bhutan:** N – Upper Kulong Chu district (Shingbe, Me La). Cliff-ledges and grassy or stony slopes, 4100–4200m. July–September.

The descriptions of floral parts are taken from Tibetan material.

## 3. *G. loureirii* (G. Don) Grisebach; *Gentiana aquatica* Loureiro non L., *G. indica* Steudel, *Ericala loureirii* G. Don

Tufted perennial, sometimes with stolons, 2–3cm, with long tap-root. Basal leaves forming rosette, elliptic or oblanceolate, 10–25 × 3–5mm, acuminate, base attenuate, sessile, margins glandular-ciliate; stem leaves elliptic, 4–6 × 1.5–2mm, acuminate, bases forming tube 1–2mm. Flowers solitary, terminal. Calyx tube 4–6mm; lobes lanceolate, 1–3 × 0.75–1mm, acuminate, margins finely glandular. Corolla blue, pale blue, pink, dull brownish red or white; tube 8–11mm; lobes ovate or oblong, 2–2.5 × 1–1.5mm, apex rounded or acute; plicae triangular, c 1mm × 0.5–1mm, acute or rounded, margins undulate. Filaments attached near base of corolla tube, 4–5mm; anthers 1.5–2mm. Ovary narrowly ellipsoid, 3–4 × 1–1.5mm; stipe 1.5–2mm. Capsule not seen.

**Bhutan:** C – Punakha, Tongsa, Bumthang, Mongar and Tashigang districts, N – Upper Kulong Chu district. In dry, hot meadows, grassy slopes and in clearings, 1220–2440m. April–May (July).

Although originally described as lacking a style with stigmas sessile and revolute, our plants have a distinct style 1.5–2mm.

## 4. *G. leucantha* Ho & Liu

Decumbent perennial c 2cm, with woody tap root and many ascending densely leafy stems from base. Lower leaves smallest, often withering at flowering, ovate

or spatulate, (2-)4-6 × (1-)1.5-3.5mm, acute, margin slightly thickened, not translucent, bases forming tube 1.5-3mm. Flowers solitary, terminal. Calyx tube campanulate, 4-5mm; lobes elliptic or spatulate, 3-4 × 1-2.5mm, slightly unequal, apex acute. Corolla white or cream with purple markings; tube 12-14mm; lobes ovate or oblong, 2-5 × 3-4mm, rounded; plicae narrowly triangular, 1-2 × 1-2mm, asymmetrical, bifid, acuminate. Filaments 3-6mm, attached to middle of corolla tube, winged at base; anthers 1.5-2mm. Ovary narrowly ellipsoid, 7-10 × 1-1.5mm; style linear, 1-2.5mm. Capsule (not seen) c 11mm long, included in corolla.

**Bhutan:** N - Upper Mangde Chu (Ju La) and Upper Kulong Chu district, (Me La). On screes and open grassy hillsides, 4270-4570m. July-August.

### 5. *G. infelix* Clarke

Decumbent perennial to 3.5cm with long woody tap-root. Stems woody, branching from base. Leaves fleshy, ovate-oblong, 3-5 × 1-2mm, acute, bases forming tube 1-2mm. Flowers 4- or 5-merous, solitary, terminal. Pedicels 1-2mm. Calyx tube 2-4mm; lobes ovate or orbicular, 2-4 × 1.5-2.5mm, apex acute. Corolla blue or white with blue markings; tube 5-9mm; lobes oblong or ovate, 2-4 × 1.5-3mm, apex rounded, inrolled; plicae narrowly triangular, c 1 × 0.5mm, auricular, sometimes indistinct. Filaments attached halfway up corolla tube, 1.5-2.5mm; anthers 0.5-1mm. Ovary narrowly cylindrical, 3.5-6 × 1-1.5mm; style absent. Capsule cylindrical, 7-8 × 2-2.5mm.

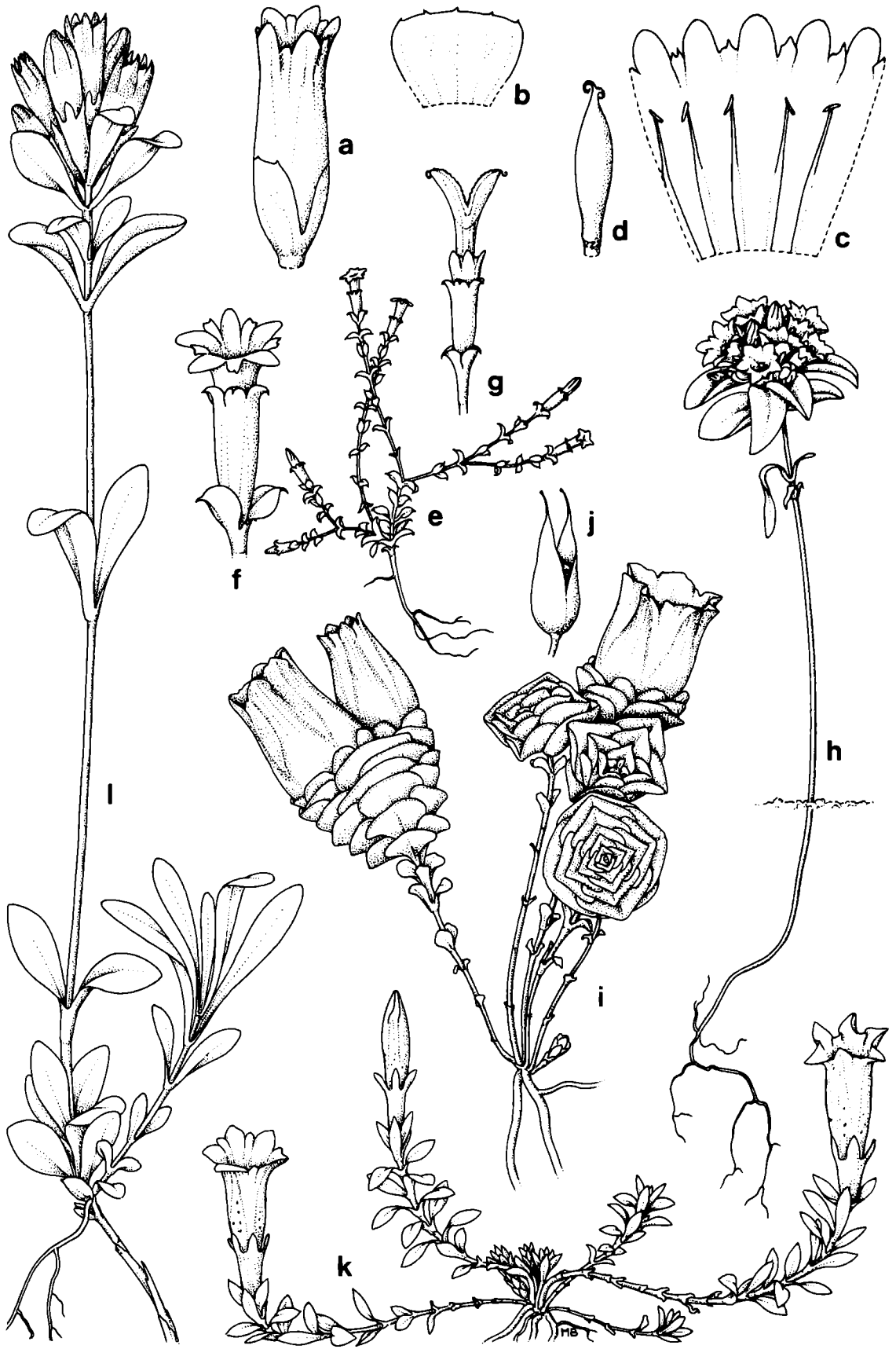
**Bhutan:** N - Upper Kuru Chu district (Narim Thang) and Upper Kulong Chu district (Me La); **Sikkim:** Yak La, Yumthang, Kanko La, Sebu La and Tangkar La. Open grassy hillsides, rock crevices and scree, 4420-5040m. July-August.

### 6. *G. tibetica* Hook.f. Fig. 63a-d.

Erect perennial to 30cm. Stems terete, unbranched. Remains of old petiole bases persistent as fibrous cluster below leaves. Leaves coriaceous, lanceolate, basal leaves 10.5-26 × 3.5-6.5cm, base attenuate to broad petiole 2-10cm; stem leaves 6-12 × 1.5-2.8cm, sessile, bases forming tube 0.5-1.5cm, apex acute, margins entire. Flowers in terminal and axillary clusters, sessile, subtended by lanceolate leaf-like bracts, 4-12 × 1.5-3.5cm. Calyx thin, papery; tube split on one side, 7-15mm, truncate; lobes almost absent, c 1mm × less than 0.5mm, tooth-like, acuminate. Corolla white, greenish or yellowish tinged brown; tube 17-20mm; lobes oblong, 3-5 × 2-2.5mm, acute; plicae very shallowly triangular, irregular, dentate, less than 1mm. Filaments 4-6mm, attached near base of

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FIG. 63. **Gentianaceae.** a-d, *Gentiana tibetica*: a, flower (× 1); b, calyx (× 1); c, corolla (× 1); d, ovary (× 1). e-g, *G. bryoides*: e, habit (× 2/3); f, flower (× 3); g, capsule (× 1 1/2). h, *G. capitata*: habit (× 2/3). i-j, *G. urnula*: i, habit (× 2/3); j, capsule (× 2/3). k, *G. prolata*: habit (× 2/3). l, *G. elwesii*: habit (× 2/3). Drawn by M. Bates.



corolla tube; anthers 1.5–2mm. Ovary ellipsoid, 10–12 × 2–3mm; stipe 1–2.5mm; style 0–2mm. mature Capsule ellipsoid, included in corolla, not seen.

**Bhutan:** C – Ha district (Ha), Thimphu district (Barshong, Dotena, Shingkarap) and Bumthang districts (Ura), N – Upper Mo Chu district (Lingshi); **Sikkim:** doubtful (unlocalised *Cooper* specimen); **Chumbi.** On sandy turf, 2740–4420m. June–September.

**7. *G. robusta*** Hook.f.; *G. tibetica* Hook.f. var. *robusta* (Hook.f.) Kusnezow, *G. pharica* Burkill, *G. lhakangensis* Marquand

Similar to *G. tibetica* but leaves linear, basal leaves 5–50 × 1–3.5cm; stem leaves 2.5–7.5 × 0.5–1.3cm, margins slightly scabrous; flower heads less dense; bracts much smaller and narrower, 1.5–3(–6) × 0.5–1(–1.5)cm; calyx tube 10–15mm; lobes unequal, very small, narrowly triangular, subulate-tipped, 2 longer than the others, 0.5–2 × 0.5mm or less, acuminate; corolla creamy white with dark stripe at base, sometimes with green markings; tube 15–25mm; lobes ovate, 2–3 × 2.5–3mm, obtuse; plicae triangular, 1–1.5 × 1.5–2mm, acute; filaments attached near middle of corolla tube, 7–9mm; anthers 2–2.5mm; ovary cylindrical, 8–13 × 1–1.5mm; stipe 1.5–3mm; style linear, 1.5–2mm. Capsule not seen.

**Sikkim:** Lhonak, Naku La; **Chumbi:** N. of Phari. On banks, 4570–5200m. August–September.

**8. *G. meiantha*** (Clarke) H. Smith; *G. ornata* Wall. var. *meiantha* Clarke

Prostrate perennial with overwintering cluster of young shoots. Stems slightly glandular. Leaves on barren shoots elliptic, 2–3 × 1–1.5mm, leaves on flowering shoots lanceolate or elliptic, 5–11 × 1.5–2.5mm, acute, margins finely scabrous, bases forming tube 0.5–2mm. Flowers terminal, solitary. Pedicels c 1mm. Calyx tube 5–6mm, membrane truncate; lobes lanceolate; unequal, 4–6 × 1–2mm, acute. Corolla tube 9–18mm, cream with dark veins at base, dark blue or purple at apex; lobes ovate, 1.5–3 × 1.5–3mm, acute; plicae shallowly ovate, rounded, less than 0.5 × 1–2mm. Filaments 3–5mm, attached halfway up corolla tube, winged, widening at base; anthers 1–1.5mm. Ovary narrowly ellipsoid, 4.5 × 1mm; stipe 1.5mm; style 1–1.5mm. Capsule ellipsoid, 8 × 3mm, not protruding from corolla; stipe elongating up to 4mm.

**Sikkim:** Pedong, Zongri, Yampung. On moist banks in *Rhododendron* forest, 3270–3960m. September.

**9. *G. veitchiorum*** Hemsley; *Gentianodes veitchiorum* (Hemsley) Löve & Löve

Trailing, procumbent perennial. Flowering stems up to 8cm long; young shoots forming central rosette of linear leaves, often longer than stem leaves, 12–20(30) × 1–2mm; stem leaves elliptic to linear-lanceolate, 6–20 × 1–2mm, acute, bases forming tube 1–2mm, margins finely glandular. Flowers terminal, solitary. Pedicels 0–3mm. Calyx tube 11–14mm, membrane truncate; lobes



linear-lanceolate, 8–11 × 1mm, apiculate. Corolla deep blue, streaked yellow-green; tube 30–50mm, very narrowly funnel-shaped; lobes ovate, 4–6 × 3–4mm, acute, mucronate; plicae shallowly ovate, 1–2 × 5–6mm, multidentate. Filaments 8–12mm, attached halfway up corolla tube, winged; anthers 1.5–2mm. Ovary very narrowly oblong-ellipsoid, 9–11 × 0.75–1.5mm; stipe 9–30mm; style slender, 2.5–3mm. Capsule not seen.

**Bhutan:** C – Bumthang/Mongar district (Rudong La); **Sikkim:** Lhonak, Bapekha. On grassy moorland, 3350–5030m. August–October.

T.N. Ho has determined a specimen from Soe (*Rushforth* 808) as the hybrid *G. farreri* Balfour f. × *G. veitchiorum* Hemsley.

#### 10. *G. ornata* (G. Don) Grisebach; *Pneumonanthë ornata* G. Don

Similar to *G. veitchiorum*, but lower leaves elliptic, 5–8 × 1.5–3mm; upper leaves lanceolate-linear, 11–15 × 2–3mm, curved to one side; calyx tube 10–16mm, lobes linear-lanceolate, 5–7 × 1–1.5mm, curved; corolla pale blue striped white or green, tube campanulate, 23–35(–40)mm, suddenly contracting above calyx, lobes broadly ovate, 2–5 × 4–7mm, obtuse; plicae 1–3 × 4–6mm; filaments attached less than halfway up corolla tube, 7–10mm.

**Bhutan:** C – Thimphu district (Tarka La); **Sikkim:** Lhonakh, Thanka La, Zongri. On peaty turf, open grassy slopes, 3960–4880(–5180)m. August–November.

#### 11. *G. nyalamensis* Ho

Decumbent glabrous perennial, to 10cm tall. Leaves on non-flowering shoots linear-lanceolate, 7–20 × 1–3mm; lower leaves on flowering shoots ovate; upper leaves elliptic to lanceolate, 6–12 × 2–3mm, acute, mucronate, margins scabrous, bases forming tube c 2mm. Flowers solitary, terminal, sessile. Calyx tube obconical, 11–15mm, lobes linear-lanceolate, 8–11 × 1–2mm, acuminate, mucronate. Corolla deep blue above, yellow-green below, striped and spotted blue; tube 40–45mm, inflated above middle; lobes ovate, 5–6mm, obtuse, mucronate; plicae broadly ovate, 2–3 × 4–7mm, margins multidentate. Filaments 8–10mm, attached below middle of corolla tube, bases free or forming short tube. Ovary linear-ellipsoid, 10–11mm; style slender, 5–6mm. Capsule ellipsoid, 13–15mm, on thick stipe to 20mm long, included in corolla.

**Bhutan:** N – Upper Bumthang Chu district (Pangothang). Open grassy hillsides, 4270m. September.

Similar to *G. veitchiorum*, but corolla deep blue, campanulate, abruptly inflated above middle, apex of lobes mucronate. According to *Flora of China* (257) the corolla lobes are entire or 2-cleft unlike the Bhutanese plant with mucronate lobes.

#### 12. *G. prolata* Balf.f.; *G. ornata* sensu F.B.I. p.p. (Sikkim plants) Fig. 63k.

Stems decumbent, to 10cm long, with ascending tips, simple or branched, dying back after flowering; central cluster of stout non-flowering leafy shoots

remaining as green overwintering buds, becoming prostrate the following year. Leaves thick, elliptic or ovate, 4–8 × 2–4mm on non-flowering shoots and lower flowering shoots; upper leaves becoming more lanceolate, 6–11 × 2–4mm, acute, slightly mucronate, margin slightly cartilaginous, scabrous. Flowers solitary, terminal, sessile. Calyx tube 6–10mm; lobes elliptic or lanceolate, 3–9 × 1–2mm, acuminate, membrane truncate. Corolla tube white, striped blue, narrowly tubular, 4–8mm diameter, 25–35mm long, widening slightly above calyx; lobes blue, ovate, 3–4 × 2–4mm, acute, often almost closed at mouth even when flower is fully developed; plicae unevenly triangular, 1–1.5 × 1–2mm. Filaments 4–5mm, narrowly winged, attached at middle of corolla tube; anthers 1–2mm. Ovary narrowly ellipsoid, 9–10 × 2–4mm; stipe 12–15mm; style 1–2mm. Capsule ellipsoid-oblong, 9–13 × 2–3mm; stipe elongating to 40 or 50mm, protruding from corolla.

**Bhutan:** C – Thimphu, Mongar and Tashigang districts, N – Upper Mo Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Zongri, Gochung, Nathang, Kupup, Tsomgo, Yak La, Pedong, above Chemathang, E. side of Onglakthang glacier; **Chumbi:** Phari plain. On mossy tussocks in wet meadows and on open grassy slopes, 3200–5180m. July–October.

### 13. *G. oreodoxa* H. Smith

Similar to *G. prolata* in habit but with shorter flowering stems to 4cm long; upper leaves ovate-elliptic or linear, 7–12 × 1–3.5mm, margins not cartilaginous; calyx tube 10–12mm; lobes linear, 6–8 × 0.5–1mm; corolla blue with darker bands, striped greenish white, tube obconical, narrow within calyx (widening more abruptly than *G. prolata*), 8–16mm diameter, 30–35mm long, lobes blue, ovate, 3–4 × 5–6mm, obtuse or rounded, mucronate; plicae broader, truncate, unevenly dentate, 1.5–2 × 4–7mm; style linear, 4mm; capsule ellipsoid 12–13mm; stipe 17mm.

**Bhutan:** C – Ha district (Saga La); **Sikkim:** Jelep La. Open moist pasture, 3350–4750m. September–October.

Very similar in appearance to *G. ornata*, but differs in not having basal rosette of linear leaves and possibly a darker blue corolla. In the only fruiting specimen seen (*Ludlow, Sherriff & Hicks* 17571, BM), the capsule is included in the corolla.

### 14. *G. obconica* Ho

Similar to *G. oreodoxa* but stem leaves ovate or elliptic, sometimes linear, 7–12 × 1–3.5mm; calyx tube 8–15mm, lobes elliptic or lanceolate, 4–6 × 1–3mm, acuminate; corolla intense blue, broadly striped or spotted dark purple or base yellow-green spotted blue, broadly obconical, tube very narrow within calyx, inflated above 10 × 20mm in diameter, 20–40mm long, lobes (more triangular in appearance than in *G. oreodoxa*) 4–5 × 5–6mm, mucronate; plicae c 1 × 4–6mm; ovary narrowly cylindrical, 6–10 × 1–1.5mm; stipe 15–25mm; style linear, 3–4mm. Mature capsule not seen.

**Bhutan:** C – Thimphu district, N – Upper Mo Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Zongri; **Chumbi:** Chho La, Yatung. Open grassy hillsides, 3960–4720m. July–October.

**15. *G. algida*** Pallas; *Gentianodes algida* (Pallas) Löve & Löve

Erect perennial to 15cm; rhizome truncate. Stems terete, to 15cm tall. Leaves linear, basal leaves 15–100 × 1–8mm, forming a long papery sheath 3cm (below ground?); stem leaves 15–35 × 2.5–5mm, apex rounded, bases forming tube 2–10mm, margin finely glandular-serrate. Flowers terminal and axillary, solitary or in 3–4-flowered cymes. Calyx tube 9–15mm; lobes unequal (1 short, 4 long), linear-lanceolate, 3–8 × 1–3mm, acute. Corolla campanulate, creamy white, striped and spotted dull green or slaty blue; tube 28–45mm; lobes ovate, 4–5 × 3–6mm, acute; plicae 0.5–1 × 3–4mm, irregular, dentate or undulate. Filaments attached less than halfway up corolla tube, 11–15mm, winged; anthers 3mm. Ovary narrowly ellipsoid, 12–15mm; stipe 12–17mm; style 3–4mm. Capsule ellipsoid, 12–20 × 4–5mm, protruding from corolla; stipe elongating to 30mm.

**Bhutan:** N – Upper Kulong Chu district (Cho La). On scree and damp grassy slopes, 4260–5030m. August–October.

**16. *G. nubigena*** Edgeworth; *G. przewalskii* Maximowicz; *G. algida* Pallas var. *przewalskii* (Maximowicz) Kuznezow, *G. algida* Pallas var. *nubigena* Edgeworth, *Gentianodes algida* (Pallas) Löve & Löve var. *nubigena* (Edgeworth) Omer et al.

Similar to *G. algida* but corolla dark blue at mouth, creamy white striped blue at base.

**Bhutan:** N – Upper Mo Chu district (Lingshi, Shingche La, Yale La) and Upper Mangde Chu district (Passu Sepu); **Sikkim:** Kanchenyao, Lhonak; **Chumbi:** Dotha and Gautsa to Phari. Rocky slopes, wet scree and grassy banks, 4100–4880m. August–October.

**17. *G. himalayensis*** Ho; *G. algida* Pallas var. *parviflora* (Clarke) Kuznezow, *G. nubigena* Edgeworth var. *parviflora* Clarke

Erect, clump-forming perennial; rhizome truncate. Leaves linear-lanceolate, arising directly from roots, bases of outer leaves forming a papery sheath up to 2cm. Basal leaves 20–30 × 2–5mm; stem leaves 15–20 × 2–3mm, apex rounded, margins finely glandular-serrate. Flowers solitary, terminal, sessile or on peduncles to 4cm. Calyx tube 10–13mm; lobes ovate, 3–4 × 1–2mm, apex obtuse. Corolla bright blue, striped darker blue; tube 25–30mm; lobes oblong, 4–5 × 2–5mm, apex rounded; plicae shallow, 0.5–1mm, irregular, dentate. Filaments attached halfway up corolla tube, 8–9mm, widening at base; anthers 2–3mm. Ovary narrowly ellipsoid, 8–10 × 1.5–3mm; stipe 10–15mm; style c 2mm. Capsule narrowly ellipsoid, 10–13 × 3mm.

**Bhutan:** C – Tongsa district, N – Upper Pho Chu district (Gafoo La) and

Upper Mangde Chu district (Passu Sepu area); **Sikkim**: Naku La, Kangchenyao, above Yume Samdong. Open grassy hill slopes, 4570–4880m. July–September.

**18. *G. phyllocalyx* Clarke**

Erect annual to 14cm. Stems solitary. Roots fibrous, with thicker runners from the axils of the basal leaves. Basal leaves forming a rosette, obovate; stem leaves similar but in widely spaced pairs, 7–18 × 4–12mm, retuse or rounded, sometimes slightly mucronate, margins minutely papillose, bases of stem leaves attenuate, semi-amplexicaul. Flowers 5-merous, solitary, terminal, sessile. Calyx obscured by upper leaves, tube 4–6mm; lobes lanceolate, unequal, 3–5 × 0.5–1mm, acuminate. Corolla deep blue, striped blue-black; tube 20–40mm; lobes ovate, 2–3 × 3–4mm, obtuse; plicae multidentate, 1 × 2–3mm. Filaments attached less than halfway up corolla tube, 8–10mm, winged; anthers 2–3mm. Ovary narrowly ellipsoid, 7–13 × 2–3mm; stipe 6–8mm; style linear, 2–5mm. Capsule ellipsoid, 15–25 × 5–7mm, protruding from corolla; stipe elongating to 12–55mm.

**Bhutan**: C – Tongsa district, N – Upper Mo Chu, Upper Pho Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim**: Thangu, Chomnagu, above Yume Samdong, Lachen, Kankola, Tangkar La, Ningbil. On scree or steep grassy slopes, sometimes among *Rhododendron*, 3960–4880m. June–September.

**19. *G. venusta* (G. Don) Grisebach; *Gentianodes venusta* (G. Don) Omer et al.**

Similar to *G. phyllocalyx* but 2–3cm high, only rarely forming erect stems; leaves smaller, 5–10 × 3–7mm; calyx not obscured by upper leaves, tube 8–10mm, lobes 2–3 × 0.5–1mm; corolla blue, paler towards base, tube 15–25mm, lobes 1.5–2 × 1.5–2mm; capsule ellipsoid, 15 × 3mm; stipe elongating to 20–30mm.

**Chumbi/Bhutan border**: East of Phari. On open grassy slopes, 3962–5200m. August–September.

**20. *G. elwesii* Clarke; *Gentianodes elwesii* (Clarke) Löve & Löve. Fig. 631.**

Erect perennial to 35cm. Stems unbranched, ridged, glandular. Basal leaves ovate to lanceolate, 12–35 × 2–10mm, attenuate to broad petiole 3–30mm; stem leaves elliptic or oblong, 16–20 × 5–12mm, base forming a short tube 2–3mm, apex rounded, acute or obtuse, margins glandular, mid-vein prominent. Flowers in cymes made up of terminal and axillary umbels or solitary flowers. Pedicels 1–10mm. Calyx tube 9–12mm, narrowing abruptly at base; lobes unequal, elliptic or lanceolate, 2–6 × 0.5–2mm. Corolla tube white at base, sometimes flecked blue, deep blue above, 22–24mm; lobes triangular, 1–2 × 2–3mm, obtuse or rounded; plicae paler blue or white, triangular, c 1 × 2mm, asymmetrical, slightly dentate, obtuse or acute. Filaments 11–15mm, widening at base, winged, attached less than halfway up corolla tube; anthers 1.5–2mm. Ovary narrowly ellipsoid, 10–15 × 2–5mm; stipe 7–9mm; style 0–2mm. Capsule ellipsoid, 13–15 × 4–5mm.

**Bhutan:** C – Ha, Thimphu and Tongsa districts, N – Upper Mo Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Tsomgo, Zongri, Yume Chu, Bikbari, Jonsang La valley; **Chumbi.** In grassy meadows among dwarf rhododendrons, 3660–5100m. July–September.

*G. longepetiolata* Kuznezow (*Gentianodes longipetiolata* (Kusnezow) Löve & Löve) seems to be a form of *G. elwesii* Clarke with more numerous flowers. It is based on a *Thomson* type from Sikkim which was not available for study.

**21. *G. sikkimensis* Clarke; *G. pseudosikkimensis* Wilkie, *Gentianodes sikkimensis* (Clarke) Löve & Löve**

Mat-forming perennial to 9(–19)cm. Stems ridged, slightly glandular. Basal leaves mainly in rosettes on non-flowering shoots, ovate or oblong, 6–11 × 3–6mm rounded or obtuse, base attenuate to broad petiole 2–4mm, forming short tube less than 1mm; stem leaves ovate or spatulate, 5–30 × 4–11mm, rounded or obtuse, petiole 2–9mm, margins glandular, mid-vein prominent. Largest upper leaves subtending and sometimes covering flowers. Flowers in terminal clusters, occasionally axillary. Calyx split at one side, tube 6–9mm; lobes unequal, elliptic or lanceolate, 1.5–3 × 0.5–1mm, acute. Corolla white or pale green on lower half, dull blue above; tube 16–20mm; lobes orbicular or ovate, 2–3 × 2.5–3mm, obtuse; plicae shallowly triangular, irregularly dentate, 1 × 1–2mm. Filaments 5–6mm, widening at base, winged, attached less than halfway up corolla tube; anthers 1–1.5mm. Ovary ellipsoid, 9–12 × 2–3mm; stipe 7–8mm; style 1–1.5mm. Capsule ellipsoid, 9–12 × 3–5mm; stipe elongating to 16mm.

**Bhutan:** C – Thimphu, Punakha and Mongar districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Sikkim:** Pedong, Zongri, Yak La, Nathang, Pheonp, Sherabthang and Lhonak. In *Abies* and *Rhododendron* forest, 3200–4270m (–5180m in Sikkim). August–October.

**22. *G. gilvostriata* Marquand**

Decumbent, little-branched, tufted perennial c 4cm. Leaves on non-flowering shoots obovate, 4–6 × 1–2mm, including broad petiole c 2cm, apex rounded; leaves on flowering shoots obovate to oblanceolate or spatulate, 7–10 × 2–3mm including broad petiole 3mm, apex acute, margins finely glandular-ciliate. Flowers solitary, terminal. Pedicels 0–3mm. Calyx tube 13–14mm, ridged, membrane truncate; lobes suborbicular, 2–5 × 2–2.5mm, narrowing abruptly at base. Corolla tube bright sky blue, striped cream, spotted purple, 22–34mm; lobes orbicular or broadly ovate, 3–4 × 3–4mm, acute; plicae obtuse, c 1–3mm. Filaments attached less than halfway up corolla tube, 10–12mm, winged at base; anthers 1.5–2mm. Ovary ellipsoid, 7–11 × 1–3mm; stipe 2–4mm; style 10–12mm. Capsule not seen.

**Bhutan:** C – Mongar district (Khoma Chu) and Sakden district (Orka La), N – Upper Kulong Chu district (Me La). Open hillsides, in moss on river banks

and on rocks and gravel patches between rhododendrons, 3660–4270m. September–October.

**23. *G. tubiflora*** (G. Don) Grisebach; *Ericala tubiflora* G. Don

Tufted perennial to 5cm. Stems very short, solitary, arising from basal rosette. Basal leaves rosulate, spatulate, 5–8(–10) × 1–2.5mm; stem leaves spatulate, 2–7 × 1–4mm, conduplicate, acute, mucronate, bases forming tube 1–2mm, margins thinly cartilaginous, scabrous. Flowers solitary, terminal, sessile. Calyx tube 7–15mm; lobes lanceolate, 2–6 × 1–1.5mm, mucronate. Corolla dark blue; tube 16–37mm, narrow; lobes ovate, 2.5–5 × 2–4mm, acute, sometimes mucronate; plicae 0.5–1 × 2–3mm, multi-dentate or undulate. Filaments attached near middle of tube, 4–6mm, winged; anthers 0.75–1.5mm. Ovary narrowly ellipsoid, 6–12 × 1.5–3mm; stipe 3–8mm; style slender, 5–9mm. Capsule ellipsoid, 9–14 × 2–3mm, protruding from corolla; stipe elongating to 40mm.

**Bhutan:** C – Ha, Thimphu and Tongsa districts, N – Upper Mangde Chu, Upper Bumthang Chu, Upper Kuru Chu and Upper Kulong Chu districts; **Sikkim:** Yak La, Yume Samdong, Gora La, Gocha La, Sebu La; **Chumbi:** Open grassy hillsides and scree, 4420–5040m. July–October.

**24. *G. depressa*** D. Don; *Pneumonanthe depressa* (D. Don) D. Don, *Ericala depressa* (D. Don) G. Don, *Gentianodes depressa* (D. Don) Löve & Löve

Mat-forming perennial with decumbent stems c 4cm high. Leaves in dense, square-shaped rosettes, ovate, elliptic or spatulate, 9–24 × 4–12mm, mid-vein prominent, apex acute or rounded, mucronate, margins finely glandular-dentate, thin, white, bases forming tube 8–9mm. Flowers terminal, solitary, sessile. Calyx tube 8–13mm, membrane truncate; lobes unequal, usually narrowed at base, elliptic or broadly ovate, 4–6 × 3–5mm, mucronate, margin thin, white, membranous, glandular-dentate. Corolla bright blue or violet inside, lower half greenish-white, spotted purple, outside dull purple; tube urceolate, 22–29mm; lobes broadly ovate, 3–4 × 4–5mm, subacute with mucronate point; plicae pale mauve or blue, ovate or broadly oblong, 2–3 × 3–4mm, acute or rounded, margin dentate. Filaments 11–12mm, attached less than halfway up corolla tube, widening at base; anthers 2.5–3.5mm. Ovary narrowly cylindrical, 10–11mm × 2mm; stipe 3.5–6mm; style 6–7mm. Capsule not seen.

**Bhutan:** C – Thimphu district (Mem La, Paro valley); **Sikkim:** locality unknown; **Chumbi:** Yatung, Phari. On cliffs and gravelly hill slopes, 3350–3660m. (May) August–October.

The records of the Tibetan *G. amplicrater* Burkill from Sikkim (135) have not been confirmed. It differs from *G. depressa* in its longer corolla tube 30–50mm and non-mucronate corolla lobes.

**25. *G. emodi*** Sealy; *G. amoena* Clarke non Weddell, *Gentianodes emodii* (Marquand) Löve & Löve. Med: *Gangachhung*.

Mat-forming perennial with decumbent stems to 5cm tall. Leaves folded,

forming dense, square-shaped rosettes, flowering shoots broadly obovate, 6–13 × 7–8mm, on non-flowering shoots 3–5 × 1–4mm, apex truncate, rounded or retuse, mucronate, margins and mid-vein broad, pale, minutely roughened, entire, not dentate, bases forming tube 2–4mm. Flowers terminal, solitary, sessile. Calyx tube 7–11mm, membrane truncate; lobes equal, broadly obovate, 4–7 × 4–5mm, apex truncate or retuse, mucronate, margins broad, pale. Corolla purple-black or dark wine purple, paler below; tube campanulate, 17–25mm; lobes ovate, 2–3 × 1–2mm, apex rounded or retuse, not mucronate; plicae shallowly triangular, 2–3 × 1–2mm, apex asymmetrical, rounded. Filaments 9–11mm, attached less than halfway up corolla tube, winged, broadening at base; anthers 1.5–2mm. Ovary narrowly ellipsoid, 8–10 × 1–3mm, including stipe, 2mm; style 4–5mm. Capsule narrowly ovoid, 1 × 3mm.

**Bhutan:** N – Upper Mo Chu, Upper Mangde Chu and Upper Bumthang Chu districts; **Sikkim:** Samdong, Dongkya La, Hangma La, Lhonak; **Chumbi:** Chomo Lhari. On sandy, gravelly scree, 4270–5030m. August–October.

**26. *G. urnula*** H. Smith; *G. amoena* Clarke forma *pallida* Marquand, *G. amoena* Clarke var. *major* Burkill, *Gentianodes urnula* (H. Smith) Löve & Löve. Med.: *Gangachhung*. Fig. 63i&j.

Rosette- or mat-forming perennial to 4cm tall. Roots thick, fibrous, much longer than in other species of this group. Stems prostrate, elongated, covered with small leaves, ending in square-shaped rosette of larger, slightly fleshy leaves. Stem leaves obovate, 4–9 × 5–8mm; upper leaves closely overlapping, broadly obovate, 13–18 × 13–18mm, retuse, slightly mucronate, recurved, margins narrow, pale, smooth, bases forming tube 0.6–1.5mm on stems, 1–2mm on rosettes. Flowers in terminal clusters. Calyx tube white, papery, 11–13mm; lobes obovate or orbicular, 5–7 × 7–8mm, apex truncate or retuse, margin narrow, pale, smooth, membrane truncate or forming flaps below lobes. Corolla papery, white or blue-violet with dark stripes and spots on upper part; tube widely cylindrical, 15–30mm; lobes ovate, 2–3 × 4–6mm, mucronate; plicae shallowly oblong, 1–2 × 2–4mm, margins entire or slightly dentate. Filaments attached less than halfway up corolla tube, 4–10mm, winged, widening at base; anthers 3–4mm. Ovary ovoid-ellipsoid, 6–13 × 2–4mm; stipe 2–8mm; style 6–7mm. Capsule ellipsoid, 18–23 × 7–9mm, protruding from corolla on long stipe 10–40mm.

**Bhutan:** C – Ha district (Ya La), N – Upper Mo Chu district (Yale La, Nelli La); **Sikkim:** no specimens seen (220) **Chumbi:** near Phari. On scree slopes, 4570–4880m. July–October.

**27. *G. lacerulata*** H. Smith

Perennial to 6cm tall with mats of square-shaped dense rosettes. Leaves broadly obovate, 4–13 × 7–10mm, apex retuse, slightly mucronate, margins and midrib thin, membranous, translucent, finely dentate or lacinulate, bases forming tube 2–7mm. Flowers solitary, terminal. Calyx tube 13–18mm; lobes

broadly obovate, 3–5 × 5–6mm, apex retuse, with small recurved mucro, margins membranous, translucent, finely dentate. Corolla tube brilliant blue tinged purple, brownish purple or blue-violet, 24–32mm; lobes ovate, 3–5 × 5–6mm, rounded or acute, slightly mucronate; plicae pale blue, sometimes tinged red, shallowly triangular or rounded, 2–3 × 4–5mm, margin coarsely dentate. Filaments 7–11mm, attached halfway or higher up corolla tube, broader at base; anthers 2–2.5mm. Ovary narrowly ellipsoid, 8–10 × 2–4mm; stipe 4–5mm; style 8–18mm. Capsule ellipsoid, 15 × 5mm, protruding from corolla on long stipe 28–40mm.

**Bhutan:** C – Thimphu district, N – Upper Mo Chu, Upper Mangde Chu and Upper Kulong Chu districts, **Sikkim:** recorded from Kabru and elsewhere (220); **Chumbi:** near Phari. On scree and gravel and on grassy rocks and damp mossy banks in ravines, beside streams, 3780–4600(–5400)m. September–October.

### 28. *G. pluviarum* W.W. Smith

Semi-decumbent annual, 2–3cm tall, branching from base. Leaves membranous, basal leaves rosulate, ovate, 5–6 × 2–3mm, subacute, stem leaves linear, 1–2(–4) × 0.5–1mm, recurved, apiculate, bases forming tube 1–2mm. Flowers 4-merous (or 5-merous in Nepal), solitary, terminal. Calyx tube 2–4mm; lobes linear, 1.5–3mm, apiculate or obtuse, recurved, often much longer than corolla. Corolla white with dark blue blotches at base; tube to 3mm; lobes shallowly ovate, 0.5 × 1mm, entire, obtuse; plicae broadly ovate, 0.5 × 0.5mm or less, rounded, mucronate. Filaments 0.5–1.5mm, attached less than halfway up corolla tube; anthers 0.5mm. Ovary ovoid, 1–2 × 0.5–1mm; stipe less than 0.5mm; style linear, 0.5mm or less. Capsule not seen.

**Sikkim:** Chomnagu, Tsomgo, Chho La. On open slopes, 3960m. July.

### 29. *G. recurvata* Clarke

Weak-stemmed, branching, decumbent annual. Stems 5–15cm long. Leaves membranous, basal leaves forming rosette, ovate or broadly spatulate, 6–11 × 4–10mm, obtuse; stem leaves ovate or oblong, 4–10 × 1–4mm, apiculate, bases forming short tube 1mm, margins scabrous. Flowers solitary or in very lax cymes. Pedicels 2–10mm. Calyx tube 2.5–3mm; lobes lanceolate, 1–1.5mm, acuminate. Corolla bright blue, tube 6–8mm; lobes ovate, 2–3 × 1.5–2mm, acute; plicae oblong, 1.5–2 × 1mm, fimbriate into linear-clavate segments. Filaments filiform, 1–1.5mm, attached halfway up corolla tube; anthers less than 0.5mm. Ovary obovoid or oblong, 0.5–2mm; stipe 2–2.5mm; style filiform, 0.5–1mm. Capsule obovoid or oblong, 5–6 × 2–3mm, crested, stipe elongating to 10mm, sometimes protruding from corolla.

**Sikkim:** Kupup, Tong, Yak La, Fiyengong, Lachung; **Chumbi.** Among bamboo on top of ridge, 2740–3660m. (May)July–October.

### 30. *G. prainii* Burkill; *G. recurvata* Clarke subsp. *prainii* (Burkill) Halda

Similar to *G. recurvata* but corolla blue or white with black spots, lobes



sometimes obtuse, mucronate, plicae not fimbriate, ovate, acute, asymmetrical, often auriculate on one side; filaments 2.5–3mm, attached less than halfway up corolla tube, winged; style absent.

**Bhutan:** C – Thimphu district (between Dotena and Barshong) and Tashigang district (near Tashigang); **Sikkim:** Tsomgo, Chomnagu, Nathang, Kupup, Sherabthang, Zongri. Peaty meadows, 3350–4270m. July–August.

### 31. *G. maeulchanensis* Franchet

Erect annual to 8cm. Stems finely glandular, branched on upper part. Basal leaves rosulate, often reddish, broadly ovate, 9–15 × 6–9mm, obtuse, mucronate, base narrowing to short, broad petiole 1–2mm; stem leaves obovate or spatulate, 4–5 × 1–2mm, acute, sometimes recurved, mucronate, with narrow, weakly papillose, membranous margin. Flowers in terminal and axillary cymes. Calyx tube 4–5mm; lobes narrowly lanceolate, 2–3 × 0.75–1mm, acute, erect, margins narrow, membranous. Corolla pale blue (greenish yellow in fruit); tube 7–9mm; lobes ovate or oblong, 1–1.5 × 1–1.5mm, acute, mucronate; plicae very shallowly ovate or oblong, 0.5–1 × 2–3mm, margin undulate or bidentate. Filaments attached less than halfway up corolla tube, filiform, 2–2.5mm; anthers 0.5–1mm. Ovary obovoid, 3–5 × 2–3mm; stipe c 2mm; style 0.5mm or less. Capsule obovoid, 5–6 × 3–4mm, crested, protruding from corolla; stipe elongating to 6–7mm.

**Bhutan:** C – Thimphu district (Dotena, Dochong La), Punakha district (Punakha) and Bumthang district (Gyetsa); **Sikkim:** Yak La, Lachen; **Chumbi:** Yatung. In mixed forest and on river banks, 2440–3200m. April–June.

The specimen from Gyetsa (*Gould* 414, K) has been identified variously as *Gentiana leucomelaena* Maximowicz, *G. pseudo-aquatica* Kusnezow and *Ciminalis baltistanica* Omer. However it is a poor specimen of *G. maeulchanensis* which has lost its basal rosette of leaves.

A specimen from Khodakha valley, Punakha district (*Chambers* s.n.) represents an additional taxon close to *G. maeulchanensis* but differs in its obtuse calyx and corolla lobes. It also resembles *G. loureirii* in its strongly papillose leaves.

### 32. *G. micans* Clarke; *G. argentea* var. *b* Clarke; *Gentiana* sp. '19 Herb Ind. Or. Hook.f. & Thomson', *G. micans* var. *latifolia* Ho

Tufted annual 1.5–7cm; branches densely leafy. Leaves coriaceous, basal leaves ovate, 3–7 × 1.5–4mm; stem leaves linear-lanceolate, (5–)8–11 × 1–2mm, apex mucronate, erect, almost 3-angled, margins and midrib cartilaginous, translucent, sometimes glandular, bases of lower leaves forming tube 0.75–1mm, 1–3mm on upper leaves. Flowers terminal, solitary, sessile. Calyx tube (4–)10–13mm; lobes linear or narrowly lanceolate, 3–7 × 0.75–2mm, apex acuminate or acute, mucronate, margins and midrib translucent. Corolla deep or bright blue with paler centre or purplish with very dark base; tube

(10–)20–24mm; lobes ovate, 2–6 × 1.5–3mm, apex rounded or acute, sometimes mucronate; plicae oblong or ovate, 1.5–4 × 1–4mm, bidentate or lacinulate. Filaments 2–4mm, attached halfway up corolla tube, slightly winged at base; anthers 1.5–2mm. Ovary narrowly cylindrical, 6–8 × 1–2mm; stipe 2–3mm; style 1.5–2mm. Capsule cylindrical, 10–12 × 2–2.5mm, protruding from corolla; stipe elongating to 16mm.

**Bhutan:** C – Thimphu and Tongsa districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Phullalong; **Sikkim:** Lhonak, Dotag; **Chumbi:** near Phari, Tuna to Dochen. On gravelly and sandy slopes, in ravines and amongst scrub on river bank, 3660–4570m. August–October.

*G. micans* var. *latifolia* Ho (see 257) was described as an endemic Bhutanese subspecies, differing from the typical plant in having stem leaves elliptic to lanceolate, not stiff, spreading 5–8 × 1–2mm and margins not as broad; calyx lobes broader, 3–7 × 1–2mm, apex acute, mucronate, not conduplicate; corolla purplish blue, almost black at base, lobes 2–3 × 1.5–2mm, plicae oblong, 1.5–2 × 1–2mm, bidentate. However these characters appear to overlap on our material and therefore it is treated as a synonym here.

**33. *G. karelinii*** Grisebach; *G. prostrata* auct. non Haenke, *G. prostrata* Haenke var. *karelinii* (Grisebach) Kusnezow, *G. aquatica* L. var. *karelinii* (Grisebach) Clarke, *Ciminalis karelinii* (Grisebach) Omer

Prostrate or semi-prostrate annual c 4cm. Stems leafy, branching from base. Leaves elliptic to spatulate, 3–7 × 1.5–2.5mm, imbricate, mucronate, margins narrowly translucent, sometimes not obvious, glandular, mid-vein prominent, base attenuate to broad petiole 2–5mm, extending in papery tube down stem. Flowers solitary, terminal. Calyx tube 7–10mm, ridged; lobes linear-lanceolate, 1.5–5 × 0.75–1mm, erect, acuminate, margins translucent. Corolla dark blue or purple, sometimes with green or purple spots; tube (13–17mm total length), very narrow, widening abruptly, narrow part 9–13mm, wider part 4–6mm; lobes ovate, 2.5–4 × 1.5–2mm, acute or rounded; plicae oblong, 1.5–2 × 1.5–3mm, multidentate. Filaments attached less than halfway up corolla tube, enclosed in narrow part, 3–5mm; anthers 1–1.5mm. Ovary narrowly cylindrical, 4–7 × 1–1.5mm; style linear, c 1mm. Capsule cylindrical, 9–13 × 2mm, protruding from corolla on long stipe (to 4cm on Nepal specimens).

**Bhutan:** N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kuru Chu districts; **Sikkim:** Chemathang and Lhonak. On grassy alpine banks and pastures, moraine and in rock crevices, 3660–5330m. August–October.

Often treated as a variety of the European *G. prostrata* in the past (eg. 257); however no specimens matching that species have been seen from our area; it differs in its more lax foliage and pedicellate flowers. Most literature records of *G. prostrata* from the East Himalaya refer to *G. karelinii*.

**34. *G. micantiformis* Burkill**

Semi-prostrate, tufted annual to 3cm. Stems densely leafy, branching from base, smooth. Leaves coriaceous, basal leaves often withered at flowering time, ovate, 4–6 × 2–3mm; stem leaves narrowly elliptic or lanceolate, 2–5 × 1–1.5mm, mucronate, almost folded, margins and midrib hard, thin, translucent, smooth or finely papillate, bases of stem leaves forming tube c 2mm. Flowers solitary, terminal. Pedicels c 2mm. Calyx tube 5–6mm; lobes lanceolate, 1.5–3 × 0.75–1mm, membrane truncate, apex acuminate, mucronate, margins thinly transparent. Corolla pale blue; tube 7–8mm; lobes ovate, 1.5–2 × 2mm, apex obtuse, mucronate; plicae ovate, 1–2 × 1–1.5mm, apex rounded, dentate or shallowly lacinate. Filaments 1.5–2mm, attached less than halfway up corolla tube. Ovary narrowly ellipsoid, 3–4 × 1mm; stipe 0.5–1mm; style c 1mm. Capsule (not seen) 10–12mm, protruding from corolla.

**Bhutan:** N – Upper Mo Chu district (Lingshi Dzong, Shingche La); **Sikkim:** Thanggu, **Chumbi:** Phari. Open peaty swards, 3200–3960m. April–June.

**35. *G. simulatrix* Marquand**

Erect, branched annual to 3.5cm. Stems branching from base and above, papillose. Basal leaves forming a rosette, ovate, 6–8 × 3–4mm; stem leaves spatulate, 2–5 × 1–1.5mm, cuspidate, sometimes recurved, bases ciliate forming a tube 1–3mm, margins and midrib thickened, translucent. Flowers solitary, terminal, sessile or on pedicels to 2mm. Calyx tube 3–4mm; lobes ovate or lanceolate, 2–2.5 × 1–1.5mm, cuspidate, margins and midrib translucent and glandular. Corolla pale blue; tube 5–7mm; lobes ovate, 1–2 × 1–1.5mm, acute; plicae variably deltoid or ovate, 0.5–1 × 1–1.5mm; acute. Filaments 1–1.5mm; anthers 0.5–1mm. Ovary ovoid-ellipsoid, 2 × 1mm, subsessile; style c 1mm. Capsule ellipsoid or obovoid, 3–4 × 2–3mm, crested; stipe 5mm.

**Bhutan:** C – Ha district (Puduna) and Thimphu district (Paga, Namselling); **Chumbi:** Yatung. On grassy hill slopes, 2150–2740m. April–July.

In the specimens examined the plicae are acute though the original description describes them as bifid.

**36. *G. pedicellata* (D. Don) Grisebach; *Ericala pedicellata* D. Don, *E. procumbens* G. Don, *Gentiana orbiculata* Wall., *G. pumila* Griff., *G. quadrifaria* sensu Clarke non Blume, *G. quadrifaria* Blume var. *pilosula* Clarke, *G. squarrosa* sensu Clarke non Ledebour, *Gentianodes pedicellata* (D. Don) Omer et al.**

Procumbent or erect, diffusely branched annual to 5.5(–9)cm. Leaves coriaceous, papillose and ciliate-margined, basal leaves forming a rosette, elliptic or lanceolate, 5–25(–35) × 2–7(–10)mm, aristate, bases forming tube 2–4mm; stem leaves elliptic-spatulate, 4–15 × 1–3.5mm, unbordered, margins finely glandular-ciliate. Flowers solitary terminal or axillary, forming loose cymes. Pedicels 2–6mm. Calyx tube 2–6mm; lobes ovate or broadly lanceolate, 1–3 × 0.5–2mm, often reflexed, mucronate, margins glandular-ciliate. Corolla bright blue or greenish outside, sky blue within, sometimes with white or yellow throat;

tube 3–8mm; lobes ovate-lanceolate, 0.5–1 × 1–1.5mm, mucronate, obtuse; plicae triangular, entire or deeply bifid, 0.5–1 × 1–1.5mm. Filaments attached halfway up corolla tube, 1–2mm, winged at base; anthers 0.5–0.75mm. Ovary ellipsoid, 1.5–3 × 1mm; stipe 0–1.5mm; style 0.5–1mm. Capsule obovoid, 3–4 × 1–2mm, crested, protruding from corolla; stipe elongating to 4–6mm.

**Bhutan:** S – Chukka, Gaylegphug and Deothang districts, C – Thimphu, Punakha and Tongsa districts; **Darjeeling:** Jorpokhri, Kalimpong and Senchal; **Sikkim:** Karponang, Phusum, Yak La. Moist grassy banks in broad-leaved forest and on open grassy hillsides, 1310–3350m. February–May.

**37. *G. vernayi*** Marquand; *G. somdavii* Naithani, *G. andersonii* Biswas non Clarke, *G. bhutanica* Grubov

Erect or decumbent annual to 3.5cm. Base of stems often woody. Leaves spatulate, 2–5 × 1–3mm, obtuse, slightly recurved, bases forming scabrous tube 1–2mm. Flowers sessile in branched cymes. Calyx tube 6–10mm, ribbed; lobes orbicular, 1–2 × 1–2mm, obtuse, sometimes overlapping, membrane truncate. Corolla pale or bright blue or greenish; tube 6–10mm; lobes ovate, 1–2.5 × 1mm, obtuse; plicae narrowly triangular, 0.5–1 × less than 0.5mm, sometimes bidentate with 1 small, auricular lobe and 1 large lobe. Filaments attached more than halfway up corolla tube, 0.75–2mm, filiform; anthers oblong, 0.5–0.75mm. Ovary narrowly oblong, 5–10 × 1–1.5mm; stipe 1–2mm; style 0.5–2mm. Capsule narrowly oblong, 7–10 × 1.5–2mm, protruding from corolla; stipe elongating to 15mm.

**Bhutan:** C – Thimphu district (Paro), N – Upper Mo Chu district (Jari La and Nelli La). Open turf slopes and in rock crevices, 4290–5000m. August–November.

**38. *G. bryoides*** Burkill; *G. stylosa* Biswas. Fig. 63e–g.

Semi-decumbent annual to 6cm, branching from base. Basal leaves forming rosette, broadly ovate, 2.5–14 × 1–4mm; stem leaves opposite, ovate 2.5–6 × 1–2mm, including broad petiole, apex mucronate, recurved, base forming tube 0.5–4mm, margins thickened and translucent, finely papillose. Flowers solitary, terminal. Pedicels 0–2mm. Calyx tube 3–6mm; lobes ovate, 1.5–3 × 0.5–1.5mm, with spreading tips, apiculate, recurved, margin thinly membranous, translucent, glandular. Corolla blue; tube 6–8mm; lobes ovate or obovate, 1–2 × 1–1.5mm, mucronate; plicae narrowly ovate, oblong or triangular, 1–2 × 1–2mm, apex entire or dentate. Filaments attached halfway up corolla tube, 0.5–3mm; anthers 0.5–1mm. Ovary narrowly ovoid, 2–4 × 1–1.5mm; stipe 1–3mm; style linear, 1–1.5mm. Capsule ovoid, 3.5–4(–5) × 1–1.5(–3)mm; stipe 1–3(–12)mm.

**Bhutan:** C – Thimphu district (Dotena to Barshong), N – Upper Mo Chu district (Yale La), Upper Mangde Chu district (Passu Sepu) and Upper Kulong Chu district (Me La); **Darjeeling;** **Sikkim:** Chomnagu, Yak La, above Thanggu, below Natu La, Chemathang, Tsomgo, Chapopla, Bikbari, Nathang, Phune;

**Chumbi:** Phari. Sandy peat and grassy hill slopes, (3050–)3350–4880m. March–September.

*G. bryoides* and *G. stylosa* are sometimes treated as separate species, but no distinct differences could be found in the present study. *G. stylosa* seems to be a smaller, denser plant. One fruiting specimen of *G. bryoides* from Nepal (Polunin, Sykes & Williams 2345) has capsules 4–5 × 2–3mm protruding from the corolla on a stipe elongating to 12mm. Capsules in *G. stylosa* have ripe seed but are narrowly oblong or ovoid, not crested and not protruding, similar to immature capsules of *G. bryoides*.

### 39. *G. crassuloides* Bureau & Franchet

Erect, scabrous annual to 6cm, branching from base. Leaves thick, leathery; basal leaves rosulate, ovate, 3–4 × 1.5–2mm; stem leaves opposite, broadly ovate or suborbicular, 1–3 × 1.5–4mm, with strongly recurved tip, margins thickened and translucent, smooth except towards base, mid-vein thickened on reverse, bases forming tube round stem. Flowers solitary, terminal. Pedicels c 1mm, hidden by upper stem leaves. Calyx tube 5–8mm, ribbed; lobes orbicular, 1–1.5 × 1–2mm, apiculate, recurved, margins thickened. Corolla bright or deep blue; tube 7–10mm, widening abruptly at mouth; lobes narrowly ovate or oblong, 1–2 × 0.75–1mm, acute; plicae oblong, 0.5–1mm, dentate, sometimes almost bifid. Filaments attached more than halfway up corolla tube, filiform, 1–1.5mm; anthers c 1mm. Ovary oblong, 3–4 × 1.5–2mm, stipe 1–3mm; style 1–1.5mm. Capsule obovoid, 3–5 × 1.5–3mm winged, protruding from corolla on elongated stipe.

**Bhutan:** C – Ha district (Damthang to Sharithang) and Thimphu district (Pumo La), N – Upper Mo Chu district (Laya) and Upper Kuru Chu district (Narim Thang); **Sikkim:** Thangu, Chapopla, Yumthang, Phaklung, Yume Samdong; **Chumbi:** Yatung. Open hillsides, in short turf and dry sandy ground, 3600–4620m. July–August.

### 40. *G. glabriuscula* Ho; *G. pedicellata* (D. Don) Grisebach subsp. *glabriuscula* (Ho) Halda

Delicate annual or biennial to 4cm. Leaves membranous, basal leaves broadly ovate to orbicular, 6–12 × 3–6mm; stem leaves ovate, 4–7 × 2–3mm, mucronate, margins slightly undulate, bases forming tube 1–2mm. Flowers solitary, terminal. Calyx tube 3–4mm; lobes broadly spatulate or ovate, 1.5–3 × 1–2mm, recurved, mucronate. Corolla pale greyish or bright blue, with darker spots in the throat; tube 4–5mm; lobes ovate, 1–2.5 × 1mm, acuminate; plicae broadly ovate c 1mm, apex irregular, bifid. Filaments filiform, 1.5mm, attached halfway up corolla tube; anthers 0.5mm. Ovary obovoid-oblong, 2 × 1mm; style c 0.5mm. Capsule not seen.

**Bhutan:** N – Upper Kulong Chu district (Lao); **Sikkim:** Bakkhim to Zongri, between Tsoka and Jamlinghang. On mossy rocks and banks in mixed forest, 2440–3170m. April–July.

**41. *G. marginata* (D. Don) Grisebach s.l.**

Dwarf annual herb 2–3.5mm. Stem leafy throughout. Leaves coriaceous, with broad hyaline margin, finely ciliate, becoming very broad in leaf base. Larger leaves (not always the most basal) broadly ovate or obovate, 6–9 × 3–5mm, including broad petiole; lower stem leaves or inner leaves elliptic or narrowly obovate, 4–5 × 1.5–2mm, apex mucronate, recurved, bases forming long translucent tube on stem, 2–3mm. Flowers solitary, on very short leafy branches aggregated into a capitulate flower head. Calyx tube 5–8mm; lobes ovate, 1.5–2.5 × 0.5–1mm, with broad translucent margin. Corolla sky blue; tube 7–10mm; lobes ovate, 1.5 × 1.5mm, subacute; plicae ovate, almost as long as corolla lobes. Ovary with short stalk, c 0.5mm, narrowly ellipsoid, 2 × 0.5mm; style c 1mm. Capsule (?immature) ellipsoid, 5–6 × 2.5mm, not protruding from corolla.

**Bhutan:** N – Upper Mo Chu district (SW of Lingshi Dzong). Silty ground above moraine, 4130m. September.

Similar to *G. albicalyx* in having a leafy stem and broad margins on leaves and calyx lobes, but differs in leaf shape and larger plicae.

**42. *G. capitata* D. Don; *G. marginata* Wall. non (D. Don) Grisebach, *G. andersonii* Clarke, *G. capitata* D. Don var. *andersonii* (Clarke) Clarke, *G. cephalodes* Edgeworth var. *andersonii* (Clarke) Sunita & Bhattacharyya, *G. carinata* sensu Rao non Grisebach, *G. argentea* sensu Rao non Royle, *Ciminalis capitata* (D. Don) Omer, *C. capitata* (D. Don) Omer var. *andersonii* (Clarke) Omer, *Ericala marginata* sensu G. Don, *E. capitata* (D. Don) D. Don. Nep: *Ban kauli*, *Hansphul*. Fig. 63h.**

Erect annual 3–17cm (including leafless part of stem). Stem single (sometimes resembling a root), glabrous and without leaves on lower part, upper part of stems often leafy and densely glandular-pubescent. Leaves surrounding flower-heads ovate or spatulate, 6–30 × 3–15mm, mucronate, reflexed, margins thickened, narrow, bases glandular-pubescent, narrowing to broad petiole 2–4mm; stem leaves sometimes larger, 30–50mm, with petioles 5–10mm, larger rosette of leaves occasionally absent on smaller plants. Flowers in capitulate heads and sometimes on small axillary branches. Bracts spatulate or lanceolate, 5–6 × 1–2mm. Calyx tube 3–6mm; lobes ovate or obovate, 1–3 × 1–2mm, mucronate, margins broadly membranous, translucent. Corolla pale or sky blue; tube (4–)7–9mm; lobes ovate or oblong, 1–3 × 1.5–2mm, rounded or mucronate; plicae rounded or oblong, 1mm or less, entire or multidentate. Filaments attached below middle of corolla tube, 1.5–3mm; anthers 0.5–1mm. Ovary narrowly ellipsoid, 2–3 × 1.5–2mm; style 1–1.5mm. Capsule obovoid, 3–6 × 2–3mm, crested, protruding slightly from corolla.

**Bhutan:** S – Deothang district, C – Thimphu, Punakha, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Kalimpong, Sandakphu. Phalut, Rhikissum, Senchal and Dilpa to Dochre; **Sikkim:** Gangtok, Chiya Bhanjang, Yoksam, Lingchom, Rishi and Lachen. On open hillsides, roadsides

and on river banks in forests, 1370–3660m. February–June, occasionally October.

A very variable species within which the name *G. andersonii* Clarke has been applied to robust forms with large, spreading leaves. This form occurs in Bhutan and Sikkim. *G. huxleyi* Kusnezow has been recorded from Bhutan (135). This name applies to slender forms with appressed stem leaves, sometimes enclosing axillary flowering branches, but no material matching *G. huxleyi* has been seen from our area.

#### 43. *G. cephalodes* Edgeworth

Erect annual 3–10cm. Stems glabrous, bare on lower part with 4 large rosette leaves subtending flower heads. Leaves coriaceous, ovate or broadly spatulate, 5–15 × 4–8mm, mucronate, reflexed, margins narrow, finely denticulate, base narrowing to broad petiole. Flowers in a dense capitate head, sessile. Bracts linear-lanceolate, 3–7 × 0.5–0.75mm. Calyx tube 3–4mm; lobes lanceolate, 2–3 × 0.5–2mm, aristate, margins broadly membranous, translucent, finely denticulate. Corolla pale blue; tube 4–6mm; lobes oblong or ovate, 1–1.5 × 1mm, acute or mucronate; plicae rounded, 0.5–1 × 0.5–1mm, apex entire or multidentate. Filaments attached less than halfway up corolla tube, 1.5–2mm, not widening at base; anthers 0.5mm. Ovary narrowly ovoid or ellipsoid, 2–3 × 1–1.5mm; style 1–2mm. Capsule obovoid, 3–6 × 2–2.5mm, crested, not protruding from corolla.

**Bhutan:** C – Mongar district (Taki La, Bagha La) and Tashigang district (Tashi Yangtshi); **Sikkim:** Thanggu; **Chumbi.** Dry open hillsides, 1520–1830m (–2500m in Nepal). August–October.

Sometimes wrongly united with *G. capitata* but distinct in its long slender naked stem bearing a flower head subtended by only 4 leaves and by its autumnal flowering.

#### 44. *G. albicalyx* Burkill; *G. capitata* D. Don var. *strobiliformis* Clarke, *Ciminalis capitata* (D. Don) Omer var. *strobiliformis* (Clarke) Omer

Annual 0.7–4cm. Stems leafy, slightly ridged, often bare in lower part. Basal leaves ovate, 3–4 × 2–3mm, sometimes withering at flowering, margin narrower and less conspicuous than upper leaves; upper leaves densely imbricate, orbicular or broadly obovate, 4–8 × 4–6mm, mucronate, sessile, mid-vein prominent, margins broad, white, translucent, wrinkled. Flowers in dense terminal and axillary clusters, often almost hidden by leaves; bracts obovate, 2–6 × 1–2.5mm, mucronate, base narrowing to broad petiole, margins broad, translucent. Calyx tube 2–4mm; lobes orbicular, 1–2 × 1–2mm, mucronate, keeled on dorsal surface, margins white, wrinkled. Corolla sky blue; tube 2–6mm; lobes ovate, 1–2 × 1–2, acute, plicae 0.5–1 × 0.5–1.5mm, slightly bifid at apex.

Filaments attached about halfway up corolla tube, 0.5–2.5mm; anthers 0.5–1mm. Ovary oblong-ellipsoid, 1.5–4 × 0.5–1mm; style filiform, 1–2mm. Capsule obovoid, c 7.5 × 4mm, apex obtuse, crested.

**Bhutan:** C – Ha, Thimphu, Punakha and Tongsa districts, N – Upper Kulong Chu district; **Darjeeling;** **Sikkim:** Zongri, Dikchu, Nathang; **Chumbi:** Yatung. Wet grassy meadows, peaty turf and stony hillsides, 2740–4420m. March–June.

*G. capitata* D. Don var. *strobiliformis* Clarke has been erroneously treated as a synonym of *G. kumaonensis* Biswas by Hara & Chater (135).

#### 45. *G. wangchukii* Aitken & Long

Erect, tufted annual to 4cm, branched from base and occasionally above. Basal leaves rosulate, ovate or broadly lanceolate, 3–7 × 2–2.5mm; stem leaves linear-lanceolate, conduplicate, 3–5 × 1–1.5mm, aristate, margins translucent, minutely ciliate, petioles forming tube c 2mm. Flowers solitary, terminal. Calyx tube 4–5mm; lobes lanceolate, 3–4 × 0.5–1mm, acuminate, erect. Corolla deep blue; tube 8–9mm, with a fringe of thick white hairs c 1mm at apex; lobes narrowly triangular, 1–2 × 0.7–1.5mm, acuminate; plicae narrowly triangular, 0.5–1 × 0.5mm, bifid. Filaments 1–1.5mm, widening slightly at base, attached halfway up corolla tube; anthers c 0.5mm. Ovary narrowly ellipsoid, 2–3 × 0.5mm; stipe 1–1.5mm; style c 1mm. Capsule obovoid, 3–5 × 1–2mm, winged at apex, protruding from corolla; stipe elongating to 6mm.

**Bhutan:** C – Tongsa district (Rinchen Chu), N – Upper Kuru Chu district (Narimthang). Open hillsides, 4120–4720m. August.

Endemic to Bhutan (246).

### Family 161. MENYANTHACEAE

by E. Aitken

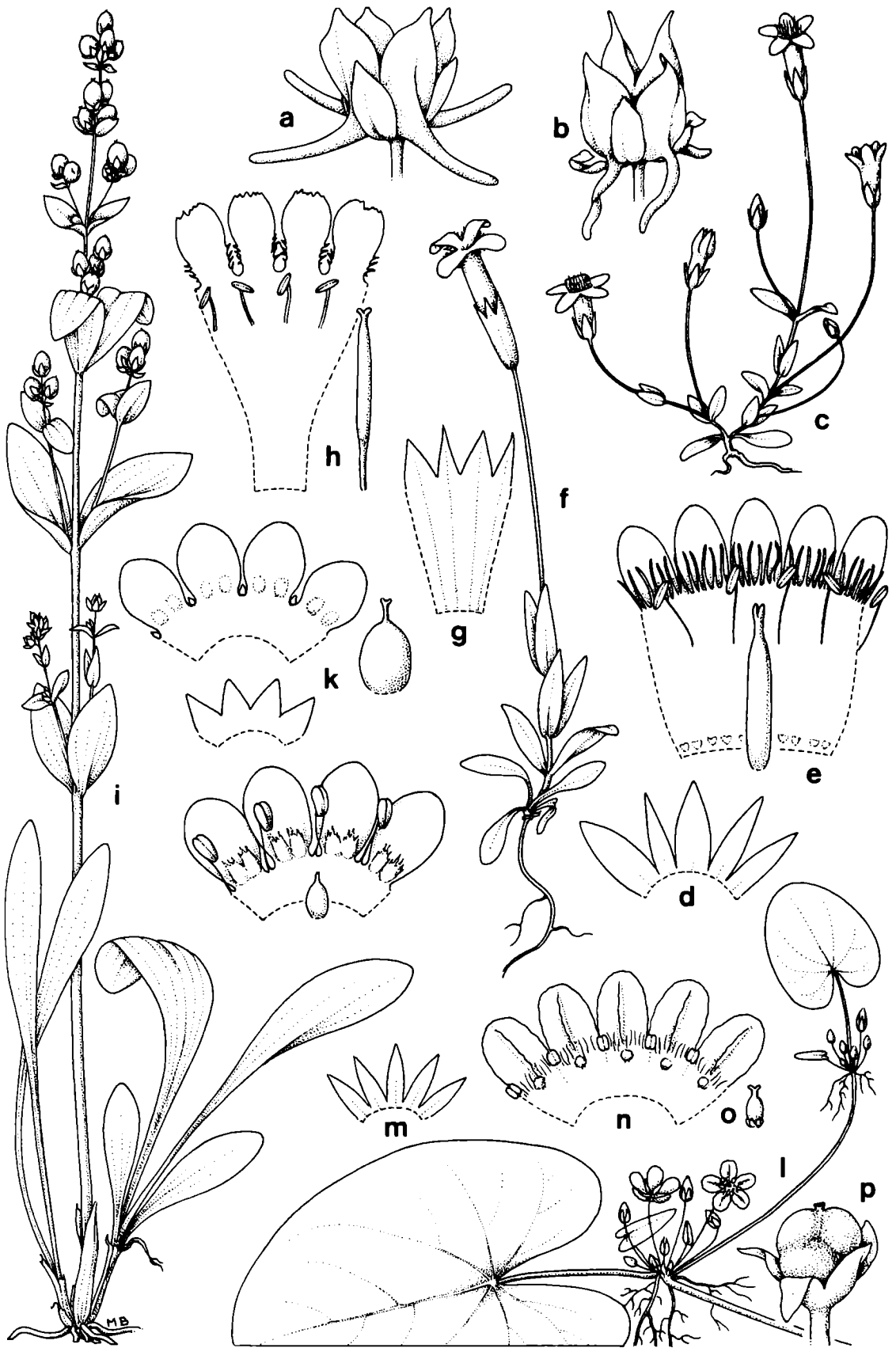
Aquatic or wetland herbs, mainly perennial, with tufted rootstocks or horizontal creeping rhizomes, sometimes annual. Leaves alternate, pinnately or palmately veined, exstipulate. Flowers in simple or branched cymes or racemes, or in dense clusters, 5–6-merous. Sepals united at base. Corolla tubular at base, lobes fringed or crested on inner surface. Filaments attached to base of corolla tube, alternating with corolla lobes, sometimes alternating with scales or staminodes; anthers 2-celled, with longitudinal slits. Ovary 1-celled; style simple, bifid. Fruit a capsule, rarely a berry, subtended by persistent calyx, ovules few to many, parietal.

Sometimes included in Gentianaceae but differing in its aquatic habit, alternate leaves and valvate aestivation of corolla.

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FIG. 64. **Gentianaceae** and **Menyanthaceae**. **Gentianaceae:** a–b, *Halenia elliptica*: a, flower (× 2); b, capsule (× 2). c–e, *Gentianella pedunculata*: c, habit (× ½); d, calyx (× 2); e, corolla and ovary (× 2). f–h, *Gentianella paludosa*: f, habit (× ½); g, calyx (× 1); h, corolla and ovary (× 1). i–k, *Veratrilla baillonii*: i, female plant in fruit (× ⅓); j, male flower (× 2); k, female calyx, corolla and ovary (× 2). **Menyanthaceae:** l–p, *Nymphoides hydrophylla*: l, habit (× ⅔); m, calyx (× 2); n, corolla (× 2); o, ovary (× 2); p, capsule (× 3). Drawn by M. Bates.





## 1. NYMPHOIDES Séguier

Perennial, rarely annual, aquatic herbs with rhizomatous stem. Leaves single or several, palmately veined, occasionally dotted beneath with glands. Flowers in fascicles or umbels on slender or thick submerged petioloid stems. Corolla throat fimbriate. Ovary with 4–5 nectaries at base. Capsule ellipsoid or ovoid, ripening under water.

**1. *N. hydrophylla*** (Loureiro) Kuntze; *N. cristata* (Roxb.) Kuntze, *Limnanthemum cristatum* (Roxb.) Grisebach, *Menyanthes cristata* Roxb. *M. hydrophylla* Loureiro, *Villarsia cristata* Sprengel. Beng: *Chooli*. Fig. 641–p.

Plant with single floating leaves, terminal on slender submerged petioloid stems up to 30 or 40cm long. Leaves broadly ovate or orbicular, 3.5–8.5 × 3.5–7cm, obtuse or rounded, base deeply cordate, margins slightly crenate. Each petioloid stem bearing a single umbel 2.5–3.5cm below leaf. Peduncles usually 5–20, 1.5–3cm long, 1–2-flowered. Sepals lanceolate or oblong, 3–6 × 1–1.5mm, acute. Corolla white, yellow towards base, tube 2mm, lobes ovate-oblong, 3–5 × 1.5–2mm, obtuse, with a median longitudinal, undulate crest on inner surface, margins undulate. Stamens alternating with staminodes. Ovary ovoid, 2–3 × 1–2mm; style less than 0.5mm. Fruit broadly subglobose, 3–4 × 2–3mm, with 5–10 scabrous seeds.

**Darjeeling:** terai at Mahanudee and Siliguri. Floating in pools or tanks of fresh water, 0–600m. September–December.

## Family 162. APOCYNACEAE

by M.F. Watson

Trees, shrubs or woody climbers, rarely perennial herbs. Sap a milky latex. Leaves simple, entire, opposite or whorled, occasionally alternate, very rarely stipulate, but often with scales at base. Inflorescence cymose, terminal, pseudo-axillary (terminal on short side branches) or axillary. Flowers 5-merous, hermaphrodite, actinomorphic, often large, showy and fragrant. Calyx and corolla usually fused into a tube with (4–)5 lobes. Calyx tube often with basal glandular scales inside. Corolla lobes usually spirally twisted in bud and characteristic in their direction of overlapping; spreading to form a wheel- or salver-shaped flower; coronal scales present or not. Disc ring- or cup-shaped, lobed or of separate glands, sometimes absent. Stamens (4–)5, epipetalous in corolla tube, filaments short, usually sessile; anthers 2-celled (sometimes with a sterile basal spur), forming a cone around the clavuncula and often fused with it. Ovary of 2 fused or free (united only by the style) carpels, 1–2-locular, each locule with 1–many pendulous, anatropous ovules; style simple or divided only at the base, thickened at apex into the club-like clavuncula bearing a 2-lobed

stigma about level with anthers. Fruit often a pair of cylindrical follicles, but also a dry or fleshy drupe or berry. Seeds various, often winged or with a coma (terminal plume of hairs).

1. Annual or perennial herbs, sometimes woody at base; flowers solitary or in pairs ..... **9. Catharanthus**
- + Shrubs or trees, often climbers; flowers few to many in cymose inflorescences ..... 2
2. Flowers present, with or without fruits ..... 3
- + Fruiting material only ..... 25
3. Flowers very small, less than 6mm long in many-flowered inflorescences; leaves always opposite ..... 4
- + Flowers larger, usually more than 1cm long; leaves opposite, alternate or whorled ..... 6
4. Corolla overlapping to left; anthers free from clavuncula; disc absent; fruit a berry ..... **6. Alyxia**
- + Corolla lobes overlapping to right; anthers fused to clavuncula; disc present; fruit a pair of follicles ..... 5
5. Flower buds not constricted, ovoid in shape; follicles long and slender c 2mm thick, spreading but not horizontally ..... **21. Ichnocarpus**
- + Flower buds constricted at middle giving an hour-glass shape; follicles c 1cm wide at base, tapering rapidly to ends and spreading horizontally ..... **22. Urceola**
6. Spiny evergreen shrubs or small trees; leaves opposite; fruit a berry ..... **1. Carissa**
- + Unarmed trees or shrubs, not as above ..... 7
7. Climbing or trailing shrubs or lianas ..... 8
- + Self-supporting shrubs or trees ..... 16
8. Corolla tube large, more than 2cm long (more than 1.5cm in *Chonemorpha griffithii*), coriaceous ..... 9
- + Corolla tube small less than 2cm long, coriaceous or not ..... 11
9. Leaves small, less than 10cm long; corolla lobes overlapping to left; fruit a spiny capsule ..... **7. Allamanda**
- + Leaves usually more than 10cm long; corolla lobes overlapping to right; fruit not as above ..... 10

162. APOCYNACEAE

10. Flowers very large; corolla funnel-shaped, more than 8cm long **14. Beaumontia**  
 + Flowers smaller; corolla tube cylindric, less than 7cm long **19. Chonemorpha**
11. Corolla lobes drawn out into long narrow threads c 1mm wide, broader at base ..... **17. Strophanthus**  
 + Corolla lobes rounded or truncate, not as above ..... 12
12. Anther cone exerted from corolla tube, each stamen with a conspicuous domed gland outside ..... **15. Vallaris**  
 + Anthers included in corolla tube, not as above ..... 13
13. Leaves large, more than 12 × 4cm, broadly elliptic; branches with brown raised tubercles ..... **19. Chonemorpha**  
 + Leaves smaller, less than 14 × 4cm, narrowly elliptic; branches smooth or with sparse lenticels ..... 14
14. Corolla lobes overlapping to right; anthers free from clavuncula; fruit a berry ..... **2. Melodinus**  
 + Corolla lobes overlapping to left; anthers fused to clavuncula; fruit a pair of follicles ..... 15
15. Corolla lobes twisted to right in bud; tube puberulent to tomentose; calyx lobes usually more than 3mm long ..... **18. Aganosma**  
 + Corolla lobes twisted to left in bud; tube glabrous; calyx lobes usually less than 3mm long ..... **20. Trachelospermum**
16. Leaves linear to linear-lanceolate, less than 2(-3)cm wide ..... 17  
 + Leaves narrowly ovate to widely obovate, usually more than 3cm wide 18
17. Leaves alternate; flowers solitary; fruit a drupe, wider than long, hard and black when mature ..... **4. Thevetia**  
 + Leaves in whorls of 3; flowers in many-flowered cymes; fruit a narrow follicle longer than wide ..... **16. Nerium**
18. Corolla lobes drawn out into long narrow threads c 1mm wide, broader at base ..... **17. Strophanthus**  
 + Corolla lobes rounded or truncate, not as above ..... 19
19. Leaves opposite ..... 20  
 + Leaves alternate, in whorls or spirally arranged ..... 22
20. Corolla lobes coriaceous; anthers exerted from mouth of corolla and fused with clavuncula ..... **13. Wrightia**

- + Corolla lobes membranous; anthers included in corolla tube and free from clavuncula ..... 21
- 21. Corolla lobes overlapping to right; follicles long and slender more than 20cm long; seeds with apical coma ..... **10. Holarrhena**
- + Corolla lobes overlapping to left; follicles short and broad less than 4cm long; seeds with fleshy aril ..... **12. Tabernaemontana**
- 22. Leaves large, usually more than 20 × 5cm and very coriaceous; inflorescence branches and stems very thick; corolla lobes obovate ..... **8. Plumeria**
- + Leaves smaller, less than 17 × 5cm, subcoriaceous to coriaceous; branches not swollen; corolla lobes oblong to ovate ..... 23
- 23. Leaves broadly oblanceolate, alternate at ends of branches; inflorescence branches thick; fruit a large drupe more than 4cm long ..... **3. Cerbera**
- + Leaves narrowly ovate to narrowly elliptic, in whorls of 3–5, rarely opposite; inflorescence branches slender; fruit not as above ..... 24
- 24. Leaves with relatively few lateral veins and no intramarginal vein; ovules 2 per carpel; fruit a small drupe, solitary or more usually in a partially fused bifid pair ..... **5. Rauvolfia**
- + Leaves with very numerous closely parallel lateral veins joining into an intramarginal vein; ovules many per carpel; fruit a pair of slender follicles  
**11. Alstonia**
- 25. Fruit a berry or drupe ..... 26
- + Fruit a capsule or follicle ..... 30
- 26. Fruit a hard, transversely ellipsoid drupe with transverse distal ridge  
**4. Thevetia**
- + Fruit a berry or fleshy drupe, ovoid or globose ..... 27
- 27. Fruit large, more than 2cm long ..... 28
- + Fruit small, less than 1.5cm long ..... 29
- 28. Fruit a thick-skinned berry with many seeds buried in a fleshy red pulp  
**2. Melodinus**
- + Fruit a drupe with fibrous flesh and a hard woody stone ..... **3. Cerbera**
- 29. Spiny shrubs; fruit a 2–4-seeded black berry ..... **1. Carissa**
- + Unarmed shrubs; fruit a 1-seeded yellow-green berry, free or partially fused  
**5. Rauvolfia & 6. Alyxia**
- 30. Fruit a spiny capsule ..... **7. Allamanda**

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- + Fruit a follicle, fused or free ..... 31
- 31. Seeds winged, without coma or cilia; leaves large, usually more than 20 × 5cm and very coriaceous; stems very thick ..... **8. Plumeria**
- + Seeds not winged, usually with coma or cilia or embedded in a fleshy aril; leaves and stems not as above ..... 32
- 32. Fruit solitary, narrowly ellipsoid, large and pendulous, formed by a pair of fused follicles ..... **14. Beaumontia**
- + Follicles free in pairs, not as above ..... 33
- 33. Follicles distinctly widened at base or centre, less than 15cm long and more than 5mm wide ..... 34
- + Follicles cylindric, long and slender, usually more than 15cm long or if shorter less than 5mm wide ..... 36
- 34. Follicles horizontally divaricate, swollen at base and tapering and up-curving towards ends ..... **22. Urceola**
- + Follicles erect, spreading or pendulous, not as above ..... 35
- 35. Follicles silver within; seeds densely ciliate ..... **11. Alstonia**
- + Follicles pale orange within; seeds glabrous embedded in a fleshy red aril  
**12. Tabernaemontana**
- 36. Follicles very slender, less than 4mm thick ..... 37
- + Follicles much thicker, usually more than 5mm thick ..... 40
- 37. Leaves with closely parallel veins; seeds ciliate ..... **11. Alstonia**
- + Leaves with reticulate veins; seeds with apical coma ..... 38
- 38. Follicles dotted with white lenticels ..... **10. Holarrhena**
- + Follicles not white spotted ..... 39
- 39. Follicles 2–4mm wide, more than 12cm long ..... **20. Trachelospermum**
- + Follicles less than 2mm wide, usually less than 10cm long **21. Ichnocarpus**
- 40. Follicles more than 25cm long (rarely to 16cm in *Wrightia*) ..... 41
- + Follicles less than 20cm long ..... 44
- 41. Follicles slender, less than 1cm wide ..... 42
- + Follicles thick, c 1–2cm wide ..... 43
- 42. Follicles densely white lenticellate; leaves without pronounced intramarginal vein ..... **10. Holarrhena**

- + Follicles sparsely cream lenticellate; leaves with pronounced intramarginal vein ..... **18. Aganosma**
- 43. Follicles conspicuously cream lenticellate ..... **13. Wrightia**
- + Follicles not conspicuously cream lenticellate ..... **19. Chonemorpha**
- 44. Follicles hirsute ..... **20. Trachelospermum**
- + Follicles glabrous ..... 45
- 45. Leaves linear-lanceolate with closely parallel veins ..... **16. Nerium**
- + Leaves elliptic to ovate-elliptic, veins reticulate ..... 46
- 46. Follicles with numerous pale lenticels; seeds with narrow beak  
**17. Strophanthus**
- + Follicles without pale lenticels; seeds not beaked ..... 47
- 47. Seeds ovate acuminate, light brown, coma white ..... **15. Vallaris**
- + Seeds linear-oblong, black, coma yellow-brown ..... **21. Ichnocarpus**

### 1. CARISSA L.

Much-branched, evergreen, spiny shrubs or small trees; stout woody spines subtending some leaves, opposite, in pairs. Leaves opposite, small and coriaceous, shiny above, paler below, glabrous or pubescent only on veins below. Flowers white or pinkish, fragrant, salver-shaped, subsessile in few- to many-flowered terminal or pseudoterminal cymes. Calyx lobes acute, glabrous and ciliate or puberulent. Corolla tube cylindric, throat glabrous; lobes overlapping to right in Bhutanese species. Disc absent. Stamens subsessile, inserted at top of corolla tube and included within it; anthers free from stigma. Style filiform, clavuncula level with or just below anthers. Ovary of 2 fused carpels, 1–4 ovules per locule. Fruit a showy ellipsoid or globose berry with coriaceous skin. Seeds 2–4 per berry, elliptic and compressed around placenta, surface glabrous and coma absent.

Widely cultivated in tropical and subtropical areas, particularly for hedges. Fruits acidic but edible and roots used medicinally.

- 1. Berries 2-seeded; leaf veins indistinct from above and not arching into a intramarginal vein ..... **1. C. paucinerva**
- + Berries 4-seeded; leaf veins distinct from above, arching into a prominent intramarginal vein ..... **2. C. spinarum**

**1. C. paucinerva** A.DC.; *C. spinarum* auct. non L., *C. paucinerva* A.DC. var. *opaca* Haines. Fig. 65a&b.

Small diffuse bushy shrub, young stems and inflorescence branches pubescent

or glabrous; spines to 3.5cm long. Leaves narrowly elliptic to ovate, 13–40 × 6–17mm, apex acute and mucronate, base cuneate, margins somewhat inrolled, veins inconspicuous from above (or only primary veins apparent) and not arching into a prominent intramarginal vein; petiole 0.5–2mm long. Peduncles very short, 2–3mm. Calyx lobes 1–2mm long. Corolla tube 6–7mm long; lobes 3–4(–6)mm, puberulent. Berries ellipsoid (to globose), 6–8(–10) × 4–7mm, 2-seeded. Seeds 5–8 × 2.5–4mm.

**Darjeeling:** Sivoke Hills. Terai plains, 100–600m. March–August.

## 2. *C. spinarum* L.

Large shrub with a zigzag branching pattern; younger parts and inflorescence branches adpressed pubescent; spines to 2cm long. Leaves elliptic to ovate, 10–35(–50) × 8–25(–30)mm, apex acute to acuminate, mucronate, base cuneate to rounded, veins forming a distinct reticulate pattern from above, paler than lamina, arching into a prominent intramarginal vein; petiole 1–4mm long. Peduncles 2–10mm. Calyx lobes 1–2(–3)mm long. Corolla tube 9–14mm, puberulent; lobes c 10mm long. Berries globose to ellipsoid, 6–8 × 4mm, 4-seeded. Seeds c 5–6 × 2.5mm.

**Darjeeling** (34): terai plains, 100–1800m (80). November–June.

This species has often been confused with *C. paucinerva* and the above literature record from Darjeeling may be based on a misidentification. However *C. spinarum* is widespread in the dry plains of India and is to be expected. Fruit edible (126).

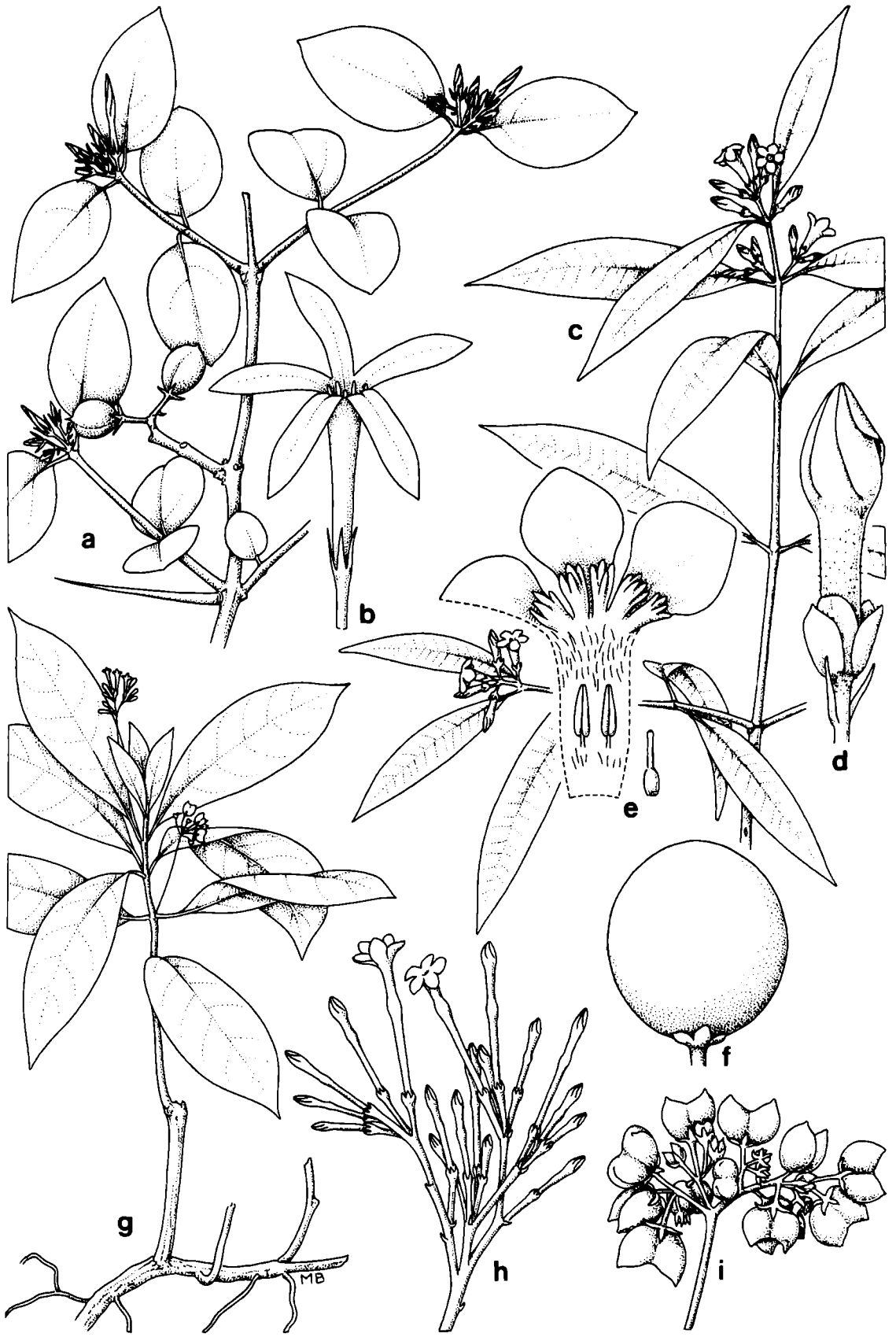
A third species, *C. carandas* L. is widely cultivated throughout India and may be grown in southern Bhutan. It is very closely related to *C. spinarum* (and may prove to be just an old cultivar of it), but differs in the more rounded-oblong leaves with obtuse ends, the glabrous young branches and larger flowers (corolla tube usually more than 15mm).

## 2. MELODINUS Forster

Evergreen erect or climbing shrubs. Leaves opposite. Flowers white or pale-pink, rarely 4-merous, salver-shaped, in terminal and axillary cymes. Calyx lobes fused only at base, eglandular within. Corolla tube cylindrical, slightly inflated above middle around anthers; mouth adorned with paired coronal scales; lobes overlapping to left. Disc absent. Stamens subsessile, free from stigma. Style short; clavuncula level with anthers or just below. Ovary of 2 fused carpels, ovules numerous. Fruit a globose berry, pericarp very coriaceous.

FIG. 65. **Apocynaceae.** a–b, *Carissa paucinerva*: a, flowering shoot (× 1); b, flower (× 3). c–f, *Melodinus khasianus*: c, flowering shoot (× 1/3); d, flower bud (× 2 1/2); e, half flower (× 3); f, fruit (× 2/3). g–i, *Rauvolfia serpentina*: g, flowering shoot (× 1/4); h, inflorescence (× 1); i, fruits (× 1). Drawn by M. Bates.





Seeds many, flat and rounded, surface wrinkled and glabrous, buried in a fleshy pulp.

1. Corolla tube c 6mm; leaves usually less than 13cm long .. **1. M. khasianus**  
 + Corolla tube c 15mm; leaves usually more than 13cm long  
**2. M. monogynus**

**1. M. khasianus** Hook.f. Nep: *Phungtse*. Fig. 65c–f.

Glabrous climber, creeping to 3–5m, branches smooth and lenticellate. Leaves subcoriaceous, elliptic-lanceolate to ovate-lanceolate, 6–14 × 1.4–4cm, apex acuminate, base cuneate, with prominent lateral veins. Flowers almost white, fragrant, in few-flowered subracemose cymes. Calyx lobes rounded, apiculate, 3–4 × 3–4mm, ciliate. Corolla tube 5–8mm long, puberulent inside and out; lobes rounded, rather thick, c 5 × 5mm. Fruit white or reddish, ellipsoid, 3–6cm long. Seeds c 13 × 9mm, buried in a reddish pulp.

**Bhutan:** **S** – Chukka district (Bunakha, Tala) and Deothang district (Samdrup Jongkhar), **C** – Thimphu district (Changkaphug) and Tongsa district (Jirgang Chu Valley, between Tongsa and Changkha). Moist warm broad-leaved forest, 1500–2300m. July.

Seeds eaten by people and monkeys.

**2. M. monogynus** Roxb.

Similar to *M. khasianus* but larger in all its parts; leaves more coriaceous, 13–16 × 3.7–5cm; corolla tube 12–20mm long; fruit orange, large, c 10cm diameter (80). No specimens seen.

**Sikkim:** Bartning (80). Rainforest, 1400m. Flowering time not recorded.

### 3. CERBERA L.

Small, glabrous, evergreen trees. Leaves alternate, crowded at ends of the branches, turning black when dried. Inflorescence a terminal cyme or pseudoaxillary. Flowers large, salver-shaped. Sepals fused only at base. Corolla tube cylindrical, slightly inflated above middle around anthers, throat with 5 hairy coronal scales; lobes overlapping to left. Disc absent. Stamens subsessile; anthers free from stigma. Style filiform with clavuncula borne level with or just below anthers. Ovary of 2 distinct carpels each containing 4 ovules. Fruit a solitary (rarely paired) globose or ellipsoid drupe, with thick fibrous pericarp and hard woody endocarp. Seeds 1–2 per locule, broad, compressed.

**1. C. manghas** L.

Small tree or large shrub to c 10m, branches very thick. Leaves coriaceous, oblanceolate to lanceolate, 8–17 × 2–5.5cm, apex abruptly acuminate, base narrowly cuneate, shiny above; petiole stout, 1–3cm. Flowers white with a pink or yellow eye, rarely entirely white, in large, many-flowered, corymbose cymes.

Inflorescence branches stout; peduncles 8–10cm long, to 8mm thick; pedicels short. Calyx lobes large, persistent, ovate-lanceolate, acuminate, 9–12 × 2–3.5mm. Corolla tube 1.5–2cm; lobes ovate (sometimes broadly so), acute to rounded, 20–25 × 8–15mm. Fruit globose, 5–10cm long. Seeds not seen.

**Darjeeling:** unlocalised Cowan specimen. Cultivated? in subtropical areas. October–January.

Seeds poisonous.

#### 4. THEVETIA L.

Shrubs and trees with alternate leaves. Flowers large, terminal, solitary or in cymes. Sepals fused only at base, eglandular within. Corolla tube narrow and cylindric below anthers, widening above; lobes overlapping to left, throat with 5 hairy coronal scales. Disc absent. Stamens subsessile; anthers free from stigma. Style filiform, with clavuncula borne level with anthers. Carpels 2, completely fused; ovules 2 per locule. Fruit drupaceous, broader than long.

1. **T. peruviana** (Persoon) Schumann; *T. nereifolia* Steudel, *Cerbera peruviana* Persoon, *C. thevetia* L., *Cascabela thevetia* (L.) Lippold. Eng: *Yellow Oleander*, *Lucky Nut*.

Evergreen shrub or small tree, to 3–5(–10)m tall, bark grey, darkening with age. Leaves coriaceous, linear to linear-lanceolate, 75–120 × 4–8.5(–10)mm, apex narrowly acuminate, base narrowly attenuate, dark green and glossy; petiole c 1.5mm, leaves almost sessile. Flowers orange or yellow, fragrant, solitary in upper leaf axils. Calyx lobes oblanceolate, 6–9mm long. Corolla tube c 15mm long below stamens, widening for c 10mm; lobes obovate, 3–3.5mm long. Fruit transversely ellipsoid with transverse distal ridge, 18–27 × 25–33mm, red, ripening black, hard. Seeds globose, 4 per fruit, c 13 × 13mm, glabrous, unwinged.

**Bhutan:** S – Deothang district (Samdrup Jongkhar); **Darjeeling** (34). Mainly cultivated but can escape, 150–900m. April–June.

Native of tropical America but widely cultivated in tropical areas. Poisonous.

#### 5. RAUVOLFIA L.

Glabrous, evergreen shrubs. Leaves in whorls of 3–5, rarely opposite; petioles with axillary glands. Inflorescence cymose, sometimes paniculate, alternate with terminal leaves, becoming lateral. Flowers salver-shaped. Sepals fused at base, eglandular within. Corolla tube cylindric, slightly inflated at or above middle around anthers, constricted at apex, throat hairy within; lobes broad, overlapping to left. Disc large, cup-shaped. Stamens subsessile, free from stigma. Style filiform, clavuncula level with anthers. Ovary of 2 distinct or fused carpels each with 2 ovules. Fruit drupaceous, of 2 free or fused drupes, each 1-seeded. Seeds ovoid, glabrous, without wings.

1. Small undershrub; branches usually smooth; leaves membranous; peduncles usually more than 5cm long; fruit solitary or in fused pairs

**1. *R. serpentina***

+ Larger shrub, branches densely lenticellate; leaves subcoriaceous; peduncles usually less than 5cm long; fruit solitary or in free pairs .. **2. *R. verticillata***

**1. *R. serpentina* (L.) Kurz.** Fig. 65g–i.

Small undershrub 0.2–1(–2)m tall, bark pale brown, rarely lenticellate. Leaves condensed near top of stems in whorls of (2–)3–4, membranous, elliptic-lanceolate to obovate, 7–13(–17) × 2.8–6.5(–9)cm, apex acuminate to acute, base cuneate sometimes attenuate, dark green above, paler below. Flowers many, white or pinkish, tube often mauve or red, in crowded cymose inflorescences (rarely racemose) with reddened branches (particularly in fruit). Peduncles long, 4–9cm, stout; pedicels very short. Calyx lobes triangular-lanceolate, 1–2(–3)mm long. Corolla tube slender, often curved, inflated slightly just above middle, 10–19mm; lobes obovate, 3–4 × 3mm. Fruit black, surface smooth, solitary or more often in a conspicuously fused bifid pair, 5–8mm long.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Gaylegphug district (between Gaylegphug and Tori Bari), C – Mongar district (Shongar); **Darjeeling:** Bamon Pokri, Birik (249), Darjeeling, Kurseong (249), Mahanadi (249), Moradabad, Rangit (249), Ryang, Sukna (249) and Tista. Semi-open areas, terai forest margins, roadside scrubs, plantations, 200–1200m. January–June.

The root yields the alkaloid reserpine which is used to treat high blood pressure (117), madness, intestinal diseases and is said to be effective as an antidote to snake venom (249).

**2. *R. verticillata* (Loureiro) Baillon; *R. densiflora* (Wall.) Benth & Hook.f.**

Similar to *R. serpentina* but a larger shrub, with copiously lenticellate branches. Leaves usually 4 per whorl, subcoriaceous, very variable in size and shape, obovate to oblanceolate, 10–22 × 3–10cm. Inflorescence more lax, peduncles shorter, 3–7cm long. Flowers rose-red or white. Sepals elongate, half the length of corolla tube. Corolla tube 5–6mm or more long, inflated at the top. Fruit solitary or in unfused pairs, 7–12mm long, surface wrinkled.

**Darjeeling:** Samsing and unlocalised specimen. Habitat and altitude not recorded. Fruiting in August.

## 6. ALYXIA R. Brown

Lianas, rarely erect shrubs; young branches angular. Leaves in whorls of 3 or opposite, usually coriaceous, with dense lateral veining. Inflorescence an axillary or pseudoterminal cyme or cymose panicle. Flowers small, white, salver-shaped, fragrant. Calyx short, deeply lobed, eglandular within. Corolla tube cylindrical, slightly inflated at or above middle, around anthers, hairy inside, around stamens; lobes short, obliquely ovate, overlapping to left. Disc absent

(or minute). Stamens free from stigma, subsessile. Style with clavuncula level with anthers. Ovary of 2 distinct carpels. Fruit a drupe or berry, solitary or in pairs. Seeds black, ovoid to oblong, grooved.

### 1. *A. gracilis* (A.DC.) Jackson

Glabrous twining shrub with slender, pale-barked, lenticellate branches. Leaves elliptic-oblong to lanceolate, 45–120 × 16–42mm, apex caudate, base cuneate, margin slightly inrolled; petiole 5–8mm. Flowers numerous, in slender-branched panicle. Calyx lobes c 1mm long, ovate-triangular. Corolla tube 1.5–3mm long, throat hairy; lobes c 3mm long, oblong, rounded. Carpels hirsute. Fruit (not seen) c 19mm long, ellipsoid, smooth (80).

**Darjeeling:** terai forest, 300–600m (80). June–September.

## 7. ALLAMANDA L.

Erect or climbing shrubs. Leaves opposite or in whorls of 3–4. Inflorescences cymose, terminal or pseudoaxillary. Flowers large and showy, salver-shaped; corolla lobes overlapping to left. Disc absent. Stamens subsessile; anthers free from stigma. Style long, filiform, with clavuncula borne level with anthers. Ovary of 2 fused carpels, ovules numerous. Fruit a large, spiny, globose capsule, dehiscent by 2 valves. Seeds many, flattened, winged, glabrous.

### 1. *A. cathartica* L. Eng: *Golden-Trumpet*.

Climbing shrub or liana, 0.5–2m tall or more; stems smooth sometimes tinged red. Leaves ovate to oblong or obovate, 6–10 × 2.7–4cm, apex abruptly acuminate to acute, base cuneate, membranous to subcoriaceous, sparsely puberulent, intramarginal veins present; petiole 0–5mm, puberulent. Flowers bright yellow with paler throat, in 1–8-flowered inflorescences; peduncles and pedicels rather thick. Sepals united only at base, ovate, acute, 8–17 × 2.5–7mm, sparsely puberulent. Corolla tube narrow and cylindric below stamen insertion point (13–35mm), then abruptly widening to funnel-shaped for c 3cm; lobes rounded 1.5–3 × 1.5–3cm; corolla glabrous except for a dense ring of hairy scales within at anther level. Fruit 1–4cm long, densely covered in woody spines 8–12mm long. Seeds elliptic with narrow marginal wing, 13–16 × 8–10mm.

**Bhutan:** S – Sarbhang district (Sarbhang) and Gaylegphug district (Gaylegphug); **Darjeeling:** Peshok (34); **Sikkim:** Gangtok. Cultivated in gardens, 400–500m. May–June.

A species cultivated worldwide as an ornamental. Several cultivars have been described, one of which has been recorded from Bhutan:

cultivar **grandiflora**; *Allamanda grandiflora* Lamarck.

Differs in the larger, paler, lemon-yellow flowers; corolla tube below anthers to 4cm long; lobes c 4 × 5cm. One Bhutanese specimen seen.

**Bhutan:** S – Deothang district (Samdrup Jongkhar, cultivated).

## 8. PLUMERIA L.

Erect trees with thick, swollen branches. Leaves large, spirally arranged at ends of branches. Flowers large, salver-shaped, in many-flowered, terminal, 2–3-chotomous, cymose inflorescences. Sepals small, eglandular within, lobes broad, obtuse. Corolla tube slender, cylindric, scarcely inflated around anthers, pubescent within; lobes overlapping to left. Disc absent. Stamens inserted near base of corolla tube; filaments short; anthers free from stigma. Style short. Carpels 2, distinct, ovules numerous. Fruit paired, cylindric to ellipsoid follicles. Seeds winged, plumeless.

1. *P. rubra* L. forma *acutifolia* (Poiret) Woodson; *P. acutifolia* Poiret, *P. acuminata* Aiton. Eng: *Frangi-Pani*, *Temple-Tree*; Nep: *Bara Massey*.

Small deciduous tree, 5–7m tall, with rough bark. Leaves glabrous, subcoriaceous, lanceolate to oblanceolate, (9–)20–35 × (2.5–)5–10cm, apex acute to acuminate, base attenuate, with numerous parallel lateral veins and conspicuous intramarginal veins; petiole 3–8cm. Flowers white with yellow centre, sometimes flushed pink-purple outside, strongly scented, petals rather thick and robust. Sepals short, 2–3mm long, blunt. Corolla tube c 15mm long; lobes 25–35 × 15–20mm, obliquely obovate. Fruit (rarely formed, not seen) cylindric, to 25 × 2–3cm.

**Bhutan:** S – Phuntsholing district and Gaylegphug district (Gaylegphug); **Darjeeling:** Pankhabari. Cultivated in gardens and occasionally naturalised in subtropical areas, to 1200m (167). January–December.

Native of tropical America, widely naturalised elsewhere in the tropics. Roots, bark and milky latex used medicinally (167).

## 9. CATHARANTHUS G. Don

Annual or perennial herbs, often woody at base. Leaves opposite, membranous to slightly coriaceous. Flowers salver-shaped in a 1–2-flowered pseudoaxillary inflorescence. Corolla tube cylindric, slender, inflated distinctly above middle, hairy within, lobes overlapping to left. Disc of 2 triangular-oblong glands. Stamens inserted just below corolla mouth. Style filiform, clavuncula free from anthers. Ovary of 2 distinct carpels, ovules many. Fruit paired, cylindric, acute, erect to spreading follicles, green when mature. Seeds plumeless, black with rough surface.

1. *C. roseus* (L.) G. Don; *Vinca rosea* L., *Lochnera rosea* (L.) Reichenbach.

Erect to decumbent undershrub, 0.3–2m high, stems yellow-green, sometimes tinged purple. Leaves glabrous, elliptic, obovate to narrowly so, 30–68 × 10–35mm, apex obtuse and rounded, mucronate, base cuneate. Petiole 3–10mm long. Flowers white with a purple, red, pink, pale yellow or white eye; tube tinged green. Sepals fused only at base, teeth lanceolate, c 4mm long. Corolla

tube 24–30mm long, inflated near mouth, glabrous outside but hairy within, around mouth and in a ring below anthers; lobes obliquely obovate, c 20 × 13mm. Fruit 14–35mm long, striate. Seeds oblong, c 2 × 1mm.

**Bhutan:** S – Phuntsholing district (Phuntsholing, Torsa River) and Gaylegphug district (Gaylegphug), C – Tongsa district (Tintibi); **Darjeeling:** Jalpaiguri Duars, Singla Bazar. Cultivated in gardens and as an escape on roadsides, 90–1100m. February–July.

This plant, indigenous to Madagascar, is widely cultivated as an ornamental and has often escaped becoming a tropical weed, particularly in dry, sandy places. It contains alkaloids of medicinal importance and is used to treat complaints such as malaria, cancer, diabetes, diarrhoea, etc., the leaves are chewed to dull the feeling of hunger.

## 10. HOLARRHENA R. Brown

Deciduous undershrubs, shrubs or trees. Leaves opposite or subopposite, membranous, veins arched and anastomising. Flowers salver-shaped, sweet-scented (towards evening), in terminal or pseudoaxillary, many-flowered corymbose cymes. Sepals free or fused only at base, narrowly elliptic to linear, usually pubescent with glandular and non-glandular hairs. Corolla tube cylindric, slender, inflated at base, pubescent inside around throat; lobes overlapping to right. Disc absent. Stamens inserted at base of corolla tube; filaments subsessile. Style short with clavuncula free from anthers. Carpels 2, distinct, ovules numerous. Fruit of paired follicles. Seeds linear to linear-oblong, ridged, with dense plume of hairs at apex.

All species contain alkaloids.

1. *H. pubescens* (Buchanan-Hamilton) G. Don; *H. antidysenterica* (L.) A. DC., *Echites pubescens* Buchanan-Hamilton, *Chonemorpha pubescens* (Buchanan-Hamilton) Sweet. Eng: *Bitter Oleander*, *Easter Tree*; Nep: *Khissa*, *Khhira* (34); Lepcha: *Fajerip* (34). Fig. 66a–d.

Shrub or tree 0.6–18m tall; bark pale to dark grey, smooth becoming rough and corky, lenticellate. Leaves elliptic-ovate to ovate-lanceolate, lower pairs on a side branch often suborbicular, 2–18 × 1.6–11cm, apex acuminate or acute, base cuneate or rounded, pubescent to glabrous on both sides; petiole short, 2–6mm, usually pubescent. Inflorescence lax, flowers white, tube sometimes tinged green. Sepals linear-elliptic, c 2mm long, subequal. Corolla pubescent to glabrous, tube 9–12mm long; lobes obovate, 10–20 × 3–8mm, somewhat recurved. Fruit usually long cylindric, 20–34 × 0.2–0.9cm, pendulous, pale grey to dark brown, often dotted white with lenticels. Seeds 9–16mm long with large deciduous coma c 4cm long.

**Bhutan:** S – Phuntsholing district (Phuntsholing), Sankosh district (Balu Khola) and Gaylegphug district (Mao River Bridge), C – Mongar district (Saleng); **Darjeeling:** Bamon Pokri, Kalimpong, Pankhabari, Ryang, Sivoke,

Sukiapokhri, Siliguri–Kurseong. Deciduous mixed forest and scrub, roadsides and river banks, 150–900m. April–June.

Bark (and seeds) used to treat dysentery, for a tonic and febrifuge. The soft white wood provides a low quality timber.

### 11. ALSTONIA R. Brown

Trees or shrubs. Leaves in whorls of 3–5, rarely opposite, shape very variable within the genus and within an individual, lateral veins numerous and closely parallel, intramarginal veins present, leaf axils with linear glands. Inflorescence an apparently terminal, corymbose cyme with short peduncle. Flowers salver-shaped. Calyx short, eglandular within. Corolla tube cylindric, inflated around anthers, pubescent or glabrous; lobes overlapping to left (in Bhutanese species). Disc ring-shaped, lobed or truncate or absent. Stamens inserted near top of corolla tube, free from stigma. Style long, filiform, with clavuncula held at anther level. Carpels 2, distinct, ovules numerous. Fruit slender, follicles linear, in pairs, many-seeded. Seeds oblong or linear, distinctly flattened, often ciliate.

1. Large tree 20–40m tall; leaves mainly more than 15cm ..... **1. A. scholaris**  
 + Shrub less than 5m tall; leaves less than 15cm long ..... 2
2. Corolla tube 9–20mm; lobes 1–2cm long ..... **2. A. neriifolia**  
 + Corolla tube less than 10mm; lobes less than 2mm long ..... **3. A. sebusi**

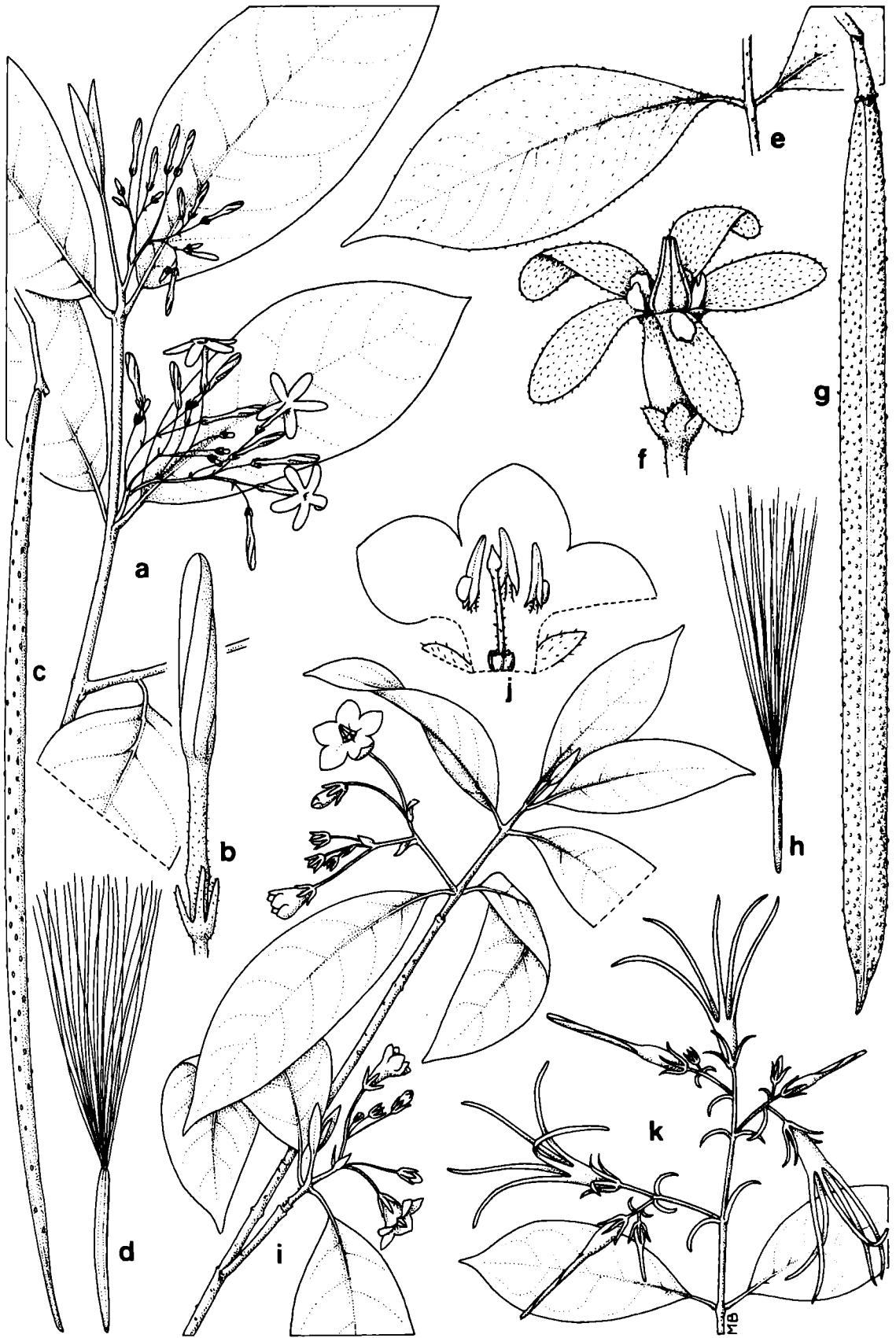
**1. A. scholaris** (L.) R. Brown; *Echites scholaris* L. Nep: *Chatiwan* (34); Lepcha: *Purbokung* (34).

Evergreen tree 20–40m tall, branches whorled, trunk tall, to 1.25m diameter, base often buttressed, bark grey-brown. Leaves in whorls of 4–7, very coriaceous, oblanceolate to elliptic-oblong, 7–28 × 2–8cm, apex obtuse to rounded or acute, base cuneate to attenuate, green above, white below, sparsely hairy, particularly along midrib; petiole stout, 0.5–2cm. Flowers green-white, numerous, in shortly branched cymes or almost sessile clusters at ends of umbellate, stout inflorescence branches. Calyx lobes ovate-lanceolate, 1.5–3mm long, densely puberulent. Corolla tube 6–10mm long, slightly inflated at apex, puberulent; lobes 2–4 × 2–4mm, rounded, both sides puberulent, margin undulate. Disc absent. Fruit very long and slender, pendulous in clusters, 30–60 × 0.2–0.5cm. Seeds c 8mm long, linear, with coma-like long brown cilia at both ends.

**Bhutan:** S – Phuntsholing district (Phuntsholing (69)) and Sarbhang district

FIG. 66. **Apocynaceae.** a–d, *Holarrhena pubescens*: a, flowering shoot (× ½); b, flower bud (× 2); c, fruit (× ½); d, seed (× 1). e–h, *Wrightia arborea*: e, leaf (× ½); f, flower (× 1½); g, fruit (× ½); h, seed (× ⅔). i–j, *Vallaris solanacea*: i, flowering shoot (× ⅔); j, half flower (× 2). k, *Strophanthus wallichii*: flowering shoot (× ½). Drawn by M. Bates.





(Phipsoo Khola); **Darjeeling** (34). Dry forests, 300–1000m. November–February.

Throughout south Bhutan, often planted (*pers. comm.* C. Dorji). Bark said to be used as pig fodder (34).

**2. *A. neriifolia*** D. Don. Nep: *Chatiwan* (34); Lepcha: *Purbo-kung* (34).

Shrub or small tree to 4m tall; branches softly pubescent. Leaves subcoriaceous, 3–4 in a whorl or opposite, lanceolate to lanceolate-obovate, 50–200 × 13–45mm, apex acuminate (sometimes rather caudate) to acute, base cuneate, hirsute-pubescent to sparsely so, more dense on underside; petiole 5–20mm, hirsute. Inflorescence lax, branches hirsute. Flowers yellow-green, pale red outside. Calyx lobes 1–2mm long, narrowly triangular, ciliate (at least at base, sometimes minutely so). Corolla tube 9–20mm long, distinctly inflated at apex, pubescent at mouth; lobes 1–2 × 0.5cm, elliptic. Disc of 2 ligulate glands alternate with the carpels. Stigma-apiculi short, blunt. Fruit 5–13cm × 6–7mm, brown, striate, silver inside. Seeds 8–10 × 2–3mm, densely long (3–10mm), brown ciliate.

**Bhutan:** C – Punakha district (Nyatoka–Kyebaka–Samtengang–Choojom); **Darjeeling:** Siliguri; **Sikkim:** literature record, unlocalised (69). Dry rocky areas, riversides, moist mixed plain and lower hill forest (34), 500–1600(–1900?)m. April–May.

Specimens with glabrous leaves and inflorescences have been treated as var. **glabra** Monachino. This variety appears to be endemic to **Darjeeling:** district (Darjeeling and Tista valley).

**3. *A. sebusi*** (van Heurck & Müller Argoviensis) Monachino; *Blaberopus sebusi* van Heurck & Müller Argoviensis.

Similar to *A. neriifolia* but differing mainly in floral characters; corolla tube shorter, c 1cm long; lobes very short, c 2 × 2mm, margins inrolled; stigma-apiculi sharp; cilia of seeds 5–6mm long.

**Bhutan:** C – Punakha district (Wangdu Phodrang) and unlocalised Griffith specimen. Habitat, altitude and flowering period unknown.

Only known from two Bhutanese collections. Hooker (80) treated the Griffith type as a mixed collection (of *A. neriifolia* and *A. venenata* R. Brown) and thus did not recognise *A. sebusi*. Monachino in his monograph of *Alstonia* disputed this, basing his work on the two gatherings. This view is accepted here, but more collections are needed to fully clarify the position.

## 12. TABERNAEMONTANA L.

Evergreen trees or shrubs. Leaves opposite. Flowers white, salver-shaped, in terminal or axillary cymes. Calyx tube glandular within. Corolla tube slender-cylindric, somewhat inflated in middle, lobes overlapping to left. Disc absent. Stamens included in corolla tube, with short filaments, free from stigma. Carpels

2, distinct, ovules many. Fruit paired, ovoid or oblong (or reniform) follicles. Seeds ellipsoid, plumeless, in fleshy aril.

1. *T. divaricata* (L.) Roemer & Schultes; *T. coronaria* (Jacquin) Willdenow, *T. recurva* Lindley, *Nerium divaricatum* L., *Ervatamia divaricata* (L.) Burkill, *E. coronaria* Stapf, *Testudipes recurva* (Lindley) Markgraf. Nep: *Tagar* (34), *Assamey*; Lepcha: *Fajeerip* (34).

Freely branching shrub to 5m, bark pale grey. Leaf pairs unequal in size, leaves subcoriaceous, elliptic to obovate-oblongate, 75–150 × 22–55mm; glabrous, apex acuminate or caudate, base cuneate to narrowly so; petiole 5–10mm, with basal scale-like appendage in the axil. Inflorescence a 1–8-flowered corymbose cyme. Flowers pure white with a small yellow eye, tube pale green at base, scentless or scented, often double in cultivated forms. Calyx tube 1.5–2mm long; lobes c 1mm, rounded to acuminate, variable in shape. Corolla tube 16–20mm long, glabrous outside, pilose inside below stamens; lobes obovate, 15–22 × 10–20mm. Stamens subsessile, inserted just below middle of tube. Follicles recurved, 20–40 × 6–12mm, tapered at both ends, orange, 3–6-seeded. Seeds 8–12mm long, with crimson aril.

**Bhutan:** S – Phuntsholing district (Phuntsholing), Sankosh district (Pinkhua), Gaylegphug district (Gaylegphug, Gaylegphug–Tori Bari) and Deothang district (Diu Ri Valley, Deothang, Satsalor), C – Tongsa district (Mangde Chu River) and Mongar district (Lhuntse Dzong); **Darjeeling:** Bamon Pokri, Daling, Darjeeling, Jalpaiguri Duars, Mahanadi, Pankhabari, Ryang, Tista. Widespread in subtropical areas, in dense evergreen forests to river banks, often cultivated, 150–1350m. August–June.

Widely cultivated in tropical countries, usually as the sweet-scented double form which does not produce fruit.

### 13. WRIGHTIA R. Brown

Shrubs or small trees, often with slender branches. Leaves opposite, deciduous. Inflorescences terminal or subaxillary cymes. Flowers salver- or trumpet-shaped. Calyx tube short, glandular within. Corolla tube cylindrical, short, with 1–2 series of coronal scales at the throat; lobes overlapping to left. Disc absent. Stamens attached at top of corolla tube forming a cone around and fused to clavuncula. Ovary of 2 free or united carpels, ovules numerous. Fruit a cylindrical follicle with tapering ends, either in pairs or fused. Seeds linear, laterally compressed and ridged, base bearing a large deciduous coma.

1. Corolla tube funnel-shaped, lobes large, c 2cm long ..... 1. **W. coccinea**
- + Corolla tube cylindrical, lobes smaller, c 1cm long ..... 2
2. Follicles and carpels fused, corolla tube c 5–7mm long; large coronal scales broad, c 3mm long ..... 2. **W. arborea**

- + Follicles and carpels free, corolla tube c 2mm long; large coronal scales narrow, c 5mm long ..... **3. *W. sikkimensis***

**1. *W. coccinea* (Roxb.) Sims; *Nerium coccineum* Loddiges**

Glabrous or pubescent timber tree to 6–7m or more, with pale bark. Leaves elliptic, sometimes narrowly so, 5–15 × 2.4–6.3cm, apex caudate-acuminate, base cuneate to obtuse-cuneate, membranous, usually glabrous except along veins on undersurface; petiole c 5mm. Inflorescence a 2–4-flowered monochasial cyme, peduncles very short, c 3mm. Flowers dark red inside with crimson corolla scales and throat; corolla greenish-yellow outside, fragrant. Calyx tube almost absent; lobes ovoid, 6–7 × 6mm. Corolla tube funnel-shaped, 8–16mm long; lobes obovoid, c 2 × 2cm, coriaceous. Coronal scales in narrow, crenate fringe around mouth of corolla. Stamens yellow-white, inserted midway up corolla tube; anther cone projecting from mouth. Carpels free. Follicles (not seen) free in pairs, linear-cylindric, c 30cm long. Seeds (not seen) c 2cm long, with white coma 3.5–4cm long.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Gaylegphug district (Tori Bari); **Darjeeling:** Tista, Darjeeling; **Sikkim:** unlocalised (34). Moist tropical evergreen forests, 300–900m. April–June.

**2. *W. arborea* (Dennstaedt) Mabberley; *Periploca arborea* Dennstaedt, *Wrightia tomentosa* (Roxb.) Roemer & Schultes, *Nerium tomentosum* Roxb. Sha: *Raba Warong Shing*; Nep: *Khirra* (34), *Dudhi*. Fig. 66e–h.**

Small, usually crooked tree 5–10(–20)m tall, with corky bark; branches lenticellate, younger parts pubescent. Leaves elliptic to ovate, (4–)6–12(–17) × (2–)2.8–5(–8.4)cm, apex caudate-acuminate, base cuneate, membranous, puberulent to tomentose on both surfaces, sometimes densely so; petioles 4–6mm. Flowers greenish-white or yellow, with orange coronal scales, in many-flowered, pubescent, peduncled cymes, fragrant. Calyx pubescent, tube c 1.5mm; lobes rounded, c 1.5mm long. Corolla tube 5–7mm long, glabrous inside and out; lobes linear-elliptic, c 1cm long, rather thick, papillose-puberulent. Coronal scales 5–10 in 1–2 series, c 3mm long, glabrous with crenulate margins. Stamens cream, pubescent on outer surface, in cone projecting c 6mm above corolla tube. Carpels fused. Follicles fused into a cylinder, densely covered in cream lenticels and grooved on opposite sides, 16–36 × 1–1.7cm. Seeds 12–20 mm long, with long white coma, 3–5cm.

**Bhutan:** S – Samchi district (Chengmari) and Phuntsholing district (Phuntsholing), C – Tongsa district (Tintibi Bridge), Mongar district (Kuru Chu) and Tashigang district (Dangme Chu and Tashigang Dzong); **Darjeeling:** Pankhabari, Tista and unlocalised specimens; **Sikkim:** unlocalised (34). Subtropical forests and scrub, wild and cultivated, 200–1350m. April–July.

**3. *W. sikkimensis* Gamble**

Climbing or erect shrub or small tree to 10m high; young shoots glabrous to minutely puberulent. Leaves like *W. arborea* but 6–15 × 3–6cm, rather thinner

and less pubescent, minutely puberulent above and on veins below, sometimes glabrous. Inflorescence similar to *W. arborea*. Flowers dull yellow-red to scarlet. Calyx lobes more ovate, c 2.5mm long. Corolla tube shorter, 1.5–2mm; lobes 10–12mm long. Coronal scales narrow, of 2 distinct types; 5 long, c 5mm and 5 short, c 1mm. Anther cone projecting further out from corolla tube to 7mm. Carpels free. Follicles free in pairs, slender, cylindric, 25–30cm long.

**Darjeeling:** Chunabati, Kurseong, Pankhabari; **Sikkim:** Ligship and other unlocalised specimens. Subtropical forests, 450–1200m. April–May.

Literature reports suggest that this species may possibly hybridise with *W. arborea* as some Indian specimens appear intermediate.

#### 14. BEAUMONTIA Wall.

Large, evergreen, woody climbers or trailing shrubs, with thick, pale and corky bark. Leaves large, opposite, membranous with distinctly arched veins. Flowers white, very large in few- to many-flowered terminal cymes. Bracts leaf-like. Calyx deeply divided, glandular or not within. Corolla broadly funnel-shaped, glabrous and rather fleshy, lobes overlapping to right. Disc deeply 5-lobed. Stamens inserted below middle of corolla tube; filaments long; anthers forming a cone level with or just below corolla mouth and fused to clavuncula. Ovary of 2 fused carpels, ovules very numerous. Fruit a large, woody pendulous pair of fused follicles. Seeds ovoid-oblong, flattened, with apical coma of white hairs.

1. **B. grandiflora** Wall. Nep: *Gautali Phul*, (34) *Gathale Phul*, *Gotale Phul*. Med: *Dung-mo-nueng*; Lepcha: *Chomrik* (34).

A very large climber with young stem and inflorescence branches rusty-brown tomentose. Leaves obovate to elliptic-oblong, (6–)12–28 × (2.2–)5–17cm, apex abruptly acuminate, base cuneate, glabrous above, rusty-brown tomentose on midrib and veins below; petiole 1–3.2cm. Flowers white, pale green below, very fragrant, in 3–19-flowered inflorescences. Calyx divided to base, lobes obovate to oblanceolate, variable, 3–4 × 1–2.5cm, rusty-brown velvet-tomentose. Corolla tube 8–12cm long and c 10cm across at the mouth, lobes short, triangular-ovate, abruptly acuminate with wavy margins, 2–2.5cm long and broad. Fruit (poorly known) narrowly ellipsoid with an obtuse apex, 22–31 × 5–6cm, divaricate towards the tip? Seeds c 2 × 1cm, coma c 4cm long.

**Bhutan:** S – Samchi district (Torsa Bridge), Sarbhang district (Lao Pani) and Gaylegphug district (Lodrai Khola), C – Tongsa district (Mangde Chu, Tintibi Bridge, Wange Khola); **Darjeeling:** Kalimpong, Pankhabari; **Sikkim:** Naya Bazar–Namchi (69), unlocalised (34). Climbing to the tops of trees and scrambling over banks and rocks in subtropical terai and warm broad-leaved forests, 200–1500m. February–April.

## 15. VALLARIS Burmann f.

Scandent or twining climbers or trailing shrubs, with pale grey-brown branches. Leaves opposite, membranous and minutely dotted. Flowers salver-shaped, in fragrant 1–10(–20)-flowered axillary or terminal, subracemose cymes. Calyx puberulent outside, glandular or not within, tube short; lobes ovate-oblong equalling corolla tube. Corolla tube glabrous except for a ring of hairs inside where the stamens are inserted; lobes broadly rounded, overlapping to right. Disc 5-lobed, ciliate. Stamens puberulent, inserted at top of corolla tube; filaments short; anthers forming an exserted cone around and fused to clavuncula, connectives with conspicuous domed glands outside. Ovary of 2 fused carpels, ovules very numerous. Fruit a tapering fibrous follicle, splitting into 4 valves when dry. Seeds ellipsoid, acuminate, flattened, with a long white basal coma.

1. **V. solanacea** (Roth) O.Kuntze; *Peltanthera solanacea* Roth, *Vallaris heynei* Sprengel, *V. dichotoma* (Roxb.) G.Don. Nep: *Duthe Lahara* (117). Fig. 66i&j.

Extensive, woody, twining shrub to 10m. Leaves elliptic to narrowly so or oblanceolate, 3–15 × 1.4–6cm, apex acuminate to acute, base cuneate to rounded, glabrous or pubescent, especially on midrib and veins below; petiole 0.3–1.5cm. Inflorescence branches puberulent, 5–30mm. Flowers fragrant, white to cream, sometimes tinged with green. Calyx tube c 1mm; lobes 4–6 × 1–2.5mm. Corolla tube c 4mm; lobes 7–9 × 5–9mm. Stamens exserted c 4mm from corolla mouth. Fruit (not seen) green to light brown, 8–14 × 1.5–3.5cm. Seeds (not seen) c 10 × 4mm, coma c 3cm long.

**Bhutan:** S – Phuntsholing district (Phuntsholing), Sarbhang district (Phipsoo) and Gaylegphug district (Gaylegphug); **Darjeeling:** Pankhabari and Siliguri. Open areas in subtropical forests, river banks etc., 270–450m. March–June.

## 16. NERIUM L.

Large evergreen shrubs or small trees with smooth silver-grey bark; young stem apices and inflorescence branches white, puberulent or plant mostly glabrous. Leaves in whorls of 3, very coriaceous, glabrous with revolute margins. Flowers funnel-shaped, very fragrant, in terminal many-flowered cymose inflorescences. Calyx divided to base, puberulent with single row of finger-like glands inside. Corolla tube glabrous except for a ring of hairs inside where the stamens are inserted; lobes broadly obovate, overlapping to right; coronal scales truncate, each with 3–8 filiform appendages. Disc absent. Stamens inserted near middle of corolla tube and included within it. Anthers forming a tight cone around and fused to clavuncula, each with a slender, hairy terminal appendage twisting together forming a woolly plug at mouth of corolla tube. Ovary of 2 fused carpels, ovules very numerous. Fruit a narrow, brown cylindrical follicle,

bivalved and tapering at both ends. Seeds oblong, densely covered with soft brown hairs which grade into the large apical coma.

1. *N. oleander* L.; *N. indicum* Miller, *N. odorum* Solander. Eng: *Oleander*.

Shrub to 6m tall. Leaves linear-oblong, 5–20 × 0.6–3.2cm, apex acute to acuminate, base cuneate to attenuate; petiole 5–10mm. Flowers rose-red, pink or white, often with darker lines. Calyx lobes rounded-oblong to linear-acute, 3–7 × 1–2.5mm. Corolla tube 1.6–2.2cm; lobes c 2 × 2cm; coronal scales with appendages to 8mm long. Fruit 7.5–17.7 × c 1cm. Seeds 4–7 × 1.5–2mm, coma 9–12mm long.

**Darjeeling:** cultivated in gardens (34); **Sikkim:** near Singtam. Cultivated, 600–1500m (167). Flowers nearly all year round.

Wild and cultivated in the Indian subcontinent and westwards into Europe. The Indian plants have in the past been separated from those in the Mediterranean at the species level. The Mediterranean plants have smaller, scentless flowers, deflexed calyx lobes and shorter, narrower leaves. Recent taxonomic revision has placed all variants into one very variable species.

The fragrant Indian plant and double forms are often cultivated in Europe. All parts are poisonous. Leaves and roots have various medicinal uses.

## 17. STROPHANTHUS A.DC.

Evergreen woody shrubs or climbers with lenticellate bark. Leaves opposite, membranous, glabrous with wavy margin. Inflorescence a many-flowered lax dichotomous cyme; bracts linear-lanceolate, recurved. Flowers pale yellow with red markings, darkening towards ends of thread-like corolla lobes; lobes overlapping to right. Calyx lobes divided to base, linear-lanceolate, recurved, very similar to bracts. Corolla funnel-shaped, glabrous, lobes ovate at base, abruptly tapering into long threads. Disc absent. Stamens inserted almost at middle of corolla tube, subsessile; anthers forming a cone around and fused to clavuncula, tips exerted and drawn out into filaments. Ovary of 2 free carpels. Fruit a large divaricate pair of cylindrical follicles, woody and lenticellate. Seeds oblong, flattened with long slender beak bearing a coma towards apex.

1. *S. wallichii* A.DC. Fig. 66k.

Self-supporting shrub to 3m high or twining up to 8m. Leaves elliptic-obovate, 5–11 × 2.2–5cm, apex shortly acuminate, base cuneate; petiole 5–8mm. Peduncles and cyme branches 1–5cm long; pedicels 5–10mm. Bracts and sepals c 1cm long. Corolla tube 9–15mm long; basal part of lobes 5–9 × 3–6mm, linear part 30–50 × 1mm. Staminal projections c 1cm long, very slender. Follicles linear-lanceolate, woody, 10–15cm long. Seeds (not seen) 10–18 × 3–4.3mm, with a narrow beak 2–4cm long, coma 0.5–1cm long on the upper 1.5–2.5cm.

**Bhutan:** S – Phuntsholing district (Phuntsholing) (71); **Darjeeling:** Jalpaiguri

Duars, Kalimpong and unlocalised specimens. Subtropical open areas, roadsides, etc., c 300m. April.

### 18. AGANOSMA G. Don

Stout evergreen woody climbers with opposite leaves; bark smooth on young shoots becoming lenticellate with age. Leaves glabrous, veins parallel and arching to a prominent intramarginal vein. Inflorescences terminal or axillary, medium to large tomentose cymes; bracts deciduous. Flowers salver-shaped, corolla lobes overlapping to right. Calyx divided almost to base. Corolla tube cylindrical; lobes linear-lanceolate; coronal scales small. Disc cup-shaped to cylindrical, 5-lobed. Stamens included within corolla tube, subsessile; anthers forming a cone around and fused to clavuncula. Ovary of 2 free follicles, ovules numerous. Fruit a divaricate pair of cylindrical follicles, very long and slender. Seeds linear-oblong, flattened, glabrous with white apical coma.

1. Calyx lobes more than 1.5cm long; corolla lobes more than 2cm long; leaves membranous, elliptic-ovate, veins obscure ..... **1. A. gracilis**
- + Calyx lobes less than 1cm; corolla lobes less than 2cm; leaves coriaceous, oblong-elliptic, veins prominent below ..... **2. A. marginata**

#### 1. *A. gracilis* Hook.f. Fig. 67a&b.

A vigorous, large climber with slender branches. Leaves elliptic-oblong, 6–12 × 2.5–5cm, apex shortly acuminate, base cuneate, membranous; petiole 5–16mm. Flowers white, yellow or pink in lax terminal dichotomous cymes. Inflorescence branches 2–4.5cm long, slender. Pedicels c 1cm. Calyx lobes linear-lanceolate, 17–30 × 1.5–3mm, tomentose, persistent after flowering. Corolla tube 1.5–2cm long, dilated at base around anthers; lobes linear-lanceolate, 3–4 × 0.5–0.9cm; tube and the outer parts of the lobes exposed in bud tomentose. Follicles (not seen) 10–15cm long. Seeds not seen.

**Bhutan:** S – Chukka district (Marichong), C – Mongar district (Saling); **West Bengal Duars:** Buxa; **Sikkim:** Ligship and several unlocalised specimens. Tropical and subtropical forests, 100–1100m. April–June.

A species restricted to the Bhutan, Sikkim, N. Bengal, Assam and Meghalaya region.

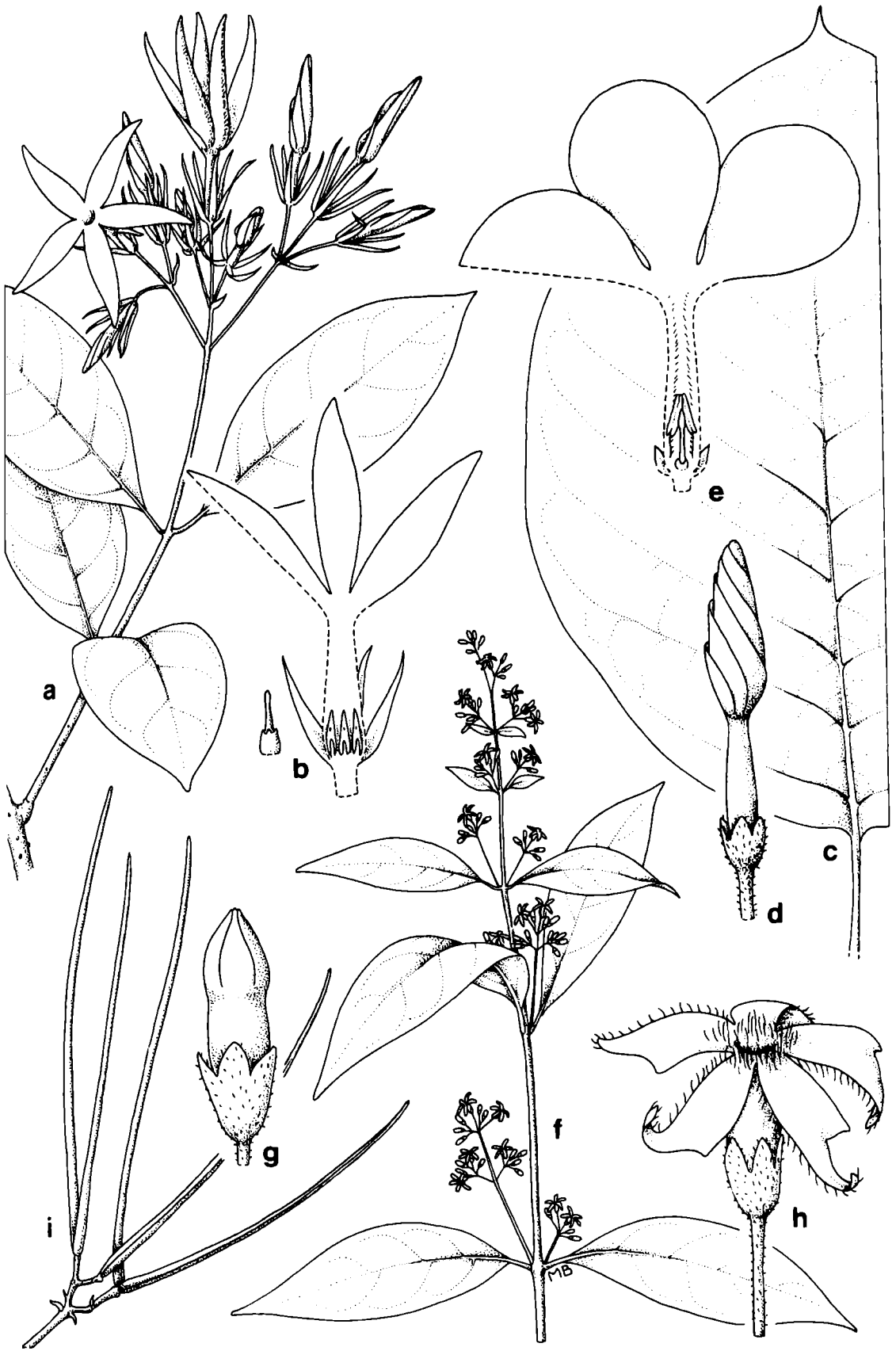
#### 2. *A. marginata* (Roxb.) G. Don

Robust scandent or subscandent shrub, somewhat similar to *A. gracilis*. Leaves coriaceous, shiny above, oblong-elliptic to oblong-ovate, 5–9.5 ×

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FIG. 67. **Apocynaceae.** a–b, *Aganosma gracilis*: a, flowering shoot (× ½); b, half flower (× 1). c–e, *Chonemorpha fragrans*: c, leaf (× ½); d, flower bud (× ⅓); e, half flower (× ½). f–i, *Ichnocarpus frutescens*: f, flowering shoot (× ½); g, flower bud (× 6); h, flower (× 6); i, fruits (× ½). Drawn by M. Bates.





1.8–3.8cm, apex abruptly acuminate, base rounded-caudate, main veins very prominent below. Inflorescence branches 1–2cm long. Flowers white, smaller in all parts than *A. gracilis*. Calyx lobes lanceolate, 1.5–5 × 1–1.5mm. Corolla tube only slightly dilated around anthers, 3–7mm long; lobes 8–15 × 1–3mm. Stamens inserted at middle of corolla tube. Fruit very long and slender to 60 × 0.5cm. Seeds c 8 × 1mm, coma c 2.5cm.

Darjeeling: unlocalised. Tropical and subtropical areas, 100–800m. April–July.

Apparently a rare species in the area.

### 19. CHONEMORPHA G. Don

Stout, woody climbers; bark with raised lenticels or tubercles. Leaves opposite, membranous to subcoriaceous, broadly elliptic to almost orbicular. Flowers large and coriaceous, salver-shaped, white, fragrant with a ring- or cup-shaped disc. Inflorescence a terminal or pseudoaxillary, lax, corymbose cyme with persistent tomentose bracts. Calyx deeply lobed, sometimes divided to base, glandular within. Corolla tube long and cylindrical, abruptly narrowed at base inside calyx below point of insertion of the stamens, glabrous outside, hairy within; lobes large, broadly truncate-spathulate, overlapping to right; corona scales absent. Stamens inserted towards base of corolla tube, subsessile; anthers included, forming a cone around and fused to clavuncula. Ovary of 2 free carpels, ovules numerous. Fruit a pair of woody follicles. Seeds broadly ovoid-oblong, flattened, with slender beak bearing a long deciduous coma.

1. Branches with raised light brown tubercles; flowers with red throat; follicles compressed ..... 1. *C. verrucosa*
- + Branches lenticellate; flowers with yellowish throat; follicles trigonal ..... 2
2. Calyx divided at most to middle; leaves large usually more than 15cm long ..... 2. *C. fragrans*
- + Calyx divided to base; leaves mainly smaller ..... 3. *C. griffithii*

1. *C. verrucosa* (Blume) Middleton; *Rhynchodia verrucosa* (Blume) Woodson, *R. wallichii* Hook., *R. rhynchosperma* (Wall.) Schumann, *Tabernaemontana verrucosa* Blume.

Glabrous shrub climbing to 20m or more. Leaves broadly elliptic-ovate, 12–22(–25) × 4.5–13cm, apex shortly acuminate, base cuneate to rounded; petiole 15–28(–32)mm. Flowers white with red centre, very fragrant, in lax, slender branched cymes. Peduncles 18–35mm long, pedicels 8–24mm. Calyx lobes ovate-lanceolate, c 3 × 1mm, minutely ciliate. Corolla tube 6–9mm long; lobes 9–14 × 7–10mm. Follicles c 40 × 1.2cm, compressed. Seeds not seen.

**Sikkim:** Pedong and unlocalised specimen. Subtropical forests, 900–1700m. May.

2. *C. fragrans* (Moon) Alston; *C. macrophylla* (Roxb.) G. Don. Nep: *Chomik* (34), *Khola Bohar*, Nep: *Goldengri*, *Hua-Lara*. Fig. 67c–e.

Very large climber with stems to 25m or more; younger parts and inflorescence branches tomentose. Leaves usually very large, broadly elliptic to orbicular, 23–35 × 17–31cm, ovate or obovate, apex abruptly acute to acuminate, base cuneate to cordate, glabrous to sparsely strigose above, particularly on main veins, more so below; petiole 1.5–5cm, stout. Inflorescence 7–15-flowered, peduncles 6–16cm long. Calyx tube 4–8mm long; lobes ovate-triangular, acute, 4–7mm long. Corolla tube 3.5–6cm long, throat yellowish; lobes large, 3.5–5 × 2.5–3.5cm. Follicles 25–40 × c 2cm, trigonous. Seeds 10–15 × c 6mm, beak 10 × 1mm, glabrous except for 5–8cm long white apical coma.

**Bhutan:** S – Sarbhang district (Sarbhang–Chirang) and Deothang district (Deothang), C – Punakha district (Wangdu Phodrang) and Tongsa district (Tintibi Bridge); **Darjeeling:** Buxa, Jalpaiguri Duars, Tista, Rishap; **Sikkim:** Pamianchi–Tingling Bridge (69) and unlocalised specimens. Climbing high on trees in wet subtropical forests, 540–1700m. April–July.

Said to make a good India-rubber (34).

3. *C. griffithii* Hook.f.

Similar to *C. fragrans* but generally smaller in all its parts; young stems and inflorescence branches more hirsute, sometimes yellow-hispid; leaves 7–17 × 3–9.5cm, usually more hairy; calyx divided to base, lobes 9–13 × 3–5mm, ovate-lanceolate, acute; corolla tube 1.6–2.5cm long; lobes 3–4.5 × 4cm; follicles 22–28 × 1.5–2cm.

**Darjeeling:** Buxa, Kurseong, Pankhabari and unlocalised specimens; **Sikkim:** Parmeeklag and unlocalised specimens. Wet subtropical forests, 600–1700m. May–July.

This species is apparently restricted to the East Himalaya and Assam Hills.

## 20. TRACHELOSPERMUM Lemaire

Climbing shrubs or lianas with opposite, somewhat coriaceous leaves. Flowers salver-shaped, white or red, fragrant, borne in terminal or axillary cymes. Calyx divided almost to base, glandular within. Corolla tube cylindrical, narrow at base, widening around stamens then contracting slightly towards mouth; lobes obliquely obovate-oblong, tightly rolled spirally to left but overlapping to right. Disc deeply lobed. Stamens subsessile, inserted on corolla tube, anthers included or only tips exerted, forming a cone around and fused to clavuncula. Ovary of 2 free carpels, ovules many. Fruit a pair of long cylindrical follicles, divergent or incurved. Seeds linear-oblong, flattened, not beaked, glabrous with white apical coma.

1. Stamens inserted at base of corolla tube; inflorescence a sub-umbellate compact cyme; leaves caudate ..... 1. **T. axillare**

- + Stamens inserted at or above middle of corolla tube; inflorescence a lax trichotomous cyme; leaves acuminate ..... 2
- 2. Stamens inserted above middle of corolla tube; tube 8–10mm long narrowed at base for 6–7mm ..... **2. T. lucidum**
- + Stamens inserted around middle of corolla tube; tube 5–8mm long, narrowed at base for 3–4mm ..... **3. T. assamense**

**1. T. axillare** Hook. Nep: *Lali-lara* (34); Lepcha: *Tochiom-rik* (34).

Large climber, bark smooth but with scattered brown lenticels; plant glabrous or only very young parts minutely puberulent. Leaves oblanceolate to elliptic-oblanceolate, 5–15 × 1.7–5cm, apex caudate to acuminate, base cuneate, membranous to subcoriaceous, shiny above; petiole 3–9mm long. Flowers in small sub-umbellate cymes in opposed leaf axils. Peduncles and inflorescence branches rather thick, 0.1–3mm long; pedicels slender, 5–9mm long. Buds and corolla tube deep glossy-red; open corolla lobes maybe paler. Calyx green, lobes broadly rounded ovate, 1–2mm long, minutely ciliate. Corolla tube 4–5mm long, 5-ribbed, slightly enlarged around anthers; lobes 5–8 × c 2.5mm, corolla shortly hirsute around corolla mouth but glabrous elsewhere. Stamens inserted near base of corolla tube; anthers completely included. Follicles divaricate, somewhat incurved and compressed, 10–20 × c 1cm, covered in red-brown indumentum. Seeds slender, tapering towards base, 18–28 × 1.5–3mm, coma not deciduous, 3.5–5cm long.

**Bhutan:** C – Tongsa district (Dakpai), Mongar district (Shersing Thang-Namning) and Tashigang district (Gomchu); **Darjeeling:** Darjeeling, Lebong, Phubsering and Singtam; **Sikkim:** Yoksam and unlocalised specimens. Wet broad-leaved subtropical forests, 1200–2400m. June–October.

**2. T. lucidum** (D.Don) Schumann; *T. fragrans* (A.DC.) Hook., *Alstonia lucida* D.Don. Nep: *Dawari-Lahara* (34); Lepcha: *Yok-chounrik* (34).

Tall woody climber, occasionally scrambling over rocks; young shoots and petioles sparsely red-brown pubescent or bark smooth. Leaves elliptic-lanceolate, 5–12 × 1.2–4cm, apex acuminate-acute, base cuneate, membranous to subcoriaceous, usually glabrous; petiole 5–7mm. Flowers white, in many-flowered axillary or terminal corymbose cymes. Cymes with lax, trichotomous branching; peduncles slender, 2–4cm long, subsequent inflorescence branches shortening to 5–10mm long pedicels. Calyx lobes ovate-acute to lanceolate, 2–3.5 × 1.5mm, persistent in fruit. Corolla tube 8–10mm long, narrow at base for 6–7mm, then abruptly dilated around anthers, lobes 7–9 × 1.5–2mm. Stamens inserted distinctly above middle of corolla tube; anthers just included. Fruit an incurved pair of slender long follicles, 12–35 × 0.2–0.4cm, smooth and glabrous. Seeds linear, 1.5–2.5cm long, coma deciduous, 2.5–4cm long.

Darjeeling: Darjeeling, Kurseong; **Sikkim:** Yoksam and unlocalised specimen. Temperate and subtropical forests, 600–2100m. April–August.

Produces a rubbery latex (34).

**3. T. assamense** Woodson

Vigorous climber very similar to *T. lucidum*; pubescence of young stems and leaves sometimes denser; leaves tend to be more coriaceous; corolla tube shorter, 5-8mm long, narrow at base for 3-4mm below anthers; lobes shorter 5-9mm long, pubescence around mouth rather more dense; stamens inserted around middle of corolla tube.

**Bhutan:** C – Punakha district (Hinglai-La to Nahi, Samtengang to Tranza-La, Bhotokha to Rinchu, Wangdi Phodrang), Tongsa district (Kyi La, Tongsa) and Tashigang district (Chorten Kora, Tashi Yangtshi), N – Upper Kuru Chu district (Dunkhar). Temperate and subtropical open areas, 1300-2000m. May-June.

This species was only described from two collections outside this area. The characters given in the literature to distinguish *T. lucidum* from *T. assamense* do not readily separate them in Bhutan. Further study may reveal them to be conspecific.

**21. ICHNOCARPUS** R. Brown

Climbing shrubs very similar to *Trachelospermum* but distinguished by corolla lobes infolded in bud and not twisted to left; flowers also tending to be much smaller, in lax paniculate cymes and clavuncula with distinctive conical apical projection.

1. Young branches glabrous; petiole more than 1cm long; flowers yellow; corolla glabrous ..... **1. I. polyanthus**
- + Young branches red-brown tomentose; petiole less than 1cm long; flowers white or tinged green or purple; corolla hirsute within ..... **2**
2. Corolla tube pubescent below on dilated part, glabrous above ..... **2. I. frutescens**
- + Corolla tube pubescent throughout ..... **3. I. volubilis**

**1. I. polyanthus** (Blume) Forster; *I. himalaicus* Yamazaki, *Micrechites elliptica* Hook.f. Nep: *Dude Lahara* (34).

Large climbing shrub with fig-like habit; branches pendent often rooting. Leaves narrowly elliptic to oblong-lanceolate, 7-14 × 1.9-5cm, apex attenuate to acuminate, base cuneate, glabrous; petiole 1-2cm, twisted. Inflorescences to 20cm long, branches 1-3.5cm long, ultimate divisions tomentose; pedicels short, c 2mm. Calyx lobes small, ovate with rounded apices, 1.5-3mm long; lobes c 1.5mm wide, glabrous to red-brown pubescent. Corolla yellow, glabrous, tube 3-5mm long; lobes rounded, oblong, 2-5 × 1.5mm. Follicles divaricately spreading, horizontal or recurved, 11-20 × c 0.7cm. Seeds narrowly oblong, flattened, 1.5-2 × 0.2cm, coma long, yellowish, c 3cm long.

**Bhutan:** C – Punakha district (Rinchu-Mishichen); **Darjeeling:** Lebong.

Kurseong, Phubsering, Kodabari; **Sikkim**: Rongbi and unlocalised collections. Tropical and subtropical forests, 700–1800m. August–November.

**2. *I. frutescens*** (L.) Aiton. Nep: *Dude Lahara* (34). Fig. 67f–i.

Extensive woody climber with young branches red-brown adpressed tomentose. Leaves very variable, lanceolate to elliptic-oblong, 5.5–13 × 1.5–5.8cm, apex acute-acuminate, base cuneate to obtuse, subcoriaceous to coriaceous, glabrous above, sparsely pubescent on main veins below; petiole 2–15mm. Flowers small and fragrant, white, sometimes tinged with green or purple. Flower buds distinctively constricted at middle. Calyx lobes ovate, obtuse to subacute, 0.6–1.5mm, white hirsute-puberulent. Corolla tube cylindrical, dilated and white puberulent-hirsute at base around anthers, glabrous above, 1.5–3mm long; lobes lanceolate, with basal side spur 2–6mm, tips curved, glabrous without, densely hirsute puberulent within, particularly around mouth. Follicles very slender, curved and divergent, 2.5–7 × 0.2cm. Seeds narrow, c 1.5cm, with scanty white coma 1.2–2cm long.

**Bhutan**: S – Phuntsholing district (Phuntsholing) (117); **Darjeeling**: Birik, Jalpaiguri Duars, Lebong, Mungpong and Sivoke. Subtropical forests and open areas, 150–1500m. June–December.

**3. *I. volubilis*** (Loureiro) Merrill; *I. ovatifolius* A.DC., *Gardenia volubilis* Loureiro

A tall climbing shrub very similar to *I. frutescens* but generally more hairy, larger leaved and with longer petioles. Young branches and leaves red-brown tomentose; stems particularly hirsute around the nodes. Leaves elliptic-oblong, 5.5–13 × 2.4–5.8cm; petiole 5–15mm. Flowers more densely crowded and panicles with whitish hue, due to the dense white hirsute pubescence on the buds and inflorescence branches. Calyx lobes 0.6–0.8mm long, spreading, densely white hirsute. Corolla tube 1.5–2mm long, white hirsute throughout; lobes 4–6mm long, parts exposed in bud and mouth region white hirsute, other parts glabrous.

**Darjeeling**: Sivoke and an unlocalised specimen. Subtropical forests, 150–1200m. June.

This species is sometimes included within *I. frutescens*.

## 22. URCEOLA Roxb.

Almost glabrous climbing shrubs with pustular lenticellate branches; younger parts and inflorescence branches puberulent. Leaves opposite, subcoriaceous and glabrous. Flowers minute, white or greenish-yellow in Bhutanese species, borne in large many-flowered di- or trichotomous paniculate cymes. Inflorescences axillary or terminal, lax with long peduncles. Calyx tube very short, lobes ovate-triangular, covered in red-brown pubescence. Corolla tube cylindrical to urceolate, glabrous on the outside, sparsely pilose within; lobes short and rounded, not spreading but undulate and erect, overlapping to right.

each with a small incurved apical extension of right hand edge (viewed from inside). Disc ring-shaped. Stamens inserted at very base of corolla tube; filaments short; anthers included, forming a cone around and fused to clavuncula. Ovary of 2 free carpels, ovules few. Clavuncula with short conical apical projection. Fruit a pair of horizontally divaricate follicles, sometimes dilated at base, tapering and somewhat curved towards apex. Seeds flattened, elliptic-oblong to oblong with truncate ends, surface red-brown puberulent and apex with persistent crown of short hairs around base of deciduous white coma.

1. *U. tournieri* (Pierre) Middleton; *Parabarium hookeri* Spire

Extensive woody climber with slender pendulous branches. Leaves variable, ovate-elliptic to elliptic-oblong, 5.5–20 × 2.1–5.5cm, apex abruptly acuminate to caudate, base cuneate to obtuse; petiole 3–18mm. Peduncles 2–10cm long. Flowers white with yellow eye, cream or greenish, c 2mm long. Calyx tube 0.2–0.5mm; lobes 0.8–1mm. Corolla tube 0.8–1mm; lobes 0.5–1mm long, sparsely puberulent on outer surface exposed in bud or glabrous, apical extension 0.4–0.6mm long. Follicles 6.5–8.5(–12) × 1–1.5cm, surface coriaceous, red within. Seeds 12–20 × 2.5–4mm, coma 2–4.5cm.

**Bhutan:** S – Samchi district (Tamangdhanra Forest) and Gaylegphug district (Sham Khara), C – Punakha district (Rinchu–Mischichen); **Darjeeling:** Babookhola, Dulkajhar, Kodabari, Kurseong and unlocalised specimens. Subtropical, warm broad-leaved forests, 150–1500m. April–May.

This species is easily confused with *U. micrantha* (G. Don) Middleton, but is distinguished most readily in fruit, as the former has thick and tapering follicles as compared to the thin and linear follicles in *U. micrantha*. *U. tournieri* more commonly has pubescent branchlets and axillary inflorescences.

## Family 163. ASCLEPIADACEAE

by M.F. Watson

Woody climbers, shrubs or perennial herbs, sap of white latex usually present. Leaves simple, generally entire, opposite or whorled in Bhutanese species; usually with a small group of extrafloral nectaries (stiff glandular hairs) on upper surface of midrib at base of lamina; stipules minute or absent. Inflorescence cymose, often umbellate, sometimes racemose, usually axillary. Flowers 5-merous, actinomorphic, hermaphrodite. Calyx fused and deeply divided almost to base. Corolla fused with lobes contorted or valvate; tube often with a ring of hairs within; both or either corolla lobes or stamens bearing scales or appendages which form corolline and staminal (double or single) coronas respectively. Stamens inserted at base of corolla or on corolline coronal scales; filaments short to absent; anthers usually fused into a ring and united with style apex

(alternating with stigmatic lobes) forming gynostegium; filaments or backs of anthers usually bearing cartilaginous appendages involved in pollination mechanisms (not in subfamily Periplocoideae: *Cryptolepis*, *Hemidesmus*, *Streptocaulon* and *Periploca*); pollen in each half of bilocular anthers usually united into a waxy pollinium (pollen mass); pollinia united in pairs by translator, forming the pollinarium which aids pollen transfer; translator consisting of two translator arms (horny wings or retinaculi) attaching pollinia to a corpusculum (or gland); pollen in subfamily Periplocoideae granular, not forming pollinia, instead the translator arms have a sticky, spoon-shaped end (viscidium) to which pollen adheres. Ovary superior or partly inferior, of 2 free carpels united only by style apices; styles 2, short, each bearing peltate stigma of 5 spreading lobes; carpels containing numerous anatropous ovules in several rows on single adaxial placenta. Fruit a pair of erect to divergent follicles, or solitary by abortion. Seeds flattened, ovate to oblong, with deciduous terminal coma of long, silky white hairs.

Many species of this family are cultivated as ornamentals for their showy and bizarre flowers.

1. Large erect shrubs, small trees, erect to sprawling herbs or epiphytes .... 2  
+ Twining shrubs ..... 8
2. Large erect shrubs or small trees more than 50cm tall ..... **9. Calotropis**  
+ Epiphytes or terrestrial herbs, sprawling or erect, but usually less than 50cm tall (to 1m in *Vincetoxicum*) ..... 3
3. Succulent-leaved epiphytes; stem sprawling or trailing; flowers in showy umbels; corolla fleshy or waxy ..... **19. Hoya**  
+ Leaves coriaceous to membranous; or if fleshy then flowers small and inconspicuous ..... 4
4. Sprawling herbs, terrestrial or epiphytic ..... 5  
+ Erect to arching herbs ..... 6
5. Terrestrial herbs; leaves in two ranks without extrafloral nectaries; flowers purplish; corolla tube short, lobes filiform ..... **3. Streptocaulon**  
+ Epiphytes; leaves usually fleshy, with extrafloral nectaries appearing as a black spot at base of leaf; flowers yellow; corolla tube globose, lobes minute  
**22. Dischidia**
6. Leaves ovate-acute, not acuminate; inflorescences sessile and crowded in the upper leaf axils; flowers small and green, c 0.5cm broad  
**8. Vincetoxicum**  
+ Leaves lanceolate-acuminate; inflorescences pedunculate; flowers larger, white or orange and purple ..... 7



7. Erect-stemmed herbs; flowers purple with an orange-yellow centre; lobes short, reflexed ..... **10. Asclepias**  
 + Erect herb with arching stems; flowers white with long pendulous lobes  
**13. Pentasacme**
8. Corolla tube usually elongated and variously inflated; lobes narrow and fused at apex forming a crown over corolla mouth; fruits long and slender  
**25. Ceropegia**  
 + Corolla tube usually short and campanulate; lobes not fused at apex; fruits various ..... 9
9. Mature leaf bases distinctly cordate with a wide sinus ..... 10  
 + Mature leaf bases cuneate, rounded or truncate, sometimes cordate but not with a wide sinus ..... 14
10. Flowers large, showy, in few-flowered inflorescences; plant glabrous ... 11  
 + Flowers small, in many-flowered inflorescences; plant pubescent or not 12
11. Peduncles more than 3cm long, stout; coronal scales long and horn-like, overtopping anther column ..... **11. Raphistemma**  
 + Peduncles less than 3cm long, more slender; coronal scales truncate forming a low membranous ring at base of anther column ..... **12. Holostemma**
12. Woody herbs; inflorescence a crowded, umbellate cluster, coronal scales long, overtopping gynostegium; plants glabrous or almost so; fruits with soft spines or flanges ..... **7. Cynanchum**  
 + Tall, twining undershrubs; inflorescences various, coronal scales not as above, plants pubescent (or at least on main leaf veins); fruits smooth or striate ..... 13
13. Inflorescence a crowded umbellate cluster; corolla lobes more than 8mm long ..... **16. Telosma**  
 + Inflorescence a lax, many-flowered cyme; corolla lobes to 3.5mm long  
**17. Marsdenia**
14. Flowers small, less than 7mm broad ..... 15  
 + Flowers larger, more than 8mm broad ..... 22
15. Inflorescence a crowded spike; stems and leaves bluish-tinged (particularly evident in dried material) ..... **17. Marsdenia**  
 + Inflorescence a branched cyme or umbellate cluster ..... 16
16. Inflorescence an umbellate cluster ..... 17  
 + Inflorescence a laxly branched cyme ..... 19
17. Inflorescence and leaves sessile ..... **2. Hemidesmus**

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- + Inflorescence and leaves stalked ..... 18
- 18. Leaves and stem glabrous or with a short adpressed puberulence; inflorescence at least 9-flowered ..... **14. Gymnema**
- + Leaves and stem densely covered with spreading hairs; inflorescence few-flowered ..... **24. Tylophora**
- 19. Mature stems distinctly pustular or lenticellate ..... 20
- + Stems smooth or at most striate ..... 21
- 20. Inflorescence branches red-brown pubescent; corolla densely white-pubescent within ..... **6. Genianthus**
- + Inflorescence branches pale puberulent; corolla glabrous .... **17. Marsdenia**
- 21.
  - Plant glabrous; corolla lobes coriaceous and twisted in bud; flowers small, c 5mm broad ..... **15. Gongronema**
  - + Plant usually pubescent; corolla lobes rotate, membranous, unopened flower buds globose; flowers minute less than 4mm broad ..... **24 Tylophora**
- 22. Flowers large, more than 2cm broad, pale pink to dark purple ..... 23
- + Flowers smaller, less than 2cm broad, white, greenish or yellow (pink-red in *Marsdenia lucida*) ..... 24
- 23. Leaves glabrous; inflorescence pedunculate ..... **18. Treutlera**
- + Leaves rusty-brown pubescent; inflorescence sessile or almost so  

**19. Dittoceras**
- 24. Leaves pubescent, at least on main veins ..... 25
- + Leaves glabrous ..... 26
- 25. Calyx lobes scarcely pubescent; corolla lobes lanceolate ..... **16. Telosma**
- + Calyx lobes densely pubescent; corolla lobes lanceolate to triangular  

**17. Marsdenia**
- 26. Inflorescence a many-flowered umbel ..... 27
- + Inflorescence a few- to many-flowered cyme, or if umbellate then subsessile  

28
- 27. Young stems without pale pustules; leaves elliptic-oblong; coronal scales minute ..... **14. Gymnema**
- + Young stems with pale pustules; leaves widely ovate; coronal scales fleshy and stellately spreading ..... **21. Wattakaka**

- 28. Corolla lobes slender, erect and often twisted ..... 29
- + Corolla lobes triangular to narrowly so, spreading ..... 30
  
- 29. Cyme branches and leaves glabrous; pollen granular ..... **1. Cryptolepis**
- + Cyme branches and lower leaf surfaces rusty-brown pubescent; pollen in waxy pollinia ..... **5. Toxocarpus**
  
- 30. Leaves without extrafloral nectaries, veins unwinged converging into an intramarginal vein; pollen granular ..... **4. Periploca**
- + Leaves with extrafloral nectaries, veins winged below, intramarginal vein absent; pollen in waxy pollinia ..... **23. Heterostemma**

**1. CRYPTOLEPIS** R. Brown

Twining glabrous shrubs, leaves opposite, without extrafloral nectaries. Inflorescences few-flowered, little-branched, lax dichotomous cymes, usually axillary but sometimes terminal, branches slender. Flowers small, yellow-green to green-white. Calyx lobes ovate-acute, glandular within. Corolla tube short, cylindric; lobes long and linear, usually somewhat contorted, overlapping and tightly twisted to the right in bud; corolline coronal scales short, pale yellow, club-like, attached about midway up corolla tube, angled inwards over gynostegium. Staminal column minute; filaments broad and fused at base, slender and free above; anthers linear, without cartilaginous appendages but with acuminate apex incurved over stigmatic disc; anthers free from each other but attached to edge of stigmatic disc at base; pollen granular, attached to sticky, elongate, spoon-shaped end of minute, erect translator arm; corpusculum white. Stigmatic disc 5-lobed, with small bifid central conical projection. Follicles cylindric, glabrous with striate surface, in widely divaricate pairs. Seeds ovate-oblong with long coma.

The Nepalese local name *Dude Lahara* has been applied to both the following species.

- 1. Leaves usually more than 8cm long, lateral veins numerous and parallel; inflorescence branches with many persistent pairs of scaly bracts  
**1. C. buchanani**
- + Leaves usually less than 6cm long, lateral veins not as above; inflorescence branches mainly without persistent bracts ..... **2. C. sinensis**

**1. C. buchanani** Roemer & Schultes. Dz: *Langchu Robji, Langchu Rubjee*; Nep: *Dude Lahara* (34). Fig. 68a-d.

Woody climber; older stems often with warty lenticels and peeling bark. Leaves elliptic-oblong to narrowly obovate, 8-15(-18) × 2.5-7(-9)cm, apex abruptly acuminate to obtuse-apiculate, base cuneate, subcoriaceous to coriaceous, glabrous, green and shiny above, glaucous below; veining distinctive,

main lateral veins numerous and parallel, shortly arched into intramarginal vein; petiole 7–15mm. Cyme branches with several pairs of persistent scaly bracts along their length; peduncle 10–16mm long, branches 0.5–3cm, slender but much thickened in fruit; pedicels 2–4mm. Calyx lobes 1.5–2.5 × 0.8–1.3mm. Corolla tube 2–3mm long; lobes 5–7 × 1–1.4mm; corolline coronal scales 0.8–1mm long, with globose apex. Staminal column c 1.5mm high. Follicles narrowly conical, 5.6–10.5 × 0.7–1.1cm, with 2 lateral flanges. Seeds 5–8 × 2–3mm; coma 3–4cm.

**Bhutan:** S – Phuntsholing district (Torsa), C – Punakha district, Mongar district (Lingmethang) and Tashigang district (Tashigang Dzong); **Darjeeling:** Darjeeling, Mahanadi, Manjitar Bridge, Munsang, Panchkilla, Singla Bazar, Sukiapokhri; **Sikkim:** unlocalised Hooker specimen. Broad evergreen forests, open dry hillsides and scrub along river banks, 300–2100m. April–August.

**2. *C. sinensis*** (Loureiro) Merrill; *C. elegans* G. Don, *Pergularia sinensis* Loureiro. Nep: *Dude Lahara* (34).

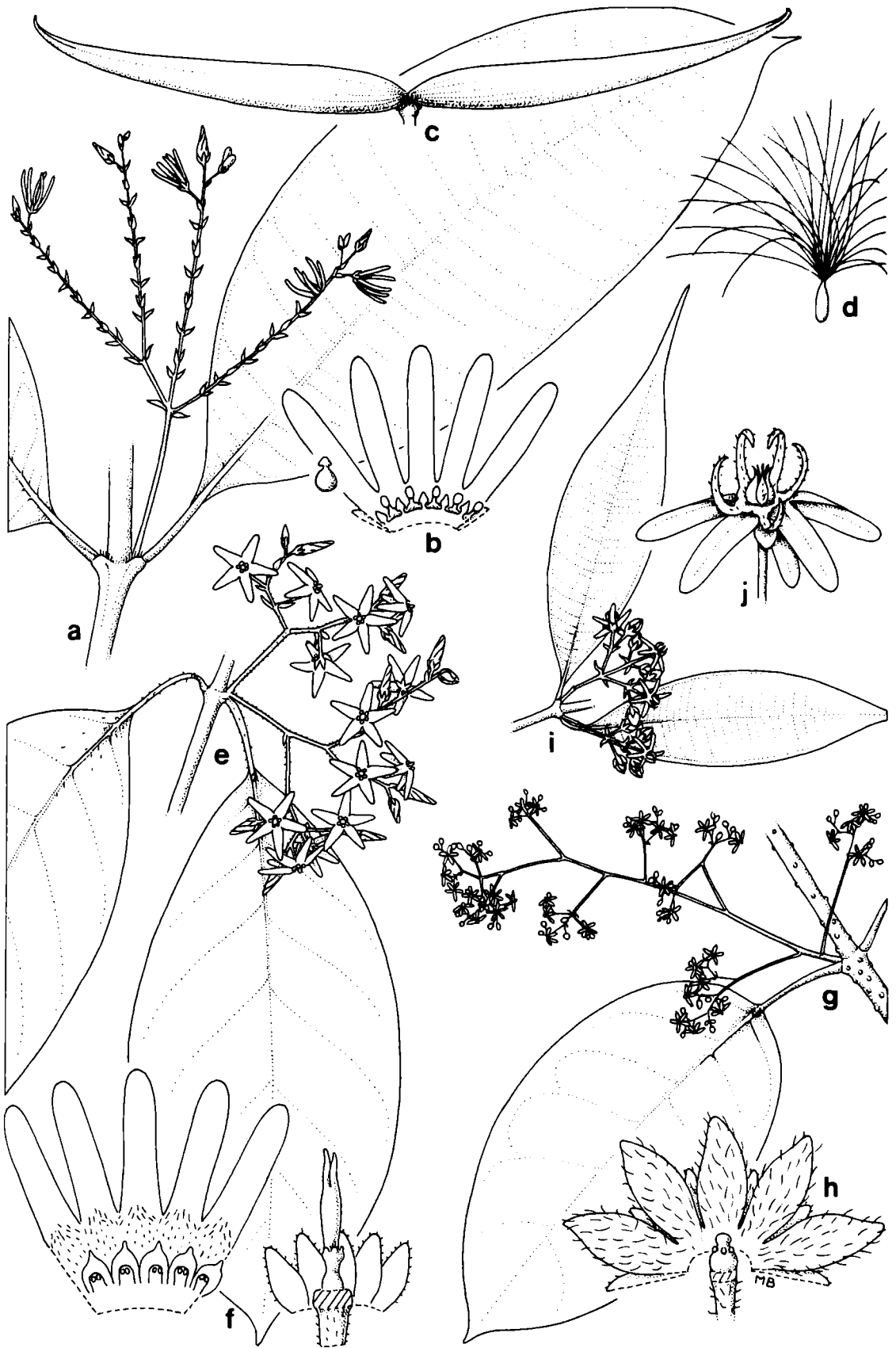
Similar to *C. buechanani* but generally a more slender climber; leaves smaller, oblong to linear-oblong, 4.2–6(–8) × 1.4–3cm, apex obtuse-apiculate to acuminate, base obtuse-truncate, rarely cordate, veins not so numerous and parallel, gradually arching into intramarginal vein, subcoriaceous; petioles 8–10mm, very slender; cymes few-flowered, very laxly branched; branches without persistent scaly bracts, very slender and not very thickened in fruit; peduncles 1.5–3cm long, branches 1–2cm; pedicels 8–17mm; calyx lobes c 2 × 1.5mm; corolla tube 4–5mm long; lobes 11–15mm long, curled and twisted, often recurved; corolline coronal scales c 1mm long, with pointed apex; staminal column c 1mm high; follicles long and slender, 13–17 × c 0.7cm, without 2 lateral flanges; seeds as for *C. buechanani*.

**Bhutan:** S – Phuntsholing district (Phuntsholing, 117); **Darjeeling:** Sivok, Sureil; **Sikkim:** Sillok, Sombari, Sittong. Open areas, roadsides, subtropical terai, 100–1500m. May–August.

## 2. HEMIDESMUS R. Brown

Twining undershrubs, woody at base; stems sparingly branched, sometimes prostrate. Leaves opposite, subcoriaceous, very variable in size and shape, without extrafloral nectaries; petioles often twisted. Inflorescences subsessile, few-flowered axillary cymes, branches much contracted and clothed in numerous persistent scaly bracts. Flowers small, yellow-green, flushed purple within. Calyx

FIG. 68. **Asclepiadaceae.** a–d, *Cryptolepis buechanani*: a, flowering shoot (× 1); b, dissected flower (× 3); c, fruit (× 2/3); d, seed (× 2/3). e–f, *Toxocarpus himalensis*: e, flowering shoot (× 2/3); f, dissected flower (× 3). g–h, *Genianthus laurifolius*: g, flowering shoot (× 2/3); h, dissected flower (× 8). i–j, *Periploca calophylla*: i, flowering shoot (× 2/3); j, flower (× 3). Drawn by M. Bates.



lobes ovate-acuminate. Corolla tube very short; lobes glabrous, thick and coriaceous; corolline coronal scales inconspicuous; short thick projections at mouth of corolla tube alternating with lobes. Stamens short, with slender free filaments supporting fused anther crown over top of stigmatic head; anthers with fused incurved apical projections but no cartilaginous appendages; pollen granular, attached to sticky spoon-shaped end of minute translator arm; translator arms erect, fused(?) appearing solitary with a bifurcating tip, corpusculum white. Stigmatic head flat, 5-angled. Follicles long and slender, cylindric, in widely divaricate pairs, surface glabrous, smooth to striate.

### 1. *H. indicus* (L.) Schultes

Small shrub, usually with tuberculate, glabrous stems, sometimes puberulent and barely tuberculate; nodes somewhat swollen and flanged. Leaves broadly obovate to elliptic, lanceolate-oblong or almost linear, (2.5–)3.5–8 × 1–3cm, apex obtuse-apiculate to acuminate, base obtuse to cuneate, dark green and shiny above, paler below, glabrous; petiole 0.5–4mm. Calyx lobes 2.5–3.2 × c 1mm, ciliate. Corolla tube 0.8–1mm long; lobes ovate-acute, 2.2–3 × c 1.5mm. Gynostegium c 1.2mm high. Follicles 5–12.5 × 0.4–0.7cm. Seeds 5–8 × 1–2mm, oblong-linear; coma 3–4cm.

**Darjeeling/Sikkim:** Great Rangit River. Open areas, 200m? July?–February.

Widely used for medicinal purposes, the roots are aromatic and used as a tonic.

## 3. *STREPTOCAULON* Wight & Arnott

Small herbaceous perennials, woody at base, with numerous little-branched flexuous stems, prostrate and spreading. Leaves opposite, subsessile in two ranks, lying flat on the ground, without extrafloral nectaries. Flowers very small, borne in few-flowered axillary cymes. Calyx lobes ovate-acute. Corolla tube short; lobes lanceolate-acute to ovate-lanceolate, overlapping to the right in bud; corolline coronal scales filiform, arching and curling, free, above gynostegium. Staminal column short; anthers without cartilaginous appendages but fused together and with fused apical processes forming a dome over stigmatic head; pollen granular, attached to sticky spoon-shaped end of minute translator arms. Stigma domed with an apical notch. Fruit unknown.

### 1. *S. sylvestre* Wight

Stems 10–33cm long; stems, petioles, inflorescence branches, leaf surfaces and sepals densely covered with short stiff hairs. Leaves ovate to elliptic, 16–34 × 10–27mm, apex obtuse-apiculate, base shallowly-cordate to truncate-cordate, membranous; petiole 0.1–1.5mm. Flowers purple (80). Cymes subsessile, branches slender, 0.1–5mm. Calyx lobes 1.5–2 × 0.8–1mm. Corolla tube 0.7–1mm long; lobes 3–5 × 1–1.4mm; filiform lobes 2.5–3.5mm long, sparsely pubescent. Staminal column c 1.5mm high.

**Darjeeling:** Siliguri, Titalia. Habitat not recorded, c 100m. March–May.

This plant is only represented in British herbaria from three collections (including the type).

#### 4. PERIPLOCA L.

Twining, glabrous shrub, with slender branches, becoming lenticellate with age. Leaves opposite, coriaceous, shiny green on both surfaces, without extrafloral nectaries; lateral veins numerous and parallel, united into an intramarginal vein, margin undulate. Flowers small, in numerous lax dichotomous cymes, sessile, often in opposed leaf axils. Calyx lobes broadly ovate-obtuse. Corolla tube very short; lobes ovate-oblong, acute, overlapping to the right; corolline coronal scales 3-lobed, outer lobes reduced, forming a short collar, central lobe greatly enlarged into a long, linear process, erect and arching over gynostegium. Staminal column short; anthers without cartilaginous appendages; filaments free; pollen granular, attached to sticky spoon-shaped end of translator arm, the 5 cream corpuscula each bearing a solitary erect translator arm. Stigmatic head domed, level with anther tips. Fruit a pair of parallel or slightly divergent smooth follicles, narrow-cylindric, straight or slightly curved. Seeds linear-oblong; coma long.

##### 1. *P. calophylla* (Wight) Falconer. Fig. 68i&j.

Extensive, wiry twiner. Leaves narrowly ovate-lanceolate to lanceolate, 4–8 × 0.5–2.2cm, apex long acuminate to caudate, base cuneate; petiole 1.5–3mm. Flowers yellow-green, pinkish to purple-red, in 5–15-flowered cymes. Cyme branches 3–9mm long, slender; pedicels 2–3mm. Calyx lobes c 2mm long, minutely ciliate. Corolla tube c 1mm long; lobes 5–6 × c 2mm, glabrous or puberulent within, margins often recurved; central lobe of corolline coronal scale 3–5mm long, pubescent. Stamens bearded on their backs, c 1.5mm high. Follicles 8–17 × 0.5–0.7cm. Seeds 1–1.3 × c 0.1cm; coma 3–4cm.

**Bhutan:** S – Chukka district (Chukka Dzong) and Gaylegphug district (Chabley Khola), C – Punakha district (Mishichen to Khosa (71)) and Tongsa district (Tashiling to Tongsa, Shamgong); **Darjeeling:** Ghumpahar, Kalimpong, Munsang, Rangnu Khola, Rayeng RS; **Sikkim:** Boktak and unlocalised specimens. Warm broad-leaved forests, 900–2000m. November–April.

#### 5. TOXOCARPUS Wight and Arnott

Slender climbing shrubs, older stems glabrous, striate and with sparse tubercles. Leaves opposite, subcoriaceous to coriaceous, extrafloral nectaries present, often obscure. Inflorescence a 5–30-flowered, widely branched, dichotomous, axillary cyme; branches densely red-brown pubescent. Flowers cream to pale

yellow. Calyx lobes ovate to lanceolate, apex obtuse, densely red-brown tomentose. Corolla tube short; lobes long and narrow or short and ovate, overlapping to the right in bud, white-pubescent inside only at base and within tube; corolline coronal scales very small and obscure, firmly attached to and just overtopping staminal column. Staminal column very short, cartilaginous appendages absent; pollen in pendulous non-flattened minute, waxy pollinia, two per anther locule, four pollinia sessile on pale corpusculum. Stigma produced well beyond ring of anthers, projection club-like, usually somewhat 2-lobed.

1. Corolla lobes more than 5mm long, linear ..... 1. **T. himalensis**  
 + Corolla lobes less than 4mm long, ovate-obtuse ..... 2. **T. aurantiacus**

**1. T. himalensis** Hook.f. Fig. 68e&f.

Twining climber; young stems and petioles densely red-brown pubescent. Leaves elliptic to obovate, sometimes broadly so, 5–12.5 × 2.2–7cm, apex abruptly cuspidate to attenuate, base cuneate, subcoriaceous, glabrous above, pubescent below with red-brown multiseptate hairs, particularly on main veins; petiole 7–14mm. Inflorescence with conspicuous linear-lanceolate bracts and bracteoles to 3mm long; branches 2–12mm; pedicels 1–2.5mm. Calyx tube c 1mm long; lobes c 1.5–1mm. Corolla cream, tube 2–3mm long; lobes long and strap-like, 6–8 × 1–1.5mm, recurved and twisted. Staminal column 0.8–1.2mm long. Stigma projecting 1.5–2mm above ring of anthers. Follicles divaricately paired, narrowly cylindrical, gradually tapering and incurved towards apex, 9.5–15 × 1–1.5cm, red-brown pubescent when young, smooth when mature. Seeds large, ovate and shortly beaked, c 15 × 6mm; coma 2–5cm.

**Bhutan:** S – Chukka district (Chukka); **Darjeeling:** Lat, Panchor, Tista; **Sikkim:** Rangit Valley. Warm forests, 1200–3000m (80). April–June.

**2. T. aurantiacus** C.Y.Wu

Climber of similar habit to *T. himalensis*, but stems more tuberculate and less hairy. Leaves broadly oblong-ovate, 4.5–13 × 2.5–6.5cm, apex attenuate to cuspidate, base obtuse-cuneate to widely cordate, coriaceous, glabrous above, sparsely red-brown pubescent below, mainly on veins; petiole 1–3.2cm, sparsely red-brown pubescent. Inflorescence without conspicuous bracts. Flowers pale yellow, scented. Calyx tube almost absent; lobes c 1.5 × 1.5mm. Corolla tube c 1mm long; lobes ovate-obtuse, 2.5–3.2 × 1.2–2mm, spreading but not twisted. Staminal column 0.8mm long. Stigma projecting c 0.8mm above ring of anthers. Follicles not seen.

**Bhutan:** C–Tongsa district (Wangde Khola). Habitat unknown (specimen on loan and fieldbook missing), 970m. Warm, broad-leaved forest, 970m. April.

This species has recently been described from two gatherings from Yunnan. The Bhutanese specimen matches well with the description and detailed drawing given, but has not been compared with the Chinese type.



## 6. GENIANTHUS Hook.f.

Twining, climbing shrubs; stems brown, glabrous but striate and distinctively pustulate. Leaves opposite, coriaceous, extrafloral nectaries present. Flowers small, green-yellow, very numerous, in lax, divaricate, much-branched, dichotomous compound cymes; inflorescences axillary, branches densely red-brown tomentose. Calyx divided almost to base, lobes very small, elliptic-ovate, red-brown tomentose. Corolla tube short; lobes ovate to narrowly so, spreading to recurved, valvate, subcoriaceous, densely white-hirsute within; corolline coronal scales very small, cuspidate, fused at base to staminal column and barely overtopping it. Anthers almost sessile, cartilaginous appendages absent; pollinarium as in *Toxocarpus*. Stigmatic head capitate to domed, just above anthers. Follicles usually in divaricate pairs, long slender cylinders gradually tapering to apex, glabrous, finely striate and tuberculate like stems. Seeds truncate-oblong with very long coma.

1. *G. laurifolius* (Roxb.) Hook.f. Fig. 68g&h.

Leaves broadly ovate-elliptic, 5.5–11(–18) × 3–6.6(–9.5)cm, apex abruptly acuminate to obtusely so, base cuneate to obtuse, glabrous; petiole 1–3cm. Inflorescence branches 0.5–4cm long; pedicels 0–1.5mm. Calyx lobes c 0.7mm long, corolla lobes 1.5–2 × 0.8mm. Gynoecium c 1mm long. Follicles 13–14 × c 0.7cm. Seeds c 20 × 2mm; coma 6–7cm.

**Darjeeling:** Labha, Glen Cathcart, Tista. Subtropical areas, 1500–1850m. April–May.

Hooker (80) records two types of flowers; small ones with densely hirsute corolla lobes and larger ones with less hairy lobes. It appears that the former type is in the great majority and the latter is infrequently seen. Fruiting material is also scarce and, when present, the infructescences have only very few follicles. It may be the case that the smaller, more numerous flowers are functionally male and only the larger ones bear fertile carpels.

## 7. CYNANCHUM L.

Twining woody herbs, climbing on shrubs and small trees. Leaves opposite, membranous, extrafloral nectaries present. Inflorescences many-flowered, corymbose or racemose cymes borne in leaf axils. Flowers small, green-yellow, sometimes purplish. Calyx lobes ovate-lanceolate to linear-lanceolate, glandular within. Corolla tube very short; lobes divided almost to base, linear-oblong to lanceolate, spreading to recurved; corolline coronal scales fused into a large, erect tube overtopping gynostegium but fused to it below, somewhat fleshy and with or without internal appendages. Anthers sessile, with small cartilaginous triangular-auriculate appendages outside and a membranous apical projection inflexed over stigmatic disc; pollen in pendulous non-flattened waxy pollinia, one per anther locule; translator arms short; corpusculum dark brown-black.

Stigmatic head apiculate. Follicles large, wide at base, narrowly conical and beaked.

1. Corolla lobes pubescent within; corolline coronal scales deeply lobed and with an inner appendage; fruits without soft spines . . . . . **1. *C. auriculatum***
- + Corolla lobes glabrous; corolline coronal scales crenate, not lobed and without inner appendages; fruits densely covered in soft spines  
**2. *C. corymbosum***

### **1. *C. auriculatum* Wight**

Twining climber to 3m; stems, petioles and inflorescence branches puberulent. Leaves broadly ovate to ovate-lanceolate, 5–18 × 4–12cm, apex acuminate, base deeply cordate with obtuse sinus, pubescent above and below, particularly on main veins; petiole 2–4cm. Inflorescences 10–19-flowered umbellate racemes; peduncles long and stout, (2–)6–8(–14)cm; pedicels slender 8–12mm. Calyx lobes 2–5 × c 1mm, sparsely ciliate, green flushed red to purplish. Corolla lobes 4–10 × 1.5–5mm, pubescent within; corolline coronal scales deeply divided; lobes ovate, each scale bearing a fleshy horn-like appendage on inner face. Anther column c 2.5mm long. Follicles 7–11 × 1.5–2cm, glabrous, striate and with 2 side flanges. Seeds ovate, 6–7 × 3–4mm; coma 2–3cm.

**Bhutan:** C – Ha district (Ha), Thimphu district and Punakha district (Ritang, Tinlegang), and Tongsa district (Chendebi), N – Upper Mo Chu district (Gasa) and Upper Kuru Chhu district (Denchung); **Sikkim:** Lachen, Lachung, Zemu Valley; **Chumbi:** between Chumbi and Phari, Trakarpo. In temperate areas, climbing in hedgerows, over bushes and shrubs, 900–2750m. June–September.

### **2. *C. corymbosum* Wight**

Slender, woody climber, similar in habit to *C. auriculatum*; stems sparsely puberulent to glabrous, petioles and inflorescence branches puberulent. Leaves very similar in size and shape to *C. auriculatum*, 4.5–12 × 2.8–8.5cm, glabrous to sparsely puberulent above, glabrous below; petiole often long and slender, 1.5–9cm. Inflorescence a many-flowered, corymbose cyme; peduncles 1.9–6cm long; pedicels 5–18mm. Calyx and corolla very similar to *C. auriculatum*, but usually slightly smaller; calyx green and corolla lobes glabrous within. Corolline coronal scales not deeply divided but rather forming a crenulate ring some 3mm tall, inner appendages much reduced and almost absent. Staminal column very short, c 1.5mm. Follicles 10–14 × 1.5–3cm, densely covered in soft, hooked spines 5–12mm long. Seeds orbicular-oblong, 8–13 × 5–8mm, margin undulate, apex serrate.

**Bhutan:** S – Chukka district (Giengo); **Darjeeling:** Birik, Mongpu, Tista; **Sikkim:** Kalej, Lachen. Subtropical areas, 100–1500m. September–October.

## 8. VINCETOXICUM Wolf

Small erect herbaceous perennials, woody at base, rootstock often with dense fascicles of roots. Leaves opposite, subcoriaceous to coriaceous, extrafloral nectaries present. Inflorescences sessile or shortly pedunculate umbellate cymes, 2–9-flowered, in upper leaf axils. Flowers small, yellow-green. Floral structure similar to *Cynanchum* but corolline coronal scales smaller, ovate obtuse to triangular, without internal processes. Follicles narrowly conical, usually paired, surface smooth and glabrous.

1. *V. hirundinaria* Medicus; *V. album* (Miller) Ascherson, *Cynanchum vincetoxicum* (L.) Persoon.

Stems erect, 30–100cm, usually simple or branched at base, rarely with side branches; stem, petioles and inflorescence branches pubescent-hirsute, often densely so. Leaves very variable in size and shape, large and broadly ovate in lower pairs, apex acute to acuminate or shortly mucronate, base broadly cordate to rounded, leaves gradually becoming smaller and more lanceolate-ovate towards stem apex; lowest pair usually comparatively small and suborbicular, 3.5–8.5 × 1.8–4.5cm, pubescent above and below, particularly on main veins, rarely glabrous; petioles short, 4–8mm. Peduncles 0–13(–20)mm long; pedicels 5–9(–15)mm. Calyx lobes lanceolate, 1.5–2 × 0.5mm, acute, green, ciliate. Corolla tube 2–3mm long, campanulate; lobes spreading, ovate to lanceolate, 3–3.5 × 1–2mm, glabrous to sparsely pubescent, or densely hirsute within; corolline coronal scales c 1mm long. Staminal column c 1mm long. Follicles 34–46 × 5–8mm. Seeds ovate, 3–6 × 1.5–3mm; coma 1.5–2.5cm.

Two subspecies occur:

a. subsp. **hirundinaria**

Inflorescence usually pedunculate, somewhat lax, with pedicels 5–10mm. Inner surface of corolla lobes glabrous or sparsely pubescent.

**Bhutan:** C – Thimphu district, Punakha district (Ritang, Ritang to Tsarza La), Bumthang district (Byakar, Shabejetang) and Tashigang district (Tashi Yangtse Dzong), N – Upper Mo Chu district (Tatsi Markha) and Upper Kuru Chu district (Shawa); **Sikkim:** Lachen valley, Lachung valley, Zemu valley; **Chumbi:** near Chumbi, Tromo Chhu. Open, dry habitats in varied situations from pine woodland to grassland and river banks, 2100–3650m. April–August.

b. subsp. **glaucum** (Wight) Hara; *Cynanchum glaucum* Wight

Inflorescences always sessile; crowded; pedicels short, c 5mm. Inner surface of corolla lobes densely white pubescent, appearing bearded.

An often misidentified species; all Bhutanese herbarium material seen has proved to be subsp. *hirundinaria*; subsp. *glaucum* occurs in Nepal and may yet be found in Bhutan.

## 9. CALOTROPIS R. Brown

Large erect shrubs or small trees, usually rather succulent and greyish in general appearance. Leaves opposite, coriaceous, extrafloral nectaries present. Inflorescences corymbose-cymose, appearing as simple or compound umbels. Flowers large, scentless, purple to pale purple or white. Corolla lobes divided but not to base, reflexed and spreading or erect, more intensely pigmented at tips, membranous to subcoriaceous; corolline scales of erect fleshy horns closely adpressed to staminal column, darker purple than petals; horns laterally compressed with upturned spur at base and 2-lobed apex. Anthers with cartilaginous triangular yellow appendages outside, and apical membranous projection overtopping stigmatic surface; pollen in pendulous flattened waxy pollinia, one per anther locule; translator arms long; corpusculum black; anther column yellow-green. Stigmatic head depressed, 5-angled, green. Follicles usually paired, thick-skinned and beaked.

1. Small shrub; young stems and inflorescence branches not cottony pubescent; leaves glabrous; petiole more than 1cm..... 1. *C. acia*
- + Large shrubs with young stems; inflorescence branches and undersurface of leaves cottony pubescent; petiole less than 1cm ..... 2
2. Corolline coronal horns shorter than staminal column (anther ring clearly visible), with 2 auricles either side of apex ..... 2. *C. gigantea*
- + Corolline coronal horns level with or (more usually) overtopping stigmatic head, auricles absent ..... 3. *C. procera*

1. *C. acia* Buchanan-Hamilton. Nep: *Auk* (34)

Herbaceous, semi-erect glaucous shrub; stems, leaves and inflorescence branches not white cottony pubescent. Leaves obovate to oblong, 14–25 × 7–15cm, apex acute to abruptly acuminate, base cuneate, glabrous; petiole long, 1.5–2.5cm. Inflorescence 4–many-flowered; peduncle 2.5–4.5cm long; pedicels c 2.5cm. Calyx lobes ovate-lanceolate, acute, c 7 × 2–3mm. Corolla tube c 6mm long; lobes erect to spreading, ovate acute to triangular, 8–10 × 7mm, green at base, purple tipped; corolline coronal horns c 6mm long; basal spur large, apex overtopping stigmatic surface, with 2 small auricles either side just below apex. Follicles large, c 10 × 5cm. Seeds ovate, c 8 × 5mm; coma c 3cm.

**Sikkim:** unlocalised (80, 135); **Darjeeling:** Bamon Pokhri, Kurseong, terai. Waste places, 100–900m. April–May.

2. *C. gigantea* (L.) Dryander; *Asclepias gigantea* L. Nep: *Aank*, Sha: *Noo-Ngon*, Eng: *Madar*. Fig. 69a–c.

Large shrub to small tree, 1.5–3m tall; stout hollow trunk with white or pale grey, vertically cracked bark; young stems and inflorescence branches yellow-green, covered in a white cottony pubescence. Leaves most dense at ends of

branches, obovate to oblong, 8–20 × 4–10(–12)cm, apex acute, base strongly cordate, subsessile, glabrous above, white tomentose below; petiole 0–5(–10)mm. Inflorescence 4–many-flowered; peduncles 4–8cm long; pedicels 2–3cm. Calyx lobes ovate-triangular, 3.5–4.5 × 2.5–3mm. Corolla tube 5–7mm long, widely campanulate; lobes ovate to lanceolate, spreading, white with purple tips or all purple, puberulent outside; corolline coronal horns c 11mm long, just shorter than anther collar, pale purple, with two small auricles on either side just below apex. Stigmatic surface c 4–5mm broad. Follicles recurved, short and thick, 7–10 × 2–3cm, usually one pair per inflorescence. Seeds broadly ovate, c 6–8 × 5mm; coma 2.5–4cm.

**Bhutan:** S – Samchi district (near Kalapani); **Darjeeling:** Singla Bazar, Tista; **Sikkim:** Rayong. Subtropical terai forests, 100–900m. February–November.

A strong fibre (*Madar*) is obtained from the stem and used for thread, fishing lines and nets (48). The milky sap and roots are used medicinally, and an intoxicating liquor can be produced from the sap. The coma is also used as low grade stuffing.

### 3. *C. procera* (Aiton) Dryander

Very similar to *C. gigantea*, but differs in being a smaller shrub to 2m; corolla lobes rather more leathery; apex of corolline coronal horns level with, or more usually overtopping stigmatic head, without auricles.

**Darjeeling?:** unlocalised *Hooker* 'Sikkim' specimen. Subtropical terai forests, 100–900m? February–November?

Used for same purposes as *C. gigantea*.

## 10. ASCLEPIAS L.

Perennial herbs, becoming woody at base. Leaves opposite, narrowly oblong-lanceolate, membranous, extrafloral nectaries present. Inflorescence an umbelliform cyme, axillary. Calyx lobes linear to very narrowly lanceolate, acute, reflexed, glandular within. Corolla lobes deeply divided almost to base, ovate-oblong, rounded, totally reflexed; corolline coronal scales (cuculli) erect and spoon-shaped, cupped towards stamens, forming nectar pouches; coronal horn projecting vertically from inner surface of cucullus. Stamens held level with cup of coronal scales; anthers with a membranous apical projection inflexed over stigmatic surface; pollen in flattened pendulous waxy pollinia, one per anther locule; corpusculum black; translator arms long. Stigma 5-angled with depressed surface. Follicles 1(–2) per flower, beaked and glabrous. Seeds ovate-elliptic with thin border; coma deciduous.

### 1. *A. curassavica* L.

Small to large herb, sometimes shrubby, to c 1m tall. Leaves lanceolate to oblong-lanceolate, 5–15 × 0.6–4cm, apex acute, base cuneate, usually glabrous; petiole short, 0.2–1.2cm, glabrous. Flowers in umbels of 7–12, corolla orange

to red, coralline coronal scales and gynostegium bright yellow to orange. Peduncles 2–4cm long; pedicels 8–20mm, both puberulent. Calyx lobes c  $3 \times 0.5$ mm. Corolla lobes 7–8  $\times$  2–3.5mm. Gynostegium column c 2.5mm long, head c 3mm long. Stigmatic head c 2.5mm broad. Follicles 5.5–8  $\times$  c 1cm, pale grey. Seeds c  $6 \times 3.5$ mm; coma 2–2.5cm long, white.

**Bhutan:** S – Samchi district (Deo Pani Khola) and Tashigang district (Tashigang); **Darjeeling:** Kalimpong (cultivated), Labha, Mongpu (field record), Tista; **Sikkim:** Rumtek (cultivated), Temi. Cultivated and becoming weedy in subtropical areas, 250–1350m. Flowers all year round.

A pantropical weed from tropical America.

## 11. RAPHISTEMMA Wall.

Climbing, glabrous shrubs with smooth, slender, herbaceous branches. Leaves opposite, membranous, glabrous below, glabrous to sparsely hairy above (particularly on main veins), extrafloral nectaries present. Inflorescence an umbellate cyme, 4–14-flowered on long, stout peduncle with long, slender pedicels. Flowers large and showy, white to cream, scentless. Calyx lobes membranous. Corolla subcoriaceous, tube cylindrical-campanulate; lobes spreading to reflexed; corolline coronal scales horn-like, white and membranous, closely adpressed and adnate to staminal column with slender tips extending above stigmatic head. Anthers with a 2-winged cartilaginous yellow back plate attached to connective and thin membranous apical projection incurved over stigmatic head; pollen in pendulous non-flattened waxy pollinia, one per anther locule; corpusculum black; translator arms short and horizontal. Stigmatic head domed, 2-lobed. Follicles usually one per flower, pendulous, broadly oblong with tapering beak, skin rather thin and furrowed.

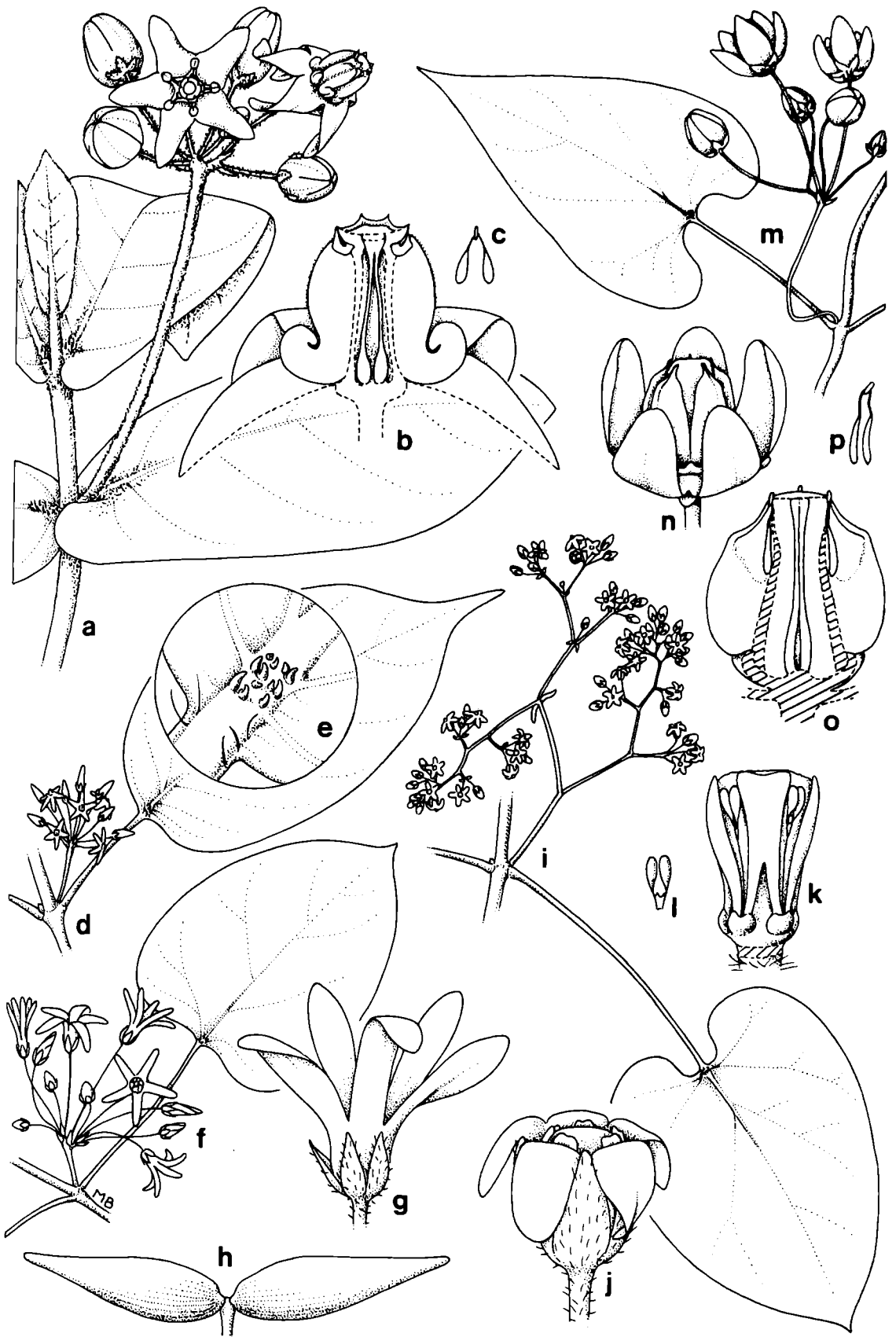
### 1. *R. pulchellum* (Roxb.) Wall.

Tall, twining shrub with pale branches twisting to the right. Leaves ovate to oblong-ovate, 8–19  $\times$  5–13cm, apex acuminate, base cordate with wide blunt sinus, 1–3cm wide; petiole 3–13cm. Peduncles (3–)5–14cm long; pedicels 1.5–5cm. Calyx lobes broadly ovate, 5–6  $\times$  4–5mm. Corolla tube 12–14mm long, lobes broadly oblong-ovate, apex obtuse, 13–18  $\times$  9–11mm; corolline coronal scales c 15mm long. Staminal column c 10mm long. Follicles large, c 11  $\times$  3.5cm. Seeds broadly ovate, c 10  $\times$  7mm; coma c 3cm.

**Darjeeling:** Pankhabari; **Sikkim:** Sikkim Himalaya and unlocalised specimens.

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FIG. 69. **Asclepiadaceae.** a–c, *Calotropis gigantea*: a, flowering shoot ( $\times \frac{2}{3}$ ); b, half flower ( $\times 1\frac{1}{2}$ ); c, pollinia ( $\times 3$ ). d–e, *Gymnema tingens*: d, flowering shoot ( $\times \frac{1}{2}$ ); e, extrafloral nectaries ( $\times 6$ ). f–h, *Telosma pallida*: f, flowering shoot ( $\times \frac{2}{3}$ ); g, flower ( $\times 2$ ); h, fruit ( $\times \frac{1}{3}$ ). i–l, *Marsdenia tenacissima*: i, flowering shoot ( $\times \frac{1}{2}$ ); j, flower ( $\times 4$ ); k, gynostegium ( $\times 2$ ); l, pollinia ( $\times 6$ ). m–p, *Holostemma ada-kodien*: m, flowering shoot ( $\times \frac{2}{3}$ ); n, flower ( $\times 2$ ); o, half gynostegium ( $\times 3$ ); p, pollinia ( $\times 3$ ). Drawn by M. Bates.



Climbing on trees and shrubs in subtropical forests, 100–1100m. August(–October).

## 12. HOLOSTEMMA R. Brown

Glabrous, twining shrubs with similar habit and leaves to *Raphistemma pulchellum*; stems sparingly branched, pale and smooth. Leaves opposite, membranous, glabrous above, puberulent on veins below, extrafloral nectaries present. Inflorescence a 4–9-flowered umbellate cyme, in leaf axils, on short peduncles. Flowers subglobose with subcoriaceous corolla lobes, deep red-purple within, white outside flushed pink. Calyx green with purple margin and midrib. Corolla lobes divided for more than half their length, erect; corolline coronal scales short and truncate, forming a membranous ring around base of staminal column. Stamens highly ornamented; filaments expanded laterally into 2 fleshy wings, connectives bearing yellow, black-tipped, triangular, cartilaginous appendages on their backs, anther tips with thin, membranous apical projection, incurved over stigmatic surface; pollen in flattened, elongate, pendulous waxy pollinia, one per anther locule; corpusculum black; translator arms long. Stigmatic head 5-lobed, domed. Follicles usually solitary, large, short and thick, woody, smooth with 2 flanges.

**1. *H. ada-kodien*** Schultes; *H. rheedei* Wall., *H. annularis* (Roxb.) Schumann. Fig. 69m–p.

Extensive climber to 3m or more; stems twining to the right, with abundant latex. Leaves ovate to ovate-lanceolate, 4.5–13 × 2.5–8cm, apex acuminate, base widely cordate with blunt sinus; petiole 2–5cm. Peduncles 11–30mm long; pedicels 5–18(–25)mm. Calyx lobes narrowly ovate, 3–5 × 2–3mm, ciliate. Corolla tube c 3mm long; lobes ovate, obtuse, 7–12 × 5–6mm; corolline coronal ring 1–2mm high. Stamens 8–10mm long, overtopping stigmatic head with membranous apical appendages. Stigmatic head 2.5–3mm broad. Follicles 7–12 × c 3cm. Seeds ovate, c 7 × 3cm; coma c 2cm.

**Bhutan:** C – Punakha district (Wangdu Phodrang) and Tashigang district (Thangjang); **Darjeeling:** unlocalised specimens; **Sikkim:** Great Rangit River and unlocalised specimen. Hot open terai, scrub and open forested areas, 100–1400m. July–September.

## 13. PENTASACME Wight

Tufted, almost glabrous, perennial herbs with numerous arching stems, woody at base. Leaves opposite, in two rows, membranous, subsessile; extrafloral nectaries appearing as a conspicuous black gland at base of pale green leaves. Inflorescence a few-flowered umbellate cyme, sessile, borne between petiole bases of a leaf pair (interpetiolar), one per leaf pair and on alternating sides of stem. Flowers (in Bhutanese species) white, large and showy with long corolla lobes,



horizontal at first, becoming pendulous. Corolla tube very short; lobes long and narrow, overlapping to the right; corolline coronal lobes reduced to small oblong appendages on corolla tube. Staminal column very short, anthers large, incurved over stigmatic surface; pollen in non-flattened, ovoid, erect, waxy pollinia, one per anther locule; corpusculum golden-brown; translator arms short, horizontal. Stigmatic head conical, concealed by anthers.

#### 1. *P. pulcherrima* Grierson & Long

Stems 30–40cm long, little-branched. Leaves ovate to ovate-lanceolate, 6–13 × 1.6–4cm, apex acuminate to narrowly acute, base cuneate; petiole 2–7mm. Inflorescences 3–5-flowered; pedicels 1–2cm long, slender. Calyx lobes ovate-acute, c 2.5mm long. Corolla tube c 1mm long; lobes lanceolate, (15–)20–30 × 2.5–4mm; corolline coronal lobes c 1.5mm long. Staminal column c 2mm high; anthers obovate, apex broadly acute. Follicles unknown.

**Bhutan:** S – Deothang district (Samdrup-Jongkar to Deothang). Shaded steep banks and gully walls in subtropical rainforest, 250–550m. June–September.

Endemic to Bhutan.

### 14. GYMNEMA R. Brown

Extensive climbing shrubs, sometimes undershrubs, with opposite leaves, extrafloral nectaries present. Flowers small to medium sized, creamy-yellow to white, in crowded umbellate cymes. Inflorescences interpetiolar (as in *Pentasacme*), branches usually puberulent. Corolla tube short; lobes rather thick and often twisted; coronal scales minute, often reduced to villous longitudinal bands inside corolla tube. Gynostegium short, stigmatic dome projecting above ring of anthers. Stamens subsessile, anthers with narrow cartilaginous appendages outside and broadly ovate membranous apical scales adpressed to stigmatic dome; pollen in non-flattened, ovoid, erect waxy pollinia, one per anther locule; corpusculum golden-brown; translator arms short, horizontal. Follicles slender, narrowly conical, smooth, usually solitary. Seeds ovate-acuminate with thin marginal wing.

1. Flowers less than 5mm broad; peduncles less than 2cm long    **1. *G. tingens***  
 + Flowers more than 8mm broad; peduncles more than 2cm long

#### **2. *G. macranthum***

#### 1. *G. tingens* (Roxb.) Sprengel. Lepcha: *Rheom* (34). Fig. 69d&e.

Nearly glabrous climber with only young stems pubescent. Leaves broadly ovate to elliptic, 10–14 × 5.5–8.3cm, apex acuminate, base cordate to truncate, membranous, glabrous or sparsely pubescent below, particularly on main veins; petiole 2–3cm. Peduncle 1–2cm long, slender; pedicels 5–12mm; bracts oblong, 4–9mm long. Calyx lobes oblong-ovate, 3–4 × 1–1.5mm, sparsely puberulent.

Corolla tube 3–4mm, as long as or just shorter than calyx; lobes broadly oblong-ovate, 4–6 × 2–2.5mm. Stamens c 3mm long, stigmatic dome protruding c 1mm. Follicles large, 17–18 × c 2cm. Seeds 12–15 × 6–8mm; coma c 6–7cm.

**Darjeeling:** Rangit; **Sikkim:** Rangpo. Subtropical forests, 150–700m. May–August.

Plant yields a blue dye known as *Rheom* to the Lepchas (34)

## 2. *G. macranthum* Hook.f.

Stout climber with glabrous stems. Leaves broadly ovate to elliptic, 6–17 × 3.5–9cm, apex abruptly acuminate, base rounded, truncate to shallowly cordate, subcoriaceous, glabrous, sometimes sparsely puberulent on main veins; petiole 2–6cm. Peduncle 2–6cm long, rather stout; pedicels 6–12mm; bracts absent. Calyx lobes broadly elliptic-ovate, c 5 × 4mm, minutely pubescent outside. Corolla tube 5–6mm, just longer than calyx; lobes oblong-ovate, 4–5 × 2–3mm, corolla colour unrecorded. Stamens c 2mm long, stigmatic dome protruding 1.5mm. Fruit unknown.

**Darjeeling:** Mongpu, Sureil; **Sikkim:** Rangpo and unlocalised specimens. Subtropical forests?, 600–1800m. June.

This species can be distinguished from the superficially similar *Marsdenia lucida* by the domed stigmatic head.

## 15. GONGRONEMA (Endlicher) Decaisne

Mainly glabrous, twining shrubs. Leaves opposite, veins few, arching but without intramarginal vein; extrafloral nectaries present. Flowers small, borne in axillary, umbellate, interpetiolar cymes (as in *Pentasacme*). Corolla tube about as long as lobes; corolla lobes with recurved margins, often rather thick and twisted, corolline coronal scales small, adnate to base of short staminal column. Anthers sessile, with narrow semi-cartilaginous longitudinal appendages on their backs and membranous apical appendages covering domed stigmatic head; pollen in flattened, ovoid, erect waxy pollinia, one per anther locule; corpusculum golden-brown. Follicles slender, tapering, glabrous. Seeds ovate with thin marginal wing.

1. Corolla distinctly inflated; peduncles less than 2cm ..... 3. *G. ventricosum*  
 + Corolla not greatly inflated; peduncles usually more than 2cm ..... 2
2. Peduncles always with a main trichotomous division, sometimes more; anthers with one apical appendage ..... 1. *G. nepalense*  
 + Peduncles usually without branches, bearing a solitary umbellate cluster of flowers; anthers with two apical appendages ..... 2. *G. thomsonii*

1. *G. nepalense* (Wall.) Descaisne; *G. sagittatum* Wall.

Extensive climbing shrub; young shoots and inflorescence branches puberulent. Leaves oblong to ovate, 8.8–18 × 2.4–10cm, apex acuminate sometimes abruptly so, base rounded to shallowly cordate, membranous, sparsely pubescent above, usually glabrous or nearly so below; petiole 1.5–5.6cm. Inflorescence many-flowered; peduncle long and stout, 4–16cm, usually once trichotomously branched, sometimes more; flowers crowded in umbellate clusters at the ends of the main branches; pedicels short and slender, 3–10mm. Calyx tube 0.5–1mm long; lobes ovate, 1–2 × 1mm. Corolla tube 1.5–2mm long, glabrous; lobes ovate, 2.5–3 × 1.2–2mm. Staminal column 2–2.5mm high. Follicles 5–7 × 0.5–0.6cm, solitary or in pairs. Seeds 5–6 × 2mm; coma 2–2.5cm.

**Darjeeling:** Badamtam, Kalimpong, Little Rangit, Great Rangit, Tista, Torsa River; **Sikkim:** Sosing, Rangit. Subtropical forests, 300–1200m. June–September.

2. *G. thomsonii* (Hook.f.) Matthew; *Gymnema? thomsonii* Hook.f.

Slender-stemmed woody climber; inflorescence branches and nodal areas puberulent. Leaves coriaceous, narrowly-elliptic to linear-lanceolate, 8–13 × 1.8–5cm, apex acuminate, base cuneate, margin sometimes shallowly crenulate, dark green above, paler below, glabrous but minutely puberulent on main veins; petiole 1–1.8cm. Inflorescence an umbellate cyme, pedunculate, usually simple or little-branched, with terminal umbellate cluster of 7–9 flowers; peduncle 1.4–5.5cm, stout; pedicels 7–11mm, slender. Calyx lobes broadly oblong to ovate-acute, 1.2–1.6 × c 0.5mm. Corolla tube 1.2–3mm long, puberulent within; lobes linear-oblong, 2.5–4 × 0.7–1.2mm; corolline coronal scales elongate, forming inverted V-shaped appendages adnate to lower half of stamens. Gynostegium c 3mm high. Anthers sessile, with extra membranous appendage outside, just below apex and overlapping ligulate apical appendage; apical appendages long and often only just covering the globose stigmatic head. Follicles c 9 × 1.3cm. Seeds c 13 × 4mm; coma 2–3cm.

**Darjeeling:** Ghum, Kurseong to Chattakpur, Labha, Mim forest, Rambh Chhu, Rimbi Chhu. Twining on undershrubs in subtropical forests, 1600–2200m.

3. *G. ventricosum* Hook.f. var. **bhutanicum** Hara

Glabrous, slender, climbing shrub. Leaves ovate-lanceolate to ovate, 5–9 × 2.3–4.3cm, apex acuminate, base rounded to truncate, glabrous, subcoriaceous; petiole 0.8–2.5cm. Inflorescence 3–9-flowered, shortly pedunculate umbellate cymes; peduncle 2–20mm long; pedicels 4–10mm, slender. Flowers purple-brown outside, yellow-green within. Calyx lobes broadly ovate-acute, c 1.5 × 1.5mm. Corolla tube distinctively inflated, 4–5 × 4–5mm, glabrous; lobes lanceolate, 4–5 × c 1.5mm; corolline coronal scales small, triangular with recurved margins attached at base of staminal column. Gynostegium 2.5–3mm high. Follicles unknown.

**Bhutan:** C – Punakha district (Bhotokha to Rinchu). Subtropical forests, 1400–1500m. May.

Only known from the type collection. Distinguished from the typical variety (itself only known from one Khasian specimen) by its longer petioles, peduncles, pedicels and slightly larger flowers.

## 16. TELOSMA Coville

Woody, twining undershrubs; young stems, petioles and inflorescence branches shortly pubescent. Leaves opposite, veins few, arching, not merging into intramarginal vein; extrafloral nectaries present. Flowers in little-branched, umbellate cymes. Inflorescences interpertiar (as in *Pentasacme*). Calyx lobes sparsely puberulent and ciliate. Corolla salver-shaped, tube inflated at base around gynostegium; lobes lanceolate, overlapping to the right in bud, spreading, margins often recurved with age; corolline coronal scales absent. Anthers subsessile, highly ornamented; membranous apical appendage incurved, covering domed stigmatic head; longitudinal, linear, semi-cartilaginous appendages on either side of anther; staminal coronal scale attached just below middle of anther, obovate-oblong, with caudate tip arching over membranous appendage; pollen in non-flattened, erect, waxy pollinia, one per anther locule; corpusculum golden-brown. Follicles usually paired, woody, lanceolate in outline. Seeds ovate-oblong with a thin marginal wing.

**1. T. pallida** (Roxb.) Craib; *Pergularia pallida* (Roxb.) Wight & Arnott. Fig. 69f–h.

Tall climber; older stems becoming lenticellate. Leaves ovate to broadly so, 5–12 × 2.5–10.5cm, apex abruptly acuminate, base usually cordate, sometimes truncate, membranous, usually sparsely hirsute above, more so on main veins and below; petiole 2–4cm. Flowers yellow-white, faintly scented, in many-flowered, short-stalked inflorescences; peduncle short and stout, 0.4–2.4cm; pedicels 0.8–1.4cm long, slender. Calyx lobes lanceolate, 3–5 × 1–1.5mm. Corolla tube 5–6mm long, glabrous outside and within; lobes much longer than tube, 8–14 × 2–4mm. Gynostegium 3–4mm high; pollinia subcylindric. Follicles 9–10 × 1.5–2cm, poorly known. Seeds 8–9 × 4mm; coma 2–2.5cm.

**Darjeeling:** Darjeeling, Rangit, Tista; **Sikkim:** unlocalised record. Subtropical areas, 300–1200m. June–September.

## 17. MARSDENIA R. Brown

Twining undershrubs with opposite leaves; extrafloral nectaries present. Flowers small to medium sized, in many-flowered terminal or interpertiar (as in *Pentasacme*) cymose inflorescences. Inflorescences variable, from umbellate to paniculate, corymbose or rounded. Corolla tube cylindric, to inflated or

campanulate; lobes long or short, overlapping to the right; corolline corona absent. Staminal corona of erect flattened lobes arising from base of staminal column and fused to backs of anthers. Anthers with membranous apical appendage inflexed over (or up) the stigmatic head, and small lateral, semi-cartilaginous triangular appendages; pollen in minute non-flattened, oblong-ovoid, erect waxy pollinia, one per anther locule, corpusculum golden-brown. Stigmatic head rounded-conical, usually enclosed by anthers but sometimes protruding above. Follicles large, woody, lanceolate-acuminate in outline. Seeds ovate, beaked, with thin marginal wing.

1. Plant nearly glabrous; leaves only weakly cordate or rounded at base; stems and leaves blue tinged, especially when dry ..... **1. M. tinctoria**
- + Plant tomentose, at least on inflorescence; leaf bases cordate, cuneate or rounded; stems pubescent or sometimes with only 2 lines of hairs; leaves not blue tinged ..... 2
2. Stems with 2 lines of hairs ..... **5. M. lucida**
- + Stems hairy all round ..... 3
3. Corolla tube twice length of calyx lobes ..... **2. M. calesiana**
- + Corolla tube just longer than calyx lobes ..... 4
4. Corolla glabrous within; lobes more than 3mm long; staminal coronal scales with 2 short apical horns ..... **3. M. tenacissima**
- + Corollas with longitudinal pilose bands within; lobes less than 2.5cm long; staminal coronal scales long and slender with tips extending above anther column ..... **4. M. roylei**

**1. M. tinctoria** R. Brown. Lepcha: *Rheom* (34), *Kembre Lahara* (Cowan specimen).

High-climbing undershrub to 7m or more. Plant nearly glabrous, young parts often softly pubescent-tomentose; stem beneath bark, leaves, calyx, etc., suffused with purple-blue dye, especially apparent in dried material. Leaves ovate to elliptic, 7.2–12(–19) × 3.4–7.5(–11)cm, apex acuminate or caudate, base rounded to truncate to shallowly cordate, membranous, sparsely hairy, particularly on veins; petiole 1.7–3(–6)cm. Flowers white, very small, c 2mm long, subsessile, in distinctive crowded spike-like cymose (thyrsoid) inflorescences; flowering axis 3–6cm long; peduncle short and stout, 1–6cm; pedicels slender, 0–2mm. Calyx lobes rounded-ovate, c 1.2 × 1mm, ciliate, sparsely puberulent. Corolla tube cylindric, c 1.5 × 1.5mm, slightly swollen at base around minute gynostegium, glabrous outside but with lines of brown hairs inside and throat closed by a dense ring of bristles c 0.8mm long; lobes very short, oblong-rounded, 0.9–1 × 1mm, glabrous. Gynostegium 1–1.2mm high; staminal coronal scales with caudate tips extending above and incurved over anthers; stigmatic

head hidden by anthers. Follicles c  $7 \times 0.8$ cm, densely covered in fine pubescence. Seeds  $12 \times 4$ mm; coma 2–4cm.

**Bhutan:** C – Punakha district (Rinchu to Mishichen); **Darjeeling:** Chamarchi, Lat, Rishep, Rummai, Sivok, Sureil; **Sikkim:** unlocalised specimen (69). Subtropical forests, 250–900m. August–October.

Gives a blue dye known as *Rheom* to the Lepchas (34).

## 2. *M. calesiana* Wight

Stout-stemmed, pubescent climber; young branches, petioles, inflorescence branches, bracts and sepals densely pubescent, older stems less so. Leaves broadly ovate,  $7\text{--}15 \times 5.5\text{--}13$ cm, apex abruptly acuminate, base cordate, pubescent, especially on veins; petiole 4–8cm. Flowers small, yellow, c 7mm long, in many-flowered corymbose cymes. Inflorescences with many somewhat lax branches; peduncle short and stout, 1.2–3cm; cyme branches thick, 0.5–2cm; pedicels slender, 0.5–1cm. Calyx lobes ovate-oblong,  $2\text{--}2.5 \times 1.5$ mm. Corolla tube cylindric, slightly inflated at base around gynostegium, 4–5mm long, shortly hairy outside, glabrous within; lobes rather short and narrow, oblong,  $2.5\text{--}3.5 \times 0.7$ mm, thick with recurved margins, shortly hairy outside, glabrous within. Gynostegium c 3mm high. Anthers with several appendages; ligulate membranous apical appendage incurved, covering the slightly protruding rounded stigmatic head; lateral cartilaginous appendages linear and with a basal staminal coronal scale; coronal scale a small, fleshy, compressed triangular spur pointing away from anther. Follicles c  $8 \times 2$ cm. Seeds  $8\text{--}10 \times 4\text{--}5.5$ mm; coma c 4cm.

**Darjeeling:** Chunabati, Mongpu, Pankhabari, Rungchong; **Sikkim:** (69, 80, 135). Subtropical forests, 750–900. May–June.

## 3. *M. tenacissima* (Roxb.) Moon. Nep: *Bahuni Lahara* (34); Lepcha: *Kamtiongrik* (34). Fig. 69i–l.

Extensive, tomentose-pubescent climber with stout stems; young branches, petioles and inflorescences densely velvety tomentose, older parts less so. Leaves broadly ovate,  $6\text{--}18 \times 4.5\text{--}13$ cm, apex acuminate, base cordate with a wide sinus, tomentose to sparsely pubescent above, more so to velvety-tomentose on veins and below; petiole long and stout, 4–12cm. Flowers medium sized, c 8mm long, yellow becoming green towards centre with 5 black tips of staminal corona surrounding and arching over white dome in eye. Inflorescences of many-flowered, much-branched corymbose cymes; peduncle short and thick, 0.4–3.5cm; cyme branches widely branched, thick, 0.5–3.5cm; pedicels slender, 2–10mm. Calyx lobes lanceolate to narrowly ovate,  $2.5\text{--}4 \times 1.3\text{--}2$ mm, densely puberulent. Corolla tube cylindric, 2–3.5mm long, about equal to, or just shorter than calyx, puberulent outside, glabrous within; lobes oblong-lanceolate,  $3\text{--}3.5 \times 1.5\text{--}2$ mm, thick, spreading, puberulent outside, glabrous within. Gynostegium 3–3.5mm, tip level with, or slightly protruding from mouth of corolla. Anthers with several appendages; ligulate membranous apical appendage incurved, covering domed and slightly protruding stigmatic head; lateral

semi-cartilaginous appendages linear and with a distinctive staminal coronal scale; coronal scale oblong-ligulate, with 2 short apical horns, to nearly truncate, black, coriaceous, adnate to midway up the back of anther, slightly longer than anther and arched over stigmatic head. Follicles large, 11–12 × 2–3cm, surface finely longitudinally wrinkled and covered in a short, dense pubescence. Seeds c 13 × 8mm; coma c 4cm.

**Darjeeling:** Sukna, Tista. Subtropical terai vegetation, c 300m. May–June.

The stems yield a very strong silky fibre used to make rope (48). This species is sometimes confused with *M. roylei*.

#### 4. *M. roylei* Wight

Large climbing shrub very similar to *M. tenacissima* and sometimes confused with it, but differing in floral structure. Leaves 5–14 × 5–11.5cm; petiole 2–5.5cm. Inflorescences appearing more densely flowered, ultimate cyme branches shorter and pedicels very short; linear bracts and bracteoles sometimes present; peduncles 1.5–5cm long; pedicels 0–4mm. Flowers orange-yellow to brick-red, with unpleasant scent. Calyx lobes lanceolate-ovate, slightly longer than corolla tube, 2–2.5 × 1.2mm, densely tomentose outside, glandular within. Corolla tube short, c 2mm long, campanulate, glabrous outside, with longitudinal pubescent bands opposite lobes within; lobes rounded, oblong to oblong-triangular, 2–2.5 × 0.8–1.5mm, thick, spreading, glabrous or with a small patch of hairs outside, densely creamy-yellow tomentose with glabrous margin inside. Gynostegium 2.5–3mm high, level with, or slightly protruding (especially slender corona scales) from mouth of corolla. Stamens 1.5–2mm long; anthers similarly adorned as *M. tenacissima* but with a very different staminal corona; coronal scales long and slender, white, adnate to midway up the back of anther, tapering into a fine tip, extended 1–1.5mm above anthers. Follicles 7–9 × 1.8–2cm, beaked, surface deeply wrinkled and undulate, covered in a fine pubescence. Seeds 9–12 × 5–6mm; coma 3–4cm.

**Bhutan:** C – Punakha district (Hinglai La to Nahi) and Tongsa district (Shamgong); **Darjeeling:** (34); **Sikkim:** Lingdam. Subtropical forests and open areas, 1200–2000m. May–July.

The roots can be eaten (34).

#### 5. *M. lucida* Madden

Extensive climber, branches stout, with 2 broad lines of adpressed hairs either side of stem; petioles and inflorescence branches densely pubescent. Leaves elliptic to ovate, 6.5–12(–20) × 2.5–5.5(–16)cm, apex abruptly acuminate to acute, base cuneate to rounded (to cordate in lower parts), subcoriaceous, pubescent to sparsely so, denser on main veins and below, dark green above, pale below; petiole 2–3cm. Flowers medium sized, pink to dark red, in many-flowered, crowded, umbellate cymes; peduncle 2–3.5cm, stout; pedicels 1–1.5cm, stout. Calyx lobes ovate-rounded, 3.5–4 × 2.5–3mm, ciliate and puberulent.

Corolla tube short, campanulate, 3–3.5mm long, glabrous outside, finely puberulent within; lobes oblong-acute, 5–6 × 2.5–4mm, fleshy, spreading, glabrous on their backs, densely white tomentose within; corolline coronal scale triangular with recurved margins, fused to lower half of staminal column. Gynostegium with slender stigma protruding from corolla mouth. Staminal column c 3mm long, anthers with membranous apical scale inflexed over stylar disc, level with corolla mouth; staminal coronal scale small, oblong-rounded, attached above middle of anther but not extending to tip. Stigma c 3mm long, slender, pale green, 2-lobed at maturity. Follicles lanceolate in outline, 9–15 × 2–3cm with thick finely wrinkled skin, glabrous. Seeds ovate-lanceolate, 1.3–1.5 × 4–5mm, beaked; coma 3–4cm.

**Bhutan:** C – Tongsa district (Tashiling and between Tashiling and Charikhachor). Climber on shrubs in forests, 2200–2450m. August–September.

This species can be distinguished from the superficially similar *Gymnema macranthum* by the long, slender stigmatic head.

## 18. TREUTLERA Hook.f.

Stout, glabrous, climbing shrubs with smooth branches. Leaves opposite, coriaceous, sometimes thickly so, extrafloral nectaries present. Flowers large, pale pink to dark purple with a green centre, in many-flowered umbellate cymose, axillary inflorescences. Calyx small. Corolla rather thick, divided almost to middle, puberulent within tube towards base, otherwise glabrous, tube widely campanulate; lobes spreading and not overlapping; corolline coronal scales absent. Gynostegium small and green. Stamens subsessile; anthers with long linear lateral cartilaginous appendages, apical membranous appendage incurved over domed stigmatic head, and with thick ligulate scale on the back, fused to anther for most of its length, but with rounded tip free and almost level with anther tip; pollen in minute, non-flattened, subcylindric, erect waxy pollinia, one per anther locule; corpusculum golden-brown. Stigmatic surface dome-shaped with 2 small central projections, slightly protruding above ring of anthers. Fruit unknown.

### 1. *T. insignis* Hook.f.

Tall twiner, leaves ovate to elliptic, sometimes narrowly or widely so, 8–14(–18) × 3–6(–8)cm, apex abruptly acuminate to apiculate, base cuneate to rounded, glabrous except for fine pubescence on midrib above and below; petiole 2–3(–4.5)cm long, stout. Inflorescence 5–11-flowered; peduncles 3–6.5(–8)cm long, stout; pedicels 3–4(–5)cm, more slender. Flowers 2–3cm broad, fragrant. Calyx lobes ovate to ovate-lanceolate, c 3 × 2mm, sparsely pubescent outside. Corolla tube c 7mm long; lobes broadly triangular-ovate, 6–8 × 6–9mm. Gynostegium c 4mm high.

**Bhutan:** C – Thimphu district (Hinglai La) and Punakha district (Sinchu La);  
**Darjeeling:** Kurseong, Budhwari to Bhotia Basti, Peshok, Senchal, Tanglu;



**Sikkim:** unlocalised specimens. Temperate wet forests, (900–)2200–3000m. August–September.

### 19. HOYA R. Brown

Succulent shrubs of varied habit; stems twining, pendulous or rambling, often rooting, rarely erect. Leaves opposite, thick and fleshy or thickly coriaceous, flat unless otherwise indicated. Extrafloral nectaries present. Flowers in axillary or terminal, simple umbels. Pedicels deciduous, peduncles often persistent, end becoming thickened and scarred with age. Calyx small, inconspicuous. Corolla tube widely campanulate to flattened or reflexed; lobes fleshy or waxy, spreading to reflexed, not overlapping, often with revolute margins; corolline coronal scales absent. Gynostegium large and showy; staminal corona often large and succulent, lobes stellately spreading or ascending, variously shaped, saccate, with vertical appendage at inner angle, extending above anthers. Anthers short, subsessile, with small membranous apical appendages incurved, covering small stigmatic head; lateral semi-cartilaginous linear appendages slender; large fleshy staminal coronal scale adnate to full length of back of anther; pollen in small, subcylindric, erect waxy pollinia, one per anther locule; corpusculum golden-brown. Follicles usually slender, linear-lanceolate in outline, and thin-skinned. Seeds very small, ovate to linear-oblong, with a long coma.

The species of this genus are often cultivated and much prized for their unusual, showy flowers. The sizes and shapes of the staminal coronal scales are given as seen from above unless otherwise stated.

1. Leaves small, less than 3cm long, rounded or obcordate in outline, (0.5–)1 or more times as wide as long ..... 2
- + Leaves usually larger, more than 3cm long (sometimes shorter in *H. linearis* and *H. lanceolata*), linear, oblong to elliptic, not as above ..... 3
2. Leaves with rounded apices; stems sparsely minutely papillose  
  1. *H. serpens*
- + Leaf apices distinctly obcordate; stems densely minutely papillose  
  2. *H. obcordata*
3. Corolla lobes strongly reflexed, distinctly longer than wide, or with long slender coronal processes exceeding stamens ..... 4
- + Corolla lobes not strongly reflexed, about as long as wide, coronal processes not as above, or plant without flowers ..... 5
4. Corolla lobes only just longer than wide; coronal processes long and slender, projecting c 2mm above stamens ..... 13. *H. edenii*
- + Corolla lobes much longer than wide; coronal processes not as above  
  14. *H. acuminata*

163. ASCLEPIADACEAE

5. Leaves narrow, linear, lanceolate or oblanceolate, usually less than 2(–3)cm wide, or leaves less than 2cm long ..... 6  
+ Leaves wider, ovate, elliptic, obovate, oblong or rhomboid, usually more than 2cm wide (except some forms of *H. lanceolata*) ..... 8
6. Leaves linear, semicircular in cross-section, less than 5mm wide  
3. **H. linearis**  
+ Leaves not linear, usually more than 6mm wide ..... 7
7. Leaves distinctly oblanceolate, acuminate, more than 6cm long; staminal coronal scales white ..... 4. **H. longifolia**  
+ Leaves lanceolate (sometimes widely so) to lanceolate-elliptic, acute to acuminate, less than 6cm long; staminal coronal scales crimson or white  
5. **H. lanceolata**
8. Leaves broadly rhombic in outline, primary nerves numerous and parallel, at an acute angle with midrib ..... 6. **H. polyneura**  
+ Leaves ovate, elliptic, obovate or oblong, nerves not as above ..... 9
9. Leaves oblong to oblong-elliptic, with sides parallel or nearly so, primary veins many ..... 10  
+ Leaves ovate to obovate, sides not parallel, primary veins few ..... 12
10. Primary veins perpendicular to midrib; corolla yellow-brown .. 7. **H. fusca**  
+ Primary veins not perpendicular to midrib; corolla white or creamy-yellow  
11
11. Leaves large, more than 3cm wide, abruptly acuminate to shortly cuspidate obtuse; flowers in many-flowered dense, pubescent, domed umbels  
8. **H. globulosa**  
+ Leaves smaller, less than 3cm wide, acuminate to acute; flowers in 2–5-flowered umbels ..... 14. **H. acuminata**
12. Leaves ovate to elliptic, primary veins arising at leaf base ..... 13  
+ Leaves normally obovate to elliptic, primary veins not as above or indistinct  
14
13. Petioles very thick, more than 8mm long; leaves very coriaceous; flowers all white ..... 9. **H. parasitica**  
+ Petiole thick, less than 8mm long; leaves subcoriaceous; flowers white with purple centre ..... 10. **H. bhutanica**
14. Leaves very large, more than 8cm long, very thick and fleshy; coronal lobes longer than corolla tube ..... 11. **H. arnottiana**

- + Leaves smaller, usually less than 8cm long, not so thick and fleshy; coronal lobes shorter than corolla tube ..... 15
15. Stems and leaves puberulent; sap clear; flowers pure white; corolla flat or slightly recurved ..... **12. H. aff. *carcosa***
- + Stems glabrous; leaves sparsely pubescent above; sap milky; flowers off-white to yellow; corolla strongly reflexed ..... **13. H. *edenii***

### 1. *H. serpens* Hook.f.

Very slender-stemmed creeper, rooting freely at nodes, stem shortly pubescent to sparsely so, sparsely minutely papillose. Leaves suborbicular, ovate or very broadly elliptic, 8–19 × 7–17mm, apex rounded, base rounded to subcordate, fleshy, c 3mm thick, upper surface minutely papillose and shortly pubescent, lower surface less so, venation obscure in fresh material; subsessile; petiole 0–6mm long, densely pubescent. Flowers large, 1.5–2cm broad, white, sweetly scented, in many-flowered hemispherical umbels. Peduncle 2–5.5cm long, stout, perennial; pedicels 1.5–2.4cm, slender, green sometimes tinged purple. Calyx lobes ovate, c 2 × 1.5mm. Corolla glabrous outside, densely white pubescent within; tube 5–6mm long, widely campanulate to almost flat; lobes ovate-oblong, 5–6 × 5mm, spreading to slightly recurved. Staminal column c 3mm high; coronal scales very succulent, horizontally stellately spreading, ovate in outline c 4 × 2.5mm, with small tooth near anther apex. Follicles very slender, c 11 × 0.4cm, glabrous, in divaricate to slightly recurved pairs. Seeds minute, c 2.5 × 0.5mm; coma 3–4cm.

**Bhutan:** S – Phuntsholing district (Kamji); **Darjeeling:** Darjeeling; **Sikkim:** Dentam to Pemayangtse. Subtropical forests, laurel forests, 1400–1700m. May–June.

This species is very similar to *H. nummularia* Hook.f. (of the Khasia Hills). The latter is readily distinguished by its smooth leaves compared to the papillose leaves of *H. serpens*. This character is also apparent in dried material as *H. nummularia* is smooth between the veins when dry, whereas *H. serpens* remains textured.

### 2. *H. obcordata* Hook.f.

Very slender-stemmed creeping and rooting epiphytic shrub, somewhat similar to *H. serpens*. Stem minutely papillose and sparsely pubescent. Leaves distinctly shaped, obcordate or kidney-shaped, 15–34 × 11–23mm, apical sinus usually shallow, base rounded, fleshy, glabrous, nerves obscurely reticulate, surface smooth; petiole short and stout, 4–8mm long, sparsely pubescent. Inflorescence and floral structure very similar to *H. serpens*. Peduncle 3–8cm long, persistent, with numerous slender pedicels 7–13mm. Flowers white, c 8mm broad. Calyx lobes lanceolate c 1.5 × 0.5mm. Corolla glabrous outside, minutely papillose-pubescent within, tube 2–3mm long; lobes triangular, c 3 × 3mm. Staminal coronal scales ovate, c 2 × 1mm. Fruit not seen.

**West Bengal Duars:** Buxa (277); **Sikkim:** Chakung, Yoksam. Mixed broad-leaved forests, 1200–1700m. August–November?

Apparently only known from Sikkim and Darjeeling.

### 3. *H. linearis* D. Don. Nep: *Harchur*

Slender, long-stemmed (to 1m or more), little-branched, limp, pendulous or trailing epiphyte, younger parts and pedicels densely hirsute. Leaves linear-lanceolate in outline, size very variable  $1.5-5(-7) \times 0.2-0.5$ cm and 2–3mm thick, semicircular in cross-section with lower surface flattened, apex acute to acuminate, base rounded, softly pubescent and minutely papillose above, less so below; subsessile; petiole 0–1mm. Inflorescence a terminal sessile umbel of 4–12 waxy white flowers, sometimes suffused pink; pedicels 1.5–2.2cm, flowers 1–1.3cm broad. Calyx lobes linear-lanceolate, c  $2.5 \times 1$ mm. Corolla glabrous outside, glabrous to densely papillose puberulent within; tube very broadly campanulate to almost flat, 2.5–4mm long; lobes broadly triangular-acute,  $2.5-3.5 \times 4.5$ mm, spreading. Staminal column c 1.5mm high; coronal scales horizontally stellately spreading, white to suffused pink, subcylindric to saccate, rounded-oblong in outline,  $2.5-3 \times 1$ mm, with a small tooth near anther apex. Follicles slender and straight,  $5-6.5 \times 0.5$ cm, glabrous. Seeds ovate-oblong,  $1.5-3 \times 0.5-1.3$ mm; coma 2.5–3.5cm.

**Bhutan:** S – Chukka district (Marichong, Tala) and Deothang district (Samdrup Jongkhar), C – Punakha district (Gichha, Ritang to Ratsoo, Tinlegang), Tongsa district (Tongsa, Tongsa tpoTashiling) and Tashigang district (Shapang, Tashi Yangtsi); **Darjeeling:** Daling, Great Rangit, Mongpu, Sonada, Takdah; **Sikkim:** Damthang Temi, Gangtok, Kabi, Lachen to Lachung, Lusing, Rishi, Tista, Yoksam to Bakhim. Epiphytic on moss-covered rocks, trees, banks and cliff-faces in warm, mixed broad-leaved forests, (900–)1500–2200m. July–October.

This species is very variable in leaf size and corolla indumentum. Hooker separated the Nepalese plants with papillose-puberulent inner corolla surface from the glabrous Sikkimese specimens at the varietal level. When looking at the whole range of this plant (Nepal to Burma and West China) a continuous variation is seen, from the totally glabrous corollas of the Burmese plants, through intermediates in Bhutan and Sikkim, to the papillose-puberulent in Nepal. There appears to be two sizes of leaves in this range; short (less than 3cm) and long (more than 4cm). This character does not correlate with any other characters and may be environmentally controlled. Further study of this complex variation pattern is needed before infraspecific taxa can be accepted.

### 4. *H. longifolia* Wight

Slender to stout-stemmed, almost glabrous creeper with long flexuose pendent branches. Leaves variable in shape, narrowly oblanceolate to linear-oblanceolate,  $6-16 \times 0.9-3$ cm, apex acuminate, base cuneate, glabrous above, sometimes with a sparse pubescence below, very fleshy, subcoriaceous, lamina

bent downwards at junction with petiole, nerves indistinct; petiole 0.5–2cm long, stout. Inflorescence and floral structure very similar to *H. linearis*. Flowers white, c 1.3(–1.8)cm broad, in umbels of 4–15; peduncle (0.6–)2.5–4(–5) cm long, slender or slightly thickened, persistent, with enlarged and scarred end, glabrous or sparsely puberulent; pedicels 2–2.5cm, very slender, glabrous. Calyx lobes narrowly ovate, 1.5 × 0.7mm, glabrous. Corolla densely papillose-puberulent within, glabrous outside, tube 3.5–5mm long; lobes triangular-acute, 5–9 × 5–8mm. Staminal coronal lobes white, oblong-ovate, 3 × 2mm, horizontal. Follicles slender and straight, 9–11 × 0.5cm. Seeds oblong, 3–4 × 1mm; coma c 3cm.

**Bhutan:** S – Chukka district (Giengo), N – Upper Mo Chu district (Khosha to Tamji); **Darjeeling:** Kurseong, Lat, Pankhabari, Sivok; **Sikkim:** Kubbee, Yoksam. On trees and sometimes rocks in mixed forests, 450–2000m. May–October.

The superficially similar *H. oblanceolata* Hook.f. has been recorded as growing in the area, but all specimens seen have been misidentified and are *H. longifolia*. *H. oblanceolata* differs in having short, very thick peduncles 12–25mm, heavily scarred almost to the base, and suberect coronal lobes.

### 5. *H. lanceolata* D. Don

Stout-stemmed, epiphytic shrub with long pendulous branches; young stems, petioles and inflorescence branches densely pubescent. Leaves elongate-rhomboid to ovate-lanceolate, 1.5–6 × 0.6–1.5cm, apex acute to acuminate, base cuneate, 1.5–2mm thick, fleshy and coriaceous, glabrous, dark green above paler below; petiole 1–5mm. Umbels 6–10-flowered, terminal or axillary; peduncles 1–1.5cm long, stout; pedicels 1–2cm. Flowers c 13mm broad, white sometimes with a pink to crimson centre (cf. *H. bella*), very similar to *H. linearis*. Calyx lobes lanceolate, 2.5–3 × 1–1.5mm, puberulent. Corolla glabrous outside, minutely papillose-puberulent within, tube c 3mm long; lobes triangular, c 3 × 5mm. Staminal coronal scales shorter and more rounded-elliptic, c 2.5 × 2mm, white or crimson. Follicles long and very slender, 8–15 × 0.3cm, surface thin, glabrous and finely striate. Seeds 2.5–3 × 1mm; coma 2–2.5cm.

**Bhutan:** S – Samchi and Phuntsholing districts (117), Chukka district (Marichong, Raidak Valley) and Gaylegphug district (Moa River Bridge), C – Tashigang district (Jiri Chhu); **Darjeeling:** Mongpu, Rambhi Chhu, Rishap, Rongsong, Selim; **Sikkim:** Gangtok, Kabi, Sang. On trees and rock-faces in subtropical forests, 300–1770m. May–July.

This species, like *H. linearis*, exhibits a large variation in leaf size across its geographic range. An attractive red-coronal form is widely cultivated, but under the superfluous name *H. bella*.

### 6. *H. polyneura* Hook.f.

Stout-stemmed, glabrous epiphyte with long flexuous branches. Leaves distinctively rhombic-ovate to rhombic-lanceolate, 5–14 × 1.5–4.5cm, apex long

acuminate, base narrowed, ultimately rounded to subcordate, very fleshy with coriaceous surface; characteristic nervation of numerous parallel lateral veins diverging from midrib at an acute angle; subsessile; petiole 1–2mm long, thick. Inflorescence and floral structure very similar to *H. linearis*. Umbels 8–25-flowered, flowers white or pink, c 1cm broad with dark red centres. Peduncle 5–8mm long, stout, persistent; pedicels 2–2.5cm long, very slender. Calyx lobes oblong, 2–3 × 0.7mm, glabrous. Corolla glabrous outside, minutely papillose-pubescent within, tube 3.5–4mm long; lobes ovate, acute, c 5 × 5mm, spreading to recurved. Staminal coronal scales very short, orbicular, c 3 × 2.5mm. Follicles slender and slightly curved, 9–10 × 0.4cm. Seeds ovate-lanceolate, 3 × 0.7mm; coma c 2.5cm.

**Bhutan:** S – Chukka district (Tala), C – Punakha district (Tinlegang, Mischichen to Khosa) and Tongsa district (Tongsa); **Darjeeling:** Lopchu; **Sikkim:** Chakung Chhu, Champong, Chunthang, Lachung Valley, Singhik. Epiphytic on trees in mixed broad-leaved forests, 1200–2100m. July–February.

### 7. *H. fusca* Wall.

Glabrous climber with stout, somewhat succulent stems. Leaves fleshy, linear-oblong with almost parallel sides, 10–22 × 2.7–5(–6)cm, apex acuminate, base cuneate, lateral nerves numerous, at right angles to thick midrib; petiole 1–2.5cm long, stout. Inflorescence and floral structure very similar to *H. linearis*. Flowers yellow-brown with cream centre, c 12mm broad, in many-flowered umbels. Peduncle 2.5–3.8cm, short and stout; pedicels 1.2–2.5cm, somewhat thickened, sometimes fleshy. Calyx lobes broadly ovate to ovate-oblong, rounded, 2.5–3mm, glabrous, margin ciliate. Corolla glabrous outside, minutely papillose-pubescent within, tube c 3mm long; lobes triangular-ovate, acute, c 4 × 4mm, spreading to deflexed, subcoriaceous. Staminal coronal scales short and thick, ovate, c 2 × 1mm, suberect. Follicles straight and slender, 6–10(–15) × 0.6–0.8cm, rather thick-walled. Seeds linear-lanceolate to lanceolate-ovate in outline, 4–5 × 0.7–1.5mm; coma 3–4cm.

**Bhutan:** C – Tongsa(?) district (Bulli Talli Ridge) and Mongar district (Latun La); **Darjeeling:** Mongpu, Rambh Chhu; **Sikkim:** Damthang to Temi (69), Dhobi Jhora, Gangtok, Tumlang. On tree trunks, 2500m. August.

### 8. *H. globulosa* Hook.f.

Stout woody climber or creeper, younger stems pubescent, becoming glabrous with age. Leaves fleshy, elliptic to oblong, 6–17 × 3–7.5cm, apex abruptly acuminate to cuspidate, base rounded to subcordate, surfaces subcoriaceous, glabrous above, pubescent below, particularly on stout midrib, veins arching (cf. straight veins of *H. fusca*); petiole 1.5–2cm long, thick, sparsely pubescent. Inflorescence and floral structure very similar to *H. linearis*. Flowers cream to pale yellow, fragrant, in many-flowered, dense, globose umbels. Peduncle 3–9cm long, persistent, becoming thick and woody with age; pedicels 2–2.5cm, slender, densely pubescent. Calyx lobes ovate-rounded, 2.5 × 2mm, pubescent. Corolla

glabrous outside, minutely papillose-puberulent to glabrous within, tube c 2mm long; lobes ovate-triangular, c  $5 \times 5$ mm, spreading. Staminal coronal scales short, ovate-elliptic,  $2 \times 1.5$ mm as seen from above, pink at base, spreading. Follicles very long and slender,  $18-30 \times 0.3$ cm, thin-skinned. Seeds linear-lanceolate,  $1-5 \times 1$ mm; coma c 3cm.

**Bhutan:** C – Tongsa district (Kyi La); **Darjeeling:** Chamarchi, Kalimpong, Kali Khola, Rangit, Ryang Chhu, Tista; **Sikkim:** Sirong, Rangit, Rangpo. Epiphytic on trees in subtropical mixed woodland, 550–1200m. March–May.

### 9. *H. parasitica* (Roxb.) Wight

Tall climbing, glabrous epiphytic shrub with thick stems. Leaves flat, ovate, oblong-elliptic to lanceolate,  $4-16(-19) \times 1.5-4(-5)$ cm, apex acute to acuminate, base cuneate, thick and fleshy, surfaces coriaceous, strongly 3-nerved from base to middle or above; petioles 8–18mm, short and very thick. Inflorescence and floral structure very similar to *H. linearis*. Peduncles persistent, 1.5–3.5cm long, becoming very thick with age; pedicels numerous, 1.5–2.3cm long, very slender. Flowers white, c 13mm broad. Calyx lobes ovate,  $1.5 \times 1$ mm, puberulent. Corolla glabrous outside, minutely papillose-puberulent within, tube short c 1.5mm; lobes broadly ovate-rhombic, acute,  $3.5-4.5 \times 3-4$ mm. Staminal coronal lobes longer than corolla tube and protruding out between corolla lobes, ovate-acute,  $3 \times 1.5$ mm, flat-topped with longitudinal ridge. Follicles long and slender,  $11-14 \times 0.5$ cm, glabrous, thin-skinned. Seeds oblong,  $4-5 \times 1$ mm; coma 2–2.5cm.

**Darjeeling:** Sivok. On trees in subtropical forests, 100–600m (80). July–November.

### 10. *H. bhutanica* Grierson & Long

Extensive slender-stemmed, glabrous creeper to 5m, similar to *H. parasitica*. Leaves elliptic to narrowly so,  $6-15 \times 2.7-4.5$ cm, apex acuminate, base cuneate, fleshy, subcoriaceous, 3-nerved at base; petiole 5–8mm long, thick. Peduncle 1–2cm long, stout; pedicels 2.5–3cm, slender. Calyx lobes narrowly triangular, c 3mm long. Flowers c 2cm broad, lobes white, centre purple. Corolla glabrous outside, densely papillose-puberulent within, tube 3mm long; lobes c  $4 \times 5$ mm. Staminal coronal scales like *H. parasitica*, c  $5 \times 2.5$ mm. Follicles unknown.

**Bhutan:** S – Gaylegphug district (Gaylegphug). In dense forests, 450m. March. Endemic to Bhutan; only known from the type specimen.

### 11. *H. arnottiana* Wight. Nep: *Dude Lahara* (Cowan specimen). Fig. 70a–d.

Glabrous, extensive climber or creeper with stout stems. Leaves large, very variable, ovate to elliptic or elliptic-lanceolate,  $8-11(-25) \times 4-8(-11)$ cm, apex acute to acuminate, base cuneate to rounded, very thick and fleshy, surfaces subcoriaceous, nerves distinctly pale in fresh material; petiole short and stout, 0.8–3cm. Inflorescence and floral structure very similar to *H. linearis*. Flowers cream to pale yellow-pink, slightly scented, 1.2–1.7cm broad, in many-flowered

umbels. Peduncle 1–7cm long, stout; pedicels 12–28mm, slender. Calyx lobes broadly ovate-rounded, 1.5–2 × 1.5–2mm, glabrous. Corolla glabrous outside, minutely papillose-puberulent within, particularly towards centre, tube 2–3mm long; lobes triangular-acute, 4–6 × 3–3.5mm, spreading or recurved. Staminal coronal scales large, longer than corolla tube, ovate with subacute tips, 3.5–4 × 2.5mm, horizontal, off-white becoming pink towards centre. Follicles unknown.

**Bhutan:** S – Samchi district (Samchi); **Darjeeling:** Great Rangit River, Mahanadi, Rayong N, Sivoke, Tista; **Sikkim:** Lingchom, Rangit. Epiphytic on trees and soil-covered rocks, in mixed woodlands of lower hills, 300–1200m. February–May.

### 12. *H. aff. carnosa* (L.f.) R. Brown.

Extensive climbing, twining epiphyte with stout, pendulous branches. Stems and leaves whitish puberulent, sap clear, not milky. Leaves narrowly elliptic to elliptic or narrowly obovate, 4.5–17 × 2.5–4.5cm, apex acute, base cuneate, fleshy and coriaceous, dark green above, paler below; petiole 0.5–2cm long, very thick. Inflorescence and floral structure very similar to *H. linearis*. Flowers pure white, strongly scented, 1.5–2cm broad, in many-flowered axillary umbels. Peduncles short and stout, c 7mm long, persistent; pedicels 3.5–4cm long, slender, sparsely pubescent to glabrous. Calyx lobes oblong-ovate, 3 × 2mm, glabrous to sparsely pubescent. Corolla glabrous outside, densely white papillose-pubescent within, tube c 4mm long; lobes truncate-triangular with strongly revolute margins, 6–7 × 5mm. Staminal column 4–5mm high; coronal scales glossy-white, rhomboid-acute 4 × 3mm, gradually sloping down from inner apex to outer tip. Fruits not seen.

**Bhutan:** C – Punakha district (Chuzomsa). Warm broad-leaved forests, 1410m. July.

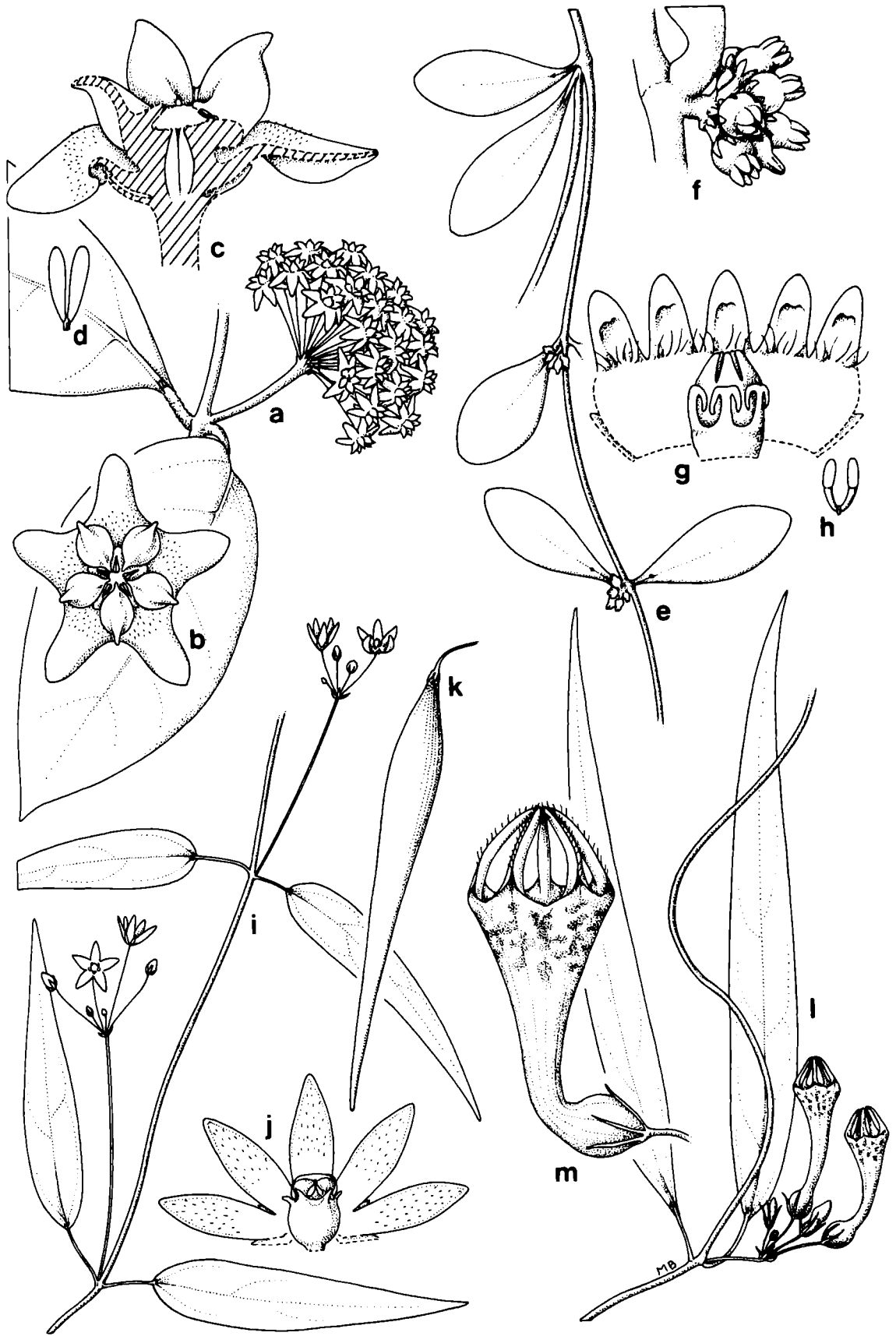
Only one collection known from Bhutan. This specimen appears to differ from the Chinese *H. carnosa* specimens in having much less pubescent pedicels and calyx lobes and much shorter peduncles.

### 13. *H. edenii* Hook.f.

Creeping and pendulous epiphyte; stems glabrous, rather slender and often rooting. Leaves ovate-lanceolate to elliptic- or obovate-lanceolate, 7–11 × 1.6–4cm, apex abruptly acuminate to caudate, base cuneate, glabrous to sparsely pubescent above, more so below and on main veins, thinly coriaceous; petiole 2–7mm, densely red-brown pubescent. Inflorescence a 5–10-flowered terminal umbel; peduncle short, 0.5–1cm; pedicels longer 2–2.5cm, both slender and

FIG. 70. **Asclepiadaceae.** a–d, *Hoya arnottiana*: a, flowering shoot (× ½); b, flower from above (× 2); c, half flower (× 3); d, pollinia (× 12). e–h, *Dischidia benghalensis*: e, flowering shoot (× ½); f, inflorescence (× 3); g, dissected flower (× 8); h, pollinia (× 16). i–k, *Tylophora tenerrima*: i, flowering shoot (× 1); j, dissected flower (× 4); k, fruit (× 1). l–m, *Ceropegia longifolia*: l, flowering shoot (× ⅓); m, flower (× 1½). Drawn by M. Bates.





glabrous. Flowers waxy-white to yellow, corolla strongly reflexed. Calyx lobes rounded, c  $2 \times 1.5$ mm, ciliate. Corolla glabrous outside, papillose-puberulent within, tube c 4mm long; lobes narrowly triangular acute,  $5-6 \times 3-4$ mm. Staminal column c 4mm high; coronal scales erect, angular-saccate, c  $2 \times 1.5$ mm from above, grooved on top, inner apical horn long and slender, overtopping anthers by c 2mm, inwardly hooked at apex, sometimes shortly 2-lobed. Follicles often borne singly, long and straight,  $8-11 \times 0.4$ cm, glabrous, striate. Seeds ovate, beaked,  $4-4.5 \times 3-3.4$ mm; coma 3-4cm.

**Darjeeling:** Baghora, Rimbi Chhu and unlocalised specimens; **Sikkim:** Chunthang. Epiphytic on trees in subtropical forests, 900-1800m. October-November.

#### 14. *H. acuminata* (Wight) Hook.f.

Stout-stemmed epiphyte with subscaudent to pendulous branches, sparsely pubescent around nodes. Leaves narrowly elliptic to elliptic-lanceolate,  $6-11 \times 1.5-3$ cm, apex acuminate, base cuneate, fleshy, subcoriaceous, glabrous or sparsely pubescent only on midrib; petiole 2-5mm, thick, sometimes sparsely pubescent above. Flowers large, white, in a 2-5-flowered, terminal or axillary umbel. Peduncle short, 1-2cm; pedicels long, 3.5-5cm, both slender and glabrous. Calyx lobes linear-oblong, c  $8 \times 2$ mm. Corolla strongly reflexed, glabrous outside, densely papillose-puberulent within, becoming glabrous towards lobe tips, tube c 6mm long; lobes long and narrowly triangular-acute,  $2-3 \times 0.5-0.8$ cm. Staminal column c 5mm high; coronal lobes laterally flattened with two wings curving towards each other and touching, appearing as one fleshy lobe, c  $3 \times 2$ mm, 5mm high; apical horn 1-2mm long, slender, incurved over anther ring. Follicles unknown.

**Bhutan:** C - Punakha district (Mara Chu); **Sikkim:** North district, Myang Chhu. Epiphytic on trees and mossy rocks in dense moist forests, 1600m. May-July.

Otherwise known from Khasia and Burma.

#### 20. *DITTOCERAS* Hook.f.

Stout, twining, climbing shrubs; stems, petioles and pedicels densely rusty-brown hirsute-pubescent, older stems corky. Leaves opposite, subcoriaceous to membranous, rusty-brown pubescent, particularly on main veins and below. Extrafloral nectaries present. Flowers large, in few-flowered, sessile, axillary umbels. Calyx small, densely rusty-brown pubescent. Corolla sparsely rusty-brown pubescent outside, glabrous within, tube widely campanulate to almost flat; lobes rotate, spreading; corolline coronal scales absent. Gynostegium small; staminal coronal scales small, lobes stellately spreading, horizontal to suberect. Anthers very small, subsessile, with minute apical membranous appendages incurved and covering stigmatic head; pollen in minute, subglobose erect waxy pollinia, one per anther locule, subsessile on corpusculum. Follicles tapered, cylindrical, strikingly recurved.

green when mature, outer layer thick and fleshy, inner layer hard and shiny. Seeds large, ovoid-oblong with a narrow wing; coma relatively short.

1. *D. andersoni* Hook.f. Lepcha: *Leem-rik* (34); Nep: *Dude-Lahara* (34).

Extensive climber. Leaves ovate to elliptic, 6–19 × 3.5–12cm, apex acute to abruptly acuminate, base broadly cordate to truncate or rounded; petiole 1.5–9cm. Flowers dark purple-red, yellow centred, c 3cm broad, in 4–5-flowered umbels. Calyx lobes ovate, obtuse, c 2.5 × 1.5mm. Corolla tube c 6mm long; lobes triangular to ovate-triangular, 7–14 × 7–8mm. Staminal coronal scales obovate to elliptic as seen from above, 2.5–3 × 1–1.5mm. Follicles 9–13 × c 1.5cm. Seeds 15–25 × 6–8mm; coma 2–3cm.

**Darjeeling:** Darjeeling, Ging, (Mandi Jhora)? Mandum Khola, Mongpu, Rambhi Chhu, Rishap, Takdah. Subtropical forests, 600–1500m. May–June.

## 21. WATTAKAKA Hasskarl

Stout, tall, twining shrubs; younger stems usually with pale pustules. Leaves opposite, subcoriaceous. Extrafloral nectaries present. Flowers yellow-green, in many-flowered umbellate axillary inflorescences. Peduncles and pedicels slender, puberulent. Corolla lobes glabrous or puberulent only outside, short, triangular, contorted, overlapping to the right in bud; tube short, widely campanulate; corolline coronal scales absent. Gynostegium small; staminal coronal lobes stellately spreading, fleshy, suberect, with a tooth at inner angle. Anthers small, subsessile, with apical membranous tips incurved, covering domed stigmatic head; pollen in minute, subglobose erect waxy pollinia, one per anther locule, with short translator arms. Follicles lanceolate-ovate in outline, thick and hard with a longitudinally striate, glabrous surface. Seeds truncate-ovate with a narrow marginal wing; coma long or short.

1. *W. volubilis* (L.f.) Stapf; *Dregea volubilis* (L.f.) Hook.

Extensive climber, often glabrous but sometimes parts puberulent. Leaves large, 9–17 × 6–13cm, ovate to suborbicular, apex acuminate, base cordate to truncate or rounded; petioles long and slender, 5–8cm. Flowers c 12mm broad; peduncle 2–6cm; pedicels 1.5–3cm. Calyx lobes 3–4 × 1.5–2mm. Corolla tube 3.5–4mm; lobes c 6 × 6mm. Staminal coronal lobes obovate-elliptic as seen from above, c 2 × 1.5mm. Follicles 8–11 × 2.5–3cm. Seeds 10–12 × 5–7mm; coma 1.5–7cm.

**Bhutan:** S – Samchi district (Khana Bharti Khola). Terai and subtropical forests, 450m. April–May.

## 22. DISCHIDIA R. Brown

Woody epiphytes with long slender freely-rooting branches, stems often densely matted or pendulous. Leaves opposite, rather distantly spaced, subsessile, extrafloral nectaries present. Flowers yellow or creamy white, very small, in

few-flowered axillary fascicles. Pedicels short, bases forming a scarred persistent peg visible on non-flowering material. Corolla glabrous, tube globose, constricted at throat; lobes minute, erect to slightly spreading, valvate; corolline coronal lobes absent. Gynostegium minute; staminal coronal lobes membranous, erect to spreading, bifid with recurved arms. Stamens subsessile, anthers minute with apical membranous tips incurved, covering stigmatic head; pollen in minute, pale, cylindrical erect waxy pollinia, one per anther locule, on flattened expanded translator arms, forked at tips, corpusculum golden brown. Follicles small, slender, tapered-cylindrical, thin-skinned. Seeds minute, linear-oblong; coma long.

**1. *D. benghalensis*** Colebrooke. Fig. 70e–h.

Extensive glabrous epiphyte; branches pendulous, up to 1m. Leaves very fleshy and coriaceous, very variable in shape from linear-elliptic to oblanceolate or obovate, 2.5–4.5 × 0.2–2cm, apex obtuse-apiculate to acute, base cuneate, pale green, veining obscure; petiole 3–7mm, stout. Pedicels c 1.5mm. Calyx lobes ovate, c 1 × 0.5mm. Corolla tube 2–3mm long; lobes ovate-triangular, 0.7–1 × 0.5mm. Gynostegium c 1mm high. Follicles 4–5.5 × 2–3mm. Seeds 2 × 0.5mm; coma c 2cm.

**Bhutan:** C – Tashigang district (Gamri Chu); **Darjeeling:** Mongpu, Rangit, Rang Chhu, Tista. On trees and rocks in subtropical forest and hot valleys, 300–1100m. June.

***D.?* wallichii** Wight

This plant (described from a sterile Singapore specimen) somewhat resembles *D. benghalensis* but its leaves are not so fleshy, less coriaceous, ovate-elliptic, apex acute; petiole and leaf surfaces pubescent. This plant has only been collected once in the area (Darjeeling: Budum Than) and is only known from a handful of specimens elsewhere (notably the Andaman Islands), all sterile. Only when flowering material becomes available can this plant be accurately assigned to a genus.

**23. HETEROSTEMMA** Wight & Arnott

Climbing, nearly glabrous, twining shrubs with slender branches. Leaves opposite, subcoriaceous, extrafloral nectaries present. Flowers rather small, in few-flowered, axillary umbellate cymes. Calyx very small. Corolla campanulate to widely so, glabrous outside, very minutely papillose-puberulent within, tube short, lobes rotate; corolline coronal scales absent. Gynostegium minute; anthers forming a central boss with incurved membranous apical appendages covering stigmatic head; staminal coronal scales ovate-lanceolate, horizontally stellately spreading, with lanceolate-acuminate appendage on upper surface likewise spreading. Anthers subsessile; pollen in minute, broadly flattened, erect waxy

pollinia, one per anther locule, with short translator arms. Follicles straight, tapered-cylindric, slender and thin-skinned. Seeds rather large, ovate with a thin marginal wing; coma long.

### 1. *H. alatum* Wight

Slender-branched twiner; stems with two lines of short hairs running along opposite sides. Leaves elliptic-ovate to widely so, 6–15 × 2.5–9cm, apex acuminate to acute, base cuneate to rounded, sparsely puberulent above on main veins and petiole, or glabrous, nerves distinctly winged below; petiole 2–5cm, slender. Flowers bright yellow with purple-red centre, in 3–6-flowered axillary umbels. Peduncle very short and thick, 2–5mm long; pedicels 1–2cm long, slender. Calyx lobes triangular, 0.7 × 0.5mm. Corolla tube 2–3mm; lobes narrowly triangular c 5 × 2mm. Anther column c 0.5mm high, c 1mm broad; coronal lobes c 1mm. Follicles 6–8 × 0.5mm. Seeds c 12 × 5mm; coma 3–4cm.

**Darjeeling:** Lebung, Rishap, Rimbi Chhu and unlocalised specimens; **Sikkim:** unlocalised specimens. Terai and subtropical forest of the lower and middle hills, 600–2000m. July–August.

## 24. TYLOPHORA R. Brown

Herbs or shrubs, many-stemmed at base, branches twining or trailing, rarely erect, with opposite leaves; extrafloral nectaries present. Flowers small, in racemose or umbellate cymose axillary inflorescences. Calyx lobes ovate or lanceolate. Corolla rotate, tube short, widely campanulate; lobes spreading; corolline coronal scales absent. Gynostegium minute; staminal coronal scales small, fleshy, usually globose, with or without a slender appendage. Anthers subsessile, with membranous apical appendage incurved around 5-lobed, flat stigmatic head; pollen in minute, globose, erect waxy pollinia, one per anther locule, with short translator arms. Follicles usually smooth, acuminate. Seeds ovate with thin marginal wing; coma long.

1. Small woody herb with stems to 50cm ..... 1. ***T. fasciculata***  
+ Larger twining or trailing shrub, stems longer ..... 2
2. Leaves orbicular to broadly ovate; petiole less than 5mm; fruit with thick wrinkled skin ..... 2. ***T. rotundifolia***  
+ Leaves ovate to lanceolate; petiole usually more than 5mm; fruit not as above ..... 3
3. Leaves, stems and inflorescence branches pubescent ..... 4  
+ Plant glabrous or minutely pubescent ..... 6
4. Flowers yellow to yellow-brown; usually 1–2 umbels per inflorescence; leaves usually more than 5cm long ..... 3. ***T. hirsuta***

- + Flowers dull or pale purple; inflorescence not as above; leaves usually less than 5cm long ..... 5
- 5. Leaves densely pubescent; corolla glabrous within; staminal coronal scales linear, spreading ..... **4. T. belostemma**
- + Leaves sparingly pubescent; corolla minutely hirsute within; staminal coronal scales globose ..... **5. T. exilis**
- 6. Inflorescence branches hairy; flowers dull purple; staminal coronal scales without appendages ..... **5. T. exilis**
- + Inflorescence branches glabrous or almost so; flowers deep red to purple; staminal coronal scales with appendages, sometimes appressed to column ..... 7
- 7. Calyx distinctly ciliate; inflorescence branches sparsely pubescent; coronal scale with out-curved appendage ..... **6. T. tenerrima**
- + Calyx almost glabrous; inflorescence branches glabrous; coronal scale with vertical appendage appressed to column ..... **7. T. himalaica**

**1. T. fasciculata** Wight

Small woody herb with several, little-branched, scrambling to trailing flexuose stems 20–50cm long, puberulent. Leaves variable, lower pairs ovate to ovate-lanceolate, becoming smaller and narrower towards the lanceolate apical pairs, 1.8–6 × 1.8–3.8cm, apex acute, base cuneate to subcordate, almost glabrous, puberulent only on main veins; petiole 0.2–1.5cm, puberulent. Inflorescence similar in structure to *T. hirsuta* but fewer flowered. Flowers brown, 0.4–1cm broad. Calyx lobes lanceolate, 2 × 0.7mm. Corolla glabrous, tube 1mm long; lobes ovate-oblong, acute, c 4 × 2mm. Gynostegium 2mm high, 1.5mm across stigmatic head. Staminal coronal scales saccate, narrow at apex, flaring out and almost bilobed towards base. Follicles ovate-lanceolate in outline, 3.8–5.5 × 1.2–1.6cm, thick-skinned, glabrous. Seeds not seen.

**Bhutan:** C – Punakha district (between Samtengang and Wangdu Phodrang). Dry forests?, 900–1800m. June–August.

**2. T. rotundifolia** Wight

Small shrub; stems pubescent, short and trailing, to longer and twining over shrubs. Leaves orbicular to broadly ovate, 2.5–5(–10) × 1.8–4.5(–9.5)cm, apex rounded to abruptly acute, base rounded to shallowly cordate, subcoriaceous; younger leaves pubescent all over; older leaves becoming glabrescent above; petiole very short, 2–5mm, pubescent. Inflorescence many-flowered, umbellate with a short peduncle or sparingly branched; peduncle 0.5–2cm; pedicels long and slender, 2.5–3cm, both pubescent. Flowers yellow to yellow-brown, c 1cm broad. Calyx lobes lanceolate, 3 × 1mm, pubescent. Corolla glabrous, tube c 1.5mm long; lobes ovate-acute, c 5 × 3mm. Gynostegium 1mm high and broad.

Staminal coronal scales small, half the height of anthers, globose, without appendage or with minute apical tooth. Follicles with thick, wrinkled skin, ovate-lanceolate in outline,  $4.5-6 \times 1.5-2$ cm. Seeds not seen.

**Bhutan:** C – Mongar district (Shongar Chu). On shrubs in open dry areas, roadsides etc., c 900m. July–August.

### 3. *T. hirsuta* (Wall.) Wight

Slender, stout-stemmed climbing shrub, densely softly pubescent throughout. Leaves ovate-elliptic to narrowly so,  $2.5-17 \times 1.2-9$ cm, apex acuminate to acute, base cuneate to rounded or truncate, membranous, pubescent on both surfaces; petiole 1–3.5cm. Inflorescences variable in structure from simple umbels to racemose cymes with flowers in umbellate clusters, usually 1–2 umbels per inflorescence. Inflorescence branches of varied lengths; peduncle 3–30mm long, slender; pedicels 3–12mm long, very slender. Flowers small, c 5mm broad, pale green to yellow. Calyx lobes lanceolate-acute,  $1.5 \times 0.5$ mm, pubescent. Corolla glabrous, tube 1.5mm long; lobes lanceolate-triangular, c  $2 \times 1.5$ mm. Gynostegium as in *T. rotundifolia*, 1–1.5mm broad and 1mm high. Follicles in horizontally spreading pairs, narrowly lanceolate in outline,  $5-7 \times 0.7-1$ cm. Seeds  $7-8 \times 2.5-3$ mm; coma 1.5–2.5cm.

**Darjeeling:** Pankhabari, Rangit, Sivoke. Terai, 300–800m. May–September.

### 4. *T. belostemma* Bentham

Slender climbing shrub with long, twining branches, densely softly-hirsute throughout. Leaves ovate to lanceolate,  $1.5-5(-8) \times 0.7-2.2$ cm, apex acuminate, base cordate to rounded, membranous; petiole 0.3–1cm. Flowers dull purple, small, c 8mm broad, in few-flowered, almost sessile umbels. Peduncle 2–5mm long; pedicels 3–5mm, both very slender. Calyx lobes narrowly lanceolate,  $2.5 \times 0.5$ mm. Corolla glabrous outside, minutely hirsute within, tube 1mm long; lobes ovate-acute,  $3 \times 1.5$ mm. Gynostegium 1.5mm high, 1mm across stigmatic head. Staminal coronal scales linear, c 1mm long, horizontally spreading on corolla. Follicles not seen.

**Darjeeling:** Mongpu, Rongsong, Silak, Tista. Climber on shrubs in subtropical areas, 300–900m. June–July.

### 5. *T. exilis* Colebrooke

Slender-stemmed shrub with twining or trailing branches; stems with two lines of fine hairs, more densely hairy above. Leaves ovate-oblong to lanceolate-ovate,  $4-11 \times 2-6$ cm, apex acuminate to acute, base cuneate to truncate, subcoriaceous, almost glabrous but often sparsely pubescent on main veins; petiole 0.7–2.5cm long, pubescent. Flowers small, c 5mm broad, pale purple, in many-flowered laxly-branched cymes. Inflorescence branches long and slender, becoming finer towards very slender pedicels, all parts finely villous; peduncles and inflorescence branches 0.5–3cm long; pedicels 2–7mm. Calyx lobes lanceolate-acuminate,  $1.5 \times 1$ mm, hispid. Corolla glabrous, tube c 1mm long; lobes

ovate-acute, c  $2 \times 1.2$ mm. Gynostegium as in *T. rotundifolia*, 1mm broad and high. Follicles lanceolate and long acuminate in outline,  $10\text{--}12 \times 0.8$ cm, thin skinned, glabrous or very sparsely pubescent at maturity. Seeds  $8\text{--}9 \times 4\text{--}5$ mm; coma 2.5–3.5cm.

**Darjeeling:** Tarkhola, Rummai; **Sikkim:** Tista. Climbing on shrubs in subtropical areas, 450–1800m. August–October.

**6. *T. tenerrima* Wight.** Fig. 70i–k.

Very slender-stemmed, free-flowering, climbing shrub with long twining branches. Plant nearly glabrous; stems with two lines of short hairs. Leaves lanceolate to lanceolate-ovate,  $1.5\text{--}8 \times 0.3\text{--}2$ cm, apex acuminate, base rounded to cuneate, membranous, sparsely pubescent above, particularly on main veins, almost glabrous below; petiole 4–11mm, pubescent. Flowers deep red to crimson, in 2–6-flowered, lax, long- and very slender-branched cymes. Peduncle 2–5cm long; pedicels 0.5–4cm, both sparsely puberulent. Calyx lobes lanceolate-ovate, c  $1.5 \times 0.5$ mm, ciliate. Corolla glabrous outside, minutely hirsute within, tube c 1mm long; lobes linear-oblong, c  $3 \times 2$ mm. Gynostegium c 2mm broad and high. Staminal coronal scales with short, out-curved apical linear appendages. Follicles slender, narrowly lanceolate in outline,  $4\text{--}7.5 \times 0.5\text{--}0.8$ cm, thin-skinned, only seen solitary. Seeds small,  $5 \times 2$ mm; coma c 3cm.

**Bhutan:** C – Punakha district (Lobeysa to Tinlegang, Punakha, Punakha to Bhotokha, Wangdu Phodrang); **Sikkim:** Chunthang, Lachen and unlocalised specimens; **Chumbi:** Peezingbow. Climber on shrubs in moist, broad-leaved forests, 1200–2100m. May–July.

**7. *T. himalaica* Hook.f.**

Very similar to *T. tenerrima* but differing mainly in the completely glabrous inflorescence branches, almost glabrous sepals, and staminal coronal scale structure; inflorescences many-flowered, laxly branched; coronal scales with apical tooth running vertically up the anther backs, to below apex; follicles lanceolate-acuminate,  $11\text{--}12 \times 0.8$ cm, glabrous, thin-skinned; seeds  $10 \times 3$ mm; coma 2.5–3cm.

**Darjeeling:** Kurseong. Climber on shrubs in subtropical areas, 900m. June. A poorly known species, apparently only known from three specimens.

## 25. CEROPEGIA L.

Twining, rarely erect herbs, with tuberous or fibrous rootstock. Leaves opposite, membranous in Bhutanese species, extrafloral nectaries present. Inflorescences peduncled umbelliform cymes in upper leaf axils, sometimes solitary. Flowers yellow, greenish or purple, often highly sculptured. Calyx lobes linear to linear-lanceolate. Corolla tube long, straight or curved, usually inflated at base, and dilated at throat; lobes very variable, broad or narrow, often incurved and connate at apex, forming a crown over mouth of corolla tube:



corolline coronal scales absent. Gynostegium complex; staminal scales of one or two rows, usually fused, forming a ring around stamens; outer row entire or minutely lobed, pubescent, lobes of inner row linear and erect. Anthers sessile, mostly without appendages; pollen in globose, erect, waxy pollinia with pellucid margins, one per anther locule, sessile on corpusculum. Stigmatic head depressed or shortly bifid, included. Follicles usually in horizontally divaricate pairs, slender, cylindric, smooth. Seeds ovate-oblong with long coma.

1. Corolla tube subcylindric, barely or not dilated at throat ..... 2  
+ Corolla tube conspicuously inflated at throat, and usually inflated below ..... 3
2. Corolla lobes more than 1.5cm long, linear, forming a slender, tapering, pointed crown; petiole more than 1cm long ..... 1. **C. pubescens**  
+ Corolla lobes less than 1cm long, linear-lanceolate to ovate, forming a short blunt crown; petiole less than 1cm long ..... 2. **C. hookeri**
3. Corolla tube conspicuously inflated, barrel shaped, c 1.5cm wide ..... 3. **C. dorjei**  
+ Corolla tube narrowed in middle, or subcylindric ..... 4
4. Inflorescences 1–4-flowered; flowers usually less than 2.5cm long; corolla tube subcylindric ..... 4. **C. bhutanica**  
+ Inflorescences more than 4-flowered; flowers large, usually more than 2.5cm long; corolla variously constricted and inflated, not subcylindric ..... 5
5. Corolla lobes long and slender, usually about as long as tube; tube somewhat pilose outside ..... 5. **C. macrantha**  
+ Corolla lobes shorter, shorter than tube; tube glabrous outside ..... 6
6. Corolla tube almost straight, inflated at base for about half its length; mouth dilation as wide as basal inflation ..... 6. **C. ugenii**  
+ Corolla tube curved, inflated at base for about a quarter of its length; mouth wider than basal inflation ..... 7
7. Corolla tube less than 4cm long; lower leaves linear to ovate-lanceolate ..... 7. **C. longifolia**  
+ Corolla tube more than 4.5cm long; lower leaves ovate-orbicular ..... 8. **C. ludlowii**

### 1. **C. pubescens** Wall.

Slender, branched, vigorous climber; stems to 4m long, sparsely pubescent to almost glabrous. Leaves ovate to narrowly so, 7–12 × 2–5cm, apex acuminate, base cordate to rounded, sparsely hispid to glabrous on both sides; petiole

1–4cm long, sparsely pubescent. Flowers large, 4–6.5cm long, in 4–8-flowered inflorescences; peduncles 2–5cm long, pubescent to glabrous; pedicels 0.7–1.8cm, glabrous. Calyx lobes 4mm long, recurved. Corolla long and slender with long slender lobes connate at tips, forming an elongate crown, very variable in colour but tube usually wine-red with paler streaks; lobes with pale yellow bases shading to brown tips; tube subcylindric, 2–3.2cm long, base and throat usually hardly (sometimes base slightly) dilated, pilose at middle within or glabrous; lobes linear with ovate bases, 1.5–3cm long, connate from above middle in newly opened flowers, becoming more free with age. Fruit 18 × 0.2cm. Seeds 10 × 1mm; coma 2–3cm.

**Bhutan:** C – Punakha district (Naki to Hinglai La, Wangdi Phodrang); **Darjeeling:** Balasun Valley, Darjeeling, Kodabari, Kurseong, Mongpu, Pankhabari; **Sikkim:** Lachen, Singtam, Takchom Chhu, Yoksum. Climber over shrubs in dense wet forests, 600–2400m. July–September.

## 2. *C. hookeri* Hook.f. var. *hookeri*

Thick-rooted climber from a tuberous base; stems stiff and erect at first (to c 20cm) then twining above, base puberulent, glabrous above except for a line of fine hairs. Leaves membranous, lanceolate to lanceolate-ovate, 3–6 × 1–3cm, apex acuminate, base cuneate to rounded or subcordate, puberulent above, densely so on margins, puberulent below only on main veins; petiole short and slender, 2–8mm, puberulent. Flowers very similar to *C. pubescens* but much smaller, 1.5–2cm long, whitish-green to dark purple, in 1–7-flowered inflorescences; peduncles short, 2–9mm, puberulous; pedicels 2–7mm, glabrous. Calyx lobes 2.5–3mm long. Corolla tube straight with slightly swollen base, 1–1.3cm long; lobes short, ovate to ovate-lanceolate, 5–7mm long, forming short ellipsoid crowns (to open conical crowns in older flowers). Fruit unknown.

**Sikkim:** Lachen; **Chumbi:** Chumbi. Forests and open grassy areas, 2400–3400m. July–August.

Flowers sometimes difficult to distinguish from those of *C. pubescens*.

## 3. *C. dorjei* Fischer

Slender twiner to 1.5m; stem glabrous or nearly so. Leaves elliptic to broadly ovate, 2–5.5 × 1.2–3.5cm, apex acute to abruptly acuminate, base rounded to truncate, sparsely minutely hispid above, sparingly so below on main veins; petiole 0.4–2cm long, shortly hispid. Flowers large and distinctively shaped, in 1–4-flowered umbels; peduncles 1–1.5cm long, stout, with a line of puberulence; pedicels to 1.5cm, glabrous. Corolla tube greatly inflated, barrel-shaped, 2–2.5cm long and c 1.5cm wide at middle, pale yellow, abruptly narrowed and cylindric at mouth for 3–5mm, glabrous; lobes linear-lanceolate, 1–1.5cm long, connate at tips, forming a narrow, blunt, conical crown; lobes and mouth dull purple-red, suffused green at crown apex. Fruit unknown.

**Bhutan:** C – Tongsa district (Tongsa Dzong and between Tongsa and Tsanka). On rocks and shrubs? in hot valleys, 2100–2300m. June–August.

Only known from these two Bhutanese localities.

#### 4. *C. bhutanica* Hara

Slender twiner, with stems sparsely puberulous in two lines. Leaves membranous, ovate to oblong-ovate, 4–9 × 1.1–3.7cm, apex acuminate, base cuneate to rounded, sparsely shortly hispid above and on the main veins below; petiole 3–11mm long, shortly hispid. Flowers rather small, 1.8–2.6cm long, in 1–4-flowered inflorescences; peduncle short, c 5mm, with a line of puberulence; pedicels 4–9mm, sparsely pilose. Calyx lobes 4–6mm long, glabrous, recurved. Corolla tube 12–18mm long, swollen in lower part to c 6mm wide, and slightly dilated at mouth, pale green below, dark purple spotted above, glabrous; lobes c 8mm long, dark purple, linear with widely auriculate bases, connate at apices, forming a domed crown, margins and within conspicuously purple hairy. Fruit unknown.

**Bhutan:** C – Thimphu district (Nimchling) and Punakha district (Ritang). Damp stony ground on river bank.

Only known from these two Bhutanese localities.

#### 5. *C. macrantha* Wight

Extensive climber; stems sparsely to densely puberulous, particularly around nodes. Leaves ovate to ovate-lanceolate, 4–20 × 1.8–8cm, apex acuminate, base cuneate to subcordate, sparsely minutely hispid above, glabrous or almost so below; petiole 0.4–3.5cm, shortly hispid above. Flowers large, 3–6cm long, slightly curved, in many-flowered simple or shortly-branched, umbellate inflorescences. Peduncle short, 1–3cm, hispid; pedicels 1–1.5cm, glabrous to sparsely puberulous. Calyx lobes c 6mm long, recurved, puberulous. Corolla tube black-purple within, pilose outside (particularly on young unopened flowers) and within, inflated below for 5–8mm, then abruptly narrowed for 8–21mm before dilating at mouth into an elongated conical crown; lobes 12–30mm long, dull green at base, mottled purple above, with dense brown-black tips, purple ciliate. Follicles c 11 × 0.3cm. Seeds linear-oblong, c 8 × 1mm; coma 2cm.

**Bhutan:** C – Tongsa district (between Tongsa and Tashiling); **Sikkim:** Lat; **Darjeeling:** Badamtam, Darjeeling, Manjhitar Bridge, Pankhabari, Rayeng RS, Sonada, Tista. Climber over shrubs in subtropical forests, 300–2300m. June–September.

#### 6. *C. ugenii* Fischer

Slender twiner, stems sparsely puberulous, particularly around nodes. Leaves elliptic to ovate, (3–)7–11.5 × (1.3–)3.8–5.5cm, apex acuminate, base cuneate, sparsely minutely hispid above, almost glabrous below; petiole 7–17mm, hispid. Peduncles short, 6–10mm long, shortly pubescent on one side, bearing 8–12 or more flowers on slender, glabrous pedicels 1–2cm. Calyx lobes 6–8mm long, glabrous, often partly recurved. Corolla colour not recorded, probably white or pale green with purple spots and reticulations darkening towards purple lobes;

tube 20–25mm long, almost straight, basal inflated region just over half length of tube, constricted for only 2–3mm, dilating to mouth, tube glabrous outside, pilose within, only in a ring above inflated region; lobes linear, 8–9mm long, auriculate at base, abruptly connate, forming an erect, narrow beak. Follicles unknown.

**Bhutan:** C – Punakha district (Ritang to Tasarza La). Habitat unrecorded, 2500–2800m. July.

Endemic to Bhutan, only known from the type collection.

**7. *C. longifolia* Wall. subsp. *longifolia*; *C. angustifolia* Wight. Fig. 70l&m.**

Slender climbing herb with leafy twining stems and fascicled roots, sparsely pubescent in 1 or two lines on stem and around nodes. Leaves linear to lanceolate, rarely ovate-lanceolate, (5–)7–16 × 0.7–3.5cm, apex acuminate, base rounded or cuneate, sparsely minutely hispid above, glabrous below; petiole 0.5–2cm, sparsely hispid. Flowers 2.3–4cm long, curved, green spotted with dark purple, in 5–10-flowered umbellate cymes. Peduncle 0.5–3.5cm, sparsely shortly hispid; pedicels 5–16mm long, glabrous or sometimes shortly hispid. Calyx lobes 4–8mm long, glabrous, sometimes partly recurved. Corolla tube 1.5–2.8cm long, inflated at base and dilated at mouth, sometimes greatly so, glabrous outside, with a ring of villous hairs inside around top of basal inflated region and throat; lobes broadly ovate to triangular, 4–10 × 3–8mm, connate at apices forming a hemispherical to conical crown, ciliate within and on margins with purple hairs. Follicles very slender, cylindrical, 12–15 × 0.7cm. Seeds c 9 × 1.5mm; coma 3–4cm.

**Bhutan:** C – Punakha district (Chusom, Rinchu) and Tongsa district (Chendebi), N – Upper Mo Chu district (Tamji); **Darjeeling:** Takvar. Amongst shrubs in temperate and warmer areas, 1200–2300m. May–August.

This species is very variable in leaf and flower shape, and hairiness. Most of the specimens have glabrous pedicels, but in a few more hirsute specimens they are hairy. Sometimes these and other variants have been equated with Wight's *C. angustifolia* but here a broad species concept is considered appropriate.

**8. *C. ludlowii* Huber**

Slender-stemmed, twining herb with rather large ovate-orbicular lower leaves; stems shortly pubescent in 2 broad lines. Leaves broadly ovate-orbicular below, c 13 × 13cm, apex obtuse, base truncate, becoming considerably smaller, 3–7 × 1–3.5cm, and more ovate-acuminate towards ends of branches, base cuneate, all leaves sparsely minutely hispid above, glabrous below; petiole 1.2–7cm long, sparsely hairy. Inflorescence and floral structure similar to *C. longifolia*. Flowers large, 4.5–6cm long, curved, dull purple with white spaces in between reticulations, in c 10-flowered inflorescences. Peduncle 1–5cm long, with a row of short hispid hairs; pedicels 1–2cm, slender, glabrous. Calyx lobes 5–8mm long, glabrous. Corolla tube 3.5–5cm long, glabrous outside, white pilose within, becoming glabrous towards basal inflated region; lobes oblong, 12–15 × 4mm, pilose on

inside margins and at tips with purple hairs. Follicles unknown.

**Bhutan:** N – Upper Kuru Chu district (Denchung). Habitat unrecorded, 2100m. August.

Endemic to Bhutan, only known from the type collection.

### Family 164. RUBIACEAE

by L.S. Springate

with contributions from R.R. Mill, J.R.I. Wood, J. Wright & D.G. Long

Trees, shrubs or herbs. Leaves opposite and decussate or whorled, usually entire, domatia sometimes present beneath in axils of primary veins; stipules interpetiolar, rarely leaf-like. Inflorescence axillary or terminal, usually cymose, sometimes forming diffuse panicles, capitate, fasciculate or flowers solitary. Flowers actinomorphic (rarely weakly zygomorphic), bisexual (rarely polygamous), sometimes dimorphic, 4–5(–6)-merous. Calyx united at base with ovary into a hypanthium, usually with tubular portion above ovary (the 'calyx tube' of the following descriptions except where stated to include the hypanthium), usually regularly 4–5(–6)-lobed above, sometimes lobes reduced to denticles, absent, irregular, one enlarged and showy or supernumerary lobes or denticles present. Corolla (in E Himalayan species) infundibular, hypocrateriform, campanulate or rarely rotate, 4–5(–6)-lobed; tube rarely curved. Stamens 4–5(–6), alternating with corolla lobes and inserted on tube; anthers dehiscent by slits or pores. Ovary inferior, 2(–5)-celled with septal placentation, rarely 1-celled with parietal placentation, usually crowned with a large nectariferous disc; ovules 2–many; style 1, terminal, with capitate or 2(–5)-lobed stigma or with fusiform or mitriform stigmatic head; rarely styles 2, with simple capitate or cylindrical stigmas. Fruit a capsule, berry or drupe, sometimes schizocarpic.

*Carlemannia* is now placed in its own family Carlemanniaceae, to appear in Volume 2 Part 3 of this *Flora*.

- |  |                   |
|--|-------------------|
| 1. Plants herbaceous or suffrutescent .....                                | 2                 |
| + Plants entirely woody .....  | 27                |
| 2. Leaves in whorls of 4–8; calyx lobes absent .....                       | 3                 |
| + Leaves opposite or, if whorled, then calyx lobes present .....           | 4                 |
| 3. Flowers usually 5-merous; fruit fleshy, smooth .....                    | <b>54. Rubia</b>  |
| + Flowers usually 4-merous; fruit dry, smooth, warted or with hooked hairs | <b>55. Galium</b> |
| 4. Ovules solitary; locules 2, rarely 5 .....                              | 5                 |
| + Ovules 2–many in each locule; locules 2, rarely 3 or 4 .....             | 14                |

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- 5. Plants herbaceous ..... 6
- + Plants woody at base ..... 10
  
- 6. Cymes capitate, sessile; stipules with setose segments ..... 7
- + Cymes more open (axes obvious); stipules various ..... 8
  
- 7. Fruit circumscissile; seeds with X-shaped furrow on ventral face  
**52. Mitracarpus**
- + Fruit loculicidal then septicidal; seeds with longitudinal groove on ventral face ..... **51. Spermacece**
  
- 8. Stipules lanceolate; fruit a capsule, glabrous except for cilia on the calyx lobes ..... **17. Neanotis**
- + Stipules leaf-like, setaceous or fimbriate; fruit of 2 mericarps covered in hooked hairs ..... 9
  
- 9. Stipules fimbriate, never leaf-like; corolla infundibular ..... **53. Kelloggia**
- + Upper stipules leaf-like, lower stipules setaceous; corolla rotate **54. Galium**
  
- 10. Ovary 5-locular ..... **49. Spermadictyon**
- + Ovary 2-locular ..... 11
  
- 11. Climbers; fruit of flattened or hemispheric pyrenes shed separately  
**48. Paederia**
- + Free-standing plants; fruit fleshy or detaching intact from carpophore . 12
  
- 12. Fruit dry, soon detaching intact from carpophore ..... **34. Knoxia**
- + Fruit fleshy, persistent ..... 13
  
- 13. Corolla tube to 3mm, not curved ..... **44. Psychotria**
- + Corolla tube 10–18mm, curved ..... **45. Chassalia**
  
- 14. Undershrubs; fruit a fleshy or coriaceous berry ..... 15
- + Herbaceous plants, or if woody, then fruit a capsule ..... 16
  
- 15. Some flowers with 1 calyx lobe much enlarged, showy, white  
**22. Mussaenda**
- + Flowers without enlarged, showy calyx lobes ..... 56
  
- 16. Corolla rotate, lobes 4–10mm ..... **14. Argostemma**
- + Corolla campanulate to infundibular or hypocrateriform, lobes 0.3–5mm  
17
  
- 17. Flowers 5-merous ..... 18
- + Flowers 4-merous ..... 22

18. Fruit obcordate, didymous, lobes strongly divergent ..... **21. Ophiorrhiza**  
+ Fruit oblong, ovoid to obovoid or hemispheric, unlobed or the lobes scarcely divergent ..... 19
19. Spike-like inflorescence with alternate compact sessile cymes and long naked peduncle ..... **20. Polyura**  
+ Inflorescence not spike-like ..... 20
20. Procumbent pellucid annuals; flowers axillary, solitary ..... **13. Dentella**  
+ Non-pellucid, sometimes erect or perennial; at least some flowers clustered, sometimes terminal ..... 21
21. Cymes capitate, sessile ..... **17. Neanotis**  
+ Cymes with elongate peduncle and branches ..... **19. Spiradiclis**
22. Annual ..... 23  
+ Perennial ..... 26
23. Leaves linear or linear-lanceolate; flowers 1–5 at each node; hypanthium glabrous ..... **16. Oldenlandia**  
+ Leaves ovate or ovate-lanceolate, or, if narrower, then flowers more than 5 at each node or hypanthium hirsute ..... 24
24. Stipules truncate, entire ..... **18. Kohautia**  
+ Stipule margin fimbriate, awned, setose or lobed ..... 25
25. Flowers in leafless axillary cymes or, if otherwise, then peduncles two or more in some leaf axils or corolla tube equalling lobes ..... **15. Hedyotis**  
+ Inflorescence leafy, terminal; peduncles solitary in leaf axils; corolla tube more than twice length of lobes ..... **17. Neanotis**
26. Plants woody at base or, if herbaceous, then calyx lobes exceeding 2mm in fruit; seeds many ..... **15. Hedyotis**  
+ Plant herbaceous, with calyx lobes less than 2mm in fruit, or seeds 8 or fewer ..... **17. Neanotis**
27. Climbers with stout axillary hooks ..... **6. Uncaria**  
+ Plants free-standing or scrambling, without axillary hooks ..... 28
28. Inflorescence of dense capitate heads, each of more than 30 (sub-)sessile flowers ..... 29  
+ Flower-heads more open or, if dense, then flowers fewer or pedicellate 35
29. Flowers 4-merous ..... **1. Cephalanthus**

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- + Flowers 5(-6)-merous ..... 30
- 30. Corolla tube 15–31mm; stigma bifid ..... **42. Morinda**
- + Corolla tube 4–10mm; stigma not divided ..... 31
- 31. Stigma length less than 2 × width ..... 32
- + Stigma length more than 2 × width ..... 34
- 32. Leaf base cordate ..... **4. Haldina**
- + Leaf base acute ..... 33
- 33. Upper part of calyx lobes clavate, deciduous ..... **3. Neonauclea**
- + Entire calyx lobes transversely oblong, persistent ..... **5. Khasiacunea**
- 34. Stigma fusiform, base tapered ..... **2. Neolamarckia**
- + Stigma cylindrical, base concave ..... **7. Mitragnya**
- 35. Inflorescence with some pale showy leaf-like bracts or calyx lobes ..... 36
- + Inflorescence without showy leaf-like organs ..... 38
- 36. Corolla tube 1.5–3mm; flowers in narrow spike-like heads  
**10. Hymenodictyon**
- + Corolla tube 13–32mm; flowers in corymbose heads ..... 37
- 37. Showy organs bracts; corolla white ..... **9. Neohymenopgon**
- + Showy organs calyx lobes; corolla lobes orange ..... **22. Mussaenda**
- 38. Ovary 1–2-locular ..... 39
- + Ovary 5-locular ..... 65
- 39. Ovules solitary in each locule ..... 40
- + Ovules 2–many in each locule or ovary abortive with all flowers functionally male ..... 50
- 40. Corolla lobes valvate in bud (sometimes with broad infolded margin) . 41
- + Corolla lobes twisted in bud ..... 47
- 41. Plant climbing; fruit eventually dry, disintegrating ..... **48. Paederia**
- + Plant free-standing; fruit fleshy, indehiscent ..... 42
- 42. Corolla tube 10–25mm ..... 43
- + Corolla tube 0.5–6mm ..... 44
- 43. Corolla tube 24mm, lobes 17–18mm ..... **43. Prismaomeris**



- + Corolla tube 10–18mm, lobes 2.5–3mm ..... **45. Chassalia**
- 44. Style 2–3-fid ..... 45
- + Style globose or mitriform ..... 46
- 45. Corolla tube 0.5–2.5mm ..... **44. Psychotria**
- + Corolla tube 5mm ..... **47. Saprosmia**
- 46. Corolla tube 4–5.5mm; stamens recurved ..... **35. Psydrax**
- + Corolla tube 3mm; stamens erect ..... **36. Canthium**
- 47. Flowers in large panicles or corymbs ..... 48
- + Flowers in compact cymes of less than 20 ..... 49
- 48. Stipular bracts at base of inflorescence free; style briefly exerted; stigma prominently 2-lobed ..... **38. Ixora**
- + Stipular bracts at base of inflorescence connate; style long-exserted; stigma apparently simple ..... **39. Pavetta**
- 49. Flowers 4-merous; corolla tube 5.5–6mm ..... **40. Nostalachma**
- + Flowers 5-merous; corolla tube 19–27mm ..... **41. Psilanthus**
- 50. Fruit a capsule; locules 2 ..... 51
- + Fruit a berry, a drupe or abortive in functionally male plants and cultivated ornamentals; locules 1 or 2 ..... 54
- 51. Seeds winged ..... 52
- + Seeds not winged ..... 53
- 52. Inflorescence paniculate; corolla tube 5–15mm ..... **8. Cinchona**
- + Inflorescence corymbose; corolla tube 20–60mm ..... **11. Luculia**
- 53. Plant free-standing; corolla lobes twisted in bud ..... **12. Wendlandia**
- + Climber; corolla lobes valvate in bud ..... **15. Hedyotis**
- 54. Stigma bifid ..... 55
- + Stigmatic head fusiform ..... 57
- 55. Inflorescences few-flowered, in most leaf axils of previous year's growth  
**33. Hyptianthera**
- + Inflorescences few, many-flowered, either mostly terminal or all leaf-opposed  
48
- 56. Inflorescence open; corolla exceeding calyx ..... **23. Mycetia**

- + Inflorescence compact; calyx exceeding corolla ..... **24. Myrioneuron**
- 57. Plant spinous ..... 58
- + Plants entirely unarmed ..... 62
- 58. Corolla lobes more than 10mm wide ..... **27. Tamilnadia**
- + Corolla lobes less than 10mm wide ..... 59
- 59. Corolla tube less than 7mm ..... **28. Catunaregam**
- + Corolla tube more than 7mm ..... 60
- 60. Corolla tube 17–25mm ..... **26. Fagerlindia**
- + Corolla tube 8–10mm ..... 61
- 61. All flowers perfect, ovary bilocular ..... **25. Himalrandia**
- + Flowers polygamous; male flowers (style present, ovary abortive) up to 20 together; perfect flowers solitary, ovary unilocular ..... **32. Ceriscoides**
- 62. Corolla pubescent outside ..... **30. 'Randia'**
- + Corolla glabrous outside ..... 63
- 63. Flowers in large cymes ..... **29. Tarrenoidea**
- + Flowers solitary ..... 64
- 64. Plants deciduous; corolla tube 8–10mm ..... **25. Himalrandia**
- + Plants evergreen; corolla tube c 35mm ..... **31. Gardenia**
- 65. Plants spinous; fruit fleshy, more than 17mm across ..... **37. Meyna**
- + Plants unarmed; fruit fleshy or dry, less than 17mm across ..... 66
- 66. Bracts and bracteoles similar, linear, free (sometimes minute) ..... **46. Lasianthus**
- + Bracts leaf-like or ligulate, herbaceous; bracteoles scarious, connate in pairs at base of each flower ..... **50. Leptodermis**

**1. CEPHALANTHUS L.**

by L.S. Springate

Shrubs to large trees. Leaves opposite or in whorls of 3 or 4, simple, entire, petiolate. Stipules often terminating in a black gland. Flowers sessile in capitate heads on simple axillary peduncles; peduncles grouped in open, leafy, inflorescences terminating lateral shoots; bracteoles interfloral, narrowly spatulate. Flowers 4-merous. Calyx tube exceeding lobes. Corolla infundibular.

Anthers subsessile at corolla throat, dorsifixed, partially exerted. Ovary 2-locular; ovules solitary; style filiform, long-exserted; stigma fusiform. Fruits free, dry, indehiscent, eventually separating into 1-seeded cocci; seeds with a large fleshy aril.

1. *C. tetrandra* (Roxb.) Ridsdale & Bakhuizen f.; *C. naucleoides* DC., *C. occidentalis* auct. non L. Nep: *Kalikath* (34).

Small tree to 9m. Leaves ovate, 10–18 × 4–8.5cm, acuminate, truncate at base, entire, ciliolate, glabrescent. Stipules broadly ovate, c 2.5mm, acuminate. Inflorescence of c 6–8 heads, peduncles 25–55mm. Flower-heads 15–25mm diameter; bracteoles slender, clavate-spathulate, c 2.2mm, pubescent towards apex; flowers white or yellowish. Calyx pubescent, tube c 1mm, lobes semicircular, c 0.3mm, thickened on back below apex. Corolla tube 5–8mm, glabrous outside; lobes ovate, c 1.3mm with black gland in each sinus. Style 4–6mm exerted.

**Darjeeling:** unlocalised. Lower hill forest (34), 600m. March–May (34).

Only one specimen seen from E Himalaya; the species is usually conspicuously pubescent.

## 2. NEOLAMARCKIA Bosser

by L.S. Springate & J. Wright

Medium to large trees, branches spreading horizontally in tiers. Leaves opposite, entire, petiolate. Stipules lanceolate, entire, caducous. Flower-heads terminal, solitary, capitate. Peduncles with 1–3 nodes and basal bracts. Flowers 5-merous, subsessile, interfloral bracteoles absent. Calyx infundibular, lobes linear-spathulate or narrowly elliptic, grey-pubescent outside, persistent or deciduous. Corolla narrowly infundibular. Stamens inserted above middle of tube; filaments glabrous; anthers basifixed, usually protruding from corolla throat. Ovary 2-locular at base, 2–4-locular above, ovules numerous; style long-exserted; stigma fusiform or oblong. Infructescence globular, fruits numerous, adherent, ± fleshy, indehiscent. Seeds small, not winged.

1. *N. cadamba* (Roxb.) Bosser; *Anthocephalus cadamba* (Roxb.) Miquel, *Anthocephalus chinensis* auct. non (Lamarck) Walpers. Nep: *Kadam* (34).

Evergreen tree to 60m. Leaves ovate to oblong-elliptic, 15–25 × 8–16cm, apex bluntly acuminate, base rounded or cuneate, coriaceous, shiny and glabrous above, finely pilose below at least on veins, veins raised above and below, lateral pairs (9–)10–12; petioles to 3cm. Stipules c 12–20mm, glabrous. Peduncles stout, 3–4cm. Flower-heads c 3.5cm diameter, scented at night. Calyx c 3mm. Corolla orange, tube c 9mm, lobes 2–2.5mm, pubescent below the tips. Ovary 4-locular above with 4 cartilaginous structures; stigma white. Infructescence 3–4cm across.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Deothang district (Samdrup Jongkhar); **Darjeeling:** Tista valley and unlocalised collections; **Sikkim:** Raniphul Bridge (probably cultivated); **West Bengal Duars:** Jalpaiguri. Tropical evergreen forest, 100–1000m. May–August.

Planted in southern Bhutan for timber and sometimes planted as an ornamental tree. Fruit edible (48).

### 3. NEONAUCLEA Merrill

by L.S. Springate & J. Wright

Trees or shrubs. Leaves opposite, entire. Stipules elliptic to obovate, rarely linear-oblong, pairs usually flattened and appressed at shoot apex, rarely coherent, caducous or semi-persistent. Flower-heads 1–3(–7), axillary and terminal, pedunculate, with modified stipules forming a caducous involucre. Flowers 5(–6)-merous, subsessile, with or without interfloral bracteoles and hairs. Calyx tube short; lobes abruptly contracted above base into a narrowly clavate, deciduous apical portion. Corolla hypocrateriform to narrowly infundibular. Stamens inserted above middle of tube; filaments short; anthers basifixed. Ovary 2-locular, ovules numerous; style exerted, upper part and stigma grooved; stigma globose to obovoid. Fruits free, dry, dehiscent. Seeds ellipsoid, more or less bilaterally compressed, shortly winged at both ends.

1. *N. griffithii* (Hook.f.) Merrill; *Adina griffithii* Hook.f. Nep: *Pahenle* (34).

Tree to 10m or larger, often buttressed, sometimes with aerial roots, bark greenish-grey, vertically fissured and cracked, sometimes warty. Leaves obovate to elliptic-orbicular, 10–20 × 5–13cm, apex shortly acuminate, base acute to cuneate, often attenuate, chartaceous to subcoriaceous, glabrous, veins raised below, lateral pairs 5–9; petioles 0–2cm. Stipules obovate to ovate-oblong, 5–10 × 3–8mm, glabrous, flattened around terminal vegetative bud. Flower-heads 1.8–3cm diameter, in clusters of 1–3, axillary or terminal, sometimes grouped in a larger terminal leafy inflorescence. Peduncles 2–3cm. Interfloral bracteoles conical, 0.5–1mm, glabrous. Calyx pubescent, tube c 1mm; lobes 2.8–4.5mm, deciduous portion 1.5–2mm, summit glabrous. Corolla white, tube 5.5–8mm, glabrous outside; lobes oblong, 1.3–3mm. Anthers ± included. Style white, exerted 5–6mm; stigma globose-capitate. Infructescence c 2cm diameter; fruits 5–6mm long, pubescent, crowned with persistent part of calyx.

**Bhutan:** S – Chukka district (Marichong), C – Tashigang district (Tashigang); **Darjeeling:** Tista and unlocalised records. Dense, moist forest, 300–1300m. October–December.

#### 4. HALDINA Ridsdale

by L.S. Springate

Semi-evergreen tree. Leaves opposite, simple, petiolate, entire or shallowly dentate towards apex. Stipules entire, caducous, pairs appressed and flattened at shoot apex. Flowers subsessile in globose pedunculate heads; peduncles simple, borne near base of current growth; bracteoles interfloral, slender, clavate. Calyx tube short, lobes narrowly clavate. Corolla hypocrateriform, tube dilated at apex; lobes short. Anthers subsessile in corolla throat, basifixed, partly exserted. Ovary 2-locular; ovules numerous; style long-exserted; stigma capitate. Fruit free, dry, dehiscent; seeds with short wing.

1. *H. cordifolia* (Roxb.) Ridsdale; *Nauclea cordifolia* Roxb., *Adina cordifolia* (Roxb.) Brandis. Nep: *Karam* (34). Fig. 71a–d.

Tree 6–18m. Leaves broadly ovate, 15–32 × 10–21cm, apex shortly acuminate, cordate at base, glabrescent above, pubescent beneath; petioles 40–100mm, pubescent. Stipules 10–18 × 8–12mm. Up to 8 flower-heads borne at lowest nodes of current season's growth with 1–3 heads in each leaf axil; peduncles 20–75mm. Flower-heads c 15mm diameter; flowers yellowish; bracteoles c 2mm. Calyx hairy, tube c 0.5mm; lobes 1–1.5mm. Corolla pubescent, tube 5–6mm; lobes oblong, c 1mm. Style 9–11mm.

**Darjeeling:** Balasun, Khairbari forest etc. Dry forest of terai and lower hill forest (34), up to 600m. June–August.

An attractive ornamental tree which yields valuable timber, used for furniture making (48).

#### 5. KHASIACLUNEA Ridsdale

by L.S. Springate

Small tree. Leaves opposite, entire, glabrous, petiolate. Stipules oblong or obovate, caducous, pairs flattened and appressed at shoot apex. Inflorescence terminal, though sometimes overtopped, with 1 or 2 capitate, pedunculate heads of subsessile flowers. Flowers 5-merous, with filiform or filiform-clavate interfloral bracteoles not exceeding calyx. Calyx tube short, exceeding obtuse persistent lobes. Corolla infundibular, lobes imbricate in bud. Anthers basifixed, subsessile, partly exserted, connective produced. Ovary 2-locular with c 6–8 flattened ovules in each locule; style long-exserted; stigma capitate. Fruitlets splitting loculicidally and septicidally, walls detaching from semi-persistent septum.

1. *K. oligocephala* (Haviland) Ridsdale; *Adina oligocephala* Haviland

Arborescent. Leaves narrowly oblong-obovate, 10.5–17 × 3–5cm, apex with oblong obtuse appendage c 10 × 2mm, base attenuate; petioles 8–20mm.

Stipules 4–6mm. Peduncles slender, 30–50mm, shortly pubescent above. Flower-heads 19mm diameter. Calyx tube c 1.2mm, appressed-pubescent; lobes transversely oblong, c 0.3mm, thickened on back below apex. Corolla tube 7mm; lobes ovate, 1.4mm, hooded and thickened on back below apex, papillose-pubescent outside. Anthers inserted c 1mm below sinuses of corolla. Style c 5mm, exserted.

**Darjeeling:** Gumpahar. In forest block, 1800m. October–November.

It was not possible to confirm the presence of interfloral bracteoles in our specimen.

## 6. UNCARIA Schreber

by L.S. Springate & J. Wright

Woody climbers, stems terete to quadrangular, usually unbranched; lateral vegetative shoots modified as hooks, glabrous or pubescent. Leaves opposite, shortly petiolate, sometimes with domatia in axils of veins. Stipules entire or bifid, with or without colleters. Flowers 5-merous, in capitate heads, subsessile with bracteoles, or pedicellate without bracteoles. Heads grouped in elongate, open, terminal racemose or paniculate inflorescences, leafy at least in lower part. Calyx tube short. Corolla hypocrateriform or infundibular, lobes ovate to oblong-elliptic. Filaments short; anthers partly exserted. Ovary 2-locular; style slender; stigma capitate. Fruit free, dry, septicidally 2-valved, with persistent calyx; seeds numerous, small, reticulate, with 2 wings, one bifid.

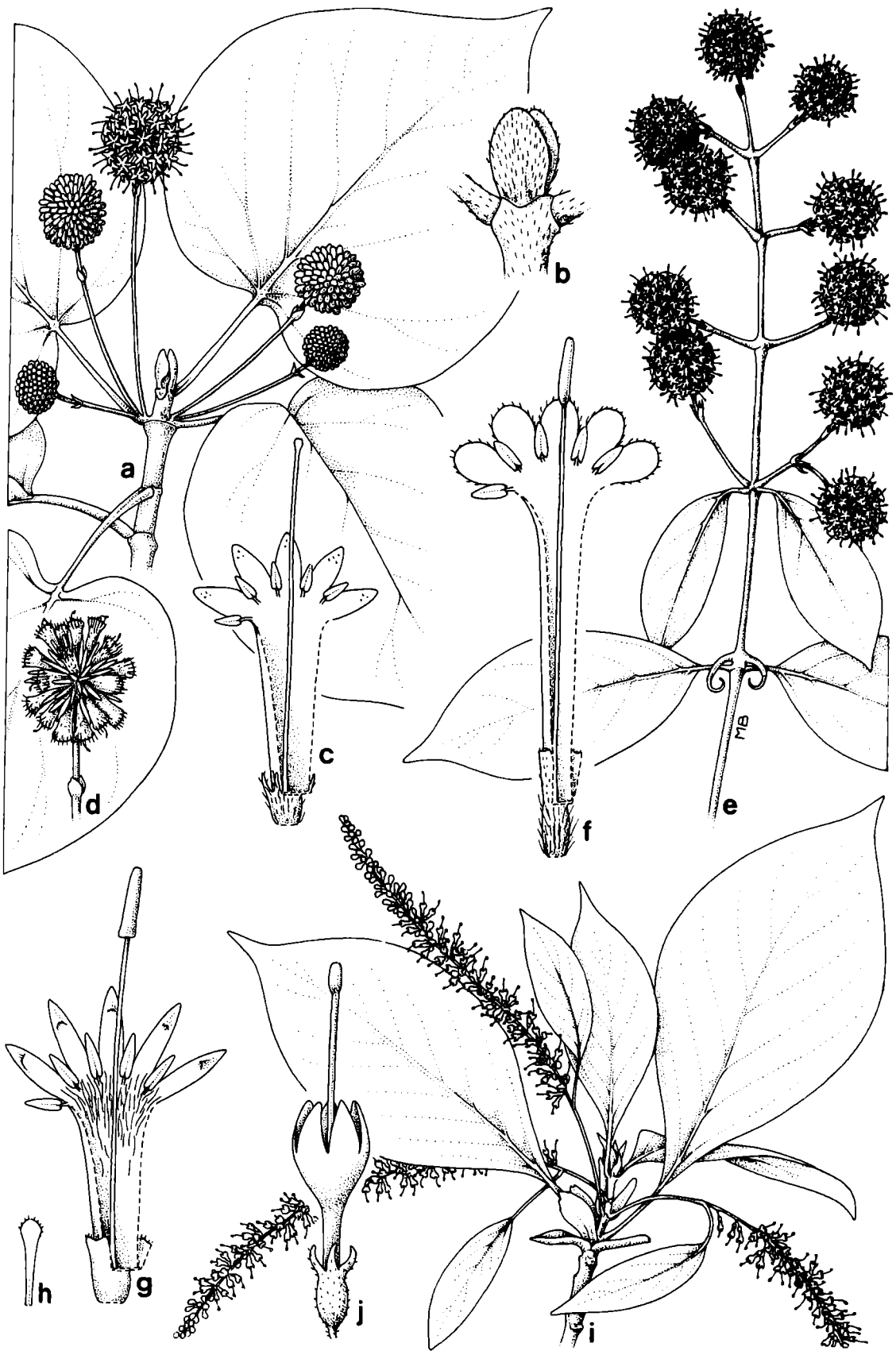
- 1. Pedicels 2–5mm in flower, 10–18mm in fruit ..... **1. U. macrophylla**
- + Flowers and fruit sessile or subsessile ..... 2
- 2. Leaf lamina glabrous beneath; main veins 4–6(–7) pairs ..... **2. U. sessilifructus**
- + Leaf lamina sparsely to densely strigose beneath; main veins (7–)8–10 pairs ..... **3. U. scandens**

### 1. *U. macrophylla* Wall.

Stems sparsely pubescent when young. Leaves ovate or broadly elliptic, 10–15(–17) × 6–9(–12)cm, acuminate or acute, base rounded to subcordate, subcoriaceous, glabrous above except on veins, rusty-tomentose below; all veins

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FIG. 71. **Rubiaceae.** a–d, *Haldina cordifolia*: a, flowering shoot (× ½); b, pair of stipules (× 1); c, dissected flower (× 1); d, head shedding fruit (× 1). e–f, *Uncaria sessilifructus*: e, flowering shoot (× ⅓); f, dissected flower (× 4). g–h, *Mitragyna rotundifolia*: g, dissected flower (× 4); h, interfloral bracteole (× 4). i–j, *Hymenodictyon flaccidum*: i, flowering shoot (× ⅓); j, flower (× 5). Drawn by M. Bates.



protruding below, primary pairs 6(-9); petioles to 10mm. Stipules bifid, lobes narrowly ovate, pubescent outside, with basal colleters. Inflorescence racemose. Flower heads c 5cm diameter; pedicels 2-5mm at anthesis. Calyx tube minute; lobes linear-oblong, 3-5mm, finely pubescent, persistent. Corolla white, pubescent outside, tube 8-10mm; lobes oblong, c 2mm, obtuse. Style exerted c 6mm; stigma oblong, 1-2mm. Infructescence 6-10cm diameter with pedicels 1-1.8 cm; fruit fusiform, 1.5-2cm.

**Bhutan:** S - Deothang district (Deothang); **Darjeeling:** unlocalised (34); **West Bengal Duars:** Lower Tendu. Lower hill forest etc., altitude not recorded. August-October.

2. *U. sessilifructus* Roxb. Nep: *Ban Kadam* (34); Lepcha: *Mayrong-zhu* (34). Fig. 71e&f.

Leaves elliptic, 10-15 × 5-8cm, acuminate, base cuneate, coriaceous, shiny above, glabrous, only primary veins prominent below, 4-6(-7) pairs; petioles 0.5-1.5cm. Stipules glabrous to sparsely pubescent outside, deeply bifid. Inflorescence sometimes paniculate. Flower heads 2-2.5(-3.5)cm diameter. Flowers sessile, interfloral bracteoles filiform-spathulate. Calyx lobes to 0.5mm, pubescent, obtuse. Corolla cream-yellow, tube 6-10mm, glabrescent outside; lobes 2mm, conspicuously sericeous. Style exerted 3-5mm; stigma elongate-clavate, c 2mm. Infructescence 2.5-3.5cm diameter; fruit sessile, ovoid, 1-1.4cm.

**Bhutan:** S - Sarbhang district (Singhi Khola), Gaylegphug district (Gaylegphug (117)) and Deothang district (Deothang), C - Tongsa district (Shemgang); **Darjeeling:** Bamanpokri, Rangit, Kalimpong etc. Subtropical broad-leaved forest on slopes and river banks, 400-1000m. October-April.

3. *U. scandens* (Smith) Hutchinson; *U. pilosa* Roxb. Sha: *Gogthur Zu*; Nep: *Bhainsi Kanra* (34); Lepcha: *Mayrong-zhu* (34).

Plant more or less pilose throughout. Stems brown-tomentose. Hooks tomentose, stout on older stems. Leaves ovate-oblong, acuminate, base obtuse to subcordate, subglabrous to strigillose above, sparsely to densely strigose beneath, veins raised, primary pairs (7-)8-10, tertiary veins distinct; petioles to 6mm, pubescent. Stipules deeply bifid, lobes ovate-triangular. Inflorescence racemose. Flower heads 4-4.5cm diameter, interfloral bracteoles numerous, filiform-spathulate. Calyx densely pubescent, lobes linear-spathulate, 2-3mm. Corolla white, greenish- or yellowish-pubescent, tube 8-10(-12)mm, lobes oblong, 2-3mm. Style exerted 2-6mm; stigma elongate-clavate, c 3mm. Infructescence 2-2.5cm diameter, pubescent; fruit subsessile, obovoid, 7-8mm.

**Bhutan:** S - Samchi district (Chenari Khola) and Gaylegphug district (Rang Khola), C - Tongsa district (Shemgang) and Mongar district (Zimgang); **Darjeeling:** Tista valley, Pankhabari, Gok, Kalimpong etc.; **Sikkim:** Pakhyong to Gangtok, Dik Chhu to Gangtok (104). Lower and middle hill forest, 300-1500m. April-July.



## 7. MITRAGYNA Korthals

by L.S. Springate

Deciduous trees. Leaves opposite, simple, entire, petiolate. Stipules entire, caducous, pairs appressed and flattened at shoot apex. Flowers sessile in capitate heads with interfloral bracteoles; heads pedunculate, sheathed by a pair of stipules at first, terminating lateral shoots, solitary or grouped in open, leafy inflorescences. Flowers 5-merous. Calyx tube short or long; lobes obsolete to linear-spathulate. Corolla hypocrateriform, glabrous outside. Stamens inserted at top of corolla tube; filaments very short or 0; anthers exerted. Ovary 2-locular, ovules numerous; style exerted; stigma subglobose to mitriform. Fruit dry, dehiscent; seeds numerous, small, with short wings.

1. *M. rotundifolia* (Roxb.) Kuntze; *Stephegyne diversifolia* (G. Don) Hook.f. p.p., *M. diversifolia* (G. Don) Haviland p.p. Fig. 71g&h.

Leaves glabrescent, very variable, those at base of inflorescence ovate, 15–17 × 11.5–15cm, subacute, cordate at base; petioles c 10mm; ultimate leaves of floral axes obovate, c 12 × 6mm, cuneate at base, sessile, caducous. Stipules oblong-obovate, subglabrous. Inflorescence of many flower-heads, corymbosely arranged; interfloral bracteoles spatulate, c 2.8mm, ciliate. Open flowers cream or yellowish, scented. Calyx c 0.6mm, dilated above, subentire or shallowly lobed. Corolla tube 4.6–5.2mm; lobes oblong-elliptic, 3.1–3.5mm, conspicuously hairy at throat. Filaments 0.6mm; anthers 1.3mm, finely apiculate. Style 9.5–10.3mm; stigma mitriform, 2.2mm, tubular (deeply concave) at base.

**Darjeeling:** Sitapahar. October. Details not recorded.

Only a single specimen of this species has been seen from the area.

## 8. CINCHONA L.

by L.S. Springate

Evergreen, unarmed shrubs or trees; shoots puberulous to tomentose. Leaves firm or rather coriaceous, broadly ovate to oblanceolate, obtuse or sometimes abruptly shortly acuminate, truncate to attenuate at base, glabrous or sparsely hairy above, glabrous to tomentose beneath, petiolate. Stipules caducous, large, oblong, sparsely hairy. Inflorescence a large, terminal, open panicle, often leafy in the lower part, pubescent or tomentose; bracts linear-lanceolate, small; pedicels short, sometimes elongating in fruit. Flowers 5-merous, fragrant, heterostylous. Calyx tube shallow, dilated; lobes short, triangular or subulate, with fewer hairs. Corolla pubescent or tomentose outside, tube cylindrical to infundibular, exceeding calyx; lobes valvate, patent, with long marginal hairs within. Filaments inserted on lower half of corolla tube, very short in long-styled flowers; anthers

of short-styled flowers partly exerted. Ovary 2-locular; ovules numerous, imbricate on septal placentae; style filiform with 2 lobes or branches, these partly exerted in long-styled flowers. Fruit dry, subglobose to subcylindric, with persistent calyx, septicidally dehiscent, opening at base, remaining joined at apex; seeds flat with fimbriate wing or pair of tails.

A genus of Central and South American plants, cultivated for quinine extracted from the bark, introduced to plantations in Darjeeling District in the Rimbi and Rayong valleys in the 1860s. Plantings were also made at several other sites in Darjeeling District, including Munsang, Kalimpong, Nimbong (all cited in 34) and Peshok. The early plantings are well-represented by herbarium specimens and include *C. calisaya* Weddell (*C. carabayensis* Weddell), *C. calisayana* cultivar 'Ledgeriana', *C. micrantha* Ruiz & Pavón, *C. officinalis* L. and *C. pubescens* Vahl. However, the species hybridise readily in cultivation and the few recent collections available (from Mongpu) could not be attributed entirely to any one species. Escapes from cultivation have been occasionally found in E Himalaya.

## 9. NEOHYMENOPOGON Bennet

by D.G. Long

Small deciduous shrubs, often epiphytic. Leaves simple, opposite, aggregated at branch ends; stipules large, simple, persistent. Flowers in loose terminal trichotomous corymbs, each main branch bearing 1–2 conspicuous white bracts at base of pedicels. Calyx tube short, lobes long, persistent. Corolla tube long, slender; limb salver-shaped, 5-lobed. Stamens 5, inserted below throat of corolla; anthers linear, included. Ovary 2-celled; ovules numerous on peltate placentae; style long, slender; stigmas 2, linear. Fruit a 2-valved capsule with persistent calyx; seeds many, linear, with long tails at each end.

**1. *N. parasiticus*** (Wall.) Bennet; *Hymenopogon parasiticus* Wall. Nep: *Lekh Biri* (34).

Deciduous shrub 0.5–1.5m; stems arching, pubescent. Leaves elliptic, oblanceolate or obovate, 10–28 × 4–9cm, apex shortly often bluntly acuminate, base attenuate, margin entire, appressed pubescent on both surfaces, especially on stout midrib and veins; petioles 0.5–2cm; stipules broadly ovate, obtuse, 6–10mm, pubescent on margins. Corymbs 10–15cm long and broad; peduncles finely villous. Lower bracts stipule-like; upper bracts leaf-like, greenish-white, oblong-elliptic, 3–7 × 1–2cm, acute at both ends, reticulately veined, on petioles 1–3cm, enlarging in fruit. Pedicels 5–12mm. Calyx tube 3–4mm, puberulous; teeth lanceolate, 6–10mm. Corolla white, tube slender, 2.8–4cm; lobes ovate, 6–8mm, villous within. Stigma shortly exerted. Capsule ellipsoid, 12–20 × 6–8mm, finely ribbed, with persistent calyx and 4 triangular valves at apex.

**Bhutan:** S – Chukka district, C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** widespread, eg. Sureil, Darjeeling, Senchal, Tanglu; **Sikkim:** Rathong Chhu. Evergreen oak and *Castanopsis* forests, epiphytic or on cliffs, 900–2100m. June–August.

Very conspicuous as an epiphytic shrub with its striking white bracts.

## 10. HYMENODICTYON Wall.

by L.S. Springate & J. Wright

Trees or large shrubs. Leaves opposite, ovate to obovate, acute or acuminate, base cuneate, glabrous or pubescent, petiolate. Stipules ovate to narrowly oblong, deciduous, brownish, glandular-serrate. Inflorescence terminal, a large drooping panicle of few spicate branches crowded with very small flowers. Lower bracts foliaceous, long-petiolate, elliptic to elliptic-lanceolate, paler than leaves and prominently reticulate. Flowers 5-merous, scented, bracteolate, pedicels very short. Calyx very short, divided almost to base, persistent. Corolla tube cylindrical below, dilated above; lobes incurved. Stamens subsessile, inserted at top of tube, included. Ovary 2-locular, ovules numerous; style slender, long-exserted; stigma globose, rarely 2-lobed. Capsule ellipsoid to oblong, 2-valved, loculicidally dehiscent. Seeds flat, winged; wing irregularly denticulate or lacerate, bifurcate at base.

1. Leaf lamina glabrous; capsules oblong, usually less than 1.5cm; seeds narrowly winged ..... **1. H. flaccidum**
- + Leaf lamina pubescent at least below; capsules ellipsoid, 1.5cm or longer; seeds broadly winged ..... **2. H. orixense**

**1. H. flaccidum** Wall. Lepcha: *Zaru-kung* (34). Fig. 71i&j.

Small tree to 10m, sometimes an epiphytic shrub. Leaves ovate-elliptic to obovate, 10–20(–30) × 5–10(–15)cm, glabrous, or sparsely pubescent on veins below; petioles 4–8cm, glabrous. Stipules oblong, 10–25 × 5–8mm, brown, glandular-serrate towards apex. Bracts elliptic-lanceolate, 4–8 × 1–3.5cm, acute, rugose, glabrous; petioles 2–4cm. Panicles villous to pruinose. Pedicels c 1mm; bracteoles minute. Calyx lobes 0.6–0.8mm, acute. Corolla white, tube 1.5–2mm; lobes elliptic, 2–3.5mm, acute, pruinose outside, glabrous within. Stamens 1–1.2mm; anthers c 1mm. Style 7–8mm; stigma globose, purple. Capsule oblong, 12–14(–18) × 3–5mm, reflexed when mature, surface warty. Seeds 10–12, orange-brown, narrowly lanceolate, 6–10mm, wing lacerate.

**Bhutan:** S – Chukka district (Giengo), C – Punakha district (Wangdu Phodrang); **Darjeeling:** Ryang, Chunabati, Kalimpong; **Sikkim:** Gangtok (254). Forested slopes and streamsides, 500–2000m. May–July.

2. *H. orixense* (Roxb.) Mabberley; *H. excelsum* (Roxb.) Wall., *H. thyrsiflorum* Wall. Nep: *Latikaram* (34), *Latijhara* (34).

Similar to *H. flaccidum* but larger and pubescent. Tree to 25m. Leaves 12–20(–30) × 7–10(–15)cm, scabrous above, puberulous below, veins and petioles pubescent. Bracts 8–10 × 3–6cm, ovate to elliptic, scabrous; petioles to 8cm, pubescent. Bracteoles to 4mm. Calyx lobes 0.5mm. Corolla pubescent, tube 2–3mm, lobes 2.5–3mm. Capsule ellipsoid, 15–20 × 6–10mm. Seeds c 20, ovate, dull brown, 11–13mm, irregularly dentate.

**Darjeeling:** Bamanpokhri, Sukna. Lower hill forests and terai. July.  
Produces useful timber (48).

## 11. LUCULIA Sweet

by L.S. Springate & J. Wright

Deciduous shrubs. Leaves opposite, entire, petiolate. Flowers 5-merous, white or pink, in terminal many-flowered corymbs. Calyx tube obsolete; lobes elongate, foliaceous. Corolla hypocrateriform, lobes simple or with two appendages at base. Heterostylous: anthers partly included to barely exerted and style included near top of corolla tube or anthers included near top of corolla tube and style briefly exerted. Filaments short; anthers oblong. Ovary 2-locular; style slender; stigma bifid. Capsule 2-valved, septicidally dehiscent. Seeds many, very small; testa rough, with toothed wings.

1. Leaves mostly less than 17 × 6cm, puberulous beneath; petioles, inflorescence and hypanthium tomentose or puberulous; corolla tube 2–4cm, lobes without appendages ..... **1. L. gratissima**
- + Leaves mostly greater than 15cm × 9cm, glabrous beneath except on veins; petioles, inflorescence and hypanthium glabrous or subglabrous; corolla tube 4–6cm, lobes with 2 appendages ..... **2. L. grandifolia**

**1. L. gratissima** (Wall.) Sweet. Dz: *Tongden Metok*; Nep: *Gadauri*, *Dawari* (34); Lepcha: *Sabrak-rik* (34).

Shrub 1–3m. Leaves elliptic to oblanceolate, 5–19 × 1.5–6.5cm, abruptly or gradually acuminate, base acute or attenuate, glabrous and shiny above, pale green beneath, matt and pilose, especially on veins; petioles c 1cm, tomentose. Stipules ovate, c 1cm, cuspidate. Peduncles tomentose. Flowers very fragrant. Hypanthium tomentose; calyx lobes ± elliptic, 8–12(–25)mm, usually acuminate. Corolla white or pink, tube 2–4cm; lobes ovate, spreading, 1–1.5cm, without appendages. Capsule obovoid, 1–1.5cm, sparsely pilose.

**Bhutan:** S – Deothang district (Keri Gompa), C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Rimbik, Rangli Rangliot, Rississum etc.; **Sikkim:** Sangacholing, Sosing. By rivers and on hillsides in scrub or open forest, 1000–2200m. August–October.

Leaves used for dyeing (34).

**2. *L. grandifolia* Ghose**

Similar to *L. gratissima* but more woody, 2–6m, branches prominently lenticellate. Leaves larger and proportionately wider, 12–25 × 8–14cm, acute or abruptly acuminate, base briefly attenuate, slightly oblique, margin and midrib crimson, sometimes suffused crimson above, glabrous except on veins below; petioles crimson, 1–2.5cm. Stipules 10–12mm, shortly acuminate. Flowers white or pale pink, faintly scented or unscented. Inflorescence ± glabrous. Hypanthium ± glabrous; calyx lobes 1–1.5cm, acute, margins crimson-brown. Corolla tube 4–6cm; lobes ovate-orbicular, c 2cm, with 2 appendages at base. Capsule almost woody, 1.5cm, surface warty.

Bhutan: C – Tongsa district (Changkar); **Darjeeling**: cultivated; **Sikkim**: cultivated in Gangtok. On hill slopes and below cliffs, 1500–2300m. June–August.

Once considered endemic to Bhutan, but recently found in India (Arunchal Pradesh). Grown as an ornamental shrub in gardens.

**12. WENDLANDIA DC.**

by J.R.I. Wood

Shrubs or small trees. Leaves in opposite pairs (sometimes whorled in *W. pendula*), entire, large, distinctly paler beneath, petiolate except in *W. pendula*; stipules distinctive for each species, persistent or early deciduous, sometimes splitting into two halves, either suborbicular with obtuse, reflexed apex or ovate, aristate, cuspidate or with terminal appendage, apex remaining erect. Inflorescence of terminal panicles composed of small compact cymes of white, fragrant flowers. Bracteoles small, lanceolate or oblong, often serrate, persistent. Calyx small, glabrous or hirsute, tube ovate, urceolate or oblong; teeth (4–)5, erect, persistent, similar in length to tube. Corolla small, tubular, often widened upwards with (4–)5 spreading or reflexed lobes, usually hirsute inside tube. Stamens inserted in upper part of corolla tube between lobes; anthers oblong or elliptic, sessile and semi-included or on short filaments and shortly exerted between corolla lobes. Ovary 2-celled; ovules many; style filiform; stigma exerted, clavate but in most species becoming bilobed. Fruit a small, subglobose, capsule crowned with persistent calyx teeth, usually c 1–1.5 × 1.5–2mm, slightly wider than long, opening by 2(–3) valves; seeds numerous, small, angled.

Apart from *W. pendula* and *W. heynei* the species are quite similar and easily confused. Plants identified using the key should be carefully checked against the descriptions. Fruiting specimens are not always easy to name but most species have distinct flowering periods and this seems to be a useful aid to correct identification.

164. RUBIACEAE

1. Leaves subsessile, often in whorls of 3, ovate, rounded at base, apex long-acuminate; stigma remaining clavate, exserted 4–8mm from corolla mouth  
**9. *W. pendula***
  - + Leaves petiolate, in opposite pairs, oblong-elliptic, not rounded at base; stigma becoming bilobed, exserted 1–3.5mm from corolla mouth ..... 2
2. Corolla lobes equalling or longer than tube; stem and leaves grey-tomentose ..... **1. *W. heynei***
  - + Corolla lobes distinctly shorter than tube; stem and leaves glabrous or sparsely pubescent ..... 3
3. Calyx and capsule glabrous ..... 4
  - + Calyx pubescent; capsule at least sparsely hairy (unless very old) ..... 5
4. Inflorescence branches glabrous; stipules aristate, tip erect, persistent; leaves oblong, usually less than 5cm wide, glabrous ..... **4. *W. coriacea***
  - + Inflorescence branches pubescent; stipules obtuse, tip recurved, deciduous; leaves oblong-elliptic, 5–6cm wide, often sparsely hairy on veins beneath  
**5. *W. wallichii***
5. Style sparsely pubescent; corolla tube 5–6mm; stipules suborbicular with rounded, reflexed tip ..... **6. *W. speciosa***
  - + Style glabrous; corolla tube less than 5mm; stipules acute, aristate or with long, ligulate appendage ..... 6
6. Leaves very large, usually at least 6cm wide and 14cm long; stipules 8–12mm, apex a long, obtuse, ligulate appendage ..... **7. *W. grandis***
  - + Leaves medium-sized, mostly 2.5–5cm wide and up to 16cm long; stipules 4–7mm, apex cuspidate with a fine point ..... 7
7. Leaves long-acuminate at both ends, completely glabrous even on veins beneath ..... **3. *W. sikkimensis***
  - + Leaves acute or shortly acuminate at one or both ends, pubescent at least on veins below ..... 8
8. Leaves essentially oblong, usually less than 12cm; anthers oblong, 1.5–1.75mm, exserted; flowering May–June ..... **2. *W. puberula***
  - + Leaves oblong-elliptic, 7–16cm; anthers elliptic, less than 1mm, semi-included; flowering February–March ..... **8. *W. tinctoria***

**1. *W. heynei*** (Roemer & Schultes) Santapau & Merchant; *W. exserta* (Roxb.) DC. Nep: *Tilki*, *Mimri* (34).

Shrub or small tree 2–6m. Branchlets quadrangular, densely grey-tomentellous. Leaves in opposite pairs, (ovate-)lanceolate-oblong, 5–15 ×

(1.5-)2.5-6(-8)cm, apex acute, base cuneate, minutely tomentellous above, grey-tomentose beneath; petioles 0.5-2.3cm; stipules 4-5mm, suborbicular, rounded, tip reflexed. Panicles very broad, (10-)13-21 × 12-24cm; branches grey-tomentose. Calyx tomentose, tube 1.25mm; teeth triangular, 0.75mm. Corolla white, tube 1-1.25mm, scarcely exceeding calyx; lobes oblong-elliptic, obtuse, 1.5-2mm. Anthers oblong, 1.25-1.5mm, shortly exserted, often erect. Style glabrous, exserted 1.5-2mm; stigma bilobed. Capsule grey-tomentellous.

**Darjeeling:** Choklong, Panchkilla (251), Kurseong (251). Subtropical forest, 300-1400m. March-May.

An attractive ornamental species with fragrant flowers (48).

2. *W. puberula* DC.; *W. sikkimensis* sensu (69) non Cowan. Sha: *Basha Rong Shing*, *Gong Jakpa Shing*; Khengkha: *Sonam Chogey*; Nep: *Kangya phul* (34).

Shrub or small tree 2.5-10m. Branchlets grey, shortly pubescent. Leaves in opposite pairs, broadly oblong(-elliptic), 5.5-12(-17) × 2.5-5(-7)cm, acute at both ends, sparsely pubescent above and usually glabrescent except on veins, pubescent beneath on and near veins; petioles 0.8-1.8cm; stipules 4-7mm, ovate, cuspidate into a long fine erect point, variable in size. Panicles ovoid, distinctly longer than broad, 17-25(-30) × 13-20(-25)cm; branches pubescent. Calyx sparsely pubescent, tube 1mm; teeth triangular, 0.25-0.75mm. Corolla white, tube 2.5-4mm; lobes ovate, obtuse, 2.25mm. Anthers oblong, 1.5-1.75mm, exserted. Style glabrous, exserted 2-3mm; stigma bilobed. Capsule greenish, very sparsely pubescent.

**Bhutan:** S - Chukka district (Marichong), C - Thimphu, Punakha, Tongsa, Mongar and Tashigang districts; **Sikkim:** Chompong, Dentam to Pemayangtse. Mixed broad-leaved and deciduous forest and secondary scrub, especially in the dry valleys of central Bhutan, 1050-2000(-2600). May-June.

The young leaves are used to make tea.

3. *W. sikkimensis* Cowan

A little known species closely related to both *W. puberula* and *W. coriacea* and apparently intermediate between them. From *W. puberula* it is distinguished by its entirely glabrous oblong-elliptic leaves, 8-17 × 3-5cm, acuminate at both ends. From *W. coriacea* it is distinguished by the pubescent calyx and inflorescence branches.

**Darjeeling:** Sivok. Terai forest, 300m. February-March.

An extremely rare plant which has not been collected this century. Although included by Gould (73) in *W. puberula* and distinguished from it by rather unsatisfactory characters, it flowers at a different time of year and grows at a much lower altitude.

4. *W. coriacea* DC. Nep: *Tilki*. Fig. 72a&b.

Shrub or small tree 2-6m. Branchlets red-brown, glabrous. Leaves in opposite pairs, oblong, 5-18 × 2-5cm, acuminate at both ends, coriaceous, glabrous on

both surfaces, with prominent brown midrib; petioles 0.4–2cm; stipules broadly ovate, shortly aristate, usually 2–3mm. Panicles ovoid, distinctly longer than broad, usually compact, c 7–15 × 5–10cm; branches glabrous or indistinctly scurfy. Calyx glabrous, tube 0.75(–1.25)mm; teeth triangular, 0.5mm. Corolla white, tube 4–4.5mm; lobes ovate-oblong, rounded or shallowly emarginate, 1.25–1.5mm. Anthers oblong, 1–1.5(–1.75)mm, shortly exserted. Style glabrous, exserted 2–2.5mm; stigma bilobed. Capsule glabrous, reddish-brown.

**Darjeeling:** Tista and Rangit valleys, Bandarjholra, Sivok, Badamtam, Mongpu etc. On well-drained rocky slopes in lowland valleys, 450–900(–1500)m. February–April.

**5. *W. wallichii* Wight & Arnott.** Nep: *Kangyo*.

A large shrub. Branchlets greyish-brown, glabrous or with a few scattered hairs. Leaves in opposite pairs, oblong-elliptic, 8–16 × (3–)5–6cm, shortly acuminate, base cuneate, with a few scattered hairs on both surfaces, veins strigose, especially beneath; petioles 0.7–2cm; stipules suborbicular, rounded, apex recurved, whole stipule early deciduous and usually missing. Panicles ovoid with relatively distant and distinct branches, 16–35 × 10–30cm; branches pubescent. Calyx glabrous, tube 0.75mm long, teeth ovate, obtuse, 0.25–0.5mm. Corolla ?white (pink in bud), tube 2–2.5mm, lobes ovate-oblong, obtuse, 1–1.5mm; anthers oblong, 0.5–1mm, exserted; style glabrous, exserted 1mm. Capsule glabrous.

**Bhutan:** without exact locality (251); **Darjeeling:** Kalimpong, Ging, Rinkinpong, Lish Block, Pankhabari (251), Lebong (251); **Sikkim:** Lusing, Chongpong. Subtropical forests, 900–1600m. September–November.

**6. *W. speciosa* Cowan; *W. speciosa* var. *forrestii* Cowan**

Shrub or small tree 3–12m. Branchlets pale brown, glabrous or with a few hairs. Leaves in opposite pairs, oblong-elliptic, 10–19 × 4–9cm, shortly acuminate, base cuneate, glabrous above, glabrous except for strigose midrib beneath; petioles 0.5–2cm; stipules c 4mm, suborbicular, rounded, apex often reflexed, persistent. Panicles very large, about as broad as long, 23–35 × 22–30cm; branches pubescent. Calyx pubescent, tube 1mm; teeth lanceolate-oblong, obtuse, 1mm. Corolla cream, tube 5–6mm; lobes oblong, rounded or emarginate, 2.5–2.75mm. Anthers oblong, 1.75–2mm, exserted. Style thinly pubescent, exserted 3–3.5mm. Capsule pubescent.

**Bhutan:** S – Phuntsholing district (Kamji (117)) and Chukka district (Marichong). Subtropical forests. November–January.

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FIG. 72. **Rubiaceae.** a–b, *Wendlandia coriacea*: a, flowering shoot (× 1/2); b, flower (× 5). c–d, *Dentella serpyllifolia*: c, flowering shoot (× 1 1/2); d, dissected flower (× 3). e, *Argostemma sarmentosum*: flowering shoot (× 2/3). f–h, *Hedyotis verticillata*: f, flowering shoot (× 2/3); g, capsule with 1 calyx lobe removed (× 6); h, seed (× 30). i, *Hedyotis scandens*: seed (× 30). j–l, *Neanotis ingrata*: j, flowering shoot (× 2/3); k, capsule (× 6); l, seed (× 30). Drawn by M. Bates.





7. *W. grandis* (Hook.f.) Cowan; *W. tinctoria* (Roxb.) DC. var. *grandis* Hook.f.  
Nep: *Tilki*

Shrub or small tree 2–14m. Branchlets red-brown, minutely puberulent, soon glabrescent. Leaves in opposite pairs, broadly elliptic, (10–)14–24 × (5–)6–11cm, acute or very shortly acuminate, base cuneate, glabrous beneath except for strigose midrib; petioles 1–2.5cm; stipules 8–12mm, ovate-triangular with erect ligulate appendage longer than base. Panicles ovoid, large, flowers very congested on secondary branches, (12–)20–28 × (10–)14–24cm; branches pubescent. Calyx densely pubescent, tube (1–)2mm; teeth triangular, acute or obtuse, 0.5mm. Corolla white, tube 2.5–4(–5)mm, strongly widened upwards; lobes triangular, acute or obtuse, 1–1.25mm. Anthers elliptic or oblong-elliptic, 0.5–0.75mm, exserted. Style glabrous, exserted 1mm; stigma bilobed. Capsule grey-pubescent.

**Bhutan:** S – Samchi district (Buduni); **Darjeeling:** common in the valleys (Tista, Rangit, Mongpu) and the terai; **West Bengal Duars:** Jalpaiguri. Subtropical forest, 380–900m. February–April.

8. *W. tinctoria* (Roxb.) DC. Nep: *Tilki* (34); Lepcha: *Mantet-kung* (34).

A small tree or shrub 3–6m, resembling *W. grandis* but smaller. Leaves 7–16 × 3–5.5(–7)cm, pubescent on veins below; petioles 1.1–1.8cm; stipules ovate, cuspidate, 4–7mm, terminating in a fine erect point. Panicles 13–16 × 12–16cm, branches pubescent. Calyx densely pubescent, tube 0.75–1mm, teeth lanceolate, 0.5–1mm. Corolla white, tube (2–)3–4(–5)mm long; lobes ovate, obtuse, 0.75–1mm. Anthers elliptic, 0.5–0.75mm, semi-included. Style glabrous, exserted 1mm. Capsule grey-pubescent.

**Darjeeling:** Rimbi Chhu, Ryang Chhu. Subtropical forests, 650m. February–March.

9. *W. pendula* (Roxb.) DC.

Small shrub, 1–1.5m, with pendulous branches. Branchlets brown, glabrous. Leaves in opposite pairs or whorls of 3(–5), subsessile, ovate, 3–13 × 2–4cm, long-acuminate, base rounded, glabrous on both surfaces, veins prominent beneath, midrib minutely scabrid; stipules ovate, acuminate, deciduous, 1–1.5mm. Panicles narrow and sparingly branched, mostly 11–20 × 7–10cm; branches sparsely to densely pubescent. Calyx subglabrous, tube 1–1.25mm; teeth oblong-lanceolate, 0.5–0.75(–1)mm. Corolla yellowish, tube 4–7mm; lobes ovate or oblong, rounded or minutely emarginate, 1.5–2mm. Anthers oblong, 1–1.25mm, exserted. Style scurfy, exserted 4–8mm; stigma remaining clavate. Capsule glabrous, pale green.

**Bhutan:** S – Samchi district (Samchi (117) and Khagra Valley), and Phuntsholing district (Torsa River). Subtropical forest, 200–1500m. November–January.

## 13. DENTELLA J. &amp; G. Forster

by L.S. Springate

Prostrate herbs, rooting at nodes. Leaves opposite, simple, entire, petiolate. Stipules scarious or pellucid. Flowers solitary, subsessile in leaf axils, 5-merous; bracts and bracteoles absent. Calyx tube shortly cylindrical, barely exceeding subulate lobes. Corolla infundibular, fugacious; lobes ovate, acute, with 2 acute or rounded teeth. Anthers in lower half of corolla tube, subsessile, dorsifixed. Ovary 2-locular; placentae peltate, inserted on septum; style bifid, branches erect, opposite anthers. Fruit globose, indehiscent, with persistent calyx; seeds many, small, angular.

1. Hypanthium and fruit covered in pellucid trichomes ..... 1. **D. repens**  
 + Hypanthium and fruit glabrous ..... 2. **D. serpyllifolia**

1. **D. repens** J. & G. Forster

Leaves elliptic or somewhat obovate, 5–7.5 × 1.3–2.5mm, apex acute and minutely apiculate, base attenuate, with few pellucid submarginal hairs; petioles c 1mm, papillate beneath. Stipules half-orbicular, c 0.7mm, with irregular ciliate margin, partially connate with petioles. Hypanthium covered in pellucid trichomes; calyx tube 1mm; lobes 0.8mm, pellucid-hairy. Corolla infundibular, white, glabrous outside, tube c 3.7mm; lobes 1.8mm, acute, with acute teeth. Fruit c 2.5mm across.

**Darjeeling?:** only one, unlocalised, specimen has been seen, labelled 'Sikkim'. collected for Griffith, probably originating from Darjeeling District.

2. **D. serpyllifolia** Airy Shaw; *D. repens* sensu F.B.I. p.p. non J. & G. Forster. Fig. 72c&d.

Similar to *D. repens* but differs in its glabrous hypanthium and fruit and larger corolla (tube 5mm, lobes 2mm) with rounded teeth on lobes.

**Bhutan:** S – Phuntsholing district (Torsa River). Seasonally inundated areas, c 200m. May.

The corolla throat was flushed pale purple in the specimen seen. It is not known whether *D. repens* differs in this respect.

## 14. ARGOSTEMMA Wall.

by J. Wright

Small erect or creeping herbs. Leaves opposite or subverticillate, entire, thin, shortly petiolate or sessile. Stipules minute, entire. Cymes pedunculate, subum-

bellate, 1–4 together at stem apex, rarely also solitary from lower leaf axils. Flowers 4- or 5-merous. Calyx campanulate, lobed, tube short. Corolla rotate, valvate, white. Filaments short, anthers exerted, often connivent, dehiscing by apical or subapical pores. Ovary 2-locular, placentae septal, ovules numerous; style filiform; stigma capitate. Fruit a thin subglobose capsule, dehiscing at apex or by an operculum. Calyx persistent. Seeds numerous, small, angled or flattened.

1. Corolla lobes 4; stamens 4; anthers 7–8mm, tapering to apex

1. *A. sarmentosum*

+ Corolla lobes 5; stamens 5; anthers 1.5–2.5mm, linear-oblong

2. *A. verticillatum*

1. *A. sarmentosum* Wall.; *Sonerila angustifolia* Wall. Fig. 72e.

Perennial herb, 5–20cm, creeping by long filiform runners. Stem slender, fleshy, villous. Leaves opposite or subverticillate, 3–5 together, often anisophyllous, elliptic to obovate, (2–)3–10(–14) × 2–5(–9)cm, acute or obtuse, base briefly attenuate, sparsely pilose, especially along veins; venation conspicuous; petioles to 10mm. Cymes solitary, terminal, rarely several together or axillary, pubescent. Bracts small, ovate, foliaceous. Flowers 4-merous. Calyx lobes ovate, 1.5–3mm, longer than tube. Corolla lobes ovate to oblong, 7–10mm, acute. Filaments bent, inserted on rim of corolla tube; anthers tapering to apical pore, 7–8mm, much longer than filaments, yellow. Style 8–10mm.

**Bhutan:** S – Gaylegphug district (Surey) and Deothang district (Deothang); **Darjeeling:** Sureil, Tista, Mongpu etc. Dense forest, in humid, shady places, often lithophytic, 300–1500m. June–August.

2. *A. verticillatum* Wall.

Similar to *A. sarmentosum*. Erect, not creeping by runners. Almost glabrous. Leaves mostly in a single verticil of 4, almost membranous, ovate to lanceolate, often two large and two small, 3–8(–11) × 1.5–3cm, abruptly or gradually acuminate, base usually tapered, sparsely pilose only on upper face towards margins. Terminal cymes often several together, sometimes compound, glabrous. Bracts oblong to lanceolate. Flowers 5-merous. Calyx lobes triangular, shorter than tube. Corolla lobes c 5mm. Filaments straight; anthers narrow oblong, c 2mm, equal to or little exceeding filaments, connivent, whitish. Style c 3mm.

**Bhutan:** S – Gaylegphug district (Surey) and Deothang district (Deothang), C – Punakha district (Tinlegang) and Mongar district (Saling to Mongar), N – Upper Mo Chu district (Gasa); **Darjeeling:** common; **Sikkim:** Bitu, Gangtok, Rathong Chhu. Forest in very wet areas (subhydrophytic), often as bark epiphyte, wet cliffs, to 2400m. June–July(–October).

## 15. HEDYOTIS L.

by R.R. Mill

Shrubs, or perennial or annual herbs, sometimes scandent. Stems erect to prostrate, branched. Leaves opposite; stipules free or connate, usually membranous, often appendaged. Inflorescences terminal or axillary, pedunculate or sessile, cymose, frequently developed as sessile verticillasters. Flowers small. Calyx lobes 4, ovate to subulate, often recurved at tips, at least in fruit. Corolla tube  $\pm$  equalling or exceeding calyx; lobes 4, often with indumentum outside and/or inside. Stamens included or anthers exerted. Ovary bilocular. Fruit globose to ovoid, capsular, dehiscent or indehiscent. Seeds numerous, angular or subglobose, sometimes with a wing-like margin.

In this genus the term 'calyx tube' is used in the sense of Bentham and Hooker, referring to the tissue enclosing the ovary, the 'calyx lobes' being the usually narrowly triangular structures surmounting the 'tube'. The genus as circumscribed here excludes *Oldenlandia* and *Kohautia* but includes *Thecagonum*; the generic status of the last needs assessment over a wider area than is covered by this *Flora*. The taxonomic position of *H. pinifolia* is uncertain; it may be better placed in *Oldenlandia*.

- |   |                         |
|---|-------------------------|
| 1. Shrubs or perennial herbs .....  | 2                       |
| + Annuals .....   | 4                       |
| <br>  |                         |
| 2. Climbing shrub 2–3m .....  | <b>1. H. scandens</b>   |
| + Non-climbing perennial herb or undershrub .....   | 3                       |
| <br>  |                         |
| 3. Leaves sessile, upper surface shortly scabrid; calyx lobes much shorter than fruit.....                              | <b>2. H. griffithii</b> |
| + Leaves shortly petiolate (0.5–5mm), upper surface glabrous; calyx lobes longer than fruit .....                       | <b>3. H. brunonis</b>   |
| <br>  |                         |
| 4. Flowers in terminal head of pedunculate cymes with none axillary .....   | 5                       |
| + Flowers in axillary sessile or pedunculate cymes .....  | 6                       |
| <br>  |                         |
| 5. Stems 15–45cm, glabrous; only 1 peduncle arising from each subtending leaf.....                                      | <b>8. H. racemosa</b>   |
| + Stems 0.5–11cm, densely brown-furfuraceous; up to 6(–9) peduncles arising from terminal pair or whorl of leaves ..... | <b>9. H. ovatifolia</b> |

6. Cymes pedunculate ..... 7  
 + Cymes sessile ..... 8
7. Leaves with petioles 5–10mm; stem hairs yellowish-green or yellowish-white; corolla mauve or pale blue ..... **4. H. vestita**  
 + Leaves sessile or very shortly petiolate; stem hairs whitish; corolla white  
**6. H. lineata**
8. Epidermal cells of upper leaf surface clearly visible with  $\times 10$  hand lens 9  
 + Epidermal cells of upper leaf surface inconspicuous or microscopic, not clearly discernible with  $\times 10$  hand lens ..... 10
9. Leaves elliptic or linear-lanceolate, 1.5–10mm wide; stems terete below, hispid ..... **10. H. verticillata**  
 + Leaves needle-like, 0.4–1mm wide; stems 4-angled throughout, glabrous, or angles scabrid ..... **11. H. pinifolia**
10. Stem unbranched, with sparse, very short, closely adpressed hairs on angles (appearing glabrous); primary veins of leaves clearly visible but not prominent ..... **7. H. macrophylla**  
 + Stem branched, densely villous or pubescent; primary veins of leaves prominent ..... 11
11. Stems villous with yellowish-tinged hairs; upper leaf surface yellowish-pubescent ..... **4. H. vestita**  
 + Stems densely but minutely pubescent, hairs not yellowish; upper leaf surface minutely scabrid ..... **5. H. auricularia**

**1. H. scandens** Roxb.; *Oldenlandia scandens* (Roxb.) Kuntze. Dz: *Khagai Niumba*; Nep: *Baksi Lahara, Kanchiru, Kannasey Lahara, Pinase Lahara, Bokri Lahara* (34). Fig 72i.

Large climbing shrub 2–3m. Stems glabrous or minutely pubescent,  $\pm$  terete. Leaves opposite or in whorls of 3, sessile or very shortly petiolate; lamina elliptic or lanceolate, 3–15  $\times$  1–4.5cm, acuminate or caudate, base cuneate, glabrous, with thickened, revolute margin; stipules connate, forming a small, broad, shallow cup with 2 lateral cusps. Inflorescence a terminal, trichotomously branched panicle of flat-topped or domed cymes; axis, peduncles and pedicels densely puberulent; peduncle pairs subtended by a pair of linear spreading bracts; pedicels ebracteate. Calyx c 1.5mm, cup-shaped with 4 short narrow lobes, puberulent below, enlarging and becoming urceolate in fruit. Corolla white, sweet-scented, c 5mm; tube short; lobes strap-shaped, erect below, obtuse, minutely appressed-puberulent outside, white-farinose near apex and densely long-bearded with thick white hairs in lower part (and upper part of tube) within. Stamens finally exserted; filaments minutely appressed-pubescent, c 4mm;

anthers c 1.2mm; pollen yellow. Style exserted, woolly below bifid stigma. Seeds very numerous, plano-convex with an irregularly angular wing-like margin.

**Bhutan:** S – Phuntsholing, Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Punakha and Tongsa districts; **Darjeeling:** Darjeeling, Mongpu, Sivok terai etc. Subtropical and warm broad-leaved forest, thickets, clearings and by roadsides and paths, 75–1800m. May–November; fruiting October–April.

## 2. *H. griffithii* Hook.f.

Suffrutescent perennial with stout woody tap-root. Stems numerous, 17–26cm or more, branched, acutely 4-angled, densely puberulent all over on younger and upper parts. Leaves opposite or sometimes in whorls of 4 or 6, sessile; lamina linear-lanceolate or narrowly lanceolate, 20–45 × 2–6mm, acuminate, base gradually attenuate, upper surface longitudinally rugose with very small epidermal cells, scabrid with hairs all pointing towards leaf apex, lower surface much paler, matt, glabrous, with distinct midrib and c 3 indistinct, alternating lateral veins on each side of midrib; stipules coriaceous, short, cuspidate. Inflorescence a terminal hemispherical head of 16–20 flowers, 8–10mm diam., becoming globose and 10–12mm diam. in fruit; sometimes a smaller whorl present in axil of leaf immediately below. Peduncle absent; pedicels c 1mm in flower, 1.5–3mm in fruit. Calyx tube c 1.5mm in flower, obovoid, shortly scabrid; lobes c 2mm, very strongly recoiled in flower and fruit, much shorter than fruit. Corolla white (drying blackish); tube c 1.5mm, shortly scabrid; lobes c 1.5 × 0.6mm, triangular-lanceolate, somewhat spreading or recurved, obtuse, scabrid outside and shortly barbate near throat within. Filaments c 0.7mm, blackish when dry; anthers exserted from corolla tube, c 0.5mm, remaining whitish when dry. Capsule globose, c 2.5mm diam., septicidally dehiscent, with large protruding top.

**Bhutan:** S – Deothang district (Tsalari Chu near Deothang), C – Punakha district (Rinchu) and Mongar district (Lhunsi Dzong). Dry hillsides, 1280–1830m. August.

Endemic to Bhutan. In dried material, the contrast between the whitish anthers and blackish corolla is very marked.

*Hedyotis tenelliflora* Blume was recorded from the Sikkim Himalaya by Hooker (80), based on a Griffith specimen supposedly from Darjeeling. This locality is probably incorrect. The distribution of *H. tenelliflora* extends from Bangladesh and Assam south and east to southern China and the Philippines; a record from our area seems unlikely. Several Cooper and Ludlow & Sherriff collections, determined as *H. tenelliflora*, have all turned out to be *H. griffithii*. *H. tenelliflora* differs from *H. griffithii* by its glabrous stems, long stipular appendages which are sometimes longer than the capsule, and indehiscent or loculicidally dehiscent capsule; its nearest relative in our area is *H. verticillata* (L.) Lamarck.

**3. *H. brunonis* Merrill; *H. monocephala* Hook.f. non Miquel**

Straggling to prostrate weak perennial or undershrub. Stems to c 40cm, branched, sharply 4-angled, densely and minutely spreading-puberulent on angles, elsewhere  $\pm$  glabrous. Leaves opposite; petioles 0.5–5mm; lamina elliptic-lanceolate, 10–35  $\times$  4–13mm, acuminate, base attenuate, glabrous on both surfaces or puberulent on midrib beneath; venation obscure, except for midrib; stipules ovate-rhombic, membranous, shortly hispid, with 1 or 2 long tapering filiform to linear-lanceolate apical bristles 2.5–4mm. Inflorescence a capitate, sessile or pedunculate, terminal or axillary cyme 6–13mm diam.; peduncle 0–12mm. Calyx lobes lanceolate, c 4  $\times$  0.5mm, longer than fruit. Corolla white; tube and outside of lobes glabrous, lobes pubescent within. Filaments at first included but finally exerted; anthers linear, at first shortly but finally distinctly exerted. Style exerted; stigma shortly bifid, glandular. Seeds small, angular.

**West Bengal Duars:** Jalpaiguri (276). Silty river banks, c 150m. March–April.

Confirmation that this species occurs in the *Flora of Bhutan* area is required. Griffith specimens labelled 'Darjeeling' are probably from Assam (80). The main known distribution is from Silhet to N Burma.

**4. *H. vestita* G. Don**

Erect annual, branched from base. Stems 30–60cm or more, densely patent-villous with yellowish-green or yellowish-white hairs. Leaves opposite (uppermost in whorl of 4); petioles 5–10mm; lamina elliptic to lanceolate, 20–80  $\times$  5–28mm, acuminate, base cuneate, upper surface yellowish-pubescent, lower surface white-hispid, hairs long especially on veins; veins 4 or 5 pairs, prominent, diverging at a very acute angle; stipules membranous, ciliate. Cymes axillary, in whorls of 4–6, simple or branched, sessile or usually pedunculate; peduncles when present 3–10mm, villous; pedicels not more than 1.5mm, villous. Bracts linear, 4–11  $\times$  0.05–0.1mm. Calyx tube campanulate, c 1.2mm, enlarging in fruit to c 2mm, with sparse, short, spreading hairs; lobes subulate, c 0.3mm increasing to 0.5–0.6mm in fruit. Corolla mauve or pale blue, campanulate; tube c 1.2mm; lobes c 0.7mm, spreading or recurved, obtuse. Anthers broadly ellipsoid, c 0.3  $\times$  0.2mm. Fruit indehiscent, globose but angled, with circular base, hard, pubescent.

**Darjeeling:** Mongpu, Darjeeling etc.; **West Bengal Duars:** Siliguri, Jalpaiguri, Jaldahka etc. Sal forest, terai etc. 150–1000m. June–October.

**5. *H. auricularia* L.**

Robust suberect annual, often with several widely-spreading, long branches from near base. Stems (25–)35–60cm or more, densely pubescent; hairs simple, very short,  $\pm$  dense, erecto-patent or occasionally retrorse. Stipules membranous, densely shortly villous, with several long, hairy bristles. Leaves opposite (uppermost in a whorl of 4), lower ones soon deciduous, sessile or very shortly petiolate; lamina ovate, lanceolate or narrowly lanceolate, 25–80  $\times$  4–20mm, acuminate, base narrowly cuneate or attenuate, upper surface drying deep green



or yellow-green, minutely scabrid, lower surface hispidulous on veins with lamina sparsely pilosulous; primary veins prominent, pinnate at a very acute angle, 5 on each side. Cymes axillary, dense, sessile; flowers apparently sessile. Bracts apparently absent. Calyx tube cup-shaped, not swollen at anthesis but becoming strongly ventricose in fruit, sparsely puberulent (hairs whitish); lobes erect, 0.4–0.5mm, ciliate-margined. Corolla white (rarely lilac), c 2mm; tube exerted from calyx; lobes obtuse, minutely appressed-setulose outside and minutely puberulent inside in a zone level with anthers. Anthers exerted, linear. Fruit indehiscent, globose, longer than calyx teeth.

**Darjeeling:** Gok, Dalka Jhar, Rishap etc. Among dense shrubs and in Sal forest etc., 120–1900m. April–December.

The description applies to E Himalayan material (Nepal to Assam), which has been referred to subsp. *venosa* (Blume) Deb (*H. venosa* Blume). The species is very variable; the typical subspecies *auricularia*, with much smaller cauline leaves which often become deflexed, is mainly confined to peninsular India.

#### 6. *H. lineata* Roxb.; *H. ulmifolia* Roxb.

Diffuse or suberect annual. Stems 8–40cm, densely pubescent; hairs jointed, erecto-patent, longer and more slender than in *H. auricularia*. Leaves opposite (except uppermost in a whorl of 4), sessile or very shortly petiolate; lamina ovate-lanceolate or elliptic-lanceolate, 15–80 × 5–25(–35)mm, acute or acuminate, base cuneate or shortly attenuate, upper surface usually drying bright yellow-green, appressed-pilose, lower surface markedly paler green with almost no yellow tinge, densely villous on veins with lamina hispidulous; primary veins prominent, pinnate, 4–6(–9) on each side. Cymes axillary, pedunculate; peduncles (3–)5–11(–20)mm, densely pubescent; pedicels 1–3mm, pubescent. Bracts linear, short, spreading. Calyx tube globose, becoming ventricose in fruit, patent-hispid (hairs yellow-green at anthesis, turning white); lobes erect, becoming spreading with recurved tips, c 1–1.5 × 0.3–0.5mm, hispid. Corolla white, c 3mm; tube exerted from calyx, pilose near top; lobes narrowly lanceolate, subacute, rather sparsely long-pilose outside and densely, very minutely puberulent inside. Anthers exerted, narrowly oblong. Fruit indehiscent, globose, shorter than calyx teeth.

**Darjeeling:** Darjeeling, Siliguri, Sukna. In shade of Sal and terai forests, on tracks and paths, 150–1070m. May–December.

#### 7. *H. macrophylla* Wall.; *Scleromitrum tetrandrum* Kurz.

Annual. Stems 15–30cm, unbranched, acutely 4-angled or -winged, pale green, smooth, with sparse, very short, closely-adpressed hairs on ridges of wings or angles. Leaves opposite, shortly petiolate (petioles 10–35mm); lamina elliptic to ovate, 6–11 × 2–6.5cm, acute or acuminate, base cuneate, glabrous, veins 3–6 on each side, indistinct though clearly visible; stipules free, with broad base and abruptly tapered apex, variously pectinate or toothed. Flowers in dense,

sessile verticillasters, sometimes encircling stem. Calyx tube shortly glandular-hispidulous; lobes c 1–1.2mm in flower, slightly longer in fruit, lanceolate. Corolla white, equalling calyx; lobes longer than tube, tips becoming recurved. Stamens subexserted from corolla tube. Capsule small; cocci dehiscent ventrally, top not protruding between calyx lobes.

**West Bengal Duars:** Jalpaiguri district (Madarihat range: Titi (276)). Weed in wasteground and amongst grass in sandy gravel and along forest paths, c 200m. September–October.

**8. *H. racemosa*** Lamarck; *Oldenlandia paniculata* L., *Hedyotis paniculata* (L.) Kurz, *Oldenlandia biflora* auct. non L., *Thecagonum biflorum* sensu Babu p.p. non (L.) Babu

Diffuse, erect or suberect annual. Stems 15–45cm, bluntly 4-angled, glabrous, flaccid. Leaves opposite, petiolate, bright green, soft; lamina elliptic to ovate, 12–75 × 5–25mm, obtuse or subacute, base attenuate, upper surface glabrous, lower with scabrid midrib and indistinct lateral veins; petioles 3–15mm; stipules truncate with a median point or bristle. Flowers in terminal and subterminal, pedunculate, paniculate cymes of 5 or more flowers. Peduncles filiform, glabrous, ± exceeding subtending leaf; pedicels 1–3.5mm in flower, 1.5–4.5mm in fruit. Calyx tube 4-angled, scarcely 0.5mm in flower but 2–2.5mm in fruit, with raphides; lobes triangular, c 0.3mm in flower, hardly accrescent in fruit. Corolla white, c 2mm, each lobe with a transverse band of hyaline hairs at base. Stamens inserted at corolla sinuses. Styles and stigma ± cylindrical. Capsule terete, 4-ridged with lateral sides arching, 2.5–3.4mm. Seeds globose, pitted.

**Darjeeling:** Darjeeling; **West Bengal Duars:** Mahanadi.

Very closely related to *H. biflora* (L.) Lamarck (*Oldenlandia biflora* L.), not yet recorded from our area; the latter differs in having cymes 1–3-flowered; peduncle stouter, never exceeding leaves; flowers 4–7mm; calyx without raphides; capsules 6–7mm, sharply 4-angled with flat sides (248). The two species have sometimes been united under *H. biflora*, but Biju et al. demonstrated that they are distinct (248).

**9. *H. ovatifolia*** Cavanilles; *Oldenlandia nudicaulis* Roth, *O. ovatifolia* (Cavanilles) DC., *Gonotheca ovatifolia* (Cavanilles) Santapau & Wagh, *Thecagonum ovatifolium* (Cavanilles) Babu, *Hedyotis nudicaulis* (Roth) Wight & Arnott.

Erect annual. Stems (0.5–)1–7(–11)cm, unbranched or with few lateral branches, quadrangular, densely brown-furfuraceous on 2 sides, other 2 sides glabrous. Leaves 0 or 1 opposite pair on stem, 1 whorl of 4 (or 1 opposite pair) at base of inflorescence and 1 whorl or pair on each inflorescence branch; petioles of cauline leaves (when present) 3–5(–8)mm, of inflorescence leaves 0.5–4(–6)mm, inflorescence leaves often appearing sessile; lamina ovate, ovate-elliptic or elliptic, 3–30 × 1.5–20mm, obtuse or subacute, base cuneate, margin entire, upper surface sparsely shortly pilose, lower surface shortly puberulent (hairs more numerous than upper surface). Inflorescence cymose,

1-6(-9) slender peduncles arising from inflorescence leaf-whorl, then very diffusely dichotomously and/or trichotomously branched, (4-)5-14 × (3.5-)5-20cm; branches and pedicels capillary. Pedicels 2-7(-14)mm in flower, 4-16mm in fruit. Bracts minute, lanceolate, at inflorescence dichotomies. Calyx 0.8-1.5 × 0.4-1.5mm in flower, 1.5-2.6 × 2-3.5mm in fruit, shallowly and broadly campanulate to hemispherical; teeth lanceolate, 0.3-0.6 × 0.15-0.3mm. Corolla white, campanulate, 2-4mm; lobes obovate, 1-2 × 0.5-1mm. Stamens subequalling corolla, included; anthers cream. Style c 1.5mm, subequalling corolla. Fruit a hemispherical capsule. Seeds subglobose; testa deeply and coarsely pitted.

**Darjeeling:** Darjeeling and terai. Waste places, disturbed ground and as a weed of crops, 200-1800m. September-October (and probably earlier).

Usually collected mainly or entirely in fruit. The only *Hooker* specimen seen, labelled 'Sikkim, swing bridge, 1/9/1850', appears to be wrongly localised; on the date given, Hooker was at Churra in the Khasia Mountains.

**10. *H. verticillata* (L.) Lamarck; *Oldenlandia verticillata* L., *Hedyotis hispida* Retzius.** Fig. 72f-h.

Annual; often robust, but very variable. Stems 10-30cm, terete or subterete below, 4-angled above, hispid. Leaves opposite (uppermost in a whorl or apparent whorl of 4), sessile; lamina elliptic or linear-lanceolate, 20-55 × 1.5-10mm, acute or acuminate, base shortly attenuate, upper surface with conspicuous epidermal cells, scabrid (hairs all pointing towards apex), lower surface paler, scabrid with prominent, hispid midrib; stipules with long, often brownish, filiform, sparsely hispid appendages 3-6.5mm. Flowers in sessile, axillary verticillasters; pedicels c 1mm in fruit. Calyx 3-4.5mm; tube and lobes subequal, densely hispid. Corolla shortly campanulate; tube very short, without a ring of hairs; lobes obovate-elliptic, c 3 × corolla tube and subequalling calyx lobes, densely glandular-hairy outside and with scattered hairs within. Stamens attached at top of corolla tube; filaments long, anthers almost reaching tips of corolla lobes. Stigma slightly overtopping anthers, shortly bifid. Capsule ovoid, c 2mm, hispid, loculicidal on crown only.

**Bhutan:** C - Mongar district (Bagha La); **Darjeeling:** Rongsong, Selim, Sukna etc.; **West Bengal Duars:** Jalpaiguri. On sandy soil mostly in terai, 150-1220m. May-December.

**11. *H. pinifolia* G. Don**

Diffuse, much-branched annual. Stems 4-25cm, usually slender, acutely 4-angled, glabrous, or scabrid on angles. Leaves opposite or at least some in fascicles of 3 or more, sessile, spreading and becoming recurved; lamina needle-like, very narrowly linear, 5-37 × 0.4-1mm, acuminate, scabrid, margins strongly revolute, epidermal cells on upper surface conspicuous; stipules connate with many unequal filiform bristles. Flowers in subsessile, axillary, capitate

verticillasters of 3 to several flowers; pedicels c 0.5mm in fruit. Calyx flask-shaped in fruit; tube c twice as long as lobes, with conspicuous epidermal cells and becoming semi-transparent in fruit, pilose with relatively long, stiff hairs; lobes spreading with recurved, narrowly triangular tips. Corolla white with a pink dot at apex of each lobe, subequalling calyx; tube c  $\frac{1}{2}$  × lobes, shorter than calyx tube, without a ring of hairs; lobes obovate-elliptic, subacute, glabrous within. Stamens subequalling corolla lobes, filaments inserted at corolla lobe sinuses. Stigma bifid. Capsule c 2mm, hispid.

**Bhutan:** C – Tashigang district (near Gomchu (48)). Open jungle, c 2500m. September.

This literature record requires confirmation.

## 16. OLDENLANDIA L.

by R.R. Mill

Annual herbs. Stems erect, decumbent or prostrate, branched. Leaves opposite; stipules with 1 to several fimbriae from short base (often adnate to base of leaf). Inflorescences terminal or axillary, cymose, lax or dense, sometimes fasciated at nodes. Flowers small, heterostylous or isostylous. Calyx lobes 4, ± triangular, equal, small. Corolla tube short, cylindrical; lobes 4, often hairy at throat. Stamens included or just exerted. Ovary bilocular with peltate placentas; ovules numerous. Fruit a subglobose to oblong capsule, sometimes didymous, usually with loculicidally dehiscent beak. Seeds subglobose or angular, numerous, with smooth or variously punctate, tuberculate or granulate testa.

1. Axillary cymes sessile; stem glabrous ..... **2. O. brachypoda**  
+ Axillary cymes pedunculate; stem scabrid, at least on angles ..... 2
2. Stems terete; upper surface of leaves with very inconspicuous epidermal cells; corolla tube without a ring of hairs inside ..... **1. O. diffusa**  
+ Stems 4-angled; epidermal cells of upper leaf surface clearly visible with × 10 hand lens; corolla tube with a ring of hairs inside ..... 3
3. Peduncles bearing 3–5 flowers; stamens often inserted on lower half of corolla tube ..... **3. O. corymbosa**  
+ Peduncles bearing 2 flowers; stamens always inserted near top of corolla tube ..... **4. O. erecta**

### 1. *O. diffusa* (Willdenow) Roxb.; *Hedyotis diffusa* Willdenow

Diffuse prostrate, decumbent or suberect annual, 10–35cm. Stems branched (often furcately), terete, rather densely scabrid, slightly zigzag in inflorescence. Leaves opposite, sessile; lamina linear or linear-elliptic, 10–28 × 0.6–2mm, acute, base gradually attenuate, not expanded at base, upper surface glabrous with very inconspicuous epidermal cells, lower surface glabrous with very few

rhaphides, margins inrolled and scabrid. Stipules inconspicuous, with indistinct connate part, apparently divided almost to base into bristle-like appendages. Cymes 2–5-flowered, solitary, axillary, pedunculate; peduncles terete, scabrid, filiform, 6–9mm; pedicels 3–7mm, unequal, scabrid, filiform. Flowers isostylous. Calyx tube subglobose, c 0.7mm, scabrid, with few rhaphides; lobes linear-triangular, suberect, c 1mm, acuminate. Corolla whitish, c 2mm; tube cylindrical, subequalling calyx lobes, exerted from calyx tube, without a ring of hairs inside; lobes c 0.7mm, narrowly triangular, acute, glabrous. Stamens inserted at top of corolla tube. Stigma bilobed, papillose. Capsule subglobose, didymous, c 2.2mm, apex strongly raised into 2 dome-shaped structures. Seeds c 0.15mm, reddish-to blackish-brown, 3-angled; testa reticulate.

**Bhutan:** S – Gaylegphug district (Gaylegphug), C – Punakha district (Punakha); **Darjeeling:** Sureil. In similar ruderal habitats to *O. corymbosa* and *O. brachypoda*, 300–1500m. May.

*O. diffusa* was also recorded from Phuntsholing, Bhutan, as *Hedyotis diffusa*, by Sivarajan & Biju (278) on the basis of *Subba Rao* 381A (CAL), which has not been studied; the same specimen has also been identified as *Hedyotis corymbosa* (117).

**2. *O. brachypoda* DC.;** *O. diffusa* sensu F.B.I. non (Willdenow) Roxb., *Hedyotis brachypoda* (DC.) Sivarajan & Biju, *Hedyotis diffusa* auct. non Willdenow

Prostrate or sprawling, sometimes creeping, annual herb, 10–35cm. Stems branched, terete or indistinctly 4-angled, subglabrous, flexuous (shallowly zigzag) in inflorescence. Leaves opposite, sessile; lamina 4–25 × 0.4–2.5mm, gradually acuminate, base gradually attenuate but expanded at base and cordate-truncate, upper surface glabrous with conspicuous epidermal cells c 0.05mm diam., lower surface glabrous with prominent midrib but no other veins, margins inrolled and sparsely scabrid. Stipules membranous, with several short unequal shortly scabrid-margined bristles 0.2–0.7mm. Cymes 1–4-flowered, axillary, subsessile or on very short, relatively stout peduncles. Flowers isostylous. Calyx tube subglobose and ± ventricose especially in fruit, usually sparsely scabrid; lobes narrowly triangular-lanceolate, suberect, becoming spreading, scabrid on margins. Corolla white, c 7mm; tube subequalling calyx lobes, exerted from calyx tube, without a ring of hairs inside; lobes c 2mm, narrowly lanceolate, obtuse, glabrous. Stamens inserted at top of corolla tube. Stigma bilobed, papillose. Capsule subglobose, didymous, with low crown. Seeds pale brown, c 0.3 × 0.2mm.

**Bhutan:** S – Samchi district (Buduni), Gaylegphug district (Gaylegphug) and Deothang district (Samdrup Jongkhar), C – Punakha district (Punakha Dzong); **Darjeeling:** Labha, Siliguri, Darjeeling etc.; **West Bengal Duars:** unlocalised. Paddy-fields, wheat-fields, damp patches by roadsides and other ruderal habitats, also in river beds, 150–1270m. Throughout the year.

Often confused with *O. diffusa* (Willdenow) Roxb., which has flowers in pedunculate, 3–7-flowered cymes or in pedunculate groups of 1–2 and

the capsule didymous with the apical half raised into two dome-shaped structures.

**3. *O. corymbosa* L.; *Hedyotis corymbosa* (L.) Lamarck**

Diffuse, prostrate or sprawling annual. Stems 5–20cm, slender, branched, 4-angled, scabrid on angles. Leaves opposite, sessile, linear or linear-lanceolate, 5–25 × 0.8–2mm, subacute, base gradually attenuate into short false ‘petiole’ not expanded at its base, margin inrolled beneath; upper surface glabrous, with conspicuous epidermal cells; lower surface paler, glabrous, with raphides. Stipules membranous, connate, with several unequal filiform appendages; lower part of stipule scabrid, appendages glabrous. Flowers axillary in pedunculate (1–)3–5-flowered cymes; peduncle 1.5–8mm, filiform, scabrid; pedicels to 6mm, scabrid. Bracts extremely minute. Calyx tube obovate and c 1mm in flower, becoming subglobose and c 2mm in fruit, with raphides; lobes narrowly triangular-lanceolate, 0.6–0.9mm, scabrid, with tips recurved in fruit. Corolla white or pinkish, 2–2.7mm, infundibular-cylindrical; tube cylindrical, 1.2–1.9mm, longer than calyx, with a ring of hairs inside; lobes short, suberect, with darker tips. Anthers usually inserted on lower half of corolla tube. Capsule subglobose or obovoid, (1.5–)2–2.5(–3) × 1.5–2mm; crown little raised.

**Bhutan:** S – Phuntsholing district (Phuntsholing), C – Thimphu district (Thimphu); **Sikkim:** Phodong Gompa. Dry banks, path-sides, drains etc., 200–2370m. Flowering and fruiting throughout most of year.

Probably under-collected in our area and also likely to occur in Darjeeling District. However, the specimens from Thimphu and Phodong Gompa bear fewer flowers and stamens inserted near top of corolla tube and may be wrongly placed under this species.

**4. *O. erecta* (Manilal & Sivarajan) Mill; *Hedyotis erecta* Manilal & Sivarajan.**

Erect, suberect or sometimes decumbent annual. Stems 7–35cm, slender, branched, 4-angled, scabrid on angles. Leaves opposite, sessile, linear-elliptic, 9–26 × 1.5–3.5mm, acute or acuminate, base gradually attenuate into short false ‘petiole’ not expanded or cordate at its base, margin inrolled beneath; upper surface glabrous, with conspicuous epidermal cells; lower surface glabrous, with raphides. Stipules membranous, connate, with 2–3 filiform appendages; lower part of stipule scabrid, appendages glabrous. Flowers axillary in pedunculate (1–)2(–3)-flowered cymes; peduncle 7–10mm, filiform, rather rigid, patent or erecto-patent, 4-angled, subglabrous; pedicels 1.5–4.5mm, those of each pair slightly unequal, subglabrous. Bracts absent or extremely minute; when present, linear and subhyaline. Calyx tube obovate and c 1mm in flower, becoming subglobose in fruit, with raphides; lobes narrowly triangular-lanceolate, 0.6–0.8mm, acuminate, setulose. Corolla white or pinkish, c 2.5mm; tube cylindrical, 2 × calyx tube but subequalling calyx lobes, with a ring of hairs inside; lobes short. Anthers inserted near top of tube, just below ring of hairs. Capsule subglobose, 1.8–2.2mm; crown low.

**Bhutan:** without details of locality (278); **Darjeeling:** Tarseng. Dry slopes, field margins, paddy-fields, 750–1675m. April–October.

As is the case with *O. corymbosa*, this species has been collected several times in E Nepal, so is possibly overlooked (or confused with *O. corymbosa*) in Sikkim.

## 17. NEANOTIS Lewis

by R.R. Mill

Perennial or (in our area) rarely annual herbs, prostrate, ascending or less commonly erect. Leaves opposite, membranous, petiolate or sessile. Stipules connate or rarely free, usually membranous, with or more rarely without bristles. Calyx with short tube (treated as including the hypanthium here), 4-lobed; lobes usually shorter than tube, valvate in bud, not or scarcely enlarging in fruit. Corolla tubular or infundibular, 4(–5)-lobed. Filaments usually inserted near mouth of corolla (occasionally near base of tube); anthers exerted or included. Style filiform, exerted or included; stigmas 2, 3 or 4. Ovary 2-, rarely 3- or 4-locular; ovules few (rarely numerous or solitary) in each locule. Fruit a didymous or laterally compressed capsule, loculicidal at top into 2 valves, rarely indehiscent. Seeds peltate, boat-shaped or plano-convex; testa pitted.

1. Inflorescence sessile in a pair of leaves ..... 7. **N. wightiana**  
+ Inflorescence pedunculate ..... 2
2. Leaves linear-elliptic, base long-attenuate ..... 4. **N. oxyphylla**  
+ Leaves ovate, lanceolate, or ovate-elliptic, base truncate, obtuse, cuneate or shortly attenuate ..... 3
3. Peduncles about equalling petioles of subtending leaf, much shorter than blade ..... 3. **N. hirsuta**  
+ Peduncles exceeding petioles of subtending leaf and usually also longer than blade ..... 4
4. Annual; peduncles shorter than subtending leaf blade ... 5. **N. rhombicarpa**  
+ Perennial; peduncles usually longer than subtending leaf blade ..... 5
5. Leaves almost glabrous beneath, with 3 or 4 veins on each side; corolla 2–3mm; filaments and style included ..... 6. **N. calycina**  
+ Leaves spreading-puberulent or -villous on veins beneath, with 4–10 veins on each side; corolla 4.5–7mm; filaments and style exerted ..... 6
6. Stems pubescent with 4 rows of brownish hairs throughout; leaves with 8–10 veins on each side ..... 1. **N. ingrata**  
+ Stems with internodes completely glabrous, or puberulent only immediately below nodes; leaves with 4–5(–6) veins on each side ..... 2. **N. gracilis**

1. **N. ingrata** (Hook.f.) Lewis; *Anotis ingrata* Hook.f. Fig. 72j–l.

Foetid decumbent perennial. Stems 20–90cm, rooting at lower nodes, brittle, brownish-pubescent in 4 rows. Leaves blackening when dry, ovate-lanceolate, 2.5–10 × 1–2.5cm, gradually long-acuminate, base truncate to shortly attenuate into short petiole, upper surface puberulent with scattered brownish hairs, lower surface puberulent with spreading hairs on veins; veins subopposite, 8–10 pairs; stipules connate, with numerous, slender, hairy bristles 4–8mm. Flowers in terminal and subterminal, pedunculate, dichotomously branched cymes; peduncle longer than subtending leaf. Calyx 1.5–3mm in flower, tube becoming enlarged and globose in fruit; lobes erect in flower, patent or recurved in fruit. Corolla white, salverform, 5–7mm; tube cylindrical below, abruptly dilated in upper  $\frac{1}{3}$ , hairy within; lobes oblong, 1.5–2mm, becoming patent or reflexed. Filaments exserted from corolla; anthers linear, c 0.8mm. Style long-exserted; stigma bifid. Fruit a loculicidally dehiscent, hemispherical, didymous, glabrous or hairy capsule.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Pomong, Darjeeling; **Sikkim:** Bitu, Kulhait Valley, Lachen, Yoksam etc. Cleared warm broad-leaved forest, margins of thickets, roadsides, 900–2300m. Late June–early October.

2. **N. gracilis** (Hook.f.) Lewis; *Anotis gracilis* Hook.f.

Diffuse very slender perennial, usually rooting from several lower nodes. Stems 30–90cm, 0.7–1.3mm thick, branched above, pale greenish or straw-coloured when dry with dark, blackish-purple nodes; internodes glabrous, or crispate-puberulent below nodes; nodes usually shortly puberulent. Leaves lanceolate or ovate-lanceolate, 1–4.5 × 0.5–1.5cm, acuminate (less so than *N. ingrata*) or acute, base cuneate, obtuse or occasionally truncate, upper surface yellowish-puberulent (hairs 0.2–0.5mm), lower surface spreading puberulent on veins (hairs 0.1–0.2mm); veins 4–5(–6) on each side. Stipules connate, bristles c 12, 3–4mm, very sparsely puberulent. Flowers in unequally dichotomous terminal and lateral cymes; peduncle longer than subtending lamina and petiole. Calyx lobes ovate-lanceolate, c 1.5mm, white-ciliate. Corolla white, infundibular; tube 2.5–3.5mm, gradually dilated upwards from base; lobes usually c 4mm, erecto-patent with reflexed or recurved tips. Anthers exserted from corolla tube, narrowly oblong, 1–1.2mm. Style exserted; stigmatic lobes c 0.8mm.

**Bhutan:** C – Punakha district (Tinlegang (71)); **Darjeeling:** Kurseong; **Sikkim:** Gangtok (69), Chatteng. Boggy places, etc., 1500–2200m. May–November.

This description applies to plants seen from our area and from Khasia (where the type was collected). Specimens seen from Nepal have smaller corollas and show other differences; their status needs further study.

3. **N. hirsuta** (L.f.) Lewis; *Oldenlandia hirsuta* L.f., *Anotis hirsuta* (L.f.) Boerlage, *Hedyotis stipulata* Hook.f., *H. lindleyana* Wight & Arnott

Slender decumbent perennial, rooting at lower nodes. Stems 13–35cm,



branched, brownish-puberulent in 4 rows or subglabrous. Leaves ovate or lanceolate,  $0.5-3 \times 0.3-2$ cm, acute, base obtuse or cuneate, brownish-puberulent above and on veins beneath, or glabrous; veins usually 4 on each side of midrib, alternate or lower ones subopposite; petioles 1–7mm; stipules divided  $\pm$  to base into filiform bristles, glabrous. Flowers in subsessile or shortly pedunculate axillary and/or terminal cymes; peduncle when present much shorter than subtending leaf (usually  $\pm$  equalling its petiole). Calyx tube becoming globose in fruit; lobes ovate, recurved or patent in fruit. Corolla white, infundibular, 4–6mm; tube cylindrical, not dilated above, with no ring of hairs within but with 4 lines of glandular white hairs in lower part, alternating with stamens. Stamens inserted in upper part of tube, subequalling corolla; filaments short; anthers white (drying yellow), 0.5–0.6mm. Style divided  $\pm$  to base. Capsule indehiscent or with a loculicidal fissure at crown; seeds numerous, pitted, angular.

**Darjeeling:** Darjeeling, Rimbi Chu, Tista; **?Sikkim:** Neebay. Damp, shady banks and rocks, often along roadsides, 300–2200m. Late May–mid October.

Not so far collected from Bhutan but possibly overlooked as it also occurs in Khasia and further east, as well as in East Nepal.

**4. *N. oxyphylla*** (G. Don) Lewis; *Oldenlandia oxyphylla* G. Don, *Anotis oxyphylla* (G. Don) Hook. f.

Erect, glabrous perennial. Stems 20–50cm, unbranched (rarely branched above), rooting at lower nodes, deeply sulcate and thus appearing angled. Leaves thin-textured, blackening when dry, linear-lanceolate or usually linear-elliptic,  $3-11 \times 0.25-1.2$ cm, gradually attenuate, base long-attenuate into short (4–12mm) petiole; stipules erect, not connate at base, lanceolate, 4–14mm, with toothed or lacinate apex. Flowers in terminal, much-divided, subcorymbose, pedunculate cymes, shortly pedicellate. Calyx 2–2.5mm at anthesis, becoming subglobose and c 3.5mm in fruit, divided to just beyond middle into ovate, acute or subacute lobes c 1.3–1.5mm. Corolla white or very pale lilac, unpleasantly scented, 3–4mm; lobes short, becoming reflexed. Stamens pinkish, c 1mm, exerted from corolla tube. Style long-exserted. Capsule hemispherical, turgid; seeds 5–8.

**Darjeeling:** unlocalised. Marshy places and damp, shady pastures, 600–1830m. July–October.

The record from Darjeeling is based on a Griffith specimen (KD 2899, K!) which may be wrongly localised. The species is otherwise known only from specimens collected in Khasia and Silhet; it cannot be confused with any other *Neanotis* species occurring in our area on account of its very distinctive, large, very narrow leaves. Ecological information refers to the Khasia and Silhet material.

**5. *N. rhombicarpa*** Yamazaki

Diffuse annual. Stems 8–18cm, ascending, flaccid, branched divaricately, glabrous. Leaves ovate or triangular-ovate,  $1.5-4.5 \times 0.5-1.5$ cm, acute, base

shortly attenuate, glabrous; veins c 4 on each side. Stipules connate, membranous, very broadly triangular, shortly 2-awned at apex. Flowers solitary or 2-4 together in axils of upper leaves; peduncles shorter than subtending lamina. Calyx campanulate; tube c 1mm, glabrous; lobes oblong-ovate, acute, with shortly pilose margins, patelliform in fruit and then 1.5-2 × 4-5mm, with 4 setaceous teeth. Corolla white, tubular-campanulate, c 3mm, glabrous; lobes ovate, c 1mm. Filaments inserted near top of corolla tube, very short; anthers narrowly oblong, c 0.8mm, just exerted from corolla tube. Capsule rhomboid, 2-3 × 4-5mm, apex slightly emarginate and apiculate. Seeds hemispherical, c 0.8mm, finely reticulate.

**Sikkim:** Zalipur, below Gangtok. Habitat not indicated, c 1000m. Early September.

Also known from three specimens from Central and East Nepal, 650-2500m, flowering mid-late August; none of the specimens has been examined and the description is based entirely on the published description and illustrations.

**6. *N. calycina*** (Hook.f.) Lewis; *Anotis calycina* Hook.f.

Slender, diffuse, erect or ascending annual. Stems 5-25cm, 4-angled, glabrous or with sparse, whitish hairs on angles. Leaves ovate-lanceolate, 0.5-3.5 × 0.2-1.5cm, acuminate or acute, base cuneate or shortly attenuate, upper surface with scattered very short whitish hairs or glabrous, lower surface sparsely puberulent on lamina or glabrous; veins 3 or 4 on each side; stipules connate, membranous, 2-2.5mm, with a few bristles shorter than membranous part. Flowers in axillary and terminal, equally or slightly unequally dichotomous, few-flowered cymes; peduncles and secondary inflorescence branches capillary; pedicels very short. Calyx campanulate, c 1.5mm in flower and 2 × 3mm in fruit; lobes ovate, erecto-patent, becoming spreading in fruit. Corolla white or very pale pink or purple, infundibular-cylindrical, 2-3mm; tube 1.5-1.7mm, slightly longer than calyx, with ring of hairs at top; lobes oblong-ovate, obtuse, erecto-patent, c 0.5mm. Stamens inserted at top of corolla tube, included. Style included. Fruit a loculicidal capsule opening across the top. Seeds numerous (at least 20), coarsely reticulate, black.

**Bhutan:** S - Deothang district (Garrison Engineer's Camp (117)); **Darjeeling:** Kurseong, Pomong. Earth banks, walls, terraces and rock crevices, 1370-2440m. June-September.

**7. *N. wightiana*** (Hook.f.) Lewis; *Anotis wightiana* Hook.f.

Low, diffuse, branched perennial. Stems 10-50cm, crispate-pubescent with brownish-white hairs, sometimes nearly glabrous. Leaves sessile or subsessile, ovate, ovate-elliptic or ovate-orbicular, 0.5-3 × 0.3-1.8cm, subacute, base cuneate, crispate-pubescent above and (especially on veins) beneath; veins usually 4 on each side. Stipules connate, membranous, with lanceolate teeth. Flowers in sessile, capitate, few-flowered cymes, terminal or on short axillary branches,

each cyme subtended by a pair of leaves. Pedicels very short. Calyx tube c 0.5mm at anthesis with minute teeth (c 0.1mm), enlarging in fruit to c 1.3mm; teeth remaining erect. Corolla white or pale lilac (our area), cylindrical-campanulate, 1.5–2mm; tube glabrous within; lobes 4 or 5, oblong-ovate, c 0.3mm, with relatively long (c 0.15mm) fine bristles outside. Stamens 4 or 5; filaments glabrous, inserted near base of corolla; anthers c 0.2mm, blue or black, exerted from corolla tube, equalling lobes. Style subequalling corolla, stigmas 2 or 3. Fruit compressed-orbicular or -ovoid, c 2 × 1.5mm, indehiscent except at top, 2-, 3- or 4-locular. Seeds 1 or 2 per loculus.

**Bhutan:** S – Gaylegphug district (Rani Camp (38)); **Darjeeling:** Ging, Darjeeling, Singtam, Rississum, Kalimpong, Tanglu, etc. Grassy forest clearings, pasture, paddy-fields, roadsides, 900–3050m. July–November.

Variable in the number of floral parts. Clarke (on herbarium specimen) has noted an apparent correlation between flower colour and number of capsule loculi, white flowers having 2-locular fruits, ‘blue’ ones 4-locular and ‘pale blue’ ones 3-locular. This variation requires further study in the field and laboratory. Unlocalised specimens labelled ‘Sikkim’ are probably from Darjeeling District.

## 18. KOHAUTIA Chamisso & Schlechtendal

by R.R. Mill

Annual or perennial, erect herbs. Leaves sessile, opposite, linear, midrib prominent beneath. Stipules connate into a membranous sheath. Inflorescence a terminal, panicle-like thyrses (often ‘broom-like’); bracts opposite, those at base of inflorescence leaf-like, those subtending pedicels and partial inflorescence branches rudimentary. Calyx campanulate with shortly obovoid to globose tube surmounted by 4 (rarely 5) short lobes. Corolla tube narrowly cylindrical, dilated and barrel- or narrowly funnel-shaped just below lobes; lobes narrowly linear to broadly elliptic. Stamens included; anthers subsessile. Ovary bilocular, ovules numerous. Style included, with 2 filiform stigmatic lobes or a single, fused stigma. Fruit a hemispherical to ellipsoid capsule, loculicidally dehiscent at apex. Seeds numerous, roundish, pale brown or blackish.

**1. K. gracilis** (Wall.) DC.; *Hedyotis gracilis* Wall., *Oldenlandia gracilis* (Wall.) Hook.f.

Slender, erect, strict annual. Stems 15–60cm, simple or sparsely branched below, scabridulous (or glabrate) and terete below, glabrous and angled above. Leaves sessile, thin and membranous, flat, linear, 35–90 × 2–5.5mm, acuminate, base gradually attenuate, glabrous. Stipules membranous, truncate, connate. Flowers in a much-branched, terminal, somewhat broom-like thyrses of cymes, each node with 2 unequal branches and a shortly pedicellate alar flower; peduncles strictly ascending to erect, 4–8cm; pedicels very slender, 4–30mm (those

on lateral branches much longer than those of alar flowers), each subtended by a pair of narrowly lanceolate bracts c 1.5mm. Calyx tube (including hypanthium) 1–1.5mm, dark green, turning violet, with truncate mouth surmounted by 4 suberect, narrowly ovate-triangular lobes 1–1.5mm much paler than tube. Corolla fawn-coloured, salverform; tube very narrowly cylindrical, 9–12mm, slightly dilated just below lobes; lobes with yellow-green tinge within and purplish tinge outside, narrowly oblong, c  $4 \times 1$ mm, obtuse. Fruit an obovoid, globose or hemispherical capsule, very variable in size.

**Darjeeling/Sikkim:** unlocalised Hooker collection; **West Bengal Duars:** Jalpaiguri etc. Dry rocky hillsides, burnt grassland, etc., c 300–2000m. February–April.

Flowers open at night and are moth-pollinated.

A second species, *K. coccinea* Royle, occurs in N India and Nepal; it has a shorter (2.5–5.5mm), greenish-red to purplish-white corolla tube and broader corolla lobes which are scarlet, red, orange, pink or lilac above and paler beneath with darker veins. It occurs in similar habitats to *K. gracilis* but has so far not been recorded from our area. Its flowers are normally butterfly-pollinated by day.

## 19. SPIRADICLIS Blume

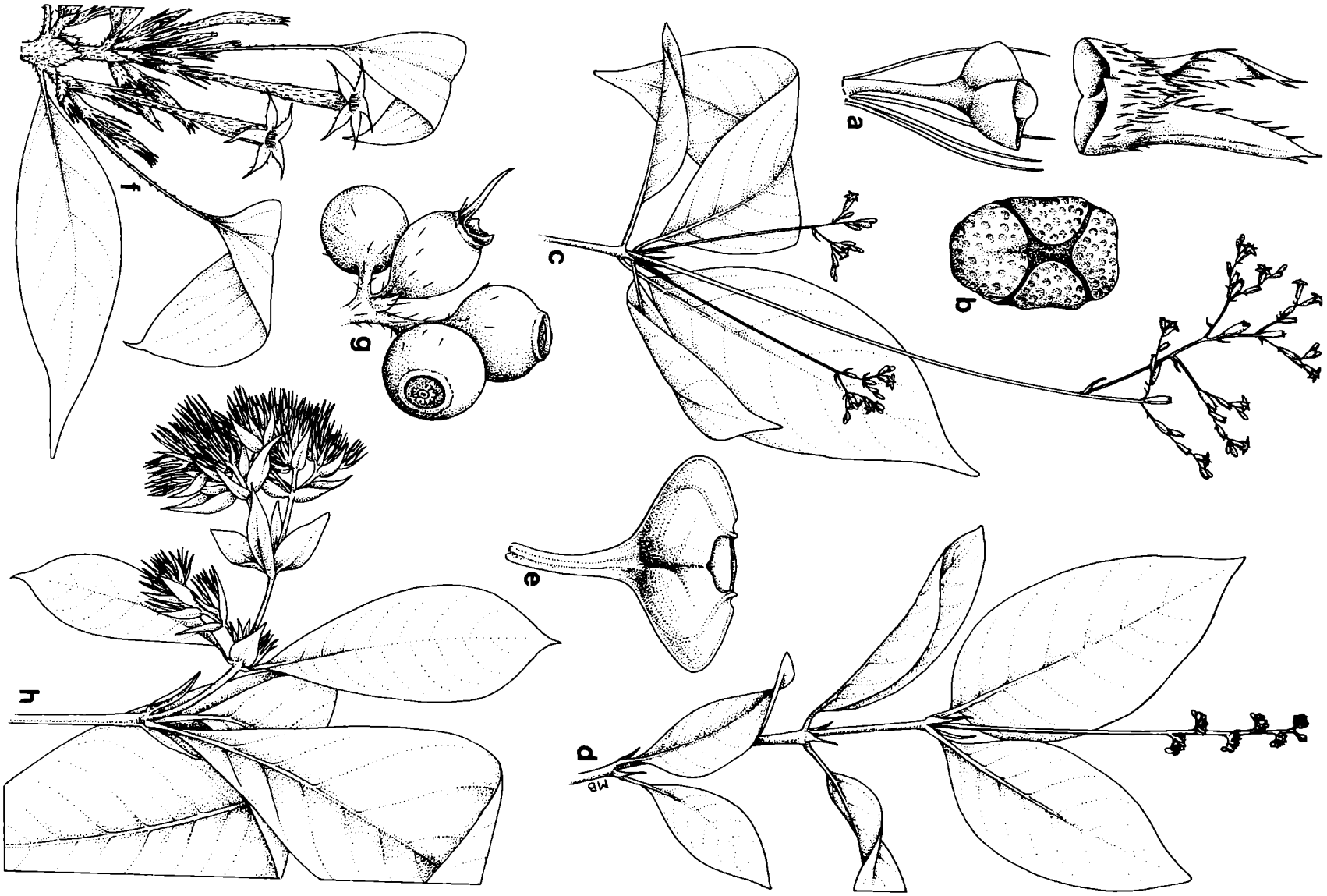
by L.S. Springate & J. Wright

Herbs or subshrubs. Leaves opposite or pseudoverticillate. Stipules long-cuspidate. Inflorescence of lax terminal and subterminal cymes; pedicels very short. Flowers many, small, 5-merous. Hypanthium obovoid or cylindrical, calyx tube obsolete, lobes small. Corolla narrowly campanulate, tube exceeding calyx; lobes obtuse. Anthers oblong, tips exerted. Ovary 2-locular, ovules numerous; style filiform, stigma bifid. Capsules small, narrowly oblong, 4-valved; calyx persistent; seeds numerous, minute, angled.

**1. *S. cylindrica*** Hook f.; *S. caespitosa* Blume forma *subimmersa* H.S. Lo p.p. Fig. 73c.

Slender creeping herb, 10–50cm. Stems woody and branched at base, slender and pilose above. Leaves opposite, upper often pseudoverticillate, often anisophyllous (two large, two small), elliptic, 6–8  $\times$  2–4cm, acuminate, base obtuse to attenuate, glabrous, entire; petioles to 10mm. Stipules to 10mm. Inflorescence a terminal cyme, to 20cm, smaller cymes also sometimes developing in axils of leaves of uppermost verticil. Axes slender, glabrous. Bracts linear, to 5mm.

FIG. 73. **Rubiaceae.** a–b, *Mitracarpus hirtus*: a, capsule ( $\times 14$ ); b, seed ( $\times 30$ ). c, *Spiradiclis cylindrica*: habit ( $\times \frac{2}{3}$ ). d, *Polyura geminata*: habit ( $\times \frac{2}{3}$ ). e, *Ophiorrhiza heterostyla*: capsule ( $\times 5$ ). f–g, *Mussaenda roxburghii*: f, flowering shoot ( $\times 1$ ); g, fruit ( $\times 2$ ). h, *Myrioneuron nutans*: flowering shoot ( $\times \frac{2}{3}$ ). Drawn by M. Bates.



Calyx to 1mm, glabrous, lobes ovate. Corolla white, glabrous, tube c 3.5mm; lobes ovate, c 1.2mm. Style exceeding anthers. Capsules erect, pale, c 4.5mm.

**Bhutan:** S – Gaylegphug district (Sham Khara and Maorey forests). On rocky, wooded slopes, 1500–1650m (117).

No specimens have been seen from our area and confirmation is desirable. The description is based on material from the Khasia Hills. The record might equally refer to *S. arunachalensis* Deb & Rout (*S. caespitosa* forma *subimmersa* sensu stricto), which differs in its narrower, elliptic leaves, pubescent hypanthium, calyx, corolla and fruit and anthers included near the middle of the corolla tube.

## 20. POLYURA Hook.f.

by J.R.I. Wood

Small herb with decumbent rooting stems. Leaves opposite, becoming crowded towards tips and sometimes apparently whorled, petiolate; stipules filiform from a broad base. Inflorescence a long-pedunculate, terminal, raceme-like panicle; flowers minute, crowded into rows between bracts on the two branches of small cymes arising alternately along axis of inflorescence. Bracts imbricate, persistent. Calyx with a subglobose tube and 5 small, erect, persistent teeth. Corolla shortly tubular, valvate in bud, 5-lobed, densely hairy in throat; stamens inserted in middle of tube, filaments linear, half-exserted; ovary 2-celled, ovules numerous, style filiform with 2 stigmas. Capsule subglobose, many-seeded.

*Polyura* bears a strong superficial resemblance to *Ophiorrhiza* but can be readily distinguished by the subglobose capsule and by the distinctive elongate, raceme-like inflorescence.

### 1. *P. geminata* Hook.f. Fig. 73d.

Small decumbent herb drying reddish; stems simple or branched at base, scurfy-pubescent, 10–25cm. Leaves equal or slightly unequal, obovate, oblanceolate, oblong or elliptic, 3–14 × 2–4.5cm, apex acute, base broadly or narrowly cuneate, green above, glabrous, greyish beneath, scurfy-pubescent especially on veins; petioles 0.3–1.2cm. Inflorescence 5–8cm in flower, elongating to 16cm in fruit, peduncle and cymes pubescent; cymes cluster-like in flower, c 0.5cm, in fruit distinctly 2-branched, branches recurving or subscorpioid, up to 2cm. Bracts oblong, obtuse, 4mm. Calyx teeth ovate, 1mm, longer than tube. Corolla 3mm, slightly bulbous at base, white, pubescent outside. Capsule 1mm, pubescent.

**Bhutan:** S – Gaylegphug district (Tatopani). Margins of subtropical forest, 700m. May–July.

## 21. OPHIORRHIZA L.

by J.R.I. Wood

Small forest herbs and undershrubs. Stems erect from a creeping rootstock, mostly 10–60cm, often entirely herbaceous, sometimes woody below, occasionally fleshy. Leaves simple, equal or unequal in each pair, broadly oblong-elliptic, petiolate; petioles often unequal in length; stipules deciduous or persistent, filiform, lanceolate or ovate, the broader often bifid or even lacinate. Flowers in terminal and sometimes axillary, pedunculate, dichotomous cymes, often compact in flower but becoming branched and scorpioid in fruit. Bracts and bracteoles present or absent. Calyx small, with suborbicular tube and 5 small, usually persistent teeth. Corolla tubular, sometimes widened above, white, pink or greenish, often dimorphic because of heterostyly, 5-lobed, usually valvate in bud; lobes sometimes with a prominent keel on dorsal side. Stamens 5, inserted in tube, subsessile; anthers linear. Disc large, 2-lobed; ovary 2-celled, ovules many in each cell; style filiform, long or short, with 2 stigmas. Fruit a compressed obcordate capsule, dehiscent by 2 large valves, many-seeded; seeds very small, angled.

1. Bracts and bracteoles deciduous before flowering time or, if present, few, filiform, lacking a central nerve ..... 2
  - + Bracts and bracteoles present until after fruit ripens, linear, oblong or elliptic with a distinct midrib ..... 5
  
2. Corolla pubescent, 6–9mm; capsule pubescent; leaves 1.5–6(–8)cm ..... **4. O. rugosa**
  - + Corolla glabrous, 9–15mm; capsule glabrous; most leaves more than 6cm ..... 3
  
3. Corolla lobes 4–5mm, usually reflexed; peduncle up to 2cm; plant anisophyllous ..... **1. O. heterostyla**
  - + Corolla lobes 1–2mm, usually erect; peduncle of flowering and fruiting plants 2–9cm; plant isophyllous ..... 4
  
4. Leaves completely glabrous, even on veins below; calyx teeth very short, c 0.5mm; inflorescence slightly fleshy ..... **2. O. ochroleuca**
  - + Leaves scurfy pubescent on veins below; calyx teeth 1–2mm; inflorescence not fleshy ..... **3. O. rosea**
  
5. Bracts and bracteoles glabrous ..... 6
  - + Bracts and bracteoles hairy at least on margins ..... 9

6. Bracts broadly elliptic, 8–9mm wide; corolla curved, 14–17mm  
12. *O. longii*  
 + Bracts/bracteoles all linear-oblong, up to 3mm wide; corolla 4.5–10mm 7
7. Leaves strictly glabrous below; peduncle 0.3–4cm, deflexed, inflorescence nodding; plant suffused with dark red ..... 7. *O. succirubra*  
 + Leaves scurfy pubescent below, at least on veins; peduncle 3–6cm, erect; plant green ..... 8
8. Leaves scurfy pubescent only on veins below, sparsely pilose above; inflorescence relatively lax, with distinct scorpioid branches; calyx teeth persistent on ripe capsule ..... 5. *O. thomsonii*  
 + Leaves uniformly scurfy pubescent below, glabrous above; inflorescence a compact head, c 2cm wide; calyx teeth deciduous in fruit ..... 6. *O. lurida*
9. Corolla 1.5–1.7cm, in bud with prominent 1–2mm spurs on back of lobes; leaves unequal ..... 11. *O. repens*  
 + Corolla 0.9–1.5cm, valvate in bud but not spurred on back of lobes; leaves equal ..... 10
10. Corolla glabrous outside; inflorescence nodding; plant covered in multicellular brown hairs ..... 8. *O. nutans*  
 + Corolla hairy outside; inflorescence erect; plant glabrous or hairy but not with multicellular brown hairs ..... 11
11. Peduncle 0–3cm; plant crisped-hirsute; corolla tube densely long-pubescent within above anthers ..... 9. *O. treutleri*  
 + Peduncle 2.5–12cm; plant pubescent; corolla tube papillose or sparsely pubescent within above anthers ..... 10. *O. fasciculata*

**1. *O. heterostyla*** Dunn; *O. seshagiriana* Sikdar & Maiti. Fig. 73e.

Stems 0.5–1.5m, woody, glabrous, grey. Leaves very unequal, broadly lanceolate or oblong-elliptic, falcate, 4–16 × 1–4.5cm, shortly acuminate, base attenuate, dark green above, paler beneath, completely glabrous; stipules filiform from a broad base, c 3mm. Cymes terminal, usually solitary, glabrous or scurfy, lax to moderately dense with distinct scorpioid branches, 1.5–3.5cm long and wide; peduncle very short, 0.4–2cm. Bracts and bracteoles filiform, unveined, 1–2mm, glabrous, quickly deciduous. Calyx c 2.5mm, teeth c 1mm, not persistent on capsule. Corolla 10–11mm, white, glabrous outside, pubescent and with a ring of hairs inside; lobes oblong, reflexed, 4–5mm. Capsule 4–6mm wide, glabrous.

**Bhutan:** S – Sarbhang district (Loring Falls); **West Bengal Duars:** Buxa to Singchhu La. Warm broad-leaved forest, 1220–1800m. March–May.

This is the only species in the area with long recurved corolla lobes.



## 2. *O. ochroleuca* Hook.f.

Stems 30–60cm, woody below, succulent above, glabrous, grey. Leaves equal, oblong-elliptic, 6–19 × 3–7cm, acute or shortly acuminate, base cuneate, green above, whitish below, slightly succulent, completely glabrous even on veins; stipules filiform from a broad base, c 0.5cm, usually deciduous. Cymes usually solitary and terminal, puberulent-papillose, rather lax, distinctly 5–8 branched with scorpioid branches, c 4–7 × 4–5cm; peduncle 1–2cm in flower, elongating to 5–9cm in fruit. Bracts filiform, glabrous, unveined, 2.5–5mm; bracteoles scale-like, c 1.5mm. Calyx c 1.5mm, teeth 0.5mm or less. Corolla 10–13mm, yellowish-white, glabrous outside, hairy inside usually with a dense ring of hairs above anthers, clearly valvate in bud; lobes triangular, erect, c 1mm. Capsule 5–7mm wide, glabrous.

**Bhutan:** S – Phuntsholing district (Kamji (117)) and Gaylegphug district (Aie Bridge), C – Mongar district (Zimgang); **Darjeeling:** Rongsong, Damsong, Pomong etc. Subtropical, broad-leaved forest, 300–1800m. May–November.

Distinctive on account of the completely glabrous vegetative parts.

## 3. *O. rosea* Hook.f.

Stems 30–80(–100)cm, woody below, herbaceous above, glabrous or scurfy, red-brown. Leaves equal, often arranged in a pseudowhorl below inflorescence, obovate-elliptic, 6–17(–22) × 2–9.5cm, acute or shortly acuminate, base cuneate, green on both surfaces, glabrous above except for a few scattered hairs, scurfy on veins below, stipules filiform from a broad base, c 0.5cm, usually deciduous. Cymes usually solitary and terminal, papillose-pubescent, lax, distinctly branched, usually broadly pyramidal, 3–9 × 3–6cm; peduncle 2–7cm. Bracts filiform, glabrous, unveined, c 8mm; bracteoles scale-like, 1.5mm, glabrous, both quickly deciduous and often absent. Calyx c 2mm, teeth 0.5–0.75. Corolla 9–15mm, whitish in bud, angled and rounded at tip, reddish in flower, glabrous outside, glabrous or hairy inside; lobes ovate, erect, c 2mm. Capsule 6–8mm wide, glabrous.

**Bhutan:** S – Chukka district (Giengo), C – Tongsa district (Dakpai); **Darjeeling:** Singtam, Mongpu, Rimbi Chhu, Lebong, Darjeeling; **Sikkim:** Myang Chhu. Moist broad-leaved forest, 1050–1970m. May–September.

## 4. *O. rugosa* Wall.; *O. harrisonii* G. Don var. *rugosa* (Wall.) Hook.f., *O. prostrata* D. Don

Stems 10–20cm, herbaceous, coarsely hirsute, especially above. Leaves equal, elliptic, 1.5–8 × 0.6–3cm, narrowed to an obtuse apex, base cuneate, sparsely hispid-pilose above, paler and scurfy on veins beneath, sometimes suffused with red; petioles often unequal in length; stipules filiform from a broad base, 2–2.5mm, soon deciduous. Cymes usually solitary and terminal but occasionally also from uppermost leaf axils, glandular-pubescent, often reduced and subcapitate, always few-flowered, rarely distinctly branched, 1.5–2.5 × 1–2cm; peduncle 1.4–4cm. Bracts and bracteoles filiform, unveined, 2–3.5mm, soon deciduous.

glabrous or scurfy. Calyx c 2mm, teeth c 0.75mm. Corolla 6–9mm, white or pale pink, scurfy-pubescent outside, hairy inside, angled in bud, valvate; lobes ovate, erect, 1.5–2mm. Capsule 4mm wide, pubescent.

**Bhutan:** C – Punakha district (Tinlegang), N – Upper Kulong Chu district (Tobrang); **Darjeeling:** Budhwari; **Sikkim:** Choka, Phusum; **West Bengal Duars:** Jalpaiguri (174). In shade in forest and on banks by streams and paths, 1750–2750(–3400)m. May–July.

*O. rugosa* is a very variable and ill-defined species but all plants from our area appear to belong to var. *rugosa*. It can be recognised by its herbaceous habit and fugacious unnerved bracts.

### 5. *O. thomsonii* Hook.f.

Stems 10–20cm, herbaceous, scurfy. Leaves equal, ovate-elliptic, 2–8 × 0.8–3.5cm, obtuse, base cuneate, sparsely hispid-pilose above, scurfy on veins beneath, paler beneath; stipules linear from a broad base, 7–8mm. Cymes usually solitary and terminal but sometimes also from uppermost leaf axils, glabrous or slightly papillose, usually distinctly and delicately branched, 1–2.5cm long and wide; peduncle 3.5–6cm. Bracts and bracteoles glabrous, linear, distinctly 1-veined, 4–6mm, persistent. Calyx 1.5–2mm, teeth c 0.75mm. Corolla 6–7mm, white with a pink flush, glabrous or obscurely papillose outside, inside hairy with a distinct ring of hairs above anthers, lobes triangular, c 1.5mm. Capsule 4–5mm wide, glabrous.

**Darjeeling:** Kurseong, Rambhi Chu, Dumsong, Labha, Ghum, Darjeeling; **Sikkim:** Gangtok, Pakhyong, Kabi. Broad-leaved forest, 1500–2300m. June–September.

A slender herb similar to *S. rugosa* with which it is often confused but readily distinguished by its persistent, distinctly nerved bracts.

### 6. *O. lurida* Hook.f.

Stems 2–10(–15)cm, herbaceous, scurfy. Leaves equal, broadly oblong-elliptic, 2.5–8 × 1–4cm, obtuse, base broadly cuneate, glabrous above, scurfy below, 'lurid' green on both surfaces; stipules filiform from a wide base, c 5mm. Cymes usually solitary and terminal but sometimes also from uppermost leaf axils, glabrous or slightly scurfy, dense, subcapitate, c 2cm long and wide; peduncle slender (2–)3–6cm. Bracts and bracteoles glabrous, oblong-linear, falcate, 1-veined, 6–7mm, persistent. Calyx 1.25–1.5mm, teeth c 0.5mm, not persistent on fruit. Corolla 4.5–5.5mm, widened near mouth, white tinged pink, nearly glabrous outside, hairy inside; lobes ovate, acute, erect, c 2mm. Capsule c 5mm wide, glabrous.

**Darjeeling:** Pankhabari, Kurseong, Mongpu, Chunabati, Rishap, Rambhi, Kalijhora. 300–1500m. May–September.

### 7. *O. succirubra* Hook.f.

Stems 10–40cm high, herbaceous, glabrous, red-brown. Leaves equal, oblong-elliptic, 5–16 × 1.2–6.5cm, shortly acuminate, base cuneate, sparsely hispid-pilose above, completely glabrous below, green flushed red; stipules filiform with a triangular base, 3–4mm. Cymes solitary, terminal, nodding, pubescent, compact and umbel-like, 1.5–2cm long, 1.5–4.5cm wide; peduncle short, nodding, 0.3–4cm. Bracts narrowly elliptic, acuminate, glabrous, 1-veined, c 12mm, persistent; bracteoles oblong-elliptic, acute, glabrous, 1-veined, 10–11mm. Calyx 1.5–2mm, teeth 0.5–0.75mm. Corolla 8–10mm, pink, glabrous outside, inside with a ring of hairs above anthers; lobes ovate, erect, 2mm. Capsule papillose-puberulent, 10–11mm wide.

**Bhutan:** C – Tashigang district (Gomchu (117)); **Darjeeling:** Mongpu, Rambi, Ghumpahar, Rangirum. Damp forest, 1980–2400m. July.

Usually distinctive because the whole plant is suffused with a dull red colour.

### 8. *O. nutans* Hook.f. Lep: *Lungrip*.

Stems 15–30cm, herbaceous, pubescent with brown multicellular hairs. Leaves equal, oblong-elliptic, 4–16 × 1.8–5.5cm, shortly acuminate, base cuneate, thinly pilose above, pubescent with multicellular hairs on veins beneath, dark green above, paler beneath; stipules broadly triangular, sometimes split, ciliate with red-brown hairs, 6–9(–15)mm, persistent. Cymes almost always solitary and terminal, nodding, pilose with multicellular hairs, compact, subcapitate, c 2cm long and 3cm wide; peduncle 2–5cm. Bracts oblong, ciliate, 1-nerved, 10–12mm, persistent; bracteoles similar but 7–8mm. Calyx 2–3mm, teeth 1–1.5mm. Corolla 9–11mm, slightly swollen at base, glabrous outside, hairy inside; lobes ovate, c 2.5mm. Capsule sparsely pilose, 7–8mm wide.

**Darjeeling:** Rambi Chhu, Sonada, Darjeeling, Ghum, Mongpu, Labha, Algorah, Kurseong. Moist forest, 1370–2300m. May–August.

Easily recognised by the red-brown multicellular hairs that clothe the whole plant.

### 9. *O. treutleri* Hook.f.

Stems 10–35cm, herbaceous, slightly fleshy, crisped-white-hirsute. Leaves equal, elliptic, 3–10 × 1.5–5cm, acute, base cuneate, thinly pilose above, paler beneath with prominent crisped-pubescent veins; stipules spreading, ovate, acuminate, often split, sparsely hairy, 9–12mm, persistent. Cymes terminal, usually solitary, sometimes 2–3, compact in flower, c 2–3 × 1.5–2.5cm, becoming clearly branched in fruit with branches 2–3cm, crisped-pubescent; peduncle 0–3cm. Bracts and bracteoles linear-oblong, ciliate, 1-nerved, 7–11mm, persistent. Calyx 1.5–2mm, teeth 0.75–1.5mm. Corolla 10–12mm, white or pink, drying yellow, crisped-pilose outside, long-pubescent inside; lobes narrowly ovate, erect, acute, c 3mm. Capsule pubescent, 6–8mm wide.

**Bhutan:** C – Mongar district (Saling); **Darjeeling:** Kurseong, Birch Hill, Senchal, Rambi Chhu, Darjeeling; **Sikkim:** Gangtok, Lebong, Phusum etc.;

**West Bengal Duars:** Jalpaiguri (174). In moist broad-leaved forest, sometimes on rocks, in coniferous plantations, 1600–2340m. June–October.

**10. *O. fasciculata* D. Don**

Stems 10–40cm, often woody below, glabrous or scurfy, more often branched than in other species. Leaves equal, ovate-elliptic, 2–14 × 1.5–6cm, acute, base cuneate and often decurrent, glabrous or thinly pilose above, scurfy on veins beneath; stipules filiform from triangular base, ciliate, 4–7mm. Cymes solitary, terminal or terminal with lateral cymes overtopping central one, compact in flower, becoming strongly divaricate in fruit, 1–6cm long, 2–10cm wide, often flattened in shape, pubescent; peduncle 2.5–12cm. Bracts and bracteoles linear-oblong, acuminate, pubescent, 1-veined, 10–12mm, persistent. Calyx c 2mm, teeth 0.75mm. Corolla 10–15mm, widened at mouth, white flushed with pink, drying yellow, pubescent outside, glabrous, papillose or sparsely pubescent inside; lobes ovate, 2–2.5mm. Capsule pubescent, 6–10mm wide.

**Bhutan:** S – Gayleghug district (Tatapani) and Deothang district (W. of Deothang), C – Punakha district (Rinchu, Pho Chu hot springs) and Mongar district (Saleng); **Darjeeling:** common; **Sikkim:** Gangtok. On rocky banks and steep slopes in and near moist subtropical forest, 150–1500(–2130)m. May–October.

Can be confused with *O. treutleri* but much less hairy, cymes with a much longer peduncle, vestiture within corolla tube reduced.

**11. *O. repens* (G. Don) Bennet; *O. calcarata* Hook.f.**

Stems 20–25cm, scurfy pubescent. Leaves unequal, ovate or oblong-elliptic, 4–10 × 1.7–3.5cm, acute, base cuneate, thinly pilose above, brownish-pilose on veins beneath; stipules lanceolate, long-acuminate, 7–8mm. Cymes solitary, terminal, capitate, c 2cm long, 3cm wide, red-brown-cripsed-pubescent with multicellular hairs; peduncle 1–2cm. Bracts and bracteoles linear-lanceolate, acute, ciliate, 1-veined, 6–7mm. Calyx 2–3mm, teeth 1–1.5mm. Corolla 15–17mm, widened near mouth, colour not known, outside pubescent, inside with a ring of hairs, in bud with 1–2mm spurs on the back of lobes; lobes 2mm. Capsule not seen.

**Bhutan:** S – Deothang district (Chenari (117)); **West Bengal Duars:** Jalpaiguri (174). Habitat unknown. August.

**12. *O. longii* Wood**

Stems 10–15cm, herbaceous, glabrous below, bifariously pubescent above, dark green. Leaves equal, ovate or broadly elliptic, 4–8 × 2–4cm, acute, base broadly cuneate to rounded, above dark green and glabrous, beneath paler, glabrous except for scurfy veins; stipules filiform with a broad base, glabrous, 8–9mm. Cymes solitary, terminal, dense, c 2.5cm long and wide; peduncle 1.5–3.3cm. Bracts obovate, obtuse, glabrous, 9–10 × 7–8mm, persistent; bracteoles similar but oblong, 8 × 2mm. Calyx c 1.5mm, teeth 0.5mm. Corolla

14–20mm, white tinged pink, curved, glabrous outside, pilose inside; lobes triangular, erect, c 4mm. Capsule not known.

**Bhutan:** C – Tongsa district (Dakpai). Ravine in moist forest, 1650m. June. The obovate bracts are quite distinctive.

## 22. MUSSAENDA L.

by J.R.I. Wood

Small shrubs of open subtropical forest and secondary scrub, readily recognised in Bhutan by the curious white petaloid calyx lobes which develop on some flowers and contrast strongly with the green leaves and small orange corollas. Stems usually erect (scrambling and perhaps climbing in *M. glabra*) and branched (often simple in *M. incana*), 1–6m; bark grey or brown, flaky. Leaves in opposite pairs, equal, petiolate, usually large and hairy at least on veins, green above, greyish beneath; stipules lanceolate, or ovate, usually forked, often with a group of glands on inner surface near base, deciduous. Inflorescence terminal or from uppermost leaf axils, formed of compact or lax (bi-)trichotomously branched corymbs with lateral branches soon overtopping the central flower or branch, usually many-flowered; flowers usually heterostylous, short-styled forms with slightly longer anthers and shorter hairs inside corolla tube. Bracts and bracteoles lanceolate, soon deciduous. Calyx with short, cylindrical tube, usually 2–4mm, 5-lobed; lobes filiform, lanceolate or oblong-elliptic, usually pilose outside but sometimes with one lobe transformed into a large, petiolate, brilliant-white petaloid structure, similar in size and shape to leaves. Corolla with greenish, cylindrical tube, usually slightly widened upwards, and 5 spreading orange lobes, hairy outside and also inside tube. Stamens sessile, inserted in upper half of corolla tube; anthers linear. Disc circular; ovary 2-celled, ovules numerous; stigmas 2. Fruit a fleshy, globose or ellipsoid berry, disc usually persistent and, in *M. roxburghii* and *M. incana* the calyx also; seeds numerous, very small.

The following species are not easily or reliably distinguished by single clearcut characters, so the key needs to be used cautiously. However, a cluster of habit, leaf, inflorescence, calyx, corolla and fruit characters are associated with each species and the descriptions should be carefully checked against a particular specimen to be certain it is correctly named.

1. Inflorescence very dense, subcapitate even in fruit; occasionally somewhat lax but then leaves subsessile; corolla lobes 2–3mm wide; calyx persistent on ripening fruit ..... 2
- + Inflorescence lax or very lax, distinctly branched even in flower; leaves petiolate; corolla lobes 2–5mm wide; calyx deciduous soon after corolla falls ..... 3

2. Corolla lobes terminating in hair-point 1–2mm; leaves petiolate, typically elliptic; berry glabrous; shrub 1–4.5m ..... **1. *M. roxburghii***  
 + Corolla lobes acute or acuminate, lacking a hair-point; leaves sessile, typically ovate; berry pilose; small undershrub less than 1m .. **2. *M. incana***
3. Calyx lobes oblong or oblong-elliptic, tapering from middle only; berry pilose, distinctly longer than broad ..... **3. *M. macrophylla***  
 + Calyx lobes lanceolate or filiform, tapering from base; berry glabrous, globose ..... **4**
4. Calyx lobes 4–8(–10); corolla lobes 3.5–5mm wide; leaves 4–13cm wide ..... **4. *M. treutleri***  
 + Calyx lobes 1–4mm; corolla lobes 2–3mm wide; leaves up to 4.5(–5.5cm) wide ..... **5. *M. glabra***

**1. *M. roxburghii*** Hook.f. Nep: *Dhobi Kat, Dhobine Ghas, Dhobine*; Sha: *Menchha Patong*. Fig. 73f&g.

Much branched shrub 1–4.5m. Stems glabrous or pilose with spreading hairs. Leaves petiolate, usually elliptic, rarely ovate or oblong, 5–25 × 4–9cm, acuminate at both ends, subglabrous or thinly pilose above, thinly to densely pilose below, veins adpressed pilose on both surfaces; petioles 2–15mm; stipules broadly triangular, 6–10(–14)mm. Inflorescence a dense terminal head, usually 3-branched from base, but undifferentiated, many-flowered. Calyx lobes filiform, tapering from base, 6–9mm × 1mm, densely covered in long silky hairs. Corolla tube 2.4–2.8cm, densely covered in long silky hairs; lobes narrowly ovate, 4–8 × 2–2.5mm, terminating in a long fine hairpoint. Berry globose, 6–10mm, glabrous calyx persistent until fruit is ripe.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Gaylegphug district (Gaylegphug, Thewar Khola); **Darjeeling:** Darjeeling, Kalimpong, Siliguri etc.; **Sikkim:** Gangtok to Rangpo, Pemayangtse to Thinglen (69). Locally common in secondary scrub and at the margins of subtropical forest, 100–1200(–1850)m. May–August.

**2. *M. incana*** Wall. Lepcha: *Tumlop* (34).

Small, erect, usually simple undershrub 0.5–1m. Stems densely pilose with adpressed and spreading hairs. Leaves sessile, usually ovate, less commonly elliptic, 5–13(–20) × 1.5–6(–10)cm, acute at both ends, thinly pilose above, densely and softly pilose beneath, veins more densely hairy; petioles 0–7mm; stipules triangular, 5–8mm. Inflorescence a clearly 2–3-branched terminal corymb, laterals overtopping central branch, usually dense on each branch but comparatively few-flowered. Calyx lobes filiform, tapering from base, 5–6mm, 1mm wide, pilose with long silky hairs. Corolla tube 1.8–2.1cm, adpressed pilose; lobes ovate, acute or acuminate, 5–6 × 2–3mm. Berry globose, 10–13mm, pilose, eventually glabrescent; calyx persistent until fruit is ripe.

**Darjeeling:** Siliguri, Bamanpokhri, Dalkajhar etc. In the terai, 130–350m. May–August.

3. ***M. macrophylla*** Wall. Nep: *Dhobine Phul* (34); Lepcha: *Tumberh* (34).

Branched shrub 1–4(–6)m. Stems sparsely or densely pilose, usually with distinct rufous hairs. Leaves petiolate, broadly elliptic, less commonly ovate, 7–15 × 3–7cm, shortly acuminate at both ends, glabrous or pilose on both surfaces but always pilose on veins; petioles 3–17mm; stipules triangular, 6–8(–10)mm. Inflorescence a lax trichotomously (sometimes repeatedly) branched few-flowered terminal corymb with laterals overtopping the central flower. Calyx lobes oblong, oblanceolate or oblong-elliptic, tapering from middle, 7–15 × 1–3mm, pilose. Corolla tube 2–2.8cm, pilose upwards, lobes ovate, acuminate or shortly apiculate, 4–7 × 3–5.5mm. Berry oblong-ellipsoid, 7–13mm, pilose; calyx deciduous as soon as berry enlarges.

**Bhutan:** S – Phuntsholing district (Kamji (117)); **Darjeeling:** without exact locality. In dense secondary forest, 150–1200. May–July.

4. ***M. treutleri*** Stapf; *M. frondosa* L. var. *grandifolia* Hook.f., *M. frondosa* sensu (73) & (117) non L. Dz: *Neptenta*; Nep: *Dhobine Phul* (34); Lepcha: *Tumberh* (34).

Much-branched shrub 1.5–6m. Stems usually glabrescent below, glabrous or pilose above. Leaves petiolate, usually broadly elliptic with uppermost often ovate, 7–12 × 4–13cm, shortly acuminate at both ends, thinly pilose above, thinly to densely pilose below, sometimes subglabrous on both surfaces but veins always pubescent; petioles 3–50mm; stipules broadly ovate, 9–15mm, densely glandular inside near base. Inflorescence a large, lax, repeatedly trichotomously branched terminal corymb, up to 20cm wide and 15cm high in fruit, usually many-flowered. Calyx lobes filiform, tapering from base, 4–8(–10) × 1mm, pilose. Corolla tube 1.6–3.2cm, distinctly widened upwards, sparsely pilose; lobes broadly ovate, apiculate, 5–7.5 × 3.5–5mm. Berry globose, 8–10mm, glabrous; calyx deciduous before berry enlarges.

**Bhutan:** S – Chukka, Gaylegphug and Sarbhang districts, C – Punakha, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** common; **Sikkim:** Gangtok; **West Bengal Duars:** unlocalised. In dense valley forest, often in clearings and by rivers, 1000–2300m. May–July.

5. ***M. glabra*** Vahl; *M. andersonii* Basu & Paul. Nep: *Kange Lahara*, *Dhobine Phul* (34); Lepcha: *Tumberh-rik* (34).

Branched scrambling or climbing shrub 2.5–4m. Stems brownish, usually glabrescent below, pilose with brownish hairs above. Leaves petiolate, oblong-elliptic, 5–11 × 1–4.5(–5.5)cm, acute at both ends (rarely shortly acuminate), glabrous or thinly pilose on both surfaces, veins always adpressed pubescent; petioles 3–15mm; stipules narrowly triangular, 4–8mm. Inflorescence a lax, repeatedly (di-)trichotomously branched, terminal corymb, characteristically

also with 1–4 axillary corymbs from uppermost leaf axils. Calyx lobes triangular, tapering from base, 1–4 × 1–1.5mm, sparsely pilose. Corolla tube 13–18mm, pilose upwards; lobes ovate, acute or shortly apiculate, 3–3.5 × 2–3cm. Berry globose, 8–11mm, glabrous; calyx deciduous before fruit enlarges.

**Bhutan:** C – Tongsa district (Berthi (117)); **Darjeeling:** Rayeng, Kalimpong, Sitong, Pedong–Rishi Chhu, Chunabati, Kolbong etc. Local, at forest margins, 300–1300(–1700m). April–May.

A specimen from Bhalukhop (Darjeeling), cited as *M. mastersii* King (34), an invalid name, has not been seen. It may belong here.

### 23. MYCETIA Reinwardt

by L.S. Springate & J. Wright

Erect or bushy shrubs; stems with shiny, pale, corky bark. Leaves opposite, sometimes anisophyllous, ovate to obovate, lanceolate or oblanceolate, petiolate or sessile, glabrous to densely tomentose. Stipules large or small, foliaceous or not. Inflorescence of terminal, axillary or cauline paniculate cymes. Flowers 5-merous, often heterostylous. Bracts and calyx glandular or not. Calyx tube short, lobes ovate or linear. Corolla infundibular or broadly campanulate, yellow or white. Stamens inserted at base, middle or throat of corolla tube, anthers included or tips barely exerted. Ovary 2-locular (in our species), ovules many; style filiform, included or barely exerted, bifurcate at or above middle, lobes linear, glandular. Berries globose, fleshy or coriaceous, white, indehiscent or splitting irregularly; calyx persistent; seeds numerous, minute.

*Brachytome wallichii* Hook.f., from the Khasia Hills, would key out to this genus. It differs in its more compact, pendulous, leaf-opposed cymes and polygamo-dioecious flowering. A Griffith collection was attributed to Darjeeling, probably in error (80).

- |     |   |    |                      |
|-----|---|----|----------------------|
| 1.  | Stipules large (15–25mm), foliaceous .....                      | 3. | <b>M. stipulata</b>  |
| + + | Stipules smaller, not foliaceous .....                          |    | 2                    |
| 2.  | Bracts and calyces glandular; calyx lobes ovate-triangular      | 1. | <b>M. longifolia</b> |
| + + | Bracts and calyces eglandular; calyx lobes linear to lanceolate |    |                      |
|     |   | 2. | <b>M. nepalensis</b> |

**1. M. longifolia** (Wall.) Kuntze; *Andenosacme longifolia* (Wall.) Hook.f. Nep: *Jughas*.

Shrub to 2m, sometimes epiphytic (117). Stems hollow with yellowish, spongy bark splitting longitudinally and falling to leave woody stems. Leaves ovate to obovate, lanceolate or oblanceolate, mostly anisophyllous, (5–)12–20(–35) × 3–10cm, apex long-acuminate, base obtuse (rarely) to attenuate, lamina narrowly decurrent on petiole, hairs sparse above, often denser below and thick on



veins, midrib raised below; petioles (0.5-)2-5(-6)cm. Stipules erect, ovate-oblong or lanceolate, 5-15mm, often bidentate, sparsely pubescent. Cymes terminal, rarely axillary, moderately to extremely diffuse, shortly peduncled or sessile. Axes of inflorescence glabrous. Lower bracts foliaceous, linear-lanceolate, 2-4cm, long-acuminate. Upper bracts and stipules connate, forming membranous, dentate scales with subsessile, capitate glands at margin. Pedicels c 5mm. Flowers dimorphic. Calyx lobes ovate-triangular, 2-3(-4)mm, acute, usually glabrous, glandular; glands (1-)2 pairs, marginal, opposite (sometimes in sinus) and 1 apical, subsessile, capitate, yellow. Corolla yellow, tube 10-14mm, pubescent within; lobes ovate-triangular, c 1.5mm. Anthers 2mm, subsessile, included, inserted at base or middle of tube. Style c 3mm or 6mm; stigma bifid, included below (short) or above (long) anthers. Berry white, 4-4.5mm; seeds black, pyriform.

**Bhutan:** S - Phuntsholing district (Kamji (117)), Chukka district (Marichong), Sarbhang district (Sarbhang) and Gaylegphug district (Surelakha (38)), C - Mongar district (Zimgang); **Darjeeling:** frequent; **Sikkim:** Rathong Chhu, Dik Chhu to Gangtok (104), Pemayangtse to Thinglen. In moist habitats in forest, frequently by water, 300-1850m. May-September.

**2. *M. nepalensis*** Hara; *Adenosacme longifolia* sensu F.B.I. p.p. non (Wall.) Hook.f.

Very similar to *M. longifolia*, but differs from that species in its leaves glabrous above; inflorescence minutely pubescent; calyx lobes linear to lanceolate, 3-5.5mm; bracts and calyces lacking conspicuous glands.

**Darjeeling** or **Sikkim**, unlocalised (253); **West Bengal Duars:** Kumai. February.

Inclusion of the specimen from Kumai is doubtful. It resembles *M. longifolia* in its triangular calyx lobes. Some specimens from northern Assam also attributed to *M. longifolia* do not differ from *M. nepalensis* in all the characters described above. *Mycetia nepalensis* occurs in forest in Nepal, 1000-1800m.

**3. *M. stipulata*** (Hook.f.) Kuntze subsp. ***stipulata***; *Andenosacme stipulata* Hook.f.

Weak shrub to 2m, stems green, pubescent, hollow. Leaves broadly elliptic to oblanceolate, 18-25 × 7-10cm, shortly acuminate, shortly attenuate at base, glabrous above, glabrescent below with veins pubescent; petioles 25-45mm, pubescent; stipules foliaceous, 15-25 × 12-20mm, ovate to oblong, subglabrous. Inflorescence open, terminal, pendulous, of 3-5 compact cymes, pubescent throughout; bracts ligulate to linear-oblanceolate, to 15mm; pedicels 1-5mm. Calyx pubescent, lobes oblong, 1.5-3.5mm, acute. Corolla broadly campanulate, greenish-white, glabrous or puberulous outside; tube 2.2-2.5mm, villous within; lobes ovate-triangular, 2.5-3mm. Anthers subsessile, tips barely exerted. Style branches just exceeding anthers. Fruit 3.5-6mm across.

**Darjeeling:** Rimbi Chhu; **Sikkim:** Khechoiperi. Wet habitats in middle hill forest, 1200-1700m. July-August.

Subsp. *macrostachya* (Hook.f.) Deb differs in its ovate inflorescence bracts, glabrous leaves and inflorescences, and larger inflorescence of lax cymes. An unlocalised collection from Sikkim or Darjeeling is cited by Deb (253).

## 24. MYRIONEURON R. Brown

by J. Wright

Small shrubs with stout branches; bark thick, spongy, pale. Leaves opposite, large, entire. Stipules triangular-lanceolate, large, chartaceous. Cymes terminal, compact, corymbose or capitate, prominently bracteate; bracts lanceolate, chartaceous; pedicels very short. Flowers 5-merous. Calyx tube obsolete; lobes linear-lanceolate, much exceeding corolla. Corolla cylindrical, throat villous, lobes valvate, short. Filaments short; anthers linear, included. Ovary bilocular, ovules many; style filiform; stigma bifid,  $\pm$  included. Berries ovoid, white, dry or fleshy; calyx persistent; seeds many, minute, angled; testa rough.

### 1. *M. nutans* Kurz; Nep: *Gujguj lahara* (117). Fig. 73h.

Undershrub to 1.5m. Leaves obovate or broadly elliptic, 12–25(–35)  $\times$  6–14(–18)cm, abruptly acuminate, base attenuate, glabrous above, minutely pubescent below at least on veins; veins prominent below, laterals in (11–)13–15 pairs; petioles 0.5–2cm, minutely puberulous. Stipules 1–2  $\times$  0.5cm. Cymes usually globose, 3–6cm across, often drooping; bracts ovate or lanceolate, 1–1.5cm, long-acuminate. Calyx lobes linear-lanceolate, 10–12mm, glabrous or scabridulous. Corolla yellow, tube 5–6mm; lobes ovate, c 1.8mm, puberulous outside. Berry 4–7mm.

**Bhutan:** S – Gaylegphug district (Gaylegphug (117)); **Darjeeling?:** Singhi Jhora. Lowland forest edges, roadsides, 270m. November–December (117).

## 25. HIMALRANDIA Yamazaki

by L.S. Springate

Rigid deciduous shrubs, sometimes spinous. Leaves opposite, entire, subsessile. Flowers solitary, sessile, on short leafy spurs or rarely terminal, 5-merous. Stipules ovate, cuspidate, pubescent. Calyx tube short, exceeded by subulate lobes. Corolla infundibular, glabrous outside, tube with a ring of dense hairs inside. Anthers subsessile, inserted on rim of corolla tube, partly exerted. Ovary 2-locular; ovules 1–3 per locule, pendulous; style head fusiform with a deep longitudinal groove. Fruit indehiscent, globose, small, with persistent calyx.

**1. *H. tetrasperma*** (Roxb.) Yamakazi; *Randia tetrasperma* (Roxb.) Brandis, *Aidia tetrasperma* (Roxb.) Yamakazi

Shrub 0.5–2m, shoots pubescent at first. Leaves usually obovate, to 5 × 2cm, obtuse with a triangular cusp or subacute, cuneate at base, glabrescent or hairs persisting on veins and margins. Flowers scented. Calyx glabrous, tube dilated, c 1mm; lobes subulate, 2–4mm, rarely laminar, oblanceolate, to 8mm. Corolla greenish-white turning pale yellow, tube 8–10mm; lobes lanceolate, patent, later reflexed, 7–10mm, often pubescent inside towards base. Anthers c 3.7mm,  $\frac{2}{3}$  exerted. Ovules 2 per locule; style head shortly exerted. Fruit c 10mm across.

**Bhutan:** C – Punakha district (Mara and Pho Chu valleys, Wangdu Phodrang) and Mongar district (Lhuntse Dzong); **Sikkim:** Gangtok, Kalej Kholā, Tendong etc. Hedgerows, open slopes and in forest (Chir pine and dense mixed forests), tolerant of heavy grazing, 1200–2100m. April–May.

Sometimes the tips of some branchlets gradually pass into straight rigid spines, but this was not observed in specimens from our area.

## 26. FAGERLINDIA Tirvengadam

by L.S. Springate

Spiny shrubs, upright or scandent; spines supra-axillary, without nodal scars. Leaves opposite, entire, shortly petiolate. Stipules ovate, cuspidate. Flowers solitary or few in condensed cymes in leaf axils or on spurs, often sessile at anthesis; peduncle, bracts and bracteoles very reduced. Flowers 5-merous. Calyx lobed, tube short. Corolla hypocrateriform, hairy inside around throat. Anthers sessile, inserted on rim of tube, partly or entirely exerted. Ovary 2-locular; ovules several per locule; placentae septal; style head fusiform, longitudinally grooved, exerted. Fruit indehiscent, globose, small.

**1. *F. fasciculata*** (Roxb.) Tirvengadam; *Randia fasciculata* (Roxb.) DC., *Oxyceros fasciculata* (Roxb.) Yamakazi, *Randia rigida* (Wall.) DC. Nep: *Maidalu Sanu*, *Bosanti* (34), *Choota Maidalu* (117),

Evergreen shrub, 0.6–3.6m; shoots, petioles and inflorescences puberulous or strigillose, at least when young; spines straight, c 10mm. Leaves ovate to oblong, 3–10 × 1.5–3.5cm, obtuse with a broad triangular cusp, truncate to attenuate at base, some hair at least on midrib beneath; petioles 4–10mm. Stipules caducous, 2–4(–6)mm. Cymes of 1–5 sessile flowers, terminating leafy or leafless lateral shoots, hairy. Flowers fragrant. Calyx hairy outside, glabrous inside, tube dilated, 2–2.5mm; lobes linear or linear-spathulate, 3.5–4.5(–6)mm. Corolla white, ageing to yellow, almost glabrous outside; tube slender, 17–25mm; lobes ovate to oblong, c 12 × 7mm, obtuse to subacute. Anthers 7–10mm, base included. Style head briefly exerted. Fruit purplish, 6–9mm across, usually glabrous; seeds 4–18; calyx almost always deciduous.

**Bhutan:** S – Samchi, Phuntsholing, Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Punakha and Mongar districts; **Darjeeling:** Birik, Siliguri, Sitong, Tista valley etc. Wide range of habitats: scrub, forest margins, dry forest, river banks, moist evergreen forest etc., 75–1500m. (December–)March–May.

## 27. TAMILNADIA Tirvengadam & Sastre

by L.S. Springate

Small evergreen tree with decussate, supra-axillary, stiffly spreading branchlets bearing leaves and 2–4 short straight divaricate spines. Leaves opposite, entire, shortly petiolate. Stipules triangular, cuspidate. Flowers usually solitary on short leafy or leafless spurs from branches and from spiniferous branchlets, pedicellate. Calyx tube and lobes short. Corolla campanulate, glabrous apart from dense ring of hairs in throat; lobes exceeding tube. Anthers subsessile on rim of corolla tube, exserted. Ovary 2-locular with septal placentae; style head fusiform, almost bilobed, briefly exserted. Fruit fleshy, ovoid to ellipsoid, large; calyx persistent; seeds numerous, oblong, compressed.

**1. T. uliginosa** (Retzius) Tirvengadam & Sastre; *Randia uliginosa* (Retzius) DC., *Xeromphis uliginosa* (Retzius) Maheshwari. Nep: *Pilanr* (34). Fig. 74a.

Tree, 4.5–12m; shoots 4-angled, pubescent at first; bark reddish-brown, scurfy; spines 5–15mm. Leaves usually obovate, c 13–20 × 6–10cm, obtuse or subacute, cuneate at base, glossy and glabrous above, glabrescent or hairs persisting on veins beneath; petioles c 5mm. Flowers scented; pedicels 4–20mm. Calyx subglabrous, tube c 2.2mm; lobes c 2mm, rounded, ciliate. Corolla white, tube 12mm; lobes patent, ovate, c 20 × 20mm. Anthers c 11mm. Fruit yellow, c 50 × 40mm; seeds reddish-brown, c 5 × 3mm.

**Darjeeling:** Gulma, Siliguri (261), Sukna (261). Common in terai forest, also in Sal and subtropical forest (34), c 150m. May–June.

Dimorphic flowers have been described in this species but only flowers corresponding to the larger morph were represented in specimens from our area.

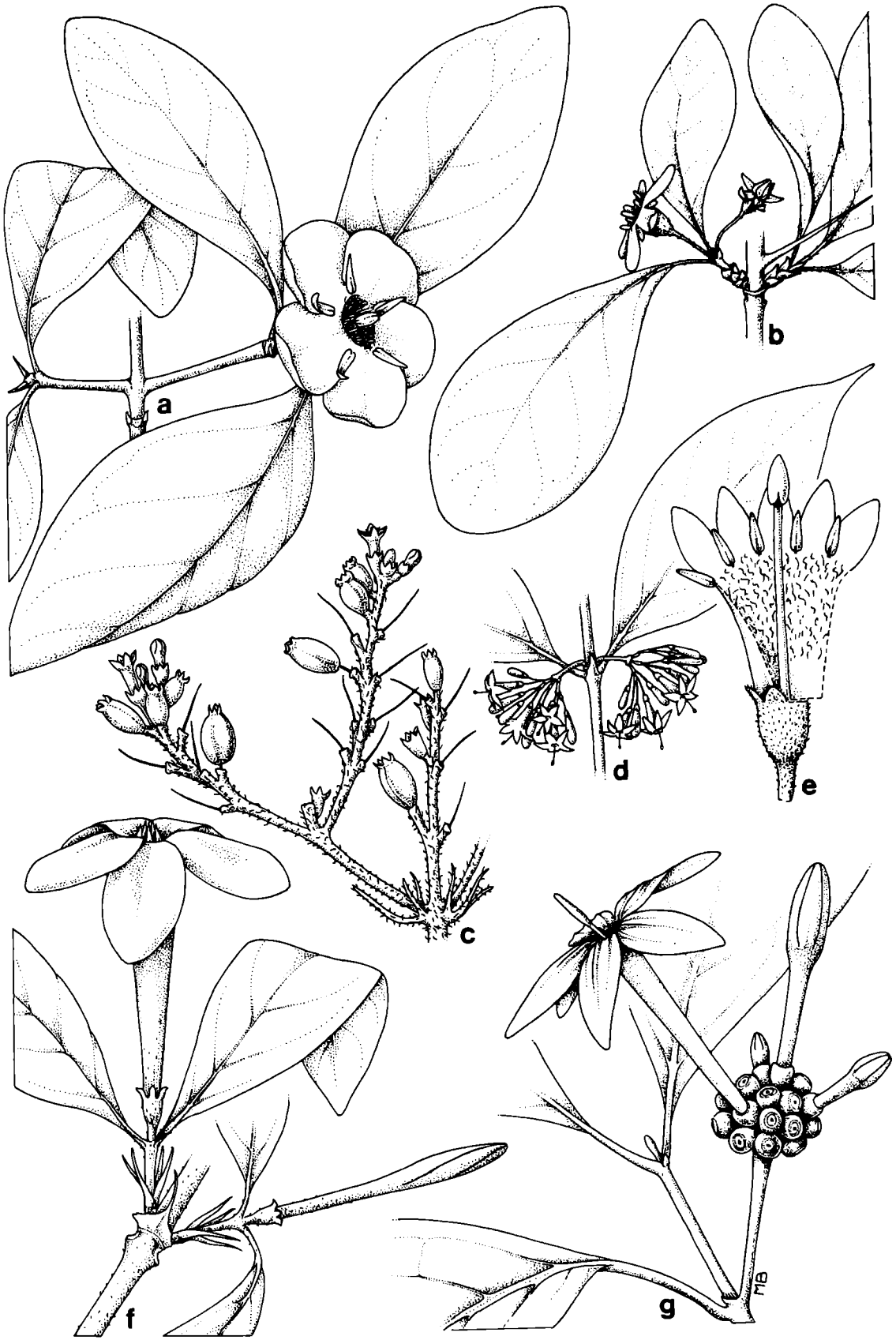
## 28. CATUNAREGAM Wolf

by L.S. Springate

Spiny, evergreen or deciduous shrubs or small trees; spines straight, supra-axillary, alternate or opposite, without nodes. Leaves opposite, entire, subsessile or shortly petiolate. Stipules ovate, cuspidate. Flowers on short spurs, 1–3

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FIG. 74. **Rubiaceae.** a, *Tamilnadia uliginosa*: flowering shoot ( $\times \frac{1}{2}$ ). b, *Catunaregam longispina*: flowering shoot ( $\times \frac{2}{3}$ ). c, *Knoxia sumatrensis*: part of inflorescence ( $\times 3$ ). d–e, *Psyrax kingii*: d, habit ( $\times 3$ ); e, dissected flower ( $\times 3$ ). f, *Psilanthus bengalensis*: flowering shoot ( $\times 1\frac{1}{2}$ ). g, *Morinda angustifolia*: flowering shoot ( $\times 1$ ). Drawn by M. Bates.



together, usually fasciculate, rarely with inflorescence axis developed, subsessile or pedicellate. Flowers 5–10-merous. Calyx lobes often irregular, linear to broad and foliaceous. Corolla narrowly campanulate to hypocrateriform; tube with a thick ring of hairs inside. Anthers subsessile, included or exerted. Ovary 2-locular with septal placentae; style head fusiform, of 2 usually coherent lobes, shortly exerted. Fruit indehiscent, ovoid to obovoid, sometimes with persistent calyx; seeds numerous, compressed.

**1. *C. longispina*** (Link) Tirvengadam; *Randia longispina* (Link) DC., *Randia dumetorum* sensu F.B.I. p.p. non (Retzius) Poiret, *Randia spinosa* auct. non (Thunberg) Blume, *Xeromphis spinosa* auct. non (Thunberg) Keay, *Catunaregam spinosa* auct. non (Thunberg) Tirvengadam. Nep: *Maidalu*, *Maidal Kankra Jat*; Sha: *Nerthung Shing*, *Shoshoma-zoo-shing*. Fig. 74b.

Small tree, 2–6m; shoots pubescent at first; spines 5–50mm. Leaves obovate, c 7–11 × 2.5–4cm, obtuse with a broad triangular cusp or subacute, cuneate at base, glabrescent or hairs persisting on veins and margins; petioles 10–15mm, pubescent. Stipules 2–5mm, ciliate, often lobulate. Flowers 1–3, fasciculate or rarely with inflorescence axis to 15mm and caducous, triangular bracts c 2mm; pedicels 4–12mm. Flowers 5-merous. Calyx tube dilated, 3–5mm, pubescent outside and on upper  $\frac{1}{3}$  inside; lobes narrowly oblong to broadly spatulate, 5–9 × 1.5–5.5mm, erect, acute or acuminate, strigillose, often alternating with denticles or rarely with smaller lobes. Corolla white, turning yellow, narrowly campanulate; tube c 5.5mm, tomentose outside; lobes obovate, 7–9 × 5.5–7.5mm, patent, obtuse, apiculate, tomentose outside and inside towards margins. Anthers c 3.2mm, attached just above base to rim of corolla tube, exerted. Fruit subglobose, 28–40 × 22–30mm, yellow, calyx very rarely persistent; seeds oblong, reddish-brown, c 5 × 3mm.

**Bhutan:** S – Sarbhang district (Jhogi Dhanra); **Darjeeling:** Badamtam, Chenga forest, Mongpu, Rangit valley etc. Sal, savannah and dry mixed plains forest of the terai and lower hill forest, 300–850m. March–May.

## 29. TARENNOIDEA Tirvengadam & Sastre

by L.S. Springate

Unarmed evergreen small tree or rambling shrub. Leaves opposite, entire, petiolate. Stipules triangular, cuspidate. Inflorescences pyramidal or corymbose, terminal but often overtopped; peduncle very short or absent; bracts triangular, small, caducous; flowers many; pedicels very short. Flowers 5-merous, small. Calyx tube short, dilated with shallow teeth. Corolla campanulate, tube with dense ring of hairs in throat, exceeded by lobes. Anthers subsessile, exerted. Ovary 2-locular; ovules 1–few per locule; style head fusiform, exerted. Fruit indehiscent, subglobose, small, without calyx; seeds (1–)2(–6), usually hemispheric.

1. **T. wallichii** (Hook.f.) Tirvengadam & Sastre; *Randia wallichii* Hook.f., *Aidia wallichii* (Hook.f.) Yamazaki

Tree to 8m or rambling shrub. Leaves coriaceous, narrowly elliptic or oblanceolate, glabrous, 11–17 × 2–4cm, acuminate, attenuate at base, glossy above; petioles c 10mm. Stipules c 8mm. Inflorescences usually dense, pubescent; bracts 1–2.5mm; pedicels c 1mm. Calyx tube c 2mm, glabrous outside. Corolla yellow, tube 3mm; lobes ovate, c 5 × 2.3mm, acuminate, spreading or reflexed. Filaments 0.6mm, inserted at rim of tube; anthers 1.8mm. Style 6.5mm. Fruit subglobose, c 10mm across; seeds c 6mm.

**Bhutan:** C – Tongsa district (Shemgang); **Darjeeling:** Kurseong, Pankhabari, Tista etc. Subtropical and warm broad-leaved forest, 300–1500m. May–June.

### 30. 'RANDIA' auct. non L.

by L.S. Springate

*Randia* L. in the strict sense is confined to the Americas, and most Asiatic species are now placed in other genera. The generic position of one species from our area formerly placed in that genus is not yet resolved.

1. **R. sikkimensis** Hook.f.

Unarmed shrub; young shoots thick, tomentose, very pithy within. Leaves opposite, ovate to oblong, acuminate, shortly attenuate at base, entire, glabrescent above, hairy on midrib and veins beneath; pairs often unequal with larger leaf c 15–22.5 × 6–10cm; petioles 10–15mm, tomentose. Stipules ovate, to 8mm, cuspidate. Cymes compact, subsessile, axillary, 3-branched, tomentose with 6–45 flowers; bracts and bracteoles triangular, 1–3mm. Calyx tube dilated, 3–4.5mm, densely hairy inside; lobes subulate, 1–2mm. Corolla broadly hypocrateriform, white fading to cream, tomentose outside and on lower half of tube within, glabrous elsewhere; tube to 23mm; lobes oblong, c 12 × 6mm, obtuse, mucronulate. Anthers subsessile, 7–8mm with 4–5mm exerted. Ovary 2-locular; style clavate, exerted. Fruit not seen.

**Darjeeling:** Pankhabari, Kalijhora, Kurseong. Lower and middle hill forest (34), 300–1200m. March–May.

In moist sites in Eastern Nepal it can form a tree to 30m with leaves to 30cm.

### 31. GARDENIA Ellis

by L.S. Springate

Unarmed evergreen or deciduous shrubs or small trees; buds resinous. Leaves opposite or verticillate, entire, shortly petiolate. Stipule pairs connate. Flowers solitary, terminal though often overtopped and displaced laterally, 5–12-merous.

Calyx subentire, regularly divided or obliquely cleft. Corolla hypocrateriform, large. Anthers subsessile, inserted on corolla tube, included to largely exserted. Ovary 1-locular or partially 2-locular with 2–8 parietal placentae; style narrowly clavate, included within corolla throat to well exserted. Fruit fleshy, often bony within; seeds numerous, immersed in pulp; calyx usually persistent.

**1. *G. augusta* (L.) Merrill; *G. florida* L., *G. jasminoides* Ellis**

Evergreen shrub, 1–2m; shoots scabridulous at first. Stipules ovate, c 8mm, cuspidate, soon chartaceous. Leaves opposite, obovate, 5.5–9.0 × 2.5–4.5cm, obtuse with a triangular cusp at apex, attenuate at base, glabrous; petioles c 2mm. Flowers subsessile, soon overtopped by lateral shoots, 5-merous, scented. Calyx glabrous, tube c 4mm, 5-ribbed; lobes subulate, eventually c 25 × 4mm (rather smaller at anthesis), erect. Corolla white, ageing to yellow, glabrous outside, tube 35mm, hairy within.

**Bhutan:** S – Phuntsholing district (Phuntsholing). Introduced garden plant.

Cultivated for its sweet-scented flowers. Only one collection has been seen, with abortive fruit. Double-flowered cultivars with obovate corolla lobes c 35 × 25mm and petaloid anthers are widely grown. Plants with single flowers have narrower corolla lobes c 25mm long; anthers c 12mm with c 2mm included; style head just exceeding anthers; fruit subglobose, orange, c 20 × 15mm, 5-ribbed, with persistent calyx.

### 32. CERISCOIDES (Hook.f.) Tirvengadam

by L.S. Springate

Spiny, deciduous or semi-evergreen shrubs and small trees. Leaves opposite or fasciculate on spurs, entire, shortly petiolate. Stipules ovate, cuspidate, non-persistent, pairs almost free. Flowers solitary or in sessile umbellate cymes at the tip of short lateral shoots, often displaced laterally by the development of a spine, rarely also terminal and solitary. Flowers usually 5-merous, dimorphic, dioecious or polygamo-monoecious or polygamo-dioecious. Calyx tubular, often truncate in female-sterile flowers, with foliaceous lobes in perfect flowers. Corolla hypocrateriform or campanulate. Anthers subsessile, included or partly exserted. Ovary 1-locular with 4–6 parietal placentae. Fruit fleshy, woody within; seeds numerous; calyx persistent or deciduous.

**1. *C. campanulata* (Roxb.) Tirvengadam; *Gardenia campanulata* Roxb.**

Spiny, deciduous shrub c 2.5m, spines terminating straight rigid divaricate lateral shoots 15–80mm; branches slender, bark becoming scurfy. Leaves lanceolate to oblanceolate, membranous, to 9 × 3.5cm, though much reduced on old spurs, acuminate, finely tapered at base; petioles c 5(–15)mm. Stipules c 5mm. Appressed whitish hairs may occur around nodes, on young internodes and in axils of main veins beneath leaves. Flowers of two types, apparently confined



to separate plants. Female-sterile flowers in clusters of up to 20; pedicels to 1mm; calyx cupuliform, glabrous, tube 3 × 3mm, lobes obsolete; corolla narrowly campanulate, yellowish-green, tube 8–9 × 3–4mm, lobes transversely oblong, 2.2–3.6 × 1.8–2.3mm; anthers subsessile, c 4.3mm, tip exerted; ovary abortive; style 4.5mm with fusiform head opposite lower part of anthers. Perfect flowers solitary, differing in prominent, oblong to spatulate calyx lobes to 5 × 2.3mm, anthers shorter c 3.3mm, though tips exerted; longer style with head opposite the whole of the anthers; ovary with 5 placentae. Fruit ellipsoid or subglobose, c 28 × 21mm; seeds numerous, c 2.4mm; calyx persistent.

**Bhutan:** S – Sarbhang district (Phipsoo). Subtropical forest on river bank, 285m. March.

This description has been supplemented by material from outside our area, where the species may form small trees with greenish-white flowers (17). The origin of the type of *Ceriscoides turgida* (Roxb.) Tirvengadam, a plant cultivated in Calcutta Botanic Garden, was given as Bhutan, probably in error as no more specimens have been seen from our area. An evergreen, large-fruited specimen from Sarbhang district (Singi Khola), cannot be reliably referred to either species.

### 33. HYPTIANTHERA Wight & Arnott

by L.S. Springate

Glabrous, aromatic, evergreen shrubs and small trees; branchlets slender, 4-sided. Leaves opposite, entire, shortly petiolate. Stipules persistent, ovate, cuspidate. Cymes axillary, condensed, bracteate, subsessile, usually borne at all nodes of previous season's growth. Flowers (4–)5-merous, very small, bracteolate, sessile. Calyx tube very short, exceeded by lobes. Corolla with a band of appressed hairs inside at top of tube and base of lobes surrounding anthers; lobes suberect. Anthers subsessile. Ovary 2-locular, ovules numerous; style included, hirsute above with 2 suberect branches. Fruit indehiscent, globose or ovoid, small; seeds imbricate, compressed.

**1. *H. stricta*** (Smith) Wight & Arnott; *Hypobathrum strictum* (Smith) Kurz. Sha: *Shayungwarong Shing*; Nep: *Akle Kat*, *Haldi Kat*.

Shrub or small tree, 2–6.5m. Leaves lanceolate to oblanceolate, 9–16(–20)cm, acuminate, attenuate at base or rarely obliquely rounded, glabrous, glossy above; petioles c 7mm. Stipules 4–7mm. Cymes c 10mm across; bracts and bracteoles ciliate, hairy within. Calyx tube c 0.5mm; calyx lobes irregular, triangular, 0.5–1.5(–2mm), acuminate. Corolla tube c 2.3mm; corolla lobes orbicular to ovate, 0.8–1.6mm, white, apex rounded or apiculate. Fruit white (38), c 6mm across; seeds c 10 seeds; calyx persistent.

**Bhutan:** S – Samchi district (Buduni, Samchi), Sankosh district (Pinkhua), Sarbhang district (Phipsoo), Gaylegphug district (Gaylegphug) and Deothang district (Samdrup Jongkhar), C – Tongsa district (Berthi, Mangde Chu); **Darjeeling:** Chunabati, Ramthi, Tista valley, etc. In or at margins of warm broad-leaved evergreen and deciduous forests, 200–1100m. April–July.

### 34. KNOXIA L.

by J. Wright & L.S. Springate

Herbaceous to suffruticose perennials, rarely annual. Erect, sparingly branched, glabrescent to densely tomentose; stems subterete with most pubescence concentrated down two lines. Leaves opposite, elliptic to linear, entire, petiolate or sessile. Stipules (2–)3–5(–6)-cleft, from a short, sheathing base, segments filiform. Inflorescence terminal (rarely pseudoaxillary), cymose, (di-)trichotomous, lax to congested-capitate. Flowers many, small, (sub-)sessile, white to blue-violet, 4-merous, dimorphic, heterodistylous. Calyx tube very short; lobes ovate to lanceolate, often very unequal. Corolla salverform to infundibular; tube hairy within. Stamens included or exerted, anthers linear-oblong. Ovary 2-celled, ovules 1 per cell, pendulous. Style included or exerted; stigma bifid, papillate. Fruits ellipsoid to obovoid, scarcely to distinctly dorsally or laterally compressed, indehiscent or splitting into 2 mericarps suspended from a columnar carpophore; carpophore often bifurcate at apex. Seeds 2, oblong to ellipsoid in stony endocarp.

1. *K. sumatrensis* (Retzius) DC. var. *sumatrensis*; *K. corymbosa* Willdenow, *K. mollis* Wight & Arnott. Fig. 74c.

Suffruticose perennial, 10–150cm, pubescent almost throughout. Stems rather quadrangular, pale brown-tomentose. Leaves elliptic to lanceolate, 4–10 × 0.8–2.5cm, acute, base cuneate, puberulous, hairs pale brown, adpressed above; petioles c 0.5cm. Stipules (3–)5–6-cleft, teeth 3.5–5mm. Cymes corymbose, lax, trichotomous, to 10cm, brown tomentose to woolly; bracts few, linear, small, obscure. Flowers white to blue-lilac. Hypanthium glabrous to scabrid, calyx lobes triangular, 0.4–0.7mm, subequal. Corolla tube dilated above, c 3mm, lobes ovate, 0.8–1.5mm. Long-styled flowers with subsessile anthers included in dilated part of corolla tube and style exerted; short-styled flowers with anthers exerted and stigma included. Fruits ellipsoid-ovoid, rather quadrangular, 2–2.5 × 1.2–1.5mm, detaching whole from carpophore; calyx teeth persistent.

**Bhutan:** C – Tongsa district (Tama (117)); **Darjeeling:** Tista, Birik, Darogadra, etc. Grassy and forested slopes, 300–900m. July–November.

## 35. PSYDRAX Gaertner

by L.S. Springate

Evergreen, unarmed shrubs or trees. Leaves coriaceous, opposite, entire. Stipules cuspidate. Cymes solitary in axils of upper leaves, compact, umbellate or corymbose; peduncle short or  $\pm$  absent; bracts and bracteoles small or absent. Flowers small, 5-merous. Calyx tube very short, dilated; lobes short. Corolla salverform, lobes valvate in bud. Filaments inserted at top of tube, short, recurved; anthers exerted. Ovary 2-locular; ovules solitary, pendulous; style long-exserted; stigma head mitriform, length c  $2 \times$  width. Fruit fleshy, didymous (at least when dry), with 2 rugose pyrenes.

1. *P. kingii* (Hook.f.) Bridson & Springate; *Canthium didymum* Gaertner var. *kingii* Hook.f., *Canthium kingii* (Hook.f.) Brandis, *Plectronia didyma* (Gaertner) Kurz var. *kingii* (Hook.f.) Cowan & Cowan. Nep: *Hare Siris*. Fig. 74d&e.

Shrub or small tree branching near base, c 5m, glabrous except inflorescence; branchlets slender. Leaves oblong or elliptic, 9–12  $\times$  3.5–4.2cm, abruptly caudate, attenuate at base; main (distinctly arcuate) lateral veins 3(–4) pairs; petioles c 7mm. Stipules ovate, c 6mm, with thick colleters but no fine hairs inside. Cymes subumbellate, puberulous; flowers 10–22; peduncle 4–8mm; pedicels 4–8mm; bracts and bracteoles small scales. Calyx subglabrous, tube to 0.5mm; lobes ovate, 0.3–0.4mm, obtuse, ciliate. Corolla white, glabrous outside, densely hairy on upper tube within; tube 4–5.5mm; lobes ovate-oblong, 3mm, subacute. Stamens reflexed. Style c 9mm. Fruit oblong-obovate, c 15  $\times$  7mm; pyrenes straight.

**Darjeeling:** Sitong, Rangit, Lal. Lower and middle hill forests (34), 450–3700m. May.

The fruit is described from a specimen from E Nepal.

## 36. CANTHIUM Lamarck

by L.S. Springate

Trees and shrubs, sometimes armed, sometimes climbing. Leaves opposite, entire. Stipules connate. Flowers 4–6-merous, small, unisexual or bisexual, pedicellate. Calyx caducous or persistent, tube and teeth short. Corolla campanulate to urceolate, tube  $\pm$  equalling (our species) to much exceeding lobes; throat usually hairy; lobes spreading, valvate in bud. Filaments inserted at top or middle of tube, short; anthers included or exerted. Ovary 2-locular; ovules solitary, pendulous; stigma head subglobose, not or briefly exerted. Fruit fleshy with 2 smooth pyrenes.

**1. C. glabrum** Blume

Evergreen, unarmed tree 6–9m, glabrous throughout; trunk erect, unbranched. Leaves dull, rather coriaceous, lanceolate to ovate-oblong, 15–20 × 5–10cm, abruptly acuminate, subacute or briefly attenuate at base; main (distinctly arcuate) lateral veins 5 pairs; petioles c 12mm. Stipules broadly ovate, c 7mm, cuspidate, with dense fine hairs and colleters inside. Cymes solitary in axils of upper leaves with 1–3 branches c 15mm; peduncle 5mm; pedicels to 3mm (5mm in fruit); bracts and bracteoles small scales. Flowers 5-merous. Calyx 1.2mm, broadly cyathiform with 5 broad, shallow teeth. Corolla greenish-white, tube subglobose, 3mm, densely hairy within in upper half; lobes ovate-oblong, 3mm, subacute. Filaments inserted at top of tube, not recurved; anthers barely exerted. Style briefly exerted. Fruit oblong-obovate, 13–21mm; pyrenes trigonous.

**Darjeeling:** locality unknown; **West Bengal Duars:** Lower Jaldhaka. Lower hill forest (34).

Only fruiting specimens have been seen from our area; flower details are based on plants from Myanmar.

**37. MEYNA** Link

by L.S. Springate

Deciduous shrubs or small trees, usually armed; spines axillary or supra-axillary, without nodes. Leaves opposite or ternate, entire, petiolate. Stipules long-mucronate with fine hairs inside. Flowers small, 4–5-merous, solitary or in few-flowered fascicles or cymes. Buds usually prominently apiculate. Calyx tube very short, exceeded by small lobes. Corolla tube shallowly cylindrical or suburceolate, densely hairy within on upper half; lobes reflexed, subequal to tube, valvate in bud. Filaments inserted at top of tube, very short. Ovary 4–5-locular; ovules solitary, pendulous; stigma head subglobose, 4–5-lobed. Fruit fleshy with 4–5 pyrenes.

**1. M. spinosa** Link; *Vangueria spinosa* Link. Nep: *Mandalu Kanrha*.

Tree 5–8m, glabrous; spines supra-axillary, 5–40mm. Leaves ovate-oblong, 7–14 × 3.5–6cm, abruptly and usually shortly acuminate, rounded to attenuate and sometimes oblique at base; main lateral veins 4–5(–6) pairs; petioles 5–12mm. Stipules broadly connate at first, ovate on flowering shoots, 6–7mm, with hairs and a few colleters inside. Cymes of 1–3 flowers, subsessile, subumbellate, glabrous or puberulous, borne on densely squamate foliate pads or spurs on old wood; bracts and bracteoles small scales. Flowers 5-merous; pedicels 2–5mm (c 12mm in fruit), glabrous or puberulous. Calyx glabrous, tube to 0.5mm; lobes ligulate to triangular, 1.0–1.2mm. Corolla greenish, tube 3.5mm, glabrous outside; lobes hooded, spreading, ovate, 3mm, bluntly apiculate on

back with incurved papillate margin. Filaments not recurved; anthers barely exerted. Style 4mm, briefly exerted. Fruit turbinate-globose, 20–23mm across, eventually yellowish.

**Bhutan:** S – Gaylephug district (Thewar Khola), C – Tashigang district (Gamri Chu); **Darjeeling:** Daling; **West Bengal Duars:** Dhupgari. Forest openings, 300–1200m. April–June (34).

### 38. IXORA L.

by J.R.I. Wood

Shrubs; stems woody, with thin brown or greyish bark. Leaves in opposite pairs, entire, sessile or petiolate; stipules ovate or triangular, cuspidate or aristate, terminating in a long, fine point. Inflorescence trichotomously branched, corymbose, very compound, panicle-like, terminal on main stem and on short lateral branches. Bracts stipule-like, at base of inflorescence but bases never connate; upper bracts linear or triangular; bracteoles present. Calyx with an ovoid or oblong tube, 4-toothed, teeth usually persistent on ripening fruit but not accrescent. Corolla often brightly coloured (usually white or red in our species) with a long, slender tube and 4 (rarely 5) spreading lobes twisted in bud. Stamens 4, inserted at mouth of tube, spreading between corolla lobes. Style filiform, shortly exerted, stigma prominently 2-lobed, lobes spreading or recurved. Fruit a globose, 1–2-seeded drupe; seeds semi-globose with one face flattened.

Very similar to *Pavetta* and distinguished by its bracts which are never connate at the base and by the style which is only shortly exerted and has a clearly bilobed stigma with spreading arms. In addition the corolla is often brightly coloured.

- |   |                             |
|---|-----------------------------|
| 1. Corolla tube longer than 20mm; corolla red, yellow or white .....  | 2                           |
| + Corolla tube 6–13mm; corolla white .....  | 5                           |
| 2. Stem and undersurface of leaves distinctly pubescent ...   | <b>2. I. balakrishnanii</b> |
| + Stem and leaves entirely glabrous .....   | 3                           |
| 3. Leaves very large (18–45 × 7–15cm); calyx teeth 1–4mm, lanceolate; corolla white or pale red, fragrant .....   | <b>1. I. athroantha</b>     |
| + Leaves medium-sized (up to 17 × 9cm); calyx teeth up to 1.5mm, triangular or indistinctly ovate; corolla usually red, rarely pale or yellow, never fragrant | 4                           |
| 4. Leaves sessile, base cordate or rounded; inflorescence compact, sessile; calyx teeth triangular, acute .....   | <b>3. I. coccinea</b>       |
| + Leaves petiolate, cuneate at base; inflorescence large, lax, pedunculate; calyx teeth ovate, rounded, obscure .....   | <b>4. I. javanica</b>       |

5. Plant drying green; corolla tube 6–8.5mm; anthers 3mm . . . . **5. *I. undulata***  
 + Plant drying black; corolla tube 8–13mm; anthers 3.5–4mm **6. *I. nigricans***

**1. *I. athroantha*** Bremekamp; *I. acuminata* sensu F.B.I. p.p. non Roxb. Nep: *Chiwariapat* (34)

Shrub or small tree. Stems stout, glabrous, with greyish-brown bark. Leaves oblong or oblong-elliptic (rarely oblong-obovate or -ovate), 18–45 × 7–15cm, acuminate, abruptly narrowed to a cuneate base, glabrous on both surfaces, paler beneath, veins prominent; petioles stout, 0.3–3cm; stipules broadly ovate, cuspidate with a long narrow point, 8–10mm. Inflorescence shortly pedunculate, usually dense and compact, 6–9 × 5–10cm; branches thinly scurfy-pubescent; peduncle 0.8–2(–5)cm. Bracts linear or filiform, 5–12mm; bracteoles linear, c 2mm. Calyx tube 1–2mm; teeth 1–4(–5)mm, lanceolate, equalling or slightly longer than tube. Corolla white, fragrant; tube glabrous, 28–44mm; lobes oblong, obtuse, spreading or weakly reflexed, 6–9mm. Anthers 4.5–5mm. Style exerted 4–6mm; stigma 2.5mm. Fruit 9–10mm wide.

**Darjeeling:** Sukna, Sivok, Selimpahar, Kali Khola, Kurseong, Dalkajhar; **West Bengal Duars:** Buxa. Subtropical and terai forests, 150–900m. April–June.

*I. acuminata* Roxb. is cultivated in West Bengal and might be found in our area. It differs in its smaller, narrower leaves (up to 25 × 8.5cm) and longer bracteoles (3–5mm) which resemble and partly obscure the 4–6mm, lanceolate calyx teeth.

**2. *I. balakrishnii*** Deb & Rout; *I. villosa* Roxb. non Poiret, *I. roxburghii* sensu Balakrishnan non Kuntze

Shrub. Stems shortly but densely pubescent, covered in greyish-brown bark. Leaves oblong or oblong-obovate, 11–32 × 4–11.5cm, shortly acuminate, base cuneate, glabrous above, shortly pubescent beneath especially on the relatively prominent veins; upper leaves sessile, lower leaves petiolate; petioles 0–0.8cm, pubescent; stipules triangular, gradually drawn out to a long fine point, 8–17mm. Inflorescence 9–11 × 9–15cm, pedunculate with the three primary branches very prominent, each appearing to bear separate dense corymbose panicles, branches pubescent; peduncle 1.5–3(–9)cm. Bracts narrowly triangular, 2–5mm; bracteoles linear, 1–2mm. Calyx tube 1mm; teeth 1.5mm, ovate, obtuse, slightly longer than tube. Corolla white, fragrant; tube glabrous or minutely scurfy, 23–26mm; lobes narrowly lanceolate, acute, 4–5mm. Anthers 3.5mm. Style exerted 4–6mm; stigma 1.5mm. Fruit 5–7mm wide.

**Darjeeling/Sikkim:** without exact locality.

**3. *I. coccinea*** L.

Shrub 0.5–2m tall. Stems relatively stout, glabrous with thin greyish bark. Leaves sessile, elliptic or obovate, acute, 4–9 × 2–5cm, obtuse or rounded and shortly mucronate, base cordate or rounded, glabrous on both surfaces, paler beneath with prominent veins; stipules narrowly triangular, cuspidate, drawn

out into a long thin point, 5–8mm. Inflorescence sessile, very compact, few-flowered, 4–7 × 4–8cm; branches scurfy-pubescent. Bracts broadly triangular, c 3mm; bracteoles similar but only 1–1.5mm. Calyx tube 1.5–2mm; teeth triangular, 1–1.5mm, shorter than or equalling tube. Corolla crimson or (var. *lutea* (Hutchinson) Corner) yellow, scentless; tube minutely and sparsely puberulent, (20–)32–38mm; lobes ovate or elliptic, acute, spreading, 10–12 × 4–6mm. Anthers 3mm. Style exserted 3–4mm; stigma 2mm. Fruit 7–8mm wide.

**Bhutan:** S – Phuntsholing district (Phuntsholing: var. *lutea*); **Darjeeling:** without exact locality (34); **West Bengal Duars:** Jalpaiguri. Cultivated in tropical regions, 250–300m. Probably flowering throughout the year.

*I. chinensis* Lamarck (*I. stricta* Roxb.) is another commonly cultivated plant which might occur in our area. It is very similar to *I. coccinea* differing in its corolla lobes which are rounded at the tips and in the petiolate leaves which are gradually narrowed to a cuneate base.

#### 4. *I. javanica* (Blume) DC.; *I. amoena* G. Don

Shrub 1–4m tall. Stems glabrous with brownish bark. Leaves broadly oblong (rarely oblong-elliptic, -ovate or -obovate), 13–19 × 4–9cm, shortly acuminate, base cuneate, glabrous on both surfaces, paler beneath with prominent veins; petioles 0.4–2cm; stipules ovate, abruptly cuspidate into a short fine point, 4–5mm. Inflorescence pedunculate, large, lax, open; primary branches very prominent, 8–17 × 8–19cm; branches thinly scurfy-pubescent; peduncle 2–8cm. Bracts triangular, 1–2mm, soon deciduous; bracteoles scale-like, 0.5–1mm. Calyx tube 0.5–1mm; teeth forming an indistinct undulate ring, 0.25–0.5mm. Corolla red, scentless; tube glabrous, perhaps slightly sticky, 23–37mm; lobes ovate or elliptic, acute, 7–11 × 3–4mm. Anthers 3mm. Style exserted 1–4mm; stigma 2mm. Fruit rarely seen, 1.2–2cm wide, red but eventually black.

**Bhutan:** S – Phuntsholing district (Phuntsholing); **Sikkim/Darjeeling:** without exact locality. Cultivated in tropical regions, 250m. February.

#### 5. *I. undulata* Roxb. Nep: *Kalikat*

Shrub 2–4.5m tall. Stems glabrous, bark greyish-brown. Leaves oblong-elliptic, 10–20 × 4–7(–8.5)cm, acute or shortly acuminate, base narrowly cuneate, margins often undulate, glabrous on both surfaces, paler beneath with prominent lateral veins; petioles 0.3–1.5cm; stipules ovate, finely acuminate, 6–9mm. Inflorescence shortly pedunculate, repeatedly branched, forming lax panicles 8–19cm long and wide; branches finely pubescent, often arising at 90° from main axis; peduncle 0.5–4cm. Bracts linear, 3–6mm; bracteoles minute, scale-like. Calyx tube 0.75–1mm; teeth triangular, acute, 0.5–0.75mm. Corolla white; tube glabrous, 6–8.5mm; lobes oblong, obtuse, deflexed, 4mm. Anthers 3mm. Style exserted 4mm; stigma 2mm. Fruit 5–7mm wide, calyx not persistent.

**Bhutan:** S – Sarbhang district (Sarbhang to Chirang) and Gaylegphug district (Mao valley), C – Tashigang district (Dangma Chu); **Darjeeling:** common in

the terai and valleys; **Sikkim:** Ligship. Subtropical forest, 300–1100m. April–June.

### 6. *I. nigricans* Wight & Arnott

Shrub 1–3m tall, drying black. Stems glabrous with greyish-brown bark. Leaves broadly oblong-obovate or oblong-elliptic, 6–20 × 2–7.5cm, acute or very shortly acuminate, base cuneate, glabrous on both surfaces, veins slender and inconspicuous; petioles 0.3–1.5cm; stipules ovate, cuspidate, terminating in a long hair-point, 5–9mm. Inflorescence shortly pedunculate, usually branched 2–3 times, forming lax panicles, 6–11 × 5–15cm, branches sparsely pubescent; peduncle 0–3cm. Bracts linear from a triangular base, 1–2mm; bracteoles scale-like. Calyx tube 1mm; teeth triangular, acute, 0.5–0.75mm. Corolla white, very narrow in bud; tube glabrous, 8–13mm; lobes oblong, acute, deflexed, 4–5mm. Anthers 3.5–4mm. Style exserted 5–6mm; stigma 2.5–3mm. Fruit 5–6mm wide, black, calyx not persistent.

**West Bengal Duars:** Jalpaiguri (Poro Forest (231)). Details not recorded.

## 39. PAVETTA L.

by J.R.I. Wood

Shrubs. Stems with smooth, thin, grey bark. Leaves in opposite pairs, petio- late, entire, often with scattered bacterial nodules; stipules ovate or triangular, cuspidate or aristate. Inflorescence terminal on lateral branches, corymbose, usually very compound and trichotomously branched but sometimes reduced to a dense head; flowering branches leafless or leafy, with 1–6 leaf nodes, usually overtopping the main non-flowering stems. Bracts stipule-like, lower ones con- nate at base, upper ones smaller, free at base. Calyx with an ovoid tube, minutely 4-toothed; teeth sometimes persistent on ripening fruit but not accrescent. Corolla usually fragrant, white or yellowish-green with a long slender tube and 4 spreading, oblong-lanceolate lobes which are twisted in bud. Stamens 4, inserted at mouth of corolla; filaments very short. Ovary 2-celled; style filiform, long-exserted; stigma obscurely 2-lobed. Fruit a black, globose, usually shiny drupe, in our species 6–7mm wide, 1–2-seeded; seeds semi-globose with one face flattened.

*Pavetta* is not distinguishable from *Ixora* by a single character apart from the lower stipular bracts which are connate at the base. However, our species can be distinguished from any similar *Ixora* by the long-exserted style with an apparently simple stigma.

1. Inflorescence a dense head with branches suppressed and flowers subsessile  
1. *P. subcapitata*
- + Inflorescence clearly branched and compound; flowers pedicellate ..... 2



2. Leaves acute or obtuse (never acuminate), scabrid-puberulent above, tomentose beneath, broad, 3–12cm wide; inflorescence very large, usually more than 15cm wide, leafless ..... **2. *P. tomentosa***
- + Leaves shortly acuminate, glabrescent above, glabrous to tomentose below, up to 7cm wide; inflorescence relatively compact, usually less than 12cm wide, leafy or leafless ..... 3
3. Inflorescence leafless; leaves oblong-elliptic, 6–18cm; corolla tube 10–18mm, lobes 5–7mm ..... **3. *P. polyantha***
- + Inflorescence leafy; leaves obovate-elliptic, up to 12.5cm; corolla slender, tube 9–13mm, lobes 4–5mm ..... **4. *P. assamica***

**1. *P. subcapitata* Hook.f.**

Shrub to c 2.5m. Stems pubescent when young, becoming glabrous. Leaves oblong-elliptic or narrowly ovate, 9–20 × 2.5–8cm, acuminate, base narrowly cuneate, glabrous above, densely pubescent or subtomentose beneath, usually with 5–6(–8) conspicuous pairs of veins; stipules triangular, weakly cuspidate. Inflorescence a dense, many-flowered head, flowers sessile; flowering branches usually with a single leaf node just below inflorescence, leaves present at anthesis. Calyx pubescent, teeth 0.5–0.6mm. Corolla greenish-white, glabrous, tube 15–20mm; lobes 6mm.

**Bhutan:** S – Gaylegphug district (Lodrai Khola). In disturbed subtropical forest, 320m. March–May.

**2. *P. tomentosa* Smith; *P. indica* L. var. *tomentosa* (Smith) Hook.f.; *P. tomentosa* var. *roxburghii* (Kurz) Bremekamp. Nep: *Kangyo*.**

Large shrub or small tree, 2–6m tall. Stems coarsely pubescent when young, becoming glabrous later. Leaves broadly oblong-elliptic, usually 8–21 × 3–12cm, apex acute, obtuse or emarginate, base broadly or narrowly cuneate, scabrid-puberulent above, grey-tomentose beneath, veins very prominent with at least 10 conspicuous pairs; stipules triangular-aristate. Inflorescence large, lax, compound, usually leafless, (8–)10–16 × (10–)15–25(–30)cm, branches prominent, relatively stout, pubescent or tomentose; flowering branches with 1–2 leaf nodes below inflorescence, leaves always(?) deciduous at anthesis. Calyx teeth 0.3–0.6mm. Corolla white, glabrous, tube 10–13mm; lobes 5–7mm.

**Darjeeling:** Siliguri, Rangit valley, Sivok, Tista etc. In bushland and open forest, especially near rocks, 150–1060m. May–July.

**3. *P. polyantha* Bremekamp; *P. indica* L. var. *polyantha* Hook.f. p.p. nom. illeg.; *P. indica* auct. (73, 117) non L.; *P. griffithii* Bremekamp; *P. naucleiflora* sensu F.B.I. p.p. non G. Don; *P. naucleiflora* G. Don var. *glabrituba* Bremekamp. Nep: *Kanjol Phul*, *Tite Phul*, *Kangya Phul* (34).**

Shrub 1.5–3m tall. Stems pubescent when young, becoming glabrous. Leaves oblong-elliptic, 6–18 × 2–7cm, shortly acuminate, base cuneate, glabrous above,

thinly or densely pubescent beneath when young, varyingly glabrescent but mature leaves usually pubescent on and around veins only, rarely persistently pubescent, usually with 6–10 pairs of conspicuous veins; stipules triangular, cuspidate. Inflorescence much branched but compact, often loosely subglobose, 6–8 × 5–11cm, leafless; branches thinly or densely pubescent; flowering branches usually with 2–5 leaf nodes below inflorescence, leaves usually present at anthesis but not extending into inflorescence. Calyx teeth 0.4–0.6mm. Corolla white, glabrous, tube (10–)13–18mm; lobes 5–7mm.

**Bhutan:** S – Phuntsholing and Gaylegphug districts, C – Mongar district (Kulong Chu, Shongar) and Tashigang district (Tashigang Dzong); **Darjeeling:** Pedong, Rongsong, Sivok etc.; **Sikkim:** Rangphap, Rangpo and Tholung valleys; **West Bengal Duars:** Buxa. Moist subtropical forest, especially in clearings, 270–1070m. April–June.

The plant collected from the Kulong Chu and used by Bremekamp as the type of *P. naucleiflora* var. *glabrituba* is remarkable for the tomentose undersurface of its leaves and short corolla tube but in leaf size and shape and in inflorescence it fits *P. polyantha* well.

#### 4. *P. assamica* Bremekamp

Shrub c 2m tall. Stems glabrous. Leaves obovate-elliptic, 3.5–12.5 × 2–6.5cm, abruptly and shortly acuminate, base long-cuneate, thin in texture, glabrescent on both surfaces but veins persistently pubescent, especially beneath, veins not very prominent with only about 8 pairs clearly discernible; stipules triangular, aristate. Inflorescence large, persistently leafy, 6–12 × (8–)10–19cm, much branched; branches thinly pubescent or subglabrous, distinct, relatively slender but corymbs very dense; flowering branches with 2–5 nodes below inflorescence, usually leafless although the inflorescence itself is leafy. Calyx teeth 0.2–0.4mm. Corolla apparently greenish-yellow, glabrous, tube 9–13mm; lobes 4–5mm.

**Darjeeling:** Tista and Mahanadi valleys and in the terai. Moist lowland forest, 50–700m. May–June.

### 40. NOSTOLACHMA Durand

by L.S. Springate

Unarmed shrubs or small trees. Leaves opposite, entire, shortly petiolate. Stipules ovate, cuspidate. Cymes small, axillary, usually sessile. Flowers 4–5-merous, unisexual or bisexual. Calyx small, cupuliform, dentate or lobed. Corolla small, tube cylindric, lobes twisted in bud. Anthers subsessile, ± exerted, surrounded by long, soft hairs. Ovary (in our species) 2-locular with solitary ovules borne on septum; style deeply bifid. Fruit a small drupe; seeds convex dorsally, flat ventrally without a groove.

1. *N. khasiana* (Korthals) Deb & Lahiri; *Coffea khasiana* (Korthals) Hook.f., *Lachnostoma khasiana* Korthals nom. illeg.

Large rambling shrub, deciduous; branchlets slender, puberulous. Leaves elliptic, thinly coriaceous, 11–20 × 4–6.5cm, finely acuminate, acute at base, glabrous except for sparse pubescence on veins; petioles c 5mm, puberulous. Stipules 7–8mm, puberulous, pairs connate. Cymes compact, sessile, puberulous; bracts and stipules connate, forming a scarious dentate ring; bracteoles small, opposite scales. Flowers 4-merous, bisexual, subsessile at anthesis. Calyx glabrous, tube 0.8mm; lobes 0.7mm, appressed to corolla. Corolla yellowish-green, glabrous outside; tube 5.5–6mm; lobes ovate, spreading, 2.5mm. Anthers 1.6mm. Style reaching base of anthers. Fruit globose or obovoid, 7mm across with persistent calyx.

**Bhutan:** C – Deothang district (Chenari (117)). 1000m.

No material has been seen from our area; the above description is based on specimens from the Khasia Hills.

#### 41. PSILANTHUS Hook.f.

by L.S. Springate

Unarmed shrubs. Leaves opposite, entire, shortly petiolate or sessile. Stipules ovate, cuspidate. Inflorescences terminal with 1–5 flowers and lateral with 1–2 flowers; peduncle with 1–2 pairs of basal bracts and 1 apical pair, rarely peduncle absent between bracts; bracts small, ovate to linear-lanceolate or apical pair large and leaf-like. Flowers 5-merous, subsessile. Calyx tube short, fimbriate to lobed. Corolla hypocrateriform, lobes twisted in bud. Anthers subsessile, included or partly exerted. Ovary 2-celled; ovules solitary, borne on septum; stigma bifid, included beneath anthers. Fruit fleshy, globose or didymous; calyx persistent.

1. *P. bengalensis* (Schultes) Leroy; *Coffea bengalensis* Schultes. Nep: *Chitu*, *Morichi-kat*; Lepcha: *Akub-fajee-rip* (34). Fig. 74f.

Deciduous shrub 0.5–3.5m; branchlets slender, puberulous at first. Leaves ovate, 7–11.5 × 3–7.5cm, abruptly acuminate, truncate to attenuate at base, hairy on veins beneath; petioles 3–8mm. Stipules c 6mm. Inflorescences terminal with 1–3 flowers and lateral with 1(–2) flowers, borne on bare wood; basal bracts 1 or 2 pairs, linear-lanceolate, small; apical bracts 1 pair, often large and leaf-like, sometimes subtending vegetative shoots after anthesis; peduncle sometimes absent. Flowers scented. Calyx tube dilated, c 0.6mm, with irregular shallow teeth and prominent colleters. Corolla white, subglabrous or puberulous outside, glabrous within; tube (19–)22(–27)mm; lobes oblong-elliptic,

17–20mm. Anthers attached to top of corolla tube, very slender, 12mm, tip barely exerted, tail long, free. Style 3.5mm; stigma 1.8mm. Fruit black (38), 6.5 × 4mm.

**Bhutan:** S – Phuntsholing, Samchi, Sarbhang and Gaylegphug districts, C – Tongsa district (Tintibi Bridge); **Darjeeling:** widespread; **Sikkim:** Namchi to Nayar Bazar (69); **West Bengal Duars:** Bandapani. Subtropical forests, often in disturbed sites, 150–900m. February–May.

Berries reputedly used for coffee by inhabitants of the terai (34).

## 42. MORINDA L.

by J. Wright & L.S. Springate

Shrubs, trees or woody climbers. Leaves in opposite pairs or solitary, opposite an inflorescence, entire, petiolate. Stipule pairs connate at base. Inflorescence apparently leaf-opposed (in our species), capitate, pedunculate, with flowers sessile, packed on a globose or oblong torus and fused at the hypanthia. Flowers 4–7-merous, homostylous or heterostylous, bisexual, andro-dioecious or dioecious. Calyx tube a shallow ring, lobes short or absent. Corolla (in our species) hypocrateriform with anthers included near middle of tube; lobes valvate in bud. Ovary 2–4-celled, ovules solitary; stigma bifid. Fruits drupaceous, usually coalesced; calyces persistent.

**1. *M. angustifolia* Roxb.; *M. citrifolia* auct. non L.** Nep: *Hardi-kat*, *Haldi Kath*; Lepcha: *Huldi-kung* (34). Fig. 74g.

Evergreen shrub or small tree to 6m. Leaves oblanceolate, 20–25(–36) × 6–9(–13)cm, abruptly or narrowly acuminate, base attenuate, glabrous above, glabrescent below; petioles 1–4cm. Stipules broadly triangular, 5–12mm. Inflorescence terminal but usually soon displaced, appearing lateral and leaf-opposed; peduncles 2–4(–12)cm. Flowers (4–)5-merous, sweet-scented, bisexual, heterostylous. Hypanthia fused below. Corolla white, entirely glabrous; tube narrow, 15–31mm; lobes spreading, elliptic, 9–15mm. Filaments very short; anthers included near middle of corolla tube. Style slender; stigma included below stamens or partly exerted. Few fruit set in each head; drupes mostly free, turbinate, bluish-white (38), black when dry, c 8 × 9mm. Pyrenes pyriform, c 6mm.

**Bhutan:** S – Samchi district (Samchi), Phuntsholing district (Phuntsholing), Sankosh district (Pinkhua) and Gaylegphug district (Gaylegphug (38), Tatapani); **Darjeeling:** Peshok, Rambhi, Tista and Rayong valleys etc. Subtropical forest understorey, scrub, 200–1500m. March–May.

Sometimes cultivated and used medicinally. Roots are used to produce a red or yellow dye and as a substitute for turmeric (34).

**43. PRISMATOMERIS** Thwaites

by L.S. Springate

Evergreen unarmed shrubs or trees; shoots slender with 2 longitudinal ridges. Leaves opposite, thinly coriaceous, entire. Stipules small, deeply bifid, becoming woody at base. Cymes of 1–few flowers, terminal and axillary, usually sessile, umbellate; bracts small scales; flowers 5-merous, usually pedicellate, heterostylous. Calyx short, truncate, usually dentate. Corolla hypocrateriform, white, lobes with a longitudinal adaxial ridge, valvate in bud. Filaments short, inserted on upper corolla tube; anthers dorsifixed, included or partly exerted. Ovary 2-locular; ovules solitary, pendulous; style filiform, bifid above, included or barely exerted. Fruit a globose drupe, eventually blackish; drupes sometimes fused; calyx persistent.

**1. *P. tetrandra*** (Roxb.) Schumann; *P. albidiflora* sensu F.B.I. non Thwaites

Small shrub glabrous throughout; branchlets 4-angled with yellowish glossy bark. Leaves narrow elliptic, 10–14 × 2.5–4mm, long-acuminate, attenuate at base; petioles 6mm. Stipules 2–5mm, lobes subulate. Cymes sessile. Pedicels 13–17mm at anthesis. Calyx cyathiform, 2–2.5mm, 5-denticulate. Corolla tube slender, 24mm; lobes lanceolate, 17–18mm. Filaments 0.5mm; anthers linear, 5mm, connective produced, subulate. Style 10mm, branches unequal, to 6mm. Fruit c 10mm across.

**Darjeeling:** Tista, Mahanadi. 300–600m. June.

Only short-styled plants have been seen from our area and described above.

**44. PSYCHOTRIA** L.

by J.R.I. Wood

Shrubs or small trees. Leaves in opposite pairs, equal, petiolate; stipules broadly ovate, often cleft and with glandular axillary hairs, usually deciduous. Inflorescence of subsessile or shortly pedunculate terminal and/or axillary cymes; bracts similar to stipules; bracteoles present, usually scale-like. Calyx with a short dilated or cylindrical tube; teeth small, triangular, persistent on ripening fruit or deciduous. Corolla white-villous in throat; tube very short; lobes 5, spreading or recurved, valvate in bud. Stamens inserted below sinuses of corolla; anthers shortly exerted. Ovary 2-celled, ovules solitary; style short; stigma bifid. Fruit a small globose or oblong drupe with fleshy skin surrounding two pyrenes; pyrenes resembling coffee beans, inner surface flat, dorsal surface convex, smooth, ridged or grooved.

1. Leaves undulate, crenate, denticulate or entire, lateral veins reaching but not crossing a prominent intramarginal vein running round leaf parallel to margin ..... **3. P. calocarpa**  
 + Leaves entire, lateral veins reaching margin or petering out just before it 2
2. Seeds grooved on dorsal surface; calyx teeth triangular, acute, c 1mm ... 3  
 + Seeds smooth or with a single ridge on dorsal surface; calyx teeth triangular, obtuse, 0.25–0.5mm, forming an undulate rim ..... 4
3. Cymes many-flowered, borne on peduncles 2–6cm; leaves broadly elliptic-obovate, 5–11cm wide; calyx persistent on fruit ..... **1. P. monticola**  
 + Cymes few-flowered, subsessile; leaves narrowly oblong-lanceolate, 1.5–6cm wide; calyx deciduous ..... **2. P. erratica**
4. Seeds smooth on dorsal surface; leaves 4–11cm wide ..... **4. P. denticulata**  
 + Seeds with a single ridge on dorsal surface; leaves 1.5–5cm wide  
**5. P. symplocifolia**

**1. P. monticola** Kurz; *P. fulva* Hook.f.

Small shrub with glabrous stems. Leaves (ovate–) broadly elliptic (–obovate), 12–25 × 5–11cm, acute or shortly acuminate, base cuneate (rarely truncate), entire, pubescent beneath when young but eventually glabrescent, drying maroon or dark reddish-brown, marginal vein absent; petioles 0.5–1(–1.5)cm; stipules ovate, acuminate, rufous-villous in axils. Cymes usually terminal, compact and dense, 2–5cm in flower, elongating to 8cm in fruit, densely rufous-pubescent; peduncles 2–4(–6)cm; bracteoles linear, obtuse, 4–5mm, relatively persistent. Calyx teeth triangular, acute, 1mm. Corolla yellow or red-brown; tube 1–1.5 mm; lobes ovate, acuminate, c 1.75mm. Fruit oblong, 7 × 4–5 mm, yellow; calyx teeth persistent; seeds with 4 grooves on dorsal surface.

**Bhutan:** S – Gaylegphug district (Gaylegphug (117)). Subtropical forest undergrowth, 270m. November.

**2. P. erratica** Hook.f.

Shrub 1–2m tall; stems glabrous. Leaves oblong-lanceolate or narrowly oblong-elliptic, 6–18.5 × 1.5–6cm, shortly acuminate, base attenuate, entire, glabrous beneath or slightly scurfy on veins, marginal vein absent; petioles 1.5–2cm; stipules narrowly ovate, acuminate and aristate, often cleft, c 8mm. Cymes usually terminal, subsessile, few-flowered, 2–3cm in flower, elongating to 6cm in fruit, finely puberulous; peduncles 0–1.2cm; bracteoles scale-like. 1.5–2mm. Calyx teeth broadly triangular, acute, 1mm. Corolla greenish-white, tube c 1mm, lobes ovate, c 1.75mm, reflexed. Fruit oblong, 8–10 × 4–6mm, reddish; calyx teeth deciduous; seeds with 4 grooves on dorsal surface.

**Bhutan:** S – Phuntsholing district (Kamji (117)) and Gaylegphug district (Rani Camp (117)); **Darjeeling:** common; **Sikkim:** Yoksam to Bakkhim,

Chunthang, Chakung Chhu, Rangphap Chhu. Forest undergrowth, (600 -)1500-2130m. May-July.

**3. *P. calocarpa* Kurz.** Nep: *Damey Gach* (117), *Aule Damai Kat*.

Shrub 1-2.5m tall; stems glabrous. Leaves oblong-elliptic, 6-19 × 2-8cm, acute, base attenuate, scurfy beneath especially on veins but usually soon glabrescent, margin undulate, crenate, denticulate or entire, lateral veins reaching but not crossing a prominent vein that runs round leaf parallel to margin; petioles 0.6-2.8cm; stipules broadly ovate, shortly aristate, usually cleft, 9-11mm. Cymes terminal and axillary, subsessile, few-flowered, 2-3cm in flower, elongating to 5cm in fruit, scurfy pubescent; bracteoles scale-like, c 1mm, deciduous. Calyx teeth lanceolate, c 1.25mm. Corolla white, tube c 0.5mm; lobes ovate, acute, c 1.5mm. Fruit oblong-elliptic, 9-11 × 5-6mm, calyx teeth persistent; seeds completely smooth on dorsal surface.

**Bhutan:** S - Phuntsholing district (Kamji (117)), Sarbhong district (Phipsoo) and Gaylegphug district (Betni and Gaylegphug (117)); **Darjeeling:** Mongpu, Sivok, Sittong etc. Subtropical forest, 310-1500m. June-July.

**4. *P. denticulata* Wall.** Nep: *Bon Golcul* (117).

Shrub c 2m tall; stems glabrous. Leaves obovate or broadly oblong-elliptic, 10-29 × 4-14cm, acute, base cuneate, entire, scurfy beneath on veins, sometimes glabrescent; petioles 0.5-2cm; stipules ovate or broadly elliptic, aristate, 8-10mm. Cymes usually axillary, pedunculate, (4-)6-8cm in flower, elongating to 15cm in fruit, scurfy-puberulent; peduncles 3-11cm; bracteoles scale-like, 0.25cm, fugacious. Calyx teeth broadly triangular, c 0.5mm, forming an undulate ring. Corolla tube 1-2.5mm, lobes ovate, acuminate, c 1.5mm, recurved. Fruit broadly ellipsoid, 6-7 × 5-6mm, reddish; calyx teeth deciduous; seeds completely smooth on dorsal surface.

**Bhutan:** S - ?Chukka district (Griffith collection) and Gaylegphug district (Gaylegphug (117)); **Darjeeling:** Kurseong, Gitjhora, Nar Forrest, Dalkhajar. Terai forest, 150-600m. June-July.

**5. *P. symplocifolia* Kurz**

Shrub or (?)small tree with a glabrous stem. Leaves oblong or oblong-elliptic (7-)12-14 × (1.5-)4-5cm, abruptly but shortly acuminate, base cuneate, entire, completely glabrous; petioles 0.5-1.5cm; stipules narrowly ovate or lanceolate, aristate, 5-6mm. Cymes terminal or axillary, pedunculate, few-flowered, c 3cm in flower, elongating to 6cm in fruit; branches thinly bifariously pubescent; bracteoles scale-like, 0.5mm, fugacious. Calyx teeth ovate, obtuse, 0.25-0.5mm, forming an undulate rim. Corolla greenish-yellow, tube 2mm; lobes triangular, c 1.5mm. Fruit oblong-elliptic, 7-10 × 6-7mm, black; calyx teeth apparently deciduous; seeds with a single prominent ridge on dorsal surface.

**Darjeeling:** Sivok hills, 762m. ?June.

## 45. CHASSALIA Poiret

by J.R.I. Wood

Evergreen isophyllous shrubs. Leaves simple, opposite or whorled, large, lateral veins prominent beneath; stipules ovate or triangular, usually bifid, persistent. Inflorescence an erect, terminal, trichotomously branched panicle; flowers small, tubular, heterostylous. Bracts and bracteoles small. Calyx tube small, persistent, lobes short, triangular. Corolla tubular, long, slender, curved, lobes 5, valvate in bud. Stamens 5, inserted near mouth of tube, included or exserted; anthers linear. Ovary 2-celled, one ovule at base of each cell; disc cylindrical, prominent; styles short or long (in different flower forms), stigmas 2. Fruit a smooth fleshy drupe with 2 pyrenes; seeds concave on inner surface and so cup-shaped.

Similar to *Psychotria* but the corolla with a long slender curved tube and the seeds concave on the lower surface and so cup-shaped.

1. *C. curviflora* (Wall.) Thwaites var. **ophioxyloides** (Wall.) Deb & Mondal; *C. staintonii* (Hara) Deb & Mondal, *Ophiorrhiza staintonii* Hara

Shrub 1–2.5m tall. Stem glabrous. Leaves very variable in shape, oblong, oblong-obovate or oblong-elliptic, 6–27 × 2–9cm, shortly acuminate or caudate, attenuate at base, glabrous, dark green above, paler beneath; petioles 0.5–2.5cm; stipules ovate, usually acute, entire, 0.5–1.1cm. Inflorescence 4–8cm long and wide, pyramidal in shape, moderately lax but with flowers in fascicles at branch tips; branches scurfy; peduncle 0–2.7cm. Bracts and bracteoles ovate or lanceolate, 1.5–3mm, scarious, persistent. Calyx glabrous, 1.5–2mm; teeth triangular, 0.5mm. Corolla 1–1.8cm, dimorphic, narrowly clavate in bud, cylindrical in flower, slightly curved, glabrous, white with purplish lobes; lobes ovate, 2.5–3mm; stamens exserted in longer corollas, included in shorter ones. Fruit globose, smooth, clearly 2-partitioned, 6–9mm wide.

**Bhutan:** S – Chukka district (descent to Buxa) and Gaylegphug district (Gaylegphug (117)); **Darjeeling:** Kalimpong, Ramthi, Singla, Mongpu, Tista valley etc.; **Sikkim:** Ligship, Dik Chhu to Singhik (104); **West Bengal Duars:** Madarihat, Titi forest (252). In subtropical forest, mainly in gullies and by streams, 200–1250. April–July.

Leaves edible (34).

## 46. LASIANTHUS Jack

by L.S. Springate

Evergreen shrubs; branchlets slender, hairy. Leaves entire, shortly petiolate; stipules ± ovate, acute to caudate. Cymes solitary (rarely paired) in leaf axils



of current year's growth, compact, sessile or shortly pedunculate; bracts and bracteoles present. Flowers 5-merous. Calyx tube cupular, truncate or with subulate or foliaceous lobes. Corolla  $\pm$  infundibular, white to bluish, upper part of tube woolly inside; lobes ovate, woolly inside, valvate in bud. Anthers subsessile, included in upper part of tube. Ovary 5-locular; ovules solitary; style filiform with 5 slender lobes, included or briefly exerted. (Description of flowers of our species only). Fruit fleshy,  $\pm$  globose.

1. Cymes pedunculate (peduncles at least 1mm) or pedicels 1–2mm  
**4. L. biermannii**
  - + Cymes sessile, flowers subsessile ..... 2
2. Bracts and bracteoles minute, concealed ..... **1. L. lancifolius**
  - + Bracts and bracteoles to 11mm, conspicuous ..... 3
3. Leaf base acute or subacute; petioles 6–10mm ..... **2. L. sikkimensis**
  - + Leaf base rounded or cordate; petioles 3–5mm ..... **3. L. plagiophyllus**

#### 1. *L. lancifolius* Hook.f.

Shoots appressed-puberulous. Leaves narrowly oblong or narrowly lanceolate, 17.5–22  $\times$  2.5–3cm, long-acuminate or caudate, attenuate at base, glabrous above, puberulous on midrib and veins beneath; lateral veins 8 pairs; petioles 4–10mm. Stipules abruptly acuminate, 2.5–3mm. Cymes sessile with c 4 subsessile flowers; bracts and bracteoles minute. Calyx puberulous, tube 1mm; lobes subulate, 0.7mm. Corolla puberulous above outside; tube narrow, 12–13mm; lobes c 2mm. Anthers c 1.5mm. Fruit ovoid, blue, c 4mm across.

**Darjeeling:** Ranga Jhora. 1200m. September–October (255).

Only one specimen has been seen from our area, lacking corollas and fruit; details of these are taken from Deb and Gangopadhyay (255).

#### 2. *L. sikkimensis* Hook.f.

Shoots brownish tomentose. Leaves narrowly oblong (sometimes lanceolate or oblanceolate), 11–20  $\times$  2.5–3cm, long acuminate or caudate, acute at base (rarely subacute), glabrous above, sparsely hairy beneath with tomentose midrib and veins; lateral veins 8–9 pairs; petioles 6–10mm, tomentose. Stipules 1.5mm, obscured by villous hairs and soon exceeded by bracts; colleters prominent. Cymes sessile with 1–3 subsessile flowers; bracts subulate, to 8mm, villous; bracteoles similar, to 4mm. Calyx tube c 1mm, glabrous; lobes ovate, 1.5–2mm, acuminate, hairy. Corolla tube c 4–5mm; lobes c 1–2mm. Fruit subglobose, blue, 5–6mm across.

**Darjeeling:** Kurseong (255), Munsang (34) and unlocalised collections. Lower hill forest (34), c 750m. July–August (255).

Flowers at anthesis not seen.

3. *L. plagiophyllus* Hance; *L. wallichii* (Wight & Arnott) Wight *nom. illeg.*

Shrub to c 2.5m; shoots covered with brownish spreading hairs. Leaves  $\pm$  oblong, 7–14  $\times$  2.5–4cm, mostly long acuminate, unequally rounded or cordate at base, glabrous above, sparsely hairy beneath, more densely so on midrib and veins; lateral veins 8–9 pairs; petioles 3–5mm, hairy. Stipules 1.5–3mm, acuminate, villous. Cymes sessile with c 3 subsessile flowers; bracts subulate, to 11mm, hairy; bracteoles similar, to 4mm. Calyx c 3.3mm, sparsely hairy; lobes triangular or lanceolate, 1.6–2.2mm. Corolla white with sparse short hairs outside; tube 14–15mm, widely flared above; lobes broad-ovate, 4mm. Fruit ovoid, bluish-green, c 4  $\times$  3mm.

**Darjeeling:** Munsang (255). In forest, April–July (255).

No material has been seen from our area, details are based on specimens from East Nepal (Arun Valley, 1500m).

4. *L. biermannii* Hook.f.; *Litosanthes biermannii* (Hook.f.) Deb & Gangopadhyay. Nep: *Siyal Phusre* (34); Lepcha: *Deomuk* (34).

Shrub 0.5–2m tall; shoots covered with yellowish appressed pubescence. Leaves narrow lanceolate or narrow elliptic, rarely broader or oblong, 11–22  $\times$  2.2–5.5cm, long acuminate or caudate, attenuate at base,  $\pm$  glabrous above, subglabrous (sparsely pubescent) beneath with midrib and veins pubescent; lateral veins 5–7 pairs; petioles 8–10mm, pubescent. Stipules 2–4mm, cuspidate; colleters sometimes prominent. Cymes solitary, pubescent, with peduncles (0.5–)3–7(–10)mm, rarely with a smaller cyme or solitary flowers beneath; bracts caudate 3–5(–11)mm; bracteoles c 2mm. Pedicels 1–2mm. Calyx tube to 1mm, pubescent; lobes foliaceous, ovate, 1.5–5mm, acuminate, often subglabrous towards margins. Corolla white, lilac or bluish, tube 7–8mm, subglabrous outside; lobes ovate, c 3.5mm, acute, pubescent outside towards tip. Fruit globose, bright blue, c 12mm across.

**Bhutan** – C: Mongar district (Namning to Lingmethang); **Darjeeling:** many collections from central part, one from Labdah; **Sikkim:** Yoksam, Bakhim, Pemayangtse. Upper hill forest, 1500–2400m. April–September.

#### 47. SAPROSMA Blume

by L.S. Springate & J. Wright

Trees or shrubs, foetid when bruised, at least young branches angled. Stipules connate, toothed. Leaves opposite or in whorls of 3 or 4, entire, petiolate. Inflorescences axillary or terminal, of fascicles, pedunculate trichotomous cymes with slender axes or solitary flowers. Flowers small, 4–5(–6)-merous, sessile or pedicellate. Our species heterostylous. Hypanthium obconic; calyx tube dilated, dentate or lobed. Corolla campanulate to infundibular, throat villous, lobes

with inflexed flat or crisped margins, valvate in bud. Anthers and stigmas included to  $\pm$  exserted. Ovary 2-celled; ovules solitary. Fruit a drupe.

1. **S. ternatum** (Wall.) Hook.f.; *Paederia ternata* Wall.

Tree to 9 m, branches pale, darker when young and angled. Stipules connate, to 1.5cm, bristle-tipped. Leaves elliptic to oblanceolate, 10–18  $\times$  3–7cm, coriaceous, glossy above, acuminate, base cuneate to attenuate, glabrous or sparsely puberulous beneath, venation prominent beneath, lateral pairs 6–8; petioles 0–1cm. Peduncles c 2cm; pedicels c 1cm. Bracts and bracteoles small and squamiform to linear and up to 3mm, pubescent. Calyx glabrous, tube c 1mm; lobes broadly triangular, 0.3–1mm. Corolla infundibular, white, pubescent; tube 5mm; lobes rounded, c 3mm. Stamens inserted at base of throat. Stigma 2(–3)-fid. Long-styled plants: anthers subsessile, included; stigma barely exserted. Short-styled plants: filaments c 3mm; anthers  $\pm$  exserted; stigma included in throat. Fruit ellipsoid, 8–10mm, smooth, brown-black, crowned by conical disk with calyx lobes at base. Pyrenes 1(–2).

**Bhutan:** unlocalised (80).

No specimens have been seen from our area, the description is based on materials from Assam.

#### 48. PAEDERIA L.

by L.S. Springate

Climbing shrubs or subshrubs, foetid when bruised. Leaves opposite or rarely whorled, entire, usually petiolate. Stipules ovate to narrowly triangular, sometimes bifid. Inflorescence terminal or lateral, thyrsoid or paniculate, lax, bracteate. Flowers pedicellate or subsessile, (4–)5(–6)-merous. Calyx tube obsolete; lobes minute to relatively long, triangular or subulate, persistent in fruit. Corolla funnel-shaped to campanulate, glabrous to pubescent outside; tube densely villous inside; lobes valvate in bud. Stamens (in our species) included, borne near centre of tube at different levels ( $\pm$  3 higher and 2 lower); filaments very short; anthers oblong. Ovary bilocular; ovules solitary; style (in our species) filiform, included, largely divided into 2 serpentine branches. Fruits globose to ovoid, sometimes compressed; exocarp thin, brittle, usually glossy; pyrenes 2, either flattened, winged, pendulous from filiform carpophore or hemispherical,  $\pm$  unwinged, without persistent carpophore.

1. Fruit ovoid, laterally compressed, 9–11mm; pyrenes winged

1. **P. cruddasiana**

+ Fruit globose, 4–6mm; pyrenes not winged ..... 2. **P. foetida**

1. **P. cruddasiana** Prain subsp. **cruddasiana**; *P. foetida* auct. non L. Nep. *Biri*. Fig. 76a–c.

Stems to c 10m, glabrescent. Leaves hairy beneath in vein axils, rarely also on veins beneath or both faces puberulous; leaves of mid-stem ovate, 110–190

× 37–85mm, acuminate, truncate at base; petioles (15–)25–55mm. Inflorescence 0.1–1m, puberulous; main axis often leafy below with narrower leaves sometimes more attenuate at base; bracts and bracteoles of subsequent axes small ciliate-lacinate scales. Flowers subsessile. Calyx lobes triangular, c 1.2mm, sometimes ciliate. Corolla outside reddish or purplish beneath whitish pubescence; tube 9–12.5(–16)mm; lobes ovate with broad undulate margin, c 1.5mm, whitish within. Fruits ovoid, laterally compressed, 9–11 × 6–8.5mm, eventually yellow-brown; pyrenes ovate, scarcely smaller than fruit, black with 2–3mm yellowish wing.

**Bhutan:** S – Sarbhang district (Jogi Dhanra), C – Mongar district (Mongar) and Tashigang district (Gunkhara, Gamri Chu); **Darjeeling:** frequent. Forest openings, secondary vegetation, 150–1900m. June–November.

**2. *P. foetida* L.; *P. scandens* (Loureiro) Merrill, *P. tomentosa* Blume.** Nep: *Biri, Biri Lahara* (34); Lepcha: *Takpaed-rik* (34). Fig. 76d&e.

Similar to *P. cruddasiana* but inflorescence occasionally densely pubescent or leafy to apex; ultimate branches of inflorescence more often conspicuously scorpioid; fruit globose, 4–6mm, yellow to reddish-brown; pyrenes black, more or less hemispherical, 3.5–5mm, without conspicuous wing, often covered with raphides.

**Bhutan:** C – Mongar district (Ngasam); **Darjeeling:** Lingtam, Ramshai, Lopchu, Sivok terai etc. Forest openings, secondary vegetation, 100–1500m. August–October.

The two species are very similar in foliage and flower and only reliably separated by their fruit. Literature records of flowering specimens are therefore unreliable. Such unidentifiable collections exist from Bhutan from Samchi district (Samchi, Samchi Hill), Phuntsholing district (Phuntsholing), Gaylegphug district (Gaylegphug) and Mongar district (Tama (117)). The leaves of one or both species are used medicinally and the fibre is valued for strength and flexibility and the Shachop name *Khiroo* applied. Fruits of both species used to blacken teeth and prevent toothache (34).

## 49. SPERMADICTYON Roxb.

by J. Wright

Erect or scrambling shrub, trichotomously branched, stems ± terete, pithy. Leaves foetid when bruised, opposite, elliptic(–ovate), entire, petiolate. Stipules broad-triangular, short, persistent, cuspidate. Flowers in tight cymules in a terminal, lax, paniculate or corymbose, pubescent cyme. Bracts and bracteoles small, narrow-triangular. Flowers sweet-scented, 5-merous, heterostylous. Calyx

short, tube obsolete; lobes ovate-acuminate to subulate. Corolla infundibular, tube slender, much exceeding lobes; lobes valvate in bud. Filaments inserted near top of tube; anthers included or  $\pm$  exerted. Ovary 5-celled, ovules solitary, basal; style filiform; stigma 5-fid, exerted or included. Fruit capsular, 5-valved; calyx persistent. Pyrenes triquetrous, coat reticulate.

1. *S. suaveolens* Roxb. var. *azureum* (Voigt) Bennet & Raizada; *Hamiltonia suaveolens* sensu F.B.I. p.p. Nep: *Bhain Chanpa* (34).

Shrub to 4m. Leaves 10–17(–27)  $\times$  3–9(–12)cm, those in inflorescence smaller, sometimes tinged crimson, acute, base cuneate, subglabrous to puberulous above, subglabrous to tomentose below, venation conspicuous, of 10–15 lateral pairs. Petioles 1–2cm. Stipules 3–4mm, denticulate and tinged crimson near apex. Inflorescence 10–25cm. Calyx densely hirsute, crimson-purple; lobes 1–2mm. Corolla blue, mauve or violet, pubescent outside, glabrous or pubescent within tube; tube c 13mm; lobes spreading,  $\pm$  ovate, 2–3.5mm. Capsules pale, oblong-ellipsoid, 7–9mm.

**Bhutan:** S – Samchi district (Samchi (117)), Phuntsholing district (cultivated in Phuntsholing) and Deothang district (Tsalari Chu), C – Punakha district (Wangdu Phodrang), Tongsa district (Dakpai (117)) and Tashigang district (Tashigang, Gamri Chu); **Darjeeling:** Rilli; **Sikkim:** Pemayangtse. On forest and scrub slopes and by rivers, 500–1400m. October–November(–February).

*S. suaveolens* var. *suaveolens* differs in its white flowers and has not been recorded in our area.

## 50. LEPTODERMIS Wall.

by L.S. Springate

Deciduous shrubs; branches terete. Leaves opposite, entire, shortly petiolate. Stipules small, triangular, persistent. Inflorescences of 1–7-flowered cymules, terminating new shoots or borne on old wood, terminating short lateral shoots. Cymules pedunculate, with ring of 2 leaf-like to ligulate bracts and 2 scarious stipules subtending flowers. Flowers heterostylous, 5(–6)-merous, on short pedicels with 2 sub-scarious, cuspidate, partly fused bracteoles. Calyx coriaceous, tube short or almost absent; lobes short. Corolla infundibular, much exceeding calyx, smooth, papillate or hairy outside; throat with many long, fine, tuberculate hairs; lobes with fewer smooth thick hairs inside, valvate in bud with broad infolded margin. Stamens inserted on upper tube; filaments short; anthers linear-oblong, dorsifixed, included or mostly so. Ovary (3–)5-celled; ovules solitary. Style filiform with 2–5 stigmatic branches included beneath stamens or exerted. Fruit capsular, cylindrical to obovoid, glossy, 5-valved to base, valves terminated by a calyx lobe; pyrenes erect, oblong-obovoid, covered with simple or reticulate, loose or appressed fibres.

Description below of shoot vestiture refers to young growth; older shoots and stipules often become covered by fine erect fungal conidia (black at least when dry).

A specimen retaining some leaves in April has been collected in Bhutan between Tashiling and Tongsa. It cannot be readily identified with any of the four species below.

- |  |                          |
|--|--------------------------|
| 1. Bracteole pairs not exceeding hypanthium .....                                    | 1. <i>L. ludlowii</i>    |
| + Bracteole pairs exceeding hypanthium .....   | 2                        |
| 2. Flower-heads terminating short shoots on old wood, overtopped by new growth ..... | 2. <i>L. kumaonensis</i> |
| + Flower heads terminating new growth .....  | 3                        |
| 3. Corolla tube less than 11.5mm; main veins of leaf 3–5 pairs                       | 3. <i>L. stapfiana</i>   |
| + Corolla tube more than 11.5mm; main veins of leaf 5–9 pairs                        | 4. <i>L. amoena</i>      |

**1. *L. ludlowii*** Springate. Fig. 75a–c.

Shrub 0.6–1.5m tall; shoots with 2 bands of hairs decurrent from stipules. Leaves ovate or ovate-oblong, to 48 × 20mm, gradually to abruptly acuminate, attenuate at base, ciliate, subglabrous to puberulous above and beneath; main veins (3–)4–5 pairs; petioles 2–4mm, pilose adaxially. Stipules 1.5–3(–4)mm, cuspidate, glandular-denticulate or laciniate, ciliate, pubescent below. Flower-heads terminating new growth, compact, of (1–)few cymules and up to 12 flowers; bract pairs foliaceous, petiolate, rarely ligulate on subsidiary 1-flowered cymules. Bracteole pairs not exceeding hypanthium, deeply divided, subglabrous, usually ciliate, central pair often more elongate and cuspidate. Calyx glabrous, tube 1.1–1.4mm; lobes triangular, rarely rounded, 0.7–0.8mm, usually ciliate, rarely extra or deeper lobes predominant. Corolla broad-infundibular, white or cream to reddish or violet, sometimes bicoloured, mamillate outside with few hairs at apex; tube 10–11.5mm; lobes 2–3mm. Stigmas (2–)3–4.

**Bhutan:** S – Chukka district (Gedu, upper Raidak valley), C – Ha district (Ha to Puduna), Thimphu district (Cheka to Gunisawa, Pyemitangka), Bumthang district (Shabejetang); **Sikkim:** Galing; **Chumbi:** Yatung. Riversides in shade, on gravel, 2200–3000m. June–September.

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FIG. 75. **Rubiaceae.** a–c, *Leptodermis ludlowii*: a, flowering shoot (× ½); b, cymule (× 2); c, dissected flower (× 3). d, *Leptodermis stapfiana*: flowering shoot (× ½). e, *Leptodermis kumaonensis*: flowering shoot (× ½). f–h, *Leptodermis amoena*: f, flowering shoot (× ½); g, bracteole (× 3); h, dissected flower (× 3). Drawn by M. Bates.



2. *L. stapfiana* Winkler; *L. scabrida* auct. non Hook.f., *L. griffithii* auct. non Hook.f. Fig. 75d.

Shrub 0.2–2.4m tall, often stunted and variable in habit; shoots with hairs in two rows or more scattered. Leaves oblong-lanceolate or elliptic, to 50 × 20mm though sometimes not exceeding 15 × 6mm, acute, attenuate at base, ± pubescent above and beneath; main veins 3–5 pairs; petioles to 5mm, pubescent. Stipules to 4mm, cuspidate, ciliate, pubescent, apex often spreading, spinulose. Inflorescence on current growth; compact clusters of up to 20 flowers at shoot apex, at upper nodes and at apex of any lateral shoots, rarely whole upper shoot a single dense inflorescence or all cymules well-separated; uppermost bract pair often shorter than its flowers, though usually still ± leaf-like. Bracteole pairs usually exceeding calyx at anthesis, c 4.5mm, divided c 1/3; lobes of central pair often more attenuate. Calyx tube 0–0.5mm, lobes ovate-oblong, sometimes irregular, 0.8–1.3(–1.8)mm, ciliate-denticulate. Corolla infundibular, white to deep maroon or violet, sometimes darkening with age or bicoloured, pubescent outside; tube 9.0–11.2mm; lobes 1.2–3mm. Stigmas (3–)4–5.

**Bhutan:** S – Chukka district (Raidak valley), C – Thimphu and Punakha districts (frequent), Tashigang district (Tashigang). Scrub on dry banks and hillsides, 1300–3350m. May–September.

3. *L. kumaonensis* Parker. Fig. 75e.

Shrub 0.5–2.5m tall; young stems glabrous or subglabrous. Leaves lanceolate, rarely elliptic, to 80 × 20mm, much smaller on short shoots, acuminate, attenuate at base, both faces ± puberulous, lower almost white; main veins 6–8 pairs; petioles 5–8mm, pubescent. Stipules carinate above, pubescent below, eciliate. Flower-heads narrow, spike-like, terminating short shoots covered with stipules below, on old wood only, (1–)2(–4) at each node; bracts all foliaceous, long-petiolate. Bracteole pairs exceeding calyx at anthesis, divided c halfway with shortly cuspidate lobes or less divided with more truncate lobes. Calyx tube c 0.5mm; lobes irregular, c 0.6mm, ciliate, often fimbriate. Corolla infundibular, pubescent and maroon outside, paler within; tube 9–10mm; lobes 3–4mm. Stigmas (4–)5.

**Bhutan:** C – Punakha district (Tang Chu) and Tongsa district (Chendebi). Open hillsides, in sun or half shade, 2600–2850m. June.

4. *L. amoena* Springate. Fig. 75f–h.

Shrub 0.6–2.5m tall; stems very slender, erect, puberulous or glabrescent. Leaves ovate-lanceolate, subglabrous or puberulous, scabridulous towards tip above, to 50 × 19mm with 5–7 pairs of main veins on flowering shoots, to 87 × 30mm with 8(–9) pairs on sterile shoots; petioles to 4mm, puberulous; stipules to 3.5mm (to 5mm on sterile shoots), cuspidate, ciliate, pubescent below. All upper nodes of new shoots fertile, bearing 2–4 floriferous lateral shoots with axillary and terminal pedunculate clusters of cymules, often forming a very open inflorescence with slender, elongate axes; bracts of cymules small, ± ligulate.



Bracteole pairs  $\pm$  equalling calyx at anthesis, 5–5.5mm, divided c halfway, mucronulate or cuspidate, ciliate. Flowers fragrant. Calyx tube absent; lobes oblong, 1.2–2.2mm, obtuse to acuminate, ciliate. Corolla narrow-infundibular pale to purplish-pink, pubescent outside; tube slender, 12–14mm with long fine hairs within; lobes 3–4mm, glabrous inside. Stigmas 5.

**Bhutan:** C – Thimphu district (Thimphu), Tongsa district (Tashiling, Mangde Chu) and Tashigang district (Jiri Chu, Gamri Chu, Tashigang). Open hillsides and in scrub, 900–2100m. October–November.

Endemic to Bhutan and adjacent Arunachal Pradesh (279).

## 51. SPERMACOCE L.

by R.R. Mill

Annual or perennial herbs. Stems erect or prostrate, often 4-angled. Leaves opposite, decussate or in false whorls, sessile or petiolate; lamina linear to ovate or obovate; stipules connate with petioles forming a broad truncate tube, fimbriate, with marginal bristles. Flowers small or minute, in  $\pm$  congested dichasial cymes often forming dense heads of up to 350 flowers subtended by 1–8 pairs of leaf-like bracts and often with filiform bracteoles. Hypanthium obconical or  $\pm$  cylindrical, pubescent above; calyx tube  $\pm$  absent above hypanthium, with 2–8 lobes. Corolla infundibular or salver-shaped; lobes 4. Stamens 4; anthers included or exserted. Ovary 2-locular with 1 amphitropous ovule in each loculus. Fruit a 2-valved capsule, with various types of dehiscence.

- 1. Leaves linear-elliptic to narrowly lanceolate ..... **5. S. pusilla**
- + Leaves elliptic or ovate ..... 2
- 2. Corolla tube much longer than calyx ..... **2. S. articularis**
- + Corolla tube subequal to or shorter than calyx ..... 3
- 3. Leaves undulate-margined; seeds c 2.5mm ..... **3. S. hispida**
- + Leaves flat-margined; seeds 0.5–1.5mm ..... 4
- 4. Inflorescences 4–8-flowered; stems and leaves usually bright yellowish-green; calyx lobes 4, triangular-lanceolate, shorter than distinct calyx tube, hypanthium c  $\frac{1}{6}$   $\times$  calyx; corolla c 2  $\times$  calyx ..... **1. S. latifolia**
- + Inflorescences 15–30-flowered; stems and leaves dull green without yellow tinge; calyx tube  $\pm$  absent, lobes 2, linear, 1.5–2mm, on top of hypanthium; corolla  $\pm$  included in calyx, greenish-yellow or cream .... **4. S. mauritiana**

**1. S. latifolia** Aublet; *Borreria latifolia* (Aublet) Schumann. Nep: *Alujhar* (272).

Prostrate or decumbent annual or perennial herb; stems and leaves bright yellowish-green. Stems 50–100cm, flattened, with 3 narrowly green-winged

angles, shortly subappressed retrorse-pubescent or -scabrid on angles or nearly glabrous. Leaves opposite, sessile or with short petioles not more than 5mm; lamina elliptic or ovate, 10–30 × 3–20mm, acute, base shortly cuneate, margin flat, entire and ± densely scabrid, sparsely pubescent or scabrid above and more so beneath especially on veins. Stipular sheath 1–2 × 3–5mm; bristles 5–8, 2.5–4mm. Flowers minute, in small clusters of 4–8 at nodes; clusters 7–9mm across, sessile. Calyx tube (incl. hypanthium) c 3mm in flower, c 5mm in fruit; lobes very short. Corolla fugacious; tube white, c 3mm; lobes lavender, c 0.5mm. Stamens exserted. Capsule finely reticulate-warty, pubescent above and glabrous below, septicial then loculicidal; seeds released apically. Seeds ellipsoid, c 1.5 × 0.5mm, blackish with magenta tinge, deeply sulcate ventrally.

**Sikkim:** Namli to Gangtok (69). 900m. September.

An introduced weed of orchards, tracks and paths (272). Readily distinguished from *S. articularis*, with which it has been confused, by its bright yellow-green leaves and stems. May occur in S Bhutan (Samchi, Phuntsholing and Gaylegphug districts); literature records (38) from these districts have not been accepted as some authorities consider that the specimens, (which have not been examined), belong to *S. latifolia* while others regard them as *S. articularis*.

**2. *S. articularis*** L.f.; *Borreria articularis* (L.f.) Williams, *S. scabra* Willd., *S. hispida* auct., sensu F.B.I., non L.

Prostrate or diffuse annual. Stems 10–40cm, sharply 4-angled, shortly pilose, pubescent or scabrid on angles, hairs usually declinate. Leaves opposite (uppermost in fours), subsessile, elliptic, 15–35 × 6–15mm, acute, base broadly cuneate, shortly pubescent on both surfaces and with narrowly thickened scabrid margins. Stipular sheath 1–2 × 3–4.5mm, with 7–9 bristles 3–7mm. Inflorescences axillary, few-flowered, 4–9mm across. Calyx lobes c 2.5mm. Corolla mauve, lilac or bluish with white tube, narrowly infundibular; tube 4–6.5mm, usually slightly expanded above; lobes 0.5–1mm. Stamens just exserted from corolla tube. Style exserted from corolla and longer than stamens, with bilobed papillose stigma. Capsule pubescent above, broadly ellipsoid. Seeds narrowly ellipsoid, c 1.5mm, with reticulate testa.

**Bhutan:** S – Recorded from Samchi and Gaylegphug districts (38) but confirmation is required.

Distinguished from *S. latifolia*, with which it has often been confused in the literature, by its grey-green, not bright yellow-green, stems and leaves; much confused also with *S. hispida*, from which it differs by its flat or scarcely undulate leaves, longer, more narrowly infundibular corollas and smaller seeds. *S. articularis* is also extremely similar in facies to *Mitracarpus hirtus* (L.) DC., from which it can, however, be readily distinguished by its darker seeds with a single longitudinal ventral groove, instead of four grooves arranged crosswise.

**3. *S. hispida*** L.; *Borreria hispida* (L.) Schumann

More or less erect, much branched annual with rather shrubby habit. Stems

11–20cm, obscurely 4-angled to terete, spreading-pilose or shortly pubescent at least on angles; internodes 8–30mm, often abbreviated. Leaves  $\pm$  sessile, opposite, 6–15  $\times$  2.5–12mm, obtuse or rarely acute, scabrid to hispidulous above, pilose to hispid beneath on veins and lamina. Stipular sheath with 8–20 bristles 2–2.5mm. Flower clusters 4–8mm across. Calyx lobes 4, ovate to elliptic, c 3.5  $\times$  1.7mm. Corolla turbinate-campanulate; tube 2.5–3mm, noticeably dilated upwards; lobes 2–3mm. Capsule c 3.5mm; seeds black, ellipsoid, c 2.5  $\times$  1.2mm, closely pitted.

**Darjeeling:** Siliguri. (Fruiting in February).

**4. *S. mauritiana*** Gideon; *Borreria repens* DC., *S. decandollei* Deb & Dutta *nom. illegit.*, *S. ocymoides* auct. non Burman f. Fig. 76f–h.

Prostrate or decumbent annual, with adventitious roots from lower nodes. Stems 8–30cm, unbranched or sparsely branched above, flexuous, narrowly winged,  $\pm$  densely pilose or scabrid on angles. Leaves opposite, sessile or very shortly petiolate; lamina ovate or ovate-elliptic, 8–25  $\times$  4–11mm, acute, base cuneate, margin flat or scarcely revolute, scabrid; upper surface darker than lower,  $\pm$  glabrous except for scabrid midrib; lower surface with (4–)5(–6) pairs of veins, glabrous except on veins. Stipular sheath 1–1.5(–2)mm, apically 2–4mm broad; bristles 3–4(–7), 3–4mm. Inflorescence of several small 15–30-flowered semi-globose axillary clusters 4–6mm across; bracts usually 4, sometimes 6, 8 or 10, largest pair similar in size to leaves, others progressively smaller; bracteoles numerous, c 2mm, filiform. Calyx tube c 0.5mm; lobes 2, linear, 1.5–2mm, recurved in fruit. Corolla  $\pm$  included in calyx, white or greenish-white; tube 0.2–0.3mm; lobes triangular, 0.3–0.4mm. Capsule urn-shaped, c 2mm; seeds 0.5–0.6mm, grooved ventrally.

**Bhutan:** S – Phuntsholing district (Toribari and above Phuntsholing). Weed of arable fields.

A widespread weed in Southern Bhutan (272). A record of *Borreria ocymoides* (Burman f.) DC. from Samchi district (Samchi (38)) probably refers to *S. mauritiana*. *S. ocymoides* Burman f. differs from *S. mauritiana* in its 4-lobed calyx; it has a more southerly distribution (S India, Java, Myanmar) and there are no confirmed records from our area.

**5. *S. pusilla*** Wall.; *S. stricta* sensu F.B.I. non L.f.

Wiry, suberect or prostrate annual. Stems 3–20cm, 4-angled, scabrid on angles, otherwise glabrous. Lower leaves opposite, upper in whorls of 4, all sessile; lamina linear-elliptic, 20–40  $\times$  2–5mm, gradually acuminate, base gradually attenuate, margin strongly inrolled, revolute margins  $\pm$  touching each other towards apex; upper surface, and midrib beneath, scabrid, epidermal cells large and hexagonal, easily visible at  $\times$  20; lower surface glaucous with some sessile reddish glands. Stipular sheaths brown, scarious, bearing c 9 long unequal brownish bristles; lower connate part densely scabrid. Inflorescence of axillary and terminal semi-globose clusters; bracts leaf-like, 2–10 at each node, unequal.

Calyx lobes 4, narrow, lanceolate, c 1mm, c 2 × tube. Corolla white or pink, tube infundibular, 1.5mm; lobes c 0.6mm, suberect, scabridulous near apex; hypanthium ovoid, hairy at top, c 1.5mm. Stamens exserted; anthers c 0.4mm. Capsule ellipsoid, 3–4 × 1–2mm, pubescent above, septicial then loculicidal, septum splitting irregularly and not detached from mericarp. Seeds oblong-ellipsoid or narrowly ellipsoid, 2–3mm, dark brown.

**Bhutan:** S – Phuntsholing district (Kamji (38)), C – Punakha district (Wangdu Phodrang to Chusom), Tashigang district (near Kheri (38)). Open sal forest, among shrubs, dry banks and field margins, 600–1670m. August–December.

## 52. MITRACARPUS J.A. & J.H. Schultes

by R.R. Mill

Annual or perennial herbs. Leaves subsessile, petioles united with stipules forming a setose stipular sheath. Inflorescences of small, terminal and axillary, semi-globose heads of numerous, minute, 4-merous flowers. Hypanthium short; calyx lobes 4, persistent, 2 much longer than other 2. Corolla infundibular, lobes 4, valvate. Stamens included or ± exserted. Fruit a 2-locular circumscissile capsule with 1 seed in each loculus. Seeds ellipsoid or ovoid, with an X-shaped groove, darker than rest of surface, on ventral surface.

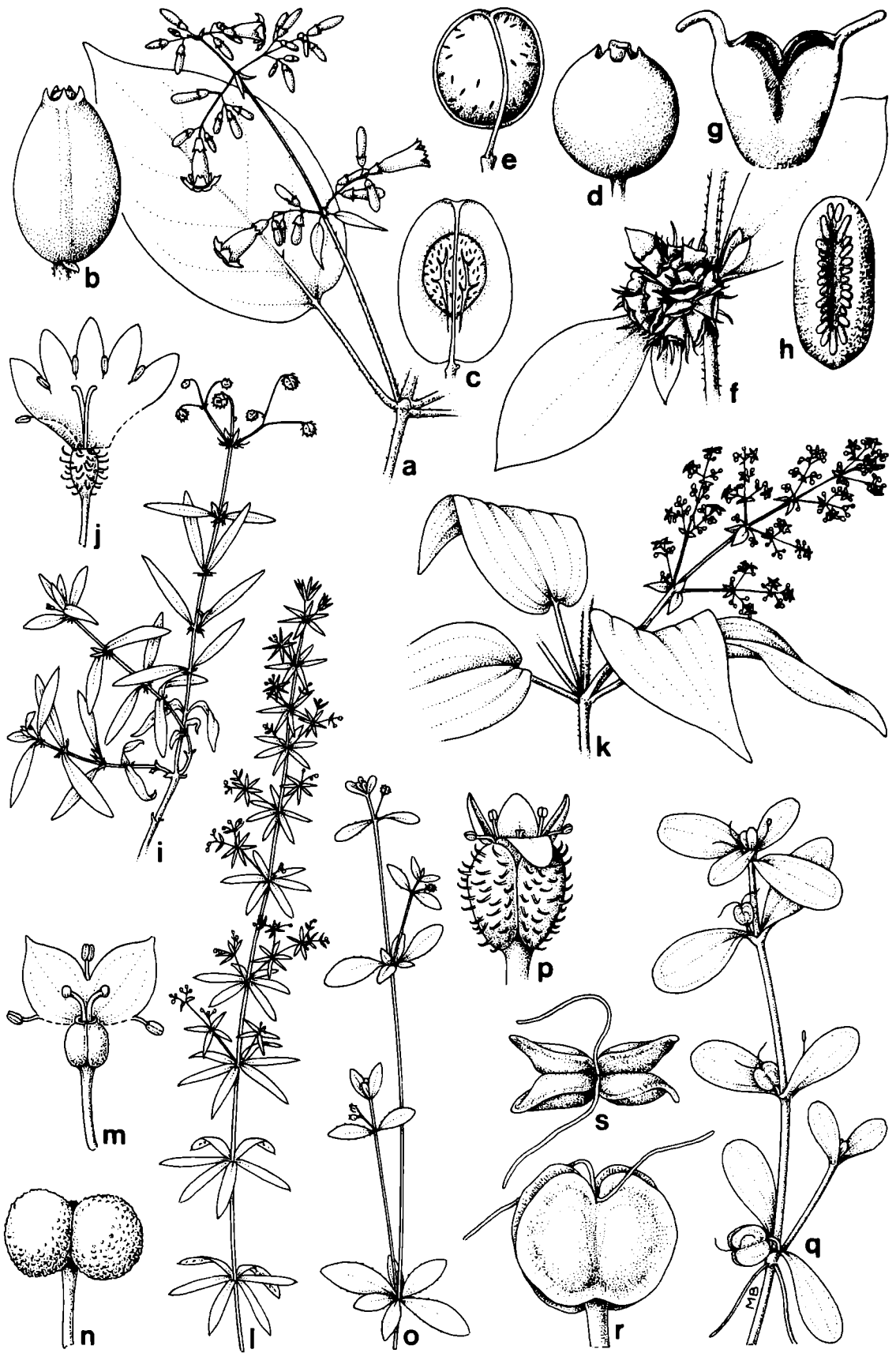
1. **M. hirtus** (L.) DC.; *Spermacoce hirta* L., *M. villosus* (Swartz) DC. Fig. 73a&b.

Erect or decumbent annual. Stems 10–25cm, simple or branched from above base, hispid to villous all round with rather long spreading or declinate hairs. Leaves elliptic, subsessile, 15–30 × 5–15mm, entire with flat margins, acute, base cuneate, shortly hispid or pubescent all over both surfaces; stipular sheath 2–3 × 4–6mm, with 8–10 bristles 2–2.5mm. Flower heads 8–11mm across; bracts 2 or 4, leaf-like; bracteoles numerous, filiform. Hypanthium short; calyx lobes persistent, lanceolate or subulate, dehiscing with fruit. Corolla white; tube c 1.8mm, lobes c 0.6mm, pubescent on margins. Anthers c 0.5mm. Seeds olive-brown, minutely pitted and with X-shaped ventral groove.

**Bhutan:** S – Samchi district (Daina Khola) and Phuntsholing district (Torsa

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FIG. 76. **Rubiaceae and Callitrichaceae. Rubiaceae.** a–c, *Paederia cruddasiana* subsp. *cruddasiana*: a, leaf and inflorescence (× 2/3); b, fruit (× 2); c, pyrene. d–e, *Paederia foetida*: d, fruit (× 3); e, pyrene (× 3). f–h, *Spermacoce mauritiana*: f, leaf and inflorescence (× 3); g, capsule (× 14); h, seed (× 20). i–j, *Kelloggia chinensis*: i, flowering shoot (× 2/3); j, flower with 2 petals removed (× 4). k, *Rubia manjith*: node and inflorescence. l–n, *Galium megacyttarion*: l, flowering shoot (× 1); m, flower with 2 petals removed (× 10); n, fruit (× 10). o–p, *Galium exile*: o, flowering shoot (× 1½); p, flower (× 18). **Callitrichaceae.** q–s, *Callitriche stagnalis*: q, fruiting shoot (× 3); r, fruit side view (× 10); s, fruit from above (× 10). Drawn by M. Bates.



River above Phuntsholing). Shingle and grassland by rivers, 230–360m. March–October.

Native of West Indies and parts of tropical S America; introduced in Asia and Africa. Very similar in its general facies to *Spermacoce articularis* L.f. but the cross-like groove on the seeds is diagnostic.

### 53. KELLOGGIA Torrey

by R.R. Mill

Low, loosely caespitose perennial herbs. Leaves opposite,  $\pm$  sessile; blade narrowly ovate to narrowly elliptic; 0 or 2 minor leaves developing at each node. Interpetiolar stipules ovate, fimbriate. Inflorescence rather compact or lax, cymose; cymes trichotomous or less commonly dichotomous, few-flowered. Peduncles (occasionally absent) and pedicels puberulent, with hamate tip or not, lacking or possessing a swelling just below ovary. Calyx lobes very small, 5 (rarely 6). Corolla infundibular, puberulent outside especially on lobes; tube narrow,  $\pm$  dilated above; lobes 5, suberect but slightly patent. Stamens exerted from corolla tube, slightly shorter than lobes; anthers linear to ellipsoid. Style subequalling corolla, divided apically into 2 short, nearly parallel stigmatic arms. Mericarps narrowly ellipsoid, densely covered with numerous hooked hairs.

#### 1. *K. chinensis* Franchet; *Galium aberrans* W.W. Smith. Fig. 76i&j.

Caespitose perennial. Stems 2–7 per plant, decumbent to suberect, 3–8cm in flower, 7–12cm in fruit, adpressed-puberulent. Leaves mainly basal and just below inflorescence, ovate-elliptic or ovate-lanceolate (lowest ones broadly elliptic), 7–15  $\times$  2.4–4mm (lowest 2–8  $\times$  1.5–4mm), acute or shortly acuminate (lowest very obtuse), base cuneate or shortly attenuate, sparsely puberulent on abaxial surface and on margin and veins of adaxial surface; stipules 2.5–4.5mm, reddish-brown, fimbriate. Inflorescence compact in flower, laxer in fruit; peduncles 0–1mm; pedicels 1–2.5mm in flower, 2.5–11.5mm in fruit, densely and minutely puberulent. Flowers 4.2–6mm. Corolla rose-pink, 3.2–5.2mm; tube (0.5–)1–1.8mm, lobes narrowly elliptic, 1.7–3.5  $\times$  0.4–1.1mm, puberulent outside. Anthers narrowly ellipsoid, 0.5–0.6  $\times$  0.2–0.25mm. Mericarps ovoid, 2–2.5  $\times$  1–1.8mm (excl. hooked hairs); hooked hairs 0.6–0.7mm, shiny and silvery, with blackish tips, hooks directed upwards.

**Bhutan:** N – Upper Mo Chu district (Gangyuel Chu). Flat grassy ground on river bank, c 3680m. April (China & Tibet); fr. September.

Only collected once in Bhutan, in fruit in September 1984; the description of the flower is based on specimens from Yunnan and SE Tibet, including the type of *Galium aberrans*.

## 54. RUBIA L.

by D.G. Long

Scrambling or climbing perennial herbs; stems quadrangular, often minutely prickly. Leaves in whorls of 4–8, often rough to touch; petioles present or absent. Flowers (4–)5-merous, solitary or in diffuse axillary and terminal bracteate panicles. Calyx adnate to ovary; lobes absent. Corolla subtrotate, with very short tube and spreading lobes. Stamens inserted on corolla tube; filaments short. Ovary 2-lobed, 2-celled; styles 2, free or partly united; stigma capitate. Fruit bilobed-subglobose, fleshy, smooth and glabrous.

1. Leaves linear-filiform or elliptic, not differentiated into petioles and lamina 2
- + Leaves with narrow petioles and lanceolate to ovate lamina 3
2. Leaves linear-filiform, 0.4–1.5mm broad 1. **R. charifolia**
- + Leaves elliptic, 15–45mm broad 2. **R. sikkimensis**
3. Stems spreading-hispid and prickly; leaves on older stems broadly ovate, 3–7cm broad 5. **R. hispidicaulis**
- + Stems glabrous, scabrous-prickly or minutely pubescent, never spreading-hispid; leaves on older stems ovate to lanceolate, 1–4cm broad 4
4. Plants suffused reddish throughout, especially when dry; flowers 3.5–4.5mm diameter 3. **R. manjith**
- + Plants green except for roots and sometimes flowers; flowers 4–6mm diameter 4. **R. wallichiana**

**1. *R. charifolia*** G. Don; *R. angustissima* sensu F.B.I. p.p. non G. Don

Scrambling *Asparagus*-like herb to 1m or more; stems wiry, quadrangular, retrorsely hooked. Leaves 4–8 in each whorl, linear, without petiole, 1.3–7cm × 0.4–1.5mm, acute, with prominent midrib beneath, scabrid-toothed or hooked on midrib and margins. Flowers solitary, axillary or in few-flowered axillary cymes; bracts linear, 2–4mm; pedicels filiform, 2–14mm. Flowers greenish, 5-merous, 4–5mm diameter. Corolla tube c 0.4mm; lobes ovate 1.8–2mm. Stamens shortly exerted. Styles curved, free; stigmas capitate. Fruit globose, c 4mm diameter, or bilobed to 6mm wide.

**Darjeeling:** Kalimpong, Pashok, Rilli Forest, Tista and Rangit valleys, Siriong, etc.; **Sikkim:** Rishi to Rinchenpong. Subtropical scrub, 300–1300m. September–October.

Sometimes wrongly united with *R. angustissima* G. Don from Burma which differs in its coarser habit, longer leaves to 15cm and shorter stouter pedicels. Early records from Bhutan are based on specimens from Kalimpong.

**2. *R. sikkimensis*** Kurz. Nep: *Manjito*; Med: *Tsod*.

Stout climbing herb to 5m; stems quadrangular, ribbed, hooked. Leaves stiff and rough to touch, in whorls of 4, without petiole, elliptic or lanceolate, 6–14 × 1.5–4.5cm, acute or acuminate, base cuneate, palmately 3–5-veined; veins prominent beneath, retrorsely hooked. Flowers in terminal and axillary panicles 5–30 × 4–10cm; bracts lanceolate, 2–3mm; pedicels 0.5–1.5mm. Flowers pale green, 4–6mm diameter. Calyx tube 0.5mm. Corolla tube very short, lobes ovate-lanceolate, c 2mm, with subulate tip. Styles recurved, united in lower half. Fruit globose or bilobed, 5–8mm diameter.

**Bhutan:** S – Chukka, Gaylegphug and Deothang districts, C – Tongsa district; **Darjeeling:** Darjeeling, Kurseong, Sittong, Rishap, Rungbee, Mongpu, Pankhabari, Ryang Chhu; **Sikkim:** Lingcham. Subtropical and warm broad-leaved forests, 500–1600m. October–June.

Stems are an important source of red dye. Some flowers appear to be functionally unisexual, others are fully bisexual.

**3. *R. manjith*** Roxb.; *R. cordifolia* auct. p.p. non L. Nep: *Manjit*, *La-nyi-roo*. Fig. 76k.

Climbing herb to 3m, reddish-tinged throughout especially when dry; stems quadrangular, weakly strigose-hooked to almost smooth. Leaves in whorls of 4, occasionally opposite, often strongly reddish-tinged beneath, ovate-lanceolate to ovate (becoming narrower up stems), 3.5–8 × 1–4cm, acuminate, base cordate on lower leaves, rounded on upper leaves, 3–5-veined, ± glabrous, minutely strigose on veins above; petioles 2.5–10cm, strigose-hooked. Flowers in axillary and terminal panicles to 20 × 8cm; lower bracts leaf-like, upper bracts small; pedicels 2–3.5mm. Flowers red or orange, 3.5–4.5mm diameter, 5-merous. Corolla tube c 0.6mm; lobes ovate, c 1.4mm with very short point. Styles 2, short, free. Fruit black when ripe, bilobed-globose, 3.5–5mm broad.

**Bhutan:** S – Chukka, Gaylegphug and Deothang districts, C – Punakha and Mongar districts; **Darjeeling:** Sivok, Sureil, Sitong, Labha, Lebong etc.; **Sikkim:** Bakhim and Gangtok. Scrambling on rocks and shrubs at forest margins, along footpaths, hedgerows in subtropical and warm broad-leaved forest zones, 1150–2300m. June–October.

Stems used to produce red dye. Some plants referred to *R. cordifolia* L. var.  *khasiana* Watt belong here; this may prove to be a synonym.

**4. *R. wallichiana*** Decaisne; *R. cordifolia* auct. p.p. non L., *R. asperrima* Jacquemont

Similar to *R. manjith* but plants green throughout; stems often more prickly with hooked prickles; leaves lanceolate to ovate, very variable in size, lower ones cordate at base; flowers larger, 4–6mm diameter (rarely smaller), green, yellow or occasionally reddish; corolla lobes 2–3mm with subulate apex.

**Bhutan:** C – Ha, Thimphu, Punakha, Bumthang and Mongar districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling:** Senchal.



Darjeeling; **Sikkim:** Chho La, Ligship, Kalipokhri, Chiya Bhanjang etc. Climbing over rocks and shrubs at margins of cool broad-leaved, evergreen oak and moist coniferous forests, 1830–3350m. April–September.

The name *R. wallichiana* is applied here in a broad sense to include plants from temperate altitudes without strong reddish pigment and with larger flowers than *R. manjith*. However, such plants are very variable, and approximately fall into three types with frequent intermediates: typical *R. wallichiana* (widespread) has relatively broad leaves, 2–3.5cm broad, stems and leaves weakly roughened with prickles; the second (also widespread) form has narrow lanceolate leaves, 1–2.5cm broad which along with the stems are very rough to the touch; this corresponds to the W Himalayan plant called *R. asperrima*; the third form is more localised, from Darjeeling district (Tanglu and Sandakphu) and central Bhutan (Mara Chu) which has almost smooth stems and very small, unarmed, narrow lanceolate leaves, less than 1cm broad. This last form will probably prove to be specifically distinct but available material is inadequate at present.

**5. *R. hispidicaulis* Long; *R. cordifolia* L. forma *strigosa* Deb & Malick.** Tongsa: Tsoi; Sha: Lani Roo.

Similar to *R. manjith* and *R. wallichiana* but stems with a mixture of decurved prickles and dense spreading hispid hairs; leaves green or weakly reddish-tinged, broadly ovate, 5–11 × 3–7cm, base deeply cordate, hispid on both surfaces; flowers 5–6mm diameter, corolla lobes sparsely hispid outside.

**Bhutan:** S – Chukka district, C – Thimphu, Tongsa and Tashigang districts, N – Upper Mo Chu district; **Darjeeling:** Pankhashari; **Sikkim:** Lachung. Climbing over shrubs and rocks at margins of evergreen oak and broad-leaved forests, 1950–3050m. June–August.

## 55. GALIUM L.

by R.R. Mill

Annual or perennial, weak, erect or scandent herbs, often clinging to other herbage by hooks or hairs. Stems 4-angled; angles winged or not. Leaves and stipules usually ± similar, in whorls of 4–8, occasionally at least lower leaves opposite, with distinct, smaller stipules; lamina orbicular to linear, often with apical cusp or apiculus, penninerved or more rarely 3-veined from base. Inflorescences ± paniculate, composed of axillary and terminal pedunculate cymes or less commonly of axillary, solitary flowers. Flowers minute; calyx tube absent above hypanthium, rarely small lobes present; corolla rotate or very shortly infundibular; lobes (3–)4(–5), valvate, often papillose, scabrid or shortly hairy. Stamens 4; filaments short; anthers didymous. Ovary bilocular; style short, with 2 arms which are free to base or (in ours) more commonly united in lower half; stigmas capitate, globose. Fruit small, didymous, ± dry, of 2

mericarps; mericarps glabrous, tuberculate, warty, or covered with hooked hairs.

Stipules are similar in shape and size to leaves unless indicated otherwise; in species with leaf-like stipules, the number of leaves in a whorl includes the stipules.

1. Stipules of lowest leaves interpetiolar and not leaf-like, of other leaves leaf-like but considerably smaller than ( $\frac{1}{3}$ – $\frac{2}{3}$  ×) the 2 true leaves of each whorl; leaves distinctly petiolate ..... 2
- + Stipules similar to leaves in both shape and size; leaves usually ± sessile (except *G. hoffmeisteri*) ..... 3
2. Leaves 10–30 × 5–18mm ..... **1. G. paradoxum**
- + Leaves 3–7.5 × 1.5–2.5mm ..... **2. G. exile**
3. Leaves (incl. stipules) on main stems in whorls of 4 ..... 4
- + Leaves (incl. stipules) on main stems in whorls of (5–)6–8 ..... 6
4. Leaves 6–15mm wide ..... **4. G. elegans**
- + Leaves 0.8–4.2mm wide ..... 5
5. Leaves hirsute all over, or at least on margins and midrib; corolla lobes hirsute at apex ..... **3. G. hirtiflorum**
- + Leaves hirsute only on midrib (not on lamina or margins); corolla lobes scabrid ..... **5. G. pusillosetosum**
6. Mericarps with hooked hairs ..... 7
- + Mericarps verruculose or papillose, without hooked hairs ..... 9
7. Stems armed with hooked prickles along angles; leaves in whorls of 6–8 ..... **6. G. aparine**
- + Stems unarmed, either completely glabrous or with non-hooked hairs; leaves in whorls of (4–)5 or 6 ..... 8
8. Leaves sessile or subsessile, c 4 × as long as broad, relatively small (3.5–16 × 0.8–4.2mm), lamina glabrous but midvein hairy .... **5. G. pusillosetosum**
- + Leaves petiolate, c 2.5–3 × as long as broad, relatively large (6.5–23 × 2.5–10mm), lamina hairy but midvein glabrous ..... **7. G. hoffmeisteri**
9. Corolla reddish or purplish ..... 10
- + Corolla greenish, yellowish or whitish ..... 11
10. All cymes 2–4(–6)-flowered; epidermal cells on adaxial leaf surface inconspicuous (not readily visible under × 20 lens) ..... **10. G. rebae**

+ Most cymes 7–13-flowered (a few 2–5-flowered); epidermal cells on adaxial leaf surface conspicuous (easily seen under  $\times 20$  lens) **11. *G. craticulatum***

11. Plant forming dense mats or carpets; leaves with glabrous margins

**8. *G. acutum***

+ Plant scrambling, straggling or prostrate but not mat-forming; leaves with at least a few prickles on margin ..... 12

12. Internodes on main stems 0.3–2cm, stems thus appearing densely leafy; mericarps 0.7–1.1mm; cells of adaxial leaf epidermis large (clearly visible under  $\times 20$  lens) ..... **9. *G. megacyttarion***

+ Internodes on main stems 2.5–7cm, stems thus appearing sparsely leafy; mericarps 0.4–0.6mm; cells of adaxial leaf epidermis very small ( $\pm$  invisible under  $\times 20$  lens) ..... **12. *G. sikkimense***

**1. *G. paradoxum* Maximowicz subsp. *duthiei* Ehrendorfer & Schönbeck-Temesy**

Slender, procumbent, stoloniferous, perennial herb with filiform rootstock. Stems 5–25cm,  $\pm$  flexuous, smooth,  $\pm$  glabrous, 4-angled with narrow herbaceous wings. Leaves petiolate (petioles 5–10mm,  $c \frac{1}{3} \times$  lamina), orbicular, orbicular-ovate or ovate-lanceolate, 10–30  $\times$  5–18mm, thin and membranous, apex obtuse and shortly apiculate, base cuneate, surfaces glabrous or with scattered, very short hairs, margins very shortly setulose or glabrous; venation penninerved with 1 main vein. Stipules of lower leaves interpetiolar, membranous, setaceous, minute; those of upper leaves leaf-like, petiolate,  $c \frac{2}{3}$  size of true leaves, upper leaves thus appearing as unequal whorls of 4. Flowers solitary and axillary, or in terminal trichotomous cymes (alar peduncle 1-flowered, laterals 1- or 2-flowered). Pedicels each subtended by a short, linear-lanceolate bracteole. Calyx lobes  $c$  0.6mm, slightly shorter than corolla lobes, obtuse. Corolla creamy-white,  $c$  2.5mm diam.; lobes ovate-lanceolate, acute, glabrous but tips appearing minutely papillate. Mericarps 0.6–1mm across excl. hairs; hairs dense ( $c$  30 on each mericarp), whitish or fuscous, with recurved hooks.

**Sikkim:** Chunthang, Ningbil; **Chumbi:** unlocalised. Fir/Juniper forest, on mossy slopes and forest floors by streams, 2400–3800m. June–August; fr. until late September.

In aspects of its stipule morphology, inflorescence type and mericarp armature this species bears a passing resemblance to *Kelloggia chinensis* but can easily be distinguished from that species by its much less tufted habit, much more orbicular leaves, and the absence of both a calyx and a corolla tube.

**2. *G. exile* Hook.f.; *G. handelii* Cufodontis, non Nábelek. Fig. 76o&p.**

Very slender, procumbent or ascending annual. Stems 6–20cm, delicate, pale green with narrow, subtranslucent wings, glabrous, usually with 1 or more short, alternate axillary branches in upper half. Leaves in distant opposite pairs, thin and membranous, grass-green, elliptic to obovate-elliptic, 3–7.5  $\times$  1.5–2.5mm,

obtuse or subacute without an apiculus (sometimes with short mucro), base cuneate or shortly attenuate into short petioles 0.5–2mm not more than half length of lamina; venation penninerved with 1 distinct midvein. Stipules of lowest leaves minute, interpetiolar, setaceous, of other leaves leaf-like and petiolate but  $\frac{1}{3}$ – $\frac{1}{2}$  size of leaves. Flowers in terminal and axillary, few-flowered, dichotomous cymes. Pedicels 1–2mm. Corolla c 0.7mm; lobes ovate-lanceolate, subacute or rounded. Mericarps strongly laterally compressed, c  $1 \times 0.5$ mm (excl. hairs), chestnut-brown, densely covered with c 40–50 whitish hooked hairs 0.1–0.2mm.

**Sikkim:** unlocalised. Open grass slopes and under overhanging boulders, 3658–4573m. July–August.

In Sikkim only known from the unlocalised type specimen collected by Hooker; the description has been supplemented with details of specimens from Nepal.

### 3. *G. hirtiflorum* DC.

Scrambling or trailing, suberect or decumbent, weak-stemmed perennial; roots thin, heavily reddish-tinged. Stems numerous,  $\pm$  tufted, 9–60cm, hirsute with thin, spreading, non-hooked hairs, or glabrate. Leaves in whorls of 4,  $\pm$  sessile, grass-green, thin and membranous, linear-elliptic or linear-lanceolate, 3–25  $\times$  0.6–3.5mm; apex obtuse, subacute or largest leaves shortly acuminate; base gradually shortly attenuate; surfaces hirsute all over or only on midrib and margins with long, straight or slightly curved, whitish, non-hooked hairs; cells on adaxial surface large, arranged in longitudinal rows (visible under  $\times 20$  lens). Inflorescences terminal and axillary, dichotomously cymose, forming small panicles; peduncles longer than leaves; pedicels 1–6mm. Corolla greenish-white, 2–2.5mm diam., lobes c 1mm, ovate, sparsely hirsute towards apex, cuspidate (cusp c 0.25mm); midvein and margins turning dark purple. Mericarps greyish, 1.1–1.5mm (excl. hairs), covered with 25–30 white or white-hyaline hooked hairs 0.5–0.7mm.

**Sikkim:** Kaysing and unlocalised. Among boulders or shrubs often in semi-shade, 1676–3050m. (Late June–)July–September (fruits until October).

Still apparently known from our area only from Hooker's and Clarke's collections, but collected several times more recently in Nepal.

### 4. *G. elegans* Roxb.

Scrambling or trailing perennial. Stems weak, to 1m or more, 4-angled, variously pubescent or hirsute. Leaves in whorls of 4,  $\pm$  sessile, ovate-elliptic or ovate-orbicular, 10–25  $\times$  6–15mm, shortly and bluntly apiculate, base cuneate or shortly attenuate, 3-veined from base, hirsute to nearly glabrous (except pubescent or hirsute veins). Inflorescence a panicle of many dichotomously branched, relatively few-flowered cymes; cyme branches widely divaricate. Corolla pale green, cream or white, (0.7–)1–2.5mm across; lobes ovate, acute, minutely hairy towards apex within. Mericarps blackish, 0.5–0.6mm excl.

hairs; hairs 20–25 on each mericarp, white or brownish, recurved or hooked at apex, surface of mericarp also very minutely puberulent.

1. Stems hirsute with dense long spreading hairs throughout; leaves densely hirsute all over, above and beneath, tips of hairs on veins of lower surface  $\pm$  touching tips of those of adjacent veins ..... b. var. **punduanum**  
 + Stems lacking long spreading hairs, but sometimes hirsute below; leaves glabrous to hirsute, tips of hairs on veins of lower surface not touching those of adjacent veins ..... 2
2. Stems hirsute below on both angles and surfaces; leaves hirsute on lamina and with short curved seta-like hairs on veins ..... a. var. **elegans**  
 + Stems very shortly retrorse-puberulent on angles, otherwise glabrous; leaves almost glabrous except on veins ..... c. var. **glabriusculum**

a. var. **elegans**; *G. latifolium* D. Don, *G. hamiltonii* Sprengel, *G. rotundifolium* sensu F.B.I. p.p. non L.

Stems sparsely hirsute, especially below; leaves  $\pm$  hirsute, hairs on veins of lower surface not touching those of adjacent veins.

**Bhutan:** S – Deothang district (Tshilingor to Riserboo), C – Punakha district (Lumichawa (38)) and Tongsa district (Dakpai (38)); **Darjeeling:** Darjeeling, Tiger Hill to Ghum, Senchal etc.; **Sikkim:** Lachen. Evergreen forest (*Castanopsis*), earthy banks, 1200–3000m. July.

b. var. **punduanum** (Wall.) Cufodontis; *G. vestitum* D. Don, *G. elegans* var. *elegans* forma *vestitum* (D. Don) Hara

Stems densely hirsute with long spreading hairs; leaves densely long-hirsute, hairs on veins of lower surface  $\pm$  touching those of adjacent veins and interlocking.

**Bhutan:** S – Chukka district (Chukka), C – Thimphu district (Chapcha, Dotena, Motithang) and Mongar district (Namning), N – Upper Mo Chu district (S of Gasa). Blue Pine and oak forest, 1400–2650m. June–September.

In *Flora of British India* (80), *G. vestitum* is treated as a species, and its leaf venation is said to be obsolete, not 3-veined from the base as in *G. elegans* sensu stricto (there treated as *G. rotundifolium*).

c. var. **glabriusculum** DC.; *G. elegans* forma *glabriusculum* (DC.) Ohba

Stems shortly retrorse-puberulent on angles, otherwise  $\pm$  glabrous; leaves subglabrous except for short hairs on veins.

**Darjeeling:** Phalut; **Sikkim:** Bakhim to Prek Chhu, Lagyap, Gangtok (69). Jumbok. Evergreen forest, 2200–2750m. July–September.

### 5. *G. pusillosetosum* Hara

Slender perennial. Stems (5–)12–40cm,  $\pm$  caespitose, ascending from often procumbent base, 4-angled with narrow hyaline or whitish wings, glabrous or with scattered spreading non-hooked setiform hairs. Leaves in whorls of (4–)6,

sessile or subsessile, membranous, thin, oblanceolate, 3.5–16 × 0.8–4.2mm, cuspidate or mucronate (cusp/mucro 0.2–0.4mm, sometimes breaking off and leaf appearing obtuse), base attenuate; midvein with long, curved, spreading or ± erect setiform hairs on both surfaces, lamina (incl. margin) otherwise glabrous; venation penninerved. Flowers in few-flowered terminal cymes on short opposite axillary branches (mostly equal, but lowest pair of branches often unequal); pedicels divaricate, 1–4mm, glabrous. Corolla reddish or purplish (rarely cream with red base), 2–2.5mm diam.; lobes ovate, shortly acuminate, scabrid apically within. Ovary with numerous dense, straight, subappressed, whitish non-hooked hairs. Mericarps subglobose, c 2mm diam., with patent rigid setae 0.5–0.7mm, shortly hooked at apex.

**Bhutan:** C – Thimphu district (Dotena). *Rhododendron aeruginosum* scrub, 2750 – 3660m. Late June–late July.

Otherwise known only from C Nepal.

**6. *G. aparine* L. var. *echinospermum* (Wallroth) Cufodontis; *G. agreste* Wallroth var. *echinospermum* Wallroth. Med: Zangtshay.**

Scrambling or trailing annual(?), sometimes forming mats or patches. Stems 10–100cm or more, pale green or straw-coloured and very glossy, retrorse-aculeate on wings. Leaves in whorls of 6–8, linear-oblanceolate, (5–)7–30 × 0.6–3mm, abruptly and shortly cuspidate (cusp 0.5–1.5mm), base gradually attenuate and petiole-like; nodes glabrous or very sparsely hispid; venation penninerved, very obscure. Flowers in axillary and terminal, leafy, 3-flowered cymes; peduncle equalling or slightly longer than leaves. Corolla cream, pale green or whitish, 2–2.5mm diam.; lobes ovate-triangular, 0.5–0.7mm, apparently glabrous. Anthers yellow. Mericarps blackish, reniform or subglobose, 1.9–2.9mm excl. hairs; hairs 50–60 on each mericarp, hyaline, 0.25–0.35mm, hooked.

**Bhutan:** C – Ha district (Ha to Damthang), Tongsa district (Shemgang (38)), Bumthang district (Bumthang, Jakar); **Sikkim:** unlocalised; **Chumbi:** Tarkapo. Weed of corn-fields, potato-fields and other crops, and in open ground in Fir/*Rhododendron* forest, 2600–4270m. July–September.

Probably much commoner than the sparse collections indicate (272). Var. *aparine* has not been recorded from the E Himalayas and var. *echinospermum* seems to be the only variety in our area.

**7. *G. hoffmeisteri* (Klotzsch) Mill; *Asperula hoffmeisteri* Klotzsch, *Galium triflorum* Michaux var. *hoffmeisteri* (Klotzsch) Hook.f., *G. asperuloides* var. *hoffmeisteri* (Klotzsch) Handel-Mazzetti, *G. asperuloides* subsp. *hoffmeisteri* (Klotzsch) Hara**

Annual? Stems 10–35cm or more, weak, suberect or ascending and forming small clumps, rather dark green, completely glabrous, unarmed; nodes glabrous. Leaves in whorls of (5–)6, elliptic or obovate, 6.5–17(–23) × 2.5–8.7(–10)mm, obtuse to rounded and abruptly shortly cuspidate or mucronate (cusp or mucro

0.1–0.7mm), base cuneate; venation penninerved, midvein glabrous on both surfaces, lamina with scattered antrorse subappressed short setiform hairs 0.4–0.7mm and a few short raphides, margins with numerous antrorse short non-hooked hairs; petioles 1–3.5(–6)mm, (0.1–)0.2–0.3(–0.5) × lamina. Flowers in terminal and axillary few-flowered bracteate inflorescences; ultimate cymes 3-flowered. Peduncles long, exceeding subtending leaves; pedicels longer than linear to lanceolate-elliptic bracts. Corolla white (tips of lobes sometimes pale pink), very shortly campanulate, 2.1–2.8mm diam.; lobes elliptic or triangular-ovate, suberect at anthesis, becoming patent, very thin and translucent, subacute, without apiculus, very minutely puberulent outside. Mericarps blackish, subglobose to broadly ovoid, 1.1–1.7 × 0.9–1.5mm (excl. hairs); hairs 60–110 on each mericarp, whitish-hyaline, 0.4–0.7mm, abruptly narrowed above middle, hooked at apex.

**Bhutan:** S – Chukka district (Chukka), C – Thimphu district (Taba and Upper Thimphu Chu), Punakha district (near Punakha) and Tongsa district (near Tongsa); **Darjeeling:** Budhwari, Sandakphu, Tanglu; **Sikkim:** Phusum, Jakeyripyak, Meguthang, Rathong Chhu; **Chumbi:** Redongbong (= Rinchingong?), Yatung. Near streams in shade of oak, birch, mixed cool broad-leaved and Spruce forest, and *Rhododendron*/Fir forest and scrub, 1800–4300m. April–August(–September).

Closely allied to *G. asperuloides* Edgeworth, and sympatric with it farther west in Nepal and NW Himalaya. Clinal variation in leaf shape seems to occur; plants from Bhutan and Sikkim have particularly broadly elliptic or obovate leaves, while those from farther west are often longer and narrower and are transitional to *G. asperuloides*.

### 8. *G. acutum* Edgeworth

Prostrate, mat-forming, delicate perennial(?), drying very dark green or blackish. Stems 9–30cm or more, glabrous, unarmed, 4-sulcate; internodes on main stems 10–60mm, on side branches 2–10mm. Leaves on main stems in whorls of 6, sessile, narrowly oblanceolate to linear-oblanceolate, 2.2–6(–8.5) × 0.3–1.2mm on main stems, acuminate-cuspidate (cusp 0.2–0.4(–0.5)mm); base shortly attenuate; upper surface semi-matt, glabrous, epidermal cells very inconspicuous (scarcely visible under × 20 lens); lower surface of lamina glabrous; venation penninerved, unarmed or largest leaves with few aculeae on abaxial midvein (none on margin); some raphides sometimes present. Flowers axillary, solitary; pedicels at anthesis 0.5–2mm, slightly shorter than subtending leaf. Corolla pale green or whitish, 2.1–2.6mm diam.; lobes narrowly lanceolate, 0.9–1.6 × 0.3–0.5mm, shortly apiculate (apiculus typically 0.15–0.3mm, sometimes shorter), glabrous beneath, adpressed-pilosulous above, margins not thickened. Mericarps subglobose, 0.4–0.6mm, blackish-brown, granular-verruculate, without hooks.

**Sikkim:** Yakla. 3050m. October.

The description given above is based on NW Himalayan material which is

typical of the species. There, it grows on rocks and slopes at 2700–3900m, flowering August–October.

A mainly NW Himalayan species, divided into 2 varieties, which become much rarer eastwards, being replaced by the two following species (264). Known from our area only from a single, anomalous gathering which is only provisionally placed within *G. acutum*, as it differs from NW Himalayan material in numerous characters, including broader side-branch leaves (0.7–0.8mm, not mainly 0.2–0.6mm), less than 4 × as long as broad (not generally at least 4.5 × as long as broad), and strongly recurved stigmatic lobes (not ascending or patent). It may need taxonomic separation but until more specimens of it are collected its status will remain doubtful.

*G. acutum* var. *himalayense* (Klotzsch & Garcke) Mill (*G. himalayense* Klotzsch & Garcke) has shorter corolla lobe apiculi (none, or to 0.1mm) than var. *acutum*; the Sikkim specimen, in this character, falls within the range of var. *acutum*. Both varieties are sympatric in the NW Himalaya.

**9. *G. megacyttarion* Mill. Sikkim (?Lepcha): *Choigyamu*. Fig. 761–n.**

Perennial(?), weak, straggling or prostrate, apparently not mat-forming. Stems 6–40cm or more, glabrous, strongly 4-sided, angles raised but unwinged, unarmed at least below, uppermost part occasionally sparsely aculeate; internodes 0.3–2cm. Leaves on main stems always in whorls of 6 (sometimes in 4's on side branches), sessile, narrowly elliptic or narrowly oblanceolate, 4–12 × 0.4–1.9mm, apiculate (apiculus 0.35–0.75mm); base ± truncate; upper surface glossy, glabrous, epidermal cells conspicuous (easily seen under × 20 lens); lower surface of lamina glabrous; venation penninerved, midrib sparsely aculeate, margin revolute and sparsely aculeate. Flowers axillary, solitary or rarely in 3-flowered cymes; pedicels at anthesis 0.2–1.5mm, 0.25–1 × subtending leaf. Corolla white or greenish-white (sometimes pale pink when dry), 1.5–2.7mm diam.; lobes broadly ovate-elliptic to rectangular-elliptic, 0.55–1.3 × 0.25–0.7mm, glabrous beneath, shortly hairy above, margins thickened, undulate-revolute. Mericarps ovoid-subglobose, 0.7–1.1 × 0.5–0.7mm, dark greyish-brown or blackish-brown, glabrous, papillose-verruculate.

**Bhutan:** C – Thimphu district (valley above Motithang, Tsalimaphe); **Sikkim:** Domang; **Chumbi:** Gumboteen. Track-sides in mixed forest etc., 1830–3600m. July–September.

**10. *G. rebae* Mill**

Straggling, ± prostrate perennial. Stems 13–40cm or more, weak, glabrous, unarmed; internodes 0.7–3.2cm. Leaves in whorls of 6, sessile, narrowly lanceolate, linear-lanceolate or uppermost narrowly ovate-oblanceolate; those of main branches (4.6–)5.2–10.2 × (0.5–)0.6–1.4mm, (5.3–)5.9–10(–11.4) × as long as broad; apex acute, terminating in a short awn; base shortly attenuate; surfaces glabrous, venation penninerved, midrib glabrous beneath or occasionally with one or two indistinct 'scabridities' but no true aculeae. Inflorescences axillary,



cymose, 2–4(–6)-flowered; peduncles shorter to longer than subtending leaf; pedicels 0.1–3.2mm, unequal. Corolla reddish-purple or crimson, (1.65–)1.95–3.2(–3.6)mm diam.; lobes ovate, 0.8–1.5(–1.7) × (0.4–)0.5–0.9(–1.0)mm, papillose along central vein and towards tip adaxially, ± evenly papillose abaxially; apiculus very short or absent. Anthers pale yellow or yellowish-orange. Style united for c 0.3mm, bifid at tip; arms blackish, c 0.15–0.25mm. Mericarps (immature) c 0.7 × 0.5mm, blackish, finely verruculose, without hooks.

**Bhutan:** C – Thimphu district (Motithang, Pajoding); **Sikkim:** Chomnagu, Lachen, Lachung, Rathong Chu, Gangtok; **Chumbi:** Chumbi. Evergreen oak forest, meadows, gravelly slopes, 2350–3900m. June–August.

The commonest species of the *G. acutum* group in our area (264).

### 11. *G. craticulatum* Mill

Prostrate perennial. Stems slender, glabrous, unarmed, broadly winged; wings green, with lattice-like pattern of parallel darker green veins (especially on peduncles and pedicels); internodes 3–4.6cm. Leaves in whorls of 6, sessile, narrowly oblanceolate, those on main stems (6–)7–10.5 × (1.2–)1.4–2.3mm; apex shortly acuminate, ending in a short apiculus less than 0.5mm; base attenuate; upper surface glabrous, epidermal cells conspicuous (under × 20 lens); lower surface of lamina glabrous but midrib of main-stem leaves with 3–10 sparse hooks 0.1–0.3mm; margins of main-stem leaves revolute with numerous small hooks, those of side-branch leaves less revolute or ± flat, with 0–2 very short hooks. Inflorescence paniculate, narrowly cylindrical; cymes numerous, shortly pedunculate, mostly 7–13-(some only 2–5-) flowered; pedicels 0.2–1.8mm, glabrous. Corolla 2.25–2.8mm diam.; lobes dark crimson above, paler greenish-purple beneath, ovate, 1.0–1.3 × 0.65–1.0mm, papillose on midvein and towards margins above, glabrous beneath, acute, very shortly mucronate. Anthers pale orange-yellow. Style 0.15–0.3mm, united below, bifid at apex; stigmatic arms widely divergent, 0.15–0.25mm, erecto-patent, finally decurving. Ovary obovoid to subglobose, 0.3–0.4mm, minutely verruculose (appearing ± smooth), unarmed. Mature mericarps not seen.

**Bhutan:** C – Thimphu district (Chenkaphug). Grassy banks in cleared conifer forest, c 3000m. July.

Readily distinguished from *G. sikkimense* by its larger, dark crimson (not whitish-yellow) corollas with lobes ending in a very short mucro, not a long cusp (264).

### 12. *G. sikkimense* Gandoger; *G. asperifolium* Wall. var. *sikkimense* (Gandoger) Cufodontis

Prostrate, straggling or scrambling perennial(?) clinging herb. Stems 30cm or often much longer, slender, shining, glabrous or sparsely retrorse-aculeate, unwinged or narrowly winged; internodes 2.5–7cm. Leaves in whorls of 6, sessile, narrowly oblanceolate or linear-oblanceolate, 5–20 × 0.5–4.5mm; apex

rounded but gradually or  $\pm$  abruptly passing into a short apiculus 0.1–0.5mm; base attenuate; adaxial epidermal cells small (scarcely visible under  $\times 20$ ); midvein (beneath) and margins with aculeae; venation penninerved. Inflorescence paniculate,  $\pm$  narrow; cymes few-flowered, dichotomous; bracts leaf-like but more ovate. Corolla whitish, cream, or greenish, normally not tinged pink, 1.2–2.2mm diam.; lobes ovate, (0.35–)0.4–1.3  $\times$  0.2–0.7mm, alar flowers with all lobes apiculate, others often with 2 or all lobes obtuse; adaxial surface papillose on midvein and towards margins. Filaments white,  $\frac{1}{3}$ – $\frac{1}{4}$   $\times$  corolla lobes; anthers pale yellowish, c 0.1mm. Style branches whitish, erectopate, not markedly arched downwards even in fruit. Mericarps 0.4–0.6mm, blackish, minutely verruculose or almost smooth, without hooks.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Bumthang, Mongar and Tashigang districts; **Darjeeling:** Darjeeling to Lebong, Batasia, Rungboo, Simkuna, Sureil, Sitong, etc.; **Sikkim:** Gangtok, Tsomgo; **Chumbi:** Chubintang to Yatung. Roadside banks and walls, in mixed forest zone where forest has been cleared, 600–3900m. May–September.

No specimens of *G. asperifolium* Wall., with densely crispulate-adpressed pubescent stems, have been seen from our area. *G. asperifolium* occurs in Nepal; it is replaced in our area by *G. sikkimense*, which has sometimes been treated as a variety of *G. asperifolium*; however, the differences are clearcut, with very few intermediate specimens, and they should be regarded as more or less allopatric species.

The earlier name *G. cavaleriei* Léveillé, based on a specimen from Guizhou, SW China, threatens to supplant *G. sikkimense* at species rank, but the type material of *G. cavaleriei* (which has apparently only been collected once) is so poor (having been collected extremely late in the season) that it is impossible to say whether the two are synonymous and consequently *G. cavaleriei* is disregarded here for nomenclatural purposes. For a fuller discussion see (264).

## Family 165. CONVULVACEAE

by R.R. Mill

Usually perennial twiners or climbers, sometimes erect shrubs or prostrate annual or perennial herbs. Leaves alternate, entire, lobed or pinnatisect, exstipulate. Inflorescences terminal or axillary, simple or compound, cymose. Flowers actinomorphic, hermaphrodite, often large and showy, sometimes strongly scented. Sepals 5, free or rarely slightly connate at base. Corolla gamopetalous, infundibular, campanulate or salverform, with 5  $\pm$  conspicuous, often hairy, longitudinal plaits (mid-petal bands) running from base to apex. Stamens 5, epipetalous, included or exerted; anthers oblong, opening longitudinally, sometimes finally twisted. Ovary superior, often surrounded by annular disc. 1–3-locular; ovules 2 per loculus, anatropous. Styles 1 (rarely 2); stigmas 2(–4).

capitate and 2-lobed or with 2 branches. Fruit indehiscent, or a 2–4-valved capsule or berry, or opening irregularly, or rarely circumscissile. Seeds usually 2–4, rarely 1 (*Porana*).

1. Corolla and calyx both 2–3mm, subequal; prostrate, mat-forming, non-twining herb with long-petiolate, small cordate-orbicular or reniform leaves  
 + Corolla at least 4mm, usually exceeding calyx; other characters not present in above combination ..... 2  
**11. Dichondra**
2. Styles 2, each bilobed; stigmas 4, filiform ..... **8. Evolvulus**  
 + Style 1 (or absent); stigmas 1 or 2, globose or subglobose ..... 3
3. Shrubs or small trees, not twining (except, finally, in *Rivea*) ..... 4  
 + Climbers or twiners (herbaceous or more rarely woody), or prostrate herbs ..... 6
4. Corolla yellowish, 13–15mm; leaves glandular-punctate beneath; style absent ..... **1. Erycibe**  
 + Corolla deep pink, rose or white, 50–80mm; leaves not glandular-punctate beneath; style present ..... 5
5. Leaves reniform or orbicular with obtuse or retuse apex; stems densely silky white-pubescent ..... **2. Rivea**  
 + Leaves ovate to lanceolate with  $\pm$  long-acuminate apex; stems glabrous or minutely puberulent ..... **4. Ipomoea** (*I. carnea*)
6. Corolla 4.5–9mm ..... 7  
 + Corolla larger than 10mm ..... 8
7. Corolla pink or purple, scarcely exerted from calyx; sepals hardly accrescent in fruit; inflorescences  $\pm$  sessile ..... **4. Ipomoea**  
 + Corolla white, c 3  $\times$  as long as calyx; sepals strongly accrescent in fruit; inflorescences distinctly pedunculate ..... **7. Porana**
8. Corolla hairy outside, at least near apex of mid-petal bands ..... 9  
 + Corolla completely glabrous outside including tips of mid-petal bands . 11
9. Corolla 1.3–2.2cm; leaves simple with hastate or sagittate base, 0.2–3cm broad ..... **9. Convolvulus**  
 + Corolla 3–8cm; leaves palmately divided or broadly ovate, usually broader than 3cm ..... 10

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10. Fruit an indehiscent berry; leaves not palmately divided, 6–30 × 5–25cm  
**3. Argyreia**  
 + Fruit a dehiscent capsule; leaves palmately divided, 3–7.5 × 2.5–10cm  
**4. Ipomoea**
11. Calyx ± concealed by bracteoles; inner calyx lobes shorter than outer  
**10. Calystegia**  
 + Calyx lacking bracteoles, or not concealed by them; calyx lobes or sepals subequal, or inner longer than outer ..... 12
12. Sepals greatly enlarging in fruit ..... 13  
 + Sepals not or scarcely enlarging in fruit ..... 14
13. Epicarp of capsule circumscissile at middle, upper part separating as a fleshy lid; stems with 3–5 narrow wings; corolla white ..... **6. Operculina**  
 + Capsule not opening at middle by a lid; stems not winged; corolla steel-blue or mauve ..... **7. Porana**
14. Corolla blue, purple, lavender or red ..... **4. Ipomoea**  
 + Corolla yellow, pink or white ..... 15
15. Sepals with a long awn; corolla very large (over 7cm), opening at night  
**4. Ipomoea**  
 + Characters not as above ..... 16
16. Apex of sepals acuminate and cuspidate; cultivated root crop with edible tubers ..... **4. Ipomoea**  
 + Apex of sepals entire or emarginate, sometimes with a short mucro but never acuminate or cuspidate; native twiners of subtropical forest margins and open places ..... **5. Merremia**

**1. ERYCIBE Roxb.**

Woody climbers, shrubs or small trees. Older branches with lenticels. Leaves simple, entire, leathery, shortly petiolate. Flowers in terminal panicles and short axillary cymes, fragrant. Bracts and bracteoles minute, caducous. Sepals 5, free, densely hairy outside except for glabrous or less hairy margins covered when in bud, glabrous inside; 2 outer sepals usually dissimilar to 2 inner sepals, fifth sepal ± laterally dimorphic, one side similar to outer sepals, the other side resembling the inner sepals. Corolla deeply 5-lobed; tube glabrous outside; lobes with mid-petal bands hairy outside, glabrous inside. Stamens 5, inserted just above corolla base. Ovary ± ellipsoid, 1-celled, with 4(–5) basal ovules; style 0; stigma large, subglobose, 2-lobed. Fruit a 1-seeded berry.

1. *E. laurifolia* Long; *E. laevigata* sensu Clarke (F.B.I.) non Choisy. Fig. 77a-c.

Scrambling or climbing shrub or small tree, to 10m. Branchlets  $\pm$  angular, sparsely appressed reddish-brown pubescent. Leaves oblong-elliptic, 8-19  $\times$  3.5-8cm, finely acuminate, base rounded or rarely cuneate, glabrous, upper surface smooth, lower surface minutely but densely glandular-punctate; petiole 12-23mm, appressed reddish-brown pubescent. Terminal panicles 4-10cm; axillary cymes few-flowered, 2-3.5cm. Flower buds globose, 4.5-5.5mm diameter. Sepals suborbicular, 4-4.5mm, outer 2 densely appressed reddish-brown pubescent. Corolla yellowish, 13-15mm; tube c 3mm. Berry subglobose, 2.5-3cm diameter.

**Bhutan:** S - Chukka district (Sinchula); **Darjeeling:** Gyabari terai, Kurseong, Labha, above Mongpu, Rishep valley, Rambi Chhu, Sureil; **West Bengal Duars:** S of Sinchula (160). Moist forest, 1220-1830m. March-June; fruiting October-November.

For a detailed account of this species, its typification and previous confusion with *E. laevigata*, see Long (160).

## 2. RIVEA Choisy

Shrubs or lianas. Young stems silvery white-pubescent. Leaves cordate to ovate-cordate, petiolate. Flowers in axillary cymes. Bracts 2-3, narrow. Sepals ovate to oblong, equal or unequal. Corolla large, white, salverform with long cylindrical tube and broadly infundibular plicate limb. Stamens included; filaments inserted near middle of tube; anthers linear-oblong, not becoming twisted. Disc annular. Ovary 4-locular, 4-ovuled; style filiform, with linear-oblong, bilobed stigma. Fruit subglobose, shining, nearly dry, indehiscent or sometimes dehiscent and breaking up irregularly. Seeds 1-4, glabrous, enclosed within a mealy pulp at least when dry.

The flowers are adapted to pollination by night-flying moths.

1. *R. ornata* (Roxb.) Choisy; *R. ornata* var. *griffithii* Clarke, *Lettsomia ornata* Roxb., *Convolvulus candicans* auct. non Roth (nom. illegit.) nec Solander. Fig. 77d&e.

Stout, erect shrub 45-150cm. Branches finally twining, densely appressed white-pubescent. Petioles 3.5-12.5cm, sericeous, with 2 green apical glands on lower side. Leaves reniform or orbicular-cordate, 5-15  $\times$  7.5-20cm, obtuse or retuse sometimes with short apiculus, base with rounded lobes, entire, glabrous above, sparsely grey-hirsute beneath and densely white or pale yellowish villous on margin. Cymes 3-7(-10)-flowered. Sepals subequal, 8-11mm, outer two ovate, acute, appressed hairy, inner three slightly longer than outer, broadly oblong-elliptic to obovate, glabrous or partly hairy. Corolla white, opening at night and withering by following morning, fragrant, completely glabrous or rarely with a few hairs on mid-petal bands; tube 5-8cm; limb 6-8cm diameter. Fruit chocolate brown, 1-1.8cm diameter.

**Darjeeling:** terai at Jhenaikuri and Sivok, altitude not recorded. Sal forest. July–September.

For a discussion of the tangled nomenclature of this species, see Mill (265).

### 3. ARGYREIA Loureiro

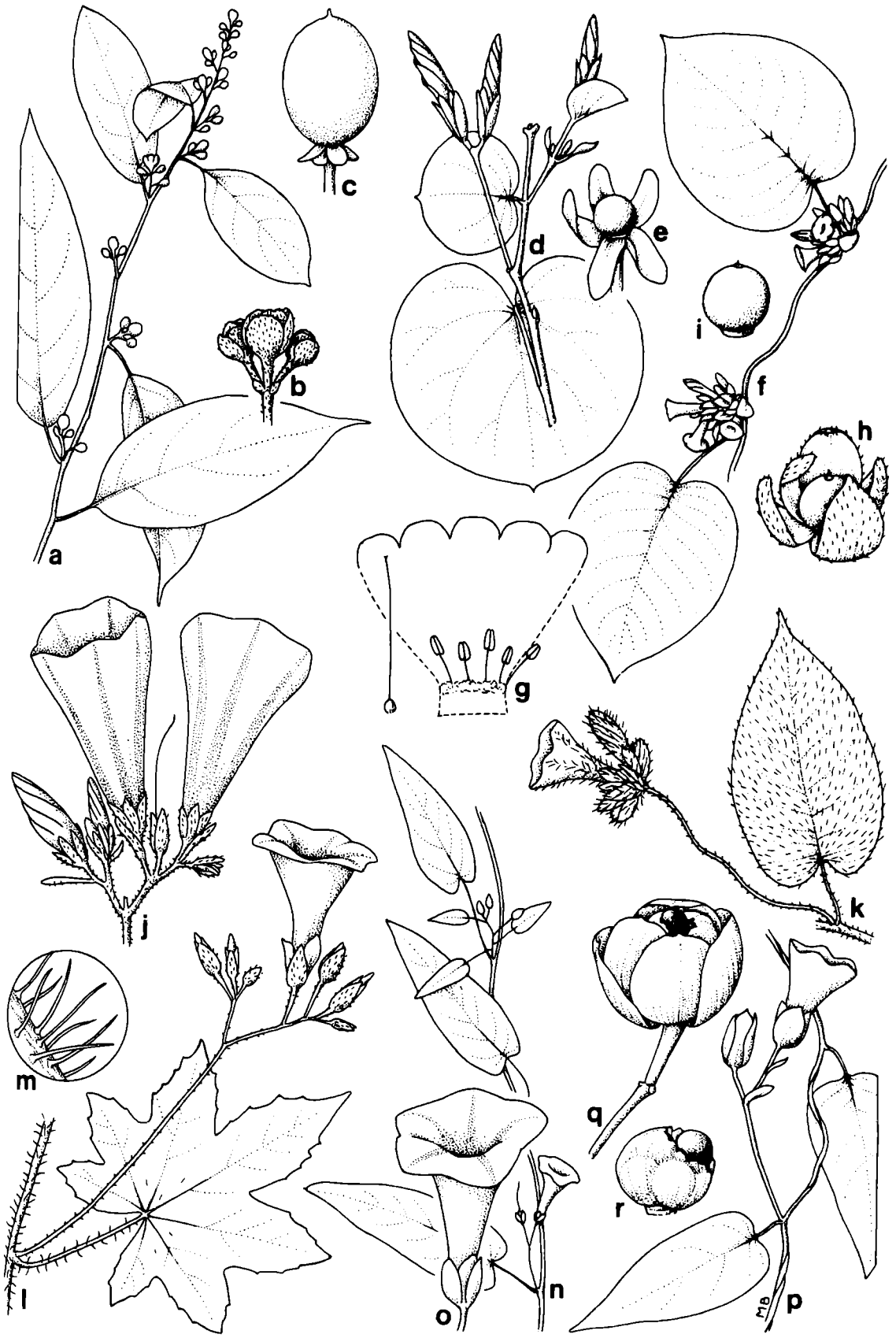
Herbaceous or woody, often large twiners or scramblers. Stems hairy. Leaves large, usually cordate at base, petiolate,  $\pm$  hairy. Cymes sessile or pedunculate, capitate or corymbose, bracteate; bracts persistent or caducous. Flowers pink, purple or rarely white,  $\pm$  large and showy. Sepals lanceolate to orbicular, subequal or inner smaller, often enlarging in fruit and sometimes turning bright red inside. Corolla infundibular, limb very shortly lobed; mid-petal bands  $\pm$  bristly or pubescent. Stamens included; anthers never twisting. Ovary 2- or 4-celled, 4-ovuled; style filiform; stigmas 2, globose. Fruit indehiscent, berry-like or  $\pm$  dry.

The species with a 2-celled ovary have often been separated as the genus *Lettsomia* Roxb. but most modern treatments follow the opinion of Prain and unite the two genera.

A record of the mainly southern Indian *A. imbricata* (Roth) Santapau & Patel (*Lettsomia aggregata* Roxb.) from Darjeeling (258) seems improbable and is possibly a misidentification of another species. *A. argentea* (Roxb.) Choisy has often been recorded from the Bhutan area but all records seem to be based on misidentifications of *A. venusta*. Although many of our species are readily identified on account of their distinctive indumentum, the taxonomy of the genus in the E Himalaya (and throughout the Sino-Himalaya) is still poorly understood. Several taxa have not been re-found recently and more collections of many species are required, especially of those of which the fruit is still unknown.

1. Sepals 4–6mm; most leaves narrowed towards both ends and broadest near middle ..... **1. *A. sikkimensis***
- + Sepals 9–20mm; most leaves broadest near cordate (at least shallowly so) base ..... 2
2. Stems  $\pm$  softly pubescent, strigose or tomentose ..... 3
- + Stems  $\pm$  roughly hispid, hispidulous, hirsute or villous ..... 5

FIG. 77. **Convolvulaceae.** a–c, *Ericybe laurifolia*: a, flowering shoot ( $\times \frac{1}{2}$ ); b, flower buds ( $\times 1$ ); c, fruit ( $\times \frac{2}{3}$ ). d–e, *Rivea ornata*: d, flowering shoot ( $\times \frac{1}{3}$ ); e, fruit ( $\times \frac{1}{2}$ ). f–i, *Argyrea wallichii*: f, flowering shoot ( $\times \frac{1}{6}$ ); g, dissected corolla ( $\times 1$ ); h, calyx with fruit ( $\times 1$ ); i, fruit ( $\times 1$ ). j, *Argyrea roxburghii*: inflorescence ( $\times \frac{1}{6}$ ). k, *Argyrea capitiformis*: leaf and inflorescence ( $\times \frac{1}{3}$ ). l–m, *Merremia vitifolia*: l, leaf and inflorescence ( $\times \frac{1}{3}$ ); m, enlargement of stem hairs ( $\times 3$ ). n–o, *Merremia umbellata*: n, flowering shoot ( $\times \frac{1}{4}$ ); o, flower ( $\times \frac{2}{3}$ ). p–r, *Operculina turpethum*: p, flowering shoot ( $\times \frac{1}{3}$ ); q, calyx with capsule ( $\times \frac{2}{3}$ ); r, capsule ( $\times \frac{2}{3}$ ). Drawn by M. Bates.



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3. Cymes sessile or very shortly pedunculate; corolla white or flesh-coloured  
2. *A. wallichii*  
 + Cymes with distinct peduncles 5–13cm; corolla bright pink or pinkish-purple ..... 4
4. Stems appressed-pubescent; leaves villous especially beneath; sepals  $\pm$  equal  
3. *A. roxburghii*  
 + Stems densely white-tomentose; leaves grey-green-tomentose above, white- or creamy-tomentose or -velutinous beneath; sepals unequal 4. *A. venusta*
5. Outside of sepals with  $\pm$  sparse indumentum of white or colourless hairs  
6  
 + Outside of sepals with very dense indumentum of yellowish or brownish hairs ..... 7
6. Leaves with c 10 pairs of veins; peduncles 13–19cm; corolla pink (darker at base), 5–8cm ..... 5. *A. hookeri*  
 + Leaves with c 7 pairs of veins; peduncles 0.5–2cm; corolla dark purple, c 4cm ..... 6. *A. atropurpurea*
7. Stem hairs 2–4mm; leaf hairs c 2mm ..... 7. *A. capitiformis*  
 + Stem hairs c 1mm; leaf hairs 0.5–1.5mm  
8 *A. thomsonii* & 9 *A. hirsutissima*

**1. *A. sikkimensis*** (Clarke) van Ooststroom; *Lettsomia sikkimensis* Clarke.

Large twiner. Stems closely appressed-strigillose with pale yellowish setiform hairs. Leaves elliptic to ovate or suborbicular, 7–16 × 5–12cm, retuse to shortly acuminate, base obtuse to cuneate, very sparsely and shortly appressed-strigose above (mainly on veins), sparsely appressed strigose with longer setiform hairs beneath, youngest leaves densely white-villous beneath, lateral veins 7–9 pairs; petiole 2–9cm. Peduncles 5–13cm, appressed-strigose,  $\pm$  same thickness as subtending petiole or slightly thicker; cymes 3–6-flowered; pedicels 6–9mm, appressed-strigose, broadening towards base of calyx. Bracts 3, inconspicuous or outermost occasionally leaf-like, caducous, 15–25mm. Sepals broadly obovate, 4–6mm, inner longer than outer, outer with narrow central band of appressed hairs. Corolla purple, campanulate, 4.5–5cm; tube c 3.5cm, almost glabrous except for 2 marginal rows of short hairs; limb c 3.5cm diameter, subglabrous. Stamens included; filaments purple, hairy at base, two longer than other 3; anthers purplish, pollen white. Ovary 2-celled, 4-ovulate; style included, white with purple stigmas. Fruit unknown.

**Darjeeling:** Pomong. Terai forest, c 900m. August–September.

In spite of the name apparently not known from Sikkim proper but in our area only known from the type locality in the terai. Similar to *A. elliptica*



(Wight) Choisy of southern peninsular India but with corolla about twice as large.

2. **A. wallichii** Choisy; *Lettsomia nervosa* auct. non Roxb. Fig. 77f-i.

Large woody twiner. Stems densely pubescent to tomentose. Leaves ovate-cordate, 10–24 × 10–19cm, obtuse or abruptly short-acuminate, base scarcely cordate, dark green, glabrous and shallowly rugose above, white or pale green and densely tomentose beneath, with (9–)11–13(–15) pairs of lateral veins. Cymes sessile or very shortly pedunculate, capitate. Bracts ovate-oblong, persistent. Outer sepals broadly elliptic, 10–12mm, inner narrower, c 9mm, all white-tomentose outside, glabrous inside and turning red inside in fruit. Corolla white, sometimes tinged rose, or flesh-coloured, tubular-infundibular, 4–5cm; mid-petal bands densely appressed-hirsute outside. Stamens and style included. Fruit depressed-globose, 8–10mm, scarlet (occasionally white).

**Bhutan:** C – Tongsa district (Wangde Khola below Shemgang), Mongar district (Ngasam); **Darjeeling:** Badamtan, Panchkilla; **Sikkim:** Lingchom, etc., common. Subtropical and warm broad-leaved forest, on slopes, 75–1220m. August–September; fruits October–April.

Both red- and white-capsuled variants have been recorded from Sikkim and Darjeeling; in the much rarer white-capsuled variant (e.g. Panchkilla) the calyx lobes do not turn red inside. Plants with more leathery leaves and sepals have been separated as var. *coriacea* Clarke (e.g. from Mongpu and Tista valley) but the gradation is so continuous that the variety is scarcely worth recognising.

3. **A. roxburghii** Choisy; *A. roxburghii* Choisy var. *ampla* (Choisy) Clarke. Fig. 77j.

Large climber, 4m or more. Stems densely appressed pubescent with whitish hairs. Leaves broadly ovate, 7–15 × 5.5–12cm, shortly acuminate, base cordate, moderately villous above with subpatent antrorse hairs and dense minute rough tubercles, densely grey-villous beneath, with usually 10 pairs of lateral veins; petioles 3–9cm. Peduncles 6–13cm, erecto-patent or suberect, slightly thinner than subtending petiole; cymes lax, dichotomous, up to 5-flowered; pedicels 5–8mm. Bracts oblong or elliptic, 12–20 × 4–7mm, villous. Sepals elliptic-lanceolate, equal, c 10 × 4mm, villous, reflexed in fruit. Corolla purplish-pink with darker throat, campanulate, 5–6.5cm; tube glabrous; limb sparsely pilose on mid-petal bands. Stamens and style included. Fruit globose, 1–1.5 × 1.3–1.5cm, blackish.

**Bhutan:** S – Phuntsholing district (Phuntsholing), C – Tongsa district (Tama, 38); **Darjeeling:** Katambari, Panchkilla, Selim. Open scrub in terai and subtropical zone, 220–1450m. February–June; fruiting October.

4. **A. venusta** Choisy; *A. argentea* (Roxb.) Choisy var. *venusta* (Choisy) Clarke. Sha: *Abikoko*.

Sprawling herb, often climbing over itself, forming tangled masses. Stems densely white-tomentose when young, later less densely pubescent. Leaves

broadly ovate, 6–16 × 6–13cm, subacute to acute, base shallowly cordate, greyish-green and appressed-tomentose above with narrow, whitish margin, whitish and densely velutinous beneath, with 9–10 pairs of lateral veins; petiole 3.5–8cm. Peduncles 5–12cm or more, tomentose, slightly thinner than subtending petiole; cymes usually 2–3-flowered; pedicels 5–8mm, tomentose. Bracts elliptic, 12–18mm, more densely tomentose beneath than above. Sepals elliptic, unequal, 9–14mm, grey-tomentose, suberect in fruit. Corolla vivid pink or purple, broadly campanulate, c 6.5cm; tube c 2.5cm, sparsely hairy; limb c 5.5cm diameter, with sparse long thin hairs on mid-petal bands outside. Stamens and style included. Fruit globose, c 1.5cm diameter, dry.

**Bhutan:** C – Punakha district (Tinleygang, Punakha and Wangdu Phodrang) and Mongar district (Lhuntse and Khoma). Sandy river banks, 1370–1830m. June–August.

Often misidentified as *A. argentea* (Roxb.) Choisy, from Bangladesh, Assam (Khasia) and E India; the leaves of the latter are unmistakable in having a densely sericeous lower surface with a shining, satiny texture (not dull and tomentose). *A. venusta* is easily distinguished from *A. argentea* by the totally different leaf and stem indumentum and should not be treated as a variety of *A. argentea* as was done by Clarke (80) and Hara et al. (135). No authentic material of *A. argentea* has been seen from the *Flora* area; a Hooker specimen with a printed Sikkim label and manuscript label ‘foot of hills, 25/8/1850’ must (from the date) have been collected in the vicinity of Churra, Khasia Hills, in Assam.

**5. *A. hookeri* Clarke.** Lepcha: *Puttokbok*.

Large, herbaceous climber to at least 8m. Stems shortly appressed-hispidulous. Leaves broadly ovate, 9–29 × 7–24cm, acuminate, base deeply cordate, densely and minutely scabrid above with short hairs on and near veins, paler grey-green beneath with scattered appressed hairs on lamina and denser appressed hairs on veins, with usually 10 pairs of lateral veins. Peduncles 13–19cm, appressed-hairy; cymes dichotomous, few-flowered. Bracts narrow, caducous. Sepals narrowly ovate to narrowly lanceolate, 10–14mm, appressed grey-villous outside in a broad central area, with ± broad, brown, glabrous, scarious margins. Corolla pink (darker at base of tube), infundibular, (5–)6–8cm; mid-petal bands with sparse, rather long, weak, appressed, silvery-white hairs. Stamens and style included. Fruit globose, completely 4-celled, 1.5–2cm diameter.

**Bhutan:** S – Phuntsholing district (Phuntsholing and above Rinchending); **Darjeeling:** Pankhabari, Kalimpong, Balasun, Tista etc. Climbing among shrubs in secondary terai and subtropical forest, 150–1220m. June–September; fruiting September–February.

**6. *A. atropurpurea* (Wall.) Raizada; *Lettsomia atropurpurea* (Wall.) Clarke**

Large, herbaceous climber. Stems slender, hispidulous with dense to rather sparse, retrorse-appressed, rust-coloured or pale yellowish, soft hairs. Leaves

rather remote, 11–13 × 5–6cm, elliptic-lanceolate with long, narrowly acuminate tip, base shallowly cordate, almost glabrous except for a few hairs along veins above, sparsely appressed-pilose beneath, with c 7 pairs of lateral veins; petioles 1.5–2cm, villous. Peduncles 3–5mm, densely villous with brownish-yellow hairs; cymes dense but few-flowered; flowers subsessile. Bracts 2–3cm, oblong-lanceolate, acuminate, membranous, persistent, inner shorter than outer. Sepals lanceolate, acuminate, c 15mm, softly hairy. Corolla dark purple (occasionally white), tubular-campanulate, c 4cm, hairy outside. Stamens and style included; filaments villous at base. Fruit globose, 4-celled, coriaceous, indehiscent.

**Darjeeling:** Siliguri. Terai. Fruiting November.

A poorly known species of which few specimens are known; the description is partly taken from Clarke (80) and Wallich's original plant from Nepal.

7. *A. capitiformis* (Poiret) van Ooststroom; *A. capitata* (Vahl) Choisy comb. illegit., *Lettsomia strigosa* Roxb. Fig. 77k.

Large climber 2.5–10m or more with milky juice. Stems hispid with spreading brownish-yellow hairs 1.5–3.5mm. Leaves broadly ovate to oblong-ovate, 7–13 × 4–11cm, abruptly attenuate into narrow acuminate tip 8–14mm, base cordate, ± densely appressed strigose above and beneath with yellowish-green or fulvous hairs, with usually 11–14 pairs of lateral veins; petioles 3–7cm. Peduncles 7–14cm, erecto-patent or spreading, hispid; cymes densely capitate, usually 5-flowered; flowers subsessile. Bracts elliptic to lanceolate, fulvous-hirsute outside, persistent. Sepals oblong to lanceolate, densely patent-hirsute outside with fulvous hairs, inside not turning red in fruit; outer 15–17mm, inner c 12mm. Corolla pink or pale purple, infundibular, 4–5.5cm, tube glabrous below but with spreading bristles above; mid-petal bands with spreading whitish bristles. Stamens and style included. Fruit globose, c 8mm diameter, 2-celled, orange-red or brownish.

**Bhutan:** S – Gaylegphug district (Gaylegphug, 38); **Darjeeling:** Guraldoba, Badamtam. Roadsides and margins of subtropical forest, c 900m. November–December.

8. *A. thomsonii* (Clarke) Babu; *Lettsomia thomsonii* Clarke, *A. nasirii* Austin nom. superfl.

Herbaceous climber. Stems usually fairly slender, densely to sparsely villous or hirsute with ± patent, whitish, glandular hairs. Leaves broadly ovate, 7–13 × (3–)5–9cm, abruptly attenuate into narrow, acuminate tip 8–15mm, base usually rather shallowly cordate, subappressed strigose above and beneath, with usually 10 pairs of lateral veins; petioles 2.5–5cm, hispidulous, like stems. Peduncles 3–8cm, patent or somewhat deflexed, hispidulous, subequalling petioles, evenly scattered along stem; cymes capitate, usually 3-flowered; flowers subsessile. Bracts oblong-lanceolate, sparsely villous, caducous. Sepals ovate,

acute, 12–20mm, very densely villous outside with long pale yellowish hairs, inside not turning red in fruit. Corolla lavender to rose-purple, 5–5.5cm, tube glabrous but limb with long,  $\pm$  horizontally-spreading, whitish bristles on mid-petal bands. Stamens and style included. Fruit a dry indehiscent berry.

**Darjeeling:** Jaldhaka, Labha, Sukna, Dalka Jhar. Terai forests, c 150m. September–October; fruiting October–December.

Austin proposed the new name *A. nasirii* for this species, assuming that *L. thomsonii* Clarke could not be transferred to *Argyreia* because of *A. thomsonii* Craib, but the latter is an invalid name published without a description. For fuller discussion see Mill (265).

**9. *A. hirsutissima* (Clarke) Raizada; *Lettsomia hirsutissima* Clarke.**

Very similar to *A. nasirii* but leaves more densely villous, with c 12–13 pairs of lateral veins; peduncles 1–4cm, usually shorter than petioles, several clustered together towards tips of branches forming a narrow dense terminal panicle; corolla purple, 3–4.5cm; hairs on mid-petal bands subpatent to subappressed, antrorse (not horizontally spreading). Fruit unknown.

**Sikkim:** Tendong. 1500m. October.

Very closely allied to *A. thomsonii* and possibly only worthy of subspecific rank within it, but retained here at specific rank until more collections, including fruiting material, are made in order that a full description can be given and a better understanding gained of the range of variation in the two taxa.

#### 4. IPOMOEA L.

Climbing herbs or rarely shrubs, usually twining but sometimes prostrate. Leaves entire, lobed or palmately divided, rarely pinnatisect. Flowers usually in 1–many-flowered axillary dichasial cymes. Sepals herbaceous or subcoriaceous, glabrous or hairy. Corolla infundibular, campanulate, salverform or tubular; limb 5-plaited, lobes very short. Stamens included or exerted. Ovary usually 2-celled and 4-ovulate but less commonly 4-celled and 4-ovulate (subgenus *Quamoclit*) or 3-celled and 6-ovulate (subgenus *Pharbitis*). Capsule globose or ovoid, 4- or 3-valved (rarely 2-valved). Seeds glabrous or hairy.

Very close to *Merremia* from which it can only be definitely distinguished by its spinulose pollen.

- |  |   |
|--|---|
| 1. Stems with at least some spreading or retrorse hairs and/or bristles .....        | 2   |
| + Stems glabrous or only sparsely or minutely hairy .....                            | 7   |
| 2. Peduncles absent, or if present less than 2cm (Sect. <i>Calycanthemum</i> ) ..... | 3   |
| + Peduncles 2–18cm .....   | 4   |
| 3. Pedicels 0–3mm; capsule hairy .....   | 1. <i>I. eriocarpa</i>                    |
| + Pedicels 5–7mm; capsule glabrous .....   | 2. <i>I. plebeia</i> subsp. <i>indica</i> |

4. Corolla entirely white, mid-petal bands hairy; leaves palmately divided into (3-)5-7(-9) segments (Sect. *Pharbitis* subsect. *Cephalanthae*)
- 6. I. pes tigridis**
- + Corolla (at least the limb) pink, red, purple or blue; mid-petal bands glabrous (Sect. *Pharbitis* subsect. *Chorisanthae*) ..... 5
5. Sepals 8-16mm, abruptly acute but lacking an awn-like apical appendage
- 5. I. purpurea**
- + Sepals 17-28mm, narrowed into a very long-acuminate apical awn-like appendage ..... 6
6. Hairs of sepals bristly, stiffly patent, usually yellowish ..... **3. I. nil**
- + Hairs of sepals  $\pm$  appressed, silvery-white ..... **4. I. indica**
7. Stamens and style  $\pm$  exerted; corolla salverform, with long narrow tube only broadening slightly, above or near middle ..... 8
- + Stamens and style included; corolla infundibular or campanulate, tube broadening from below middle ..... 11
8. Corolla scarlet, open during most of day, 2-4cm, limb 1.5-2cm diameter; stems not muricate (Sect. *Quamoclit*) ..... 9
- + Corolla pale bluish-purple or white, opening at night, tube 5-12cm, limb more than 2cm diameter; stems usually  $\pm$  muricate (Sect. *Calonyction*) 10
9. Leaves coarsely dentate or 3-lobed ..... **10. I. hederifolia**
- + Leaves pinnatisect with 9-19 pairs of very narrow segments
- 11. I. quamoclit**
10. Corolla bluish-purple or white, mid-petal bands not greenish, tube 3-6cm, limb c 4.5cm diameter; capsule 18-20mm ..... **8. I. turbinata**
- + Corolla white with greenish mid-petal bands, tube 7-12cm, limb (8-)11-15cm diameter; capsule 25-30mm ..... **9. I. alba**
11. Prostrate or climbing tuberous perennial; sepals oblong-acuminate. (8-)10-15mm; corolla lavender or white (Sect. *Batatas*) ..... **7. I. batatas**
- + Erect non-climbing shrub; sepals suborbicular, 5-6mm; corolla pink, rose, purple or white (Sect. *Eriospermum*) ..... **12. I. carnea** subsp. **fistulosa**

**1. I. eriocarpa** R. Brown; *I. hispida* (Vahl) Roemer & Schultes non Zuccagni. Fig. 78a&b.

Twining or prostrate annual. Stems slender, 1-2m, pilose with spreading or retrorse hairs. Leaves usually lanceolate to linear- or oblong-lanceolate, 2.5-6  $\times$  0.5-1.5cm (sometimes ovate or ovate-lanceolate and 2.5-9  $\times$  1.5-5.5cm), acute to acuminate, mucronulate, base cordate, shortly pilose above and

beneath, with 7–8 pairs of lateral veins; petiole 0.7–8cm, hairy. Inflorescences axillary, sessile or very shortly pedunculate, 1–4-flowered. Pedicels absent or to 3mm. Sepals subequal, 7–8mm, all linear-acuminate from ovate base, inner narrower than outer. Corolla pink or purple, tubular to infundibular, 7–9mm, scarcely exceeding sepals; mid-petal bands pilose and paler outside. Stamens and style included. Capsule broadly ovoid to globose, 5–6mm, hairy.

**Bhutan:** C – Tashigang district (Kheri (38)). 1000m. September. Confirmation of the above record is needed on account of the similarity of the species to *I. plebeia*. The two are scarcely separable unless fruit is present.

**2.I. plebeia** R. Brown subsp. **indica** Verdcourt; *I. cynanchifolia* Clarke non Meissner

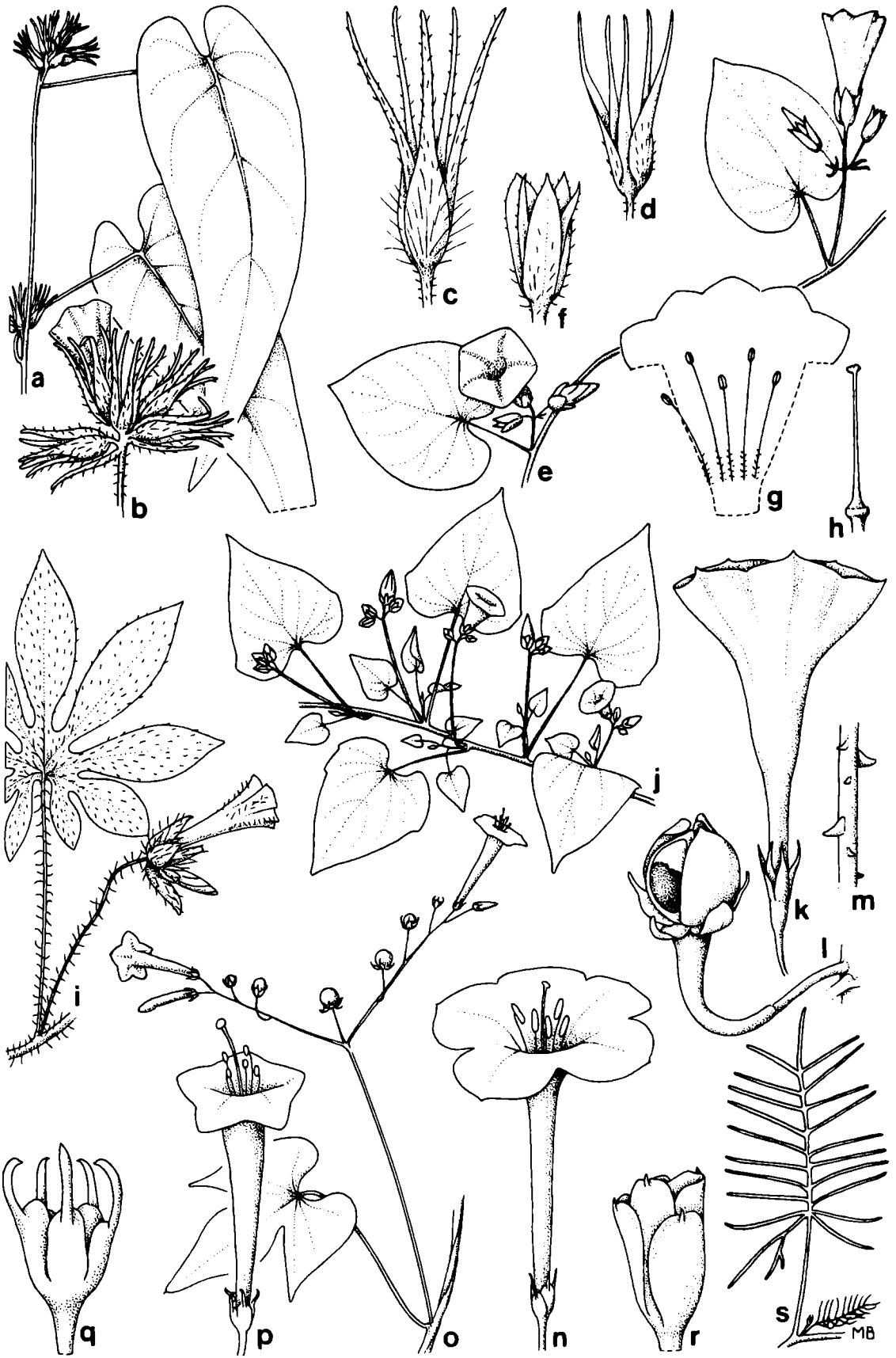
Scandent or prostrate annual. Stems to 1m, with spreading or retrorse hairs and longer spreading bristles. Leaves narrowly lanceolate to ovate, 3–10 × 1–5cm, acute to shortly acuminate and mucronulate, base cordate, shortly pilose above and beneath, with 5–7 pairs of lateral veins; petiole 1–6cm, hairy. Inflorescences axillary, sessile or very shortly pedunculate, 1–4-flowered. Pedicels 5–7mm. Sepals equal, 7–8mm, outer linear-acuminate from broad triangular base, inner with much narrower base, all hairy. Corolla pink or rose-purple, tubular to infundibular, c 8mm, scarcely exceeding calyx; mid-petal bands pilose towards apex. Stamens and style included. Capsule globose, 5–7mm, glabrous.

**Darjeeling:** Darjeeling; **Sikkim:** Dikling Khola, Lingchom and Rishi. Subtropical zone, 600–1500m. October.

**3. I. nil** (L.) Roth; *Pharbitis nil* (L.) Choisy, *I. hederacea* sensu F.B.I. non Jacquin. Fig. 78c.

Herbaceous, usually annual twiner, sometimes prostrate. Stems retrorsely hirsute or setulose. Leaves broadly ovate to orbicular in outline, 4–14 × 3–12cm, entire or 3-lobed, acute to acuminate, base cordate, appressed hairy on both surfaces; petioles 3–16cm, retrorse-hirsute. Flowers 1–several in small umbellate cymes; peduncles 2.5–12cm. Pedicels 5–10mm, retrorse-hirsute. Bracts 5–8mm, narrowly linear. Sepals 17–28mm, basal part ovate-elliptic with patent, stiff, usually yellowish bristles, narrowed into a very long, linear-acuminate, less hairy upper part. Corolla infundibular, 5–6cm, glabrous; tube 3.5–5cm, whitish; limb blue, turning red or reddish-purple. Stamens and style included. Capsule ovoid to globose, c 10mm diameter, glabrous, usually 3-celled and 3-valved. Seeds c 5mm, pear-shaped, black, grey-puberulent.

FIG. 78. **Convolvulaceae.** a–b, *Ipomea eriocarpa*: a, flowering shoot ( $\times \frac{2}{3}$ ); b, inflorescence ( $\times 1\frac{1}{2}$ ). c, *Ipomea nil*: calyx ( $\times 1$ ). d, *Ipomea indica*: calyx ( $\times 1$ ). e–h, *Ipomea purpurea*: e, flowering shoot ( $\times \frac{1}{3}$ ); f, calyx ( $\times 1$ ); g, dissected corolla ( $\times 1$ ); h, style ( $\times 1$ ). i, *Ipomea pes-tigridis*: leaf and inflorescence ( $\times \frac{1}{2}$ ). j, *Ipomea batatas*: flowering shoot ( $\times \frac{1}{4}$ ). k–m, *Ipomea turbinata*: k, flower ( $\times \frac{2}{3}$ ); l, fruit ( $\times \frac{2}{3}$ ); m, stem ( $\times \frac{2}{3}$ ). n, *Ipomea alba*: flower ( $\times \frac{1}{3}$ ). o–q, *Ipomea hederifolia*: o, leaf and inflorescence ( $\times \frac{1}{3}$ ); p, flower ( $\times 1$ ); q, calyx ( $\times 4$ ). r–s, *Ipomea quamoclit*: r, calyx ( $\times 3$ ); s, leaf ( $\times \frac{2}{3}$ ). Drawn by M. Bates.



**Bhutan:** C – Punakha district (Wangdu Phodrang), Mongar district (Lhuntse Dzong) and Tashigang district (Dangme Chu); **Sikkim:** Lingchom. Dry hills, 600–1700m. August–September (April–November in Nepal).

**4. *I. indica*** (Burman f.) Merrill; *Convolvulus acuminatus* Vahl, *I. acuminata* (Vahl) Roemer & Schultes, *I. congesta* R. Brown, *I. indica* (Burman f.) Merrill var. *acuminata* (Vahl) Fosberg. Fig. 78d.

Very similar to *I. nil* but cymes white silky-pubescent; hairs of sepals silvery-white, softer and  $\pm$  appressed; corolla 5–8cm, blue or purple; seeds brown, glabrous.

**Bhutan:** S – Phuntsholing district (Phuntsholing); **Darjeeling:** Yoksam (cultivated). Cultivated as an ornamental and sometimes naturalised in hedgerows, 200–1900m. February, July.

Native of tropical America, cultivated and naturalized throughout the tropics but uncommonly in the Indian subcontinent. Var. *acuminata* has been recognised as a distinct taxon in this taxonomically complex group.

**5. *I. purpurea*** (L.) Roth. Eng: *Morning Glory*. Fig. 78e–h.

Herbaceous annual twiner. Stems with short appressed hairs and longer retrorsely patent bristles. Leaves broadly ovate to suborbicular in outline, 2–15  $\times$  2.5–12cm, usually unlobed but occasionally 3-lobed, apex shortly acuminate, base deeply cordate, surfaces shortly appressed-pilose. Peduncles axillary, 3–18cm, cymes 1–5-flowered. Pedicels 8–15mm, deflexed in bud, erect at anthesis, finally deflexed in fruit. Sepals oblong-lanceolate, 8–16mm, rather abruptly acute but lacking awn or mucro, outer oblong with long white bristles below, inner narrower, narrowly scarious-margined. Corolla infundibular, 4–6cm long and to c 8cm across, glabrous; tube white or pink; limb white, deep pink, red or purple, mid-petal bands usually redder than rest of lobes. Stamens and style included. Capsule globose, 3-celled, glabrous, straw-coloured. Seeds pear-shaped, black,  $\pm$  glabrous.

**Bhutan:** C – Thimphu district (Paro and Tinlegang, 71), Punakha district (Punakha to Bhotokha, 71) and Mongar district (Tanmachu near Lhuntse); **Darjeeling:** Darjeeling. Cultivated in gardens, and a locally frequent weed of maize and other crops, 250–2370m. May–October.

Native to America (New Mexico to Argentina), Morning Glory is widely cultivated in tropical and subtropical countries as an ornamental, sometimes becoming naturalised. Potentially an invasive weed (272).

**6. *I. pes-tigridis*** L. Fig. 78i.

Herbaceous annual, twining or prostrate. Stems slender, 0.5–3m, patent-hirsute with stiff bristles. Leaves orbicular to transversely elliptic in outline, 3–7.5  $\times$  2.5–10cm, palmately divided nearly to base into (3–)5–7(–9) segments; segments elliptic, acuminate, narrowed at base, appressed or patent hirsute on



both sides; petioles 1.5–10cm, hirsute. Flowers in a dense capitate yellowish-hirsute cyme subtended by an involucre; peduncle 2–18cm, patent-hirsute; outer bracts oblong to linear-oblong, 1.5–3cm, inner smaller. Sepals 7–12mm, lanceolate. Corolla white, infundibular, 3–4cm, mid-petal bands sparsely hairy. Stamens and style included. Capsule ovoid, c 8mm, 1-celled, 4-valved. Seeds 4, c 4mm, sparsely tomentose.

**Bhutan:** C – Tashigang district (Kanglung, 38); **Darjeeling:** Balasun. Terai, c 150m. October.

**7. *I. batatas* (L.) Lamarck.** Eng: *Sweet potato*. Fig. 78j.

Tubers red, white or yellow. Stems prostrate, ascending or twining, 1–5m, glabrous or sparsely hairy,  $\pm$  terete (feral forms) or angular (cultivated forms). Leaves broadly ovate to orbicular in outline, 5–10  $\times$  5–11cm, entire or 3–7-lobed, acute or usually shortly acuminate, base cordate, glabrous or sparsely pubescent. Cymes few-flowered or subumbellate, flowers absent in some varieties. Outer 2 sepals usually shorter than inner 3, oblong to elliptic, 4–9mm, inner ones 5–12mm, all acuminate and cuspidate, shortly pubescent. Corolla lavender, pink or purplish (occasionally white) with darker throat, campanulate-infundibular, 4–7cm, constricted just above calyx, glabrous; limb with obtuse, mucronulate lobes. Capsule rarely formed, ovoid, glabrous.

**Bhutan:** S – Phuntsholing district (Phuntsholing). On wasteground, 200m. February.

Native of America, grown as a root crop (sweet potato) throughout the tropics and subtropics (157).

**8. *I. turbinata* Lagasca y Segura; *I. muricata* (L.) Jacquin non Cavanilles.** Fig. 78k–m.

Extensively climbing, nearly glabrous, herbaceous annual twiner with milky juice. Stems muricate. Leaves broadly ovate to orbicular, 7–18  $\times$  6–15cm, acuminate, base cordate, glabrous beneath but with some short bristles along main veins above. Inflorescence an axillary 1–few-flowered cyme; peduncles muricate, 3–12cm. Pedicels 10–20mm, much thickened in fruit, broadened near apex. Sepals subequal; outer ones oblong to ovate, 6–7mm (excluding awn), attenuate into thick patent to reflexed awn 4–6mm; inner ones 7–8mm, obtuse or emarginate, with c 4mm awn. Corolla opening at night, pale bluish-purple to white, narrowly infundibular to salverform, 5–7.5cm, glabrous; tube 3–6cm; limb c 4.5cm diameter. Stamens and style included or scarcely exerted. Capsule ovoid, 18–20mm, 2-celled, 4-valved. Seeds 4, 9–10mm, black, glabrous.

**Bhutan:** S – Deothang district (Dewangiri), C – Tashigang district (Gamri Chu near Lungten Zampa, Kheri); **Darjeeling:** Gok and Sukna. Climbing in dense broad-leaved forest and terai, 150–1220m. February–October. Fruiting October–November.

**9. *I. alba* L.; *I. bona-nox* L.** Eng: *Good-night flower, Moon flower*. Fig. 78n.

Similar to *I. turbinata* but stems less muricate, often  $\pm$  smooth; sepals unequal, 2 or 3 outer ones shorter, 5–12mm (excluding awn) with long, thick recurved or patent awn 4–9mm, inner ones 8–15mm, with much shorter, thinner mucro 2–3mm; corolla opening at night, fragrant, salver-shaped, white with greenish mid-petal bands; corolla tube 7–12cm, cylindrical, suddenly expanded into rotate limb (8–)11–14cm diameter; stamens and style exerted; capsule 25–30mm; seeds yellowish-white to brown or black.

**Bhutan:** S – Samchi district (Samchi (38)) and Phuntsholing district (Phuntsholing (38)), C – Tashigang district (Kheri (38)); **Darjeeling:** Gumbatan, Meshhash; **West Bengal Duars:** Jalpaiguri. Roadsides and jungle margins in the terai and up to 1000m. October–April.

According to field notes on a Clarke specimen from West Bengal, the flowers open two hours before sunset and close two hours after sunrise.

**10. *I. hederifolia* L.; *I. angulata* Lamarck, *I. phoenicea* Roxb., *I. coccinea* sensu F.B.I., non L.** Dz, Sha: *Chhongroo*. Fig. 78o–q.

Annual twiner. Stems 2–5m, glabrous or sparsely pilose. Leaves ovate to suborbicular in outline, 3–15 × 3–10cm, coarsely dentate or  $\pm$  deeply 3-lobed, acuminate and mucronulate, base cordate,  $\pm$  glabrous, middle lobe (when present) narrowed towards its base; petiole slender, 3–12cm. Cymes terminal and axillary, long-pedunculate; first branch dichasial with alar flower, others monochasial. Pedicels erect. Sepals oblong-rectangular, 2–3mm (excluding awns), erect at anthesis but patent in fruit and finally reflexed, each with a large, narrowly linear, herbaceous awn 3–4mm, inserted just below tip. Corolla scarlet, narrowly infundibular, glabrous; tube 3–4cm, very slender; limb 1.5–2cm diameter, spreading. Stamens and style exerted. Capsule globose, 5–7mm. Seeds 4, c 4mm, black, densely pubescent.

**Bhutan:** S – Phuntsholing district (Torsa River near Phuntsholing) and Deothang district (Samdrup Jongkhar); **Darjeeling:** Pankhabari and terai. Climbing on shrubs in stream beds in the terai, 200–600m. October–December.

Native of tropical America, now pantropical. Sometimes cultivated in gardens as an ornamental and so becoming naturalised.

**11. *I. quamoclit* L.** Eng: *Red Jasmine, Cypress Vine*. Fig. 78r&s.

Glabrous annual climber, sometimes prostrate and creeping. Petioles 8–40mm, usually with two small basal pinnatisect pseudo-stipules. Leaves 1–9cm, deeply pinnatisect with 9–19 pairs of  $\pm$  opposite very narrowly linear, patent segments 15–20 × c 0.5mm. Flowers solitary or in 3–5-flowered dichasial cymes. Peduncles 1.5–14cm, usually exceeding leaves. Pedicels (5–)9–20mm, thickened and clavate in fruit, much longer than calyx. Sepals oblong to oblong-spathulate; outer ones 4–4.5mm (excluding mucro); inner ones 5–6mm (excluding mucro), obtuse, margins hyaline, all with 0.25–1mm mucro inserted just

below tip. Corolla red or white, narrowly infundibular, glabrous; tube c 2cm × 2.5–4mm; limb patent, 1.5–2cm diameter with 5 deep triangular lobes. Stamens and style shortly exerted. Capsule ovoid, 6–8mm. Seeds dark brown or black, 5–6mm, with scattered tufts of minute hairs.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Sarbhang district (Sarbhang); **Darjeeling:** below Badamtam. Cultivated and as weed of lawns and hedges and at margins of teak plantations, 220–830m (to 1100m in Nepal). May–December.

Native of Mexico, now pantropical as a result of introduction for its ornamental value.

**12. *I. carnea* Jacquin subsp. *fistulosa* (Choisy) Austin; *I. fistulosa* Choisy, *I. crassicaulis* (Bentham) Robinson**

Erect shrub to 2.5m, not twining. Stem woody at base, hollow, glabrous or minutely puberulent. Leaves ovate to lanceolate, ± long-acuminate, base truncate to shallowly cordate, entire, densely but very minutely puberulent above and beneath. Flowers in terminal and axillary cymose-paniculate clusters. Sepals suborbicular to broadly ovate, outer 2 shorter and broader than inner 3, all puberulent. Unopened corollas densely grey-puberulent outside. Corolla deep pink to rose purple or almost white, 5–8cm, tube puberulent outside; mid-petal bands longitudinally 5-veined. Capsule ovoid to subglobose, c 2cm. Seeds with long brown comose hairs.

**Bhutan:** S – Phuntsholing district (Phuntsholing). Cultivated in park, 250m. February (–September in Nepal).

Native of tropical America; cultivated as a hedge plant and in parks in most tropical and subtropical countries, sometimes becoming naturalized. Subsp. *fistulosa* is the one most commonly introduced in Asia; subsp. *carnea* is a twiner with more ovate leaves.

## 5. MERREMIA Endlicher

Herbaceous or woody, erect or prostrate twiners. Leaves palmate or simple, dentate or entire. Flowers in axillary, sometimes umbel-like cymes, occasionally solitary. Bracts usually small. Sepals 5, usually subequal, concave. Corolla white or yellow, infundibular or campanulate; mid-petal bands with or without darker longitudinal veins; limb slightly 5-lobed. Stamens included; anthers straight or twisted. Ovary 2- or 4-celled, 4-ovuled. Fruit a capsule, dehiscing irregularly or by 4 valves. Seeds 4(–1 by abortion), glabrous or hairy.

- |  |                               |
|--|-------------------------------|
| 1. Leaves palmately 5–7-lobed, lobes ± toothed; corolla 50–60mm      |                               |
|  | <b>1. <i>M. vitifolia</i></b> |
| + Leaves linear to broadly ovate or reniform, entire; corolla 6–40mm | ..... 2                       |
| 2. Corolla 20–60mm   | ..... 3                       |
| + Corolla 6–20mm   | ..... 5                       |

- 3. Cymes dichotomous on slender peduncles; corolla 1.5–2cm  
2. *M. poranoides*
- + Cymes umbellate on relatively stout peduncles; corolla 2–6cm ..... 4
  
- 4. Peduncles 0.5–3cm; pedicels not thickened below calyx ... 3. *M. umbellata*
- + Peduncles 6–12cm; pedicels thickened below calyx ..... 4. *M. kingii*
  
- 5. Sepals unequal, elliptic or oblong ..... 7. *M. hirta*
- + Sepals subequal, broadly ovate to orbicular ..... 5
  
- 6. Corolla 15–20mm; petioles usually lacking tubercles; peduncles about same thickness as petioles; capsule c 7mm, not 4-angled ..... 5. *M. gemella*
- + Corolla 6–10(–12)mm; petioles with a few tubercles especially in lower half; peduncles thicker than petioles; capsule 5–6mm, ± distinctly 4-angled  
6. *M. hederacea*

**1. *M. vitifolia*** (Burman f.) Hallier f.; *Ipomoea vitifolia* (Burman f.) Blume. Fig. 77l&m.

Large herbaceous twiner or ground creeper. Stems stout, terete, 2–4m, older ones white- or yellowish- patent-hirsute or glabrous, younger ones ± glabrous. Petioles usually 2–15cm, patent-hirsute or glabrous. Leaves palmately 5–7-lobed, 5–18 × 5–16cm, lobes broadly triangular to lanceolate, acute to acuminate, margins dentate, crenate or subentire, sparsely to densely appressed hirsute beneath, glabrous or sparingly hirsute above. Axillary cymes usually 1–3-flowered. Peduncles and pedicels hirsute; pedicels clavate. Buds narrowly ovoid. Sepals oblong to ovate-oblong, 12–20mm, all with pellucid glandular dots, outer ones ± hirsute, inner glabrous with hyaline margins. Corolla bright yellow to pale orange, 5–6cm, infundibular, glabrous; mid-petal bands with 5 distinct dark veins. Anthers spirally twisted. Capsule subglobose, c 12mm, papery, straw-coloured. Seeds 6–7mm, blackish, glabrous.

**Bhutan:** S – Samchi district (Daina Khola), Phuntsholing district (N side of Phuntsholing and between Sorchen and Kharbandi) and Deothang district (Dewangiri); **Darjeeling:** Peshok. Secondary subtropical forest slopes and roadside banks, 200–800m. February–April.

**2. *M. poranoides*** (Clarke) Hallier f.; *Ipomoea poranoides* Clarke.

Herbaceous scandent twiner. Stems slender, glabrous. Petioles 1–5cm, glabrous or very sparingly pilose. Leaves broadly ovate-lanceolate, 4–11 × 2–10cm, abruptly caudate into very slender tip 5–15mm, base cordate (sometimes only shallowly), glabrous, veins on lower surface with narrow paler wings. Cymes divaricately dichotomous, 3–7-flowered, on long slender peduncles 4–10cm at least twice as long as subtending leaf. Bracts prominent, ovate, mucronate.

persistent. Pedicels very slender, 5–30mm, viscid, all except middle one with a pair of small median bracteoles. Buds ovoid. Sepals unequal, green, viscid, glabrous, strongly imbricated; outer 5–7mm, obtuse, inner 8–10mm, emarginate. Corolla white, with yellow ring near insertion of stamens, subcampanulate, 1.5–2.3cm, glabrous except for a tuft of hairs at tip of each mid-petal band; mid-petal bands without dark veins. Anthers straight, white; filaments hairy at base. Capsule subglobose to broadly ovoid, 10–12 × 12–14mm, smooth and membranous, 2-celled, 2–4-valved, 4-seeded. Seeds glabrous.

**Darjeeling:** Dikling Khola, Kalimpong. Subtropical zone, 600–1500m. September–October.

Sometimes misidentified as *Porana grandiflora* which it superficially resembles in habit and divaricate cymes, but differs in its white flowers. Old unlocalised records and specimens from 'Sikkim' probably all originate from Darjeeling District.

**3. *M. umbellata* (L.) Hallier f.; *Ipomoea cymosa* (Desrousseaux) Roemer & Schultes, *Convolvulus blandus* Roxb. Fig. 77n&o.**

Herbaceous or older parts woody, twining or prostrate and rooting. Stems slender, 1–3m, glabrous or softly pubescent, young parts with white milky juice. Petioles 1–9cm, glabrous or pubescent. Leaves ovate, ovate-oblong or oblong, 4–12 × 1–5cm, subacute or usually ± acuminate, base shallowly cordate to truncate, sparsely hirsute beneath (sometimes subglabrous), glabrous or sparsely hirsute above. Cymes umbellate, shortly pedunculate (peduncles 0.5–3cm, equaling or shorter than petioles), (1–)2–12-flowered. Buds ovoid. Sepals unequal, green tinged crimson; outer ones shorter, broadly elliptic to orbicular, strongly concave, emarginate, mucronate, inner ones 5–8mm, scarious-margined. Corolla white, 2–4cm, glabrous except for hairy apices of mid-petal bands; mid-petal bands without dark veins. Anthers straight, sagittate. Capsule ovoid to conical, 10–12 × c 8mm, 4-valved, splitting from base. Seeds c 5mm, densely and softly spreading-pilose.

**Bhutan:** S – Phuntsholing district (Phuntsholing), Sankosh district (Balu Khola near Phipsoo) and Sarbhang district (Singhi Khola near Sarbhang). C – Tongsa district (Birti, 38); **Darjeeling:** Little Rangit Valley. Scrub and margins of subtropical terai forest, 200–900m. February–April.

An unlocalised Hooker specimen labelled 'Sikkim' is probably from Darjeeling District.

**4. *M. kingii* (Prain) Kerr; *Ipomoea kingii* Prain, *I. cymosa* (Desrousseaux) Roemer & Schultes var. *macra* Clarke**

Very similar to *M. umbellata* but leaves generally rather larger, 6–13 × (2.5–)4–9cm; peduncles generally much longer, 4–12cm, exceeding subtending petioles; pedicels thickened just below calyx; corolla usually 4–6cm.

**Darjeeling:** Mongpu, Rishep, Rongbi. Subtropical zone, 600–1525m. September–October.

Old unlocalised specimens and published records from both 'Bootan' and 'Sikkim' remain unsubstantiated and are probably based on specimens from Darjeeling.

**5. *M. gemella*** (Burman f.) Hallier f.; *Ipomoea polyantha* Miquel non *Convolvulus polyanthus* Wall.

Twining or prostrate herb. Stems to 3m, pilose with soft appressed to patent white hairs. Leaves usually ovate or broadly ovate, sometimes reniform or narrowly ovate, 2.5–12 × 1.5–10cm, shortly acuminate (or obtuse in reniform leaves) with acute to retuse mucronulate tip, base cordate, margins entire to dentate, surfaces glabrous to sparsely pilose, hairs mostly confined to veins of lower surface; petiole appressed pilose, usually without tubercles. Peduncles about same thickness as petioles, usually 2.5–10cm, cymes usually 6–12-flowered. Sepals broadly ovate to orbicular, subequal, 4–8mm, concave, emarginate and mucronulate, with narrow scarious margins. Corolla yellow, campanulate to infundibular, 1.5–2cm, glabrous; limb shallowly 5-lobed; lobes emarginate, mucronulate. Capsule depressed globose, not 4-angled, c 7mm, coarsely wrinkled when dry.

**Darjeeling:** Darjeeling. Ecology etc. unknown.

Known only from a single Griffith collection which could be mis-labelled.

**6. *M. hederacea*** (Burman f.) Hallier f.; *Ipomoea chryseides* Ker-Gawler.

Similar to *M. gemella* but stems more slender and wiry, glabrous or sparsely hairy, smooth or minutely tuberculate; leaves usually much smaller, 1–5 × 1–4cm, apex acuminate with an obtuse and mucronulate tip; petioles 0.5–6cm, with a few distinct tubercles especially in lower half; plant more floriferous; peduncles thicker than petioles; sepals with broadly emarginate apex, with a distinct mucro pointing outwards; corolla campanulate, 6–10(–12)mm, glabrous outside, with long hairs inside near base of filaments; capsule ± distinctly 4-angled, 5–6mm.

**West Bengal Duars:** Jalpaiguri. Terai forests, altitude not recorded. October–March.

**7. *M. hirta*** (L.) Merrill; *Ipomoea linifolia* Blume.

Twining or prostrate herb. Stems very slender, 20–60cm, glabrous or with long patent yellowish bristles. Leaves linear, oblong-lanceolate, ovate-oblong or ovate, narrow leaves 3–6 × 0.3–1cm, broader ones 1.5–4.5 × 0.8–2.5cm, all obtuse to slightly emarginate, base obtuse to shallowly cordate or shortly hastate, glabrous on both surfaces or sparsely pilose beneath (rarely also above); petiole short, (1–)3–8mm. Cymes 1–6(–8)-flowered; peduncles 1–3(–7.5)cm. Sepals unequal; outer 2 elliptic, 3–4mm, obtuse, inner 3 oblong or oblong-elliptic, 4.5–6mm, all somewhat enlarged and 6–7mm in fruit, prominently veined. Corolla pale yellow or whitish, 15–20mm, glabrous; mid-petal bands with 5 distinct dark veins. Anthers spirally twisted. Capsule broadly ovoid to globose, papery, c 6mm, 1-celled, 4-valved. Seeds dark brown.

**Darjeeling:** Katambari, Siliguri and Sukna. Dry open places in terai, 150–1500m. October–December.

The leaves of this species can be very variable in shape, even on the same plant, from linear to ovate or occasionally almost orbicular. In general, the upper leaves are relatively longer and narrower than the lower ones. Old specimens labelled 'Sikkim terai' are from Darjeeling District.

## 6. OPERCULINA Silva Manso

Herbaceous twiners, usually large. Stems, petioles and peduncles winged. Leaves petiolate, cordate at base, entire. Flowers in 1–few-flowered pedunculate axillary cymes, large. Bracts caducous, often large. Sepals 5, greatly enlarged in fruit and becoming rather succulent. Corolla regular, broadly infundibular to campanulate. Stamens 5, included; filaments filiform, adnate to corolla tube; anthers large, soon spirally twisting. Disc annular. Ovary bilocular, glabrous, each loculus with 2 ovules. Style 1, simple, filiform, included. Capsule large, dry; epicarp circumscissile  $\pm$  at middle, upper part thus separating from lower part and endocarp as a  $\pm$  fleshy lid (*operculum*); endocarp scarious, splitting irregularly. Seeds up to 4, large, globose or trigonous.

**1. O. turpethum** (L.) Silva Manso; *Ipomoea turpethum* (L.) R. Brown. Eng: *Turpeth root*, *Indian jalap*. Fig. 77p–r.

Twining perennial, 2–4m, with long, much-branched, fleshy root. Stems narrowly 3–5-winged, sulcate or angled, glabrous or sparingly pilose. Leaves broadly ovate to narrowly lanceolate, 5–15 × 1–14cm, cordate to hastate at base, acuminate to obtuse at apex, margins entire or dentate (teeth sometimes confined to near base). Flowers solitary or in cymes of 2–3. Sepals ovate or broadly ovate, outer ones 1.5–2.5cm and pubescent, inner ones c 2cm and glabrous (viscid when young). Corolla white, sometimes yellowish at base, broadly infundibular to campanulate, 3–4.5cm. Capsule depressed-globose, 1.5cm broad. Seeds glabrous, black.

**Bhutan:** locality unknown.

This record is based on an unlocalised Griffith collection.

## 7. PORANA Burman f.

Large, woody or herbaceous, twining climbers. Leaves petiolate, ovate, entire, palmately veined. Flowers in cymes, forming axillary or terminal panicles or racemes. Bracts leaf-like, or small and linear-subulate, or absent. Sepals 5, small at anthesis; outer 3, or all 5, greatly enlarging in fruit and scarious, reticulate-veined, spreading. Corolla regular, white, mauve or steel-blue, small and campanulate to infundibular, or large and infundibular to salver-shaped; limb 5-lobed or subentire. Stamens 5, included; filaments adnate to corolla. Disc

annular or absent. Ovary glabrous, 1-celled and 2-ovuled or 2-celled and 4-ovuled. Style entire with simple or bifid stigma, or bifid with unequal branches and capitate stigmas. Capsule oblong to subglobose, small, 2-valved or indehiscent. Seed usually 1, glabrous.

*Porana* is retained here in the traditional broad sense; in some recent Floras it is divided into smaller genera, of which our species fall into two segregates: *Poranopsis* Roberty (woody, corolla lobes hairy) and *Dinetus* Sweet (herbaceous, corolla lobes glabrous except at apex).

1. Corolla c 30–40mm, pink, mauve or steel-blue; tube swollen at base
  1. **P. grandiflora** & 2 **P. stenoloba**
- + Corolla 4.5–10mm, white; tube not swollen at base ..... 2
2. Stems shortly appressed-pubescent, hairs in 2 narrow rows; bracts large, leaf-like, amplexicaul; peduncles and sepals glabrous to sparsely pilose; whole corolla glabrous outside; all 5 sepals equally enlarged in fruit
  3. **P. racemosa**
- + Stems, peduncles and sepals densely tomentellous; bracts small, not leaf-like; corolla tube and mid-petal bands tomentellous outside; 3 sepals much larger than other 2 in fruit ..... 4. **P. paniculata**

**1. P. grandiflora** Wall.; *Dinetus grandiflorus* (Wall.) Staples, *Dinetopsis grandiflora* (Wall.) Roberty. Nep: *Akasbeli*.

Slender, herbaceous climber, to at least 5m. Stems 1–2mm thick, often reddish, minutely pubescent. Leaves 6–11(–13) × (2.5–)3.5–8(–9)cm, acuminate, base deeply cordate, villous above when young, pubescent above and glabrous or puberulent beneath when older. Inflorescence a 4–12-flowered raceme; bracts minute, linear, 1.5–2.5mm. Sepals linear-oblong, sparsely puberulent and with ± densely ciliate margins, 3–4mm in flower, all enlarging in fruit but 3 more so than other 2. Corolla mauve or pink with whitish mid-petal bands and tube, 30–40mm, glabrous; tube very slender, swollen at base; limb 23–42mm diameter, shallowly lobed, mid-petal bands produced into a short, puberulent mucro. Stamens and style included in base of corolla tube. Capsule oblong-subglobose, c 12mm; 3 larger sepals in fruit 33–50 × (6–)10–14mm, 7–9-veined, 2 smaller ones 20–35 × 3–5.5mm, all shallowly retuse with short blunt mucro, green (occasionally tinged mauve) and rather glossy.

**Bhutan:** S – Chukka district (Chukka), C – Punakha district (Wangdu Phodrang). **Darjeeling:** Darjeeling, Lebong, Mongpu, Pankhabari, Rongbi; **Sikkim:** Lachen, Singtam. Climbing on shrubs on slopes, 1220–2135m. June–September; fruiting October onwards.

## 2. **P. stenoloba** Kurz

Similar to *P. grandiflora* but stems 2–3m, nearly glabrous; leaves distinctly or very shallowly cordate, caudate-acuminate, glabrous or minutely hairy above.



glabrous beneath; bracts narrowly ovate-lanceolate to linear, 25–40mm, ± petiolate, long-caudate, and with 2 minute bracteoles subtending calyx; corolla steel-blue; sepals in fruit all very narrow, linear-lanceolate, 3 larger ones 23–30 × 2.5–4(–5)mm, 5-veined, 2 smaller ones 14–22 × 1–2(–3.5)mm, all obtuse with pointed mucro, green with faint pinkish-purple tinge.

**Darjeeling:** Kurseong to Sonada. In bushes by roadside, on metamorphic rocks, 1525–1830m. October.

Endemic to Darjeeling (and doubtfully Sikkim). Apparently known only from the type, collected by Kurz 'in the bushes that border the road from Kersiong to Sonada', and another unlocalised specimen labelled 'Sikkim' (King 182, K) which is probably also from Darjeeling district. Sometimes synonymised with *P. grandiflora* but further collections are desirable to confirm this.

**3. *P. racemosa* Roxb.; *Dinetus racemosus* (Roxb.) Sweet.** Eng: *Snow Creeper*. Lepcha: *Somon-rik* (34), *Samonarike*.

Slender herbaceous climber 2–10m, forming dense masses. Stems 1.5–2.5mm thick, often reddish, rather densely appressed-pubescent (hairs mostly in 2 rows) at first, becoming glabrous or verrucose. Leaves 2.5–10 × 2.5–7cm, acuminate to caudate, base deeply cordate, shortly appressed-pubescent above, more densely beneath; petioles shorter than or subequalling lamina. Inflorescence a lax, axillary, compound, dichotomous raceme with a leaf-like, cordate, amplexicaul, glabrous to puberulent bract at each dichotomy. Peduncles and pedicels filiform. Sepals 2.5mm. Corolla white with yellowish tube, 6–8mm, scented; limb 5-lobed to near middle, glabrous. Filaments inserted at different levels in corolla tube. Style 1, longer than ovary; stigma bilobed. Capsule ovoid, 7–8mm, glabrous, thin and semi-transparent; sepals in fruit all enlarging equally, narrowly obovate, 9–10 × 2.5mm, obtuse, mucronulate, pale green sometimes tinged purple, scarious. Seed ovoid, to 6mm, blackish.

**Bhutan:** S – Samchi, Phuntsholing, Chukka, Gaylegphug and Deothang districts, C – Thimphu, Punakha, Mongar and Tashigang districts; **Darjeeling:** Dumsong, Kalimpong, Mongpu, Pankhabari, Rishep, Sureil, Takdar; **Sikkim:** Kulhait valley. Climbing on shrubs in shady places in subtropical and warm broad-leaved forest and bamboo scrub on hillsides and also by roadsides, 170–2500m. September–December.

The corollas of this species remain white or whitish on drying.

**4. *P. paniculata* Roxb.; *Poranopsis paniculata* (Roxb.) Roberty.** Nep: *Singhane Lahara* (34); Eng: *Bridal Creeper*. Fig. 79a–d.

Large woody climber 3–10m or more. Stems densely greyish tomentellous throughout on young branches but with 2 narrow glabrous purplish central lines on older ones. Leaves 4–9 × 2.5–6cm, obtuse to shortly acuminate, base cordate, shortly pubescent above and beneath; petiole 5–25mm. Inflorescence a large, lateral or terminal, much branched panicle; flowers very numerous. Peduncles and pedicels slender but stouter than in *P. racemosa*. Bracts c 1.5mm.

linear. Sepals linear-ovate, 1–1.5mm, obtuse, densely tomentellous. Corolla pure white or cream, 4.5–6mm, faintly scented; limb shallowly 5-lobed to crenate, mid-petal bands densely tomentellous outside. Filaments subequal, not exerted, inserted  $\pm$  at same level near base of corolla. Style very short, entire; stigma subsessile, globose, indistinctly bilobed. Capsule ovoid-globose, c 5mm diameter, hairy with 2-branched hairs; 3 sepals enlarging in fruit to  $20 \times 7$ mm, obtuse, pubescent on both surfaces, other 2 linear, c 7mm.

**Bhutan:** S – Samchi, Phuntsholing, Chukka and Deothang districts, C – Thimphu, Mongar and Tashigang districts; **Darjeeling:** Rilli forest, Great Rangit valley, Sitong, Labha; **Sikkim:** Tista. Climbing on shrubs on rocky slopes, subtropical and terai forests, 30–1220m. October–December; fruiting February–March.

The corollas of this species turn dark brownish on drying. Clarke (80) described them as glabrous, but examination of a wide range of specimens from the entire range of the species (including some collected by Clarke himself) has shown that the mid-petal bands and tube are always hairy outside. The related Chinese *Porana discifera* Schneider has been found in NE India and could occur in Bhutan; it differs from *P. paniculata* in its unequal stamens with the longest exerted, the style longer than the ovary, the fruiting calyx glabrous within and the hairs on the fruits simple.

An exceptionally beautiful plant in the fresh flowering state.

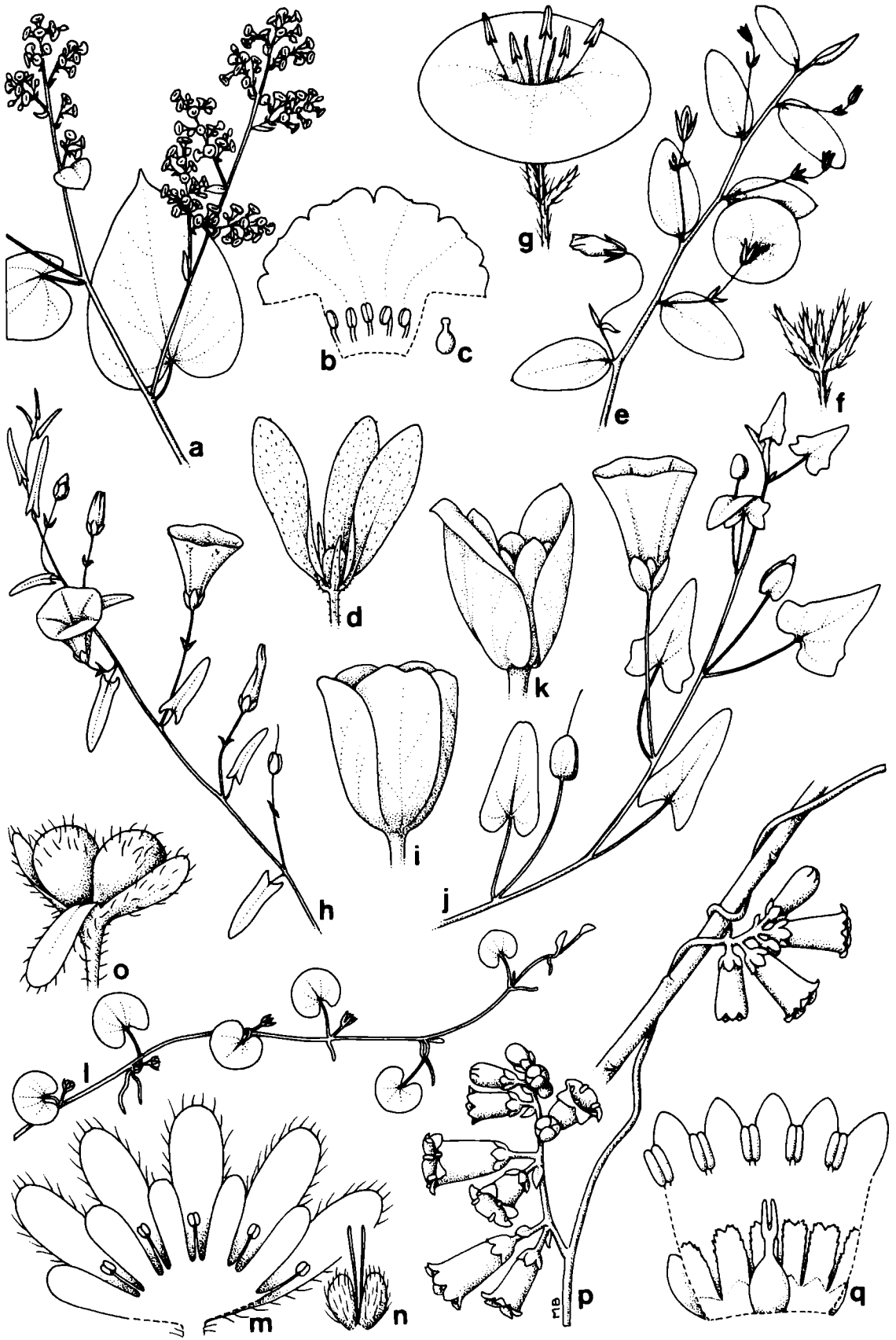
## 8. EVOLVULUS L.

Perennial herb. Stems prostrate to ascending, never twining. Leaves small, entire. Flowers axillary, 1–3 together in pedunculate, bracteate cymes. Sepals 5, subequal, not enlarging in fruit. Corolla regular, rotate, limb shallowly 5-lobed. Stamens included or exerted; filaments adnate to corolla tube, filiform, glabrous, sometimes with 2 basal teeth. Ovary 2- or occasionally 1-locular, 4-ovulate; styles 2, filiform; stigmas 2 per style, linear or slightly clavate. Capsule globose, usually 4-valved with up to 4 seeds. Seeds smooth or minutely verrucose, glabrous.

### 1. *E. alsinoides* (L.) L. Fig. 79e–g.

Perennial, with numerous prostrate to ascending annual branches 7–35cm. Leaves narrowly to broadly elliptic or spatulate, 7–20(–25)  $\times$  3–10mm, very shortly petiolate, apex obtuse or shallowly emarginate, sometimes mucronulate,

FIG. 79. **Convolvulaceae and Cuscutaceae. Convolvulaceae.** a–d, *Porana paniculata*: a, flowering shoot ( $\times \frac{1}{2}$ ); b, flower dissected ( $\times 4$ ); c, ovary and style ( $\times 4$ ); d, calyx in fruit ( $\times 1$ ). e–g *Evolvulus alsinoides*: e, flowering shoot ( $\times 1$ ); f, calyx ( $\times 3$ ); g, flower ( $\times 3$ ). h–i, *Convolvulus arvensis*: h, flowering shoot ( $\times \frac{2}{3}$ ); i, calyx ( $\times 5$ ). j–k, *Calystegia hederacea*: j, flowering shoot ( $\times \frac{2}{3}$ ); k, calyx ( $\times 2$ ). l–o, *Dichondra repens*: l, flowering shoot ( $\times 1$ ); m, dissected flower ( $\times 12$ ); n, ovary and style ( $\times 12$ ); o, fruit ( $\times 4$ ). **Cuscutaceae.** p–q, *Cuscuta reflexa*: p, flowering shoot ( $\times 1\frac{1}{2}$ ); q, dissected flower ( $\times 4$ ). Drawn by M. Bates.



± densely appressed-hirsute on both sides or sometimes glabrous above, hairs white to rufous. Peduncles filiform, shorter than, to much longer than leaves; bracts linear-subulate to linear-lanceolate, 1.5–4mm. Pedicels usually longer than calyx. Sepals c 3mm, ovate to lanceolate, villous. Corolla bright blue or white, 5.5–7(–10)mm diameter; mid-petal bands pilose outside. Capsule globose, 4-valved, subequalling calyx.

**Bhutan:** C – Punakha district (Punakha and Gon Chungnang). Dry banks on sandy soil, 1400–1800m. Mainly May–August in our area but almost throughout the year in East Himalaya.

A very polymorphic pantropical species which has been divided into numerous varieties world-wide on the basis of habit, internode length, leaf arrangement, leaf shape, colour of stem, leaf indumentum etc. Most East Himalayan plants have ascending stems, internodes longer than 4mm, non-distichous leaves and white to brownish indumentum, corresponding to var. **alsinoides**. Var. *hirsutus* (Lamarck) van Oostroom, with prostrate stems with shorter internodes (less than 4mm), smaller ± distichous leaves and rufous indumentum, may also occur in the East Himalaya. However, transitional forms occur between these varieties. The single Bhutan specimen (*Cooper* 3170) seen belongs to var. *alsinoides* but has white flowers instead of the more common blue and the internode length is relatively short, closer to that typical of var. *hirsutus*. Yamazaki in Hara (71) noted that the collection from Gon Chungnang had pale blue flowers.

## 9. CONVULVUS L.

Twining annual or perennial herb. Leaves simple, alternate. Inflorescence of 1- or few-flowered axillary cymes; flowers pedicellate; bracts and bracteoles both present at least in cymes with more than 1 flower; bracteoles not concealing calyx. Calyx lobes free, ± equal. Corolla campanulate. Stamens epipetalous, filaments unequal. Ovary 2–4-locular; style 1; stigmas 2. Fruit a glabrous or pubescent capsule with 1–4 seeds.

**1. C. arvensis** L. Eng: *Bindweed*; Nep: *Sagarkhandey* (272). Fig. 79h&i.

Prostrate or twining annual or perennial herb, 12–100cm. Stems branched from base, glabrous or pubescent. Leaf lamina ovate to linear-oblong or linear-ovate, 12–60mm, 2–30mm broad (excluding basal lobes), acute or obtuse, base sagittate or hastate, glabrous or pubescent; petiole 3–20mm. Cymes axillary, bracteate, 1–2-flowered; peduncles 30–55mm, subequalling subtending leaf; pedicels 8–30mm. Bracts and bracteoles linear, in opposite pairs, c 3mm but slightly unequal, not concealing calyx; only 1 pedicel of a 2-flowered cyme with a pair of bracteoles. Sepals broadly oblong, 3–5mm, obtuse with retuse or apiculate tip, ± broadly scarious-margined. Corolla pale pink, lilac or white with mid-petal bands darker pink or purple or sometimes white, 13–22mm; mid-petal bands sparsely hairy near apex outside, corolla otherwise glabrous.

Filaments 5–7mm, unequal; anthers c 2mm. Style filiform, 4–6mm. Capsule globose, c 5mm diameter. Seeds c 4mm, tuberculate, dark brown.

**Bhutan:** C – Mongar district (Lingmethang). Occasional weed of fodder grass plots, c 750m. June.

Leaf shape is often very variable, even on the same plant. Towards the ends of the branches there is frequently an abrupt change from relatively broad, ovate-oblong leaves to ones with an extremely narrow, linear principal lobe; sometimes nearly all leaves are of the latter form. Such plants have been called var. *linearifolius* Choisy.

## 10. CALYSTEZIA R. Brown

Glabrous, procumbent, twining herb with white latex. Leaves petiolate, reniform, cordate or sagittate. Flowers solitary, axillary. Bracteoles 2, conspicuous, inserted immediately below calyx and  $\pm$  concealing it, persistent. Calyx lobes ovate or oblong, inner smaller than outer. Corolla infundibular or campanulate. Ovary 1-locular, glabrous, with 4 ovules; style 1; stigma consisting of 2 elongate, swollen lobes. Fruit a globose, 1-locular glabrous capsule. Seeds usually 4, glabrous.

1. **C. hederacea** Wall.; *Convolvulus wallichianus* Sprengel. Fig. 79j&k.

Twining, suberect or trailing, perennial herb, 10 – 100cm. Stems glabrous. Petioles 10–40mm, slender. Lamina oblong to triangular in outline, 15–40(–75)  $\times$  5–20(–25)mm, base cordate to sagittate with  $\pm$  2 spreading, entire or 2(–3)-toothed basal lobes, apex obtuse or slightly emarginate, glabrous, upper surface with numerous microscopic semi-transparent dots. Peduncles 20–50mm. Bracteoles elliptic, 6–8mm, obtuse. Sepals oblong, obtuse, mucronulate, outer c 6(–7.5)mm. Corolla campanulate, 20–25mm long and c 30mm diam., in Bhutan white with pink mid-petal bands; mid-petal bands glabrous. Filaments slightly unequal, inserted near base of corolla. Style filiform. Capsule ovoid, c 7.5mm.

**Bhutan:** C – Mongar district (near Lingmethang). Occasional weed of wheat-field plots, rice seedling nurseries and fallow rice terraces, 900–1050m. March–June (January–August in China and Tibet).

## 11. DICHONDRA J. R. & G. Forster

Small, prostrate perennial herbs. Leaves petiolate, simple, reniform or cordate-orbicular, entire. Flowers solitary, axillary, pedicellate, small, each subtended by 2 minute, subulate bracteoles. Sepals 5,  $\pm$  free, subequal, ovate-spathulate,  $\pm$  enlarging in fruit. Corolla subequal to calyx, broadly campanulate, deeply 5-lobed, hirsute outside. Stamens 5, shorter than corolla; filaments inserted at base of corolla lobes (about middle of corolla). Ovary deeply bilobed, each lobe

2-ovulate; styles 2, inserted between lobes of ovary and appearing gynobasic. Fruit a bilobed capsule, lobes usually 1-seeded and indehiscent or irregularly bivalved. Seeds subglobose, smooth.

1. *D. repens* J. R. & G. Forster agg. Fig. 79l-o.

Stems procumbent, 5–15cm, but often forming extensive mats, rooting at nodes, moderately pubescent with  $\pm$  short, appressed hairs. Petioles (3–)6–90mm, usually much longer than lamina; lamina reniform to cordate-orbicular, 4–18  $\times$  6–22mm, usually 7-veined from base, usually glabrescent but densely and minutely papillose above, hirsute with relatively long,  $\pm$  appressed hairs beneath (occasionally also above). Axillary peduncles 1–10(–20)mm, much shorter than petiole. Calyx lobes 2–3mm, ovate-spathulate, sericeous outside. Corolla whitish-green or livid green, 2–3mm, hairy outside. Capsule lobes 1.5–2.5mm, dark brown when mature, hairy.

**Bhutan:** C – Ha district (between Ha and Puduna). Stony and moist pastures and hillsides, 1525–2800m. April–June.

The Bhutan plant may belong to the segregate *D. micrantha* Urban from tropical America, which is widespread as an alien in China. The leaves of Chinese plants are almost always glabrescent (apart from papillae) above; those of the only specimen seen from Bhutan have hairs on both surfaces and in this respect resemble Australian populations of *D. repens*. The species is almost certainly alien in Bhutan.

*Dichondra* has frequently been confused with various species of *Hydrocotyle* (Umbelliferae), and occasionally with *Sibthorpia* (Scrophulariaceae); the E Himalayan representative of the latter group (now known as *Ellisiophyllum pinnatum*), however, is easily distinguished by its pinnate leaves.

## Family 166. CUSCUTACEAE

by R.R. Mill

Twining parasitic herbs with little or no chlorophyll. Stems slender, yellowish-brown or reddish-purple, spirally twisting counter-clockwise round stems of host and attached to them by haustoria. Leaves reduced to small thin ovate or cup-shaped scales. Inflorescence a raceme or globose cluster. Calyx gamosepalous, lobes (4–)5(–6),  $\pm$  fleshy. Corolla gamopetalous, (4–)5(–6)-merous, tubular, with a ring of  $\pm$  fimbriate scales inside tube; lobes small, acute or obtuse, reflexed, erect or inflexed. Stamens same number as corolla lobes and alternating with them; filaments present or absent. Ovary bilocular with 2 ovules per loculus; styles 1 or 2, free or united, sometimes absent; stigmas linear or capitate. Fruit a capsule, with a definite line of dehiscence near base (circumscissile) or dehiscing irregularly.

A single large cosmopolitan genus, *Cuscuta*, often included in the family Convolvulaceae.

The genus has recently been divided into four segregate genera: *Cuscuta* sensu stricto, *Grammica* Loureiro, *Kadurias* Rafinesque, and *Monogynella* Desmoulins, based on style, embryo and other characters. The more traditional, broad concept of the genus has been adopted here.

## 1. CUSCUTA L.

Eng: *Dodder*.

Description as for family.

1. Flowers in small racemes or panicles; corolla 5–7mm ..... **1. C. reflexa**
- + Flowers in globose clusters; corolla 1.5–3mm ..... 2
2. Flowers pale pink; capsule clearly circumscissile ..... **4. C. europaea**
- + Flowers greenish-white or pale yellow; capsule not clearly circumscissile . 3
3. Capsule thin and membranous, seeds visible from outside; corolla scales exerted from corolla tube ..... **2. C. campestris**
- + Capsule thick and opaque, seeds not visible from outside; corolla scales shorter than corolla tube ..... **3. C. scandens**

**1. C. reflexa** Roxb.; *Kadurias reflexa* (Roxb.) Rafinesque, *Monogynella reflexa* (Roxb.) J. Holub. Dz: *Roba-je*; Nep: *Swarnlata* (PARK), *Amar Lata* (PARK). Fig. 79p&q.

Stem reddish or light to dark brown, 0.5–1.5mm thick, branched. Inflorescence a short lax raceme of up to 12 flowers. Pedicels (0–)0.5–7mm. Bracts leaf-like. Calyx lobes 5, ovate-obtuse, 0.7–3 × 1.5–2.5mm, much shorter than corolla tube, margin scarious. Corolla creamy white, sweetly scented, 5–7mm; lobes obtuse, erect, finally reflexed, 1–1.5 × 0.5–0.7mm; scales reaching middle of corolla tube, fringed. Stamens 5; filaments linear 2–3mm; anthers basifixed, 1–1.5mm, slightly exerted from corolla. Stigmas 2, unequal, thick, divergent or (subsp. *anguina*) ± erect. Capsule globose-conical, 1–3 × 23mm, dehiscent irregularly.

**Bhutan:** S – Samchi district, C – Thimphu, Punakha, Tongsa and Mongar districts, N – Upper Mo Chu district; **Darjeeling:** Kalimpong; **Sikkim:** Tchowpong, Lachen and Lugdam; **West Bengal:** Jalpaiguri Duars. Scrub and at margin of secondary subtropical and warm broad-leaved forests, 600–2700m. On *Artemisia*, *Debregeasia*, *Erythrina*, *Toddalia*, *Viburnum*, *Vitex*, *Zizyphus* and other shrubs; only rarely on herbs. February–October.

Can be a damaging weed in *Citrus* plantations (272).

A specimen of this species from Tongsa (*Cooper* 2278) was misidentified as *C. gigantea* Griffith by Yuncker and forms the basis of the doubtful Bhutan

record of the latter species in Hara (71). Two subspecies have been recognised: larger-flowered specimens with corolla lobes c  $\frac{1}{4}$ – $\frac{1}{3}$  length of tube are referred to subsp. **reflexa** while smaller-flowered specimens (corolla 5–6mm) with corolla lobes c  $\frac{1}{2}$  × tube and stigmas ± erect belong to subsp. **anguina** (Edgeworth) Yuncker (e.g. Thimphu district: Paro, 2286m, *Bedi* 685 and Yusipang, 2700m, *Parker* 7166). Some East Himalayan material, from Nepal and Assam, has been separated as *C. santapau* Banerji & Das. The original material of *C. santapau* has not been seen and its status deserves investigation; Hara (71) included it as a doubtful synonym of *C. reflexa* var. *brachystigma* Engelmann (i.e. *C. reflexa* subsp. *anguina*).

**2. *C. campestris*** Yuncker; *C. arvensis* auct. non Beyrich, *Grammica campestris* (Yuncker) Hadac & Chrtek.

Stem green when young, finally light brown, 0.2–0.5mm thick. Inflorescence a compact globular cluster of 2–8 flowers. Pedicels subequal, 0.5–2mm, ± glandular. Bracts cup-shaped, inflexed, 1–2 × 0.5–0.7mm. Calyx lobes ovate to orbicular, sometimes broader than long, 1.2–1.5 × 1–1.7mm, more than half length of corolla, very obtuse, minutely glandular, reticulate-veined. Corolla greenish-white or pale yellow, 2–3mm; lobes triangular, ± acute, finally reflexed with often inflexed tips, 1–1.5mm, reticulate-veined, glossy in lower half, becoming dull towards apex; scales exerted from corolla tube, densely fringed. Stamens 5, shorter than corolla lobes; filaments tapering from base to apex, 0.3–0.7mm; anthers oblong-elliptic or ovoid, c 0.5mm. Styles 2, linear; stigmas rounded or capitate, c 0.2mm. Capsule depressed-globose with ± small intrastylar opening, 2–2.5 × 2–2.5mm, not distinctly circumscissile, membranous, with seeds clearly visible from outside.

**Bhutan:** **S** – Deothang district (Samdrup Jongkhar), **C** – Thimphu district (Taba). Roadsides, c 500–2400m. On *Artemisia*, *Eupatorium*, *Zizyphus*, and a wide variety of herbaceous hosts. June–August.

Native of the United States, introduced to many parts of the world with seeds of clover and alfalfa. An invasive and very damaging weed of vegetable and forage crops (272).

**3. *C. scandens*** Brotero; *C. australis* R. Brown

Very similar to *C. campestris* but stems finally darker brown; calyx lobes broadly elliptic, 1.2–1.4 × 1–1.3mm unequal in width; corollas slightly smaller, 1.5–2.5mm, lobes orbicular-ovate, obtuse; scales shorter than corolla tube, deeply bifid; styles 2, unequal, subulate; capsule globose with large intrastylar opening, brown, thick and opaque with seeds invisible from outside.

**Bhutan:** **S** – Phuntsholing district (Phuntsholing). Wasteground, c 200m. On *Mikania*, *Bidens* and *Amaranthus spinosus*. May.

Plants from our area have usually been referred to subsp. *cesatiana* (Bertoloni) R. Soó (*C. australis* subsp. *cesatiana* (Bertoloni) Yuncker) but too little material has been examined for a proper assessment of the status of this subspecies.



**4. *C. europaea* L.**

Stems red (drying brown or purplish), 0.2–0.4mm thick. Inflorescence a loose or dense globular cluster of 8–22 flowers. Pedicels absent or very short. Bracts narrowly triangular. Calyx lobes (4–)5(–6), ovate to spatulate,  $\pm$  unequal, 1.5–3  $\times$  0.5–2mm, shortly connate near base, obtuse, subacute with thickened tips. Corolla pale pink, campanulate becoming urceolate in fruit, c 1.5–3mm; lobes (4–)5(–6), translucent, oblong to ovate, obtuse, reflexed; scales membranous, equalling or slightly exserted from corolla tube, slightly fringed. Stamens (4–)5(–6), shorter than corolla lobes; filaments broadest near base, tapering to apex; anthers ovoid to roundish, slightly versatile. Styles 2, linear, c 1mm. Stigmas 2, linear, purple or reddish. Capsule globose-conical or depressed-globose, 1.5–2.2  $\times$  2–2.5mm, circumscissile with definite line of cleavage.

**Bhutan:** C – Ha district (Tare La above Ha, Chappey near Ha), N – Upper Mo Chu district (Laya); **Chumbi:** W of Yatung. Grassy banks etc., 2500–4250m. On low herbs; frequent on *Artemisia* and occasional on *Astragalus stipulatus*, which it severely damages (272). July–September.

Most material from the Himalaya belongs to var. *indica* Engelmann, which is sometimes raised to species rank as *C. indica* (Engelmann) Butkov. The taxonomy of the *C. europaea* complex in the Himalaya and India needs further investigation.

**Family 167. BORAGINACEAE**

by R.R. Mill

Trees, shrubs or most commonly herbs. Leaves usually alternate (occasionally some  $\pm$  opposite), simple; stipules absent. Inflorescence paniculate, corymbose, racemose or spike-like, the basic unit a helically coiled (scorpioid) cyme which usually elongates and straightens in fruit; flowers sometimes solitary in axils of bracts or leaves. Flowers actinomorphic or sometimes slightly zygomorphic, hermaphrodite or occasionally polygamous. Calyx cylindrical to infundibular, gamosepalous,  $\pm$  divided into (4–)5 lobes or teeth. Corolla gamopetalous, rotate to cylindrical or infundibular, usually with distinct tube and  $\pm$  deeply lobed limb; tube often with small appendages (throat scales) near top, which close mouth of corolla and are sometimes replaced by a ring of hairs or absent altogether; lobes (4–)5. Stamens (4–)5, epipetalous, alternating with corolla lobes, anthers included or exserted. Ovary superior, (2–)4-locular; style terminal or more usually gynobasic. Fruit usually a group of up to 4 dry nutlets, occasionally (in certain woody genera) a fleshy or dry drupe which may separate into 2 corky mericarps or two 2-seeded or four 1-seeded pyrenes. Nutlets attached to gynobase apically, laterally or basally; attachment scar varying in size, sometimes with a sub-basal ring or stipe; body of nutlets often differentiated into disc and margin, margin sometimes with a  $\pm$  broad wing; surface and/or

margin smooth or variously ornamented, glabrous or with hairs, setules or glochidiate tubercles or spines.

The classification of this family into tribes and genera has largely been based on fruit characters. As a result, specimens without fruit can often be very difficult to identify even to genus. Certain species of even supposedly unrelated genera can closely resemble each other in leaf and flower characters and mis-identifications are frequent. Nevertheless, most specimens of Boraginaceae are collected in flower, with or without accompanying fruits. Consequently, as well as a key based on more traditional fruit characters, an effort has been made here to provide a key to flowering specimens in which fruits are absent. From couplet 16 onwards and particularly in the final couplet, this key should be used with caution and the identification confirmed with fruiting material if possible.

*Key to flowering specimens*

1. Trees or shrubs; style terminal ..... 2
- + Herbs; style almost always gynobasic (terminal in *Heliotropium*) ..... 4
  
2. Scrambling shrub; flowers in dense 2-rowed scorpioid cymes ..... 3. **Tournefortia**
- + Trees or non-scrambling shrubs; flowers in panicles or corymbs ..... 3
  
3. Style twice bifid; stigmas 4; calyx 2.5–5mm ..... 1. **Cordia**
- + Style once bifid; stigmas 2 (if rarely 4, then calyx only 1–1.5mm: *E. laevis*) ..... 2. **Ehretia**
  
4. Corolla hairy outside ..... 5
- + Corolla glabrous outside ..... 6
  
5. Corolla 7–28mm; flowers  $\pm$  nodding in 1–many few-flowered cymes, pedicellate; style gynobasic ..... 6. **Onosma**
- + Corolla 2.5–4.5mm; flowers in scorpioid, many-flowered spikes,  $\pm$  all sessile; style terminal ..... 4. **Heliotropium**
  
6. Stem  $\pm$  absent; high-alpine plants ..... 7
- + Distinct stem(s) present; habitat and altitude various ..... 9
  
7. Leaves 12–80  $\times$  7–32mm; plant perennial ..... 16. **Microula** (*M. tibetica*)
- + Leaves 2–8  $\times$  1.5–3.5mm; dwarf annuals ..... 8
  
8. Leaves petiolate; flowers solitary in leaf axils ..... 10. **Actinocarya**
- + Leaves sessile or subsessile; flowers not solitary in leaf axils ..... 9

9. Leaves sessile, mostly crowded near base, flowers in terminal umbel-like inflorescence ..... **9. Microcaryum**  
 + Leaves subsessile,  $\pm$  all cauline; flowers in diffuse, terminal, raceme-like cymes ..... **11. Setulocarya**
10. Flowers yellowish-brown, yellowish-green or yellowish-white throughout ..... 11  
 + Flowers blue or pure white, sometimes with yellow eye but never wholly yellowish ..... 12
11. Corolla 4–6mm; plant 30–90cm; leaves 30–80  $\times$  5–15mm, c 6  $\times$  as long as broad; anthers free, included ..... **5. Lithospermum**  
 + Corolla 10–15mm; plant 1–6m; leaves to 450  $\times$  190mm, c 2–3  $\times$  as long as broad; anthers joined, forming a cone, exerted ..... **19. Trichodesma**
12. Plants very densely caespitose or pulvinate, forming hummocks ..... 13  
 + Plants loosely or not at all caespitose, never forming hummocks ..... 15
13. Leaves abruptly expanded from above middle into a broadly obtuse semi-circular apical part; lower part sparsely hairy, upper part densely long-villous ..... **13. Chionocharis**  
 + Leaves elliptic, lanceolate, oblanceolate or spatulate, not abruptly expanded apically, evenly strigose throughout ..... 14
14. Calyx lobes long-hispid, lanceolate; style c 1.5mm ..... **8. Trigonotis (*T. caespitosa*)**  
 + Calyx lobes sparsely strigose, narrowly oblong or oblanceolate-oblong; style 0.4–0.5mm ..... **14. Eritrichium**
15. Calyx with some hooked hairs towards base ..... **7. Myosotis**  
 + Calyx without hooked hairs ..... 16
16. Flowers in bracteate cymes and/or in leaf axils ..... 17  
 + Flowers in terminal cymes which are ebracteate except occasionally the lowest flowers ..... 23
17. All stem hairs subappressed, antrorse ..... 18  
 + At least some stem hairs spreading ..... 20
18. At least some leaf hairs arising from conspicuous tuberculate bases ..... **17. Bothriospermum**  
 + No leaf hairs arising from tuberculate bases ..... 19
19. Perennial; leaves petiolate; corolla usually rotate with tube shorter than calyx ..... **8. Trigonotis**

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- + Annual; leaves sessile; corolla tubular-campanulate with relatively long tube ..... **11. Setulocarya**
- 20. At least some flowers axillary ..... 21
- + All flowers in terminal racemes ..... 22
- 21. Some or most stem hairs appressed, strigose, not setiform .... **8. Trigonotis**
- + All stem hairs spreading,  $\pm$  setiform ..... **16. Microula**
- 22. Stems 1–11cm; corolla 1–3.5mm, pale blue ..... **12. Lasiocaryum**
- + Stems (8–)15–60cm; corolla 6–8mm, brilliant blue  
**16. Microula** (*M. sikkimensis*)
- 23. Flowers without a white or yellow eye ..... **18. Cynoglossum**
- + Flowers with a white or yellow eye ..... 24
- 24. Corolla 1–2mm ..... **14. Eritrichium** (*E. minimum*)
- + Corolla at least 3mm ..... 25
- 25. Leaves acuminate or acute ..... **15. Hackelia**
- + Leaves obtuse, subacute or retuse ..... 26
- 26\*. Stems not more than 1.5mm thick; cymes usually with at least 12 flowers  
**8. Trigonotis**
- + Stems (1.5–)2–3.5mm thick; cymes with fewer than 10 flowers  
**15. Hackelia**

\*Nutlets are essential for accurate separation of these genera, one or two species of which are very similar in some floral and vegetative characters. If nutlets are present, those of *Hackelia* are large with long marginal spines; those of *Trigonotis* are very small, trigonal or tetrahedral, smooth and without spines.

*Key to fruiting specimens*

- 1. Fruit a drupe; trees or large shrubs; calyx much less than 2cm ..... 2
- + Fruit a group of up to 4 nutlets; usually herbaceous, sometimes shrubby to 6m and then with a large inflated fruiting calyx c 2cm (*Trichodesma*) .... 4
- 2. Infructescence a 2-rowed scorpioid cyme ..... **3. Tournefortia**
- + Infructescence a panicle or corymb ..... 3
- 3. Calyx funnel-shaped, very shallowly lobed at apex ..... **1. Cordia**
- + Calyx lobed at least to middle ..... **2. Ehretia**
- 4. Style terminal ..... **4. Heliotropium**

- + Style gynobasic, inserted between nutlets ..... 5
- 5. Nutlets attached basally to gynobase (if attachment just above base, treat as lateral and use other lead of this couplet) ..... 6
- + Nutlets attached laterally or apically to gynobase, or by most of ventral surface ..... 10
- 6. Nutlets very hard, ivory-white, glossy and smooth; leaves long and narrow, bluish-green above; flowers, if present, wholly yellowish **5. Lithospermum**
- + Nutlets not as above; if leaves long and narrow, then flowers not wholly yellowish ..... 7
- 7. Nutlets smooth and glossy ..... 8
- + Nutlets tuberculate, warty or rugose, not glossy ..... 9
- 8. Leaves 6–12 × as long as broad; calyx with some hooked hairs towards base; nutlets ovoid, neither tetragonal nor trigonal ..... **7. Myosotis**
- + Leaves not more than 3 × as long as broad; calyx without hooked hairs; nutlets tetragonal or trigonal, ± pyramidal ..... **8. Trigonotis**
- 9. Plants 9–120cm, with distinct stem(s); leaves 10–200 × 3–30mm **6. Onosma**
- + Dwarf acaulescent annual, total height including pedicels not more than 2cm; leaves 2–5 × 1.5–2mm ..... **9. Microcaryum**
- 10. Acaulescent ..... 11
- + Distinct stem(s) present ..... 12
- 11. Leaves 12–80 × 7–32mm; perennial ..... **16. Microula (*M. tibetica*)**
- + Leaves 5–8 × 1.5–3.5mm; dwarf annual ..... **10. Actinocarya**
- 12. Nutlets lacking hairs, setules or appendages ending in hooks ..... 13
- + Nutlets covered at least at margin with hairs, setules or appendages ending in anchor-like hooks (*glochids*) ..... 15
- 13. Shrub 1–6m; calyx much accrescent in fruit and then 18–20 × 14–15mm **19. Trichodesma**
- + Herbs 3–60cm; calyx less than 10mm in fruit ..... 14
- 14. Stems with subappressed antrorse hairs only; nutlets with a large centrally positioned umbilicus on ventral surface, surrounded by a thickened rim **17. Bothriospermum**
- + Stems with at least some spreading hairs; nutlets sometimes with a small subapical depression (*foveola*) but lacking a central ventral umbilicus **16. Microula**

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15. Nutlets with hairs or setules but lacking glochidiate appendages ..... 16  
+ Nutlets with glochidiate appendages on margin or surface ..... 18
16. Woolly perennial forming  $\pm$  large very dense cushions; fruits sessile, nutlets with a coma of long hairs in upper half ..... **13. Chionocharis**  
+ Low diffusely branched annuals not forming dense cushions; fruits pedicellate, nutlets shortly strigose or setulose ..... 17
17. Nutlets attached to gynobase almost throughout their length on ventral surface ..... **12. Lasiocaryum**  
+ Nutlets attached to gynobase only by lower  $\frac{1}{3}$  of ventral surface  
**11. Setulocarya**
18. Nutlets pubescent and with marginal glochidiate teeth; low caespitose plants 3–11cm with leaves 2–3mm broad ..... **14. Eritrichium**  
+ Nutlets glabrous apart from glochidiate appendages; plants usually more than 10cm tall (if less, leaves more than 6mm broad) ..... 19
19. Nutlets 1–3mm, attached to gynobase by an apical scar, unwinged, with short glochidiate appendages much less than 1mm; calyx lobes stellate in fruit ..... **18. Cynoglossum**  
+ Nutlets 5–10mm, attached to gynobase by a lateral scar, at least 2 of them with a  $\pm$  broad wing composed of long  $\pm$  confluent glochidiate spines 1–3mm; calyx lobes reflexed in fruit ..... **15. Hackelia**

**1. CORDIA L.**

Deciduous trees. Leaves generally alternate, petiolate. Inflorescence paniculate, of dichotomous corymbose cymes or clusters. Flowers polygamous, ebracteate. Calyx infundibular or campanulate, accrescent in fruit; lobes short, irregular. Corolla tubular or infundibular, in our species 4- or 5-merous, lobes recurved, imbricate. Stamens 4 or 5 (in ours), adnate to corolla tube; filaments hairy at base; anthers exserted. Ovary 4-locular; style terminal, twice bifid. Fruit a drupe with hard endocarp, 4-celled (or fewer-celled by abortion).

1. Twigs greyish-brown without pale protuberances; leaves without white dots (cystoliths) above; flowers 5-merous; drupe 12–25mm, green, yellow or pink, finally black ..... **1. C. obliqua**  
+ Twigs dark brown with pale protuberances; leaves finally with  $\pm$  dense white dots (cystoliths) above; flowers 4-merous; drupe 3–4mm, white  
**2. C. grandis**

1. *C. obliqua* Willdenow; *C. myxa* auct. (excluding var. *domestica*) non L. Sha: *Yang Shing*; Nep: *Bohori*, *Aule Bohori* (34), *Jat Bohori*; Lepcha: *Minat-kung* (34). Fig. 80a–c.

Small to medium-sized deciduous tree 6–10m. Bark greyish-brown, with numerous shallow longitudinal fissures. Young twigs glabrous or white- or brown-tomentose. Leaves orbicular, broadly ovate, elliptic or obovate, 4–15 × 3–13cm, obtuse or ± abruptly acuminate, base rounded or cuneate, margins sinuate-dentate, repand or entire, upper surface ± glabrous, lower surface shortly pubescent especially along and in axils of veins, penninerved with 3(–5) veins arising from base. Inflorescence large, composed of terminal and axillary pedunculate, repeatedly dichotomous cymes. Flowers shortly pedicellate; buds pyriform. Calyx c 2.5mm, glabrous outside (margins sometimes villous), pubescent inside, not ribbed. Corolla white, 5–10mm diameter; tube equalling calyx; lobes 5, equalling tube, oblong-ovate, recurved. Filaments setose-hairy near base. Style of fertile flowers with long, slender, recurved stigmatic arms. Fruit ovoid, 12–25mm, green becoming pale yellow or pinkish when ripe and finally almost black, shining, rugulose.

**Bhutan:** S – Gaylegphug district (Thewar Khola), C – Mongar district (Zimgang) and Tashigang district (Kulong Chu); **Darjeeling:** Buxa, Tarobari, Badamtam etc.; **Sikkim:** without locality (34). Terai forest, 300–1200m. March–April; fruits May–June.

Produces useful timber and fuel wood (48). The viscid pulp of the fruits is almost transparent and is rather sweet and edible.

The Nepalese vernacular name *Bohori* or *Boeri* has also been applied to *Ehretia serrata* and *E. wallichiana*.

2. *C. grandis* Roxb. Nep: *Asare* (34).

Large, fast-growing deciduous tree 9–21m. Branches dark brown with pale narrowly elliptic excrescences, strongly ribbed, youngest parts pilose with rows of rather long weak hairs and much shorter denser brownish pubescence, older branches glabrous. Leaves ovate to suborbicular, 10–22 × 6–18cm, subobtuse to bluntly short-acuminate, base truncate or obtuse, entire or almost so, ± densely tomentellous beneath when young, glabrescent at maturity, upper surface scabrid and finally developing numerous white cystoliths; veins 3–5 per side. Inflorescence very large (to 30cm or more), dense, paniculate, pedunculate; flowers subsessile, borne in dichotomous, corymb-like terminal cymes. Buds broadly pyriform to subglobose. Calyx infundibular-campanulate, 5mm, pubescent or subglabrous outside, accrescent in fruit, densely hairy within; lobes 4. Corolla white, 4.5–5mm diameter, tube included in calyx, hairy within; lobes 4. Stamens 4; anthers c 1mm. Drupe 3–4mm, white, conical when young, later ovoid-elliptic, mucronate, seated on accrescent funnel-shaped calyx; pulp viscid.

**Bhutan:** S – Phuntsholing district (Phuntsholing (71)); **Darjeeling:** terai (34). Terai forests, c 900m. October–February; fruits March–April (persisting until end of cold season).

Confirmation of the occurrence of this species in Bhutan and Darjeeling is required although it cannot be confused with *C. obliqua*. The description is based on material from Burma and Assam.

## 2. EHRETIA L.

Deciduous or semi-evergreen trees or shrubs. Leaves petiolate, often large, serrate or entire. Inflorescences terminal only, terminal and lateral, or lateral only, corymbose or paniculate, branches often 2–3-chotomous. Calyx divided to middle or beyond. Corolla white or cream, subrotate to infundibular, lobes spreading or reflexed. Filaments exserted; anthers basifixed or medifixed. Style terminal, divided above middle into 2(–4) stigmas. Fruit a subglobose drupe, yellow to reddish when mature, endocarp breaking up at maturity into either two 2-seeded or four 1-seeded pyrenes.

- |  |                          |
|--|--------------------------|
| 1. Leaves toothed .....  | 2                        |
| + Leaves entire .....  | 3                        |
| 2. Inflorescence semicircular in outline, branches naked below; leaf teeth large and unequal (1–3mm); corolla tube twice as long as calyx  |                          |
|  | <b>4. E. macrophylla</b> |
| + Inflorescence ovate in outline, each peduncle with clusters of flowers almost to junction with main axis; leaf teeth small (0.5mm or less); corolla tube equalling or shorter than calyx ..... | <b>5. E. serrata</b>     |
| 3. Corolla subrotate, tomentose inside towards base but glabrous outside; buds ovoid .....   | <b>1. E. laevis</b>      |
| + Corolla infundibular, glabrous inside, hairy or glabrous outside; buds clavate .....   | 4                        |
| 4. Tree 8–12m; corolla tube densely puberulent outside; leaves with 4–5 pairs of lateral veins .....   | <b>2. E. wallichiana</b> |
| + Shrub or small tree 2–3m; corolla tube glabrous outside; leaves with (5–)6–8 pairs of lateral veins .....  | <b>3. E. psilosiphon</b> |

### 1. *E. laevis* Roxb.

Large shrub or tree to 10m, deciduous or semi-evergreen. Young branches dark brown, ± densely white-eglandular-pubescent, older ones greyish, glabrous. New leaves developing just after flowering. Petiole 1–2.5cm; lamina elliptic,

FIG. 80. **Boraginaceae.** a–c, *Cordia obliqua*: a, flowering shoot (× 1); b, dissected flower (× 2); c, fruit (× 1½). d–e, *Ehretia macrophylla*: d, flowering shoot (× ½); e, dissected flower (× 2); f–h, *Tournefortia hookeri*: f, flowering shoot (× ⅔); g, dissected flower with ovary and style (× 6); h, fruit (× 4). i–k, *Heliotropium indicum*: i, flowering shoot (× ½); j, dissected flower with ovary and style (× 6); k, fruit (× 6). l–m, *H. strigosum*: l, portion of fruiting shoot (× 3); m, fruit (× 10). Drawn by M. Bates.





obovate or suborbicular, 6–18 × 5–11cm, shortly acuminate, base asymmetrical or nearly symmetrical, cuneate, minutely puberulent above and beneath and with tufts of longer hairs in vein axils beneath, lateral veins 5–6 pairs. Inflorescences terminal and lateral, lax, repeatedly dichotomous, shortly eglandular-pubescent. Calyx 1–1.5mm, lobed to c  $\frac{3}{4}$ , densely and shortly pubescent. Buds ovoid. Corolla white or very pale green, subrotate, 4–5mm, tube very short, glabrous outside but densely tomentose within, lobes oblong-ovate 3–4mm, obtuse, patent becoming recurved, glabrous. Filaments shortly exerted, reaching middle of corolla lobes; anthers c 0.7mm, pinkish-grey. Style exerted, lobes to c 1mm, stigmas 2(–4), dilated towards apex. Drupe orange when ripe, 5–6.5mm, breaking up into 4 1-seeded parts.

**Sikkim(?)**: Pernak. Secondary subtropical forest, to c 900m. January–April.

A polymorphic, very widespread species. The description applies to East Himalayan material only. Apparently very rarely collected in our area. The Pernak specimen (*Clarke 27910A, BM*) is not typical, having narrower, distinctly acuminate leaves.

**2. *E. wallichiana*** Hook.f. & Thomson. Nep: *Boeri, Bohori* (34), *Lekh Bohori* (34), *Dowari*; Lepcha: *Noom-kung* (34), *Kalet*.

Small to medium tree (2–)5–12(–25)m. Young branches chocolate-brown, older ones greyish-brown, glabrous. Leaves  $\pm$  fully developed at flowering time, elliptic, obtuse or shortly acuminate (sometimes both together on same branch), base obtuse or shortly cuneate, entire, glabrous, lateral veins 4–5 pairs, diverging at (57–)62–77(–80)°. Inflorescences lateral in axils of fallen leaves, usually several close together on a branch, twice trichotomous; peduncles 2–3cm, glandular-pubescent; first trichotomies c 6mm,  $\pm$  obscured by flowers at anthesis, glandular. Calyx 2–4mm, lobed to c halfway, ciliate-margined, otherwise glabrous. Buds clavate. Corolla white, sweetly fragrant, 6.5–11mm; tube densely puberulent outside; lobes acute or obtuse, strongly reflexed. Anthers exerted, oblong, 1.2–1.5mm, nearly medifixed. Style exerted, deeply bifid, gradually dilated upwards to indistinct, almost flat-topped stigmas. Fruits green,  $\pm$  globose, 5–7mm diam., with c 12 prominent longitudinal ridges when dry.

**Bhutan**: S – Gaylegphug district, C – Punakha, Tongsa, Mongar and Tashigang districts, N – Upper Bumthang Chu and Upper Kuru Chu districts; **Darjeeling**: Kurseong, Lebong, Lopchu; **Sikkim**: Talung, Dentam, Namchi, Gangtok. Warm broad-leaved forest, 1500–1800m. April–May.

According to Brandis (17), often gregarious and an important component of secondary growth after clearance of primary forest. Wood used to make charcoal (34).

The circumscription of *E. wallichiana* and the next species has recently been clarified by Mill (266). No literature records have been accepted on account of confusion between these species.

### 3. *E. psilosiphon* Mill

Shrub or small tree 2–3m. Young branches dark brown, older ones greyish-brown, glabrous. Leaves still expanding at start of flowering period, elliptic, acute to rather long-acuminate, base cuneate, entire, glabrous or minutely pubescent above and/or on veins beneath, lateral veins (5–)6–8 pairs, diverging at (28–)33–50°. Inflorescence lateral, usually solitary near a vegetative shoot axil, 2–4 times dichotomous; peduncles 1–3.5cm, glabrous or glandular; first dichotomies 10–25mm, clearly visible at anthesis, glabrous or glandular. Calyx 2–3mm, divided almost to base, densely or sparsely short-pubescent and ciliate-margined. Buds clavate. Corolla white, unpleasantly scented, 4–8mm; tube glabrous outside, lobes acute, strongly reflexed. Anthers exerted, linear, 1.8–2mm, almost basifixed. Style exerted, shortly to deeply bifid, style branches little dilated upwards, stigmas distinct and  $\pm$  convex. Fruits subglobose or broadly ellipsoid, to 6  $\times$  5–8mm, blackish and longitudinally ridged when dry.

**Bhutan:** S – Sarbhang district (near Lao Pani) and Gaylegphug district (Lodrai Khola), C – Punakha district (Wangdu Phodrang to Samtengang), Tongsa district (Byiti Sam) and Tashigang district (near Ningala); **Darjeeling:** Rangit, Badamatam, Dhobi Jhora, Rilli River. Subtropical forest, 340–1900m. March–April.

Specimens of this have all previously been treated as *E. wallichiana*, but the two are quite distinct (266).

### 4. *E. macrophylla* Wall. Dz: *Jambo*. Fig. 80d&e.

Tree (3–)8–10m. Young branches greenish becoming dark brown, crispate-hirsute with thin brownish hairs, older ones with greyish-brown bark. Leaves shortly petiolate (petiole 2–4cm, shortly hairy mainly on abaxial side), lamina broadly ovate to broadly obovate, 7–16  $\times$  4–12.5cm, acute or shortly acuminate, base cuneate to rounded, unequally serrate (teeth with upward-directed hooked tips), shortly and sparingly hirsute above (hairs with tuberculate bases), sparsely pubescent beneath, mainly on veins, lateral veins prominent beneath, 7–9 pairs. Inflorescence a terminal, dense, compound panicle,  $\pm$  broadly triangular or semicircular in outline, 6–15  $\times$  6–15cm in flower. Peduncles brownish-hirsute like upper part of branches. Calyx c 4mm, divided to just beyond middle into oblong-lanceolate lobes, minutely pubescent outside and densely ciliate-margined. Corolla white or creamy, strongly scented, 6–8mm, tube with 5 lines of short hairs; lobes reflexed, densely hairy on back. Anthers exerted, oblong-ovoid, 1.2–1.5mm, greyish-white. Style exerted, shortly bifid. Berry green (drying blackish and wrinkled), c 6mm diameter.

**Bhutan:** C – Punakha district (Wangdu Phodrang etc.) and Mongar district (Manjibi). Warm mixed and broad-leaved forest, 1680–2150m. April–May.

### 5. *E. serrata* Roxb.; *E. acuminata* R. Brown var. *serrata* (Roxb.) Johnston, *E. acuminata* sensu F.B.I. non R. Brown. Nep: *Chille*, *Bohori* (34).

Tree to 15m. Young branches glabrescent. Leaves shortly petiolate (petiole

1–2cm, very sparsely pilose), lamina elliptic-oblong, 5–16 × 2–5.5(–6.5)cm, acuminate, base cuneate, serrulate, glabrous above, sparsely short-pilose on veins beneath, lateral veins 7 pairs, orange-brown. Inflorescence a terminal, ovate, divaricately branched, white-pubescent panicle 8–18 × 6–15cm; flowers sessile in ovoid subracemose glomerules. Calyx cup-like, c 1.5mm, lobes obtuse, ciliate. Corolla white, rotate, scented; tube equalling calyx; lobes oblong, 1.9–2.2mm, minutely crenulate. Filaments shorter than corolla lobes. Anthers basifixed, oblong, 0.8–1mm, pinkish-grey. Style exserted, shortly 2-lobed. Drupe subglobose, 3–5.5mm.

**Darjeeling:** Jalpaiguri duars and Darjeeling terai, common; **Sikkim:** Rishi Chu below Pedong; Rangpo Chu. Subtropical forest, 300–850m. March–April; fruiting June–August.

Records from Bhutan (e.g. *Griffith* 6000, K) are old and unlocalised and await confirmation.

### 3. TOURNEFORTIA L.

Scandent shrubs. Leaves alternate, entire, shortly petiolate. Cymes terminal, dichotomous, scorpioid, secund with flowers in 2 rows. Flowers numerous, dense, sessile, ebracteate, 5-merous (in our species). Calyx lobes lanceolate to ovate. Corolla greenish-yellow or white, strigose outside; tube narrowly cylindrical, lacking throat scales or appendages; lobes small, finally patent. Stamens included in corolla tube; anthers oblong. Ovary 4-locular; style terminal, short, shortly bifid. Fruit a small ovoid to globose scarcely fleshy drupe, in ours indistinctly separating into two 2-seeded pyrenes.

The above description refers to Sect. *Tournefortia* (including Sect. *Pittonia* (Adanson) G. Don), to which our two species belong.

1. Calyx lobes 1.5–2mm; corolla much exceeding calyx, 6–12mm

1. *T. montana*

+ Calyx lobes 3–4mm; corolla scarcely exceeding calyx, 3–5(–8)mm

2. *T. hookeri*

1. *T. montana* Loureiro; *T. viridiflora* (Roxb.) Wall. including var. *griffithii* Clarke, *T. roxburghii* Clarke, *T. candollei* Clarke

Large scrambling shrub. Current growth and older branches ± densely short-pubescent (less so below), hairs brownish to whitish. Leaves very shortly petiolate (petiole 0.5–1(–1.5)cm), lamina ovate-lanceolate, acuminate, base obtuse, upper surface very shortly and sparsely pubescent becoming glabrous and sometimes rugose, lower surface minutely puberulent mainly along veins, greenish, reticulate-veined. Inflorescences 2–6cm in flower, strongly scorpioid when young but finally ± straight. Calyx lobes 1.5–2mm, ovate, shortly hairy, mainly on margin. Corolla with pale green tube and yellow-green lobes, 6–12mm, tube much longer than calyx, pentagonal, narrowly flask-shaped, narrowed towards

base and more gradually upwards; limb 2–3mm diameter. Fruit c 4mm diameter.

**Bhutan:** S – Gaylegphug district (Taklai Khola) and Deothang district (Samdrup Jhonkar to Deothang and Deothang to Tashigang (38)); **Darjeeling:** Buxa; **Sikkim:** Tista. Subtropical forest slopes, c 400m. February–November.

This species is treated here in a broad sense; it is very variable in corolla length, leaf indumentum and other characters. Most plants from Bhutan and Sikkim seem to be referable to the segregate known as *T. candollei* Clarke (leaves glabrous beneath; corolla long); some are nearer *T. roxburghii* Clarke (leaves  $\pm$  hairy beneath; corolla long).

**2. *T. hookeri* Clarke** (including var. *subtropica* Clarke). Nep: *Arupate Lahara* (34); Lepcha: *Tiplo* (34). Fig. 80f–h.

Scrambling or climbing shrub to at least 1m. Current growth including peduncles densely short-pubescent with yellowish-white hairs, older branches almost glabrous. Leaves shortly petiolate (petiole 1–2cm), lamina elliptic-lanceolate to broadly ovate, apex either obtuse with short mucro or  $\pm$  gradually acute or acuminate, base unequally obtuse to cuneate, upper surface with few short yellowish hairs or glabrous, lower surface prominently reticulate-veined and often golden-brown, glabrescent or with sparse hairs along veins. Inflorescences 3–5cm in flower, usually shallowly scorpioid or almost straight even when young. Calyx lobes 3–4mm, linear, subulate. Corolla greenish-yellow, 3–5(–8)mm, usually only slightly longer than calyx; tube gradually narrowed upwards towards limb c 2mm diameter. Fruit green becoming white, c 4mm diameter.

**Bhutan:** S – Samchi district (Khagra valley near Gokti), Sankosh district (near Pinkhua) and Gaylegphug district (near Tatapani; Gaylegphug (38)); **Darjeeling:** Jalpaiguri, Rongbi, Chunbati, etc.; **Sikkim:** common in lower valleys. Subtropical and terai forests, 300–1500m. March–June.

Var. *subtropica* is a large-flowered variant described from Sikkim with corollas c 8mm in which the tube distinctly exceeds the calyx. In this respect it parallels the form of *T. montana* commonly called *T. roxburghii*.

#### 4. HELIOTROPIUM L.

Prostrate to erect, annual or perennial herbs or undershrubs. Leaves alternate or subopposite. Inflorescence of bracteate or ebracteate spike-like cymes or spikes, scorpioid at first, elongating and straightening in fruit. Calyx divided into 5 lanceolate to linear segments or lobes. Corolla white or blue, tubular, infundibular or salver-shaped, usually hairy outside and sometimes also within. Stamens 5, inserted on corolla tube, included; anthers sessile or with short filaments. Style terminal, ending in a stigmatic disc with  $\pm$  conical appendage. Ovary completely or imperfectly 4-locular, 4-ovuled. Fruits 2–4-lobed, composed of up to 4 nutlets.

1. Prostrate perennial; leaves linear-lanceolate, 4–15 × 0.7–2mm, almost sessile ..... **1. *H. strigosum***  
 + Erect annual; leaves ovate to broadly lanceolate, 50–150 × 30–100mm, with petiole almost as long as lamina ..... **2. *H. indicum***

**1. *H. strigosum*** Willdenow subsp. ***brevifolium*** (Wall.) Kazmi; *H. brevifolium* Wall., *H. strigosum* var. *brevifolium* (Wall.) Clarke. Fig. 80l&m.

Prostrate, decumbent or erect, intricately branched, loosely appressed-strigose perennial 5–30cm. Leaves linear-lanceolate, 4–15 × 0.7–2mm, 1-veined, very shortly petiolate or sessile. Inflorescence of solitary or paired bracteate spikes, 2.5–7.5cm, lengthening to c 15cm in fruit; lower bracts to 3mm, upper reduced or rarely absent; lower flowers on 1–2mm pedicels, upper sessile. Calyx deeply 5-lobed, lobes lanceolate, to 3mm, strigose outside. Corolla white with minute yellow centre, infundibular or tubular, 3mm long and c 2mm diameter, strigose outside; throat glandular, inside puberulent at mouth. Anther tips coherent when young. Fruits rounded, not or scarcely 4-lobed, not depressed at top.

**Bhutan:** C – Punakha district (Punakha), Mongar district (Shongar Chu–Kuru Chu confluence) and Tashigang district (Dangme Chu near Cha Lam); **Darjeeling:** Siliguri. Dry roadsides and grassland, clearings in terai forest, 925–1370m. June–September.

Subsp. *strigosum*, with longer leaves 15–25mm, denser, more closely appressed greyish-white indumentum, and fruits distinctly 4-lobed and depressed at the top, has not been recorded from Bhutan. It has a more western distribution in India, Pakistan, NW Himalaya and Africa.

**2. *H. indicum*** L. Fig. 80i–k.

Coarse, erect annual with 'shrubby' habit, 10–100cm. Stems branched above middle, hirsute. Leaves ovate to broadly lanceolate, 5–15 × 3–10cm, with 5–6 pairs of lateral veins, acute, base cuneate to almost cordate, margin repand to undulate; surfaces (especially lower) ± strigose; petioles 4–10cm, subequalling lamina and winged just below its base. Inflorescence of ebracteate, terminal and leaf-opposed lateral spikes 5–30cm; flowers all sessile. Calyx lobes c 1.5mm in flower, c 2.5mm in fruit, subulate. Corolla blue, violet or rarely white, salver-shaped; tube 2.5–4.5mm, longer than calyx, hairy outside; limb 2–4mm broad. Anther tips free. Fruit ovoid, strongly ribbed, glabrous, with 2 deep apical lobes, eventually breaking up into 4 brown, glabrous, angular, shortly beaked nutlets 2–3mm.

**Bhutan:** S – Gaylephug district (Gaylephug); **Darjeeling:** Mahanadi; **Sikkim:** unlocalised Hooker specimen. Roadsides, c 300m. May.

## 5. LITHOSPERMUM L.

Rhizomatous perennial herb. Stems erect, leafy, much-branched. Leaves all cauline, discolourous. Flowers in terminal and axillary bracteate cymes which

elongate in fruit. Calyx 5-lobed almost to base, lobes enlarging in fruit. Corolla cylindrical to infundibular; tube with 5 small, glandular throat scales or folds and a glabrous, basal annulus. Stamens included; filaments inserted near middle of tube. Style included, simple; stigma bilobed. Nutlets ovoid to ovoid-globose, hard, whitish, glossy and very smooth.

1. **L. officinale** L. Eng: *Gromwell*. Fig. 81a–c.

Stems 1–many, 30–90cm, much-branched especially above, appressed scabrid-pubescent. Leaves ovate-lanceolate to narrowly elliptic, subsessile, 3–8 × 0.5–1.5mm, dark green and very unequally strigillose above, greyish beneath and pubescent-setulose mainly on veins; hairs of upper surface all arising from prominent circular tuberculate bases. Flowers subsessile at anthesis; pedicels to c 5mm in fruit. Calyx lobes oblong-linear, 3.5–5mm, obtuse. Corolla yellowish- or greenish-white, 4–6mm, tube subequalling calyx. Nutlets whitish- or brownish-ivory, ovoid, 2.7–4 × 1.7–2mm, rounded on dorsal surface, obscurely keeled ventrally, detaching completely from receptacle.

**Bhutan:** C – Thimphu district (Thimphu, Paga and Chapcha). Dry banks in evergreen oak forest, 2000–2500m. May–August.

## 6. ONOSMA L.

Hispid, perennial, biennial or annual herbs. Leaves alternate. Inflorescence of 1 to many bracteate cymes. Flowers white, yellow, reddish or bluish, often markedly changing colour with age, sessile or shortly pedicellate. Calyx divided to middle or beyond into 5 acute segments, sometimes enlarged in fruit. Corolla campanulate or urceolate, dilated or contracted at throat; lobes 5, short, sometimes reflexed. Stamens 5; anthers connivent at base and sometimes also towards top, with sterile tips. Ovary deeply 4-lobed; style filiform, included or exerted. Nutlets 4, ovoid, acute, erect or ± incurved, usually tuberculate, with large, flat, basal attachment scar.

*Onosma* has often in the past been treated as being of neuter gender, but here it is treated as feminine as now accepted; synonyms are left as spelled by their author.

1. Inflorescence a large panicle; anthers joined at base and near top; style hairy in lower  $\frac{2}{3}$  ..... 1. **O. paniculata**
- + Inflorescence not paniculate, of 1 or few cymes; anthers joined only near base; style glabrous ..... 2
2. Corolla 16–28mm, campanulate; style 22–30mm ..... 2. **O. hookeri**
- + Corolla 9–13mm, urceolate; style 7–12mm ..... 3
3. Stellate hairs present on leaves (at least beneath)

3b. **O. emodi** var. **stelligera**

- + Stellate hairs absent ..... 4
- 4. Stems with white or creamy spreading setae and at least a few much shorter  $\pm$  appressed hairs; corolla (except in rare albino forms) pink or red, changing to blue or violet ..... 5
- + Stems with yellowish-brown setae and no underlying indumentum; corolla white ..... 6. *O. griersonii*
- 5. Annual or biennial, rootstock thin ..... 5. *O. bicolor*
- + Perennial, rootstock stout ..... 6
- 6. Cauline leaves 5–18cm  $\times$  7–33mm, upper middle ones largest; leaf indumentum sparsely to moderately dense, veins inconspicuous beneath  
3a. *O. emodi* var. *emodi*
- + Cauline leaves 1–3cm  $\times$  4–8mm, all subequal or lowest very slightly larger; leaf indumentum very densely hispid or villous, veins prominent beneath  
4. *O. bhutanica*

Species 3 to 5 have in the past been treated as a separate genus, *Maharanga* A.DC., based on differences in corolla morphology, but intergradations occur and the genus is here retained in its broad sense.

### 1. *O. paniculatum* Bureau & Franchet

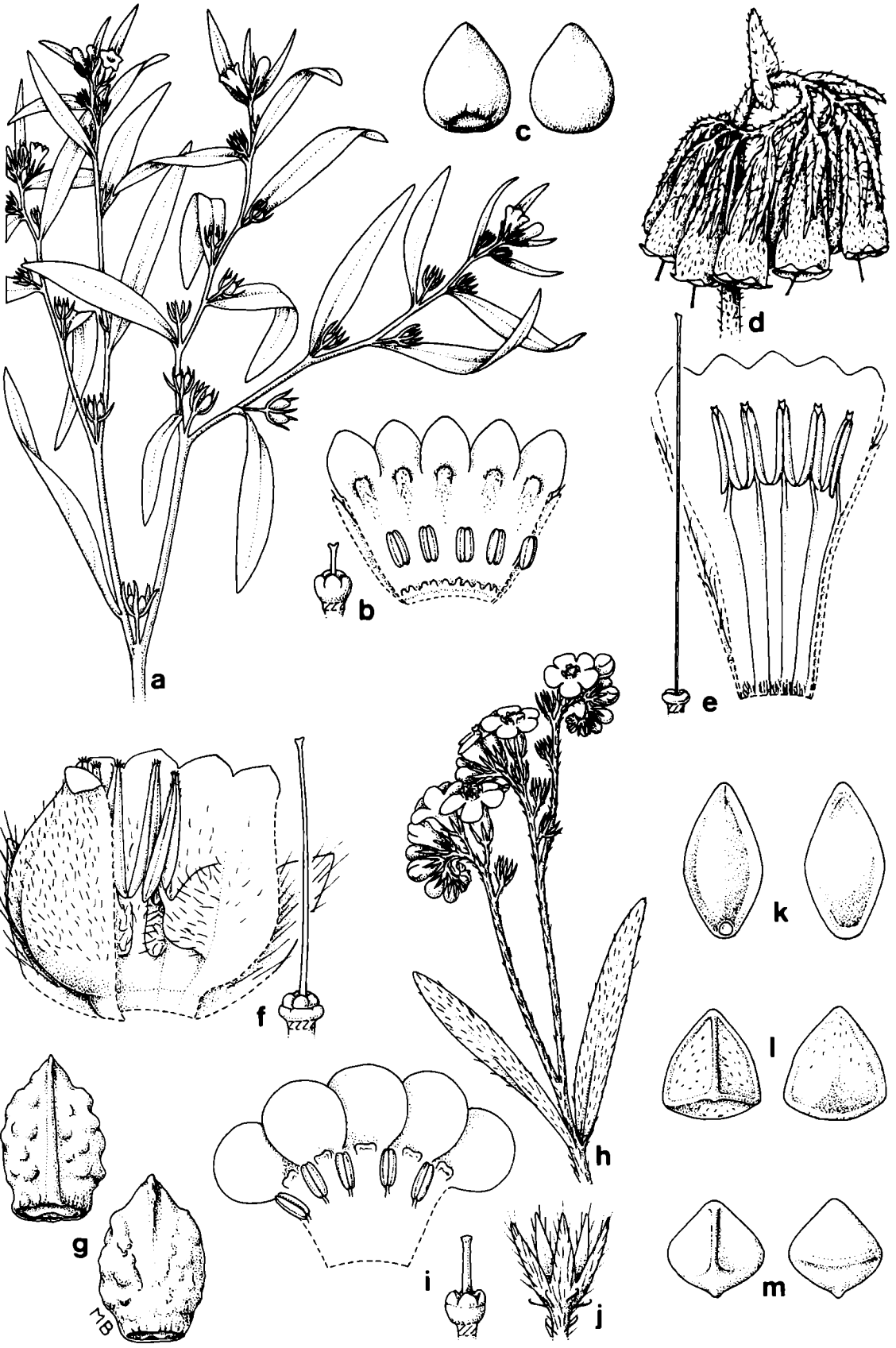
Robust perennial or biennial; rootstock stout, yielding blue-purple dye. Stems single, 30–120cm, sparingly hispid with long patent setules and densely and shortly retrorse-villosulous. Leaves oblanceolate, linear-oblong or linear-elliptic, 10–20cm  $\times$  10–30mm, lower with winged petiole, middle sessile, upper reduced and  $\pm$  sagittate or amplexicaul, all acute, upper surface appressed-hispid with tubercle-based setiform hairs, lower surface densely but very shortly villosulous and with long setiform hairs on midrib and revolute margin. Inflorescence a large panicle of many cymes. Calyx lobes linear-lanceolate, 8–10mm, patent-hispid and appressed-strigillose. Corolla rose-pink, changing to blue or purple, often whitish at base, 12–17mm, densely appressed-strigillose throughout outside and also inside on throat below each lobe. Anthers 6–8mm, joined at base and laterally towards top; sterile tips  $\pm$  exserted; filaments villous. Nectary villous. Style 15–18mm, appressed-hairy in lower  $\frac{2}{3}$ , exserted; stigma shallowly bilobed. Nutlets c 2mm, warty.

**Bhutan:** C – Punakha to Mongar districts; **Chumbi:** Upper Chumbi Valley. Open sandy soil under *Pinus* and on grassy hillsides, 1830–3660m. July–September.

The outer covering of the root is used to make a red dye.

FIG. 81. **Boraginaceae.** a–c, *Lithospermum officinale*: a, flowering shoot ( $\times \frac{2}{3}$ ); b, dissected flower with ovary and style ( $\times 4$ ); c, nutlets ( $\times 4$ ). d–e, *Onosma hookeri*: d, inflorescence ( $\times \frac{2}{3}$ ); e, dissected flower with ovary and style ( $\times 1\frac{1}{2}$ ). f–g, *O. emodi*: f, dissected flower with ovary and style ( $\times 3$ ); g, nutlets ( $\times 5$ ). h–k, *Myosotis alpestris*: h, flowering shoot ( $\times 2$ ); i, dissected flower with ovary and style ( $\times 6$ ); j, calyx ( $\times 6$ ); k, nutlets ( $\times 10$ ). l, *Trigonotis gracilipes*: nutlets ( $\times 12$ ). m, *T. smithii*: nutlets ( $\times 12$ ). Drawn by M. Bates.





**2. *O. hookeri*** Clarke; Med: *Drimook*. Fig. 81d&e.

Perennial with short sturdy rootstock yielding purple dye. Stems 1(-3), 9-30cm, with numerous stout, erecto-patent setules and underlying indumentum of short, fine, appressed hairs. Basal leaves numerous, linear-oblong, 4-8cm × 3-12mm, subacute, base gradually attenuate with no distinct petiole, upper surface greyish with dense, loosely appressed setiform hairs and underlying dense, short hairs, lower surface greener with dense tuberculate, setiform hairs but no underlying short hairs; midrib prominent especially beneath, on both surfaces with very long setiform hairs directed forwards at 45°. Cauline leaves few, similar but smaller, sessile, erect and usually held close to stem. Flowers in a single dense, terminal, subcapitate inflorescence. Calyx lobes linear-lanceolate, 12-22mm, appressed-villous with indumentum similar to leaves. Corolla reddish-blue or purple, campanulate, (16-)19-26(-28)mm, with abrupt sinus c 3mm above base, 5-12mm broad above sinus and 2-3mm broad below, densely appressed-sericeous outside. Anthers 5.5-8mm, joined at extreme base, sterile tip c 0.5mm. Nectary villous. Style 22-30mm, glabrous, exserted with unlobed or scarcely bilobed stigma. Nutlets c 3mm, ± rugose.

**Bhutan:** C - Thimphu district (Dotena and near Tremo La; Shodu to Barshong and Upper Cheka (71)), N - Upper Mo Chu district (Lingshi La and Lingshi) and Upper Pho Chu district (Keshu La and Lunana); **Sikkim:** Lungnak; **Chumbi:** Chakalung La etc., common. Open grassy hillsides, 2834-5800m. May-September.

According to Clarke (80) this species is the best source of Lepcha red dye, which among other purposes is used to colour butter. *Cooper* 1747 from Upper Mo Chu district (Lingshi) represents a white-flowered form otherwise resembling the type. Three geographical variants occur from Bhutan to Tibet; the plant in our area is var. *hookeri*.

**3. *O. emodi*** Wall.; *Maharanga emodi* (Wall.) DC., *O. vestitum* G. Don. Fig. 81f&g.

Perennial; tap root stout. Stems several, 20-50cm, decumbent, ascending or suberect, hispid with long, patent, white setae 2-3mm and also sparsely to moderately strigose with minute hairs. Leaves 5-18cm × 7-33mm, usually upper middle ones largest (other than basal ones), mostly oblanceolate, acute or acuminate, minutely mucronate, base attenuate, radical and lower cauline shortly petiolate, others sessile; surfaces discolorous, typically loosely ± antrorse-hispid with underlying short hairs above and usually less so beneath with no stellate hairs but setae arising from tuberculate bases; rarely radical leaves densely stellate-hispid above and beneath; cauline stellate-hispid above. Inflorescence a rounded terminal cluster of usually forked cymes. Calyx 6-10mm, green or often blackish-mauve, hispid; lobes triangular-lanceolate, 3-6mm. Corolla pink changing to blue-violet, urceolate with 5 longitudinal

plaits and sinuses above middle, 9–13mm, rather sparsely and  $\pm$  retrorse appressed-hairy outside, hairy inside near stamen bases and on lower part of tube; lobes small, recurved, c 1–1.5  $\times$  1.5–2mm. Anthers joined only at base, 4–5.5mm, sterile tips included, serrulate. Style 10–12mm, glabrous. Nutlets 2–3mm, coarsely tuberculate and minutely papillate.

1. Stellate hairs absent ..... a. var. **emodi**  
 + Stellate hairs present on both surfaces of rosette leaves, and on lower surface of cauline leaves ..... b. var. **stelligera**

a. var. **emodi**

**Bhutan:** C – Thimphu, Tongsa, Bumthang and Tashigang districts, N – Upper Kulong Chu district; **Sikkim:** Phalut, Tsomgo. Grassy banks and rocky places, Fir forest, 3050–3810m. July–September.

b. var. **stelligera** (Johnston) Mill; *Maharanga emodi* (Wall.) DC. var. *stelligera* Johnston.

**Bhutan:** C – Punakha district (Tang Chu at Ritang). Cliff-ledges and steep open slopes among stones, c 3810m. June. Flowering much earlier than var. *emodi*.

4. **O. bhutanica** (Johnston) Grierson & Long; *Maharanga bhutanica* Johnston.

Coarse, tufted perennial with stout root. Stems several, 7–21cm, villous with dense rather rigid spreading white hairs 1.5–3mm. Basal leaves persistent, 5–9cm  $\times$  10–20mm, prominently veined, greyish; cauline small, lanceolate, 1–3cm  $\times$  4–8mm, lower larger than or subequalling upper, all leaves appressed-hispid and also (especially beneath) minutely strigose; long hairs on upper surface arising from large cystolith bases. Calyx divided to middle, 4–6mm, lobes triangular, acute, hispid. Corolla pink at first, changing to blue, 9–11mm, barrel-shaped with narrow base c 1.5mm thick, widest at middle (4–5mm broad) and with narrow mouth 1–2.5mm diameter, appressed strigillose outside, 5-sulcate from base of sinus to middle of tube, with 5 inflated ribs and 3 flat, elliptic areolae below middle of tube. Anthers 4–4.5mm, joined at base, included; sterile tips c 0.8mm, with 2 small apical teeth. Style 10–11mm, glabrous. Nutlets unknown.

**Bhutan:** S – Deothang district (Keri Gompa). Cliff-ledges, c 2135m. June. Endemic to Bhutan and only known from the type.

5. **O. bicolor** G. Don; *Maharanga bicolor* (G. Don) A. DC.

Biennial or annual with slender root. Stems slender, 15–40cm, sprawling to suberect, hispid with long patent creamy white setae 1–3mm and also minutely retrorse-strigose. Leaves 1.5–6cm  $\times$  5–12mm, all subequal, lower oblanceolate, middle and upper elliptic or lanceolate, mucronate, base attenuate, sessile; surfaces somewhat discoloured, loosely antrorse appressed-hispid with long weak hairs, those of upper surface with tuberculate bases. Inflorescence compact

and glomerate at anthesis, lax and racemose in fruit. Calyx 5–7mm; lobes triangular, 2.5–4.5 × 1.5–2mm, setose outside, densely appressed-pubescent inside. Corolla usually scarlet turning to deep blue, urceolate, 9–12mm, shortly appressed-hairy outside, hairy inside near stamen bases and on lower part of tube; lobes recurved, 0.5–0.8mm. Anthers joined only at base, 3–4mm, sterile tips included, c 1mm, with 3 small apical teeth. Style 7–10mm, glabrous. Nutlets c 1.5mm, tuberculate and very densely papillate.

**Bhutan:** C – Thimphu, Punakha and Bumthang districts, N – Upper Mo Chu district (Gasa Dzong); **Sikkim; Chumbi.** Grassy slopes, field margins and open waste places, 1980–3350m. June–August.

White- or yellow-flowered forms occasionally occur; these do not seem to differ in any other character from the typical scarlet-and-blue flowered form.

### 6. *O. griersonii* Mill

Perennial? (rootstock unknown). Stems 28–35cm, somewhat flexuous, densely patent-hispid with yellowish-brown hairs 1.5–4.5mm but no underlying indumentum. Basal leaves narrowly oblanceolate, c 20cm × 20mm, acute, base attenuate, both surfaces greyish but lower paler than upper, densely subappressed-strigose above with long weak antrorse setiform hairs 2–5mm and with very dense underlying indumentum of very short appressed hairs, lower surface with complex indumentum of relatively sparse long and short antrorse and denser subequal short retrorse hairs on midrib and veins, and very dense short strigillose indumentum on lamina. Cauline leaves narrowly lanceolate, 6–7cm × 6–10mm, patent, indumentum resembling that of basal leaves but long hairs on midrib beneath patent and short midrib hairs much less dense, straight, closely appressed. Inflorescence of 3 terminal cymes, compact at anthesis. Pedicels 6–7mm, densely patent-hispid. Calyx 7–8mm, divided to c  $\frac{3}{4}$ , lobes narrowly triangular, hispid outside, appressed-pubescent on surface and long-sericeous on midrib within. Corolla creamy white, urceolate, c 10mm, similar in form to that of *O. emodi*; lobes suberect or finally scarcely reflexed; surfaces densely short-pubescent outside. Anthers joined only at base; sterile tips included or just exerted, equalling corolla lobes, with 5 small apical teeth. Style c 11mm, exerted by up to 2mm, glabrous. Nutlets unknown.

**Bhutan:** C – Punakha district (Nobding). Mixed forest on steep slopes, c 2550m. May.

Endemic to Bhutan and known only from the type gathering (262).

## 7. MYOSOTIS L.

Eng: *Forget-me-not*.

Perennial erect herbs. Leaves alternate, narrow. Inflorescence of usually paired cymes, scorpioid at first, later elongating and forming a lax raceme. Flowers ebracteate. Calyx scarcely accrescent in fruit, divided to at least halfway into 5 lobes, sometimes with hooked hairs, at least in lower half. Corolla blue

(occasionally white, and often opening pink), rotate or subrotate, with 5 spreading lobes; throat closed by  $5 \pm$  emarginate scales of contrasting colour. Stamens included, with terminal ligulate appendage. Nutlets 4, usually ovoid and compressed, smooth, glossy, with small whitish basal attachment scar.

**1. *M. alpestris* Schmidt subsp. *asiatica* Hultén.** Fig. 81h–k.

Stems 6–40cm, unbranched or branched above, pilose with fairly dense weak spreading hairs below, densely short-appressed pubescent above. Basal leaves  $\pm$  tufted (especially in bogs and other grazed habitats), narrowly oblanceolate or linear-lanceolate, 2–6cm (including  $\pm$  indistinct petiole)  $\times$  3–6(–10)mm, obtuse with very blunt apiculus, both surfaces moderately hirsute with spreading or antrorsely subappressed, weak, setiform, tuberculate-based hairs. Cauline leaves similar but slightly narrower, 1.5–5(–9.5)mm broad, generally held close to stem. Cymes dense and compact, 8–16mm across at first, much longer and lax in fruit. Calyx 2–3mm in flower, divided to c  $\frac{3}{4}$  into acute lobes, densely silvery-hairy at margins and with slightly less dense, closely appressed, very short hairs outside, basal part rounded and with only a few, forward-directed hooked hairs together with numerous appressed straight hairs. Corolla Delft or Wedgwood blue, 4–6mm diameter; tube longer than calyx; lobes rounded; throat scales yellow. Nutlets dark brown, shining, c  $1.5 \times 0.8$ mm, obtuse, with relatively large attachment scar and lateral folds.

**Bhutan:** C – All districts except Tashigang district, N – Upper Kulong district (Me La). Almost certainly also occurring in Sikkim and probably Chumbi but no material has been seen; widespread across the Himalaya from Kashmir to China (including SE Tibet). Bogs, damp alpine meadows, hillsides and open Fir forest, 3048–3810m. May–July. Variable in height and stem branching, depending on whether the plant is growing on grazed open hillsides or bogs or in damp woodlands.

This is the only species of *Myosotis* of which specimens have been seen from Bhutan. Records of *M. silvatica* Hoffmann from Bhutan (e.g. 135) appear to be based on misidentifications of two specimens (Ludlow & Sherriff 147 & 628, E, BM) labelled *M. silvatica* but which are *M. alpestris*. *M. silvatica* prefers slightly lower altitudes; the calyx bears numerous patent to retrorse hooked hairs and the nutlets have a  $\pm$  acute apex, very small attachment scar and lateral folds. The basal leaves are also frequently broader (10–20mm broad or more). The two species are, however, very difficult to separate when not in fruit and consequently literature records of either must be treated with caution. No authentic specimen of *M. silvatica* has been seen from any locality east of Kashmir.

## 8. TRIGONOTIS Steven

Weak or diffuse, low, perennial herbs, sometimes caespitose. Stems slender. Leaves alternate, petiolate (petioles of lower leaves often much longer than

lamina), lamina ovate-elliptic or lanceolate. Inflorescence a scorpioid cyme, often elongate and many-flowered, ebracteate or lowest pedicels bracteate. Calyx 5-fid or 5-partite, hardly enlarging in fruit. Corolla blue or white, small, usually rotate; tube shorter than calyx; lobes orbicular, spreading, imbricate in bud. Throat scales present, small,  $\pm$  crescent-shaped, yellow, orange or orange-red. Stamens included, inserted near middle of corolla tube. Style short; stigma capitate. Nutlets 4, sessile or borne on a straight or bent stipe, usually tetrahedral but sometimes trigonal owing to suppression of one face,  $\pm$  smooth, glabrous or minutely hairy; attachment scar small, at basal end of ventral keel.

A genus which has acquired a reputation for being taxonomically difficult. Two keys are provided, for flowering and fruiting material. As most fruiting material also bears some flowers, the identification can usually be cross-checked with the key to flowering specimens. Hairs near the middle of the leaf surface should be used to determine the angle of orientation with the midrib; near the apex where the leaf is narrower, the angle is less than stated.

*Key to flowering specimens*

1. Densely caespitose, forming cushions 7–10cm across ..... **3. T. caespitosa**  
+ Loosely or not caespitose, never forming cushions ..... 2
2. Leaves with midrib and lateral veins raised beneath and indumentum, at least beneath, of a mixture of short weak and longer setiform hairs ..... 3  
+ Leaves with only midrib, or no veins at all, raised beneath; setiform hairs absent, all hairs  $\pm$  similar ..... 4
3. Upper leaf surface with short hairs 0.05–0.3mm, lacking setiform hairs; calyx lobes 1.5–2mm ..... **8. T. microcarpa**  
+ Upper leaf surface with short hairs 0.3–0.4mm and longer setiform hairs; calyx lobes 1.2–1.5mm ..... **9. T. peduncularis**
4. Leaves not mucronate, or with very indistinct mucro less than 0.1mm ... 5  
+ Leaves with  $\pm$  distinct mucro at least 0.1mm long ..... 7
5. Corolla white with lobes tipped blue or pink ..... **10. T. tibetica**  
+ Corolla deep blue or purplish-blue ..... 6
6. Stems with only appressed hairs; calyx lobes in flower 1.5–2mm ..... **4. T. rotundifolia**  
+ Stems with a few spreading hairs as well as appressed hairs; calyx lobes in flower c 1mm ..... **6. T. multicaulis**
7. Basal leaves apparently absent at flowering time; petioles of lowest cauline leaves 1–8mm, shorter than lamina; hairs on upper leaf surface sparse.

- markedly unequal, 0.1–1.2mm ..... **1. T. ovalifolia**
- + Basal leaves present at flowering time, their petioles 10–135mm, equalling or longer than lamina; hairs on upper leaf surface  $\pm$  dense, subequal ... 8
8. Hairs on upper leaf surface c 0.5mm, lying at 60–80° to midrib  
**5. T. smithii**
- + Hairs on upper leaf surface c 0.2–0.3mm, lying at c 45° to midrib ..... 9
9. Leaves with lateral veins distinctly raised beneath; all except uppermost cauline leaves distinctly petiolate ..... **2. T. clarkei**
- + Leaves without obvious lateral veins; all except lowest cauline leaves sessile ..... **7. T. gracilipes**

*Key to fruiting specimens*

1. Leaves with short hairs interspersed, at least beneath, with markedly longer setiform hairs often overlaying short hairs at a different angle ..... 2
- + Leaves strigose, hairs on each surface  $\pm$  similar in form and orientation, either all thin or (on lower surface only) all  $\pm$  setiform ..... 3
2. Nutlets tetrahedral with four equilateral-triangular faces, inner faces glabrous, outer face minutely muriculate; setiform hairs only present on lower leaf surface ..... **8. T. microcarpa**
- + Nutlets trigonous-pyramidal with three equal faces and one much reduced, all faces minutely pubescent especially on edges; setiform hairs present on both leaf surfaces ..... **9. T. peduncularis**
3. Nutlets sparsely or densely pubescent ..... 4
- + Nutlets glabrous ..... 6
4. Stem hairs greyish-white, all appressed; nutlets c 1mm ..... **7. T. gracilipes**
- + Stem hairs brownish-white, at least some of them spreading or erecto-patent; nutlets 1.5–2mm ..... 5
5. Stems villous with horizontally spreading setiform hairs and shorter appressed hairs; nutlet hairs very short; petioles of lower leaves 1–6(–8)mm  
**1. T. ovalifolia**
- + Stems strigose with some erecto-patent (not horizontally spreading) non-setiform hairs; nutlet hairs relatively long; petioles of lower leaves 10–27mm  
**2. T. clarkei**
6. Nutlets tetrahedral with four subequal faces ..... 7
- + Nutlets trigonal with fourth face suppressed or reduced ..... 8

7. Lower leaves suberect on very long petioles 35–135mm; hairs on upper leaf surface at 60–80° to midrib ..... 5. *T. smithii*  
 + Lower leaves shortly petiolate; hairs on upper leaf surface at c 45° to midrib  
 10. *T. tibetica*
8. Plant forming very dense low cushions 7–20cm across .... 3. *T. caespitosa*  
 + Plant loosely caespitose at base but not forming cushions ..... 9
9. Calyx lobes obtuse; most stems less than 12cm ..... 4. *T. rotundifolia*  
 + Calyx lobes acute; most stems 12–35cm ..... 6. *T. multicaulis*

1. *T. ovalifolia* (Wall.) Clarke; *Myosotis ovalifolia* Wall., *Eritrichium ovalifolium* (Wall.) A.DC.

Weak perennial. Stems erect from ± decumbent base, 10–30cm, unbranched (except in inflorescence) or occasionally branched from near base, villous with rather dense, spreading, weak, setiform, brownish-white hairs 0.5–1mm and underlying shorter, appressed hairs. Basal leaves absent at flowering time. Cauline leaves numerous, subequal, lower leaves shortly petiolate with petioles 1–6(–8)mm; upper leaves sessile; lamina ovate-elliptic, 10–40 × 5–20mm, obtuse or shallowly retuse with very short mucro 0.1–0.5mm, sparsely strigose above with markedly unequal, randomly orientated antrorse hairs 0.1–1.2mm and with similar unequal setiform hairs beneath (mainly confined to slightly raised veins). Flowers confined to a terminal, usually forked, ebracteate raceme of usually 9–20 flowers per branch. Pedicels 2–3mm in flower, deflexed and 2–7mm in fruit. Calyx lobes ovate, 2.5–3 × c 0.8mm in flower, acute, scarcely lengthening but slightly broader in fruit, strigose. Corolla blue, 3–4mm; limb 4–6mm diameter. Nutlets 2 × 1.5mm, tetrahedral, black, rather densely minutely pubescent on all faces; stipe very short, confluent with ventral keel.

**Darjeeling:** Tanglu. Alpine slopes, 3050m. June–July.

Literature records have not been accepted. In his description of *T. ovalifolia*, Clarke confused two or possibly three elements. The Wallich type material and a Gamble specimen from Tanglu (Darjeeling) are the only gatherings seen which have patent stem hairs and relatively long, sparse hairs on the upper leaf surface and thus only these are considered here to be *T. ovalifolia*. Some of Clarke's material, especially those described as having axillary flowers, may be *T. gracilipes*. Other specimens collected by Clarke from Darjeeling differ from *T. ovalifolia* in having uniform short hairs on the upper leaf surface, appressed stem hairs and longer pedicels. These are referred to *T. clarkei* (see below).

2. *T. clarkei* Mill; *T. ovalifolia* sensu Clarke p.p. excluding type.

Similar to *T. ovalifolia* but stems strigose, spreading hairs absent; all leaves, even uppermost, petiolate, petioles of lower leaves usually 10–27mm, of upper leaves 1–3mm; leaves 10–30 × 7–20mm, apex very obtuse to shallowly retuse with short acute mucro; upper leaf surface rather densely and finely strigose



with hairs  $\pm$  equal, 0.2–0.3mm, lying at c 45° to midrib, less densely strigose beneath, hairs on both lamina surface and veins unequal; veins prominently raised beneath; inflorescence terminal, unbranched, usually with 1–several axillary flowers; longest pedicels 8–10mm in flower, to 12mm in fruit; calyx lobes 1.5–2mm in flower, 2.5–3mm in fruit; corolla 3.5–4mm long, 4.5–7mm diameter; nutlets pale brown to black, 1.5 × 1.2mm, very sharply trigonal with prominent edges, densely pubescent with rather long hairs.

**Sikkim:** Singalila and Chunthang. Habitat not recorded, 1707–3353m. May–October.

A recently described species endemic to Darjeeling and Sikkim (263).

### 3. *T. caespitosa* S.P. Banerjee

Densely caespitose; cushions 7–10cm across and 4–8cm high. Petioles of lower leaves to 15mm,  $\pm$  concealed by other leaves; uppermost leaves sessile. Leaves elliptic to lanceolate, 8–15 × 2–7mm, obtuse, not mucronate, base obtuse or shortly attenuate, finely and minutely strigose above with hairs c 0.3mm, lying at 45–60° to midrib, strigose beneath with hairs c 0.5mm, lying at c 30° to midrib. Flowering stems 5–6cm, densely strigose. Racemes terminal, few-flowered, ebracteate. Pedicels to 2mm. Calyx divided to near base, lobes lanceolate, c 1.5mm in flower and c 3mm in fruit, acute, long-hispid outside and inside. Corolla pale blue, tubular-rotate, 3–3.5mm; tube 1–1.5mm; lobes 1.5–2mm, minutely hairy inside but glabrous outside. Anthers ovoid, c 0.5mm. Nutlets trigonal, 1.5mm, shining dark brown, glabrous, narrowly winged, with straight stipe.

**Sikkim:** Khora Phu Chu near Lhonak. Known only from the type, collected at an altitude of 4785m in early August.

The description of the nutlets is taken from the original description as none could be found on the K isotype.

### 4. *T. rotundifolia* (Bentham) Clarke; *Myosotis rotundifolia* Bentham, *Eritrichium rotundifolium* (Bentham) A.DC.

Small, loosely caespitose perennial, with thin blackish vertical roots sometimes longer than plant height. Stems 2–12(–18)cm, erect to decumbent, unbranched (except inflorescence), strigose with a few spreading hairs. Basal leaves usually numerous, relatively long-petiolate, petiole 7–30mm; lamina suborbicular to elliptic, 3–20 × 3–12mm, obtuse or subacute without mucro, base cuneate to subobtuse, upper surface moderately strigose, hairs 0.3–0.6mm, lying at c 30–45° to midrib, lower surface sparsely strigose, hairs 0.2–0.3mm, almost parallel to midrib and sometimes  $\pm$  confined to it; only midrib prominent. Cauline leaves usually rather few, lower petiolate, upper sessile, lamina more elliptic than most basal leaves. Inflorescence a short rather dense scorpioid cyme (sometimes forked), lengthening in fruit. Calyx lobes narrowly ovate, c 1.5–2 × 0.5mm, obtuse, strigose. Corolla deep blue or purplish-blue (occasionally white),

3–5mm; limb 4–6mm diameter. Nutlets almost trigonal, 1–1.5mm, with 3 sub-equal inner faces and very narrow inner face, glabrous; one nutlet often aborting or poorly developed.

**Bhutan:** C – Punakha/Tongsa districts (Dungshinggang); **Sikkim:** Zongri, Thangshing; **Chumbi:** Yampung. On rocks and under boulders on hillsides and near streams, and in disturbed pasture, 3800–5640m. June–September.

**5. *T. smithii*** S.P. Banerjee. Fig. 81m.

Rather robust, usually many-stemmed caespitose perennial. Stems 10–30cm, ascending or suberect, unbranched (except inflorescence), closely but rather sparsely strigose without spreading hairs. Basal leaves numerous, held erect on very long petioles 35–135mm; lamina elliptic, 12–45 × 7–20mm, obtuse or rounded with short blunt mucro, base obtuse or shortly cuneate, upper surface moderately strigose with hairs usually c 0.5mm, lying at c 60–80° to midrib, lower surface as densely strigose as upper, with hairs evenly dispersed, unequal, 0.1–0.5mm, lying at 10–45° to midrib; only midrib prominent. Cauline leaves numerous, lower shortly petiolate, upper sessile, narrower than basal leaves, held close to stem. Inflorescence a 9–15-flowered scorpioid cyme, dense at first, lengthening considerably after flowering. Calyx lobes ovate, 1.5mm, subacute, strigose with usually pale yellow-tinged hairs. Corolla pink at first, changing to bright blue, 4–6mm; limb 6–8mm diameter. Nutlets apparently rarely developing, tetrahedral, c 1mm, shining brown, glabrous, outer face broadest, ventral keel shortly stipitate.

**Bhutan:** N – Upper Bumthang Chu district (Waitang); **Sikkim:** Lhonak and Lagyap. In peat and sand by rivers and on open slopes, 3350–4450m. June–August.

The description of the nutlets is taken from the original description. Not one nutlet was found in a careful examination of over a dozen sheets from eastern Nepal, Sikkim and Bhutan; in most specimens, all the calyces appeared to be totally sterile. Nutlets would appear to be rarely formed.

**6. *T. multicaulis*** (DC.) Clarke; *Eritrichium multicaule* DC.

Many-stemmed caespitose perennial, less robust than *T. smithii*. Stems 10–35cm, ascending to subprostrate, weak and slender (0.6–1.5mm thick), sparsely strigose (hairs very short, 0.2–0.3mm) without spreading hairs. Basal leaves ± long-petiolate, petiole 2–6cm; lamina rather narrowly elliptic-oblong, 12–20 × 5–7mm, obtuse or subacute, not mucronate, base cuneate or shortly attenuate, upper surface sparsely strigose with hairs 0.2–0.4mm, evenly dispersed, lying at c 45° to midrib, lower surface strigose with less dense, slightly stouter hairs lying ± parallel to or up to 30° to midrib; only midrib prominent. Cauline leaves several, lower distinctly petiolate, upper shortly petiolate, erecto-patent. Inflorescence a slender terminal cyme with few axillary flowers below, dense at first, becoming lax in fruit. Calyx lobes ovate, c 1mm in flower, to 1.5mm in fruit, acute, strigose, hairs silvery grey. Corolla dark purplish-blue

(when dry), 2–3mm; limb c 2.5mm diameter. Nutlets trigonal (lower basal face poorly developed or suppressed), 1.1–1.3mm, glabrous, olive-brown, shining; stipe short, straight or slightly curved.

**Bhutan:** C – Ha district (Tare La) and Thimphu district (Paro), N – Upper Mo Chu district (Lingshi and Lingshi La); **Sikkim:** Zemu Valley, Tumracha, etc. 3900–3963m. July.

An isotype of var. *cavei* S.P. Banerjee has been examined (*Smith & Cave* 1607, K!). It has proved not to belong to *Trigonotis*, but to *Hackelia obtusifolia*. However, Banerjee's illustration of the fruit clearly shows a nutlet belonging to *Trigonotis*. The status of this taxon, described from Sikkim (Eumtso La [Yumchhola]) is therefore unclear; the taxon may have been based on a mixed gathering. The Calcutta holotype (*Smith & Cave* 1607A) and isotype (1607B) have not been seen.

#### 7. *T. gracilipes* Johnston. Fig. 811.

Perennial, loosely caespitose except in the most depauperate individuals. Stems erect or decumbent, 5–25(–40)cm, unbranched or branched below middle, slender, sparsely strigose, with narrow paler wings. Basal leaves numerous, relatively long-petiolate, petiole 10–45mm, very slender; lamina elliptic, oblong-lanceolate or (smallest leaves) suborbicular, (5–)10–25 × (3–)5–12mm, subacute, at least larger leaves indistinctly mucronate, moderately to rather densely strigose above with hairs subequal, 0.2–0.3mm, lying at c 45° to midrib, but less densely beneath with hairs unequal, 0.05–0.5mm, lying at 30° or less to midrib. Terminal racemes dense, with up to 12 flowers (including buds), strongly scorpioid at first; some long-pedicellate extra-axillary solitary flowers also present in middle and lower part of stem. Pedicels 1–6mm in flower, 5–25mm in fruit, those of extra-axillary flowers at least twice as long as those in terminal raceme. Calyx lobes ovate, 1.5–2mm in flower, to 3mm in fruit, acute, strigose. Corolla bright Cambridge blue, 2–3mm; limb 3–4.5mm diameter. Nutlets tetrahedral, c 1mm, olive-brown, sparsely short-pubescent; stipe abruptly bent to one side.

**Bhutan:** C – Ha district (Damthang), N – Upper Mo Chu district (Lingshi, Lingshi La and Yale La), Upper Bumthang Chu district (Tolegang and Waitang) and Upper Kulong Chu district (Me La); **Sikkim:** Zongri and Pheonp. Steep rocky slopes and grassy places, among dwarf rhododendrons, 3050–4260m. May–August.

#### 8. *T. microcarpa* (DC.) Clarke; *Eritrichium microcarpum* DC.

Perennial, rootstock sometimes creeping. Stems erect to ± procumbent, 17–35cm, usually branched above, moderately to very sparsely appressed-hispid with a few patent hairs. Leaves all shortly petiolate, or occasionally uppermost ± sessile; petioles of lower ones 10–40mm; lamina ovate, obtuse to subacute with distinct mucro to 0.7mm, base obtuse to truncate, upper surface densely and very shortly strigose with hairs mostly 0.05–0.3mm, lying at c 25° to midrib.

with no longer, setiform hairs; lower surface less densely strigose-hispid with hairs 0.1–0.6mm, lying at 20–40° to midrib interspersed with longer, setiform hairs 0.7–1mm; midrib and lateral veins prominently raised beneath. Inflorescence a many-flowered terminal ebracteate raceme with several axillary flowers below. Pedicels 1–3.5mm in flower, 3–8mm in fruit, erecto-patent in flower, usually deflexed in fruit. Calyx lobes narrowly ovate, 1.5–2mm in flower, c 2.5mm in fruit, acute, strigose, hairs greyish-white. Corolla powder or sky blue, c 2.5mm; limb c 3.5mm diameter. Nutlets tetrahedral, brown, c 1mm, faces equilateral-triangular with raised margins, outer dorsal face minutely muriculate, inner ventral faces glabrous; stipe slightly bent to one side.

**Bhutan:** C – Punakha, Tongsa, Bumthang and Tashigang districts; **Sikkim:** Lemar etc. Damp or wet, often wooded river banks, 1500–2745m. May–September.

### 9. *T. peduncularis* (Treviranus) Baker & Moore

Low annual or sometimes with suffrutescent base. Stems numerous, erect or ascending from decumbent base, 4–12(–18)cm, appressed-hispid and with a few subpatent hairs. Basal leaves petiolate, petiole 10–35mm, lamina elliptic to ovate or obovate, 10–18 × 4–7mm, obtuse, not mucronate, base shortly attenuate, upper and lower surfaces ± densely strigose with hairs c 0.3–0.4mm, lying at c 45° to midrib, interspersed (especially beneath and along margin) with longer subappressed to patent setiform hairs 0.8–1.5mm, lying at 10–20° to midrib, with prominent tubercular bases, midrib and lateral veins prominently raised beneath. Inflorescence a many-flowered raceme with few axillary flowers below, densely scorpioid at first, becoming straight in fruit with pedicels usually close together. Pedicels 1–2mm in flower, to 4mm in fruit, patent, or lowest ones deflexed. Calyx lobes narrowly ovate, 1.2–1.5mm in flower and fruit, acute, strigose, hairs greyish-white. Corolla pink in bud, changing to blue, 1.5–2mm; limb 2–3mm diameter, lobes oblong. Nutlets trigonous-pyramidal, c 0.8mm, very minutely pubescent especially on edges, olive-brown, shining; stipe basal, very short, straight.

**Bhutan:** C – Tongsa district (Mangde Chu) and Tashigang district (Sherpang). On and under rocks and boulders, 1830–4725m. April–July.

**10. *T. tibetica*** (Clarke) Johnston; *Eritrichium tibeticum* Clarke, *Pedinogyne tibetica* (Clarke) Brand; including var. *minor* (Clarke) Johnston, *Eritrichium tibeticum* var. *minus* Clarke.

Prostrate, diffuse perennial. Stems numerous, 3–25cm, slender, radiating from rootstock, shortly strigose. Leaves, except uppermost, shortly petiolate; lamina ovate-elliptic, 5–20 × 2–8mm, obtuse or subacute, not mucronate (occasionally with very short tip less than 0.1mm), rather densely strigose above with hairs orientated at c 45° to midrib, longest ones 0.4–0.5mm, less densely strigose beneath. Racemes many-flowered. Pedicels 1–1.5mm, lower bracteate, upper ebracteate. Calyx lobes ovate, 0.5–1mm in flower, 1–1.5mm in fruit, strigose.

Corolla white (lobes tipped blue or pink according to age), tubular-rotate, 1–2mm; lobes obovate, glabrous. Nutlets tetrahedral, 0.9–1.1 × c 0.7mm, pale olive-brown, glabrous, with stipe abruptly bent to one side.

**Bhutan:** N – Upper Kulong Chu district (Me La (var. *minor*)); **Sikkim:** Nachengon (var. *tibetica*); Lhonak (var. *minor*); **Chumbi(?):** Pu-Uo (var. *minor*). Shallow soil on open alpine grassland and on roofs, 3660–5180m. July–September.

Var. **minor** (Clarke) Johnston, from slightly higher altitudes, is distinguished only by its smaller leaves c 5–10 × 2–4mm and shorter stems and seems to have been collected more often than the type variety. Although well-marked in Sikkim, a few collections from Nepal are intermediate in dimensions. The type variety seems to have slightly less prostrate stems than var. *minor* and is easily confused with *T. multicaulis* unless the nutlets are carefully examined; in the latter species they are trigonal, not tetrahedral, with a ± straight (not bent) stipe.

## 9. MICROCARYUM Johnston

Dwarf, almost acaulescent annual of high-alpine habitats. Leaves alternate, oblanceolate, obtuse, sessile and rather crowded at base. Inflorescence subumbellate; flowers borne well above leaves on rigid pedicels. Calyx 5-fid, not enlarging in fruit. Corolla minute; tube cylindrical, slightly shorter than calyx; lobes short, ovate, imbricate, spreading. Stamens included in corolla tube; anthers ovoid, minute, positioned in upper part of tube just below throat. Ovary 4-lobed; gynobase elongated; style short; stigma subcapitate. Nutlets 4, erect, immarginate, dorsal (abaxial) surface with narrow median longitudinal sulcus, ventral (adaxial) surface with small basal triangular attachment scar and a much broader sulcus which bifurcates at its base around the two lateral margins of the attachment scar.

*Microcaryum* has been defined in different ways by different authors but the genus is now considered to be monospecific. *M. diffusum* Brand and *M. duthieanum* Brand are here included in *Lasiocaryum*, the latter as a synonym of *L. munroi*.

**1. *M. pygmaeum*** (Clarke) Johnston; *Eritrichium pygmaeum* Clarke. Fig. 82a–d.

Villous annual with long thin vertical root to c 8cm; aerial parts in total rarely exceeding 2cm. Leaves 2–5 × 1.5–2mm, loosely spreading- or subappressed-hirsute with long, thin, white hairs c 1mm. Pedicels (2–)6–20 per plant, rather rigid, at first very short, but rapidly lengthening to c 6–8mm at anthesis and c 12–15mm in fruit, white appressed-villous, inner ones suberect, outer decumbent. Calyx 1.5–2mm, lobes acute, loosely spreading-villous. Corolla pale blue or white, scarcely exceeding calyx. Nutlets ovoid-suborbicular with narrowed apex, c 0.8 × 0.6mm, greyish-brown, rugose; dorsal (abaxial) surface rugose, convex; ventral surface concave, rugose towards margin and with broad raised sulcus.

**Sikkim:** Yume Samdong, Lhonak, Thanggu etc. Cliff-ledges and crevices, 4400–4900m. July–August.

This minute plant has a wide range in the eastern Himalaya W to Garwhal (India) and may well occur in suitable habitats in Bhutan.

### 10. ACTINOCARYA Bentham

Slender, sometimes almost acaulescent herbs. Leaves alternate. Flowers solitary in axils, pedicellate, minute. Calyx divided to base, 5-lobed, scarcely enlarging in fruit. Corolla campanulate, tube longer than lobes; lobes imbricate in bud, broadly ovate. Throat scales present, 5, very small. Stamens inserted in lower part of corolla tube; anthers included, ovoid. Style short. Nutlets 4, attached apically to flat gynobase, obovoid-oblong, with turgid margins and glochidiate appendages forming a marginal wing or cone-like dorsal crest.

1. **A. acaulis** (W.W.Smith) Johnston; *Eritrichium acaule* W.W.Smith. Fig. 82e–h.

Dwarf annual herb, forming small compact tufts 2.5–5cm across. Rootstock 1–3cm, thin, vertical. Leaves numerous, spatulate to narrowly obovate, 5–8 × 1.5–3.5mm, obtuse, base gradually narrowed into rather flaccid, narrowly winged petiole 4–10mm, entire (margins sometimes slightly revolute), surfaces loosely crispate-hirsute with spreading hairs c 0.5–0.7mm. Pedicels 8–16mm. Calyx lobes ovate, c 1mm in flower and 1.5mm in fruit, erect in flower but ± spreading in fruit, sparsely hairy. Corolla c 1.5mm; tube white, subequalling calyx; lobes blue, c 0.5mm. Throat scales transversely linear, c 0.3mm wide. Nutlets 2–2.5mm, with glochidiate marginal appendages in upper  $\frac{2}{3}$ , confluent and dilated at base, forming a finally incurved wing 0.7–1mm broad.

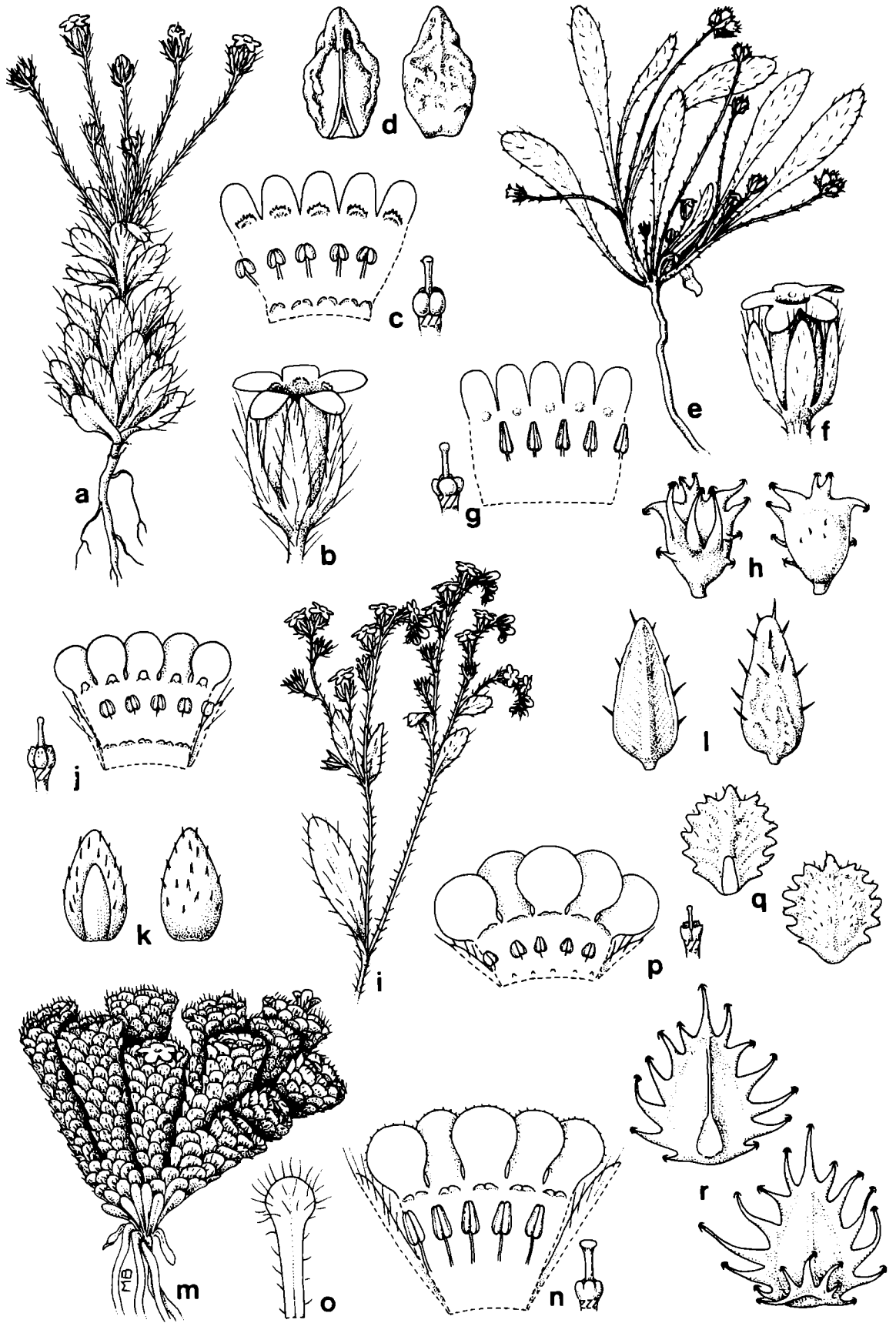
**Sikkim:** Naku La and Chho Lhamo. High-alpine zone, 4870–5330m. August–September.

Only the two cited collections are known from our area. Elsewhere reported only from Ladakh and NW India.

### 11. SETULOCARYA Mill & Long

Low, diffuse annual herbs of disturbed habitats in alpine zone. Stems diffuse, slender, erect to decumbent. Leaves sessile, ovate, sparsely hispid with relatively ± long setules on veins and margin. Inflorescence of diffuse bracteate

FIG. 82. **Boraginaceae.** a–d, *Microcaryum pygmaeum*: a, habit (× 3); b, flower (× 8); c, dissected flower with ovary and style (× 8); d, nutlets (× 18). e–h, *Actinocarya acaulis*: e, habit (× 2); f, flower (× 8); g, dissected flower with ovary and style (× 10); h, nutlets (× 8). i–k, *Lasiocaryum densiflorum*: i, leaf and inflorescence (× 1½); j, dissected flower with ovary and style (× 6); k, nutlets (× 12). l, *Setulocarya diffusa*: nutlets (× 12); m–o, *Chionocharis hookeri*: m, habit (× 1); n, dissected flower with ovary and style (× 5); o, leaf (× 3). p–q, *Eritrichium laxum*: p, dissected flower with ovary and style (× 5); q, nutlets (× 10). r, *Hackelia bhutanica*: nutlets (× 5). Drawn by M. Bates.



terminal raceme-like cymes. Calyx divided almost to base, lobes narrowly oblong to narrowly lanceolate-elliptic, patent-hairy on midrib and margins. Corolla very small, whitish with blue lobes, tubular-campanulate; tube relatively long, lobes very small. Throat scales minute, semilunar. Anthers ovoid, minute, apparently sessile, at middle of corolla tube. Style shorter than calyx. Nutlets small, ovoid, attached to gynobase by a triangular scar occupying lower  $\frac{1}{3}$  only of ventral surface, setulose on outer (dorsal) surface.

**1. *S. diffusa*** (Brand) Mill & Long; *Lasiocaryum diffusum* (Brand) Johnston, *Microcaryum diffusum* Brand. Fig. 821.

Diffuse, sparsely hispid annual. Stems 2–9cm, erect-ascending or lowermost subprostrate, branched in inflorescence, sparsely hispid, hairs  $\pm$  appressed, c 0.5–0.7mm. Leaves  $\pm$  all cauline, sessile, elliptic to ovate, 3–10  $\times$  2–4mm, obtuse, sparsely crispate-hispid with long weak hairs 0.5–1mm lacking tuberculate bases. Cymes rather diffuse even in flower. Lowest pedicel  $\pm$  remote, (4–)6–10mm, others shorter (up to 2mm at anthesis). Calyx lobes c 1.5mm in flower, oblong, obtuse, with weak spreading hairs on margin and in a line along midrib. Corolla white with yellow eye and pale blue tips to lobes, tubular-campanulate, 2mm; tube subequalling calyx; limb c 1mm diameter, lobes orbicular. Throat scales semilunar, c 0.1  $\times$  0.3mm, shallowly emarginate. Nutlets c 1–1.5mm, ovoid, outer face rugose, covered with rigid  $\pm$  erecto-patent hairs; attachment area triangular, in lower  $\frac{1}{3}$  of ventral surface.

**Sikkim:** Nurchil, Thangshing; **Chumbi:** Gyong. Sandy places, often among boulders, by streamsides, 4000–4420m. July.

A recently described genus (263) with a single mainly Central Himalayan species (principally Himachal Pradesh to Nepal).

## 12. LASIOCARYUM Johnston

Low annual herbs. Flowers in dense terminal bracteate inflorescences which are scorpioid at first but elongating and straightening in fruit to appear racemose. Calyx divided to base. Corolla blue or whitish, with transverse folds inside below middle; tube cylindrical, subequal to calyx; lobes imbricate, orbicular; throat scales distinct. Stamens 5, included, inserted on corolla tube. Style short with capitate stigma. Gynobase columnar, nutlets attached to it almost throughout their length. Nutlets 4, erect, immarginate, with longitudinal keel on abaxial (inner) face, hairy on dorsal surface.

On account of the considerable confusion in the taxonomy of this genus in the past, with numerous misidentifications and misinterpretations, literature records have not been accepted.

1. Corolla limb 2.5–4mm diameter, lobes c 1  $\times$  1mm ..... **1. *L. densiflorum***  
 + Corolla limb 1–2mm diameter, lobes c 0.5  $\times$  0.5mm .....



2. Plant branched with numerous stems; most flowers with pedicels 0.5–3mm but lowest pedicel of each inflorescence up to twice as long; throat scales of corolla subquadrate, about as broad as high ..... **3. *L. munroi***  
 + Plant unbranched in vegetative part, 1-stemmed; all flowers with pedicels c 1mm; throat scales of corolla shallowly trapeziform, about 3 × as broad as high ..... **2. *L. ludlowii***

**1. *L. densiflorum*** (Duthie) Johnston; *Oreogenia duthieana* Brand, *Microcaryum duthieanum* Brand. Fig. 82i–k.

Stems numerous, erect, ascending or outermost sometimes subprostrate, 3–10cm, usually branched below, villous with long, patent and antrorsely appressed silvery hairs to 1.5mm. Basal leaves shortly petiolate, lamina obovate to spatulate, to 15 × 5mm; cauline leaves elliptic or uppermost ovate, 6–12 × 1.5–3.5mm, obtuse to subacute; all loosely hispid with sparse thin hairs 1–2mm arising from prominent, white, tuberculate bases. Terminal cymes 3–7, very compact in flower, 1–2cm in fruit. Flowers sessile or very shortly pedicellate. Calyx lobes linear-oblong, 2–2.5mm, erect, patent-hirsute. Corolla pale blue with yellow eye, tubular-campanulate, 2.5–3.5mm; tube equalling or slightly exceeding calyx; limb 2.5–4mm diameter; lobes c 1 × 1mm. Throat scales subquadrate, c 0.2 × 0.3mm, slightly emarginate. Anthers broadly ovoid, tips not reaching scale bases. Style c 0.7mm; stigma just reaching anther bases. Nutlets lanceolate-ovoid, 0.9–1 × 0.5mm, greyish-brown, sparsely hirtellous, transversely wrinkled; pericarp with elongate, broadly elliptic ventral attachment area.

**Bhutan:** N – Upper Mo Chu district (Lingshi, Lingshi Dzong); **Chumbi:** Buckham near Chumbi. Open sandy and gravelly places near streams and lakes, c 4000m. July.

## **2. *L. ludlowii*** Mill

Similar to *L. densiflorum* but stems (3–)6–7(–11)cm, in vegetative part simple or rarely with a single branch; basal leaves withered at anthesis; cauline leaves 6–8mm, sessile or slightly amplexicaul and held fairly close to stem; terminal cymes usually 3–4 per stem; pedicels c 1mm; calyx lobes c 1.5mm; corolla china blue with white tube and pale yellow eye, 2–2.5mm, tube distinctly exceeding calyx; limb c 2mm diameter; lobes c 0.5 × 0.5mm; throat scales shallowly trapeziform to almost crescent-shaped with spreading lateral projections, c 0.1 × 0.3mm, apex distinctly but shallowly and broadly emarginate.

**Bhutan:** N – Upper Pho Chu district (Gyophu La). Scree and open grassy slopes, 4270–4725m. July–August.

A recently described species also known from Nepal and Tibet (263).

## **3. *L. munroi*** (Clarke) Johnston; *Eritrichium munroi* Clarke.

Similar to *L. densiflorum* but stems usually shorter, 1–5(–6)cm; basal leaves in a rosette, usually 4–7 × 1–2mm; cauline leaves rather numerous and dense,

elliptic or usually narrowly elliptic, 3–8(–10) × 1–3.5mm; most pedicels 0.5–3mm in flower but the lowest one occasionally up to 6mm; calyx lobes usually 1–1.7mm in flower, densely villous; corolla bluish-white or white, 2–2.5mm, tube equalling calyx, limb c 1.5mm diameter, lobes c 0.5 × 0.5mm; nutlet attachment scar narrowly oblong.

**Bhutan:** N – Upper Mo Chu district (Laya), Upper Bumthang district (Dole La) and Upper Kulong district (Me La); **Sikkim:** frequent; **Chumbi:** Ponglung and (?)Phari to Tsethanka. In similar habitats to *L. densiflorum*, 3600–4570m. June–August.

One of the specimens cited by Smith & Cave (113) from Sikkim (Smith 4185) was later described as *Microcaryum diffusum* Brand, here treated as *Setulocarya diffusa* (Brand) Mill & Long (see above). This specimen has not so far been traced, but although a syntype it is not the lectotype of that species and its identity therefore remains uncertain. *L. munroi* has often been confused with *S. diffusa* but upon careful examination the two species are seen to differ considerably, especially in nutlet morphology, and *S. diffusa* is hence awarded generic status.

### 13. CHIONOCHARIS Johnston

Densely pulvinate, woolly perennial herb. Leaves very numerous, densely imbricate, alternate. Calyx divided into 5 narrowly obovate-spathulate segments not enlarging in fruit. Corolla shortly campanulate; tube subequalling calyx, lobes imbricate, spreading, obtuse; throat closed by 5 obtuse scales. Stamens included in corolla tube; filaments short; anthers ovoid, obtuse, tips well below scale bases. Style c ½ as long as calyx lobes, broad and thickened towards flat apex. Nutlets attached to gynobase laterally above their base by a small triangular areola, erect, immarginate, densely strigose-pubescent.

**1. C. hookeri** (Clarke) Johnston; *Myosotis hookeri* Clarke, *Eritrichium hookeri* (Clarke) Brand. Fig. 82m–o.

Cushions up to 10cm high and to 45cm diameter but often much smaller. Individual stems (with leaves) clavate in outline, simple or dichotomously branched. Leaves linear-spathulate with narrowly rectangular lower portion, abruptly expanded into semicircular apex, 6–10 × c 2mm, very broadly obtuse, lower part dorsally keeled with sparse hairs, upper part densely villous with long straight soft silvery white hairs. Flowers sessile, scarcely protruding from cushions; buds pink. Calyx lobes c 2.5mm excluding hairs, densely white- or pale yellowish villous. Corolla brilliant sky blue with yellow eye, 5–6mm; tube c 2.5mm; lobes c 3 × 2mm. Scales crescent-shaped, c 0.15 × 0.6mm. Nutlets lanceolate, black, with coma of long white hairs in upper half.

**Bhutan:** N – Upper Mo Chu district (Linji La), Upper Pho Chu district (Gyophu La) and Upper Bumthang district (Marlung); **Sikkim;** **Chumbi.** Earthy

patches on boulder screes, moraines and stony hillsides in alpine zone, 4400–5800m. Mid-May–late August.

An extremely beautiful plant of horticultural merit, much of whose attractiveness is lost on drying.

#### 14. ERITRICHIUM Schrader

Low, caespitose perennials. Lower leaves petiolate, oblanceolate or spatulate, entire. Flowering stems slender, decumbent or suberect. Inflorescence a few-flowered scorpioid cyme elongating and straightening in fruit; bracts few, not subtending pedicels. Flowers pedicellate. Calyx divided to near base; lobes narrowly oblong or oblanceolate. Corolla small, blue or white, subrotate. Throat scales yellow or orange. Nutlets dorsiventrally compressed with attachment scar just above middle; dorsal surface pubescent, with triangular marginal glochidiate appendages forming a finally incurving wing-like margin.

The description above applies only to the two species occurring in the *Flora of Bhutan* area, which are rather anomalous in the genus. Most species have nutlets with an attachment scar situated at or below the middle, and silvery-sericeous (not greyish-green) vegetative parts.

1. Corolla 2.5–4mm; plant densely caespitose, forming hummocks 3–11cm across ..... **1. E. laxum**  
 + Corolla 1–1.5mm; plant loosely caespitose ..... **2. E. minimum**

##### 1. *E. laxum* Johnston. Fig. 82p&q.

Low, greyish-green, very densely caespitose perennial forming hummocks 3–11cm across. Lower leaves of current year's growth narrowly spatulate or oblanceolate, 5–16 × 2–3mm excluding petiole, obtuse, base gradually attenuate into slender petiole 16–22mm, appressed-strigose; previous years' leaves persistent, often twisting (especially petioles). Flowering stems decumbent to suberect, 1–6cm (occasionally longer in fruit), very slender, subappressed-hispid. Pedicels 1–5mm in flower (those towards base of stem 5–15mm). Calyx 1.5–2mm, lobes narrowly oblong or oblanceolate-oblong, sparsely strigose. Corolla creamy white or pale blue, fragrant, 2.5–4mm; tube 1.3–1.7mm, broadening towards throat; limb 4.5–6mm diameter, lobes spreading, rounded. Throat scales yellow. Anthers c 0.3mm. Style 0.4–0.5mm in flower, 0.5–0.7mm in fruit. Nutlets 1.2–1.7 × 0.8–1mm excluding marginal appendages, with obovate ± hispidulous dorsal surface and margin of confluent triangular-attenuate usually glochidiate-tipped appendages c 0.3–0.6mm.

**Sikkim:** Lhonak, Naku La. Forming tufts under cliffs and large boulders, 4270–5270m. June–August.

2. *E. minimum* (Brand) Hara; *Hackelia minima* Brand, *E. spathulatum* sensu W.W. Smith p.p. non Clarke.

Similar to *E. laxum* but much less densely caespitose, only rarely hummock-forming; petioles of lower leaves usually 8–16mm; calyx lobes c 0.7mm at anthesis but twice as long in fruit; corolla pale blue with orange eye, 1–2mm long and 1.3–2.5mm diameter.

**Chumbi:** Kambajong. In similar habitats and altitudes to *E. laxum*. July–September.

Although Hara (135) treated *E. minimum* in a broad sense including *E. laxum*, it does seem sufficiently distinct to retain them as separate species. *E. laxum* is widespread from Nepal to China, and is relatively constant in its flower size. *E. minimum* (the earlier-described taxon) seems to be restricted to Chumbi and adjacent Nepal (one collection from Sisne Himal). Further collections of both species are needed to assess their status; the fruits of *E. laxum* are insufficiently known as almost all collections are of flowering material, while for *E. minimum* the reverse is the case.

*Eritrichium minimum* has also been treated wrongly as a depauperate form of *Actinocarya acaulis*, which has led to some confusion in the literature.

## 15. HACKELIA Opiz

Perennial herbs. Stems branched, especially in inflorescence. Leaves alternate, often broad and acuminate. Inflorescences terminal and lateral, often numerous; cymes condensed at first, elongating in fruit. Pedicels deflexed in fruit. Calyx 5-partite with a distinct basal receptacular portion which is often more densely hairy than the lobes; lobes ovate to oblong, reflexed in fruit. Corolla blue or white, rotate or shortly campanulate; lobes spreading. Throat scales oblong or subquadrate, papillose or hairy. Stamens included. Style included, equalling or shorter than calyx. Nutlets dorsiventrally compressed with flat dorsal area and  $\pm$  distinct wing bearing  $\pm$  long glochidiate appendages; nutlets either all similar or of two kinds in each mericarp, differing in the form of the wing and marginal appendages.

Previous treatments have grouped all East Himalayan material of this genus under a single species, *H. uncinata* (Bentham) Fischer, sometimes divided into two varieties, var. *uncinata* and var. *brachytuba* (Diels) Hara. This has been found unsatisfactory and a revision of the Sino-Himalayan taxa is in preparation. Three closely allied taxa, here treated as species, occur in Bhutan and Sikkim.

*Hackelia* is sometimes treated as part of *Eritrichium* in a broad sense, but as the Bhutanese members of *Eritrichium* differ considerably from the following species, *Hackelia* is here maintained, provisionally, as a distinct genus. Further investigations on the generic limits in this group of the Eritrichieae are needed.

1. Leaves with  $\pm$  dense hairs on lower surface of lamina, as well as on veins  
     **3. *H. uncinata***  
 + Leaves glabrous or almost so on lower surface, except on veins ..... 2
2. Leaves with acuminate apex; corolla tube c 2mm, subequalling calyx; style  
     c 1.5mm, subequalling or slightly shorter than calyx ..... **1. *H. bhutanica***  
 + Leaves with obtuse,  $\pm$  mucronate apex; corolla tube rarely exceeding 1mm,  
     shorter than calyx; style in flower 0.3–0.8mm, not more than  $\frac{1}{2} \times$  calyx  
     **2. *H. obtusifolia***

**1. *H. bhutanica*** Mill; *H. brachytuba* auct. non Diels. Fig. 82r.

Stems erect or ascending, 22–75cm, weakly pilose to subglabrous below, shortly appressed-strigose above. Radical leaves  $\pm$  long-petiolate, petiole 3.5–21cm, lamina ovate, acuminate or acute, base at least shallowly cordate; cauline leaves similar but more shortly petiolate and upper subsessile, 25–100  $\times$  10–60mm, always acuminate; upper surface of leaves shortly pilose, hairs sparse, rather long, mostly 0.5–1mm, and often with a yellow tinge; lower surface glabrous except on veins. Calyx lobes 1.5–2.5mm, ovate, usually  $\pm$  acute, sparsely hairy; receptacular portion densely short-strigose outside. Corolla pale blue or white with white tube, subcampanulate, 3–5mm long and 5–8(–9)mm diameter; tube c 2mm, subequalling calyx and slightly shorter than lobes; lobes (1.5–)2–3.5mm, spreading, obtuse. Throat scales subquadrate, c 0.5  $\times$  0.6–0.8mm, apex emarginate and darker than rest of scale. Style c 1.5mm, subequalling or slightly shorter than calyx. Nutlets 2–3mm (excluding appendages), all similar; marginal appendages 1.5–3mm, glochidiate.

**Bhutan:** C – Thimphu, Punakha, Tongsa, Bumthang and Sakden districts, N – Upper Kulong Chu district (Me La); **Darjeeling:** Sandakphu, etc.; **Sikkim:** Tsomgo etc. Hillsides and open places in Hemlock forest, often by streams, 2440–4268m. June–September.

By far the commonest species of *Hackelia* in Bhutan and Sikkim, occurring in a variety of different habitats over a wide altitudinal range (263).

**2. *H. obtusifolia*** Mill; *H. brachytuba* auct. non Diels.

Similar to *H. bhutanica* but stems often shorter, 4–45cm, and usually decumbent or ascending; leaves with obtuse, usually  $\pm$  mucronate apex (never acuminate); hairs on upper surface of leaves 0.3–0.7(–1)mm, more often white than yellow-tinged; corolla rotate, tube rarely more than 1mm, distinctly shorter than calyx lobes; style 0.3–0.8mm, usually much shorter than calyx lobes.

**Bhutan:** C – Punakha district (Dungshinggang) and Bumthang district (Penge La), N – Upper Mo Chu district (Karchu La), Upper Bumthang Chu district (Tsampa), Upper Kulong district (Me La); **Sikkim:** Tsomgo, Kupup etc., common. Wet grassy and rocky hillsides, moist scree, peaty hollows, 2745–4268m. June – July.

Preferring generally higher altitudes than *H. bhutanica* and apparently also with narrower ecological preferences (263).

**3. *H. uncinata*** (Bentham) Fischer; *Cynoglossum uncinatum* Bentham, *H. glochidiata* (A.DC.) Brand, *Echinosperrnum glochidiatum* A.DC.

Similar to *H. bhutanica* but leaves  $\pm$  densely hairy on lamina beneath as well as on veins; corolla  $\pm$  rotate, paler blue with slightly longer lobes 2.5–3.5mm; throat scales shortly oblong, longer than broad, c  $1 \times 0.6$ mm; style c 0.5mm, much shorter than  $\pm$  obtuse calyx lobes; nutlets c 4mm, heteromorphic, 2 in each mericarp with spreading wing-like margin bearing glochidiate appendages 2.5–3.5mm, the other two with a narrower incurved wing bearing very small incurved teeth c 0.2mm.

**Bhutan:** N – Upper Bumthang Chu district (Tsampa); **Darjeeling:** Phullalong, Sandakphu, etc.; **Sikkim:** Rathong Chhu. Open slopes and in forest, 3050–3963m. June–July.

This taxon is common in Nepal but is of limited occurrence in our area, where most plants differ slightly from typical Nepalese material in their slightly longer hairs on the upper leaf surface, tending towards *H. bhutanica* in this respect but readily distinguishable by the  $\pm$  dense indumentum on the lower leaf surface. Pending a full revision of the species throughout its range, no infraspecific recognition is here given to the variant occurring in our area.

## 16. MICROULA Bentham

Annual or perennial herbs, acaulescent or with erect to prostrate stems. Leaves petiolate, lamina oblong-ovate to broadly elliptic, entire. Flowers axillary or in terminal or lateral cymes, hardly elongating in fruit. Calyx divided to near base; lobes ovate to oblong. Corolla blue or whitish, subrotate to shortly campanulate. Throat scales present, subquadrate or crescent-shaped. Stamens included; anthers ovoid to lanceolate. Nutlets ovoid (often rather irregular), tuberculate or rugose, usually minutely pubescent, with a subapical pit (foveola); attachment scar either near apex (sect. *Microula*) or towards base or near middle (sect. *Schistocaryum*).

A mainly Chinese genus with two of its six sections represented in Bhutan.

1. Plant almost stemless; flowers arising from amongst rosette of leaves (Sect. *Microula*) ..... **1. *M. tibetica***
- + Plant with distinct stems at least 3cm; flowers in axillary or terminal inflorescences (Sect. *Schistocaryum* (Franchet) W.T. Wang) ..... 2
2. Spreading hairs of stem 1–3mm; corolla 6–8mm ..... **4. *M. sikkimensis***
- + Spreading hairs of stem 0.5–1mm; corolla c 3mm ..... 3
3. Nutlets pale brown, 1.5–2mm; throat scales subquadrate, c 0.5mm high  
**3. *M. pustulosa***
- + Nutlets greyish, c 2–2.5mm; throat scales shallowly crescent-shaped, c 0.1mm high ..... **2. *M. bhutanica***

1. *M. tibetica* Bentham; *M. benthamii* Clarke. Fig. 83a-c.

Almost acaulescent perennial with thick, unbranched, vertical rootstock 5–15cm. Leaves in a rosette; petioles 1–6cm, winged, flat, broadened at base, densely short-pubescent; lamina oblong-ovate to ovate, 12–80 × 7–32mm, obtuse, base abruptly attenuate, margin entire or irregularly dentate with few robust short setules; upper surface densely appressed short-pubescent intermixed with a few stout tuberculate setules to c 1mm; lower surface with sparse robust setules. Inflorescences several, massed together, very shortly pedunculate; flowers shortly pedicellate, pedicels c 6–10mm, recurving in fruit. Calyx lobes ovate to triangular, 1–1.5mm. Corolla white or pale blue, broadly cylindrical, c 3mm; tube subequalling calyx; lobes rounded, c 1 × 1.5mm. Throat scales ovate to semilunar, c 0.2 × 0.4mm. Anthers c 0.6mm, apices scarcely reaching throat scales. Nutlets white or bluish, ovoid, 2–2.3 × 1.5–1.7mm, covered with minutely glochidiate tubercles and with a small dorsal pit.

**Sikkim:** Naku La; **Chumbi:** Sashethang. Earthy slopes in alpine zone, 4250–5330m. Late June–early September.

2. *M. bhutanica* (Yamazaki) Hara; *Actinocarya bhutanica* Yamazaki. Fig. 83g&h.

Delicate perennial. Stems erect to prostrate, slender, 3–25cm, ribbed and narrowly winged, patent hirsute with scattered, weak, setiform hairs 0.5–1mm. Basal leaves in a loose rosette, petiolate; petiole 4–20mm, patent-hirsute; lamina elliptic to spatulate, 9–35 × 5–18mm, obtuse, shortly mucronate, base obtuse to shortly cuneate, surfaces sparsely hispid with subpatent setiform hairs. Cauline leaves shortly petiolate, similar to basal leaves but smaller. Flowers axillary, and in short, few-flowered, terminal cymes subtended by a small leaf-like bract; pedicels filiform, axillary, 8–15mm in flower, elongating in fruit to c 30mm, those of terminal cymes only 2–6mm in flower. Calyx c 2.5mm, lobes lanceolate, 1.5mm, acute, sparsely white-hirsute especially on margin. Corolla whitish, subrotate, 3mm; tube c 1–1.6mm, shortly pilose at base inside; limb c 4–5.5mm diameter; lobes c 1mm. Throat scales shallowly crescent-shaped, c 0.1 × 0.5mm, pilose. Anthers lanceolate, 0.4–0.5mm, tips just below scale bases. Nutlets greyish, irregularly ovoid, c 2–2.5mm, scabrous-hispid, dorsal surface with dentate cartilaginous margin, heavily rugose except on inner (attachment) face, with whitish-grey, ribbed subapical pit c 1.5 × 0.5mm.

**Bhutan:** N – Upper Mo Chu district (Yabu Thang, Lingshi Dzong and near Phoudingi) and Upper Pho Chu district (Oke La). In herbage along streams and in *Betula* forest, 3000–4320m. May–September.

3. *M. pustulosa* (Clarke) Duthie; *Eritrichium pustulosum* Clarke

Low weak perennial with long thin vertical root. Stems several, 3–12cm in flower, up to 25cm in fruit, slender, outermost usually decumbent or subprostrate and finally ascending, others suberect, especially in fruit, strigose-hispidulous with shorter retrorse appressed and a few longer, stouter patent setules 0.5–1mm.

Basal leaves few, withered in fruit; petiole when mature longer than lamina. Low and middle cauline leaves shortly petiolate, upper almost sessile; lamina elliptic to obovate, 10–30 × 3.5–10mm, subacute, mucronate, base shortly attenuate, upper surface green, rather sparingly appressed pilose with very unequal setiform hairs, lower surface greyer with scattered, stouter retrorse setules. Flowers axillary and in a few-flowered terminal inflorescence. Pedicels 1–2mm in flower, to 25mm in fruit. Calyx lobes ovate, suberect and 1.5–2mm in flower, c 3mm and finally spreading in fruit. Corolla dark blue, 3–3.5mm. Throat scales distinct, broadly rounded, c 0.5 × 0.5mm, pilose, darker than corolla lobes. Anthers oblong-ovoid, c 0.5mm, tips almost reaching or just exceeding scale bases. Nutlets pale brown, irregularly ovoid with acute edges, c 1.5–2mm, tuberculate, minutely pubescent but not glochidiate, some or all in each fruit with a subapical pit 0.8 × 0.2mm, with raised rim, towards top of outer face.

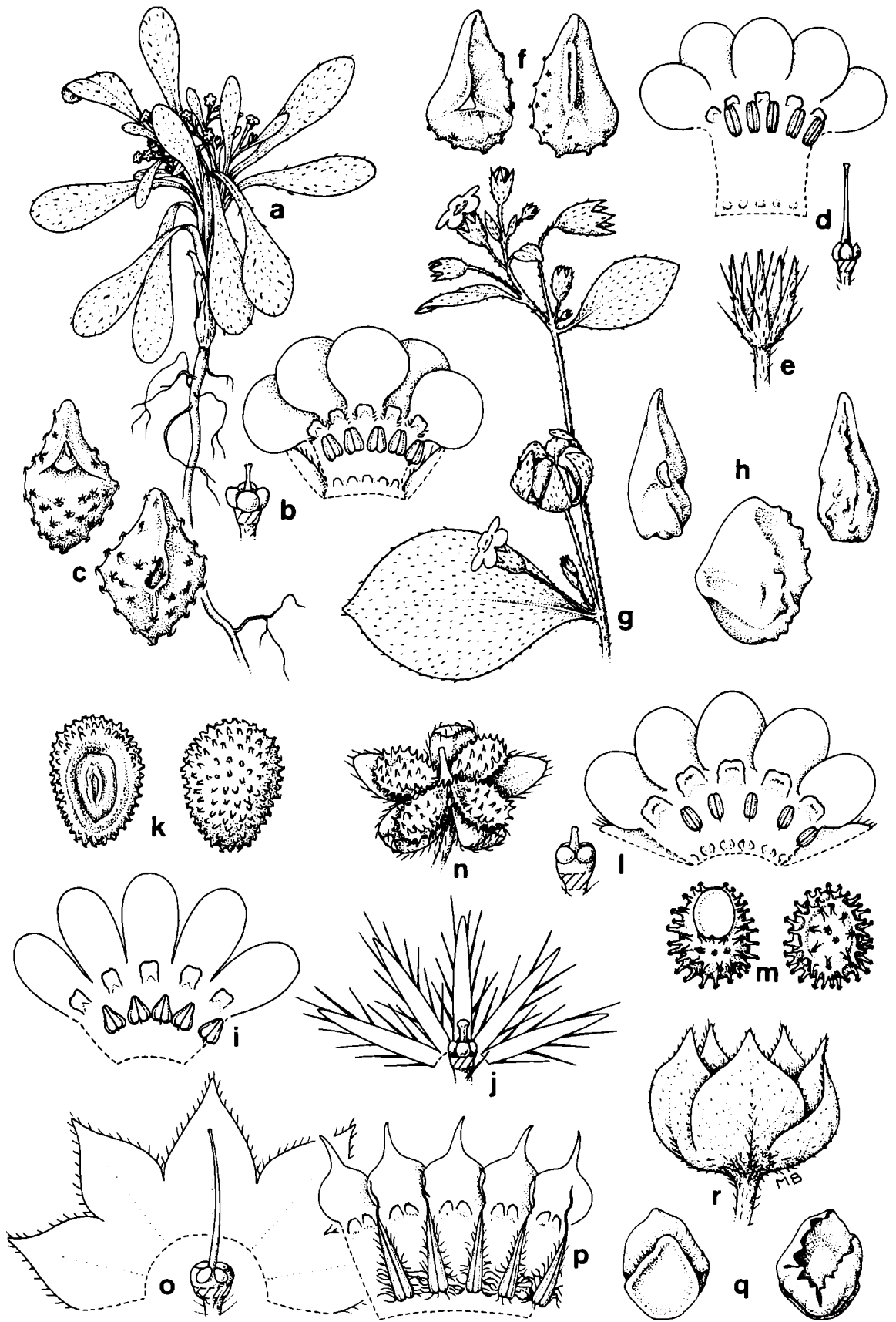
**Bhutan:** N – Upper Mo Chu district (Lingshi); **Sikkim:** Lachen, Lhonak, Sherabthang etc., frequent; **Chumbi:** Phari and Dotha. Scree and short turf on alpine slopes, 3960–5420m. May–September.

**4. *M. sikkimensis*** (Clarke) Hemsley; *Anchusa sikkimensis* Clarke, *Tretocarya sikkimensis* (Clarke) Oliver, *Anoplocaryum limprichtii* Brand, *M. duthiei* S.P. Banerjee, *M. trichocarpa* sensu S.P. Banerjee & R.N. Banerjee non Maximowicz. Fig. 83d–f.

Annual?, usually rather coarse and robust. Stems (8–)15–60cm, erect or outer ± decumbent, usually with numerous short or long lateral branches but sometimes ± unbranched, somewhat flattened, brownish, hispid with spreading hyaline bristles (often dark-tipped) 1–2.5mm; shorter appressed hairs absent or confined to inflorescence. Basal leaves with 2–7cm petioles; lamina ovate to lanceolate, 2–7 × 1–3cm, acute, not mucronate, base shortly attenuate, surfaces weakly hispid and with stouter setules on veins beneath. Inflorescence paniculate; flowers in compact terminal bracteate cymes. Pedicels 1–2mm in flower and fruit. Calyx lobes greyish-mauve, narrowly oblong, 2.5–3mm, obtuse, densely grey-villous on margins, less so on back. Corolla deep brilliant sky or cobalt blue with whitish tube, 6–8mm. Throat scales yellow. Anthers ovoid, at top of tube. Nutlets irregularly ovoid or rhomboid with diamond-shaped back, c 2.5 × 1.5mm, shortly tuberculate but otherwise glabrous, lacking glochidiate appendages; attachment scar triangular, near or just above middle of ventral surface.

FIG. 83. **Boraginaceae.** a–c, *Microula tibetica*: a, habit (× 2/3); b, dissected flower with ovary and style (× 6); c, nutlets (× 8). d–f, *M. sikkimensis*: d, dissected flower with ovary and style (× 3); e, calyx (× 3); f, nutlets (× 6). g–h, *M. bhutanica*: g, flowering shoot (× 3); h, nutlet, front and side view (× 6). i–k, *Bothriospermum tenellum*: i, dissected flower (× 8); j, calyx, ovary and style (× 8); k, nutlets (× 12). l–n, *Cynoglossum furcatum*: l, dissected flower with ovary and style (× 4); m, nutlets (× 4); n, group of nutlets (× 3). o–r, *Trichodesma calycosum*: o, calyx, ovary and style (× 1½); p, dissected flower (× 1½); q, nutlets (× 2); r, fruiting calyx (× 1). Drawn by M. Bates.





**Bhutan:** C – Thimphu district (Cheka Paro Chu), N – Upper Mo Chu District (Lingshi La, Yale La, Laya etc.) and Upper Bumthang Chu (Tolegang); **Sikkim:** Megu, etc.; **Chumbi:** Phari, etc. Grassy meadows and hillsides, often at margin of cultivated land and near herdsman's huts, 3900–4420m. June–September.

*M. duthiei* S.P. Banerjee seems, on the basis of the original description and a probable isotype at K, to be simply a starved form of *M. sikkimensis* with a single stem. *M. sikkimensis* has frequently been confused with, or included in, the Chinese *M. trichocarpa* Maximowicz; the two species have a similar habit (although the latter when full-grown has stems much more slender than *M. sikkimensis* at a similar stage of development), but there are significant differences in nutlet morphology which places them in different sections (58).

## 17. BOTHRIOSPERMUM Bunge

Slender annual or biennial herbs. Leaves alternate. Flowers small, solitary in upper leaf axils and in a short terminal bracteate raceme. Calyx 5-lobed  $\pm$  to base, lobes hardly accrescent in fruit. Corolla with cylindrical tube and  $\pm$  spreading lobes; throat with 5 scales. Stamens included. Nutlets ellipsoid, parallel with backs together, attached apically to slightly elevated gynobase but with a very small basal scar (areola), with a depression (umbilicus) surrounded by a tumid marginal rim on ventral surface.

The small scar near the base of the nutlet has frequently been mistaken for the real attachment area, which is situated apically, near the radicle of the embryo.

**1. B. tenellum** (Hornemann) Fischer & Meyer; *Cynoglossum diffusum* Roxb., *C. prostratum* D. Don. Fig. 83i&k.

Diffuse, much-branched annual. Stems prostrate to ascending, 8–25cm, slender, each  $\pm$  unbranched, with subappressed antrorse white setules. Basal leaves soon withering, obovate. Cauline leaves numerous, lower petiolate and obovate-lanceolate to lanceolate, upper sessile, lanceolate, 15–35  $\times$  3–8mm (uppermost smaller, c 7–8  $\times$  2mm, passing into bracts), acute, margin undulate, surfaces appressed-setulose, hairs on lower surface with swollen multicellular bases. Pedicels 1–3(–5)mm. Calyx lobes linear-lanceolate, c 2mm. Corolla pale blue with paler throat, or white, c 2.5mm, tube subequalling and included in calyx, lobes short,  $\pm$  patent, rounded. Throat scales trapeziform with emarginate apex. Anthers inserted below throat. Nutlets 1–1.5mm, minutely tuberculate-granular on dorsal surface.

**Bhutan:** C – Thimphu district (Pangri Zampa and Babesa) and Punakha district (Chusom to Wangdu Phodrang, at Mishina). Weed of paddy-fields and mustard and wheat plots, 1200–2350m. March–May.

A minor agricultural weed (272).

## 18. CYNOGLOSSUM L.

Biennial or perennial herbs, occasionally (*C. lanceolatum*) behaving as an annual. Stems  $\pm$  branched, especially in inflorescence, pubescent or setulose. Radical leaves present or absent at anthesis, petiolate. Cauline leaves  $\pm$  numerous, petiolate or sessile. Inflorescence of numerous often furcate scorpioid cymes which elongate considerably in fruit. Calyx divided to c  $\frac{3}{4}$ , often enlarging in fruit and lobes, then spreading stellately. Corolla blue or white; throat scales present, crescent-shaped or subquadrate. Stamens included; style shorter than or subequalling calyx. Nutlets attached apically to an elevated gynobase with the style projecting between them; dorsal surface of nutlets glochidiate, either evenly (nutlets immarginate) or mainly on the central area and at margin (nutlets marginate).

1. Corolla white with blue centre, very small, 1.5–2mm long, limb to 3.5mm diameter; nutlets 1.5–2mm ..... **1. *C. lanceolatum***  
 + Corolla blue, larger, 4–7mm long, limb 5–10mm diameter; nutlets 2–3mm ..... **2**
2. Leaves softly and minutely pubescent, hairs on upper surface not more than 0.2mm; nutlets immarginate or almost so ..... **3**  
 + Leaves more roughly hairy, hairs on upper surface 0.4–2mm; nutlets marginate ..... **4**
3. Stem hairs all appressed; hairs on lower leaf surface evenly distributed on lamina and midrib; corolla 5.5–6.5mm diameter; nutlets 2–2.5mm with glochids c 0.5mm ..... **2. *C. furcatum***  
 + Stem hairs spreading or deflexed-spreading; hairs on lower leaf surface somewhat less dense on lamina surface than on veins, those on veins spreading; corolla 6–10mm diameter; nutlets 2.5–3mm with glochids c 0.6–0.7mm ..... **3. *C. amabile***
4. Middle and upper leaves sessile and decurrent on stem, 60–110mm long; hairs on upper leaf surface 0.4–0.8mm, tubercular bases absent or inconspicuous, not touching each other even on old leaves ..... **4. *C. wallichii***  
 + Middle and upper leaves shortly petiolate, 20–60mm long; hairs on upper leaf surface 1–2mm with underlying indumentum of extremely short hairs less than 0.1mm, tubercular bases  $\pm$  conspicuous and  $\pm$  touching each other on old leaves ..... **5. *C. glochidiatum***

**1. *C. lanceolatum*** Forsskål; *C. micranthum* Desfontaines, *C. racemosum* Roxb.  
 Nep: *Khirpatey* (272).

Hispid annual, biennial or perennial, with often stout rootstock. Stems 20–120cm, erect, much branched,  $\pm$  densely hispid with erecto-patent hairs to

1.5mm and shorter appressed hairs, all tubercle-based. Basal leaves absent at flowering time, petiolate, 10–20 × 2–4cm including petioles, subacute to acute, base shortly attenuate; upper surface greyish strigose-hispid with markedly unequal hairs, all tubercle-based; lower surface ± densely greyish-hispid on veins but less so on lamina. Inflorescence intricately branched, ultimate branches 5–16cm, furcate and widely divaricate in fruit (ultimate fork of main axis making an angle of 80–140°, forks of side branches more acute); hairs on upper branches whitish, greenish-white or very pale straw-coloured. Pedicels 1–2mm. Calyx lobes c 1mm, ovate, obtuse, strigose. Corolla white with blue centre, 1.5–2mm long; limb to 3.5mm diameter. Throat scales blue, shallowly crescent-shaped. Gynobase (including style) 2.5–3mm in fruit; style 0.15–0.2mm thick. Nutlets 1.5–2mm, ovate-orbicular, immarginate, evenly glochidiate all over; glochids c 0.3mm.

**Bhutan:** S – Gaylegphug district (near Tama (38)), C – Thimphu district (Paro etc.), Punakha district (Punakha etc.) and Tongsa district (several localities); **Sikkim:** Tista; **Darjeeling:** Birik, Mungpoo, Ryang. Mainly a ruderal weed (272) of roadsides, field margins, paddy-fields etc., sometimes on open hillsides, 300–3050m. Flowers almost throughout the year.

**2. *C. furcatum* Wall.; *C. zeylanicum* auct. non (Lehmann) Brand. Dz: *Cimba*; Nep: *Bhende kuro*, *Khirpatey* (272). Fig. 831–n.**

Biennial with ± stout rootstock. Stems 25–100cm, usually erect, unbranched below but much-branched in inflorescence, densely and softly appressed-pubescent; hairs retrorse below and antrorse above, none tubercle-based, spreading hairs absent. Basal leaves absent (or withered) at flowering time. Cauline leaves numerous, lower ones shortly petiolate, upper sessile and ± clasping stem, lamina ± narrowly elliptic or oblanceolate, middle ones 40–150 × 8–35(–50)mm, acute, upper surface densely short-pubescent (hairs soft, ± uniform, not more than 0.2mm, lacking tuberculate bases), lower surface with similarly dense indumentum on lamina and short retrorse-appressed hairs on veins. Inflorescence branched, ultimate branches 5–9cm, furcate, making an acute angle of 30–70°; upper branches densely villous, hairs pale yellowish or straw-coloured. Pedicels c 1mm, increasing to 2–4mm in fruit. Calyx lobes ovate-lanceolate, 1.5–2.5mm in flower, 3.5–4.5mm in fruit, acute, finely strigose. Corolla deep blue often with violet tinge, 4–5mm long; limb 5.5–6.5mm diameter. Throat scales bluish-brown, emarginate. Style 1.5–2mm in fruit, c 0.3mm thick. Nutlets ovate, 2–2.5mm, immarginate, evenly glochidiate all over; glochids c 0.5mm.

**Bhutan:** S – Phuntsholing and Sarbhang districts, C – Ha, Thimphu, Punakha, Tongsa and Mongar districts, N – Upper Kuru Chu district; **Darjeeling:** Rimbi Chhu etc.; **Sikkim:** Bakkhim, Rimbik, Chiya Bhanjang. Roadsides and river shingle, in warm broad-leaved and evergreen oak forest etc., 1220–2700(–3660)m. April–October.

A minor weed of crops (272). Very frequently misidentified as *C. zeylanicum*

(Lehmann) Brand, a species of tropical India and Ceylon which does not reach the Himalaya. The latter has a much less dense, rough leaf indumentum with the hairs arising from conspicuous basal tubercles.

### 3. *C. amabile* Stapf & Drummond

Similar to *C. furcatum* but stem hairs spreading or deflexed-spreading (not appressed); radical leaves usually present at flowering time; hairs on lower surface of leaves noticeably denser on veins than on lamina surface, hairs on veins spreading; hairs on upper part of inflorescence usually bright yellow or fulvous; corolla limb usually 6–10mm diameter; nutlets 2.5–3mm, indistinctly marginate, mature glochids slightly longer (0.6–0.7mm).

**Bhutan:** C – Thimphu district (Thimphu, Nimchling, Paro and Bondey Farm) and Tongsa district (Shamgong). Blue Pine forest, grassy wasteground and damp roadside banks, 1550–2750(–3050)m. April–October.

Two of the five records from Thimphu district are from hotel grounds but the others are from natural, although usually ruderal, habitats. The Bhutan specimens are very close to Chinese material in indumentum but in some the flowers are smaller. Further investigation on the taxonomic status of these small-flowered plants is needed. Several literature records from Punakha district (71), although quite probable, require confirmation on account of the similarity between this species and *C. furcatum*.

### 4. *C. wallichii* G. Don

Robust biennial. Stems 30–75cm, unbranched below but with branched inflorescence, thinly hispid below, with long, weak, setiform, spreading hairs 0.5–2.5mm, appressed-pubescent in inflorescence. Radical leaves absent at flowering time. Lower cauline leaves petiolate (petiole to 40mm), elliptic, 50–80 × 20–25mm, middle ones largest, sessile and decurrent on stem by broad base, oblong-elliptic, 60–110 × 15–20mm, upper ones sessile, ovate, smaller; apex acute or shortly acuminate, margins entire or slightly undulate; upper surface sparsely short-hispid (hairs 0.4–0.8mm, tubercular bases absent or very small, not touching each other even on old leaves), lower surface with similar hairs, broad brownish midrib and indistinct lateral veins; margins, especially of upper leaves, with spreading setules 1–2mm. Inflorescence usually rather narrow when young, branches 7–12(–15)-flowered, finally erecto-patent (terminal fork making an angle of 45–90°). Calyx velvety blackish or dark purplish, lobes broadly ovate to suborbicular, 1.5–2mm in flower, 4–5mm in fruit (longer than nutlets), obtuse or rounded, shortly strigose. Corolla deep blue, c 4mm long; limb c 6mm diameter. Throat scales bluish-white, hairy. Nutlets c 3mm, ovate-elliptic, marginate, with confluent marginal glochids c 1mm and a few shorter ones in centre, mainly along slightly raised dorsal keel.

**Bhutan:** C – Thimphu district (Pajoding near Thimphu, near Barshong). Punakha district (Lamse La) and Sakden district (Sakden), N – Upper Mo Chu district (Gasa to Kohina), Upper Bumthang Chu district (Tsampa) and Upper

Kulong Chu district (Me La at Shingbe); **Darjeeling:** Sandakphu; **Sikkim:** Tsomgo and Chomnagu. Open grassy slopes, in Fir forest and *Rhododendron* scrub zones, mainly 3000–4180m. May–October.

**5. *C. glochidiatum* Wall.**

Similar to *C. wallichii* but stem hairs stiffer; most cauline leaves (even upper ones) at least shortly petiolate, lamina ovate; hairs on upper leaf surface longer (mostly 1–2mm), thin, arising from tubercles which enlarge and finally become conspicuous and dense, touching each other; indumentum of lower leaf surface a combination of long, weak, spreading setules 1–2mm on lamina and especially midrib, and underlying extremely short hairs; midrib and lateral veins prominently raised on lower leaf surface; calyx lobes shorter in fruit (c 3mm, not 4–5mm); ripe nutlets smaller, 2.5–3mm.

**Bhutan:** S – Chukka district (Chukka and Raidak valley), C – Ha district (Ha); **Sikkim:** confirmation required (67). Open meadows, 1220–2770m. June–July.

**19. TRICHODESMA R. Brown**

Large, coarse, erect, perennial herbs or shrubs. Stems terete or 4-angled. Leaves opposite or upper alternate, large. Inflorescence a large, often many-flowered panicle of racemes; lower flowers axillary, bracteate, others ebracteate. Flowers (4–)5-merous. Calyx lobes ovate, accrescent in fruit. Corolla campanulate; lobes acuminate, contorted, overlapping to left; throat scales present or more often absent. Stamens 5, adnate to corolla tube; anthers large, acuminate, connivent and forming a cone; connectives excurrent from anther apices, finally twisted and  $\pm$  exerted from corolla. Fruit enclosed in persistent, much enlarged papery calyx. Nutlets attached to gynobase by almost whole ventral surface; dorsal surface smooth or tuberculate, with raised, entire or pectinate margin.

The single species treated is unique in the genus in possessing (4–)5 pairs of throat scales; in other E Himalayan species these are absent. This character was used to segregate the genus *Lacaitaea* but the broader treatment is retained here.

**1. *T. calycosum* Collett & Hemsley; *Lacaitaea calycosa* (Collett & Hemsley) Brand. Fig. 83o–r.**

Stout, erect perennial, 1–6m. Stems 4-angled, densely short-pubescent with soft pale brownish-white hairs. Basal leaves oblong-elliptic, to 45 × 19cm; cauline leaves subsessile, lanceolate to elliptic, acute or shortly acuminate, base cuneate, upper surface dark, densely and very shortly puberulent and with scattered longer hairs; lower surface greyish, densely short-pubescent without longer hairs; hairs all etuberculate. Calyx lobes ovate, 9–12 × 4.5–7mm in flower, 18–20 × 14–15mm in fruit, shortly acuminate, densely pubescent outside, glabrous inside. Corolla yellowish-brown, 10–15mm, scarcely exceeding calyx; throat scales c 1 × 1.5mm. Anthers c 6.5mm excluding excurrent part of

connectives, long white-villous on back; excurrent connectives c 3.5mm. Nutlets c 6mm diameter, glabrous, convex or cup-shaped, with shallowly but coarsely dentate slightly incurved margin.

**Darjeeling:** Labhah, Rayeng and Dumsong; **Sikkim:** Mongpu, etc. Slopes, 350–1800m. February–April.

Curiously disjunct between Sikkim and Darjeeling in the west and from China and Burma to Cambodia and Vietnam in the east; it may have been overlooked in Bhutan. A closely allied species, *T. khasianum* Clarke, occurs eastwards from Arunachal Pradesh and Assam and may occur in adjacent Bhutan although no Bhutan material has been seen. It differs from *T. calycosum* in the hairs of the upper leaf surface having conspicuous small white tuberculate bases; flowers most commonly 4-merous; calyx lobes long-acuminate (not acute or short-acuminate); throat scales entirely absent; connectives sparsely (not densely) villous.

### Family 168. VERBENACEAE

by D.G. Long; *Callicarpa* by S.J. Rae

Herbs, shrubs or trees; stems often quadrangular; indumentum of simple or stellate, rarely medifixed hairs, often with gland-dots or scales. Leaves opposite, sometimes whorled, simple or palmately compound, sometimes lobed, exstipulate. Flowers in heads, racemes, cymes, corymbs or panicles, zygomorphic or rarely actinomorphic, bisexual. Calyx tubular at base, 2–6-lobed, sometimes entire. Corolla tubular below, salverform, funnel-shaped or 2-lipped, 4–6-lobed. Stamens (2–)4(–6), often in unequal pairs, or with 2 fertile stamens and 2 staminodes; filaments inserted within corolla tube; anthers included or exerted. Ovary superior, 2–8-celled; ovules 1–2 per cell; placentation axile. Fruit a dry or drupaceous capsule containing 1–4 1–2-seeded stones, or 4 nutlets in *Verbena*.

- |  |                   |
|--|-------------------|
| 1. Leaves palmately compound .....   | <b>11. Vitex</b>  |
| + Leaves simple, lobed or unlobed .....  | 2                 |
| 2. Leaves glabrous or with simple or medifixed hairs .....   | 3                 |
| + Leaves pubescent or tomentose with stellate or compound hairs .....  | 16                |
| 3. Flowers sessile in slender spikes or compact heads (in <i>Nyctanthes</i> heads aggregated into cymes; in some <i>Premna</i> flowers clustered forming interrupted spikes or condensed panicles) ..... | 4                 |
| + Flowers pedicellate, sometimes shortly, in racemes, lax cymes or panicles  | 10                |
| 4. Leaves entire; shrubs or small trees .....  | <b>10. Premna</b> |
| + Leaves toothed at least in upper half; herbs, subshrubs or shrubs .....  | 5                 |

168. VERBENACEAE

5. Creeping herb rooting at nodes; leaves toothed only in upper half; hairs medifixed ..... **4. Phyla**  
 + Erect or suberect herbs, subshrubs or shrubs; leaves toothed (or lobed) almost to base; hairs simple, basifixed ..... 6
6. Flowers 3–7 in small heads (these aggregated into broad cymes); calyx unlobed; stamens 2; fruit a flattened 2-lobed capsule ..... **16. Nyctanthes**  
 + Flowers many in broad heads or narrow spikes; calyx 2–5-lobed; stamens 4 or 2 with 2 staminodes; fruit fleshy or dry, not flattened or 2-lobed .... 7
7. Leaves sessile, pinnatifid or coarsely doubly serrate, or narrowly oblong-elliptic; calyx shortly 5-lobed; fruit of 4 1-seeded nutlets ..... **1. Verbena**  
 + Leaves petiolate, ovate, ovate-lanceolate or broadly elliptic; calyx 2 or 4-lobed; fruit a capsule or drupe ..... 8
8. Flowers appressed and sunk into pits in stout rachis; calyx 4–5-lobed; stamens 2 with 2 staminodes ..... **5. Stachytarpheta**  
 + Flowers spreading from slender rachis without pits; calyx 2-lobed; fertile stamens 4 ..... 9
9. Stems often prickly; petiole 10–30mm; flower heads flat-topped, 2–3cm diameter; fruit fleshy ..... **2. Lantana**  
 + Stems unarmed; flower heads ovoid-cylindric or subglobose, 1–1.5cm diameter; fruit dry ..... **3. Lippia**
10. Flowers in racemes ..... 11  
 + Flowers in lax or condensed cymes or panicles ..... 13
11. Leaf base cuneate or attenuate; calyx small, c 4mm long including minute lobes c 0.5mm ..... **7. Duranta**  
 + Leaf base rounded or truncate; calyx large and showy, 20–30mm diameter, red and saucer-shaped or blue and deeply lobed ..... 12
12. Leaves entire; petiole 5–10mm; calyx blue, deeply 5-lobed; corolla blue or purple, tube 6–7mm ..... **6. Petrea**  
 + Leaves shallowly serrate; petiole 10–30mm; calyx red, unlobed; corolla orange or crimson, tube 17–22mm ..... **14. Holmskioldia**
13. Flowers small; corolla tube 1.3–5mm, lobes 0.8–9mm ..... 14  
 + Flowers large; corolla tube 7–130mm, lobes 7–20mm ..... 15
14. Flowers in narrow or broad terminal panicles, cymes or corymbs; corolla tube 1.3–3mm, lobes 0.8–2.5mm ..... **10. Premna**



- + Flowers in narrow terminal and axillary panicles; corolla tube 3–5mm, lobes 2–9mm ..... **15. Caryopteris**
- 15. Tree 10–20m; corolla brownish-yellow, tube funnel-shaped with broad mouth, limb strongly asymmetric with enlarged lower lip; stamens shortly exserted ..... **12. Gmelina**
- + Shrub 1–3m, or climber or tree to 6m; corolla white, cream, blue, pink or red, tube slender with narrow mouth, limb  $\pm$  rotate with subequal lobes; stamens long-exserted ..... **13. Clerodendrum**
- 16. Flowers in compact rounded axillary cymes; calyx unlobed or shortly 4-lobed ..... **8. Callicarpa**
- + Flowers in broad terminal panicles 10–45cm diameter; calyx distinctly 5–6-lobed ..... 17
- 17. Large tree to 50m; leaves 15–30cm broad; panicles 20–45cm broad; stamens 5–6 ..... **9. Tectona**
- + Small tree 5–10m; leaves 4–9cm broad; panicles 10–20cm broad; stamens 4 ..... **10. Premna (*P. bengalensis*)**

### 1. VERBENA L.

Perennial herbs, woody at base. Leaves opposite, simple, pinnatifid or coarsely toothed. Flowers sessile, in elongate terminal and axillary spikes. Calyx tubular, shortly 5-lobed. Corolla tubular below, limb weakly 2-lipped, 5-lobed. Stamens 4, in 2 pairs; anthers included in corolla tube. Ovary 1-celled, 4-lobed; style short; stigma weakly 2-lobed. Fruit of 4 oblong 1-seeded nutlets.

- 1. Leaves ovate in outline, attenuate at base, deeply pinnatifid or coarsely doubly serrate; spikes long, slender; bracteoles 2.5mm; corolla tube 3.5–4mm ..... **1. V. officinalis**
- + Leaves oblong-elliptic in outline, rounded and semi-amplexicaul at base, unlobed but coarsely serrate; spikes short, dense; bracteoles 4–6mm; corolla tube 8–10mm ..... **2. V. rigida**

**1. V. officinalis** L. Eng: *Vervain*. Fig. 84a–c.

Erect or decumbent herb 20–70cm; stems stiffly hairy. Leaves ovate in outline, deeply pinnatifid or coarsely doubly serrate, 2–8 × 1.5–5cm, base attenuate, sessile, margins bluntly toothed. Spikes slender, 5–25cm; flowers subtended by lanceolate bracteoles 2.5mm. Calyx 2.5–3mm, including short lobes, pubescent. Corolla pale mauve or purple; tube 3.5–4mm, hairy within throat; limb 5-lobed, weakly bilabiate, 2–2.5mm. Fruit c 2mm.

**Bhutan:** S – Chukka and Gaylegphug districts, C – Thimphu, Punakha,

Tongsa and Tashigang districts, N – Upper Mo Chu district; **Darjeeling:** Darjeeling, Lebong. Field margins, roadsides, grassy banks and wasteground, 1220–2470m. March–November.

An occasional agricultural weed (272).

## 2. *V. rigida* Sprengel; *V. venosa* Gilbert

Erect perennial herb 15–50cm, scabrous-pubescent throughout; stems rigid, quadrangular; roots tuberous. Leaves oblong-elliptic, 5–8 × 1–2.5cm, acute, sessile, base rounded, half sheathing on stem, margins coarsely sharply serrate. Flowers sessile in terminal branched spikes 1–5cm; lateral spikes on peduncles 1–2cm; bracteoles 4–6mm. Calyx c 4mm, shortly lobed. Corolla purple; tube 8–10mm, pubescent; lobes c 2mm. Fruit c 1.8mm, enclosed by persistent calyx which is contracted at apex.

**Sikkim:** locality unknown. Introduced weed, probably escaped from cultivation, 1830m. August.

Native of S America, cultivated as an ornamental, known in our area only from an unlocalised Treutler specimen.

## 2. LANTANA L.

Shrubs, sometimes armed with hooked prickles. Leaves opposite, simple, often rugose. Flowers sessile in dense axillary pedunculate bracteate spikes or heads. Calyx thin, shortly tubular at base, 2-lobed. Corolla with long cylindrical tube; limb weakly 2-lipped, asymmetric, 4–5-lobed. Stamens 4 in 2 pairs; anthers not exerted. Ovary 2-celled; style short; stigma unequally bilobed. Fruit a fleshy drupe with two 1-seeded stones.

1. *L. camara* L.; *L. aculeata* L., *L. mista* L. Nep: *Barra Mase*; Eng: *Lantana*. Fig. 84d.

Sprawling or scrambling shrub 1–3m, often forming thickets; stems quadrangular, glabrous or roughly hairy and with recurved prickles. Leaves foetid when crushed, ovate, 4–9 × 3–5cm, acute, base truncate or attenuate, margin serrate-crenate, upper surface scabrous, lower surface stiffly hairy and with sparse minute gland dots; petiole 1–3cm, hairy. Flowers showy, in round flat-topped heads 2–3cm diameter, in axils of upper leaves; peduncle stout, 2–7.5cm; bracts lanceolate, 3–5mm, hairy. Calyx with short tube 1.5mm and 2 triangular lobes c 0.5mm. Corolla white, creamy, yellow, orange, pink or red, with buds at centre of head darker; tube cylindrical 9–10mm, pubescent outside; lobes 4–5, unequal, rounded, c 2mm. Drupes black, shiny, c 5mm diameter.

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FIG. 84. **Verbenaceae.** a–c, *Verbena officinalis*: a, habit (× ¼); b, inflorescence (× 2); c, fruit (× 10). d, *Lantana camara*: portion of flowering shoot (× ⅓). e, *Callicarpa arborea*: flowering shoot (× ⅓). f, *Tectona grandis*: fruit (× 1). g–i, *Vitex negundo*: g, leaf and inflorescence (× ⅓); h, dissected flower (× 4); i, fruit (× 4). Drawn by M. Bates.



**Bhutan:** S – Phuntsholing, Gayleghug, Sarbhang and Deothang districts; **Darjeeling:** common in foothills and terai, eg. at Jaldhaka, Rambh Chhu, Mongpu, Rayeng; **Sikkim:** Rongni Chhu between Raniphul and Singtam. Occasionally cultivated and commonly naturalised on degraded hillsides, roadsides, etc. 250–600m. May–August.

Native of tropical America; some showy forms are cultivated as ornamentals, but the plant is generally regarded as an invasive weed; foliage poisonous to stock. Both armed and unarmed plants occur in the East Himalaya: those with glabrous unarmed stems belong to var. **camara**; those with prickly stems (by far the commonest form) belong to var. **aculeata** (L.) Moldenke.

### 3. LIPPIA L.

Similar to *Lantana* but fruit dry, dehiscing into 2 stones.

1. **L. alba** (Miller) Britton & Wilson; *L. geminata* Humboldt, Bonpland & Kunth, *L. asperifolia* A. Richard, *nom. illeg.*

Small aromatic subshrub 1–1.5m; stems ribbed, whitish hairy. Leaves lemon-scented when crushed, finely rugose, ovate-lanceolate, 3.5–7 × 2–3.5cm, acute, base cuneate, margins finely crenate-serrate, 3-veined at base, softly greyish hairy on both surfaces; petiole 5–8mm. Flowers fragrant, in dense subglobose or ovoid-cylindric heads 1–2 × 1–1.5cm; peduncles 1 per axil, 1–2cm; bracts ovate-acuminate, 3–4mm, villous. Calyx 2-lobed almost to base, lobes c 1.3mm. Corolla lilac or pink, tube narrow, 3.5–4mm; lip large, c 2mm, other lobes c 0.7mm. Fruit depressed-globose, c 2mm diameter, with persistent appressed calyx lobes.

**Sikkim:** locality unknown. Introduced weed. March.

Native of tropical America. Sometimes united with *Lippia javanica* (Burman f.) Sprengel, which is an African species with more numerous smaller heads in each axil. Often confused with *Lantana indica* Roxb., which has more coarsely crenate-serrate leaves, broader flower heads 1.5–2cm diameter, larger bracts 8–13mm, and fleshy fruit, but is not yet known from our area.

### 4. PHYLA Loureiro

Prostrate herbs. Leaves opposite, simple. Flowers sessile in compact heads. Calyx thin, shortly tubular at base, 2-lobed. Corolla with cylindrical tube, limb unequally 5-lobed, weakly 2-lipped. Stamens 4 in 2 pairs; anthers not exerted. Ovary 2-celled; style short; stigma capitate. Fruit a dry capsule splitting into two 1-seeded stones.

1. **P. nodiflora** (L.) Greene; *Lippia nodiflora* (L.) Michaux. Eng: *Fog Fruit*.

Perennial creeping herb, rooting at nodes, ± woody at base; stems ribbed,

stiffly whitish appressed-hairy with medifixed hairs. Leaves with thick texture, spatulate, 1–4 × 0.5–1.5cm, obtuse, attenuate at base, margin serrate-dentate in upper half, lateral veins obscure, densely clothed on both surfaces with thick appressed medifixed hairs; petiole 3–7mm. Heads ovoid or cylindrical, compact, 6–12mm diameter, on peduncles 1–5cm; bracts obovate, mucronate, 2–2.5mm, hairy. Calyx tube short, 0.5mm; lobes 0.8mm, hairy. Corolla white to purple, with cylindrical tube c 2mm and 5 unequal lobes 0.2–0.4mm. Stones paired, 1.3mm long, with inconspicuous persistent calyx.

**Bhutan:** C – Mongar district (Yayung Research Site); **Darjeeling:** Rangit valley, Torsa River. Weed of wasteground, roadsides, paddy-fields, etc. 600–900m. March–July.

Probably native to tropical America; occasionally cultivated as a tropical ground-cover plant.

## 5. STACHYTARPHETA Vahl

Coarse perennial herbs, woody at base, or small shrubs. Leaves opposite, simple. Flowers sessile, borne in pits in stout rachis of elongate terminal bracteate spikes. Calyx thin, 4-ribbed, shortly 4–5-toothed. Corolla with slender curved tube; limb oblique, 5-lobed. Stamens 2; anthers included; staminodes 2. Ovary 2-celled; style long, filiform, exserted; stigma capitate, flat-topped. Fruit a capsule sunk in pit in stout rachis, enveloped by thin persistent calyx, splitting into two 1-seeded stones.

1. Leaves sharply toothed; corolla dark blue ..... **1. *S. urticifolia***  
 + Leaves bluntly toothed; corolla pale blue ..... **2. *S. cayennensis***

### **1. *S. urticifolia*** (Salisbury) Sims. Eng: *Dark Blue Snakeweed*.

Coarse herb, woody at base, or subshrub 0.8–2m; stems glabrous or sparsely hairy. Leaves thin, turning blackish when dry, ovate to elliptic, 3–10 × 2–5cm, acute, base cuneate or attenuate, margin closely serrate with sharp spreading teeth, glabrous except for sparse hairs on veins beneath; petiole 3–15mm. Spikes long, slender, 8–32cm; peduncle 1–2cm. Flowers subtended by a single lanceolate, subulate-tipped bract, 3–4mm. Calyx tube 4-ribbed, 5–6mm, with 4 short teeth 0.5mm. Corolla dark blue; tube slender, c 6mm, curved; lobes rounded 3–4mm. Capsule ellipsoid, 3–3.5mm, embedded in pit in rachis and subtended by persistent bract.

**Darjeeling:** terai at Jalpaiguri. Roadsides and river banks in terai, 100m. August–October.

### **2. *S. cayennensis*** (Richard) Schauer

Similar to *S. urticifolia* but stems pubescent; leaves more bluntly crenate-serrate; calyx 5-lobed, with 4 equal outer lobes and a smaller inner tooth; corolla pale blue.

**Darjeeling:** below Takvar and Great Rangit opposite Manjhitar. River shingle and roadsides, 440–920m. July–August.

## 6. PETREA L.

Woody twiners or subshrubs. Leaves opposite, simple. Flowers in lax axillary racemes, actinomorphic. Calyx with short tube; limb showy, much exceeding corolla, with 5 long lobes and 5 short scales in throat. Corolla tubular at base; limb subequally 5-lobed. Stamens 4; anthers shortly exerted. Ovary 2-celled; style short; stigma asymmetrically capitate. Fruit dry, indehiscent, enclosed by enlarged calyx, 1–2-seeded.

### 1. *P. volubilis* Jacquin. Eng: *Queen's Wreath*.

Woody twiner or subshrub to 10m; stems puberulous. Leaves rigid, elliptic, 5–15 × 2.5–7cm, acute or shortly acuminate, base rounded, margin entire, veins prominent on both surfaces, finely scabrid on both surfaces; petiole 5–10mm. Racemes 3–18cm, rachis puberulous; bracts filiform 6–7mm; pedicels slender 4–15mm. Flowers pale blue to purple. Calyx tube c 3mm, hairy; lobes membranous, linear, 14–16 × 2.5–3mm, obtuse, puberulous. Corolla tube 6–7mm; lobes oblong, 5–6mm, obtuse, puberulous. Fruit c 4mm, enclosed by persistent calyx tube and with enlarged calyx lobes 15–20mm.

**Bhutan:** S – Phuntsholing district (Phuntsholing); **Darjeeling(?):** Bankipore. Cultivated in gardens, 250m. February–March.

Native of tropical America, cultivated as an ornamental vine.

## 7. DURANTA L.

Shrubs; older shoots armed with straight spines. Leaves opposite or whorled. Flowers in curved terminal and axillary racemes. Calyx 5-ribbed, shortly 5-toothed. Corolla tubular at base; limb 2-lipped, 5-lobed, middle lobe of lower lip larger. Stamens 4; anthers included. Ovary 8-celled; style slender, included; stigma capitate. Fruit a drupe with 4 2-seeded stones, closely enveloped by enlarged persistent calyx.

### 1. *D. erecta* L.; *D. plumieri* Jacquin, *D. repens* L.

Shrub 2–5m; stems quadrangular, finely appressed pubescent; older shoots with straight axillary spines 15–22mm. Leaves membranous, obovate or elliptic, 2.5–8 × 1.5–4cm, acute, base cuneate or attenuate, margin serrate in upper half, rarely entire, glabrous above, sparsely appressed pubescent on veins beneath; petiole 3–11mm. Racemes slender, curved, 4–10cm; bracts linear, 1–2mm; pedicels short 2–3mm. Flowers blue with white eye. Calyx tube c 3.5mm, appressed pubescent, lobes short, 0.5mm, acute. Corolla tube cylindrical

6–7mm; lobes unequal, 3–4mm. Fruit orange, globose, c 8mm diameter, closely enveloped by beaked persistent calyx; pedicels often curved.

**Bhutan:** S – Phuntsholing district (Phuntsholing); **Darjeeling:** Darjeeling, Takvar; **Sikkim:** Gangtok, Tadong. Cultivated in gardens and hedgerows, 200–1650m. April–October.

Native of Central America, often cultivated as a hedge plant.

## 8. CALLICARPA L.

Trees or shrubs, with mealy, stellate or branched indumentum, sometimes with shiny gland-dots. Leaves opposite, rarely whorled. Flowers small, in lax axillary cymes. Calyx shortly campanulate, entire or minutely 4-lobed. Corolla campanulate or tubular at base; limb not bilabiate, equally 4-lobed. Stamens 4; anthers exerted. Ovary 2-celled; style slender; stigma swollen, slightly bifid. Fruit a small globose drupe, with 4 or fewer 1-seeded stones, subtended by persistent but not enlarged calyx.

Specimens of *C. lobata* Clarke labelled ‘Sikkim’ originate from temperate NE Nepal. It is a distinctive species with suborbicular palmately lobed leaves 30–40cm diameter, on long petioles 10–20cm.

- |   |                          |
|---|--------------------------|
| 1. Leaves entire or almost so; petioles 3–8cm .....   | 2                        |
| + Leaves crenate, serrate or serrulate; petioles 0.3–1.8cm .....  | 3                        |
| 2. Branchlets closely yellowish stellate-hairy; leaves closely yellowish stellate-tomentose beneath, cuneate at base .....                  | 1. <i>C. arborea</i>     |
| + Branchlets thickly brownish villous with long branched hairs; leaves thickly and softly white tomentose beneath, mostly rounded at base . | 2. <i>C. vestita</i>     |
| 3. Leaves narrowly cordate at base; petiole 3–6mm .....   | 5. <i>C. rubella</i>     |
| + Leaves attenuate or narrowly rounded at base; petiole 8–18mm .....  | 4                        |
| 4. Leaves narrowly rounded at base, stellate tomentose or villous beneath   |                          |
|   | 3. <i>C. macrophylla</i> |
| + Leaves attenuate at base, stellate pubescent only on veins beneath  |                          |
|   | 4. <i>C. longifolia</i>  |

1. *C. arborea* Roxb. Dz: *Khalema* (38); Nep: *Guenla* (38), *Gwelo*, *Guenylo*, *Guenyhlo* (34); Lepcha: *Suna-kung* (34). Fig. 84e.

Tree 5–10(–20)m; branchlets closely yellowish stellate tomentose. Leaves coriaceous, ovate-elliptic, 11–28 × 5–13cm, acuminate, base cuneate, margin entire, almost glabrous above, closely yellowish stellate tomentose beneath, with hidden small yellow gland-dots; petiole 3–7cm. Flowers in rounded axillary cymes 7–14cm; peduncle 3–6cm; bracts minute, linear, 1–1.5mm; pedicels 0.5mm. Calyx funnel-shaped, tube c 0.5mm, stellate pubescent, lobes shallow.

Corolla pinkish or mauve, tube 2–2.5mm; lobes 1mm. Drupes black or purple when ripe, globose, c 3mm.

**Bhutan:** S – Phuntsholing, Chukka and Gaylegphug districts, C – Mongar and Tashigang districts; **Darjeeling:** terai and foothills, Sivok, Siliguri, Rayeng, Darjeeling, Mahanadi; **Sikkim:** Rangpo Chhu, Pandam, Gangtok, Rumtek. Subtropical and terai forests, 250–1520m. April–June.

Records of *C. tomentosa* (L.) Murray from Bhutan (38) refer to this species. Wood is used for fuel and charcoal (34).

## 2. *C. vestita* Wall. Nep: *Guenyhlo* (34).

Similar to *C. arborea* but branchlets brown-villous with long soft branched hairs; leaves ovate with usually rounded base; lower surface thickly and softly white villous with long branched hairs; cymes 4–8cm; bracts 2–5mm; calyx tube with only a few stellate hairs; corolla tube 1.3–1.8mm.

**Bhutan:** S – Sarbhang, Gaylegphug and Deothang districts; **Darjeeling:** Tista valley, Ryang Chhu, Farseng, Kalimpong, Badamtam, Pankhabari, Mongpu, Sittong; **Sikkim:** Melli. Subtropical forests, 400–1400m. May–July.

## 3. *C. macrophylla* Vahl

Evergreen shrub or small tree to 6m; branchlets densely white stellate-villous. Leaves coriaceous, elliptic or ovate-elliptic, 11–22 × 4–10cm, acute or acuminate, base narrowly rounded, margin serrate to crenate, stellate above, becoming glabrous, densely white stellate villous or tomentose beneath; petiole 9–18mm. Flowers in dense axillary cymes 2–5cm; peduncle 1–2cm; pedicels 0.3–0.5mm. Calyx tube funnel-shaped, 1–1.5mm, tomentose and gland-dotted; lobes very shallow. Corolla white, pink or mauve; tube 2.4–2.6mm, gland-dotted; lobes c 1mm. Drupes white, globose, 3–4mm.

**Bhutan:** S – Phuntsholing district (above Phuntsholing); **Darjeeling:** Jalpaiguri, Siliguri, Kali Khola, Rangit, Tista, Darjeeling, Gok. Terai and subtropical forests, 300–600m. May–July.

The specimen from Phuntsholing differs in having branchlets tomentose not villous and broader ovate leaves. A second, unlocalised specimen collected in Bhutan by Griffith was described as var. *griffithii* Clarke and differs in its leaves becoming glabrous beneath.

## 4. *C. longifolia* Lamarck; *C. lanceolaria* Roxb., *C. longifolia* var. *lanceolaria* (Roxb.) Clarke. Nep: *Sanu Guenyhlo* (34).

Similar to *C. macrophylla* but branchlets stellate pubescent; leaves elliptic, 9–16 × 3–5cm, acuminate, attenuate at base, stellate pubescent on veins beneath; cymes 2–3cm on short peduncle 3–7mm; corolla tube 0.8–1mm, lobes c 0.5mm.

**Bhutan:** S – Gaylegphug district (Gaylegphug (38)); **Darjeeling:** Mal Forest and Jaldakar. Terai forests, 270–300m. August–December.



**5. *C. rubella* Lindley. Dz: *Nangay Wam*.**

Deciduous shrub 1–4m; branchlets stellate tomentose. Leaves thinly coriaceous, oblong-elliptic, 7–17 × 2–4cm, acuminate, base narrowly cordate, margins crenate-serrate, pubescent above with simple and stellate hairs, stellate pubescent and gland-dotted beneath; petiole 3–6mm. Flowers in compact axillary cymes 1.5–4cm; peduncle 0.5–1.5cm; bracts 0.5–1.5mm; pedicels c 1mm. Calyx funnel-shaped, stellate and gland-dotted; tube c 1mm; lobes short, c 0.3mm. Corolla pink or purple, tube 1.8–2mm; lobes 0.8mm, gland-dotted. Drupes purple, globose, 3–4mm diameter.

**Bhutan:** C – Punakha district (Mendegang, Rinchu, Tinlegang, etc.); **Darjeeling:** Mongpu. Warm broad-leaved forests, 610–1830m. June–August.

**9. TECTONA L.f.**

Trees; indumentum stellate. Leaves large, opposite or whorled, entire. Flowers small, shortly pedicellate, numerous in broad terminal panicles. Calyx campanulate, 5–6-lobed. Corolla tube short; limb ± equally 5–6-lobed. Stamens 5–6, inserted on corolla tube; anthers exerted. Ovary 4-celled; style slender; stigma shortly bifid. Fruit a drupe, 4-celled, with one 1–4-seeded stone, enclosed by persistent inflated bladder-like calyx.

**1. *T. grandis* L.f. Nep: *Sagwan* (34), *Sagun*; Lepcha: *Ripnyok*; Eng: *Teak*. Fig. 84f.**

Deciduous tree to 50m; branchlets quadrangular, finely matted with whitish stellate hairs. Leaves opposite or occasionally in whorls of 4, broadly ovate, elliptic or obovate, 20–40 × 15–30cm, acute or obtuse, base attenuate, smooth or scabrid above, finely stellate-tomentose beneath; petiole 1–3cm. Panicles large, to 45cm long and broad, stellate tomentose; bracts lanceolate, deciduous 5–10mm; pedicels 2–3mm. Calyx tube c 1mm, lobes 1.5–1.7mm, tomentose outside. Corolla white, with short tube c 1mm and rounded lobes 2–2.5mm. Drupe depressed globose, c 12mm diameter, thickly hirsute, enclosed in membranous bladder-like calyx 2–2.5cm diameter.

**Bhutan:** S – Phuntsholing and Gaylegphug districts, cultivated; **Darjeeling:** foothills and terai, cultivated, eg. at Badamtam and Bamanpokri; **Sikkim:** Rangpo to Melli. Timber plantations, 250–300m. July–August.

Cultivated for its very valuable, strong, durable timber used in house construction, furniture-making, shipbuilding etc. Leaves used as plates and yield a dye (48).

**10. PREMNA L.**

Trees or shrubs, rarely a stemless subshrub, sometimes epiphytic or climbing; indumentum of simple, rarely stellate, hairs. Leaves opposite. Flowers sessile or

pedicellate, small, in terminal, dense, spike-like to wide-branched, corymbose cymes or panicles. Calyx funnel-shaped, entire or shortly 2–5-toothed, sometimes weakly 2-lipped. Corolla shortly tubular at base; limb weakly to strongly bilabiate, 4–5-lobed. Stamens 4; anthers exserted. Ovary 2–4-celled; style slender, exserted or included, bifid. Fruit a drupe, with one 1–4-celled stone, 1–4-seeded, subtended by persistent calyx.

1. Stemless subshrub with 2–6 leaves ..... **8. P. herbacea**  
+ Shrubs, woody climbers or trees with numerous leaves ..... 2
2. Calyx subentire or shallowly 2-lobed ..... 3  
+ Calyx distinctly 4–5-lobed ..... 5
3. Leaf base rounded; petioles 2.5–5cm; flowers in broad corymbs  
**3. P. scandens**  
+ Leaf base cuneate or attenuate; petioles 0.2–1.3cm; flowers in dense clusters aggregated into condensed panicles or branched interrupted spikes ..... 4
4. Leaves obovate, subsessile or with short petiole to 5mm; flower clusters forming narrow interrupted panicles 1.5–2.5cm broad; corolla tube 2.5–2.8mm ..... **1. P. interrupta**  
+ Leaves ovate-elliptic, on petioles 7–13mm; flower clusters forming interrupted spikes aggregated into broad panicles up to 15cm broad; corolla tube 1.3–1.6mm ..... **2. P. bracteata**
5. Young growth, leaf midribs, leaf veins and panicles densely stellate-pubescent ..... **4. P. bengalensis**  
+ Plants with only simple hairs ..... 6
6. Leaves usually serrate towards apex; corymbs usually 2–5cm broad; calyx lobes 4, c 1mm ..... **5. P. barbata**  
+ Leaves entire throughout; corymbs or panicles 3.5–17cm broad; calyx lobes (4–)5, 0.3–0.5mm ..... 7
7. Leaves turning black when dry, cuneate at base; corolla 5-lobed, strongly bilabiate ..... **6. P. mucronata**  
+ Leaves remaining green when dry, rounded or shallowly cordate at base; corolla 4-lobed, weakly bilabiate ..... **7. P. lucidula**

### 1. *P. interrupta* Schauer

Large shrub 2–6m, often epiphytic or climbing; branchlets pubescent when young, soon glabrous. Leaves thinly coriaceous, obovate, 12–21 × 5–10cm, apiculate, base attenuate, margin entire, glabrous; petiole 2–5mm. Flowers

fragrant, sessile, in dense clusters forming narrow condensed interrupted terminal panicles 6–15 × 1.5–2.5cm; bracts few, c 6mm. Calyx glabrous, tube 1.6–2mm; lobes 2, rounded, c 0.8mm. Corolla white, tube 2.5–2.8mm, hairy in throat; lobes 4, rounded, 1.5–2mm. Style c 3.5mm. Drupe dark red, globose 3–4mm.

**Bhutan:** S – Chukka district, C – Punakha, Tongsa and Mongar districts; **Darjeeling:** Darjeeling, Rambhi Chhu, Ging, Sureil; **Sikkim:** Yoksam, Lachen. Cool broad-leaved forests, 2000–2400m. May–July.

## 2. *P. bracteata* Clarke

Tree 5–10m; branchlets finely greyish puberulous; leaves thin, ovate-elliptic, 11–19 × 5.5–9.5cm, abruptly acuminate, base rounded or cuneate, margin entire, glabrous, finely reticulate on both surfaces; petiole 7–13mm. Flowers pale green or white, sessile, in dense clusters forming interrupted spikes aggregated into broad panicles up to 15 × 15cm; bracts ovate-triangular, 3–3.5mm. Calyx cup-shaped, 2mm including 2 short rounded lobes, pubescent. Corolla tube 1.3–1.6mm; limb with 3 reflexed lobes c 1mm and broader shallowly bifid lip. Fruit not seen.

**Bhutan:** S – Chukka district (Marichong); **Darjeeling:** foothills, Birik, Tista, Pankhabari, Kurseong, Chunabati; **Sikkim:** Rhenok. Subtropical forests, 600–1000m. May.

## 3. *P. scandens* Roxb.; ?*P. coriacea* Clarke var. *oblonga* Clarke. Nep: *Genauri* (34), *Ginari Lahara*; Lepcha: *Chepchurldum* (34).

Large woody climber; branchlets glabrous. Leaves leathery, oblong-elliptic, 11–21 × 4–9cm, abruptly acuminate or caudate, base rounded, margin entire, glabrous on both surfaces, reticulate; petiole 2.5–5cm. Flowers in broad corymbs 10–20cm diameter, closely villous; peduncle 2–5cm; bracts linear, to 2mm; pedicels 0.5mm. Calyx cup-shaped, 1–1.2mm, pubescent or almost glabrous, very shallowly 2-lobed. Corolla white, tube c 2mm, hairy within; lobes 4, subequal, 1.3mm. Stamens exserted. Fruit black, globose, c 4mm.

**Bhutan:** S – Phuntsholing district (above Phuntsholing); **Darjeeling:** Darjeeling, Siliguri, Pankhabari, Garidhura. Subtropical and terai forests, 150–600m. May–June.

## 4. *P. bengalensis* Clarke. Nep: *Gineri*, *Seti Guenyhlo* (34).

Small tree 5–10m; branchlets densely stellate-pubescent. Leaves thin, ovate-elliptic, 13–25 × 4–9cm, acuminate, base cuneate, margin entire, stellate on midrib and veins on both surfaces; petiole 1.3–4.5cm. Flowers in broad terminal panicles 9–15 × 10–20cm; peduncle densely stellate pubescent; bracts lanceolate c 1.5mm; pedicels 1–1.5mm. Calyx stellate pubescent, tube c 2mm; weakly bilabiate, lobes 5, c 0.5mm. Corolla white, tube c 3mm, hairy in throat; limb strongly bilabiate, lobes c 2.5mm, upper lip rounded, lower lip 3-lobed. Stamens shortly exserted. Fruit globose, c 4mm, subtended by cup-shaped stellate

pubescent calyx.

**Bhutan:** S – Deothang district (between Samdrup Jongkhar and Deothang); **Darjeeling:** Sivok, Siliguri, Sukna, Darjeeling. Subtropical and terai forests, often on river banks, 150–550m. May–June.

**5. *P. barbata*** Schauer. Nep: *Gineri* (34).

Deciduous shrub or small tree 2.5–6m; branchlets pubescent with whitish crispate hairs. Leaves thin, ovate to elliptic, 6–18 × 2.5–9cm, finely acuminate, base cuneate, rounded or shallowly cordate, margins irregularly serrate in upper 1/3 to almost entire, palmately 3–5-veined at base, crispate pubescent on veins when young, often becoming glabrous; petiole 1–3cm. Flowers appearing with young leaves, in terminal corymbs 2–5cm diameter, pubescent and minutely scaly; peduncle 1–4cm; bracts minute; pedicels 1–1.5mm. Calyx cup-shaped, tube c 2mm; lobes 4, subequal, c 1mm, rounded. Corolla greenish-white, tube 2.5–3mm, hairy in mouth; lobes 4, subequal, c 2.5mm. Stamens exserted. Drupe black when ripe, obovoid, 5–6mm diameter.

**Bhutan:** S – Chukka district (Marichong) and Gaylegphug district (Tatapani and Aie Bridge), C – Tongsa district (between Tongsa and Shamgong); **Darjeeling:** Pul Bazar, Rambhi Chhu, Kurseong, Pankhabari, Daling, Sureil, Sitong, Mongpu, Panchkilla, Peshok; **Sikkim:** Dentam to Pemayangtse (69). Subtropical and terai forests, 270–1100m April–May.

Leaves variable in size and degree of serration; var. **anodon** Clarke from Sikkim (Singtam to Gangtok, Rhenok) and Darjeeling (Kalimpong and Tista valley) has leaves almost entire and is close to *P. lucidula* which differs in its broader corymbs 10–17cm diameter.

**6. *P. mucronata*** Roxb.; *P. latifolia* Roxb. var. *mucronata* (Roxb.) Clarke. Nep: *Gineri* (34).

Shrub or tree 7–15m; branchlets pubescent and minutely scaly when young. Leaves thin, becoming blackish when dry, ovate, 7–19 × 3.5–9cm, acuminate, base cuneate, margin entire, densely pubescent beneath, pubescent on veins above; petiole 0.8–2.5cm. Flowers in broad, rounded, terminal panicles 3–8 × 3.5–11cm, on peduncle 1–3cm; bracts lanceolate 1–3mm; pedicels 0.4–0.8mm. Calyx tube c 1mm, pubescent; lobes 5, subequal, c 0.5mm. Corolla white, tube c 2mm, hairy in throat; limb 2-lipped; lower lip 3-lobed, 2.5mm, upper lip 2-lobed, 1mm. Anthers exserted. Fruit black, globose, c 5mm diameter.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Gaylegphug district (Gaylegphug, 38), C – Tashigang district (Gamri Chu); **Darjeeling:** Kalabari, Siliguri, Kalimpong, Tondu, Takvar, Pankhabari, Tista, Badamtam; **Sikkim:** Ligship. Subtropical forests and hot dry valleys, 270–1080m. March–May.

**7. *P. lucidula*** Miquel; *P. hamiltonii* Ellis, *P. flavescens* Clarke non Jussieu.

Similar to *P. mucronata* but leaves not turning black when dry, 7–12.5 × 4.5–7cm, base rounded or shallowly cordate, villous to almost glabrous beneath; petiole 2–3cm; calyx tube c 1.5mm, lobes 4 or 5, shallow, c 0.3mm; corolla tube 2.5mm, lobes 4, subequal, c 1.5mm.

**Darjeeling:** Chunabati, Rayong, Darjeeling; **Sikkim:** between Gangtok and Temi (71). Habitat not recorded, 900m. June–July.

**8. P. herbacea** Roxb.; *Pygmaepremna herbacea* (Roxb.) Moldenke

Dwarf subshrub with woody rootstock and very short pubescent stems 2–4cm. Leaves crowded in 1–3 pairs, obovate, one pair small, 3–5 × 1.5–3cm, 1–2 pairs large, 5–12 × 1.5–7cm, apex rounded, base attenuate, sessile, margins crenate-dentate in upper half, pubescent on margins and veins beneath. Flowers in solitary terminal cyme 1.5–2.5cm diameter; peduncle 3–12mm, pubescent and minutely scaly; bracts lanceolate, c 2mm; pedicels 0.5–1mm. Calyx pubescent and minutely scaly, tube c 2mm; lobes 5, c 0.5mm, unequal. Corolla greenish-white, tube c 2mm, densely hairy within; limb weakly bilabiate with broader lower lip weakly retuse and 3 narrower lobes c 1.8mm. Stamens included. Fruit globose, c 3mm diameter.

**Darjeeling:** Dalka Jhar, Torsa terai; **Assam:** S of Deothang. Terai grasslands. April–May.

The record from Bhutan (80) is based on the *Griffith* specimen from the Assam terai.

## 11. VITEX L.

Shrubs or trees. Leaves opposite, palmately 3–5-foliolate. Flowers pedicellate, in terminal and axillary panicles or dichasial cymes. Calyx campanulate, not or weakly 2-lipped, shortly 5-toothed. Corolla tubular at base; limb 5-lobed, lower lobe (lip) larger. Stamens 4, in 2 pairs; anthers exerted. Ovary 2–4-celled; style long, slender, exerted; stigma bifid. Fruit a drupe, 1–4-celled, each cell with 1 seed, subtended by persistent calyx.

1. Inflorescence of panicles with distinct main axis, borne terminally and/ or in upper leaf axils ..... 2
- + Inflorescence of dichasial cymes, borne only in upper leaf axils ..... 5
2. Panicles all axillary; leaflets always 3, glabrous; petioles of juvenile leaves sometimes winged ..... **2. V. peduncularis**
- + Panicles terminal and axillary; leaflets 3–5 (if 3, then pubescent); petioles all unwinged ..... 3
3. Leaflets narrowly lanceolate, 1–2.5cm broad, densely matted white tomentose beneath ..... **1. V. negundo**
- + Leaflets ovate to elliptic, mostly 3.5–10cm broad, glabrous, pubescent or tomentose beneath but not white ..... 4
4. Leaflets mostly 5, glabrous or sparsely pubescent beneath; terminal petioles 12–30mm ..... **3. V. quinata**

- + Leaflets mostly 3, stiffly pubescent beneath; terminal petiolules 1–6mm  
4. **V. pinnata**
5. Leaflets acuminate, with dense gland-dots beneath; lateral petiolules 2–6mm; cymes mostly 2 per axil ..... 5. **V. burmensis**
- + Leaflets bluntly pointed, eglandular beneath; lateral petiolules 7–17mm; cymes 1 per axil ..... 6. **V. glabrata**

**1. V. negundo** L. Nep: *Sewali* (34), *Simali*. Fig. 84g–i.

Shrub or small tree 2–10m; branchlets minutely white tomentose. Leaves palmately compound; leaflets 3–5, narrowly lanceolate, terminal one 5–12 × 1–2.5cm, acuminate, base cuneate, glabrous above, densely matted white tomentose beneath, eglandular; petiole unwinged, 1.6–6cm; terminal petiolule 9–20mm, lower lateral leaflets ± sessile. Flowers in long slender panicles 10–26 × 2–4cm, terminal and in upper leaf axils; branches cymose; peduncle minutely white tomentose; pedicels 0–1.5mm. Calyx tube 2–2.5mm, white tomentose; lobes subequal, c 0.5mm. Corolla violet-blue to purple; tube 5.5–6mm, pubescent in throat; lobes unequal, lip c 4mm, others c 1.5mm. Ovary subglobose. Fruit c 5mm, black when ripe, enclosed by persistent cup-shaped calyx.

**Bhutan:** S – Phuntsholing and Gaylegphug districts, C – Tashigang district; **Darjeeling:** terai and foothills. Cultivated and possibly naturalised on scrubby hillsides, 300–1700m. May–November.

Commonly grown as a hedge-plant. All specimens seen are of var. **negundo** with entire leaflets. Var. **cannabifolia** (Siebold & Zuccarini) Handel-Mazzetti differs in its more elliptic, coarsely crenate-serrate leaflets; it is widespread in Nepal but not yet known in our area.

**2. V. peduncularis** Schauer

Tree 15–20m; branchlets subglabrous. Leaves palmately 3-foliolate; leaflets elliptic to oblong, 9–15 × 3–3.5cm, finely acuminate, base cuneate, glabrous and conspicuously shiny glandular-scaly beneath; petiole 5.5–8cm (sometimes winged on young plants); terminal petiolule 2–15mm; lateral petiolules 0–10mm. Panicles borne in upper leaf axils, slender, 10–22 × 3–5cm, branches cymose; pedicels 0–1mm. Calyx tube c 2mm, pubescent and glandular; lobes 0.4mm. Corolla white; tube c 3mm; lobes unequal, lip 2mm, others 0.8mm. Ovary ovoid. Fruit globose, c 6mm, subtended by persistent saucer-like calyx.

**Darjeeling:** Tookiea Jhar. Terai forests. Altitude and flowering time not recorded.

**3. V. quinata** (Loureiro) Williams; *V. heterophylla* Roxb. Nep: *Panchpate* (34); Lepcha: *Maragak-kung* (34).

Tree 6–10m; branchlets minutely puberulous. Leaves palmately (3–)5-foliolate; leaflets ovate-elliptic, 10–17 × 3–7cm, acuminate, base cuneate entire, glabrous or sparsely pubescent beneath, with minute gland-dots; petiole

6–10cm; terminal petiolule 12–30mm; lateral petiolules 5–25mm. Panicles terminal and axillary, widely branched, 14–25 × 5–12cm, peduncle minutely puberulous. Flowers fragrant. Calyx tube 2.5mm, puberulous and glandular outside; lobes 0.7mm. Corolla white or yellowish with blue lip; tube 6mm, puberulous and glandular outside, hairy in throat; lip 3.5mm, other lobes 2mm. Fruit globose, c 7mm, subtended by saucer-shaped, lobed, persistent calyx.

**Bhutan:** S – Chukka district (Chukka); **Darjeeling:** Mangpong, Pankhabari, Kodabari, Bamanpokhri, Darjeeling, Tista and Rangit valleys; **Sikkim:** Dikchu. Subtropical and warm broad-leaved forests, 300–1200m. May–June.

#### 4. *V. pinnata* L.; *V. pubescens* Vahl

Tree 10–15m; branchlets finely tomentose. Leaves 3-foliolate, thinly coriaceous; leaflets ovate-elliptic, terminal one 8–20 × 4–9cm, shortly bluntly acuminate, base rounded to acute, margin entire, stiffly pubescent above, tomentose and obscurely, sparsely glandular beneath; petiole 2-ribbed, 3–7cm; terminal petiolule 1–6mm; lateral petiolules 0–3mm (leaflets subsessile mostly). Panicles terminal and in uppermost axils, dense, 5–10 × 4–7cm, pubescent. Bracts persistent, 10–13 × 3–4mm or larger. Calyx tube 4.5–5mm, tomentose outside; teeth acute, 1.4mm. Corolla white with blue lip; tube 8mm, tomentose and densely glandular outside, hairy at base within; lip 7.5mm, other lobes 4–4.5mm. Fruit 6–8mm, enclosed by enlarged cup-shaped calyx.

**Darjeeling:** ‘Darjeeling’. Subtropical forests.

Known from our area only from a single Cowan collection.

#### 5. *V. burmensis* Moldenke; *V. lanceolata* P’ei non Turczaninow

Tree to 14m; branchlets densely minutely puberulous. Leaves palmately 3–5-foliolate; leaflets ovate-elliptic, 10–15 × 5–7cm, acuminate, base cuneate, margin entire, sparsely stiffly pubescent and glandular above, puberulous on veins beneath, densely minutely gland-dotted beneath; petiole 4–10cm; terminal petiolule 10–15mm; lateral petiolules 2–6mm. Cymes mostly paired in leaf axils, broad, dichasial, 8–12 × 4–9cm, lax, puberulous. Calyx tube 2.2mm, puberulous and glandular; lobes 0.5mm. Corolla pale pink; tube 6mm, puberulous outside, glabrous within; lip c 3mm, other lobes c 2.5mm. Fruit globose, 7mm diameter, almost completely enclosed by enlarged cup-shaped calyx.

**Bhutan:** C – Mongar district (above Mongar). Evergreen oak forest, 1900m. June.

New to Himalaya; elsewhere found in Upper Myanmar and Yunnan.

#### 6. *V. glabrata* R. Brown

Small deciduous tree 10–12m; branchlets appressed pubescent. Leaves 3–5-foliolate; leaflets elliptic-obovate, 8–17 × 4–10cm, bluntly pointed, base cuneate, margin entire, appressed pubescent on veins beneath, eglandular; petiole 5–9cm; terminal petiolule 18–30mm; lateral petiolules 7–17mm. Flowers in broad, lax, dichasial cymes, borne singly in upper leaf axils, to 15cm long and

broad. Calyx tube 2–2.5mm, pubescent outside; lobes 0.5mm. Corolla white or pinkish, with purple lip; tube 6–7mm; lip 10–12mm; other lobes 5mm. Fruit ellipsoid, fleshy, c  $2 \times 1.3$ cm, subtended by persistent disc-like calyx.

**Darjeeling:** 'Darjeeling'.

Distinct from all other species in its much larger fruit; the single Cowan specimen from 'Darjeeling' may possibly be a mislabelled collection from Chittagong.

## 12. GMELINA L.

Trees or shrubs. Leaves simple, opposite, entire, glandular near base. Flowers large, pedicellate, in terminal and axillary racemiform panicles. Calyx campanulate; limb shortly 5-toothed. Corolla shortly tubular at base; limb oblique, 5-lobed, with enlarged lower lobe forming a lip, other lobes shorter, reflexed. Stamens 4, in 2 pairs; anthers  $\pm$  exserted. Ovary 4-celled; style slender; stigma unequally 2-lobed or unlobed. Fruit a fleshy drupe, 2–4-celled, with one 2–4-seeded stone, subtended by persistent but not enlarged calyx.

**1. G. arborea** Roxb. Nep: *Khamari* (34), *Gamar*, *Gammari*; Lepcha: *Numbong-kung* (34). Fig. 85g–j.

Deciduous tree 10–20m; branchlets stout, glabrous. Leaves simple, ovate-triangular, 8–20  $\times$  8–18cm, shortly acuminate, base truncate or shallowly cordate, margin entire, with 2–4 rounded disc-like glands at insertion of petiole, glabrous above, densely minutely white scaly beneath, often obscured by dense soft tomentum when young; petiole 3–17cm. Flowers often appearing when tree leafless; panicles racemiform, terminal and in upper leaf axils, 8–25  $\times$  3–7cm, tomentose; pedicels 3–7mm. Calyx campanulate, tube 5mm, pubescent; lobes short, acute, 1–1.2mm. Corolla brownish-yellow; tube oblique, 1.5–2cm; lip yellow, obovate, 2  $\times$  1.8cm; other lobes rounded, c 1cm, reflexed. Fruit an obovoid drupe c  $2 \times 1.2$ cm, with persistent calyx.

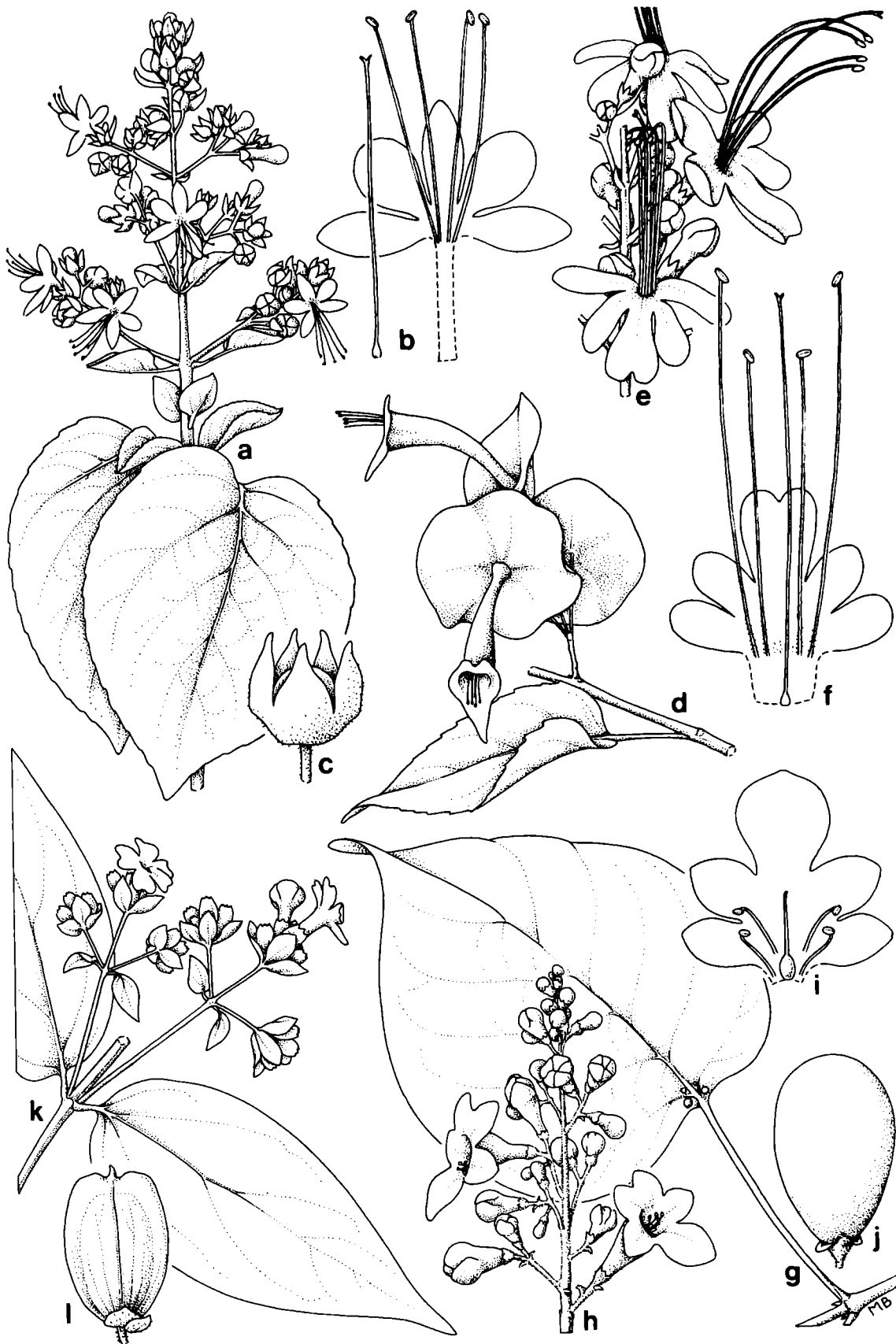
**Bhutan:** S – Phuntsholing, Sarbhang and Gaylegphug districts, native and cultivated; **Darjeeling:** Sivok, Pankhabari, Balasun, Siliguri, Kalijhora, Birik, Tista and Great Rangit valleys; **West Bengal Duars:** Buxa, cultivated. Native in terai and on river banks in foothills; widely cultivated, 250–1700m. February–April.

A fast-growing timber tree; wood durable with many uses including furniture-making (48). A valuable firewood crop (130).

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FIG. 85. **Verbenaceae.** a–c, *Clerodendrum viscosum*: a, leaf and inflorescence ( $\times \frac{1}{4}$ ); b, dissected flower and style ( $\times 1$ ); c, fruit ( $\times 1$ ). d, *Holmskioldia sanguinea*: leaf and inflorescence ( $\times 1$ ). e–f, *Caryopteris bicolor*: e, inflorescence ( $\times 1\frac{1}{2}$ ); f, dissected flower ( $\times 2$ ). g–j, *Gmelina arborea*: g, leaf ( $\times \frac{1}{3}$ ); h, inflorescence ( $\times \frac{1}{2}$ ); i, dissected flower ( $\times \frac{2}{3}$ ); j, fruit ( $\times 1$ ). Drawn by M. Bates.





## 13. CLERODENDRUM L.

Shrubs, small trees or woody climbers; indumentum of simple hairs and often sessile gland dots. Leaves opposite or whorled, sometimes palmately lobed. Flowers in terminal or axillary cymes, corymbs or panicles, sometimes with large bracts. Calyx campanulate at base, limb with 5 teeth or lobes or entire. Corolla with long slender tube; limb not bilabiate, with 5 subequal spreading lobes. Stamens 4; filaments curved; anthers long-exserted. Ovary 4-celled; style filiform; stigma bifid. Fruit a fleshy or almost dry globose drupe with 2 2-celled or 4 1-celled stones, 1–4-seeded.

1. Corolla with long slender tube 7–13cm; leaves deeply 3–5-lobed, or narrowly linear-oblongate 1–3cm broad ..... 2
- + Corolla with short tube 0.7–3.5cm; leaves unlobed, ovate to elliptic, mostly more than 3cm broad ..... 3
2. Leaves deeply 3–5-lobed, 10–19cm broad; stems smooth .. **1. C. hastatum**
- + Leaves narrowly linear-oblongate, 1–3cm broad; stems ribbed  
**2. C. indicum**
3. Leaves entire or sinuate ..... 4
- + Leaves serrate or dentate ..... 8
4. Leaves elliptic or narrowly obovate, attenuate at base; flowers in elongate panicles ..... **3. C. wallichii**
- + Leaves ovate or broadly ovate, cordate, rounded or cuneate at base; flowers in broad corymbs or cymes ..... 5
5. Native erect shrubs or small trees; leaves 13–25 × 11–22cm ..... 6
- + Cultivated scrambling or climbing shrubs; leaves 6–13 × 3.5–8cm ..... 7
6. Leaves pubescent only on veins beneath; bracts inconspicuous, linear, c 5mm; corolla tube 17–20mm ..... **4. C. colebrookeanum**
- + Leaves softly villous beneath; bracts leafy, 10–40 × 34–13mm; corolla tube 30–35mm ..... **5. C. bracteatum**
7. Leaves mostly cordate at base; calyx lobes in flower 3–4mm, green; corolla lobes 12–13mm ..... **6. C. splendens**
- + Leaves mostly cuneate at base; calyx lobes in flower showy, white, 13–20mm; corolla lobes 7–8mm ..... **7. C. thomsonae**
8. Leaves elliptic to obovate, attenuate at base; petiole 0.3–1cm; flowers in elongate panicles ..... **8. C. serratum**
- + Leaves ovate or broadly ovate, cordate or truncate at base; petiole 2–20cm; flowers in rounded corymbs or broad panicles ..... 9

9. Leaves irregularly coarsely dentate; flowers in compact rounded corymbs 4–7cm diameter; corolla lobes usually numerous; stamens absent

**9. *C. chinense***

- + Leaves regularly serrate or serrulate; flowers in broad panicles 6–30cm diameter; corolla lobes 5; stamens present ..... 10

10. Leaves villous and minutely gland-dotted beneath, truncate or shallowly cordate at base, margin regularly serrate; panicles villous or pubescent; corolla white or pinkish ..... **10. *C. viscosum***

- + Leaves glabrous beneath but with conspicuous glandular scales, deeply cordate at base, margin finely serrulate; panicles almost glabrous; corolla red ..... **11. *C. japonicum***

**1. *C. hastatum* (Roxb.) Lindley**

Shrub 1–3m; stems solid, pilose. Leaves ovate, palmately 3–5-lobed or hastate, 11–22 × 10–19cm, base cordate, 5-veined at base, mid-lobe largest, ovate, abruptly acuminate, margin entire, pilose on both surfaces, sparsely so above; petiole 4–13cm, pilose. Flowers fragrant, in broad terminal showy corymbose panicles up to 23 × 26cm; bracts large, leafy, becoming smaller and unlobed upwards; bracteoles linear, 3–6mm; pedicels 8–20mm. Calyx glabrous, gland-dotted; tube campanulate, 4–5mm; lobes 5, narrowly ovate, 11–13 × 4–5mm. Corolla white or creamy; tube long and slender 8–11cm, glandular-pilose; lobes 5, equal, spreading, elliptic-oblong, 17–19 × 4–6mm. Anthers purplish. Drupe (80) blackish-purple, 4-ribbed, 8–12mm, enclosed in enlarged red calyx.

**Bhutan:** S – Gaylegphug district (Gaylegphug, 38) and Deothang district (Deothang). Subtropical jungle, 270–760m. April–June.

**2. *C. indicum* (L.) Kuntze; *C. siphonanthum* R. Brown, *C. verticillatum* D. Don**

Similar to *C. hastatum* but stems hollow, ribbed, glabrous except for hairs at nodes; leaves opposite or 3–6 in whorls, narrowly linear or oblanceolate, 10–24 × 1–3cm, acuminate, base attenuate, glabrous but gland-dotted; sessile or on short petiole to 10mm; panicles elongate, 20–50 × 11–25cm, branches whorled; flowers not fragrant; calyx lobes 5–8 × 4–5mm; corolla tube 7–13cm, glandular-pubescent, lobes 10–12mm; drupes 1–4-lobed, 8–15mm diameter.

**Darjeeling:** terai at Pankhabari, Singhi Jhora, Sukna, Chenga Forest, Lote Kumai. Probably cultivated in subtropical zone, 200–600m. October–December.

Widely cultivated as an ornamental and for medicinal uses.

**3. *C. wallichii* Merrill; *C. nutans* D. Don non Jack**

Arching or scrambling shrub 1–3m; stems quadrangular, glabrous except for hairs at nodes. Leaves membranous, elliptic or narrowly obovate, 10–21 × 3–6.5cm, abruptly acuminate, base attenuate, margin entire or sinuate, glabrous but minutely gland-dotted beneath; petiole 0.8–2.5cm. Flowers not fragrant, in pendulous elongated panicles 15–24 × 9–14cm; bracts leafy below, becoming linear, 4–5mm above; pedicels 5–12mm. Calyx inflated, tube short, c 2mm.

5-angled; lobes 5, reddish, lanceolate, 7–9mm. Corolla white, tube narrow, 15mm; lobes 5, spathulate, reflexed, 12–15 × 6mm. Style long exerted; stigma swollen, unlobed. Fruit dark purple, globose, 12–14mm, 2–4-seeded, subtended by enlarged persistent red calyx.

**Bhutan:** S – Sarbhang district (Kami Khola) and Gaylegphug district (Gaylegphug, 38); **Darjeeling:** Rambhi Chhu, Sureil, Ghum, Lal, Sitong and Kalimpong. Subtropical and warm broad-leaved forests, 270–2100m. August–October.

**4. *C. colebrookeanum*** Walpers. Nep: *Boka Kane* (38), *Bankar* (34); Lepcha: *Kaombi* (34).

Shrub to 3m or small tree to 6m; stems stout, quadrangular, pubescent when young. Leaves thin, broadly ovate, 13–25 × 11–22cm, acuminate, base broadly cordate or almost truncate, margin entire, palmately 5-veined at base, pubescent on veins beneath, sparsely gland-dotted; petiole 8–12cm, pubescent. Flowers in dense flat-topped corymbs to 20 × 25cm; peduncle stout; bracts linear, c 5mm; pedicels slender 2–8mm. Calyx tube cup-shaped, 3–3.5mm, with several large glands; lobes 5, lanceolate, 3–5mm. Corolla white; tube slender, 17–20mm; lobes oblong, spreading, 7–8.5mm. Stamens straight, long exerted. Drupe blue, 2–4-lobed, 8–10mm diameter, enclosed in enlarged pink calyx.

**Bhutan:** S – Gaylegphug district (38), C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** Kalimpong, Darjeeling, Lebong, Pomong, Jinglam, Phubsering. Scrubby slopes and secondary warm broad-leaved forests, 760–1670m. August–November.

The whole plant has a strong disagreeable smell (34).

**5. *C. bracteatum*** Walpers. Sha: *Yang Ziba*; Nep: *Chitu* (34); Lepcha: *Kaomnyok* (34).

Similar to *C. colebrookeanum* but stems villous; leaves mostly truncate at base, more rarely cordate or cuneate; villous and densely gland-dotted beneath; flowers in dense rounded terminal and axillary corymbs 4–7cm diameter; bracts conspicuous, green, ovate, 10–40 × 3–13mm, pubescent and gland-dotted; bracteoles linear, 6–10mm; calyx pubescent and gland-dotted, lobes ovate-acuminate, 8–10 × 3–4mm; corolla puberulous and gland-dotted, tube 3–3.5cm; anthers shortly exerted; drupes purple.

**Bhutan:** S – Chukka district (Marichong) and Gaylegphug district (Gaylegphug), C – Tongsa district (Shamgong) and Mongar district (Mongar); **Darjeeling:** Tista Valley, Lebong, Pedong, Kalimpong, Peshok, Mongpu, Tondu; **Sikkim:** Gangtok to Rangpo. Scrub in Chir Pine and secondary subtropical and warm broad-leaved forests, 300–1740m. May–July, October.

Pollinated by butterflies.

**6. *C. splendens* James**

Woody vine, scrambling and twining; stems weakly angled, puberulous. Leaves ovate, 6–13 × 3.5–8cm, shortly acuminate, base cordate to rounded, margin entire, puberulous and minutely gland-dotted beneath; petiole 3–10mm. Flowers in broad supra-axillary corymbs 6–9cm broad; peduncle stout, 4–10cm; bracts linear, 3–5mm; pedicels 4–7mm. Calyx glabrous, tube 3–4mm; lobes 4, triangular, 3–4mm. Corolla red, tube slender, 13–18mm; lobes obovate, 12–13 × 6–7mm. Stamens long-exserted. Fruit black, glossy.

**Bhutan:** S – Phuntsholing district (Phuntsholing). Cultivated in garden, 200m. February.

Native of tropical Africa cultivated as ornamental.

**7. *C. thomsonae* Balfour f.**

Similar to *C. splendens* but leaves acute or shortly acuminate, cuneate to rounded at base, almost glabrous; petiole 6–30mm; cymes lax; peduncle slender 2–5cm; pedicels 7–15mm; flowers showy with enlarged white or yellowish calyx lobes 13–20 × 5–12mm; corolla red, tube 18–22mm; lobes elliptic, 7–8 × 3–4mm; fruit deeply lobed, black with red aril uniting lobes.

**Bhutan:** C – Tashigang district (Tashigang). Cultivated in garden, 1350m. June.

Native of tropical west Africa, widely cultivated for its showy flowers.

**8. *C. serratum* (L.) Moon; *C. divaricatum* Jack. Sha: *Yang Shing*; Nep: *Andekhi* (34); Lepcha: *Satapat-kung* (34).**

Shrub or small tree 2–5m; branchlets quadrangular, puberulous when young. Leaves membranous, opposite or in 3s, obovate or elliptic, 12–29 × 3.5–9cm, acute or apiculate, base attenuate, margins shallowly to coarsely, somewhat distantly serrate, rarely subentire, glabrous or puberulous on veins; petiole 0.3–1cm. Flowers not fragrant, in elongate panicles 7–30 × 4–9cm; bracts leafy, lower ones 4 × 3cm, upper ones c 1.5 × 0.8cm, pubescent; bracteoles elliptic, c 10 × 2mm; pedicels 2–6mm. Calyx cup-shaped, puberulous; tube 4–5mm, subentire or shortly 5-lobed. Corolla bilabiate, creamy or white, sometimes pale blue, with blue or purple lip; tube 7–10mm, hairy in throat; lobes obovate, 10–15 × 7–10mm. Stamens long exserted. Drupes 2–4-lobed, 6–10mm diameter; calyx scarcely enlarged.

**Bhutan:** S – Chukka, Sankosh, Sarbhang, Gaylegphug and Deothang districts, C – Punakha, Tongsa, Mongar and Tashigang districts; **Darjeeling:** widespread in terai and foothills; **Sikkim:** N side of Rangit valley. Terai grasslands, forests, subtropical scrub and forest margins, 300–1500m. May–October.

A very variable species; several varieties have been proposed, but are probably extremes of variation. Var. **wallichii** Clarke, from Bhutan and Darjeeling has the upper leaves entire and calyx truncate; var. **dentatum** H.J. Lam, from Darjeeling district, has coarsely serrate leaves and strongly 5-toothed calyx. Other forms vary in flower size and colour.

Leaves used in Bhutan to prepare a green dye. Often cultivated as an ornamental.

**9. *C. chinense*** (Osbeck) Mabberley; *C. fragrans* (Ventenat) Willdenow, *C. philippinum* Schauer

Subshrub to 1.5m; stems quadrangular, pubescent. Leaves thin, ovate, 9–27 × 8–24cm, acute, base truncate or shallowly cordate, margin irregularly dentate, pubescent or villous, especially beneath; petioles 3–11cm. Flowers showy, fragrant, mostly 'double', in dense rounded terminal corymbs 4–7cm diameter; peduncle absent or 1–2cm; bracts leafy, 1–3 × 0.5–1cm, with large glands; pedicels 3–4mm. Calyx purple or red, glabrous, tube 4–6mm; lobes lanceolate, 6–8mm, glandular. Corolla white or pinkish, tube 12–13mm; lobes numerous, obovate, 12–14 × 8–10mm. Stamens and ovary modified into sterile petals. Fruit not produced.

**Darjeeling:** Darjeeling, Gorubathan, cultivated. Subtropical zone, 800–1500m (Nepal). August.

Native of China cultivated widely as an ornamental and medicinal plant.

**10. *C. viscosum*** Ventenat; *C. infortunatum* sensu F.B.I. non L. Nep: *Chitu*, *Barte*; Lepcha: *Kambaldum* (34). Fig. 85a–c.

Shrub or subshrub 1–2m; stems quadrangular, villous. Leaves thick, broadly ovate, 10–21 × 6–15cm, acute, base truncate or cordate, margin sharply serrate, pubescent above, villous and minutely gland-dotted beneath; petiole 2–11cm. Flowers sweet-scented, in broad terminal villous or pubescent panicles 10–30 × 14–24cm; bracts small, leafy, 2–3cm, villous; bracteoles minute, 2–3mm; pedicels 3–12mm. Calyx red, pubescent, tube 3.5mm; lobes narrowly ovate, 8–10mm, gland-dotted. Corolla white, pubescent, sometimes tinged pink; tube 15–18mm; lobes 5, obovate, 10–15 × 5–9mm. Stamens long exserted. Fruit black, 1–4-lobed, 8–10mm diameter, subtended by enlarged red fleshy calyx 3.5–4.5cm diameter.

**Bhutan:** S – Samchi, Phuntsholing and Gaylegphug districts; **Darjeeling:** Rayong Chhu, Kalijhora, Rongsong, Pankhabari, Takvar, Mongpu, Rangit, Badamtam. Amongst scrub and in secondary subtropical forest, 200–900m. February–April.

**11. *C. japonicum*** (Thunberg) Sweet; *C. kaempferi* (Jacquin) Steudel, *C. squamatum* Vahl. Nep: *Asare* (34); Lepcha: *Kombalhir* (34).

Similar to *C. viscosum* but stems smooth, sparsely pubescent, ribbed when dry; leaf base deeply cordate; margin finely serrate to obscurely serrulate; sparsely pilose above, glabrous beneath but with numerous glandular scales; panicles almost glabrous 25–40 × 15–30; bracteoles linear 4–10mm; pedicels 5–20mm; calyx almost glabrous, lobes lanceolate 9–13mm; corolla red, tube 20–25mm; fruiting calyx blue.

**Darjeeling:** Tista and Rangit valleys, Rayong Chhu, Kalimpong, Pankhabari,

Badamtam; **Sikkim**: Gangtok, Pemayangtse, Rongni Chhu. Probably cultivated and naturalised, 600–1200m. June–September.

Native of Japan widely cultivated as an ornamental.

#### 14. HOLMSKIOLDIA Retzius

Shrubs. Leaves opposite, simple. Flowers pedicellate, in axillary and terminal racemes. Calyx showy, broadly saucer-shaped, unlobed. Corolla narrowly funnel-shaped, curved; limb 5-lobed, lower lip longer. Stamens 4, in 2 pairs; anthers exserted. Ovary 4-celled; style equalling stamens; stigma shortly bifid. Fruit a drupe, 4-celled, 4-lobed, separating when ripe into 1-seeded parts, subtended by enlarged showy calyx.

1. **H. sanguinea** Retzius. Sha: *Chhaling Momnang*; Eng: *Chinese Hat Plant*; Nep: *Aputo, Hare Lahara, Katli Lahara* (34). Fig. 85d.

Shrub, often scrambling, 2–5m; stems with short gland-tipped hairs and longer eglandular hairs. Leaves ovate, 4–11 × 2.5–7cm, acuminate, base truncate or rounded, margins shallowly serrate, thinly pubescent with eglandular hairs and with sessile glandular scales; petiole 1–3cm. Racemes 3–6-flowered, 2.5–6cm; peduncle glandular-hairy; pedicels 5–13mm. Calyx cup 2–2.5cm diameter, bright crimson, glandular-pubescent. Corolla orange or crimson, tube curved, 17–22mm, glandular-pubescent; lip 4–5mm, other lobes c 1.5mm. Drupe 4-lobed, obovoid, 6–8mm diameter, scaly, subtended by enlarged calyx c 3cm across.

**Bhutan**: S – Samchi, Phuntsholing, Chukka and Gaylegphug districts, C – Tashigang district; **Darjeeling**: Mongpu, Darjeeling, Pankhabari, Badamtam, Sivok; **Sikkim**: Pandam, Rhenok, Mamring. Scrubby hillsides, forest margins, in terai and foothills, 230–1220m. October–March.

Sometimes cultivated as an ornamental.

#### 15. CARYOPTERIS Bunge

Erect or scrambling aromatic shrubs; indumentum of simple hairs mixed with shiny sessile glands. Leaves opposite. Flowers shortly pedicellate, in dense cymes aggregated into terminal and axillary panicles. Calyx tubular at base, divided to middle into 5 teeth. Corolla tube short; limb 5-lobed, upper 4 subequal, lip longer, shortly bilobed. Stamens 4, in 2 pairs, curved; anthers long-exserted. Ovary 4-celled; style slender, curved; stigma shortly bifid, long-exserted. Fruit a dry 4-celled capsule, splitting into four 1-seeded valves.

1. Panicles mostly terminal, 5–14 × 2–3cm, many-flowered; corolla blue, lip 7–9mm ..... 1. **C. bicolor**
- + Panicles mostly axillary, 2–6(–10) × 1–2cm, few-flowered; corolla purplish, lip c 3mm ..... 2. **C. paniculata**

1. **C. bicolor** (Hardwicke) Mabberley; *C. odorata* (D. Don) B. L. Robinson, *C. wallichiana* Schauer. Nep: *Sun Pati*; Lepcha: *Matetrip* (34). Fig. 85e&f.

Spreading or scrambling shrub 2–3m; branches finely greyish-tomentose when young, becoming glabrous. Leaves elliptic-lanceolate, 6–13 × 1.5–5cm, acuminate, base cuneate, margins distantly sharply to bluntly serrate, pubescent on veins beneath, densely minutely reddish gland-dotted beneath; petiole 5–15mm. Flowers fragrant, in dense many-flowered panicles 5–14 × 2–3cm, finely tomentose; bracts narrowly lanceolate, 1.5–4mm; pedicels 2–4mm. Calyx tomentose with glands obscured, tube c 3mm; lobes triangular, 1.8–2mm. Corolla tube c 5mm; lobes pale blue, upper 4 oblong, rounded, 5–7mm, lip 7–9mm, bilobed. Stamens 2–2.5cm. Style 2.5–3cm. Capsule subglobose, with 4 rounded angles, 3.5–5mm, hairy.

**Bhutan:** S – Phuntsholing district (Torsa River) and Deothang district (Demri Chu), C – Punakha district (east of Wangdu Phodrang); **Darjeeling:** Panchkilla, Rangit, Pankhabari, Jalpaiguri, Badamtam, Barmiak and Rilli Chu; **Sikkim:** between Naya Bazaar and Namchi, Singtam, Gangtok, Pandam. Amongst shrubs in hot dry valleys, 200–1500m. December–February.

Sometimes cultivated for its fragrant flowers; dry bark used as scent (34).

2. **C. paniculata** Clarke. Nep?: *Lahruma* (38); Lepcha: *Ripnyok* (34).

Similar to *C. bicolor* but leaves ovate-lanceolate, 7–15 × 2–7.5cm, base rounded or cuneate, glabrous or puberulous only on veins beneath, dotted on both surfaces with minute golden glands; petiole 4–8mm; cymes compact, aggregated into open axillary panicles 2–6(–10) × 1–2cm; pedicels 1–2mm; calyx tube 1.5–1.8mm; lobes c 1mm; corolla tube c 3mm; lobes pinkish-purple, 4 equal, 2mm, lip bilobed, c 3mm; stamens 3–3.5mm; style c 7mm.

**Bhutan:** S – Samchi, Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Punakha, Tongsa and Tashigang districts; **Darjeeling:** Little Rangit, Ging, above Tukvar, Dumsong, Kurseong, Sureil, Rambi, Labha; **Sikkim:** Tumlang. Steep hillsides and cliffs in subtropical and warm broad-leaved forests, 350–1950m. October–April.

## 16. NYCTANTHES L.

Shrubs or small trees. Leaves opposite, simple. Flowers sessile, few in axillary and terminal pedunculate heads, each head subtended by 2–4 bracts, heads often aggregated into cymes or panicles. Calyx tubular, subentire. Corolla actinomorphic, salverform; limb 5-lobed, lobes equal, asymmetric. Stamens 2, anthers included. Ovary 2-celled; style short, included; stigma capitate. Fruit a flattened 2-celled, 2-lobed, 2-seeded capsule.

The genus is sometimes placed in Oleaceae.



**1. *N. arbor-tristis* L.**

Shrub or small tree 3–10m; branches quadrangular, appressed pubescent when young. Leaves rigid, ovate, 8–16 × 3–7cm, acuminate, base rounded or cuneate, margin entire or coarsely serrate, scabrid-hairy above, appressed pubescent on veins beneath; petiole 6–16mm. Flowers fragrant, sessile, 3–7 in heads; peduncles 1–2.5cm; bracts 2–4 at base of each head, ovate to obovate, 8–20mm. Calyx of subtire tube cleft on one side, pubescent. Corolla tube orange or red, 6–8mm; lobes white, obtriangular, emarginate, 7–10mm. Capsule elliptic or suborbicular, 15–18 × 14–15mm, 2-lobed.

**Bhutan:** S – Phuntsholing district (Phuntsholing, Torsa River); **Darjeeling:** Ranshin; **Assam:** terai at Cooch Behar. Cultivated in gardens, 200–600m. September–January.

Cultivated as a garden ornamental. The very fragrant flowers open at night and drop at sunrise.

**Family 169. CALLITRICHACEAE**

by D.G. Long

Annual or perennial glabrous herbs, usually aquatic or semi-aquatic; stems slender, fragile, creeping and rooting below. Leaves opposite, decussate, often dimorphic, upper ones often crowded towards shoot tips, entire, exstipulate. Monoecious; flowers minute, unisexual, actinomorphic, sessile, axillary, each subtended by 2 bracteoles, solitary or one of each sex per axil. Perianth absent. Male flower with 1 stamen. Female flower with a 4 (rarely 2)-celled superior ovary; styles 2, long and slender, papillose; ovule 1 per cell, axile. Fruit a 4 (rarely 2)-lobed schizocarp, each lobe narrowly winged or keeled, splitting into 4 (rarely 2) 1-seeded nutlets.

**1. CALLITRICHE L.**

Description as for Callitrichaceae.

The treatment here is provisional as very few good specimens are available from the area and better material is much needed. Only fruiting material is adequate for identification. A residue of immature specimens exists for Sikkim and Bhutan, amongst which are probably three additional species: *ESIK* 1047 from Lloyd Botanic Garden, Darjeeling, 2070m, is a small terrestrial species similar to *C. terrestris* Rafinesque; *ESIK* 718 from between Dzongri and Mon Lapcha, Sikkim, 4000m, is a submerged species with linear leaves, possibly *C. hermaphroditica* L. and *Wood* 7327 from Daga La, Thimphu district, Bhutan, 4400m, is a dwarf terrestrial species similar to *C. peploides* Nuttall.

1. Usually semi-aquatic or on mud; leaves all spatulate; fruits broader than long or suborbicular, 1.2–1.5mm long ..... 1. **C. stagnalis**  
 + Free-floating; upper leaves spatulate, lower leaves oblanceolate or linear; fruits longer than broad, 1–1.1mm long ..... 2. **C. palustris**

1. **C. stagnalis** Scopoli; *C. wightiana* Wight & Arnott. Fig. 76q–s.

Prostrate, usually semi-aquatic herb; stems 10–20cm. Leaves not dimorphic, spatulate or broadly elliptic, up to 8 × 4mm, obtuse, base attenuate. Stamens 1.7–2.1mm. Fruit compressed, suborbicular or broader than long in side view, 1.2–1.5 × 1.4–1.6mm, not tapering at base; nutlets narrowly winged throughout their length.

**Bhutan:** C–Punakha district (E side of Dochu La) and Tongsa district (between Chendebi and Gangle Pokte); **Darjeeling:** Senchal, Mongpu, Kurseong; **Sikkim:** Dentam, Yoksam (69), Lachen, Cheungthang. Ditches and paddy-fields in broad-leaved forest zone, 1400–3000m. May–October.

2. **C. palustris** L. Eng: *Water Starwort*.

Similar to *C. stagnalis* but with floating terminal rosettes; leaves dimorphic, upper ones crowded, spatulate, 3–5 × 1–2mm, obtuse, base attenuate into short petiole; lower ones distant, oblanceolate or linear, to 8 × 1mm; fruit compressed, obovoid-ellipsoid in side view, 1–1.1mm, longer than broad and narrowed towards base, nutlets narrowly winged only at apex.

**Bhutan:** N – Upper Mo Chu district (east bank of Tharizam Chu); **Sikkim:** Pedong. Floating in pond and in wet hollows in marsh, 3750–4080m. July–September.

In the Himalaya normally an alpine plant. Sterile specimens reported from alpine Sikkim, doubtfully identified as *C. verna* L. (80), probably belong to this species.

## Family 170. LABIATAE

by R.A. Clement

Herbs, subshrubs or shrubs, often aromatic. Stems usually quadrangular. Leaves simple, rarely pinnatisect or compound, opposite and usually decussate or rarely whorled. Stipules absent. Inflorescence of cymes, often condensed, paired and appearing as whorls (verticillasters), in spike-like, capitate or paniculate arrangements, occasionally cymes pedunculate and lax, forming a panicle. Bracts caducous or persistent; bracteoles present or absent. Flowers usually hermaphrodite. Calyx usually 5-lobed, bilabiate to regular or oblique. Corolla gamopetalous, regular to zygomorphic, 4–5-lobed. Stamens 4, equal or varying in length or 2 with 2 staminodes; anthers 1- or 2-celled. Ovary superior, 4-lobed, becoming 4-celled, each locule containing 1 basally attached ovule. Style completely gynobasic (arising from base of ovary between lobes) or only partially

gynobasic, 2-lobed or rarely punctate. Fruit of 4, usually dry, one-seeded nutlets, included in persistent calyx.

1. Plant with compound leaves, rarely some leaves simple ..... 2
- + Plant with simple leaves, sometimes deeply pinnatisect ..... 3
  
2. Corolla tube 4–5mm; stamens exerted well beyond upper lip of corolla  
**2. Rubiteucris**
- + Corolla tube 12–15mm; stamens included, equal to upper lip of corolla  
**24. Salvia** (*S. plectranthoides*)
  
3. Plant with stellate hairs on leaves or stems ..... 4
- + Plant with simple hairs ..... 10
  
4. Bracts and calyx teeth spinose with strongly hooked tips .. **11. Notochaete**
- + Bracts and calyx teeth never with hooked tips ..... 5
  
5. Calyx 4mm or less at anthesis ..... 6
- + Calyx 6mm or more at anthesis ..... 7
  
6. Leaves 5.5cm or more long; stamens exerted 4–5mm beyond corolla lobes  
**33. Pogostemon** (*P. tuberosus*)
- + Leaves 5cm or less long; stamens not exceeding corolla lower lip  
**38. Isodon** (*I. rugosus*)
  
7. Stamens exerted, 2 × as long as corolla; flowers in dense terminal spike  
**4. Leucosceptrum**
- + Stamens equal in length to upper lip of corolla; flowers in whorls or axillary cymes not forming a very dense spike ..... 6
  
8. Corolla pink, purple or dark red, upper lip densely hairy inside; calyx teeth spinose at apex ..... **12. Phlomis**
- + Corolla greenish-white, yellow or orange-red, upper lip not densely hairy; calyx teeth not spinose ..... 9
  
9. Corolla greenish-white, yellow or orange-yellow; calyx teeth narrowly triangular, 4–6mm ..... **5. Gomphostemma**
- + Corolla orange-red; calyx teeth triangular, 1.5–2mm ..... **19. Colquhounia**
  
10. Corolla regular or sub-bilabiate, 1.5–4(–7.5)mm long ..... 11
- + Corolla clearly zygomorphic, 2.5–40mm long ..... 17
  
11. Calyx regular; plant annual or perennial ..... 12
- + Calyx bilabiate; annual herbs ..... 15

170. LABIATAE

12. Shrubs 1.5–3m; spikes becoming plumose in fruit; calyx teeth subulate, 1.5mm, lengthening to c 5mm in fruit ..... **34. Colebrookea**  
 + Herbs or shrubs; spikes not plumose in fruit; calyx teeth triangular or if subulate then scarcely lengthening in fruit and plant herbaceous ..... 13
13. Stamens included, not exceeding corolla lobes ..... **32. Elsholtzia**  
 + Stamens exerted beyond corolla lobes ..... 14
14. Herb with creeping rhizome, strongly aromatic; leaves opposite; filaments glabrous ..... **29. Mentha**  
 + Herb or shrub, sometimes rooting at nodes, aromatic or not; leaves opposite or whorled; filaments hairy ..... **33. Pogostemon**
15. Leaves sessile, long attenuate at base; inflorescence a dense ovoid head, 9–17 × c 10mm ..... **40. Acrocephalus**  
 + Leaves petiolate, cuneate at base; inflorescence a spike ..... 16
16. Leaves ovate, 5.5cm or more long; stamens 4 ..... **30. Perilla**  
 + Leaves ovate to elliptic, less than 5cm long; stamens 2 ..... **31. Mosla**
17. Corolla 7–12mm, upper lip absent; stamens well exerted from corolla tube ..... **3. Teucrium**  
 + Corolla 2–40mm, upper lip present; stamens not as above ..... 18
18. Calyx regular or very weakly bilabiate with all teeth similar ..... 19  
 + Calyx zygomorphic, oblique at apex or clearly bilabiate ..... 38
19. Corolla less than 9mm ..... 20  
 + Corolla 9mm or more ..... 27
20. Leaves entire ..... 21  
 + Leaves serrate, crenate or dentate ..... 22
21. Leaves 1cm or less long; flowers 1–3, in leaf axils ..... **26. Micromeria**  
 + Leaves 1.2cm or more long; flowers many, in terminal corymbose cymes ..... **28. Origanum**
22. Fruiting calyx campanulate, 8–10mm, prominently ribbed, teeth subulate 2–3mm ..... **35. Hyptis**  
 + Fruiting calyx not as above ..... 23
23. Corolla 5mm or more, lower lip entire, concave ..... **38. Isodon**  
 + Corolla 2–8.8mm, lower lip lobed ..... 24
24. Inflorescence of slender, one-sided cymes arranged in a panicle; corolla 3.5–4mm ..... **22. Craniotome**

- + Inflorescence of spikes sometimes arranged in a panicle; corolla 2–8.8mm  
25
25. Stamens exerted beyond corolla lower lip; stems often swollen at or above nodes ..... **33. Pogostemon**
- + Stamens not exerted beyond corolla lower lip; stems not swollen ..... 26
26. Corolla 8mm or more; nutlets with large attachment scar  $\frac{2}{3}$  of its length  
**1. Ajuga**
- + Corolla less than 8mm; nutlets with small attachment scar .. **32. Elsholtzia**
27. Calyx densely shaggy with hairs up to 1cm long; plant densely white-lanate, up to 17cm ..... **14. Eriophyton**
- + Calyx with much shorter hairs or glabrous; plant usually taller ..... 28
28. Corolla upper lip densely villose within ..... **12. Phlomis**
- + Corolla upper lip not densely villose within ..... 29
29. Corolla upper lip entire, often forming ‘hood’ ..... 30
- + Corolla upper lip 4- or 2-lobed ..... 36
30. Leaves more than 14cm long; corolla yellow to white ..... **13. Paraphlomis**
- + Leaves 10cm or less long; corolla variously coloured ..... 31
31. Corolla 22mm or more; flowers in lax pedunculate cymes, peduncles 1–4.4cm ..... **23. Microtoena**
- + Corolla 20mm or less; flowers in dense, sessile (sometimes few-flowered) verticillasters ..... 32
32. Leaves 2cm or less long, broadly ovate to reniform, sessile, margin coarsely crenate to lobed ..... **17. Lamium**
- + Leaves 2cm long, ovate, lanceolate or linear, sessile or petiolate, margin serrate, crenate or entire, never lobed ..... 33
33. Corolla upper lip densely lanate on outside ..... **15. Leucas**
- + Corolla upper lip sparsely hairy to glabrous ..... 34
34. Stamens exerted; corolla upper lip flat, lower lip deeply notched  
**21. Anisomeles**
- + Stamens included; corolla upper lip hooded, lower lip not deeply notched  
35
35. Calyx teeth spinescent, 2–4mm ..... **16. Galeopsis**
- + Calyx teeth not spinescent, 1–2.5mm ..... **18. Stachys**

- 36. Corolla upper lip 4-lobed, lower lip entire; inflorescence of slender lax cymes arranged in panicle ..... **22. Isodon**
- + Corolla upper lip 2-lobed, lower lip 3-lobed; inflorescence of spike-like or verticillasters in leaf axils ..... 37
  
- 37. Corolla lower lip much longer than upper lip; nutlets with large attachment scar,  $\frac{2}{3}$  of its length ..... **1. Ajuga**
- + Corolla lower lip scarcely (1.5mm) longer than upper lip; nutlets with very small attachment scar ..... **20. Achyrospermum**
  
- 38. Calyx oblique at apex, essentially 1-lipped with some very small teeth 39
- + Calyx not or scarcely oblique at apex, 2-lipped, teeth various ..... 40
  
- 39. Corolla lower lip 3-lobed; inflorescence of verticillasters subtended by leaves ..... **15. Leucas**
- + Corolla lower lip entire, concave; inflorescence of erect cylindrical spikes, up to 7 × c 1.5cm ..... **36. Anisochilus**
  
- 40. Calyx upper lip entire with a prominent sail-like fold (scutellum) ..... **6. Scutellaria**
- + Calyx upper lip entire or not, without scutellum ..... 41
  
- 41. Corolla upper lip 4-lobed, lower lip entire; stamens declinate ..... 42
- + Corolla upper lip entire or 2-lobed, lower lip lobed; stamens ascending 47
  
- 42. Inflorescence of slender, pedunculate, lax cymes arranged in a panicle; fruiting calyx 5.5mm or less ..... **38. Isodon**
- + Inflorescence a spike or arrangement of spikes; fruiting calyx 4–11mm 43
  
- 43. Corolla tube exerted 8–10mm beyond calyx ..... 44
- + Corolla tube not or scarcely exerted ..... 45
  
- 44. Leaf margin serrate, teeth apiculate; calyx upper lip of 3 subulate teeth ..... **39. Siphocranion**
- + Leaf margin crenate or crenate-serrate, teeth not apiculate; calyx upper lip of 1 obtuse lobe ..... **43. Orthosiphon**
  
- 45. Fruiting calyx tubular with prominent reticulate venation, suberect; bracts conspicuous, whitish, persistent ..... **41. Geniosporum**
- + Fruiting calyx campanulate without prominent venation, deflexed or spreading; bracts caducous ..... 46
  
- 46. Corolla 8–20mm, lower lip concave; ovate tooth of calyx upper lip not decurrent ..... **37. Plectranthus**

- + Corolla 3–8mm, lower lip flat; ovate tooth of calyx upper lip decurrent  
**42. Ocimum**
47. Stamens 2, with cells separated by staminal connectives ..... **24. Salvia**  
+ Stamens 4, without staminal connectives ..... 48
48. Corolla 20mm or more; calyx teeth with swollen folds at basal sinuses  
**8. Dracocephalum**  
+ Corolla 16mm or less; calyx teeth without folds ..... 49
49. Leaves sessile, suborbicular, crenate; plant of scree and stony slopes at high altitudes, over 4500m ..... **9. Marmoritis**  
+ Leaves petiolate, sometimes also sessile, ovate, ovate-oblong or broadly ovate, serrate, crenulate to subentire; high altitude or not ..... 50
50. Posterior pair of stamens longer than anterior; calyx prominently 15-nerved  
**7. Nepeta**  
+ Posterior pair of stamens shorter than anterior; calyx 5–15-nerved ..... 51
51. Staminal filaments with small spur near apex; calyx upper lip truncate with 3 very small teeth ..... **10. Prunella**  
+ Staminal filaments without spur; calyx upper lip not truncate, 3-toothed  
52
52. Calyx 6.5mm or more; corolla white to pale yellow ..... **25. Melissa**  
+ Calyx 6mm or less; corolla mauve to purplish ..... **27. Clinopodium**

### 1. AJUGA L.

Annual or short-lived perennial herbs. Stems usually straggling, prostrate or ascending. Leaves sessile to petiolate, crenate-serrate or dentate. Inflorescence sometimes with leaf-like bracts,  $\pm$  capitate or elongate; verticillasters 2–6-flowered. Calyx regular to sub-bilabiate, campanulate; teeth 5, subequal. Corolla bilabiate, tube sometimes geniculate; upper lip short, 2-lobed; lower lip longer than upper, 3-lobed, at least middle lobe emarginate. Stamens 4, didynamous, anterior pair longer, usually exerted; anthers becoming 1-celled. Style not fully gynobasic, 2-lobed. Nutlets with large attachment scar covering  $\frac{2}{3}$  of length, rugose.

1. Leaves broadly ovate to suborbicular; corolla 16mm or more **1. A. lobata**  
+ Leaves ovate to oblong-elliptic; corolla 10mm or less ..... 2
2. Corolla tube parallel-sided, not geniculate or gibbous; calyx lobes triangular; leaf-like bracts often exceeding flowers on upper verticillasters  
**2. A. bracteosa**

- + Corolla tube geniculate or gibbous on upper side near base; calyx lobes  $\pm$  oblong; bracts on upper verticillasters not exceeding flowers

### 3. *A. macrosperma*

#### 1. *A. lobata* D. Don

Low creeping herb. Stems up to 30cm long, sparsely or densely villous. Leaves broadly ovate to suborbicular, 1.3–3.6  $\times$  1.2–3.5cm, apex usually obtuse, base cordate, margin irregularly crenate-serrate, upper surface villous, lower surface villous to glabrescent often dull purple; petiole 0.8–3.5cm. Verticillasters few, in axils of leaves, approximating in short spike of 2–5cm. Calyx 7–8mm; teeth 3.5–4mm, linear-oblong, acute. Corolla mauve or bluish-purple, 16–22mm; tube 9–13mm, straight. Nutlets oblong-obovoid, c 2.2  $\times$  1.3mm.

**Bhutan:** S – Chukka district (Chukka), C – Punakha district (Samtengang to Ritang (71), SW of Wangdu Phodrang); **Darjeeling:** Tanglu, Rimbick to Ramman, Sandakphu; **Sikkim:** Gangtok to Karponang, Kalipokri, Dentam, Chiya Bhanjang, Bakkhim. Damp places, pathsides in forest, roadsides, 1680–3700m. April–August.

#### 2. *A. bracteosa* Benth

Low herb. Stems ascending or trailing, 6–30cm long,  $\pm$  densely villous with multicellular hairs. Leaves ovate to oblong-elliptic, 3.5–2.5  $\times$  1.4–2.5cm, apex usually obtuse, base cuneate, margin irregularly dentate or crenate-serrate, both surfaces with scattered to dense villous hairs; petiole up to 0.4cm. Verticillasters in axils of upper leaves or leaf-like bracts; bracts usually conspicuous, exceeding flowers. Calyx 4–6mm; teeth 2–3mm, triangular, acute. Corolla pale mauve, blue-purple or white, 8–10mm; tube 6–7mm, straight or curved but parallel-sided. Nutlets ellipsoid, 2  $\times$  1.1mm.

**Bhutan:** S – Chukka district (117), C – Ha district (117), Thimphu, Tongsa, Mongar and Tashigang districts, N – Upper Mo Chu district; **Darjeeling:** Kalimpong, Jhepi; **Sikkim:** Sangacholing, Lachung; **Chumbi:** Yatung. Grassy hillsides, roadsides, weed of paddy-fields, 1220–3000m. April–September.

A variable species. Specimens with reduced bracts appear similar to *A. macrosperma* but are readily distinguished from that species by the lack of geniculation of the corolla tube and the sharply acute calyx lobes. Var. *densiflora* (Benth) Hook.f. has been recorded from Bhutan (135) but the type of this variety does not resemble any material seen from our area.

#### 3. *A. macrosperma* Benth. Fig. 86a&b.

A variable, straggling herb. Stems prostrate or ascending, 12–47(–90)cm, glabrescent to densely villous. Leaves ovate-elliptic, 2.5–13  $\times$  1.5–6.2cm, acute

FIG. 86. **Labiatae.** a–b, *Ajuga macrosperma*: a, corolla ( $\times$  5); b, calyx ( $\times$  4). c–d, *Rubiteucris palmata*: c, inflorescence ( $\times$  1); d, leaf ( $\times$   $\frac{2}{3}$ ). e, *Teucrium quadrifarium*: flower ( $\times$  4). f, *Leucosceptrum canum*: flowering shoot ( $\times$   $\frac{2}{3}$ ). g–h, *Gomphostemma parviflorum*: g, portion of inflorescence ( $\times$   $1\frac{1}{2}$ ); h, hairs ( $\times$  22). i, *Scutellaria dependens*: flowering habit ( $\times$  1). j–k, *Dracocephalum wallichii*: j, inflorescence ( $\times$   $\frac{2}{3}$ ); k, flower ( $\times$  2). Drawn by M. Bates.





to somewhat obtuse, base cuneate to attenuate, margin usually irregularly crenate-serrate, pubescent to sparsely pilose; petiole up to 2cm. Verticillasters distant or conferted, all but lowermost subtended by bracts less than 1cm long. Calyx often sub-bilabiate (3.5–)4.5–5.5mm, sparsely to densely hairy, teeth 0.7–2mm,  $\pm$  oblong. Corolla light to dark blue or purple, 8–10mm; tube 6–7mm, clearly geniculate or at least gibbous on upper side near base; upper lip c 2.4mm; lateral lobes of lower lip oblong, usually emarginate, subequal in length to middle lobe. Nutlets c  $2.5 \times 1.7$ mm, obovoid.

**Bhutan:** S – Phuntsholing, Chukka, Sarbhang, Gaylegphug and Deothang districts, C – Punakha and Tongsa districts; **Darjeeling:** Rishap, near Jhepi, Lebong, Kalimpong; **Sikkim:** Gangtok, Gehzing, Tista. Edge of *Quercus griffithii*/*Rhododendron arboreum* forest, roadside banks, wall crevices, streamsides, damp rough grassland in clearings, 610–1805m. Flowering almost throughout the year.

Another variable species, particularly with respect to the inflorescence. Two varieties are recognised from our area, var. *thomsoni* (Maximowicz) Hook.f. and var. *breviflora* Hook.f. but intermediates occur.

## 2. RUBITEUCRIS Kudo

Aromatic rhizomatous herb. Leaves petiolate, serrate. Inflorescence terminal; verticillasters few-flowered. Bracts lanceolate, small. Calyx bilabiate, campanulate, enlarging in fruit; upper lip 3-toothed, lower lip 2-toothed. Corolla bilabiate; upper lip deeply bilobed, shorter than lower; lower lip 3-lobed, middle lobe largest, entire. Stamens 4, straight, anterior pair longer. Nutlets obovoid.

### 1. *R. palmata* (Hook.f.) Kudo; *Teucrium palmatum* Hook.f. Fig. 86c&d.

Stems erect, slender, 30–60cm, sparsely pubescent to subglabrous. Leaves 3-foliolate; leaflets sessile, ovate-elliptic to ovate-rhombic,  $2-7 \times 1-3.2$ cm, acute or acuminate, base cuneate to attenuate, coarsely serrate, upper surface with scattered multicellular hairs, lower surface with similar hairs on veins and with minute capitate-glandular hairs; petiole 2–6.5cm. Inflorescence c 4cm long, verticillasters few-flowered. Calyx 5–6mm; upper lip c 3mm, teeth triangular, c 1mm; lower lip c 4mm, teeth triangular, c 1.5mm; densely capitate-glandular-hairy; fruiting calyx enlarging to 9mm long. Corolla white, 8–9mm; tube c 4.5mm. Stamens exerted by c 4mm. Nutlets obovoid, c  $2.7 \times 2$ mm, pale brown, scar c  $2 \times 1.6$ mm.

**Bhutan:** C – Thimphu district (between Dotena and Barshong, Hongtso) and Bumthang district (Shabjethang); **Sikkim:** Lachen and Zemu Valley. Among shrubs, moist shaded banks in *Quercus*/Hemlock forest, by track in disturbed scrub, 2560–3050m. July–August.

## 3. TEUCRIUM L.

Fairly stout herbs (in Bhutan). Leaves simple, petiolate. Inflorescence spike-like, spikes often arranged in panicles; verticillasters 2-flowered, lax. Calyx bilabiate, tubular-campanulate, teeth 5, of subequal length but upper 3 differing from lower 2. Corolla 5-lobed, with deep sinus instead of upper lip, lateral lobes small, median lobe of lower lip large, entire, often deflexing. Stamens 4, curved, clearly exerted, anterior pair longer. Style not fully gynobasic, 2-lobed. Nutlets broad ovoid, with large scar.

1. Leaves 10 × 6.4cm or more; plant up to 200cm ..... **3. T. grandifolium**  
 + Leaves 8 × 4.5cm or less; plant 120cm or less tall ..... 2
2. Leaves cuneate to truncate at base; stems pubescent; corolla 8mm or less long ..... **1. T. viscidum**  
 + Leaves rounded to cordate at base; stems tomentose with spreading villous hairs; corolla 11mm or more long ..... **2. T. quadrifarium**

**1. T. viscidum** Blume; *T. stoloniferum* Roxb.

Stoloniferous herb, 30–60cm. Stems erect, retrorsely pubescent. Leaves ovate, 3.9–8.5 × 2.1–4.5cm, acute, base broadly cuneate to truncate, irregularly serrate-crenate, upper surface sparsely pubescent, lower surface pubescent on veins; petiole 1.2–2.5cm. Bracts ovate, 2–8mm long, inconspicuous. Calyx 2.5–3.5mm; upper teeth c 0.5mm, obtuse; lower teeth c 0.7mm, acute. Corolla white with purple lower lip, 7–8mm. Nutlets 1.5 × 1.3mm, scar c 0.8mm long.

**Bhutan:** S – Gaylegphug district (Gaylegphug, 117), C – Mongar district (near Zimgang); **Darjeeling:** Badamtam, Kalimpong, Siliguri, Sonada; **Sikkim:** Bakkhim, Rangpo, Tista. Forest paths, roadside banks in warm broad-leaved forest, 300–1220m. May–July.

**2. T. quadrifarium** D. Don. Fig. 86e.

Erect herb, 60–90(–120)cm. Stems tomentose with spreading, villous hairs. Leaves ovate to ovate-oblong, 3.5–7 × 3–3.6cm, acute to ± obtuse, base rounded to cordate, serrate or serrulate, upper surface appressed pilose or villous; lower surface sparsely to densely tomentose-villous, paler; petiole up to 1.7cm, upper leaves sessile. Bracts broadly ovate, 5–13mm, sometimes tinged reddish-purple. Calyx 5.5–6mm; upper teeth obtuse, middle tooth ovate, c 1.5mm; lower teeth narrowly triangular, c 2mm. Corolla pink or pale mauve with white tube, 11–12mm. Nutlets 1.2 × 1mm, scar c 0.5mm long.

**Bhutan:** C – Punakha district (Chuzomsa); **Sikkim:** unlocalised (80). Open dry grassland with scattered shrubs in area of Chir Pine, 1200–1220m. August–September.

**3. T. grandifolium** Clement

Tall perennial herb. Stems up to 200cm, quadrangular-sulcate, retrorsely

pubescent. Leaves ovate, 10–14 × 6.4–9.5cm, acute or shortly acuminate, base rounded-truncate with lamina slightly extended on petiole, margin coarsely serrate; upper surface sparsely hairy, hairs short; lower surface puberulent with short hairs on veins; petiole 2.5–5.5cm. Inflorescences terminal and axillary, of rather weak spikes, 3–9 × c 1.8cm. Verticillasters 2-flowered. Bracts ovate, ciliate, whitish at base, green above. Calyx tubular-campanulate, 7–7.6mm, hirsute on main veins; tube whitish and somewhat inflated above base, 4.5mm; upper lip c 3mm; middle tooth largest, broadly ovate; lower lip 3mm, teeth narrowly triangular. Corolla dull red, 10.5–11mm, tube 5–5.4mm.

**Bhutan:** S – Sankosh district (above Daga Dzong towards Daga La). Amongst scrub by streams in dry, open *Quercus* woodland, 1700–2438m. August.

An East Himalayan endemic; known only from the type locality in Bhutan and the Yigrong Valley in Tibet (250).

#### 4. LEUCOSCEPTRUM Smith

Tomentose shrubs or small trees. Leaves petiolate, subentire to shallowly crenate. Inflorescence a dense, many-flowered, cylindrical, terminal spike. Bracts caducous. Calyx sub-bilabiate, 5-toothed, tubular-campanulate; teeth subequal. Corolla bilabiate, 5-lobed. Stamens 4, exserted, anterior pair longer. Style gynobasic. Nutlets cuneate, scar small.

1. **L. canum** Smith. Sha: *Yangrem*; Nep: *Ghurpis* (34). Fig. 86f.

Shrub or small tree, 4–10m. Young stems white-tomentose with branched hairs. Leaves elliptic to oblanceolate, 13.5–30 × 6–11cm, acuminate, base cuneate, subentire to shallowly crenate, upper surface subglabrous, lower surface white-tomentose with branched hairs; petiole 1.8–3.5cm. Inflorescence 8.5–14 × c 2.5cm (excluding exserted stamens). Bracts broadly ovate, c 0.8 × 0.8cm. Calyx 6–9mm, white-tomentose; teeth triangular, subequal, c 1mm. Corolla creamy white, 9–10mm; tube c 6mm; upper lip c 1.5mm, lobes obtuse; lower lip c 3.5mm, middle lobe largest. Stamens 4, purple-pink, exserted by c 17mm. Nutlets 5mm long.

**Bhutan:** S – Samchi district (Dorokha, 117), Chukka district (Chukka and Chasilakha), Gaylegphug district (Sureylakha, 117) and Deothang district (Deothang), C – Tongsa district (between Tashiling and Tongsa, 71); **Darjeeling:** Darjeeling, Pankhabari, Sitong; **Sikkim:** Lachung. Open jungle and forest margins, mixed broad-leaved forest, sometimes cultivated, 610–2300m. December, February, April.

#### 5. GOMPHOSTEMMA Bentham

Perennial herbs, sometimes with tuberous roots. Leaves simple, usually petiolate. Inflorescences axillary, few- to many-flowered. Calyx regular, 10-nerved,

5-toothed, teeth subequal. Corolla bilabiate, tube long and slender; upper lip entire or emarginate, equal to or shorter than lower lip; lower lip 3-lobed. Stamens 4, anterior pair longer,  $\pm$  included under upper lip. Nutlets drupaceous, usually only 1 or 2 maturing, scar small.

1. Shrub; upper leaf surface with branched hairs; corolla less than 25mm long  
**G. parviflorum**
- + Herb, scandent, prostrate or ascending; upper leaf surface  $\pm$  glabrous or with simple hairs; corolla more than 25mm long ..... 2
2. Verticillasters 2–6-flowered; leaves  $\pm$  glabrous above .. **2. G. melissifolium**
- + Verticillasters more than 10-flowered; leaves with scattered, simple, appressed hairs above ..... **3. G. ovatum**

**1. G. parviflorum** Benthams; Dz: *Kaman Dhusur* (117). Fig. 86g&h.

Erect shrub, 2.5–3m. Stems stout, densely stellate-tomentose. Leaves elliptic to elliptic-ovate, 15–29  $\times$  5–12cm, acuminate, base cuneate-attenuate, margin serrate-dentate, upper surface with numerous branched hairs, lower surface densely stellate-tomentose; petiole 1–3.5cm. Verticillasters many-flowered. Bracts lanceolate to ovate. Calyx 10–12mm, densely tomentose; teeth linear-lanceolate, c 4mm. Corolla yellow or orange-yellow to greenish-white, 20–24mm, tube c 18mm, upper lip not emarginate. Nutlets ovoid, c 6  $\times$  3mm, succulent, red.

**Bhutan:** S – Gaylegphug district (Gaylegphug, 117); **Darjeeling:** Mongpu, Jalpaiguri, Bamon Pokri, Badamtam, Ryang, Pankhabari; **Sikkim:** Tista, Sillok, Rayong. Wet shady places, rainforest, 305–1220m. May, August.

Material from our area with broader (ovate) bracts was recognised by Prain (274) as var. *farinosa* Prain but, as he stated, there are many intermediates.

**2. G. melissifolium** Benthams

Scandent or prostrate herb. Stems slender, 50–100cm, often rooting at nodes. Leaves ovate-elliptic, 6–8.5  $\times$  3–4.2cm, acute to obtuse, base cuneate, margin shallowly serrate-dentate, upper surface  $\pm$  glabrous, lower surface stellate-hairy on veins only; petiole up to 2.5cm. Verticillasters 2–6-flowered. Calyx 10–12mm, stellate-hairy; teeth narrowly triangular, 5–6mm. Corolla yellow, c 35mm; tube c 25mm, upper lip emarginate. Nutlets c 4  $\times$  3mm, red.

**Sikkim:** locality unknown. 600m.

Known from our area only from a single unlocalised Hooker specimen.

**3. G. ovatum** Benthams

Ascending herb. Stems somewhat slender, 15–30cm, rooting near base only. Leaves ovate-elliptic, 8–12(–18)  $\times$  5–8(–9)cm, acute, base rounded to cuneate, margin crenate; upper surface with scattered, simple, appressed hairs; lower surface stellate; petiole 2–7cm. Verticillasters many-flowered. Outer bracts elliptic,  $\pm$  obtuse at apex. Calyx 10–12mm, stellate-tomentose; teeth narrowly

triangular, c 5.5mm. Corolla pale yellow, 35–38mm; tube c 25mm; upper lip entire. Nutlets 6 × 4mm.

**Darjeeling:** Ryang, Rangit River, Sitong, Rishap, Balasun. 610–1220m. July–August.

Two varieties have been recognised: var. *ovatum* (var. *typica* Prain nom. superfl.) and var. *flaccidum* Prain. Both are recorded from Darjeeling but only differ in the degree of hairyness.

*G. mastersii* Bentham has also been recorded from ‘Sikkim’ (80) but the material has been wrongly identified and is in fact *G. ovatum* collected from Darjeeling.

## 6. SCUTELLARIA L.

Herbs (in Bhutan). Leaves sessile or petiolate. Inflorescence of 2-flowered verticillasters in leaf axils or arranged in spike. Calyx bilabiate, lips entire, upper lip folded, forming a sail-like scutellum, mouth closed in fruit. Corolla bilabiate, tube often long and curved near base so that upper corolla held erect; upper lip smaller than lower, galeate, enclosing stamens, with 2 lateral lobes; lower lip 1 lobed. Stamens 4, anterior pair with smaller anthers. Nutlets small, minutely tuberculate.

1. Leaves grouped at base of stem, shallowly crenate or crenulate, usually dull purple on lower surface; flowers rarely opposite on spike .... **1. S. discolor**  
+ Leaves distributed along stem, serrate or serrate-crenate, if dull purple then less than 2cm long; flowers always opposite on stem or spike ..... 2
2. Leaves 2cm or less long, with only 2–3 pairs of teeth; flowers in leaf axils  
..... **4. S. dependens**  
+ Leaves more than 2cm long, with 5 or more pairs of teeth; flowers in spikes and uppermost leaf axils ..... 3
3. Decumbent herb; leaves rounded to cordate at base; corolla blue-violet or mauve with paler lower lip ..... **2. S. violacea**  
+ Erect herb; leaves truncate or cuneate at base; corolla creamy white to dull yellow ..... **3. S. grossa**

### 1. *S. discolor* Bentham

Herb. Flowering stems ± erect from creeping rootstock, 8–38cm, usually unbranched, pubescent. Leaves mostly near base of stem, ovate to elliptic, 2.5–9.2 × 1.6–5.1cm, obtuse, base rounded to cordate, margin shallowly crenate or crenulate, upper surface puberulent, often with scattered short hairs, lower surface similar with veins densely hairy, often dull purple; petiole 0.5–6cm. Verticillasters arranged in lax spike, flowers frequently not opposite. Calyx 2–2.5mm, enlarging to 5–5.5mm in fruit. Corolla pale purple or blue to deep

purple with white lower lip, 11–16mm; tube 8–10mm, strongly curved near base. Nutlets  $\pm$  ellipsoid,  $0.8 \times 0.5$ mm.

**Bhutan:** S – Gayleghug district (117) and Deothang district, C – Punakha, Tongsa and Mongar districts, N – Upper Mo Chu and Upper Kuru Chu districts; **Darjeeling:** Rangit, Badamtam, Gurubathan. Open rocky or dry grassy hill slopes, deciduous oak forest, cliff-faces, 460–2440m. July–November.

## 2. *S. violacea* Benth

Decumbent herb. Stems up to 68cm, pubescent with longer multicellular hairs. Leaves distributed along stem, ovate to ovate-elliptic,  $2.1\text{--}6 \times 1.7\text{--}3.6$ cm, acute or obtuse, base rounded to cordate, margin clearly serrate or serrate-crenate, both surfaces  $\pm$  hairy; petiole up to 3cm. Verticillasters arranged in lax spike, flowers always opposite. Calyx 2.6–3mm, enlarging to 8mm in fruit. Corolla blue-violet or mauve with paler or white lower lip, 11–15mm; tube 8–12mm, curved at base. Nutlets  $\pm$  ellipsoid,  $1.4 \times 0.9$ mm.

**Bhutan:** S – Sankosh district (between Laugau and Daga River) and Deothang district (Diu Ri valley), C – Tongsa district (Jirgang Chu valley); **Darjeeling:** Kurseong, Rimbik, Budhwari, Batasia, Sittong, Balasun valley, Senchal. In partially cleared jungle, on moist banks in dense bamboo scrub, along irrigation channels near cultivation, 1000–2700m. April, June–September.

A widespread species in the Indian subcontinent, Hooker (80) recognised four varieties placing East Himalayan material in var. *sikkimensis* Hook.f.

## 3. *S. grossa* Benth

Erect herb. Stems up to 65cm, pubescent, frequently branched, often dull purple. Leaves ovate,  $2.2\text{--}8.2 \times 1.3\text{--}5.4$ cm, acute to shortly acuminate, base truncate or broadly cuneate, margin coarsely serrate-crenate, both surfaces sparsely hairy to  $\pm$  pubescent; petiole 0.8–3cm. Verticillasters arranged in lax spike, flowers opposite. Calyx 3mm, up to 6 or 7mm in fruit. Corolla creamy white to dull yellow, 11–12mm; tube 9–10mm, strongly curved near base. Nutlets ellipsoid,  $1.3 \times 0.9$ mm.

**Bhutan:** C – Thimphu district (Chapcha, Ginnekah). Base of rock-face in evergreen oak forest, open stony hillsides with scattered Blue Pine, 2130–2700m. July–August.

A further species, *S. repens* D.Don, has been recorded from Sikkim (80) but this record has not been confirmed and may be a misidentification of *S. grossa*.

## 4. *S. dependens* Maximowicz. Fig. 86i.

Very slender herb. Stems ascending-erect, c 30cm, subglabrous or puberulent. Leaves triangular-ovate,  $0.8\text{--}1(-2) \times 0.5\text{--}0.6(-0.9)$ cm, acute, base truncate, margin usually serrate at base with only 2–3 pairs of teeth, both surfaces sparsely hairy; petiole 1–2(-5)mm. Verticillasters in axils of mid- and upper-stem leaves. Calyx 2mm, up to 4mm in fruit. Corolla purplish-blue, c 6.5mm; tube c 4.5mm. not curved near base.

Nutlets ellipsoid, c  $0.6 \times 0.4$ mm.

**Bhutan:** C – Thimphu district (6km N of Thimphu Dzong). Moist meadow, 2450m. June.

A new record for the Himalayas when collected by Grierson & Long in 1975; no further material from our area has been seen.

## 7. NEPETA L.

Herbs. Leaves simple, petiolate or sessile. Inflorescences terminal, verticillasters many-flowered, arranged in short, usually dense spikes and sometimes in uppermost leaf axils. Bracts present. Calyx  $\pm$  bilabiate, tubular, 15-nerved, upper lip 3-toothed, lower lip 2-toothed. Corolla bilabiate, tube narrow, dilated abruptly at throat, upper lip subequal to lower, 2-lobed. Stamens 4, posterior pair longer than anterior. Nutlets ellipsoid to obovoid.

1. Leaves ovate to broadly ovate, length less than  $2 \times$  width; calyx teeth subulate ..... 1. **N. lamiopsis**
- + Leaves ovate-oblong, length more than  $2 \times$  width; calyx teeth narrowly triangular ..... 2. **N. coerulescens**

### 1. **N. lamiopsis** Hook.f. Med: *Jiptshi, Jib-rtsi-dkar-po*

Decumbent, perennial herb with somewhat tuberous roots. Stems ascending, decumbent or trailing, 15–95cm, often unbranched, glandular-pubescent to  $\pm$  tomentose. Leaves ovate to broadly ovate,  $1.2\text{--}4.5 \times 1.2\text{--}3.8$ cm, obtuse, base subcordate, margin usually crenate, rarely serrate, upper surface with scattered pilose hairs, lower surface glandular-pubescent and with longer hairs on veins, sometimes whitish; petiole up to 2cm. Inflorescence 2–8cm long. Calyx 8–9.5mm, often purplish-black; teeth subulate, upper lip teeth 4–4.5mm, slightly longer than lower. Corolla purple to deep violet, 12–16mm; tube 9–12mm. Nutlets c  $1.5 \times 1$ mm.

**Bhutan:** C – Thimphu district (Pajoding, Pumo La), N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Lachen, Samdong, Thangu, Chomnagu, Bijan, Rathong Chhu; **Chumbi:** Chumolhari, Phari, Dotha, Yatung. Open grassy hillsides, in low forest and damp sand and gravel areas, 2500–4880m. June–September.

A rather variable species in habit, leaf shape and bracts.

Two further species have been recorded from our area, *N. laevigata* (D. Don) Handel-Mazzetti (117) and *N. discolor* Benth (113). Both reports are probably the result of confusion with the variable species *N. lamiopsis*.

### 2. **N. coerulescens** Maximowicz; *N. thomsonii* Hook.f.

Perennial herb. Stems erect, 15–30cm, subglabrous to  $\pm$  pubescent. Leaves ovate-oblong,  $2\text{--}4.2 \times 0.6\text{--}1.8$ cm, acute, base rounded to subcordate, margin serrate to crenulate, upper surface glandular-pubescent, lower surface pubescent



on veins and with numerous sessile glands on lamina; often sessile or petiole up to 7mm. Inflorescence 3.5–4.5cm long. Calyx 6–7mm; teeth narrowly triangular, those of upper lip c 2mm. Corolla blue, mauve or lilac, 10–12mm; tube 7.5–8mm, upper lip subequal to lower. Nutlets c 1.7 × 1.2mm.

**Sikkim:** Chamgong and Thanggu (113). Dry rocky alpine slopes, 4270–4570m. September.

## 8. DRACOCEPHALUM L.

Perennial herbs. Leaves pinnatifid, crenate, serrate or subentire. Verticillasters in axils of upper leaves or forming short, dense, terminal spikes. Calyx ± bilabiate, tubular, 15-nerved; upper lip 3-toothed; lower lip 2-toothed; base of teeth with small, thickened folds at sinuses. Corolla bilabiate, upper lip subentire or 2-lobed, lower lip 3-lobed with median lobe largest. Stamens 4, usually included under upper lip. Nutlets ovoid-oblong, trigonous, attachment scar V-shaped.

- |   |                            |
|---|----------------------------|
| 1. Leaves pinnatifid .....  | <b>3. D. tanguticum</b>    |
| + Leaves not pinnatifid .....   | 2                          |
| 2. Leaves all sessile, margin entire or only partially serrate; bushy herb up to 1m   | <b>4. D. hemsleyanum</b>   |
| + Leaves petiolate (at least radical or lower stem leaves), crenate or serrate along whole margin; tuft-forming herbs, stems usually unbranched, up to 62cm ..... | 3                          |
| 3. Leaves 3cm long or more; petioles of basal leaves 5–30cm; corolla deep purple or dark blue-violet .....  | <b>1. D. wallichii</b>     |
| + Leaves 2cm long or less; petioles of basal leaves less than 2cm; corolla very pale pink or white .....  | <b>2. D. heterophyllum</b> |

**1. D. wallichii** Sealy; *D. speciosum* Benth non Sweet. Fig. 86j&k.

Flowering stems 15–62cm. Leaves usually mostly radical. Radical leaves ovate, 3.2–8.5 × 2.2–5cm, obtuse, base cordate, margin crenate, upper surface glabrous or puberulent, lower surface villous and with some sessile glands; petiole 5–30cm. Stem leaves similar, uppermost sessile and ± rounded at base, lower with petiole up to 2.5cm. Inflorescence a dense spike, 3–7 × 4–7cm with broadly ovate to suborbicular bracts. Calyx 14–19mm, usually flushed deep purple; teeth subequal in length, 4.5–6mm, middle tooth of upper lip ovate. Corolla deep purple or dark blue-violet, 21–30mm; upper lip 5–8mm, subequal to lower lip. Nutlets 4.5 × 2mm; scar c 0.8mm long.

**Bhutan:** C – Thimphu and Ha districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Darjeeling:** Phullalong; **Sikkim:** Chaerlung, Dotha, Nathang, Meguthang, Phuthung,

Singalila, Tsomgo; **Chumbi**: Phari, Yatung. Scree, open hillsides, alpine pastures, amongst scrub of *Juniperus* and *Salix*, 3350–4880m. June–September.

## 2. *D. heterophyllum* Benth

Tuft-forming herb. Stems 4.5–11cm, decumbent, pubescent. Leaves oblong or ovate-oblong, 1.2–1.6(–2) × 0.4–0.8(–1.2)cm, apex often obtuse, base truncate to cordate, margin usually crenate, sometimes serrate, both surfaces ± pubescent, lower surface with numerous sessile glands; petiole up to 1.8cm. Inflorescence a dense spike, 3.5–5 × 3–5cm; bracts oblong-ovate with triangular awned teeth. Calyx 15–20mm; teeth awned, unequal in length, upper 3–5mm, lower 6.5–10mm. Corolla very pale pink or white, 20–29mm; upper lip 5–8mm, subequal to lower lip. Nutlets c 3.8 × 1.5mm; scar c 0.8mm long.

**Sikkim**: Giaogang, Dongkung; **Chumbi**: Phari. Rocky or gravelly slopes, grassy meadows, 3350–5560m. August–September.

Strongly aromatic herb.

## 3. *D. tanguticum* Maximowicz; *D. hookeri* Hook.f.

Stems 11–30(–62)cm, ascending-erect, pubescent. Leaves sessile, pinnatifid, 2–3.6 × 1–2.5cm, segments narrowly linear, upper surface puberulent, lower surface pubescent. Inflorescence a ± dense spike, 3–11 × 5cm, bracts similar to leaves but smaller and with fewer segments. Calyx 12–18mm, usually flushed dull purple; teeth subequal in length, 4–6mm. Corolla blue-violet or purple, 23–30mm; upper lip 6–8mm, shorter than lower lip. Nutlets c 2.5mm long.

**Chumbi**: Phari. Grassy hill slopes, cliffs, 4570m. August.

Hooker (80) doubtfully recorded this species from north Sikkim.

## 4. *D. hemsleyanum* (Prain) Marquand

Suffruticose, clump-forming herb. Stems 26–100cm, tomentose-pubescent, branched. Leaves sessile, oblong-elliptic to oblong-ovate, 2–5 × 0.6–1.5cm, acute, base rounded, margin entire or partially serrate, both surfaces pubescent and with numerous sessile glands. Inflorescence of verticillasters in axils of upper leaves, bracts lanceolate. Calyx 12–16mm, sometimes flushed dull purple; teeth unequal in length, upper 3–4mm, lower 4–6mm. Corolla blue-violet, 29–35mm; upper lip 4–5mm, shorter than lower lip. Nutlets c 3.5 × 1.7mm; scar c 0.5mm long.

**Chumbi**: beyond Phari. Recorded from adjacent areas on open rocky hillsides, at 3350–4270m. July–September.

Mukerjee (269) recorded this from 'Lungtiya, Bhutan' based on a J.C. White specimen; this locality has not been traced and may be in Tibet.

## 9. MARMORITIS Benth

Perennial herbs. Stems short, densely leafy. Leaves sessile, crenate. Flowers in axils of middle and upper leaves. Verticillasters axillary, few-flowered. Calyx

bilabiate, tubular-campanulate, sublanate; upper lip longer than lower, 3-toothed; lower lip 2-toothed. Corolla bilabiate, tube scarcely dilated at throat, glabrous within; upper lip bifid, shorter than lower; lower lip 3-lobed. Stamens 4, in 2 pairs, anterior pair shorter.

1. **M. pharica** (Prain) Budantzev; *Nepeta pharica* Prain, *Phyllophyton pharicum* (Prain) Kudo

Stems erect, 10–13cm. Upper leaves close-set, suborbicular, 1.3–2.9 × 1.2–2.8cm, obtuse, base ± truncate, upper surface lanate, margin crenate, lower surface hairy on veins and with numerous glandular hairs and sessile glands. Calyx 13–15-nerved, c 9mm, sublanate; upper lip with teeth c 1.5mm. Corolla pale blue, 14–16mm; upper lip c 2mm. Nutlets 2.75mm long.

**Chumbi:** Phari and between Phari and Lhasa (274). Screes and stony ground, 4880m. July.

## 10. PRUNELLA L.

Perennial herbs with creeping rhizome. Stems procumbent to erect. Leaves petiolate, entire to obscurely serrate. Inflorescence a dense terminal spike. Bracts broadly ovate. Calyx bilabiate, obconical, lips subequal; upper lip ± truncate at apex, with 3 small teeth; lower lip 2-toothed. Corolla bilabiate; upper lip hooded, longer than lower; lower lip 3-lobed. Stamens 4, didynamous, included under upper lip of corolla; filaments with a small spur near apex; anthers 2-celled, diverging. Nutlets obovoid, scar small.

1. **P. vulgaris** L.; *Brunella vulgaris* L. Eng: *Selfheal*. Fig. 87a.

Stems 5–32cm, pilose to subglabrous. Leaves ovate to ovate-oblong, 1.5–5 × 0.7–1.8cm, acute, base rounded, margin entire to obscurely serrate, both surfaces pilose; petiole up to 1.7cm. Flower spike 2–4 × 2cm. Calyx 8–9mm, tube c 3.5mm; teeth of lower lip triangular, c 3.5mm. Corolla deep purple or sometimes white, 10–12mm; upper lip c 3.5mm. Nutlets c 1.6 × 1mm.

**Bhutan:** S – Chukka district (71), C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu and Upper Kulong Chu districts; **Darjeeling:** Jalapahar; **Sikkim:** Chomnagu, Samdong, Phalut, Rathong Chu; **Chumbi:** E of Yatung. Sandy places, damp meadows and open banks, roadsides, 1370–3960m. May–August.

Hooker (80) recorded var. *hispid*a Bentham from Sikkim, which, as its name implies, is more hispid than the type variety.

## 11. NOTOCHAETE Bentham

Woody perennial herbs with stellate hairs. Stems erect. Leaves with long petiole, serrate. Inflorescence axillary, verticillasters many-flowered, globose.

Bracts spinose, with hooked tips. Calyx regular; teeth equal, spinose, hooked at apex. Corolla bilabiate; lips hairy; upper lip 2-lobed; lower lip 3-lobed, subequal to upper. Stamens 4, included under upper lip; anther cells diverging. Style lobes minute, subequal. Nutlets obovoid-trigonal, scar minute.

**1. *N. hamosa* Benth.** Fig. 87b&c.

Stems 40–60cm, minutely stellate-hairy at least on younger stems. Leaves ovate-elliptic, 10.5–19.5 × 5.7–14cm, acuminate, base rounded to cordate, margin serrate, upper surface sparsely hairy with stellate or simple hairs, lower surface stellate-hairy; petiole 2.2–16cm. Calyx 17mm, tube villous; teeth 9mm. Corolla white, 9–10mm; lips c 3mm. Nutlets 4 × 2mm.

**Bhutan:** S – Chukka, Gaylegphug and Deothang districts, C – Punakha district (between Ritang and Ratsoo, 71), Mongar/Tashigang district (Kori La) and Tashigang district (117); **Darjeeling:** Algarah, Shiri Khola, Simonbong, Rambi Chhu, Kurseong; **Sikkim:** Lachen, Sakkurgong, Chho La. Among shrubs in broad-leaved forests, streamsides in wet bamboo-rich forest, 1220–3050m. July–August.

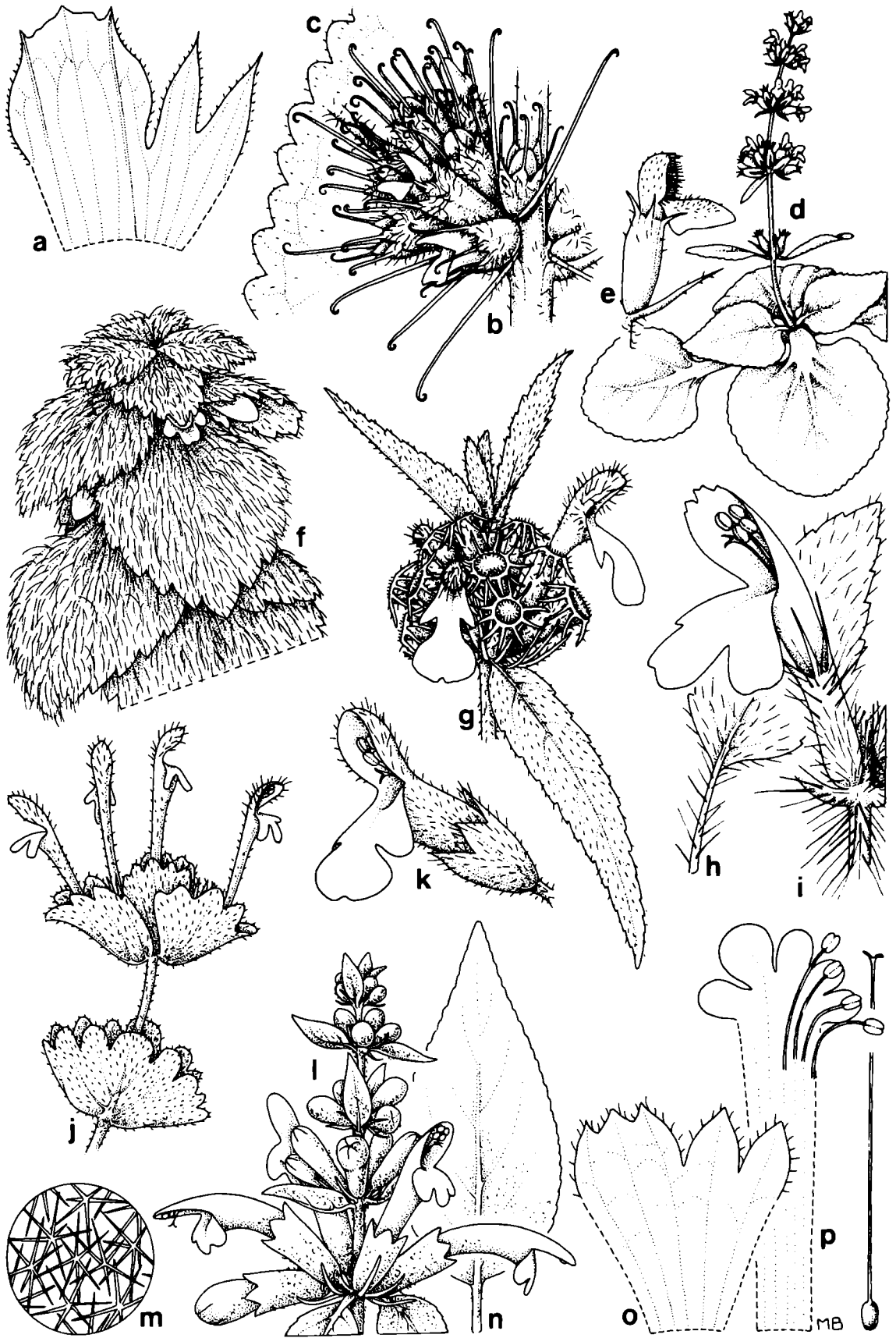
## 12. PHLOMIS L.

Erect perennial herbs, sometimes quite woody, usually with some stellate hairs. Leaves petiolate or sessile, crenate or crenate-serrate. Inflorescence of distant verticillasters in axils of upper leaves or conferted in short terminal spikes; verticillasters many-flowered; bracts numerous, linear or filiform. Calyx regular, 5–10-nerved, tubular, ± truncate at apex with 5 equal teeth; teeth broad at base, often with spinose tip. Corolla bilabiate, tube ± included within calyx; upper lip falcate, densely hairy on inside; lower lip 3-lobed. Stamens 4, didynamous, anterior pair longer than posterior pair, included; anthers 2-celled. Style unequally 2-lobed. Nutlets obovoid, trigonal.

*P. spectabilis* Benth. has been recorded from Bhutan (135) but no material has been seen from our area of this showy west Himalayan species. It is conceivably a confusion with *P. macrophylla* although *P. spectabilis* differs in many respects including having larger flowers (c 2.5cm) and lacking long simple hairs on the calyx nerves.

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FIG. 87. Labiatae. a, *Prunella vulgaris*: calyx (× 4). b–c, *Notochaete hamosa*: b, inflorescence (× 3); c, leaf margin (× 1). d–e, *Phlomis rotata*: d, habit (× ½); e, flower (× 2). f, *Eriophyton wallichii*: habit (× ⅔). g, *Leucas ciliata*: leaf and inflorescence (× 1½). h–i, *Galeopsis bifida*: h, leaf (× 1½); i, flower (× 3). j, *Lamium amplexicaule*: flowering habit (× 1½). k, *Stachys melissifolia*: flower (× 3). l–n, *Colquhounia coccinea*: l, inflorescence (× 1); m, hairs (× 30 approx.); n, leaf (× 1). o–p, *Achyrospermum wallichianum*: o, dissected flower with ovary and style (× 4); p, calyx (× 4). Drawn by M. Bates.



1. Leaves acuminate with sparse indumentum on lower surface; tall herbs, 90–180cm ..... 2
- + Leaves obtuse to acute with dense indumentum on lower surface; herbs 7–72cm, rarely up to 100cm ..... 3
  
2. Calyx 12–14mm, usually green, teeth 2–4mm; corolla 18mm or more, pink or red with white marking ..... **1. *P. macrophylla***
- + Calyx 7–9.5mm, often dull purple, teeth 1–2mm; corolla 16mm or less, usually dark maroon or dark purple ..... **2. *P. breviflora***
  
3. Basal leaves with petioles up to 26cm long and not more than 3mm wide; corolla more than 15mm; calyx and bracts often with dark brown villous hairs ..... **3. *P. tibetica***
- + Basal leaves with petioles up to 7cm long and 4mm or more wide; corolla 15mm or less; calyx and bracts with whitish villous hairs ..... **4. *P. rotata***

### **1. *P. macrophylla* Bentham; *P. setigera* Bentham**

Stout herb. Stems 90–180cm, erect, retrorsely hairy to glabrescent. Leaves ovate, 11–18 × 6.5–11.5cm, acuminate, base cordate to truncate, margin coarsely serrate or crenate-serrate, upper surface sparsely villous; lower surface sparsely stellate hairy; petiole up to 11cm. Verticillasters in axils of upper leaves. Bracts linear-lanceolate with whitish villous hairs. Calyx 12–14mm, sparsely pubescent, hairs sometimes stellate; teeth 2–4mm. Corolla pink or red with white marking, 18–22mm; tube with oblique annulus near base; upper lip 8–10mm, pale brown villous on inside. Nutlets ± oblong-obovoid, 4.5 × 2.5mm, truncate at apex.

**Bhutan:** C – Thimphu district (Barshong, above Dotena), N – Upper Kulong Chu district (Me La); **Darjeeling:** Sandakphu; **Sikkim:** Longrong, Tari, Chomnagu, Phalut, Lachen, Tumbok, Tsomgo, Zongri; **Chumbi:** unlocalised. Alpine meadows, riversides, partly cleared Hemlock forest, 2740–3960m. July–August.

The two collections from Me La in the extreme north-east of Bhutan (*Ludlow & Sherriff* 371 and *Ludlow, Sherriff & Hicks* 20780) appear rather anomalous for this species.

### **2. *P. breviflora* Bentham**

Similar to *P. macrophylla* but leaves more deeply cordate with rounded lobes; calyces shorter, 7–9.5mm, often dull purple; teeth 1–2mm; corolla dark maroon to blackish-purple, rarely paler, up to 16mm.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling:** Tanglu, Garibans to Tanglu; **Sikkim:** Tari, Lebrung, Phalut; **Chumbi:** unlocalised. Forest margins, Fir/Hemlock forest, 2360–3960m. June–August.

### 3. *P. tibetica* Marquand & Shaw

Perennial herb, 7–72(–100)cm. Stems pubescent to villous. Basal leaves ovate to oblong-ovate, 1.8–8.5 × 1.6–6.5cm, obtuse, base cordate, margin crenate, upper surface densely villous, lower surface villous, sometimes with some stellate hairs; petiole 2–26cm. Stem leaves few, smaller, short-petiolate or sessile. Inflorescence of 1–5 conferted or distant verticillasters. Bracts linear-filiform usually with dark brown hairs. Calyx 8–12mm, usually brown-villous on nerves, sometimes with small stellate hairs near base of teeth; teeth 1–1.5mm. Corolla pink, purple or dark red, 16–25mm; tube with oblique annulus near base; upper lip 5–10mm, densely pale or dark brown villous on inside; lower lip 5–6mm. Nutlets ellipsoid, c 4 × 2mm.

**Bhutan:** C – Ha, Thimphu, Punakha and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu and Upper Kulong Chu districts; **Sikkim:** Yampung, Onglakthang, Kupup, Tsomgo, Tosa, Gocha La, Temo La, Zongri; **Chumbi:** Yatung. Open alpine meadows and grassy slopes, sometimes among shrubs, moist scree, gravel river beds, (2440–)3500–4725m. May–September.

This is a variable species in indumentum, petiole length and height. Records of *P. bracteosa* Bentham from our area appear to be based on misidentifications of *P. tibetica*; although the two species have similarities, *P. bracteosa* has broader (linear) bracts and white villous hairs on the bracts and corolla upper lip. Judging from material of *P. tibetica* that has been seen, the variation may in part be due to hybridisation and further field studies would undoubtedly clarify the situation.

### 4. *P. rotata* Hook.f.; *Lamiophlomis rotata* (Hook.f.) Kudo. Med: *Tapak*, *Rtapags*. Fig. 87d&e.

Low perennial herb. Flowering stems to 20cm. Leaves in basal rosette, reniform to broadly ovate, 2.4–19 × 2.2–19cm, rugose, apex obtuse, base truncate to cordate with lamina merging into broad petiole, margin crenate; upper surface densely villous, some hairs with stellate arms at base; lower surface similar with most hairs stellate; petiole 1–7cm long, usually more than 4mm wide. Inflorescence a ± dense terminal spike, 3.5–18 × 2.5–3.5cm. Bracts linear to filiform. Calyx 8–10mm, with villous hairs on nerves and sometimes dendroid hairs; teeth spinose, rarely not, 1.5–2.5mm. Corolla purple or purple with white throat, 12–15mm; upper lip c 5mm, densely white villous on inside; lower lip c 6mm. Nutlets ± ellipsoid with flattened apex, trigonous, c 2.3 × 1.9mm, smooth.

Two subspecies are recognised:

1. Calyx teeth spinose; leaves broadly ovate to reniform; lower lip of corolla equal to or longer than upper lip, hairy on upper surface ... subsp. **rotata**
- + Calyx teeth sometimes with small mucro but not spinose; leaves ovate to broadly ovate; lower lip of corolla shorter than upper lip, glabrous on upper surface ..... subsp. **bhutanica**

a. subsp. **rotata**

**Bhutan:** C – Thimphu (71) and Bumthang districts, N – Upper Mo Chu, Upper Mangde Chu, Upper Bumthang Chu and Upper Kulong Chu districts; **Sikkim:** Chaerlung, Lungma Chhu, Pem La, Tchula to Lasha, Thanggu; **Chumbi:** Phari. Open rocky slopes, scree and turf, sometimes amongst scrub, 3660–5000m. May–September.

b. subsp. **bhutanica** Clement

**Bhutan:** C – Punakha/Tongsa district (Dungshinggang). Open grassy hillsides and among dwarf *Rhododendron*, 4265m. June.

This subspecies is endemic to Bhutan, known only from one collection (*Ludlow & Sherriff* 3298) from the Black Mountain (250).

13. **PARAPHLOMIS** Prain

Herbs. Stems pubescent. Leaves petiolate, serrate-crenate to shallowly dentate. Inflorescence of many-flowered verticillasters in axils of leaves. Bracts small, linear. Calyx regular, 5-nerved; teeth equal. Corolla bilabiate, tube with annulus near throat; upper lip  $\pm$  entire, narrow; lower lip 3-lobed, median lobe broader than lateral lobes. Stamens 4, anterior pair longer than posterior pair, included under upper lip; anthers 2-celled. Style unequally bifid. Nutlets obovoid.

1. **P. javanica** (Blume) Prain; *P. rugosa* (Bentham) Prain, *Phlomis rugosa* Bentham

Stems 60–100cm, retrorsely pubescent. Leaves elliptic or oblong-ovate, 14.5–20  $\times$  5.5–10cm, acuminate, base rounded to broadly cuneate, coarsely serrate-crenate to shallowly dentate and appearing subentire, upper surface sparsely pilose, lower surface pubescent on veins; petioles 4.5–10.5cm, slender. Calyx 8–9mm, pubescent; teeth triangular at base, filiform at apex, 2.5–3mm. Corolla yellow to white, c 20mm; upper lip 10–11mm, narrow; lower lip 7–8mm. Filaments hairy. Nutlets c 5mm long.

**Darjeeling:** Pomong. In forest, 610–1520m. October.

Also reported by Prain from 'Bootan, *Cummins*' but this is likely to refer to Darjeeling district.

14. **ERIOPHYTON** Bentham

Dwarf, densely woolly herbs. Stems erect, with woody rootstock. Leaves petiolate, serrate-dentate. Verticillasters few, usually congested in leaf axils. Calyx regular, campanulate, 5-toothed. Corolla bilabiate; upper lip entire, hooded, densely hairy on outside; lower lip 3-lobed, median lobe emarginate. Stamens 4,  $\pm$  included under upper lip; anthers 2-celled. Style unequally bifid. Nutlets broadly obovoid, trigonous, scar small.



1. *E. wallichii* Bentham; *E. wallichianum* Hook.f. Med; *Dautshegangsham*, *Pangtshen Puroo*. Fig. 87f.

Stems above-ground 6–17cm, with as much again below-ground in scree or rock-crevices, originating from woody rootstock. Leaves broadly ovate to suborbicular, 2.5–5 × 2.6–4.2cm, obtuse, base cuneate, margin serrate-dentate; petiole broad, short (c 5mm). Verticillasters 6-flowered. Calyx 12–14mm; teeth triangular-acuminate, 5–7mm. Corolla red, pink or purple, 20–25mm; upper lip 10–12mm; lower lip c 7mm. Nutlets c 3.5 × 3mm.

**Bhutan:** C – Thimphu district (Chekha, Somana, Wasa La) and Punakha district (Black Mountain), N – Upper Mo Chu district (Laya, Lingshi, Yale La, Shingche La), Upper Mangde Chu district (Saga La) and Upper Bumthang Chu district (Marlung, Pangothang); **Sikkim:** Yume Samdong, Ningbil, Kupup La, Bikbari, Gocha La, Thakla, Lachung, Lasha Chhu; **Chumbi:** Tangkar La. In alpine screes, 4000–5460m. July–October.

## 15. LEUCAS R. Brown

Annual or perennial herbs. Leaves sessile or shortly petiolate, entire or serrate. Inflorescences of many-flowered verticillasters, crowded or distant. Bracts ovate-lanceolate to subulate. Calyx 10-nerved, tubular; apex straight or oblique, not bilabiate; teeth 8–10. Corolla bilabiate, upper lip entire, densely hirsute on outside; lower lip 3-lobed, longer than upper lip, median lobe larger than lateral lobes. Stamens 4, ascending; anthers 2-celled. Style bifid. Nutlets oblong, trigonous, scar small.

- |   |                           |
|---|---------------------------|
| 1. Calyx mouth oblique .....  | 2                         |
| + Calyx mouth straight .....  | 4                         |
| 2. Bracts ovate-lanceolate, 2–3mm wide; leaves oblong-elliptic, 1cm or more wide .....  | <b>5. L. cephalotes</b>   |
| + Bracts subulate or linear, 1mm or less wide; leaves linear-oblong or linear-lanceolate, rarely lanceolate, usually less than 1cm wide ..... | 3                         |
| 3. Bracts ciliate with long hairs; veins on calyx prominent, with villous hairs .....   | <b>6. L. aspera</b>       |
| + Bracts pubescent; veins on calyx not prominent, calyx pubescent .....   | <b>7. L. indica</b>       |
| 4. Leaves linear, entire, 0.5cm or less wide .....  | <b>3. L. hyssopifolia</b> |
| + Leaves lanceolate to ovate, serrate or serrulate, 1cm or more wide .....  | 5                         |
| 5. Calyx teeth long, 4.5–5mm, spreading; upper lip of corolla densely yellow-brown hirsute .....  | <b>4. L. ciliata</b>      |

- + Calyx teeth short, 0.5–1.2mm, not spreading; upper lip of corolla densely white hirsute ..... 6
6. Leaves greyish-green; stem indumentum usually retrorse, appressed; plant 40–120cm ..... 1. *L. mollissima*
- + Leaves white lanate; stem indumentum antrorse or spreading; plant up to c 30cm ..... 2. *L. lanata*

### 1. *L. mollissima* Benth

Perennial herb. Stems erect to ascending, slender, 40–120cm, branched, densely appressed retrorsely hairy. Leaves ovate-oblong, 3.5–6 × 1.3–2.4cm, acute, base rounded to ± cuneate, margins serrate, indumentum of both surfaces variable, from sparsely hairy to fairly densely sericeous, hairs appressed; petiole up to 11mm. Verticillasters distant, in leaf axils. Calyx 6–8mm, apex straight; teeth 10, triangular, mucronulate, 0.5–1.2mm. Corolla white, 11–12mm, tube annulate; upper lip c 4mm. Nutlets 2 × 1.8mm.

**Bhutan:** C – Punakha district (E of Punakha Dzong, between Wangdu Phodrang and Chirang) and Tashigang district (Kheri, 117); **Darjeeling:** Mongpu, Rishep, Gok; **Sikkim:** Rangpo Chhu (270), Selim. 760–1220m. October–November.

The variable indumentum in this species has led to the recognition of varieties (80) but the material seen does not appear to justify division into infraspecific taxa in our area.

### 2. *L. lanata* Benth

Similar to *L. mollissima* but plants up to c 30cm, with procumbent to ascending stems; stems with lanate indumentum; leaves with very dense white sericeous indumentum.

**Bhutan:** C – Thimphu district (Thimphu) and Tashigang district (Shiri Chu valley). Rocky banks in dry valleys, 940–2410m. June, August.

### 3. *L. hyssopifolia* Benth

Perennial herb. Stems erect, slender, c 30cm, with spreading rather stiff hairs. Leaves sessile, linear, 3–4.5 × 0.4–0.5cm, acute, base narrowly cuneate, margins ± entire sometimes revolute, upper surface with appressed hairs similar to those of stem, lower surface hairy on veins only with sessile glands. Verticillasters distant, in leaf axils. Bracts subequalling calyx. Calyx c 6mm, apex straight, glabrous; teeth 10, c 0.5mm, mucronate. Corolla white, 10–12mm; upper lip c 5mm; lower lip c 10mm. Nutlets 2.5 × 1.5mm.

**Sikkim/Darjeeling:** locality unknown. Subtropical zone, 305–610m.

Only known from our area from a single unlocalised collection.

### 4. *L. ciliata* Benth. Sha: *Betangmomnang*. Fig. 87g.

Annual herb. Stems erect, 30–90cm, often branched, usually densely yellow-brown villous. Leaves lanceolate, 4.4–12.8 × 1–3.5cm, acuminate, base cuneate,

margins shallowly serrate, both surfaces sparsely to densely villous; petiole up to 14mm. Bracts subulate. Verticillasters usually only 2 on branches, just separated. Calyx 12–15mm, apex straight; teeth 10, 4.5–5mm. Corolla white, 17–18mm; upper lip 5–6mm, densely yellow-brown hirsute; lower lip c 10mm. Nutlets  $2.5 \times 1.4$ mm.

**Bhutan:** S – Chukka district, C – Thimphu, Punakha, Tongsa (71), Mongar and Tashigang districts, N – Upper Mo Chu district; **Sikkim:** Lachung. Roadsides and pathsides in warm broad-leaved forest, 915–2740m. June–October.

### 5. *L. cephalotes* (Roth) Sprengel

Annual herb. Stems erect, 18–50cm, pubescent with some spreading hairs. Leaves oblong-elliptic,  $3.5\text{--}7 \times 1\text{--}2.4$ cm, acute, base cuneate, margins remotely serrulate, upper surface appressed pilose, lower surface  $\pm$  pubescent; petiole up to 0.8mm. Bracts ovate-lanceolate, equal to or longer than calyces. Verticillasters 1–2 on branches, globose, distant. Calyx 12–14mm, apex slightly oblique; teeth 10, c 1mm. Corolla white, 14–15mm; upper lip c 3mm; lower lip c 5mm. Nutlets  $3 \times 2$ mm.

**Bhutan:** C – Tashigang district (Tashigang). Weed of waste places and cultivation, 915–1220m. May, August.

### 6. *L. aspera* (Willdenow) Link; *L. plukenetii* (Roth) Sprengel

Similar to *L. cephalotes* but leaves linear to linear-lanceolate and bracts narrowly linear.

**Sikkim/Darjeeling:** locality unknown (80). Waste places in subtropical zone.

No specimens from the *Flora* area have been seen to support the single literature record.

### 7. *L. indica* (L.) Vatke; *L. lavandulifolia* Smith, *L. linifolia* (Roth) Sprengel. Sha: *Kurta Khi Phogpa*

Annual herb. Stems erect, 25–40cm, branched, antrorsely pubescent. Leaves sessile, linear-oblong, rarely lanceolate,  $2.7\text{--}6.5 \times 0.2\text{--}0.9\text{--}1.4$ cm, acute, base cuneate, margins entire to remotely serrulate, both surfaces pubescent. Bracts subulate. Verticillasters 1–2 on branches, 6–many-flowered. Calyx 8–10mm, apex oblique; teeth 10, 0.5mm. Corolla white, 14–16mm; upper lip c 5mm, densely white-hirsute; lower lip 7–9mm. Nutlets  $2.6 \times 1$ mm.

**Bhutan:** S – Phuntsholing district (Phuntsholing) and Sarbhang district (Sarbhang), C – Tongsa district (Tintibi Bridge), Mongar district (Mongar) and Tashigang district (Tashigang, Shali, Cha Zam); **Darjeeling:** Madari Hat. Moist places, disturbed ground, among shrubs and on stony banks in arid valleys, 200–1525m. March, May–July, October–November.

## 16. GALEOPSIS L.

Annual herbs. Stems slender, erect, hispid. Leaves petiolate, serrate, both surfaces appressed villous-hairy. Inflorescence of distant, few to many-flowered verticillasters in upper leaf axils. Calyx regular, tubular-campanulate; teeth 5, equal, with spinescent tips. Corolla bilabiate; tube slender; upper lip hooded, dentate at apex; lower lip 3-lobed, lobes all similar. Stamens 4, didynamous, anterior pair longer, under upper lip of corolla; anthers 2-celled. Style unequally bifid. Nutlets obovoid, scar small.

**1. *G. bifida*** Boenninghausen; *G. tetrahit* sensu Hook.f. non L. Eng: *Lesser Hemp-nettle*. Fig. 87h&i.

Stems 8–78cm, reddish-brown, retrorsely hispid and with some capitate-glandular hairs. Leaves ovate-elliptic, 2.5–7.5 × 1.2–4cm, acute to acuminate, base rounded to cuneate, margins serrate, both surfaces appressed villous-hairy; petiole up to 2.5cm. Calyx 7–9mm; teeth triangular with spinescent tips, 2–4mm. Corolla yellow or white with purplish marking on lower lip, 12–14mm; tube 8–10mm; upper lip 4mm, dentate at apex with a few long hairs on outside; lower lip 5mm. Nutlets c 3 × 2mm.

**Bhutan:** C – Ha district (near Ha) and Thimphu district (Dotena to Barshong, Pajoding), N – Upper Mo Chu district (Gasa, Lingshi), Upper Pho Chu district (Chojo Dzong) and Upper Kulong Chu district (Me La); **Sikkim:** Lachen, Bakkhim to Yoksam, Talung; **Chumbi:** Chumbithang, Trakarpo, Yatung. Among grass in shubbery, waste places, roadsides, moist fir and juniper forest, 2740–4000m. June–October.

The record of *G. tetrahit* L. from Bhutan is based on Hooker (80) but refers to *G. bifida*.

## 17. LAMIUM L.

Annual or perennial herbs. Stems slender, erect, ascending or prostrate. Upper leaves sessile, lower leaves petiolate, margins crenate to lobed. Inflorescence of many-flowered verticillasters in axils of leaves. Calyx regular, tubular, 5-toothed; teeth equal. Corolla bilabiate; tube widening at throat, upper lip entire, hairy outside; lower lip subequal to upper, 3-lobed, median lobe very narrow at base and emarginate. Stamens 4, didynamous, under upper lip of corolla, posterior pair shorter than anterior; anthers 2-celled, hairy. Style bifid. Nutlets obovoid, trigonous, scar small.

**1. *L. amplexicaule*** L. Eng: *Henbit Dead-nettle*. Fig. 87j.

Annual herb. Stems slender, 8–37cm, sparsely pubescent or glabrescent, often reddish-brown, usually branched near base. Leaves broadly ovate to reniform, 0.8–2 × 1.1–2.6cm, obtuse, base truncate to cordate, margin crenate to lobed, both surfaces pilose and with sessile glands on lower surface; upper leaves

sessile, petiole of lower leaves up to 1.8cm. Calyx 5–7mm; teeth narrowly triangular, 2.5–3.5mm. Corolla pink-purple to blue-violet, 15–20mm; tube 12–14mm. Nutlets c 2 × 1mm, brown usually with white blotches.

**Bhutan:** C – Ha, Thimphu, Punakha, Tongsa (117), Bumthang and Tashigang districts; **Sikkim:** Lachen; **Chumbi:** Gyong. Open grassy hillsides, paths, corn-fields and other cultivated areas, 2740–4270m. April–September.

A minor agricultural weed (272).

## 18. STACHYS L.

Herbs. Leaves sessile to petiolate on same plant, crenate-serrate or serrate. Inflorescence of many-flowered verticillasters in axils of leaves. Bracts present. Calyx ± regular, campanulate to tubular-campanulate; teeth 5, subequal. Corolla bilabiate; upper lip entire; lower lip subequal to or longer than lower lip, 3-lobed, median lobe largest, emarginate. Stamens 4, under upper lip of corolla, posterior pair shorter than anterior; anthers 2-celled. Nutlets obovoid, scar minute.

1. Stems softly hairy; bracts as long as calyx ..... 1. **S. melissaefolia**  
 + Stems scabrid; bracts very small ..... 2. **S. scaberula**

### 1. **S. melissaefolia** Benth. Fig. 87k.

Foetid herb. Stems erect, 25–120cm, often with slender branches, softly villous, sometimes glabrescent below. Leaves ovate to oblong-ovate, 2–6.8 × 1.3–3.4cm, acute, base rounded to cordate, margin crenate-serrate, upper surface villous-pubescent, lower surface densely white-pubescent, rarely indumentum on both surfaces not dense; petioles longer on lower leaves, up to 3.2(–9)cm. Bracts linear to linear-lanceolate, 3.5–6mm. Calyx 5–8mm; teeth triangular, 1–2.5mm. Corolla mauve or pink with darker blotches, 12–13(–15)mm; upper lip 3–4mm, shorter than lower. Nutlets broadly obovoid, 2–2.5 × 1.5–2mm.

**Bhutan:** C – Ha, Thimphu, Tongsa and Bumthang districts, N – Upper Mo Chu district (Gasa); **Sikkim:** Lachen; **Chumbi.** Open grassy banks and meadows, among shrubs, Blue Pine forest, 2130–3800m. June–September.

### 2. **S. scaberula** Vatke

Similar to *S. melissaefolia* but differing in stems with deflexed scabrid hairs, rough to the touch; leaves triangular-ovate, base often more deeply cordate and indumentum thinner, not whitening, lower leaf surface; bracts very small, not equal to calyx in length; corolla mauve and white or pale yellow.

**Bhutan:** C – Tongsa district (Yuto La to Tongsa) and Bumthang district (Bumthang, Badar La), N – Upper Kulong Chu district (Tobrang). In fir forest, near cultivated areas, 2195–3660m. May–July.

Although *S. sericea* Bentham has been recorded from Bhutan this is based on misidentification of *S. melissaefolia* which lacks the spinose calyx teeth of the former species. *Stachys oblongifolia* Bentham has also been recorded from Bhutan as a result of the incorrect determination of a *Griffith* collection.

### 19. COLQUHOUNIA Wall.

Large, aromatic, sprawling or scandent shrubs. Stems branched, with dendroid hairs. Leaves petiolate, serrulate or crenulate, both surfaces dendroid-hairy. Inflorescence of 6–8-flowered verticillasters in axils of upper leaves, sometimes crowded and forming a short terminal spike. Calyx regular, tubular campanulate, dendroid-pubescent; teeth 5, equal. Corolla bilabiate; tube curved, broad at throat; upper lip entire; lower lip 3-lobed, shorter than upper, median lobe small. Stamens 4, ascending; anthers 2-celled. Style unequally bifid. Nutlets narrowly ellipsoid, flattened at apex.

#### 1. *C. coccinea* Wall. Nep: *Gurbis*. Fig. 87l–n.

Stems branched, 1.5–5m, tomentose with dendroid hairs, glabrescent below. Leaves ovate to elliptic, 3.6–13 × 2.4–7.2cm, acuminate, base rounded, margins serrulate or crenulate, both surfaces sparsely or densely dendroid-hairy, lower surface often rust-coloured or whitish; petiole 0.6–2.5cm. Calyx 8–10mm, densely whitish dendroid-pubescent; teeth triangular, 1.5–2mm. Corolla orange-red, 25–30mm; tube 15–22mm; upper lip oblong, 5–10mm. Nutlets c 6 × 1.4mm.

A variable species, both in density of leaf indumentum and length of corolla tube; two varieties are recognised from our area:

1. Leaf indumentum sparse, lower surface green, margins serrulate var. **coccinea**
- + Leaf indumentum dense, lower surface rust-coloured or whitish, margins crenulate ..... var. **mollis**

#### a. var. **coccinea**

**Bhutan:** S – Deothang district (Keri Gompa), C – Ha district (Ha, 270) and Thimphu district (Paro, 117); **Sikkim:** Lachung, Singalila, Lachen, Dzongri. Open oak forest, 1980–2700m. July, November, January.

#### b. var. **mollis** (Schlechtendal) Prain; Nep: *Nevara pati* [Bedi].

**Bhutan:** C – common in Thimphu and Punakha districts; **Darjeeling:** Balasun; **Chumbi.** Dry places, dry scrub with *Quercus semecarpifolia*, often at edge of cultivation, 1580–2560m. May–November.

The one specimen seen (from Chumbi) named var. *vestita* (Wall.) Prain has been included under var. *mollis* as it does not appear to be distinct.

## 20. ACHYROSPERMUM Blume

Suffrutescent herbs. Stems terete, ascending to erect. Leaves with lamina decurrent on petiole, margins serrate. Inflorescence terminal and axillary, spike-like; verticillasters many-flowered, condensed. Calyx weakly bilabiate, campanulate; teeth 5; upper lip 3-toothed. Corolla bilabiate; tube straight, annulate; upper lip bifid; lower lip 3-lobed, longer than upper, median lobe larger than laterals. Stamens 4, ascending, subequal, not exerted beyond upper lip; anthers 2-celled. Style bifid. Nutlets obovoid, with scaly processes on ventral surface and apex, scar small.

### 1. *A. wallichianum* Benth. Fig. 87p.

Stems 28–100cm, pubescent to glabrescent. Leaves elliptic-ovate, 8.5–14.5 × 3.8–6.5cm, shortly acuminate, base cuneate with lamina extending along petiole, margins serrate, upper surface appressed pilose, lower surface pubescent on veins otherwise glabrous; petiole 1–3.5cm. Inflorescences 4–9 × c 2.5cm. Calyx 7–9mm; teeth triangular-ovate, those of upper lip 1.5mm, those of lower lip 3.5mm. Corolla white with pink markings, pink or pale purple, 9–12mm; tube 7–10.5mm. Nutlets 2.5 × 1.7mm.

**Bhutan:** S – Samchi (117), Phuntsholing, Chukka, Gaylegphug and Deothang districts; **Darjeeling:** Sonada, Rayeng; **Sikkim:** Lusing. Subtropical forest slopes, among shrubs, 610–1520m. October–November.

*A. wallichianum* is sometimes united with the Malesian *A. densiflorum* Blume (eg. 135), but following (260) they are kept separate.

## 21. ANISOMELES R. Brown

Tall, rank-smelling herbs. Stems erect, 4-angled. Leaves petiolate, serrate-crenate. Inflorescence spike-like; verticillasters condensed above, many-flowered. Bracts filiform. Calyx regular, campanulate, enlarging slightly in fruit; teeth 5, subequal. Corolla bilabiate, tube straight, annulus a ciliate flap of tissue; upper lip entire; lower lip 3-lobed, longer than upper, median lobe much larger than lateral lobes, clearly notched. Stamens 4, ascending, exerted beyond upper lip, filaments with some long hairs; anthers of posterior pair 1-celled, anthers of anterior pair 2-celled. Style unequally bifid. Nutlets ellipsoid, rounded, trigonous, scar small.

### 1. *A. indica* (L.) Kuntze; *A. ovata* R. Brown. Fig. 88a.

Stems 60–150cm, sparsely hairy to densely villous-pubescent. Leaves ovate to broadly ovate, 5–10 × 3.4–5.5cm, acute or acuminate, base truncate or rounded, margins serrate-crenate, both surfaces sparsely hairy to densely villous-pubescent; petiole 1–4cm. Inflorescence 6–17 × 3–3.5cm. Bracts 3–4mm. Calyx 5–6.8mm, pubescent; teeth narrowly triangular, 2–2.5mm. Corolla yellow or greenish-white with red or purple marking, 14–17mm; tube c 7mm; upper lip

± oblong, 4.5mm. Nutlets 1.8 × 1.2mm.

**Bhutan:** S – Samchi (117), Phuntsholing and Gaylegphug (117) districts, C – Thimphu, Punakha and Tashigang (117) districts; **Darjeeling:** Sivok terai, Jaldhaka, Katambari, Rongsong, Siliguri, Tanglu; **Sikkim.** Among shrubs, often at edge of cultivation, roadsides and waste places, 610–2300m. August–November.

## 22. CRANIOTOME Reichenbach

Perennial herbs. Stems erect, branched, pubescent. Leaves petiolate, serrate, villous. Inflorescence of paired, pedunculate, many-flowered cymes. Calyx regular, campanulate, globose in fruit; teeth 5. Corolla bilabiate; upper lip minute, entire; lower lip 3-lobed, slightly longer than upper. Stamens 4, ascending, subequal to upper lip; anthers 2-celled. Style apically flattened, bifid. Nutlets subglobose, scar minute.

### 1. *C. furcata* (Link) Kuntze; *C. versicolor* Reichenbach. Fig. 88b&c.

Stems 18–200cm, branched, softly villous-pubescent, glabrescent below. Leaves ovate to broad elliptic, 5.6–9.5 × 3.4–6.3cm, acuminate, base rounded to shallowly cordate, margins serrate, both surfaces appressed villous; petiole 1–5.6cm. Calyx 1.8–2mm; teeth triangular, 0.5mm. Corolla pale purple or pink, 3.5–4mm; upper lip entire, c 0.5mm. Nutlets 0.8 × 0.7mm.

**Bhutan:** S – Phuntsholing (117), Chukka (117), Gaylegphug (117) and Deothang (117) districts, C – Punakha district (E of Wangdu Phodrang, Lometsawa); **Darjeeling:** Sittong, Lebong, Sonada, Kurseong, Takdah; **Sikkim:** Lachung, Chungthang, Yak La. Roadside banks and rocks in broad-leaved forest, 1000–2440m. August–October.

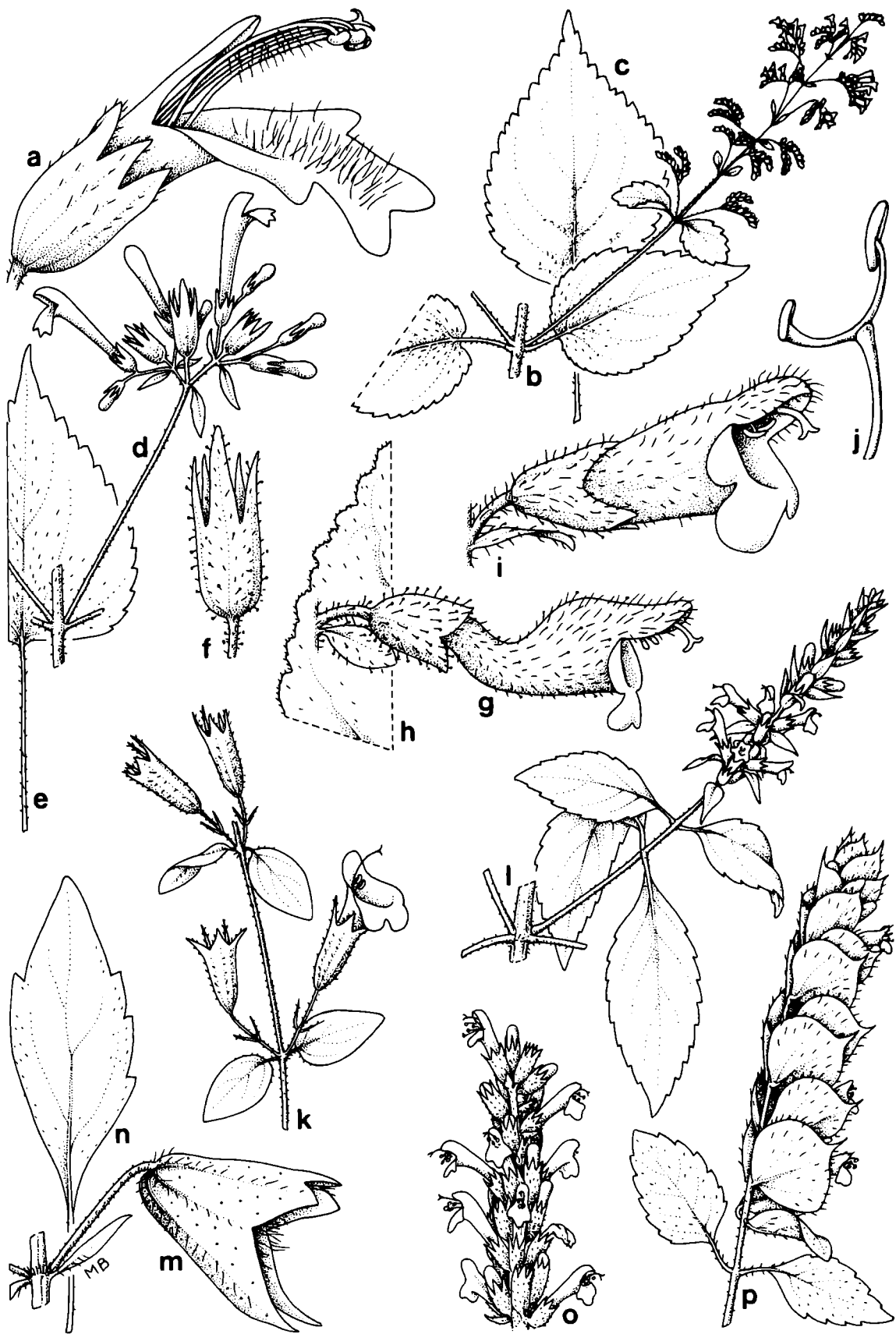
## 23. MICROTOENA Prain

Erect perennial herbs. Stems branched, with glandular hairs. Leaves petiolate, serrate, lower surface with capitate-glandular hairs. Inflorescence axillary and terminal, cymose, pedunculate, few-flowered, lax. Bracts linear. Calyx ± regular, teeth 5. Corolla bilabiate; tube slender; upper lip hooded; lower lip 3-lobed. Stamens 4, ascending, subequal to upper lip; anthers apparently becoming 1-celled. Style unequally bifid. Nutlets not seen.

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FIG. 88. **Labiatae.** a, *Anisomeles indica*: flower (× 4). b–c, *Craniotome furcata*: b, inflorescence (× ½); c, leaf (× ½). d–f, *Microtoena bhutanica*: d, inflorescence (× ⅔); e, leaf (× ⅔); f, calyx (× 3). g–h, *Salvia castanea*: g, flower (× 1); h, leaf margin (× ⅔). i, j, *S. campanulata*: i, flower (× 1½); j, stamen (× 3). k, *Micromeria biflora*: inflorescence (× 3). l, *Perilla frutescens*: inflorescence (× 2). m–n, *Mosla dianthera*: m, calyx (× 5); n, leaf (× 2). o, *Elsholtzia fruticosa*: inflorescence (× 2). p, *E. concinna*: inflorescence (× 2). Drawn by M. Bates.





**1. *M. bhutanica*** Stearn; *M. insuavis* auct. non (Hance) Briquet. Fig. 88d–f.

Stems c 90cm, branched, with minute glandular hairs and few pilose hairs. Leaves ovate, 4.8–8.3 × 3.5–6.6cm, apex shortly acuminate, base truncate to shallowly cordate, margins serrate, upper surface appressed hairy, lower surface pubescent on veins and with capitate-glandular hairs elsewhere; petiole slender, 2–5.5cm. Peduncles 1–4.4cm. Bracts linear, up to 8mm. Calyx 7–10mm, in fruit up to 14mm; teeth triangular acuminate, uppermost 4.5–6mm, remainder 2–2.5mm. Corolla pink or red above with white tube, 22–25mm; tube c 17mm; upper lip c 8mm; lower lip c 11mm.

**Bhutan:** C – Thimphu/Punakha district (Hinglai La) and Mongar district (Lhuntse). In shady moist forest, 1830–2440m. July–August.

A further Bhutanese specimen of this genus has been recorded from Tashigang district (Gomchu, 117) and is described as having yellow flowers. This material may represent a collection of *M. wardii* Stearn, described from Dirang Dzong, Assam; however there are other yellow-flowered species in the eastern Himalaya and as the specimen was unavailable for study, it has not been possible to make a positive identification.

**24. SALVIA L.**

Perennial, biennial or annual herbs. Leaves petiolate, simple, rarely pinnate. Inflorescence of distant or conferted verticillasters arranged in a spike. Calyx bilabiate, tubular or campanulate; upper lip entire or 3-toothed; lower lip 2-toothed. Corolla bilabiate; upper lip straight or falcate; lower lip 3-lobed, middle lobe largest. Stamens 2, filaments fairly short with a short or long connective bearing a fertile cell (theca) at upper end and a smaller cell or sterile appendage at lower end; staminodes 2, very small. Style 2-lobed. Nutlets obovoid to suborbicular, trigonous.

Peter (1936) (273) revised the Indian and Tibetan species of *Salvia* and described new species and varieties from our area. A number of taxa undoubtedly require further investigation and revision over a wider geographical area than is possible here.

- |  |                                     |
|--|-------------------------------------|
| 1. Most leaves pinnate, sometimes a few also simple ....                     | <b>1. <i>S. plectranthoides</i></b> |
| + All leaves simple .....  | 2                                   |
| 2. Corolla very small, 3–4mm .....   | <b>9. <i>S. plebeia</i></b>         |
| + Corolla 6mm or more .....  | 3                                   |
| 3. Corolla crimson, scarlet or white; plants cultivated or naturalised ..... | 4                                   |
| + Corolla blue, violet, maroon or purple-brown or yellow; plants native ...  | 6                                   |
| 4. Corolla white; calyces violet-lanate .....                                | <b>11. <i>S. leucantha</i></b>      |
| + Corolla crimson or scarlet .....   | 5                                   |

5. Leaves 2.5cm or less broad; calyces green flushed with dark purple  
 12. **S. coccinea**  
 + Leaves 2.6cm or more broad; calyces scarlet ..... 13. **S. splendens**
6. Corolla blue, violet, maroon or purple-brown ..... 7  
 + Corolla yellow with or without purple or brown marking ..... 9
7. Corolla blue or violet, usually more than 35mm ..... 2. **S. wardii**  
 + Corolla purple, dark red or purple-brown, usually less than 35mm ..... 8
8. Corolla 25–35mm, with strong sigmoid curve in tube ..... 6. **S. castanea**  
 + Corolla 20–25mm, tube scarcely curved ..... 7. **S. species A**
9. Corolla 12–17mm; erect annual herb ..... 8. **S. roborowski**  
 + Corolla 22mm or more; perennial herb ..... 10
10. Lower anther cells dolabriform, sterile; leaves hastate at base; corolla pale lemon yellow ..... 10. **S. nubicola**  
 + Lower anther cells not as above; leaves usually cordate at base; corolla yellow ..... 11
11. Calyx 20mm or more long ..... 5. **S. amplicalyx**  
 + Calyx 10mm or less long ..... 12
12. Large coarse plant, 40–75cm high, with much-branched inflorescence  
 3. **S. campanulata**  
 + Small plant up to 40cm, with unbranched or rarely branched inflorescence  
 4. **S. sikkimensis**

### 1. **S. plectranthoides** Griff.

Annual or biennial herb. Stems 10–60cm, often unbranched, puberulent and with some villous hairs. Leaves often grouped at base with few on stem, pinnate, rarely a few simple; terminal leaflet and simple leaves ovate to narrowly ovate, 2.5–6 × 1.3–4cm, lanceolate in upper leaves; lateral leaflets 1–3 pairs, smaller than terminal leaflet; serrate or crenate, pubescent on venation or subglabrous; petiole 1–6cm, puberulent and with villous hairs near base. Verticillasters distant, 2–8-flowered. Calyx 6–7mm, upper lip suffused purple. Corolla pale blue to mauve, (10–)12–15mm.

**Bhutan:** C – Punakha district (Punakha, Lobeysa to Lometsawa, Tinleygang, Mendegang, Chuzomsa), Mongar district (Lhuntse Dzong, Khinay Lhakang) and Tashigang district (Chorten Kora), N – Upper Khoma Chu district (Tsekang); **Darjeeling:** Rungirun; **Arunachal Pradesh:** Nyam Jang Chu. Shady banks in warm broad-leaved forest, damp ground, moist shrubberies, 1300–2440m. April to June, August, November.

Another pinnate-leaved *Salvia*, *S. japonica* Thunberg, has also been recorded from Darjeeling (273) but the Clarke specimen on which this was based is *S. plectranthoides*.

## 2. *S. wardii* Peter

Erect herb. Stems 40–75cm, with dense multicellular capitate-glandular hairs. Leaves at base numerous, ovate to subhastate, 7–17.5 × 5–10cm, acute or obtuse, base cordate or subhastate, margin crenate, upper surface pilose, lower surface pilose on veins and with dense sessile glands; petiole 11.5–17.5cm; middle and upper stem leaves smaller and with short petioles. Verticillasters conferted above, c 6-flowered. Calyx campanulate, 1.5–2.2cm, with multicellular, capitate-glandular hairs and sessile glands, flushed dull red or purple. Corolla usually blue or violet, sometimes with white lower lip, (30–)35–40mm; tube straight, 8–11mm diameter at throat; upper lip straight, 7–9mm; lower lip 8–12mm. Nutlets not seen.

**Bhutan:** C – Bumthang district, N – Upper Mo Chu, Upper Pho Chu, Upper Mangde Chu and Upper Bumthang Chu districts. Open slopes, among *Rhododendron* or in clearings in Fir forest, 3050–4370m. May–August, October.

## 3. *S. campanulata* Bentham; *S. sikkimensis* Peter var. *chaenocalyx* Peter p.p. Med: *Jiptshi Karpo*. Fig. 88i&j.

Robust, glandular, perennial herb. Stems erect, 40–75cm, with spreading capitate-glandular hairs above, tomentose to glabrescent below. Leaves at base ovate to ovate-oblong, 13–24.5 × 5–11cm, acute to obtuse, base usually cordate, serrate to crenate, upper surface sparsely to densely pubescent; lower surface sparsely to densely tomentose and with numerous sessile glands; petiole 8–20cm; stem leaves similar, often smaller and with shorter petiole, sometimes sessile. Inflorescence branched, bracts ovate acuminate. Verticillasters distant, 2–6-flowered. Calyx campanulate, 11–15mm, usually flushed dull red-purple especially on upper lip, densely glandular-hairy, in fruit up to 20mm. Corolla yellow, often with brownish or purple marking on upper lip, 22–28mm; tube c 8mm diameter at throat, narrower within calyx; upper lip straight, 6–10mm; lower lip subequal in length, deflexed. Nutlets obovoid, c 4 × 3mm.

**Bhutan:** C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Mo Chu, Upper Mangde Chu and Upper Kulong Chu districts; **Darjeeling:** Singalila; **Sikkim:** Yumthang, Lachen, Phalut, Tsomgo; **Chumbi.** In clearings in Fir/ *Rhododendron* forest and moist *Quercus* woodland, 2430–4270m. June–September.

Peter (273) recognised three varieties of this species within our area (var. *pilinophylla* Peter, var. *fissa* Peter and var. *hirtella* Peter) based essentially on indumentum and calyx lobe differences. However the material seen cannot readily be separated into her taxa. Some of the material (including the type) cited under var. *hirtella* Peter is purple-flowered and discussed below under 'species A'.

**4. *S. sikkimensis* Peter**

Similar to *S. campanulata* but differing in its smaller habit, stems 12–40cm; more basal and fewer stem leaves; basal leaves 4.5–10(–12) × 2.5–5(–7.5)cm; petiole up to 13cm and inflorescence rarely branched.

**Bhutan:** C – Thimphu and Bumthang districts, N – Upper Mo Chu, Upper Pho Chu and Upper Bumthang Chu districts; **Sikkim:** Chomnagu, Zongri, Lachen, Fallum; **Chumbi:** Yatung, Chumbithang. Open meadows, marshes and Fir forest, 3050–4270m. May–August.

**5. *S. amplicalyx* Peter**

Similar to *S. campanulata* but differing in its exceptionally large calyces, 20–22 × 15–17mm, which are rather truncate at apex; corolla yellow with tube scarcely exerted.

**Bhutan:** C – Thimphu district (Chekha) (270); **Sikkim:** Lachen. 3050–4000m.

**6. *S. castanea* Diels. Fig. 88g&h.**

Perennial herb. Stems erect or ascending, 40–100cm, with dense multicellular capitate-glandular hairs above. Leaves oblong to ovate, 10–18 × 5–8.5cm, base cordate or subhastate, irregularly dentate-crenate, upper surface puberulent to pilose, lower surface dense greyish tomentose; petiole 9–15cm, shorter on uppermost leaves. Verticillasters distant, 4–6-flowered. Calyx (9–)11–14mm long. Corolla dark red or dark purple-brown, whitish at base, 25–35mm, often densely white-hairy; tube strongly curved, narrow lower part exerted, enlarging to 7–10mm at throat; upper lip straight, 6–10mm; lower lip subequal to upper. Mature nutlets not seen.

**Bhutan:** C – Thimphu district (Lungtenphu, Thimphu, Barshong) and Tongsa district (Chendebi), N – Upper Mo Chu district (Kohina, Laya, Chebesa), Upper Pho Chu district (Gyophu La) and Upper Bumthang Chu district (Kurmathang). In clearings in *Quercus semecarpifolia* forest or in open Spruce/*Pinus* forest, 2590–3960m. July, September, October.

**7. *S. species A*; *S. campanulata* Benthham var. *hirtella* Peter p.p.**

Differs from *S. castanea* in its broadly ovate leaves, less than 2 × as long as broad, indumentum of lower surface usually sparsely puberulent on veins only; calyx 11mm or less; corolla purple or dark red but never brownish, 20–25mm, tube not strongly curved.

**Bhutan:** C – Thimphu district (Barshong, Chenkaphug, Dotena, Changri Monastery) and Punakha district (Nahi to Hinglai La), N – Upper Mo Chu district (Kohina); **Darjeeling:** Darjeeling; **Sikkim:** Phalut, Lagyap, Kalipokhri, Meguthang, Phedup; **Chumbi:** Yatung. Moist mixed forest on limestone, *Quercus* woodland, 2500–4270m. July–September.

This taxon appears distinct from both *S. campanulata* and *S. castanea* in the deep red corolla and short, straight corolla tube; no name has been found for it but further research is needed to establish if it has been described elsewhere.

**8. *S. roborowskii* Maximowicz**

Erect, annual herb. Stems 8–35(–72)cm, glandular-hirsute. Leaves simple, triangular-ovate, 1.5–5.4 × 0.8–4.2cm, acute, base truncate to cordate, irregularly crenate to erose, upper surface sparsely hairy; lower surface densely sessile-glandular, pubescent on veins; petiole 1.2–3cm. Verticillasters ± distant, (2–)4–6-flowered. Calyx 6–9mm, densely glandular-hirsute, lips 2–2.5mm. Corolla pale yellow or cream, 12–17mm; tube straight; upper lip c 4.5mm.

**Bhutan:** N – Upper Mo Chu district (Laya); **Sikkim:** Gyong, Thanggu; **Chumbi:** Phari. Weed of barley-fields, open grass slopes, 3840–4270m. September.

Foliage lemon-scented.

**9. *S. plebeia* R. Brown**

Erect, annual herb. Stems simple or branched, 9.5–17(–60)cm, hairs spreading-glandular above, eglandular-retrorse below. Leaves ovate to ovate-oblong, 1.8–3.5(–7) × 0.8–1.4(–3.5)cm, acute, base cuneate to rounded, crenulate to serrulate, upper surface sparsely hairy; lower surface with sessile glands, hairs mainly on veins; petiole 0.3–1.4(–3)cm, often narrowly winged. Verticillasters conferted, 4–6-flowered. Calyx c 3mm, with capitate-glandular hairs and sessile glands, lips c 0.5mm. Corolla mauve or pink, 3–4mm, tube straight; upper lip straight, c 0.6mm. Nutlets c 1 × 0.5mm.

**Bhutan:** C – Mongar district (Lhuntse Dzong); **Sikkim:** locality unknown. Open dry slopes, often weedy or in disturbed habitats, 1525m. April.

**10. *S. nubicola* Sweet; *S. glutinosa* auct. non L., *S. glutinosa* L. subsp. *nubicola* (Sweet) Murata**

Perennial, viscid herb. Stems erect, 50–130cm, densely hirsute with glandular and eglandular hairs. Leaves triangular-ovate, 7.5–14 × 2.5–5.5cm, acute to acuminate, base clearly hastate-sagittate, usually crenate, sometimes serrate, both surfaces pilose with numerous sessile glands below; petiole up to 5cm. Verticillasters distant, 2–6-flowered. Calyx tubular-campanulate, 6–8mm, densely glandular-hairy and with numerous sessile glands; lips subequal, 3–4.5mm; upper lip appearing 1-toothed. Corolla pale yellow with light purplish mottling on upper lip and streaks on lower, c 30mm; tube narrow, c 3mm wide at midpoint; upper lip clearly falcate; middle lobe of lower lip emarginate.

**Bhutan:** C – Thimphu district (Thimphu, near Dotena, Motithang, on road to Chelai La from Paro); **Sikkim:** unlocalised (270). Among shrubs and at forest margins, often in dryish *Pinus* woodland, 2440–2600m. August–October.

Strongly lemon-scented when bruised.

**11. *S. leucantha* Cavanilles**

Subshrub. Stems branched, 50–95cm, white or violet lanate when young. Leaves linear-lanceolate, 5–9 × 0.9–1.7cm, thick-textured, acute, base rounded, margin serrulate, both surfaces with lanate hairs but much thicker on lower

surface; petiole 0.7–1cm. Verticillasters distant. Calyx densely lanate with hairs usually violet-tipped. Corolla white, 18–22mm, tube straight, upper lip porrect.

**Sikkim:** Kurseong (95). Cultivated.

A native of Mexico.

### 12. *S. coccinea* Etlinger

Erect herb. Stems 40–100cm, indumentum of short, curled and villous hairs. Leaves ovate to triangular-ovate, 2.5–5 × 1.5–2.5cm, acute, base truncate to cordate, serrulate, pubescent; petiole 1–2cm. Verticillasters distant, 2–8-flowered. Calyx green, sometimes flushed dull purple, 7–9mm, pubescent and with numerous sessile glands; lips 1.5–2mm; upper lip entire, acute. Corolla scarlet to deep red, 2.4–3.1cm.

**Darjeeling:** Kalimpong (69); **Sikkim:** unlocalised (274). Semi-naturalised escape from cultivation, often a weed of cultivated areas, 1000m. June.

A native of S America.

### 13. *S. splendens* Roemer & Schultes

Erect herb to 1m. Leaves ovate, 4–7.8 × 2.6–5.2cm, acuminate, base broadly cuneate to truncate, serrate, subglabrous to puberulous and with sessile glands; petiole 2.2–5.3cm. Verticillasters ± conferted, 2–6-flowered. Calyx scarlet, 1.5–1.9cm, becoming pale brownish in fruit. Corolla 3–3.5cm, scarlet.

**Bhutan:** S – Phuntsholing district (Phuntsholing). Cultivated in garden, 260m. April.

A native of Brazil cultivated as an ornamental.

## 25. MELISSA L.

Erect herbs. Leaves simple, petiolate. Inflorescence of distant, few- to many-flowered verticillasters in leaf axils. Calyx bilabiate, tubular-campanulate; upper lip shallowly 3-toothed; lower lip 2-toothed, slightly longer than upper. Corolla bilabiate, upper lip 2-lobed, lower lip 3-lobed. Stamens 4, didynamous, not exceeding corolla; anthers 2-celled. Nutlets narrowly ellipsoid.

1. Leaves ovate to narrowly ovate, base truncate to cuneate, puberulent to glabrescent ..... **1. *M. axillaris***  
 + Leaves broadly ovate to elliptic, base cordate to cuneate, pilose to villous  
**2. *M. officinalis***

### **1. *M. axillaris*** (Bentham) Bakhuizen van den Brink; *M. parviflora* Bentham

Perennial herb. Stems 60–115cm, puberulent to glabrescent. Leaves ovate to narrowly ovate, 1.1–5.5 × 0.8–3.3cm, acute, base truncate to cuneate, margins crenate, upper surface sparsely puberulent, lower surface subglabrous, often

purplish; petiole 2–20mm. Calyx 6.5–7.5mm, hairy on main veins, teeth 1–2mm; fruiting calyx up to 8.5mm. Corolla white to pale yellow with purple marking, 8–10(–12)mm; tube straight, 6.5–8.5mm, exserted. Nutlets 1.8 × 0.8mm.

**Bhutan:** S – Chukka, Gaylephug (117) and Deothang districts, C – Ha (117), Thimphu, Punakha, Tongsa and Tashigang districts; **Darjeeling:** Rungirun, Rambi Chhu; **Sikkim:** Rattray valley, Lachen. Open damp slopes, shady forest or among scrub, 1070–3660m. June–September.

*M. flava* Bentham has also been recorded from Bhutan (80) and Sikkim (269). It is described from Nepal as differing from *M. axillaris* in its longer calyces and corollas but it is doubtfully distinct. All specimens seen from our area fall within an acceptable range of variation for *M. axillaris*.

## 2. *M. officinalis* L.

Similar to *M. axillaris* but indumentum glandular-puberulent, sometimes softly villous; lower leaves larger, broadly ovate, obtuse and cordate or truncate becoming elliptic, acute and cuneate above; corolla 9–14mm.

**Darjeeling:** Tista Bridge (85). Among rubbish, probably an escape from cultivation, 230m.

## 26. MICROMERIA Bentham

Aromatic perennial herbs. Stems ascending, pubescent to villous. Leaves almost sessile, margin thickened, entire, sparsely hairy, lower surface with sessile glands. Inflorescence of shortly pedunculate cymes of 2–6 flowers in middle and upper leaf axils. Calyx sub-bilabiate, distinctly ribbed; teeth 5, unequal. Corolla bilabiate; upper lip emarginate; lower lip slightly longer with 3 broad lobes. Stamens 4, included under upper lip, upper pair shorter; anthers 2-celled. Style unequally bifid. Nutlets ellipsoid.

### 1. *M. biflora* (D. Don) Bentham. Fig. 88k.

Low herb. Stems 5–35cm, pubescent to villous. Leaves ovate to elliptic, 0.35–0.5 × 0.18–0.3cm, acute, base rounded, margin thickened, entire, sparsely hairy, lower surface with sessile glands; petiole 0.5mm. Flowers 2–6 in middle and upper leaf axils. Calyx 2.5–4.5mm; teeth c 1mm, ciliate; upper 3 triangular; lower 2 subulate, slightly longer. Corolla pink to mauve, 5.5–7mm. Nutlets c 0.8 × 0.4mm.

**Bhutan:** C – Ha district (Ha), Thimphu district (Namseling, Paga, Dotena, Drugye Dzong, Pajoding, Thimphu) and Punakha district (Punakha); **Chumbi.** Dry grassy banks, pathsides and disused fields, 2200–2800m. April–July, September.

All material seen from our area belongs to var. **biflora**. Var. *hispida* Kitamura & Murata, described from Nepal and differing only in indumentum, has also been reported from Bhutan (135) but this has not been confirmed.



## 27. CLINOPODIUM L.

Erect or ascending perennial herbs. Leaves shortly petiolate, serrate to subentire. Inflorescence of remote 10–20-flowered verticillasters in axils of upper leaves. Calyx bilabiate, tubular, curved, distinctly ribbed; teeth 5, slightly unequal. Corolla bilabiate; upper lip emarginate, pilose; lower lip slightly longer with 3 broad lobes; tube not annulate within. Stamens 4, didynamous, included under upper lip of corolla; anthers 2-celled. Style unequally bifid. Nutlets ellipsoid to subglobose.

1. **C. umbrosum** (Bieberstein) Koch; *Calamintha umbrosa* (Bieberstein) Fischer & Meyer

Ascending herb. Stems 18–40cm, pubescent to villous. Leaves ovate, 1.6–4 × 0.8–2.5cm, acute, base rounded to broadly cuneate, margin serrate, sparsely pilose to villous; petiole 2–10mm. Calyx 5–6mm, teeth 0.8–2mm, ciliate, upper 3 triangular, lower 2 subulate, slightly longer. Corolla pink, mauve or purplish, 7–8mm. Nutlets 0.9 × 0.6mm.

**Bhutan:** S – Samchi (117), Phuntsholing and Chukka districts, C – Thimphu, Punakha, Tongsa and Bumthang districts, N – Upper Kulong Chu district; **Darjeeling:** Rambhi Chhu; **Sikkim:** Lachung, Lachen, Pakar range; **Chumbi:** unlocalised. Open screes, roadsides, damp banks and among shrubs, 200–3660m. May–September.

Weed of apple orchards and buckwheat crops (272); leaves fragrant when crushed.

## 28. ORIGANUM L.

Perennial herbs and subshrubs. Leaves petiolate, usually entire. Inflorescence a cluster of terminal corymbose cymes forming a panicle. Bracts obovate to elliptic. Calyx regular, tubular, equally 5-toothed or not. Corolla bilabiate; upper lip 2-lobed; lower lip 3-lobed, slightly longer than upper. Stamens 4, didynamous, anterior pair longer than posterior, included or exerted; anthers 2-celled. Style unequally bifid. Nutlets smooth, ± ellipsoid.

1. **O. vulgare** L. Eng: *Marjoram*.

Rhizomatous, perennial herb, 28–85cm. Stems ± erect. Leaves ovate, 1.2–2.2 × 0.7–1.3cm, acute, base rounded, margin usually entire, sparsely villous and with punctate glands; petiole 1–5mm. Bracts obovate to elliptic, c 6 × 3.5mm, purplish. Calyx 2.6–3mm, white-hairy in throat; teeth 5, triangular, c 0.6mm, equal. Corolla pink, 6–7mm. Nutlets c 0.8 × 0.5mm.

**Bhutan:** C – Ha, Thimphu, Tongsa, Bumthang and Mongar districts, N – Upper Kuru Chu district; **Sikkim:** locality unknown; **Chumbi:** Lingmathang. Roadsides, in Spruce forest, grassy slopes and sandy areas, 2130–3660m. June–September.

Occasional weed in buckwheat. Aromatic when crushed.

## 29. MENTHA L.

Aromatic, perennial herbs with creeping rhizome. Leaves simple. Inflorescence of short terminal spikes; verticillasters many-flowered, mostly conferted, subtended by linear-lanceolate or rarely leaf-like bracts. Bracteoles small. Calyx regular, subequally 5-toothed. Corolla subequally 4-lobed; upper lobe wider, emarginate. Stamens 4, subequal, exserted. Nutlets smooth or reticulate.

1. Stems and leaves densely hairy; leaves widest at or above middle, lower surface grey or white tomentose ..... **1. *M. longifolia***
- + Stems and leaves usually glabrous or sparsely hairy; leaves widest near base ..... **2. *M. spicata***

### 1. *M. longifolia* (L.) Hudson; *M. sylvestris* L.

Clump-forming herb 40–100cm. Leaves oblong-elliptic to oblong-lanceolate, 3–7.5 × 1–2.2cm, acute, base rounded to cordate, margins distantly serrate, grey or white tomentose, indumentum thicker on lower surface; sessile or petiole up to 5mm. Bracts 4–7mm. Calyx 1–3mm. Corolla white or lilac, 2.5–4mm. Nutlets c 0.8 × 0.5mm, reticulate.

**Bhutan:** C – Thimphu district (Paro, 117). Damp areas, along ditches and nullahs, in cultivation, 2500m. July–August.

### 2. *M. spicata* L. Nep: *Babari*; Eng: *Spear Mint*.

Differs from *M. longifolia* in usually being glabrous or sparsely hairy; leaves widest near base; nutlets smooth or reticulate.

**Bhutan:** C – Thimphu district (Paro). Damp areas, in cultivation, 2285m. September.

Although no material of *M. arvensis* L. has been seen from our area it is likely to occur as an arable weed; it is easily distinguished from *M. spicata* in having remote verticillasters subtended by large, leaf-like bracts.

## 30. PERILLA L.

Coarse aromatic annuals with simple eglandular hairs. Stems erect, little-branched. Leaves petiolate, crenate to serrulate. Inflorescence dense, spike-like, terminal and in upper leaf axils. Verticillasters 2-flowered. Calyx sub-bilabiate; upper lip 3-toothed; lower lip 2-toothed. Corolla sub-bilabiate, 5-lobed; tube squat, villous at throat. Stamens 4, scarcely exserted; anthers 2-celled. Style equally bifid. Nutlets subglobose with prominent reticulation.

**1. *P. frutescens* (L.) Britton; *P. ocimoides* L. Fig. 88l.**

Stems 40–100cm, sparsely hairy to sublanate. Leaves ovate, 5.5–12 × 3–9.5cm, acute or shortly acuminate, base usually broadly cuneate, margin serrate, hairy mainly on veins; petiole 2–5.5cm, often sublanate. Inflorescences 2–8cm. Calyx 3mm, in fruit enlarging to 8–10mm. Corolla white, 3.5mm. Nutlets 1.8 × 1.5mm.

**Bhutan:** S – Gaylegphug district (Gaylegphug), C – Thimphu district (Tash Chho Dzong), Punakha district (Mendegang and near Khelekha) and Tongsa district (near Tintibi); **Darjeeling:** Kalimpong, Rishap; **Sikkim:** Yoksam, Chunthang. Roadside banks in warm broad-leaved forest, orchards, field margins, 300–2300m. October–November.

Often cultivated for its valuable seed oil.

**31. MOSLA (Bentham) Maximowicz**

Annual, erect, aromatic herbs. Leaves petiolate, serrate. Inflorescence of axillary and terminal spikes; whorls 2-flowered. Calyx bilabiate; upper lip truncate or obscurely 3-toothed; lower lip 2-toothed. Corolla sub-bilabiate, 5-lobed, posterior lobe larger. Stamens 2, anterior pair reduced to staminodes; anthers 2-celled. Style deeply bifid. Nutlets subglobose with prominent reticulation.

**1. *M. dianthera* (Roxb.) Maximowicz. Fig. 88m&n.**

Stems erect, 18–40cm, pilose. Leaves ovate to elliptic, 1.5–4.2 × 0.8–2.3cm, base cuneate, margin serrate, sparsely pilose; lower surface paler than upper, with punctate glands; petiole 0.5–1.2cm. Inflorescence 2–12cm long. Calyx 2–2.5mm, lower lip with teeth narrowly triangular, about half length of calyx; fruiting calyx enlarging to 4–5.5mm long. Corolla white or purplish, 3.5mm. Nutlets c 1 × 1mm.

**Darjeeling:** terai, Siliguri, Dalka Jhar; **Sikkim:** Tumlang, Chalung. Subtropical and terai zones, 120–1830m. October, December.

Although reported from Bhutan (80) no material has been seen to support this.

**32. ELSHOLTZIA Willdenow**

Herbs or shrubs. Leaves petiolate or sessile. Inflorescence spike-like, terminal and axillary; spikes slender or stout, terete or secund; whorls usually conferted. Flowers small. Bracts linear to suborbicular, sometimes imbricate. Calyx ± regular, 5-toothed, teeth subequal. Corolla sub-bilabiate or bilabiate; upper lip emarginate; lower lip 3-lobed. Stamens 4, didynamous; anthers 2-celled, becoming 1-celled. Style subequally 2-lobed. Nutlets smooth or tubercled.

1. Shrub; corolla 4–7.5mm, yellow, white or cream ..... 2  
 + Herb; corolla 2.5–4mm (or, if 5–6mm, then herb of less than 25cm), yellow, white, mauve or purple ..... 3
2. Leaves ovate, less than 2 × as long as wide, base cuneate to subcordate; corolla 7–7.5mm, yellow ..... **1. E. flava**  
 + Leaves lanceolate to ovate-elliptic, more than 2 × as long as wide, base attenuate; corolla 4–6mm, white or cream ..... **2. E. fruticosa**
3. Bracts linear, subulate or lanceolate, less than 0.5mm wide ..... 4  
 + Bracts broadly ovate to suborbicular, more than 3mm wide ..... 6
4. Bracts longer than flowers, ciliate; stems pilose ..... **3. E. pilosa**  
 + Bracts shorter than flowers; stems pubescent ..... 5
5. Leaves lanceolate to elliptic-lanceolate, serrate ..... **4. E. blanda**  
 + Leaves ovate, coarsely crenate-serrate ..... **5. E. stachyodes**
6. Flowers yellow ..... **8. E. eriostachya**  
 + Flowers white, mauve, pink, purple or violet ..... 7
7. Spikes densely lanate, 1.8–3.5cm long; bracts neither conspicuous nor concealing calyx ..... **7. E. densa**  
 + Spikes not densely lanate, 1.2–7.5cm long; bracts conspicuous, concealing all or most of calyx ..... 8
8. Spikes cylindrical; bracts connate ..... **9. E. strobilifera**  
 + Spikes secund; bracts not connate ..... 9
9. Herb 25–100cm; calyx 2mm ..... **6. E. ciliata**  
 + Herb up to c 18cm; calyx 3.2–3.7mm ..... **10. E. concinna**

**1. E. flava (Bentham) Bentham**

Aromatic shrub 60–130cm. Stems pubescent. Leaves broadly ovate to ovate-oblong, 9.5–15 × 5–9cm, acuminate, base cuneate, rounded or subcordate, margins crenate-serrate, pubescent on main veins, otherwise sparsely hairy, lower surface with numerous sessile glands; petiole 2.5–7cm. Spikes 2.5–10 × 1.5cm, pubescent. Bracts ovate-acuminate, c 5mm. Calyx c 5mm; teeth triangular, c 1.5mm. Corolla yellow, 7–7.5mm. Nutlets ellipsoid.

**Darjeeling:** Tanglu. 2130–2740m. September.

**2. *E. fruticosa*** (D. Don) Rehder; *E. polystachya* (Bentham) Bentham. Nep: *Bhote pati* (Bedi). Fig. 88o.

Shrub 1–5m. Stems pubescent-tomentose, subterete when older. Leaves sessile, lanceolate to ovate-elliptic, 8–15 × 3–6cm, acute or acuminate, base attenuate, margins serrate or crenate-serrate, both surfaces pubescent and densely sessile-glandular. Spikes 3–11 × 1cm, pubescent. Bracts lanceolate, 4–8mm. Calyx 1.5–2mm; teeth triangular, c 0.5mm. Corolla white or cream, 4–6mm. Nutlets oblong, 1.4 × 0.5mm.

**Bhutan:** C – Thimphu district (Paro, Drugye Dzong, Tsalimaphe, Dotena, Tataka) and Bumthang district (Bumthang), N – Upper Mo Chu district (Gasa, Laya) and Upper Kulong Chu district (Tobrang); **Sikkim:** Lachen, Lachung; **Chumbi:** Yatung. Open hillsides among shrubs or in Spruce and *Juniperus* forest, 2130–3505m. August–October.

**3. *E. pilosa*** (Bentham) Bentham

Erect herb, 28–60cm. Stems pilose. Leaves ovate to ovate-elliptic, 2–5.5 × 0.9–3.8cm, acute, base cuneate, margins serrate, both surfaces pilose and sessile-glandular; petiole 0.5–4cm. Spikes 1.5–7 × 0.8cm, with bracts exceeding flowers. Bracts subulate, c 4 × 0.5mm, ciliate, tips often purplish. Calyx 2.2–2.5mm, in fruit up to 5mm; teeth subulate, about half length of calyx. Corolla pink to rose-purple, c 3.5mm. Nutlets oblong-ellipsoid, 1.2 × 0.8mm.

**Bhutan:** S – Gaylegphug district (Rani Camp to Tama, 117); **Darjeeling:** Rambhi Chhu, Rayeng; **Sikkim:** Yoksam, Hi Khola, Chho La, Chunthang, Kalej Khola. Grassy slopes and among shrubs, 1220–2130m. October.

**4. *E. blanda*** (Bentham) Bentham. Dz: *Shingtsem*; Nep: *Mirey Pati* (117).

Herb, 70–100cm. Stems erect, pubescent. Leaves lanceolate to elliptic-lanceolate, 4–13.5 × 0.9–3cm, acuminate, base cuneate to attenuate, margin serrate, both surfaces with sessile glands, pubescent on main veins; petiole up to 2cm. Spikes slender, 2.5–11.5 × 0.7–1cm, arranged in narrow panicle. Bracts lanceolate, 1–2.5mm. Calyx 1.5–1.8mm, pubescent; teeth 0.5–0.8mm. Corolla white, 2.5mm. Stamens scarcely exerted. Nutlets ellipsoid, 0.8 × 0.5mm.

**Bhutan:** S – Samchi (117), Chukka, Gaylegphug (117) and Deothang (117) districts; C – Punakha, Tongsa (270) and Tashigang districts; **Darjeeling:** Rambhi Chhu and Kalimpong; **Sikkim:** Tumlang. Roadside banks in evergreen oak and warm broad-leaved forests, 1070–2130m. October–December.

**5. *E. stachyodes*** (Link) Raizada & Saxena; *E. incisa* Bentham

Slender herb, 50–150cm. Stems erect, pubescent. Leaves ovate, coarsely crenate-serrate, 1.5–6.5 × 1.1–4.7cm, acute or shortly acuminate, base cuneate, pubescent on veins, otherwise sparsely hairy, lower surface with numerous sessile glands; petiole 0.6–4cm. Spikes slender, 2–6 × 0.6cm. Bracts linear, 1.5–2mm. Calyx 1.5mm, pubescent, in fruit up to 4mm; teeth narrowly triangular, 0.7mm. Corolla white or pale violet, c 2.5mm. Nutlets ellipsoid, 0.8 × 0.5mm.

**Bhutan:** C – Punakha district (Wache and S of Wangdu Phodrang); **Darjeeling:** Darjeeling, Rayeng; **Sikkim:** Chungthang. Among herbs by stream, dry rocky slopes, 1000–2130m. October.

**6. *E. ciliata*** (Thunberg) Hylander; *E. cristata* Willdenow

Erect herb, 25–100cm. Stems quadrangular with white crisped hairs on opposing sides, otherwise  $\pm$  glabrous. Leaves ovate, 1.5–8  $\times$  1–4cm, acute or shortly acuminate, base cuneate, margin crenate-serrate, pubescent to pilose, with sessile glands on lower surface; petiole 0.5–4cm. Spikes secund, 2.5–7.5  $\times$  0.8–1.4cm. Bracts broadly ovate, apiculate, 4–6.5  $\times$  4–7mm, ciliate. Calyx 2mm, teeth triangular, 0.8mm; fruiting calyx up to 6mm. Corolla purple to pale pink, 4mm. Stamens slightly exerted. Nutlets obovoid, 1.2  $\times$  0.7mm.

**Bhutan:** S – Gaylegphug district (Sham Khara, 117), C – Thimphu district (Hongtso, Paro, Simtokha to Talukhah), N – Upper Bumthang Chu district (Kopup); **Darjeeling:** terai, Rambh Chhu; **Chumbi:** Yatung. Roadside banks, sandy flats, Spruce/Pine forest and disturbed ground, 1680–3660m. September–November.

Leaves smell of mint.

**7. *E. densa*** Bentham

Annual herb, 15–45cm. Stems branched, sparsely pubescent to pilose. Leaves oblong to narrowly ovate, 2.7–7.5  $\times$  0.8–2.4cm, acute, base cuneate, margin serrate, indumentum as on stem; petiole 0.3–1.2cm. Spikes 1.8–3.5  $\times$  1cm, lanate, hairs often mauve. Bracts broadly ovate, shorter than flowers. Calyx 2.5mm, teeth triangular c 1mm; fruiting calyx up to 7mm. Corolla mauve, 3mm. Nutlets obovoid, c 2  $\times$  1.4mm, tuberculate at apex.

**Bhutan:** N – Upper Mo Chu district (Laya and Chebesa); **Sikkim:** Ternu La, Lhonak valley; **Chumbi:** Phari. Often on cultivated ground, 3840–4880m. September.

Strongly smelling of mint.

**8. *E. eriostachya*** (Bentham) Bentham

Annual herb, (6–)12–38cm. Stems erect, with or without slender erect branches at the nodes, pilose. Leaves ovate-elliptic to ovate-oblong, 1.2–4(–8)  $\times$  0.6–1.2(–2.5)cm, acute, cuneate, serrate to serrate-crenate, pubescent; petiole 0.1–0.5cm, always  $\frac{1}{5}$  or less length of lamina. Spikes 1.2–4  $\times$  0.5–0.8cm, villous, hairs often yellow. Bracts broadly ovate, shorter than flowers. Calyx c 1.2mm, teeth triangular; fruiting calyx up to 4mm. Corolla yellow, 2.5mm. Nutlets obovoid, 1.3  $\times$  0.8mm.

**Bhutan:** C – Ha district (Tare La) and Thimphu district (Chekha, Shodug), N – Upper Mo Chu district (Tharizam Chu) and Upper Pho Chu district (Chojo Dzong); **Sikkim:** Thangu, Lachung, Samdong, Phaklung, Yume Samdong, Tsomgo, Lhonak; **Chumbi:** Dotag, Phari, Yatung. Stream banks, in grass and damp areas, 3050–4880m. June–September.

Two varieties are recognised from our area: var. **pusilla** (Bentham) Hook.f. which differs from the typical var. **erioslachya** in its smaller (up to 15cm) unbranched habit and smaller fruiting calyx.

### 9. *E. strobilifera* (Bentham) Bentham

Similar to *E. erioslachya* but leaves distinctly ovate, not more than 3cm long, narrowly attenuate at base but with petiole from  $\frac{1}{3}$  to equal in length to lamina; spikes cylindrical, with connate bracts overlapping and completely concealing calyces; corolla mauve or violet.

**Bhutan:** C – Thimphu, Punakha and Tongsa districts, N – Upper Mo Chu and Upper Kulong Chu districts; **Darjeeling:** Darjeeling; **Sikkim:** Lachung, Rathong, Tsomgo, Yumthang, Goombathang, Yak La; **Chumbi:** Yatung. Roadsides and tracksides in Spruce and open Fir forest, among bamboo, 2130–4170m. September–November.

### 10. *E. concinna* Vautier. Fig. 88p.

Erect, branched herb, up to c 18cm. Stems pilose. Leaves ovate, 1.3–2 × 0.6–1.2cm, acute, base cuneate, margin serrate, both surfaces  $\pm$  pubescent, lower surface paler than upper and with numerous sessile glands; petiole 2–6mm. Spike 2–5cm. Bracts very broadly ovate to suborbicular, 5–8 × 6–10mm, apiculate, ciliate, pilose on outer surface. Calyx 3.2–3.7mm; teeth triangular, awned, 1.5–2mm, lower 2 longer than upper. Corolla pale violet to white, 4–5mm. Nutlets not seen.

**Bhutan:** N – Upper Mo Chu district (Laya). On soil-covered wall, 3840m. September.

## 33. POGOSTEMON Desfontaines

Herbs or undershrubs, stems often swollen at or above nodes. Indumentum of simple or rarely, stellate hairs. Leaves opposite or verticillate, broad or linear, sessile or petiolate. Inflorescence spike-like, either solitary or terminal and axillary; whorls  $\pm$  dense, distant or conferted. Bracts persistent. Flowers sessile or pedicellate, small. Calyx  $\pm$  regular, teeth 5, subequal. Corolla subequally 4-lobed or bilabiate. Stamens 4, exserted, straight or declinate, filaments hairy; anthers 1-celled. Style 2-lobed. Nutlets ovoid, ellipsoid or subglobose.

The genus *Dysophylla* Blume is treated here as a synonym of *Pogostemon*, but in other treatments (eg. 260) it is maintained as a distinct genus distinguished by its whorled, sessile leaves and subequally 4-lobed (not bilabiate) corollas.

*Pogostemon dasianus* De & Mukerjee (sect. *Pogostemon*) has been recorded (117) from Wamrung (Deothang district) but this record has not been confirmed. A record of *P. paniculatus* (Willdenow) Bentham based on a *Griffith* specimen is probably due to confusion with *P. benghalensis* (Burman f.) Kuntze.

Several of the species treated below are known from our area only from

unlocalised specimens or from literature reports. Further collections from the subtropical zone are badly needed.

1. Leaves opposite, petiolate, rarely sessile ..... 2
- + Leaves whorled (4–10 in a whorl), always sessile ..... 10
2. Stems stellate-hairy ..... **9. P. tuberculosus**
- + Stems with simple hairs or glabrous ..... 3
3. Bracts ovate, c 6 × 3.5mm, partially concealing calyces, flushed purple; shrub 1–3m ..... **5. P. benghalensis**
- + Bracts various, not concealing calyces, usually green; herb or undershrub ..... 4
4. Calyx less than 2.5mm ..... 5
- + Calyx 2.5mm or more ..... 7
5. Stems densely villous ..... **3. P. auricularius**
- + Stems pubescent or subglabrous ..... 6
6. Herb 60–150cm; leaf margins irregularly serrate ..... **1. P. amaranthoides**
- + Herb 8–15cm; leaf margins entire ..... **4. P. andersonii**
7. Calyx teeth triangular, 0.6mm or less ..... 8
- + Calyx teeth subulate, 1mm or more ..... 9
9. Leaves ovate ..... **2. P. glaber**
- + Leaves lanceolate ..... **7. P. elsholtzioides**
9. Stems villous; stamens exerted by 2mm ..... **6. P. brachystachyus**
- + Stems pubescent; stamens exerted by 4mm ..... **8. P. fraternus**
10. Stems 45cm or more, erect, usually unbranched ..... 11
- + Stems 42cm or less, erect or ascending, usually branched ..... 12
11. Plants essentially glabrous (stems sometimes pubescent) .... **10. P. linearis**
- + Plants densely villous throughout ..... **11. P. cruciatus**
12. Leaves less than 2cm long, linear-oblong to oblong ..... **12. P. helferi**
- + Leaves 2cm or more long, usually linear ..... 13
13. Spikes 1.4–2.2cm; internodes at base of stem very short (c 3.5mm); basal leaves 1.5mm or less broad ..... **14. P. pumilus**
- + Spikes 2cm or more; internodes at base of stem 8mm or more; basal leaves 2mm or more broad ..... 14



14. Corolla c 3.5mm; calyx teeth in fruit straight, not spreading

13. *P. crassicaulis*

+ Corolla c 1.6mm; calyx teeth in fruit spreading ..... 15. *P. stellatus*

1. *P. amaranthoides* Benthams; Dz: *Namda*, Sha: *Nam Tshodma*; Nep: *Rudilo*.

Herb 60–150cm. Stems erect or sprawling, pubescent-tomentose on young growth, otherwise glabrous, often brownish-purple. Leaves narrowly ovate to lanceolate, 3.8–13 × 1.5–6cm, acute to acuminate, base cuneate to attenuate, margins irregularly serrate, sparsely pilose to subglabrous and with numerous minute glands on lower surface; usually petiolate, petiole 0.5–3.5cm. Spikes slender, 2–11 × 0.5–0.8cm, whorls usually distant. Calyx obovoid, 2–2.4mm; teeth triangular-ovate, 0.6mm, ciliate. Corolla white, 4mm; lobes c 0.6mm, acute or obtuse. Stamens purple, straight, exerted. Nutlets broadly ovate in outline, trigonous, 0.6 × 0.5mm.

**Bhutan:** S – Chukka district (Sinchula, above Chukka Dzong), C – Punakha district (Rinchu); **Darjeeling:** Darjeeling, Dumsong. Evergreen oak and mixed broad-leaved forest, 1410–2130m. September–October.

Used locally in curries.

2. *P. glaber* Benthams

Similar to *P. amaranthoides* but larger, up to 200cm; leaves ovate to ovate-oblong, not lanceolate, 6–13.5 × 3–6.5cm; always petiolate, petiole 1.3–5cm; spikes broader, c 1.2cm, whorls often conferted; calyx 3–3.5mm, pubescent, ribbed.

**Darjeeling/Sikkim:** locality unknown. 305–915m. October.

Known from our area only from an unlocalised Hooker specimen; it has also been reported from Bhutan (260) but this requires confirmation.

3. *P. auricularius* (L.) Hasskarl; *Dysophylla auricularia* (L.) Blume

Softly villous herb 30–60cm. Stems erect, spreading villous. Leaves ovate-oblong to elliptic, 2.5–7 × 1.2–2.5cm, acute, base usually rounded, margins serrate; sessile or with petiole up to 5mm. Spikes often solitary, (1.5–)6–14 × 1.1–1.3cm, whorls densely conferted. Calyx 1mm with numerous sessile glands; teeth broadly triangular, very short, inwardly curved in fruit. Corolla white or pink, 2.5mm, lobes short. Stamens straight, exerted by c 2mm. Nutlets obovoid, trigonous, 0.7 × 0.6mm.

**Darjeeling:** Balasun, Siliguri, Jalpaiguri (276). 150m. October.

4. *P. andersonii* (Prain) Panigrahi; *Dysophylla andersonii* Prain

Small herb, 8–15cm. Stems erect, appressed pubescent. Leaves lanceolate or oblong-lanceolate, 3–4 × 1cm, acute, margins entire, appressed pubescent. Spikes softly pubescent, 1.5–2 × 0.9cm. Calyx short, glabrescent, teeth triangular; fruiting calyx 2mm. Corolla 4mm, tube included. Nutlets subglobose.

**Darjeeling:** terai. (274).

This record is based on the type collection made by T. Anderson.

**5. *P. benghalensis*** (Burman f.) Kuntze; *P. plectranthoides* auct. non Desfontaines, *P. parviflorus* Benth. Fig. 89a&b.

Shrub, 1–3m. Stems erect, stout, branched, pubescent above, glabrescent below, often dark purple. Leaves ovate, 4–12 × 2.5–7.8cm, acuminate, base truncate to cuneate, margin doubly serrate, both surfaces villous-pubescent to subglabrous; petiole 1–7.4cm. Spikes subsecund, pubescent, 1.5–5.5 × 1.4–1.8cm, arranged in panicle, whorls densely conferted; bracts ovate, often obscuring calyces. Calyx c 4.5mm; teeth narrowly triangular, 1.2mm. Corolla pink or white, 6.5–7.4mm; lobes 1.2–1.5mm. Stamens straight, exerted by c 3mm. Style bifid at apex for 1.5mm. Nutlets ellipsoid, c 0.9 × 0.6mm.

**Bhutan:** S – Phuntsholing district (Torsa River); **Darjeeling:** Kalimpong, Darjeeling, terai; **Sikkim:** Lusing, Manasoom. By roadside ditch, 200–600m. January–February.

This species yields the aromatic *Patchouli* oil and is a source of nectar for bees, yielding panagol honey (247). An atypical specimen of this species from Chukka district (*Wood* 6079) is probably a hybrid with *P. tuberculosus*.

**6. *P. brachystachyus*** Benth

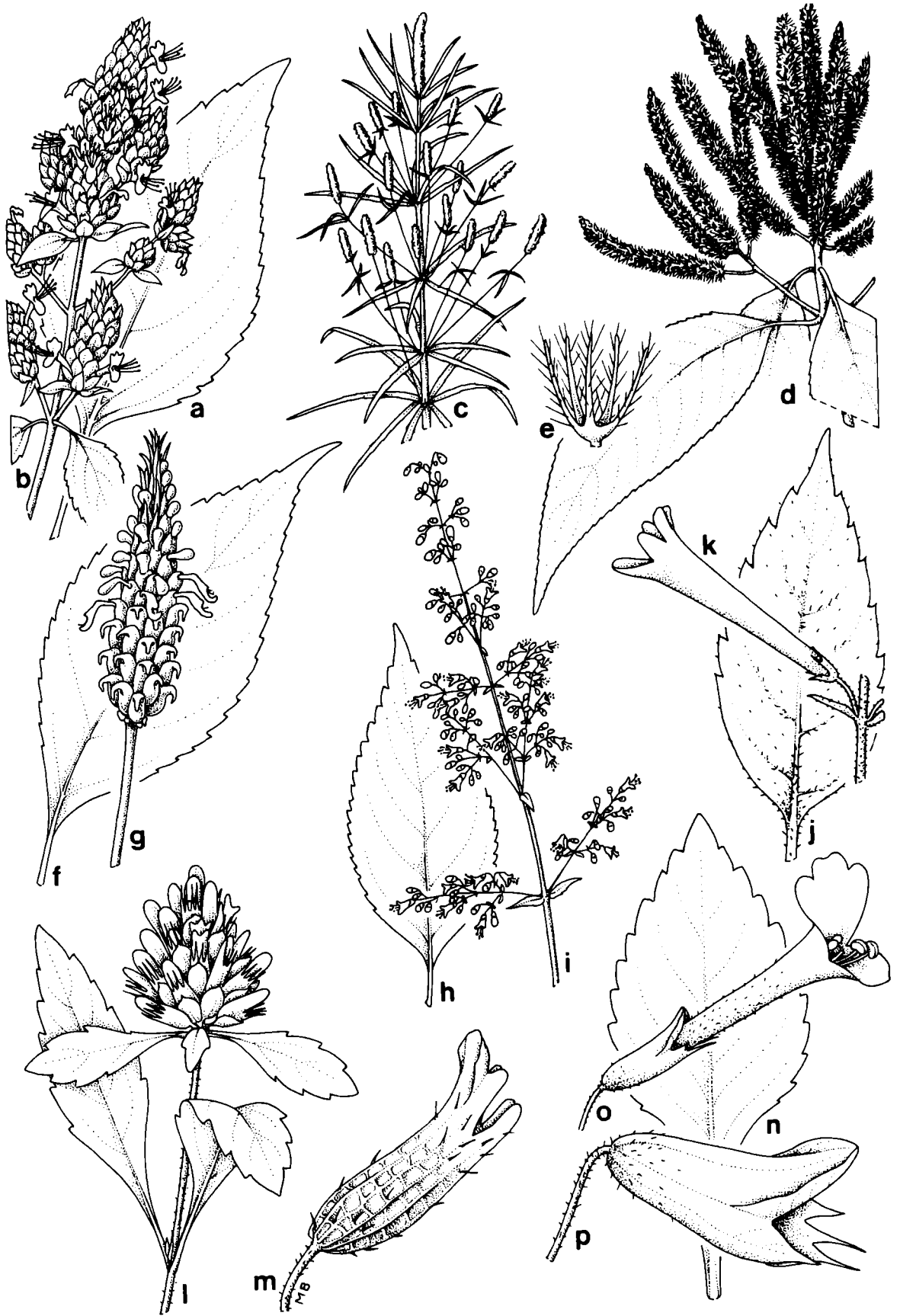
Herb up to 45cm. Stems procumbent, branched, rooting near base, retrorsely pubescent. Leaves ovate, 2.2–6 × 0.9–3.3cm, acute to obtuse, base cuneate to somewhat rounded, margin crenate-serrate, both surfaces appressed villous and with numerous sessile glands; petiole 0.2–2.1cm. Spikes 2–9 × 1.5–1.7cm; whorls conferted or sometimes distant at base. Pedicels 1–2mm. Calyx 2.5–3.5mm; teeth subulate, 1mm. Corolla violet or mauve, 4mm; lobes oblong, 1.5mm. Stamens straight, exerted by 2mm. Nutlets subglobose, 1 × 0.9mm.

**Bhutan:** S – Chukka district (Chukka to Chimakothi) and Deothang district (Pemagatshel); **Sikkim:** Gangtok (69). Bank in open broad-leaved forest, open scrub on seasonally wet slopes, 1220–1800m. September–October.

**7. *P. elsholtzioides*** Benth

Aromatic shrub, 1–3m. Stems branched, young stems pubescent, older stems often purple-brown. Leaves lanceolate, 4.5–12.2 × 1.4–3.8cm, long acuminate, base attenuate, margins serrate to serrulate, dark green above, paler below, both surfaces sparsely pilose and with dense, sessile glands; petiole 0.2–1.7cm. Spikes subsecund, 2.5–9 × 1.4–1.7cm; whorls ± conferted except at base. Flowers subsessile. Calyx tubular, 3–3.5mm; lobes triangular, 0.6mm. Corolla mauve or

FIG. 89. Labiatae. a–b, *Pogostemon bengalensis*: a, leaf (× 2/3); b, inflorescence (× 1/3). c, *P. stellatus*: inflorescence (× 1/4). d–e, *Colebrookea oppositifolia*: d, inflorescence (× 1/3); e, calyx (× 20). f–g, *Anisochilus pallidus*: f, leaf (× 1/2); g, inflorescence (× 1/2). h–i, *Isodon lophanthoides*: h, leaf (× 1/2); i, inflorescence (× 1/2). j–k, *Siphocranion macranthum*: j, leaf (× 2/3); k, flower (× 1 1/2). l, *Acrocephalus indicus*: inflorescence (× 2). m, *Geniosporum coloratum*: calyx (× 5). n–p, *Orthosiphon rubicundus*: n, leaf (× 2/3); o, flower (× 2); p, calyx (× 5). Drawn by M. Bates.



purple, 5–6mm; lobes ovate, c 1mm. Stamens straight, exerted by 3–3.8mm. Mature nutlets not seen.

**Bhutan:** S – Phuntsholing, Chukka and Deothang districts, C – Tashigang district; **Assam Duars:** Buxa Duar hills (276). In *Quercus* forest, in scrub of cleared wet broad-leaved forest, 900–1800m. October–November.

### 8. *P. fraternus* Miquel

Decumbent herb, 60–90cm. Stems straggling, branched, pubescent above, glabrescent below, often dull purple. Leaves ovate to ovate-oblong, 2–8.4 × 1.6–4.6cm, acute, base rounded, margins irregularly serrate, both surfaces sparsely pilose and with numerous sessile glands; petiole 0.8–4cm. Spikes 3.5–14 × 2cm; whorls distant or conferted. Pedicels 1–2.5mm. Calyx tubular-campanulate, 3–4mm, up to 5mm in fruit; teeth subulate, 1–1.5mm, lower 2 slightly longer. Corolla mauve to violet, 6.5–7mm; lobes ± oblong, 1–2mm. Stamens exerted beyond corolla for 4mm. Nutlets subglobose, rounded trigonous, 0.9 × 0.9mm.

**Bhutan:** S – Gaylegphug district (25km N of Gaylegphug); **Darjeeling:** Jinglam, Mongpu; **Sikkim:** below Gangtok. Steep grassy bank in damp forest, 915–1525m. March–April.

### 9. *P. tuberculosus* Bentham

Shrub 1–3m. Stems erect, stellate-pubescent. Leaves ovate, 5.5–11 × 2.8–7.6cm, acuminate, base cuneate to attenuate, margins doubly serrate, both surfaces stellate-hairy; petiole 1–3cm. Spikes 3.5–18.5 × c 1.5cm; whorls distant, at least below. Flowers subsessile. Calyx obovoid, 3–4mm; lobes narrowly triangular, 1mm. Corolla blue-purple, 6–7mm; lobes ± oblong, 1–1.5mm. Stamens exerted for 4–5mm. Mature nutlets not seen.

**Bhutan:** S – Samchi district (Samchi Hill, 117), Phuntsholing district (Phuntsholing) and Gaylegphug district (Sureylakha, 117), C – Tashigang district (Jiri Chu); **Darjeeling:** Kurseong, Kalimpong. Subtropical jungle, among shrubs, 780–1520m. November–December.

### 10. *P. linearis* (Bentham) Kuntze; *Dysophylla linearis* Bentham

Rhizomatous herb, 45–100cm. Stems erect, usually unbranched, glabrous or glandular-pilose. Leaves sessile, in whorls of 4(–6), linear or linear-lanceolate, 2.6–6 × 0.25–0.7cm, acute; margins serrulate, somewhat revolute, teeth distant; glabrous with ciliate margins, lower surface gland-dotted. Spikes 2–6.4 × 1.2–1.5cm; whorls conferted; bracts deep purple. Flowers sessile. Calyx c 2mm; lobes triangular, c 0.5mm. Corolla white, pinkish or purple, 4–5mm; lobes c 1mm. Stamens exerted for 3–4mm. Nutlets ellipsoid, 0.5mm.

**Bhutan:** C – Tashigang district (Tashiyangtsi, Kanglung). In damp or marshy areas, 1520–2440m. July–August, October.

### 11. *P. cruciatus* (Bentham) Kuntze; *Dysophylla cruciata* Bentham

Similar to *P. linearis* but densely villous throughout; leaves shorter, 2–3.5cm × 0.2–0.3cm; spikes up to 8cm long.

**Darjeeling:** locality unknown. Damp areas. October.

This record is based on an unlocalised Cowan specimen.

**12. *P. helferi* (Hook.f.) Press; *Dysophylla helferi* Hook.f.**

Small annual herb, up to 15cm. Stems and branches slender, suberect, somewhat puberulent. Leaves sessile, in whorls of 4, linear-oblong to oblong, 0.8–1.8(–2.5) × 0.2–0.35cm, apex acute, margins serrulate, glabrous and with sessile glands. Spikes 0.8–2.5 × 0.3–0.6cm; whorls conferted. Calyx c 1.5mm; lobes triangular, c 0.4mm. Corolla pink or purple, c 2mm, lobes c 0.5mm. Stamens exserted for 1–1.5mm. Nutlets orbicular-oblong, 0.5mm.

**Darjeeling/Sikkim:** locality unknown.

This record is based on an unlocalised Kurz specimen.

**13. *P. crassicaulis* (Benth) Press; *Dysophylla crassicaulis* Benth**

Stems ascending, rooting at basal nodes, 27–42cm, glabrous to somewhat puberulent, usually branched with 1–4 slender branches at nodes; internodes 1.5–6cm. Leaves linear to linear-oblong, 2–7 × 0.3–1.2cm, acute, margin flat, minutely serrulate, ± glabrous. Inflorescence 2.5–8 × c 0.7cm; bracts lanceolate c 2.5 × 0.8mm, ciliate; flowers exceeding bracts. Calyx c 2mm, pubescent; fruiting calyx lobes straight, not recurved. Corolla pink when dry, c 3.5mm. Stamens exserted by c 1mm, with dense tuft of long, pink hairs on filament. Nutlets obovoid, 0.8 × 0.5mm.

**Darjeeling/Sikkim:** locality unknown (80). In swamps.

A doubtful record, based on a Griffith collection, which has not been located, from 'Sikkim'.

**14. *P. pumilus* (Graham) Press; *Mentha pumila* Graham, *Eusteralis pumila* (Graham) Rafinesque, *Dysophylla pumila* (Graham) Benth, *D. crassicaulis* Benth var. *pumila* (Graham) Hook.f.**

Stems ascending, rooting at basal nodes, 12–23cm, glabrous or subglabrous, usually branched, 1–4 slender branches at nodes; internodes very short at base, c 0.35cm long, 1.1–3.1cm above. Leaves lanceolate to linear, 1–3 × 0.15–0.45cm (basal leaves narrowly linear, 1.5–3 × 0.08–0.15cm), acute, margin remotely and minutely serrulate, glabrous. Inflorescence 1.4–2.2 × c 0.5cm; bracts obovate, c 2 × 0.8mm, ciliate; flowers scarcely exceeding bracts. Calyx c 1mm, pubescent; fruiting calyx teeth straight, not recurved. Corolla purple, 1.5–2mm, pubescent. Stamens scarcely exserted, some hairs on filament. Nutlets obovoid, 0.8–0.5mm.

**Darjeeling/Sikkim:** locality unknown (269).

**15. *P. stellatus* (Loureiro) Kuntze; *Dysophylla verticillata* Benth. Fig. 89c.**

Erect, annual herb, 20–40cm. Stems usually branched, 1–8 slender branches per node, ± glabrous. Leaves sessile, in whorls of 4–10, linear, 2.5–9 × 0.2–0.6cm, apex acuminate, margins serrulate, usually flat, glabrous and with

numerous sessile glands. Spikes pubescent, 2–7.5 × 0.6–0.7cm, width very uniform; whorls conferted. Flowers sessile. Calyx c 1mm; teeth ovate-triangular, 0.4mm; fruiting calyx teeth spreading, giving star-shaped appearance to calyx. Corolla 1.6mm, lobes 0.3mm. Stamens exserted for c 1mm; some hairs on filament. Nutlets ovoid, 0.6 × 0.4mm.

**Darjeeling/Sikkim:** locality unknown (269). In wet places at low altitude. November–January.

### 34. COLEBROOKEA Smith

Shrubs. Leaves petiolate, crenulate to serrulate. Inflorescence of numerous, slender spikes, arranged in a panicle; verticillasters dense, many-flowered. Calyx deeply divided into 5 equal subulate teeth. Corolla slightly bilabiate, 5-lobed, lowest lobe broader and larger than others. Stamens 4, exserted; anthers 1-celled. Style subequally bifid. Nutlets ellipsoid, pilose at apex.

1. **C. oppositifolia** Smith. Nep: *Dosro* (34), *Chusre*; Lepcha: *Kumhyemkung* (34). Fig. 89d&e.

Shrub, 1.5–3m, softly pubescent throughout, often sericeous on young growth. Leaves elliptic to ovate-elliptic, 10–18 × 3.5–7.5cm, acuminate, base cuneate, margin crenulate to serrulate, whitish tomentose beneath; petiole 1–4cm. Spikes 1.5–11cm, arranged in a panicle, becoming dull pink and plumose in fruit. Calyx 0.6–0.8mm; teeth hairy, lengthening in fruit to 4.5–5.5mm. Corolla whitish, 1.5–2mm. Stamens 4, exserted by c 1.5mm; anthers 1-celled. Nutlets c 0.5mm long, usually only 1 developing, dispersed within calyx.

**Bhutan:** S – Samchi district (Samchi) and Phuntsholing district (Torsa River, Kharbandi); **Darjeeling:** Pankhabari, Pul Bazar, Rieng, Tista valley; **Sikkim:** Rangit, Farseng. Among shrubs on bank of stream, secondary scrub, edge of cultivation, 200–1220m. December–February.

### 35. HYPTIS Jacquin

Perennial or annual aromatic herbs. Stems ascending to erect, branched. Leaves petiolate, serrate and serrulate. Verticillasters in axils of leafy bracts. Calyx ± regular, enlarged in fruit, veins prominent, tubular-campanulate; teeth 5, subequal. Corolla bilabiate, upper lip 2-lobed; lower lip 3-lobed, middle lobe shorter, deflexed; tube slender, not annulate within. Stamens 4, didynamous, included; anthers becoming 1-celled. Style shortly bifid. Nutlets oblong, laterally flattened.

1. **H. suaveolens** (L.) Poiteau. Nep: *Gande Jhar*.

Annual herb. Stems ascending to erect, 30–100cm, villous. Leaves ovate to ovate-elliptic, 1.4–7 × 1–5cm, base usually rounded to cordate, apex acute,

margins serrate and serrulate, glandular-pubescent and with some villous hairs; petiole up to 4cm. Verticillasters 2–6-flowered. Calyx 4–5mm, teeth subulate, 2–3mm; fruiting calyx enlarging to 10mm. Corolla pale blue to blue-purple, 7–8mm; upper lip c 3mm, lobes obtuse. Nutlets c 3.5 × 2.2mm.

**Bhutan:** S – Samchi district (Samchi, 117), Phuntsholing district (Torsa River, between Phuntsholing and Kharbandi) and Gaylegphug district (between Gaylegphug and Tori Bari); **Darjeeling:** Tista Bridge; **Sikkim:** Rangpo. Roadsides, streamsides and field margins, 200–400m. May, November.

A weedy species native to tropical America.

### 36. ANISOCHILUS Benthams

Herbs. Leaves petiolate, simple. Inflorescence of erect, dense, cylindrical spikes, arranged in the form of a narrow panicle. Calyx oblique, 1-lipped or with very reduced lower lip; upper lip 1–3-toothed, curved or strongly deflexed in fruit. Corolla bilabiate, tube deflexed, upper part dilated, upper lip short, lower lip concave. Stamens 4, declinate. Style 2-lobed.

1. Leaves densely pubescent, acute at apex, margins crenulate-serrate

1. **A. mitis**

+ Leaves sparsely pubescent to subglabrous beneath, acuminate at apex, margins serrate ..... 2

2. Lower leaves ovate-elliptic, teeth not hooked at tip; fruiting calyx with mouth closed by strongly deflexed upper lip ..... 2. **A. pallidus**

+ Lower leaves lanceolate, teeth hooked at tip; fruiting calyx with upper lip slightly decurved but not closing mouth ..... 3. **A. polystachyus**

#### 1. **A. mitis** Clement

Robust herb, forming clumps. Stems erect, 60–120cm, densely pubescent-tomentose, glabrescent near base. Leaves ovate-elliptic to elliptic, 6–11.2 × 3.1–7.1cm, acute, base rounded to cuneate, margins crenulate-serrate, both surfaces pubescent-tomentose and with orange-red sessile glands, velvety to touch; petiole 0.5–2.5cm. Spikes 2–7 × c 1.5cm, in fruit densely tomentose. Bracts ovate-acuminate, caducous. Calyx 2.2–2.5mm, densely pubescent; upper lip ovate, 0.6–0.7mm; truncate, very reduced; fruiting calyx up to 4.5mm long, upper lip strongly deflexed. Corolla pale blue-violet, mauve or purple, 12–14.5mm; tube 5.5–6.5mm; upper lip very reduced, truncate, obscurely 2-lobed; lower lip 5–5.5mm, concave. Nutlets ellipsoid, 1 × 0.7mm, dark brown.

**Bhutan:** C – Punakha district (Wangdu Phodrang), Tongsa district (between Shemgang and Dakpai), Mongar district (N of Lhuntse, Khoma) and Tashigang district (Ghunkarah). Dry hillsides and open areas, 1070–1700(–2850)m. July–September, November.

An East Himalayan endemic, known only from Bhutan and Assam (250).

**2. *A. pallidus* Benth.** Fig. 89f&g.

Annual herb. Stems erect, 100–130cm, terete, pubescent and with sessile glands, usually with dark purple spots. Leaves ovate-elliptic becoming lanceolate above, 7–15 × 1.5–5cm, long acuminate, base cuneate, margins serrate, upper surface sparsely pubescent, lower surface covered with orange sessile glands, pubescent on veins; petiole 0.4–4cm. Spikes 1–3.8cm long. Bracts linear, up to 7.5mm, apparently caducous. Calyx 1.4–1.5mm, 1-lipped, densely hairy; lip with 3 teeth, centre tooth longest; fruiting calyx enlarging to 4mm long, upper lip lengthening and deflexing, closing mouth. Corolla pale purple or pink, 5.6–6.2mm; upper lip very reduced with 3 minute teeth; lower lip c 2mm. Nutlets ellipsoid, 1 × 0.6mm, dark brown.

**Bhutan:** S – Samchi district (Samchi, 117), Phuntsholing district (above Phuntsholing, above Kharbandi) and Sarbhang districts; **Darjeeling:** Darjeeling, Munsang, Rishep, Rambai Chhu. Roadsides in dense forest, 305–1600m. October–November.

**3. *A. polystachyus* Benth.**

Similar to *A. pallidus* but up to 3m, stems quadrangular-sulcate; leaves lanceolate, 11–16.5 × 2–3cm, acuminate, subsessile; margins distantly serrate, teeth slightly hooked; spikes up to 4.7cm long; calyx lip 5-toothed, slightly decurved but not strongly deflexed in fruit, not closing mouth; corolla white.

**Darjeeling:** terai. Dry subtropical areas, 150–610m. November.

### 37. PLECTRANTHUS L'Héritier

Subshrubs or herbs. Leaves petiolate, toothed. Inflorescence paniculate or spike-like with lax, few-flowered cymes or appearing verticillate. Calyx conspicuously bilabiate, upper lip with single large tooth, lower lip 4-toothed. Corolla bilabiate; tube not saccate; upper lip 4-lobed; lower lip concave, boat-shaped, entire. Stamens 4. Style 2-lobed. Nutlets globose, slightly flattened laterally.

The Asiatic species of *Plactranthus* are sometimes segregated under *Coleus* Loureiro (eg. 260) but they are united here.

1. Leaves cordate at base, pubescent to glabrescent; corolla pale pink or mauve, c 8mm long..... **1. *P. mollis***

+ Leaves cuneate to attenuate at base, villose and with numerous sessile glands on lower surface; corolla blue-purple (rarely white), 15–20mm long

**2. *P. barbatus***

**1. *P. mollis* (Aiton) Sprengel; *P. incanus* Link**

Herb. Stems 30–80cm, ± erect, quadrangular, pubescent above, glabrescent below. Leaves ovate, 4.5–10.5 × 4–10.5cm, base cordate, apex acute, margins



crenate-serrate, both surfaces pubescent on veins, pubescent to glabrescent elsewhere; petiole 1.5–12cm. Bracts  $\pm$  obovate, c 5mm long. Inflorescence of branched, lax spikes 14–30cm long, cymes paired, sometimes sessile, 1–3-flowered. Calyx campanulate, 2.5–3mm, densely glandular-puberulent and with some short white hairs; upper lip shorter than lower, tooth ovate; lower lip c 2mm, teeth triangular-subulate; fruiting calyx enlarging to c 10mm long. Corolla pale pink or mauve, c 8mm; tube c 4.5mm; upper lip erect, c 2.5mm, lobes obtuse; lower lip c 3.5mm. Stamens equal to lower lip. Nutlets c 2  $\times$  2mm, pale brown.

**Darjeeling/Sikkim:** locality unknown (80). Moist places, c 1220m. August–September.

**2. *P. barbatus*** Andrews; *Coleus barbatus* (Andrews) Bentham, *C. forskahlaei* Aiton non Vahl nec Willdenow

Semi-succulent herb with fleshy rootstock. Stems 25–80cm, lanate-villose and with small glandular hairs, often branched near base. Leaves ovate to elliptic, 2.5–4.5(–8)  $\times$  1.4–2.2(–5)cm, base cuneate to attenuate, apex acute to obtuse, margin crenate-serrate, both surfaces villose (densely so when young), lower surface also with numerous orange-red sessile glands; petiole 0.5–1cm. Bracts broadly ovate, acuminate, c 1  $\times$  0.7cm, caducous. Inflorescence a  $\pm$  lax spike, 10–21cm long, cymes paired, sessile, 3–4-flowered. Calyx  $\pm$  campanulate, c 4.5mm, shortly hairy with villose hairs near base and reddish sessile glands; upper lip slightly shorter than lower, ovate, apiculate; lower lip 2–2.5mm, teeth narrowly triangular; fruiting calyx deflexed, c 8mm long. Corolla blue-purple, rarely white, 15–20mm; tube 4–5mm, bent at right angle just below throat; upper lip c 3mm, shallowly 4-lobed; lower lip 10–12mm. Stamens slightly exerted beyond lower lip; filaments connate in lower part, forming a tube around style. Nutlets c 1.4  $\times$  1.4mm, shiny, dark brown.

**Bhutan:** C – Thimphu district (Thimphu, Paro), Punakha district (Punakha, Wangdu Phodrang to Kyebaka) and Mongar district (Lhuntse). Open dry slopes, dry stony hills, Chir Pine forest, 1400–2290m. August–September.

### 38. ISODON (Bentham) Spach

Shrubs, subshrubs or herbs. Leaves petiolate, serrate, crenate or crenulate. Inflorescences terminal and axillary of  $\pm$  lax cymes forming panicles or, more rarely, dense cymes forming spikes; bracts persistent, not conspicuous. Flowers small. Calyx equally or subequally 5-toothed or bilabiate with upper lip 3-toothed. Corolla bilabiate; tube exerted, gibbous or not on dorsal surface near base; upper lip 4-lobed, usually recurved; lower lip concave, entire. Stamens 4, declinate, didynamous; anthers 1-celled. Style 2-lobed. Nutlets oblong or ovoid.

1. Leaves in whorls of 3 or 4; inflorescence lanate-tomentose, dense and spike-like ..... **1. I. ternifolius**  
 + Leaves in pairs, always opposite; inflorescence not lanate-tomentose, usually  $\pm$  lax ..... 2
2. Subshrubs or shrubs up to 2m; lower stems much-branched, woody with flaking bark; leaves mostly 5cm or less long; hairs simple or branched ... 3  
 + Herbs; lower stems not usually branched, sometimes woody but without flaking bark; leaves mostly 5cm or more long, rarely less; hairs simple ... 4
3. Indumentum of branched (dendroid) hairs ..... **5. I. rugosus**  
 + Indumentum of simple hairs ..... **6. I. pharicus**
4. Corolla gibbous or shortly spurred near base of tube on upper side ..... 5  
 + Corolla not gibbous near base of tube ..... 8
5. Leaves orbicular or ovate-orbicular, apex  $\pm$  obtuse; plant procumbent or ascending; stems up to 40cm long; stamens included ..... 6  
 + Leaves ovate, apex acuminate; plant erect or ascending; stems usually more than 40cm long; stamens included or exerted ..... 7
6. Leaf base truncate, margin crenate ..... **7. I. repens**  
 + Leaf base cuneate, margin serrate ..... **8. I. kurzii**
7. Stamens included; calyx weakly bilabiate with lips equal; corolla purple or purple-blue ..... **9. I. coetsa**  
 + Stamens clearly exerted; calyx conspicuously bilabiate with lower lip slightly longer than upper; corolla white, cream or yellow with red marking  
**10. I. scrophularioides**
8. Corolla dark crimson ..... **4. I. atroruber**  
 + Corolla white, pink or mauve, with or without purple marking on upper lip ..... 9
9. Calyces densely villous with multicellular hairs ..... **2. I. hispida**  
 + Calyces puberulent and sometimes with a few villous hairs near base  
**3. I. lophanthoides**

**1. I. ternifolius** (D.Don) Kudo; *Plectranthus ternifolius* D.Don; *Rabdosia ternifolia* (D.Don) Hara. Dz: *Peng-dong-dongla*

Subshrub or robust herb. Stems 0.5–2m, obscurely angled, villous-tomentose to pubescent. Leaves usually in whorls of 3 or 4, narrowly elliptic, 5.4–11 × 1.7–3.2cm, base  $\pm$  cuneate, apex acute or shortly acuminate, margin regularly

serrulate, upper surface pilose, lower surface densely white-tomentose; petiole 2–6mm. Inflorescences lanate-tomentose, (12–)22–40 × 1.7cm, spike-like, axillary, suberect, cymes dense. Pedicels up to 1.5mm. Calyx sub-bilabiate, campanulate, c 2mm, densely white-hairy; teeth 1–1.5mm; fruiting calyx tubular, up to 5mm long, prominently ribbed. Corolla white to pale violet, c 6.5mm; tube c 2mm, gibbous; upper lip erect or recurved; lower lip straight. Stamens not exceeding lower lip, curving up at apex. Nutlets oblong-ovoid, rounded trigonous, c 2mm.

**Bhutan:** S – Deothang district (Sassi), C – Punakha district (Wangdu Phodrang, Wangdu Phodrang to Chirang), Tongsa district (Tama to Birti, 117) and Mongar district (Mongar to Kuru Chu); **Darjeeling:** terai at Siliguri. In dry, open bushland, under Chir pine or open forest, 610–1370(–2130)m. September–November.

## 2. *I. hispidus* (Bentham) Murata

Erect perennial herb. Stems 90–100cm, densely yellow-brown septate-villous. Leaves elliptic to ovate-elliptic, 8.5–16.5 × 4–9cm, acuminate, base cuneate or rounded with lamina somewhat decurrent on petiole, margin crenate-serrate, upper surface hispid, lower surface septate-villous on veins; petiole 4–8mm. Inflorescences terminal and axillary, 8–10 × 3.5cm, densely brownish villous, cymes ± lax. Calyx bilabiate, campanulate, c 1.5mm, densely villous and with sessile glands; teeth triangular; fruiting calyx tubular, up to 3mm, curved. Corolla white or pale mauve, sometimes with purple spots on upper lip, 6.5–7mm; tube 4–4.5mm, not gibbous. Stamens exerted c 2.5mm beyond lower lip of corolla. Nutlets ovoid, c 1 × 0.7mm.

**Bhutan:** S – Deothang district (Chungkar, between Deothang and Wamrung, Wamrung), C – Tongsa district (Yuto La) (270). Steep open slopes and banks in dense forest, 1220–2700m. October–November.

3. *I. lophanthoides* (D. Don) Hara; *Rabdosia lophanthoides* (D. Don) Hara, *Plectranthus lophanthoides* (D. Don) Grierson & Long, *P. striatus* Bentham, *P. stocksii* Hook.f. Dz: *Dolo patey*, *Mirey pati* (117)

1. Herb up to 100cm; leaves up to 8.5 × 3.3cm, lower surface greyish  
var. **lophanthoides**
- + Herb up to 150cm; leaves up to 20 × 8.5cm, lower surface not usually greyish ..... var. **gerardianus**

a. var. **lophanthoides**. Fig. 89h&i.

Perennial herb. Stems erect to ascending, 15–60(–100)cm, slender, distinctly quadrangular, ± white tomentose. Leaves ovate, 1.5–4.5(–8.5) × 0.9–3.3cm, base truncate to cuneate, apex acute or occasionally acuminate, margin crenate to crenate-serrate, upper surface with fairly dense, coarse, white, villous hairs, lower surface similar with fewer hairs and numerous dark red sessile glands;

petiole 4–11(–22)mm on lower leaves, upper leaves sessile. Bracts ovate, leaf-like below, reducing to c 4mm long above. Inflorescence 6–15 × 3.5cm. Pedicels 2–6mm. Calyx inconspicuously bilabiate, broadly campanulate, 1.5–2.1mm, puberulent and with some tomentose hairs near base and scattered, dark red, sessile glands; upper lip teeth oblong-acute, c 0.6mm; lower lip subequal to upper, teeth rounded; fruiting calyx enlarging to 3–3.5mm, becoming tubular and curved. Corolla white, pink or mauve with purple or crimson marking on upper lip, 5.5–6.5mm; tube 4.2–5mm, straight, not gibbous; upper lip recurved, c 1.5mm; lower lip 3–3.5mm. Stamens exserted. Nutlets oblong-ellipsoid, 0.9 × 0.6mm, pale brown with darker marking.

**Bhutan:** C – Thimphu district (Paro and Thimphu valleys), Punakha district (near Lometsawa, Mo Chu valley) and Tongsa district (between Tongsa and Tashiling); **Darjeeling:** Darjeeling; **Sikkim:** Yoksam, Rangyjhan. Roadsides, cleared *Pinus wallichiana* forest, 1370–2480m. September–October.

b. var. **gerardianus** (Bentham) Hara; *Plectranthus gerardianus* Bentham, *Rabdosia lophanthoides* var. *gerardiana* (Bentham) Hara

Differs from var. *lophanthoides* in its taller habit (up to 150cm), larger leaves (5–14 × 2.5–7cm), with serrate-dentate margin, more attenuate base and longer petioles (up to 40mm).

**Bhutan:** C – Punakha district (Wangdu Phodrang, Tinlegang and Lometsawa), N–Upper Mo Chu district (Gasa Dzong); **Darjeeling:** Dumsong, Kurseong, Tista, Pomong, Rississum; **Sikkim:** Yakla, Lachung, Chunthang. Among rocks, near streams or in scrub in moist broad-leaved forest or with *Rhododendron arboreum*, 915–3050m. September–October.

*I. lophanthoides* var. *graciliflorus* (Bentham) Hara has also been recorded from our area (80, 259), but none of the material seen has been confirmed as this variety.

#### 4. *I. atroruber* Clement

Perennial herb. Stems erect, 30–50cm, little-branched, quadrangular, glandular-pubescent and with some villous hairs. Leaves ovate, 5.7–10.8 × 4.1–6.8cm, acuminate, base rounded-truncate with lamina slightly decurrent on petiole, margin serrate-dentate; upper surface glandular-pubescent and with villous hairs and some sessile glands; lower surface villous on veins and with many sessile glands; petiole 1.2 – 4.5cm. Inflorescence a narrow panicle 4.5 – 13 × c 2cm. Calyx bilabiate, campanulate, 1.8 – 2mm, puberulent and with numerous orange-brown sessile glands; upper lip lobes oblong-obtuse, 0.5mm; lower lip slightly longer, lobes similar; fruiting calyx tubular, curved, 3 – 3.5mm. Corolla deep wine red to deep reddish-purple, 4.5 – 5.5mm; tube 2 – 2.5mm, not gibbous; upper lip erect or recurved, c 2.5mm, lobes 1.5 – 2mm, obtuse at apex; lower lip c 2.5mm. Stamens exserted, extending 2 – 3mm beyond lip. Nutlets ellipsoid, 1.2 × 0.8mm, pale brown.

**Bhutan:** C – Thimphu district (Dotena and Hing Lai La) and Tashigang district (Tashi Yangtshi and Bomdeling). Pathsides and banks in *Quercus semecarpifolia* and mixed forests, 2100–2740m. August–November.

Endemic to Bhutan, so far having only been found in two widely separated valleys (250). It is very distinctive within the genus in its dark red flowers and narrow panicle.

**5. *I. rugosus*** (Bentham) Codd; *Plectranthus rugosus* Bentham, *Rabdosia rugosa* (Bentham) Hara; Dz: *Siluguka* (Bedi)

Aromatic, bushy shrub, 1–2m. Stems much-branched with flaking bark when old, when young with white dendroid hairs. Leaves ovate to oblong-ovate, 0.7–5 × 0.5–2.5cm, base cuneate to rounded, apex acute to rounded, margin crenulate-serrulate, densely white dendroid-tomentose, especially on lower surface; petiole up to 11mm. Bracts leaf-like, small. Inflorescences terminal and axillary, paniculate, up to c 20 × 1.5–2cm; pedicels 2–4mm. Calyx inconspicuously bilabiate, campanulate, 2.5–3mm, glandular-puberulent and with white, simple and dendroid hairs mainly near base; teeth 5, subequal, broadly triangular, 1–1.2mm; fruiting calyx enlarging to 5mm, tubular-campanulate. Corolla white tinged with pink, lilac or pale blue, 7–8.5mm; tube 3.5–4.5mm, straight, conspicuously gibbous; upper lip 3mm; lower lip straight, 3.5–5mm. Stamens shorter than lower lip. Nutlets oblong-ellipsoid, 1.2 × 0.9mm, mid-brown often with obscure darker reticulation.

**Bhutan:** C – Thimphu district (Paro and Thimphu valleys, common) and Punakha district (Chuzom). Among scrub, roadsides and dry hillsides, 1450 – 2450m. April, August, October.

**6. *I. pharicus*** (Prain) Murata; *Plectranthus pharicus* Prain, *Rabdosia pharica* (Prain) Hara

Similar to *I. rugosus* but with simple, not dendroid hairs; a slightly smaller shrub, 0.3–1m; leaves with margins crenate-serrate; inflorescence more lax, up to 4cm wide; calyx 2.5–5mm; teeth triangular, slightly acuminate, 1.2–2mm; fruiting calyx up to 6mm; corolla pale blue, mauve or whitish with mauve upper lip, larger than *I. rugosus*, 9–10mm; tube not gibbous or spurred; nutlets oblong-ellipsoid, c 1.6 × 1.1mm, brown.

**Chumbi:** Phari. Dry rocky slopes, 2300–4300m (260). July–September.

**7. *I. repens*** (Bentham) Murata; *Plectranthus repens* Bentham, *Rabdosia repens* (Bentham) Hara

Procumbent perennial herb. Stems ascending, 10–25cm long, often unbranched, pilose to puberulent. Leaves ovate-orbicular, 2.5–4 × 2.2–4.3cm, base ± truncate, apex rounded to subacute, margin crenate, with scattered villous hairs and glandular-puberulent on both surfaces; petiole 1.2–2.5(–4)cm. Inflorescences mainly terminal, narrowly paniculate, 6.5–17 × 3cm, cymes 3–5(–7)-flowered; pedicels 2–3mm. Calyx bilabiate, campanulate, 1–1.5mm, puberulent and with numerous sessile glands; teeth triangular, 0.4–0.6mm; upper lip slightly shorter than lower; fruiting calyx urceolate, lengthening to c 3mm. Corolla white with purple marking, mauve to dark blue, 5–5.5mm; tube 3–4mm,

acutely gibbous or shortly spurred; upper lip recurved, 2–2.2mm; lower lip slightly deflexed, equal to upper. Stamens included, same length as tube, outer pair with tufts of hairs at base of filaments. Nutlets oblong-ovoid, c 1.2 × 0.6mm, dull brown.

**Bhutan:** C – Mongar district (between Mongar and Kuru Chu); **Darjeeling:** Darjeeling; **Sikkim:** Lagyap. In shade in moist mixed forests, on dripping cliffs, 2300–3350m. September–October.

Recorded from Paro (117) but this has not been confirmed; also recorded from Tongsa (259) on the basis of *Cooper* 2285 but the material seen has been incorrectly determined.

**8. *I. kurzii* (Prain) Hara; *Plectranthus kurzii* Prain**

Perennial herb. Stems ascending, 30–40cm, simple or branched, puberulous. Leaves suborbicular, 4–4.5 × 4–5cm, obtuse or acute; base cuneate, somewhat decurrent along petiole, margin serrate with few large teeth, terminal tooth sometimes large and blunt; petiole 1–3cm. Inflorescence narrow, 2–10 × 1.5cm. Calyx sub-bilabiate, campanulate, c 2mm; teeth narrowly triangular, subequal; fruiting calyx slightly dilated. Corolla colour not known, 5.5–6mm; tube gibbous; upper lip reflexed, c 1.5mm; lower lip c 2.5mm. Stamens included. Nutlets broadly ovoid, small.

**Sikkim:** Rathong to Yoksam. On slopes, 760–1520m.

Known only from the syntypes—*T. Anderson* 1098 and *Kurz* s.n.

**9. *I. coetsa* (D. Don) Kudo; *Plectranthus coetsa* D. Don, *Rabdosia coetsa* (D. Don) Hara, *Plectranthus maddenii* Hook.f.**

Perennial herb or subshrub. Stems 0.5–2m, branched, pubescent. Leaves broadly ovate to narrowly ovate, 3–6.5 × 1.9–5.2cm, base truncate-cuneate (lamina extending down petiole) or rounded-cuneate, apex acuminate, margins crenate-serrate, upper surface ± densely pilose and with sessile glands, lower surface similar and with additional capitate-glandular hairs; petiole 5–15mm. Lower bracts leaf-like; upper bracts ovate, sessile, c 10 × 6mm. Inflorescences narrowly paniculate, terminal and axillary, 4–15 × 1.5–2.5cm, pubescent; cymes 2–7-flowered; pedicels up to 3.5mm. Calyx slightly bilabiate, campanulate, 2–2.5mm, pubescent and with short capitate-glandular hairs; teeth triangular-acuminate, lower 2 slightly longer than upper 3; fruiting calyx tubular-campanulate, up to 4mm. Corolla purple or purple-blue, 6–9mm; tube 3–3.5mm, conspicuously gibbous; upper lip reflexed, c 3.5mm; lower lip straight, boat-shaped, 5–5.5mm. Stamens included, almost equalling lower lip. Nutlets ellipsoid, rounded trigonous, c 1 × 0.7mm, pale brown.

**Bhutan:** S – Chukka district (Chasilakha (117), Chukka to Awakha) C – Thimphu district (Thimphu, Decchenphu, Dotena, Hinglai La, Drugye Dzong, Chekha, Shingkarap, Serbitang, Paro) and Punakha district (Nangshing Gompa, Khelekha to Nobding); **Darjeeling:** Munsang; **Sikkim:** Chiya Bhanjang.

In cleared *Pinus wallichiana* forest, forest margins and banks, 1280–3750m. August–November.

Two varieties are recognised within this species, var. *coetsa* and var. *cavaleriei* (Léveillé) Li, the latter variety has a denser leaf indumentum. Records from our area for *I. japonicus* (Burman f.) Hara probably refer to this species. The collection of *Sinclair & Long* 5666 has a denser indumentum and broadly ovate apiculate bracts on upper inflorescence; it is similar to *Plectranthus menthoides* Bentham which Li (259) includes as a synonym under *I. coetsa* var. *coetsa*.

**10. *I. scrophularioides* (Bentham) Murata; *Plectranthus scrophularioides* Bentham**

Perennial herb. Stems erect, 40–80cm, pubescent to subglabrous. Leaves ovate, 4–11 × 2.9–8.2cm, base ± truncate with lamina slightly decurrent on petiole, apex acuminate, margin coarsely serrate or crenate; upper surface sparsely hairy; lower surface with scattered, small, dark red glands, hairy on veins; petiole 2–7.4cm. Bracts ovate to ovate-oblong, 3–5 × 1–4mm. Inflorescence 10–35 × 4–4.5cm. Pedicels 4–12mm. Calyx clearly bilabiate, broadly campanulate, c 2.5mm, glandular-pubescent and with scattered dark red sessile glands; upper lip teeth c 1mm; lower lip slightly longer than upper, teeth c 0.5mm; fruiting calyx enlarging to 5mm, upper lip recurved, lower lip ± straight. Corolla white, cream or yellow with red marking on upper lip, 7–8mm; tube c 4.5mm, gibbous; upper lip recurved, c 1.5mm; lower lip straight, c 4mm, ovate. Stamens exserted; outer pair of filaments with tuft of hairs at base. Nutlets broadly ellipsoid, c 1.5mm.

**Bhutan:** C – Thimphu, Punakha and Bumthang/Tongsa (Yuto La) districts, N – Upper Mo Chu and Kulong Chu districts; **Darjeeling:** Labha, Tanglu; **Sikkim:** Chiya Bhanjang, Kulhait. Damp grassy banks or streamsides in *Pinus wallichiana/Quercus semecarpifolia* forest, 2130–3350m. July–August.

**39. SIPHOCRANION Kudo**

Perennial herbs. Stems weakly erect. Leaves petiolate, serrate. Inflorescence a slender spike, whorls 2-flowered. Bracts ovate-acuminate. Calyx bilabiate, obconical, enlarging in fruit, glandular-puberulent and with scattered sessile glands; upper lip 3-toothed; lower lip with 2 teeth. Corolla bilabiate, upper lip 4-lobed; lower lip subequal to upper, entire. Stamens included in corolla throat. Nutlets globose.

**1. *S. macranthum* (Hook.f.) Wu; *Plectranthus macranthus* Hook.f., *Isodon macranthus* (Hook.f.) Kudo, *Rabdosia macrantha* (Hook.f.) Hara. Fig. 89j&k.**

Stems 30–60cm, tomentose, glabrescent below. Leaves ovate to elliptic, 5–8.5 × 2.8–5.2cm, base cuneate or rounded, apex acute to acuminate, margins serrate, both surfaces tomentose on veins, sparsely tomentose elsewhere; petiole 0.5–4cm. Inflorescence 8–18cm, whorls 2-flowered; pedicels 4–5mm. Bracts ovate-acuminate, 3–5mm long. Calyx c 4mm, glandular-puberulent and with

scattered sessile glands; upper lip c 2mm with 3 subulate teeth; lower lip slightly shorter than upper and with 2 subulate teeth; fruiting calyx enlarging, up to 10mm long. Corolla pink-purple, 2–2.4cm; tube straight, 1.5–1.8cm; upper lip c 5mm, 4-lobed, lobes obtuse; lower lip subequal to upper, entire. Stamens inserted in throat, not exceeding corolla. Nutlets c 2 × 2mm.

**Bhutan:** C – Punakha district (between Punakha and Sinchu La) and Tashigang district (Rocha); **Sikkim:** Gangtok. 2740m. August.

#### 40. ACROCEPHALUS Benth

Annual herbs. Stems erect, branched. Leaves petiolate or sessile, crenate or serrate. Inflorescence in dense, ovoid, axillary or terminal heads; bracts subequal to flowers. Calyx bilabiate, tubular-campanulate, enlarging in fruit; upper lip oblong; lower lip with 4 narrow teeth, shorter than upper. Corolla scarcely bilabiate, with 5 subequal teeth. Stamens 4, not exerted; anthers 2-celled. Style bifid. Nutlets ellipsoid, glabrous, basal scar minute.

1. **A. indicus** (Burman f.) Kuntze; *A. capitatus* (Roth) Benth. Fig. 89l.

Stems 5–50cm, branched, distinctly 4-angled with line of hairs on 2 opposing sides. Leaves elliptic with attenuate base, 1–4.2 × 0.37–1.1cm, apex acute, margins with a few serrate teeth, both surfaces sparsely pilose and punctate-glandular, hairs mainly on veins; petiole up to 4mm. Inflorescence 9–17 × c 10mm; bracts broadly obovate, apex acute, subequal to flowers. Calyx 2–2.6mm; fruiting calyx lengthening, up to 4.5mm. Corolla white or purplish, c 2mm with 5 teeth. Nutlets c 1mm.

**Bhutan:** S – Phuntsholing/Samchi districts (Torsa River); **Darjeeling:** Little Rangit valley. 460–600m. September–October.

#### 41. GENIOSPORUM Benth

Annual or perennial, non-aromatic herbs. Leaves petiolate, serrate. Inflorescence spike-like, flowers in whorls of 8–10, each whorl subtended by 2 ovate, pale-coloured bracts. Calyx bilabiate; upper lip 3-toothed, middle tooth broader than laterals; lower lip shorter than upper, with 2 shallow teeth; tubular in fruit, with prominent reticulate veins. Corolla bilabiate; upper lip erect, 4-toothed; lower lip entire, deflexed. Stamens 4, exerted, declinate; anthers 2-celled. Style bifid. Nutlets obovoid, papillose at apex, basal scar minute.

1. **G. coloratum** (D. Don) Kuntze; *G. strobiliferum* Benth. Fig. 89m.

Erect herb, 60–90cm. Stems often branched. Leaves oblong-ovate to lanceolate, 6.5–15 × 2.4–4.5cm, base attenuate almost to base of petiole, apex acuminate, margin serrate, upper surface with scattered short hairs, veins pubescent on both surfaces; petiole 4–10mm. Inflorescence 4–14cm long; flowers in whorls



of 8–10, each whorl subtended by 2 ovate, pale-coloured bracts. Pedicel erect or spreading-erect, c 2mm. Calyx 2–4mm; fruiting calyx 6–7mm. Corolla white with pink marking or pale purple, 5–6mm; tube c 2.5mm; upper lip broad, erect, 2–2.5mm, 4-toothed; lower lip narrowly spatulate, 2.5–2.7mm, deflexed. Nutlets c 1.5mm.

**Darjeeling:** Darjeeling, Rangit valley, Munsong, Darogadra; **Sikkim:** Tista valley. In dry forests, 600–1520m. September.

Recorded from Bhutan (80) but no specimen has been traced to support this record.

## 42. OCIMUM L.

Strongly aromatic herbs, sometimes woody. Leaves petiolate, simple. Inflorescence of terminal and axillary spikes; verticillasters 4–10-flowered. Bracts small, caducous. Flowers small, pedicellate. Calyx bilabiate, ovoid-campanulate, enlarged and deflexed in fruit; upper lip 3-toothed, middle tooth decurrent on tube, becoming suborbicular in fruit; lower lip 2-toothed, teeth lanceolate-acuminate. Corolla bilabiate; upper lip 4-lobed, shorter than lower; lower lip entire, flat. Stamens 4, didynamous, exserted; anthers 1-celled. Nutlets with minute basal scar.

1. Fruiting pedicels spreading; fruiting calyx not strongly deflexed

3. **O. tenuiflorum**

+ Fruiting pedicels erect and appressed to inflorescence axis; fruiting calyx strongly deflexed .....

2

2. Corolla 7–8mm, pink, pale purple or white; fruiting calyx 7–9mm

1. **O. basilicum**

+ Corolla 5–6mm, white; fruiting calyx 4–6mm .....

2. **O. americanum**

1. **O. basilicum** L. Eng: *Basil*.

Annual or perennial herb, 25–130cm. Stems erect, often branched, subglabrous or with short retrorse hairs. Leaves ovate-elliptic, 2–6 × 1–2.5cm, acute, base cuneate or attenuate, margin subentire to remotely serrate, both surfaces sparsely pilose and glandular; petiole 0.5–2cm. Calyx 4–5mm; fruiting calyx 7–9mm, strongly deflexed. Corolla pink, pale purple or white, 7–8mm; tube 3.5–4mm. Nutlets oblong-ellipsoid, c 2 × 1.3mm, punctate, blackish.

**Bhutan:** S – Chukka/Phuntsholing district (Chimakhoti to Phuntsholing, 101), Gayleghphug district (Gayleghphug, 117) and Deothang district (Kheri, 117); **Darjeeling/Sikkim:** locality unknown (269). Frequently cultivated, 900–2000m.

2. **O. americanum** L.; *O. canum* Sims

Similar to the above species but generally smaller in all respects and more woody; stems up to 75cm, usually more hairy; leaves narrowly ovate to elliptic,

1.5–2 × 0.65–0.8cm; petiole 0.25–0.8cm; fruiting calyx 4–6mm long; corolla white, 5–6mm long; nutlets 1.5 × 0.9–1.2mm.

**Bhutan:** S – Phuntsholing district (Phuntsholing), C – Tashigang district (between Yadi and Tashigang). Roadsides in Chir Pine forest, often near gardens, 900–915m. July, October.

**3. *O. tenuiflorum* L.; *O. sanctum* L.**

Perennial herb, 30–60cm. Stems erect, with short and long spreading hairs. Leaves ovate-oblong to elliptic, 1.5–3.5 × 0.8–1.5cm, acute, base ± cuneate, margin serrate to serrulate, both surfaces pubescent; petiole 0.7–1.2cm. Calyx c 2mm, in fruit 4mm. Corolla pink or white, c 3mm. Nutlets oblong-ellipsoid, 1 × 0.8mm, somewhat rugulose.

**Darjeeling/Sikkim:** locality unknown. Frequently cultivated, 1525m. May–December.

Only known from a single Hooker specimen labelled ‘Sikkim’.

### 43. ORTHOSIPHON Bentham

Perennial herbs or subshrubs. Leaves sessile or petiolate, crenate-serrate. Inflorescence a slender terminal spike. Verticillasters 2–6-flowered, distant. Bracts usually longer than pedicels. Calyx bilabiate, tubular; upper lip entire; lower lip 4-toothed. Corolla bilabiate; tube exserted; upper lip 3-lobed with middle lobe emarginate; lower lip entire. Stamens 4; anthers 1-celled by fusion. Style punctate. Nutlets broadly ellipsoid, pale brown with darker reticulation.

**1. *O. rubicundus* Bentham; *O. incurvus* Bentham. Fig. 89n–p.**

Herb or subshrub. 20–60cm, sparsely pubescent. Leaves ovate-elliptic with attenuate base, 5.5–11.5 × 2–5.7cm, apex acute to acuminate, margins crenate-serrate, sparsely puberulent and with sessile glands; sessile or petiolate up to 4cm. Bracts 3–6mm, usually longer than pedicels. Calyx 6–7mm; lobes of upper lip broadly ovate, decurrent, recurved, purplish; lower lip 4-toothed, teeth triangular-subulate; fruiting calyx up to 11mm, deflexed. Corolla pale purple or pink, 17–26mm; tube exserted; upper lip 2–4mm; lower lip elliptic, c 5mm, slightly concave. Nutlets 1.8 × 1.5mm.

**Bhutan:** S – Samchi district (above Samchi on Chamurchi River); **Darjeeling:** Rangpo, Tista, Rangit; **Sikkim:** Pertaghosa and Perasam. 300–1525m. May–August, November.

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