

THE  
ORCHID FLORA  
OF  
NORTH WEST HIMALAYA



By  
SOM DEVA & H.B. NAITHANI

## **About the Book**

The North-Western Himalaya spreads over two countries, India and Pakistan, and in the words of Kenneth Mason, formerly a superintendent of the Survey of India, "They are the greater physical features of the earth". There are many peaks above 7000 metres and a few K2 (8611 m), Nagaparnbat (8126 m), Nanda Devi (7817 m), Kamet (7756 m) and Badrinath (7138 m) are amongst the highest in the world. The study of orchids of these mountains has always fascinated plant scientist, mountaineers, tourists and common men and women. The only book available to them so far is that of J.F. Duthie's "The Orchids of North-Western Himalaya" published three quarters of a century ago, describing 173 species which were known at that time, and giving illustrations of only 53 species.

To meet the demands of a modern inquisitive man the present authors brought out a new comprehensive volume describing 239 species with 260 illustrations, many of them for the first time and provided modern keys for easy identification. They re-examined all those specimens on which Duthie's original flora was based and also checked all those which have been described as new since then. As a result of critical study many identifications in Duthie's Flora have been changed and corrected, and it was also found that many of the new additions were based on wrong identifications. Six new species have been added. Almost all the material present from North-Western Himalaya at Dehra Dun-Herbarium, Dehra Dun, Botanical Survey Herbarium, Dehra Dun, Universities and other Institutional Herbaria situated at Nainital, Almora, Ranikhet, Chandigarh, Srinagar, Jammu, Lucknow etc. have been consulted. In addition, fresh expedition in the Himalaya were organised to collect and examine the orchids in fresh conditions.

The descriptions have been prepared from actual specimens giving detailed notes on their taxonomy, distribution and ecology. All the specimens examined have been listed with their locality collector's name and numbers. The illustrations are based on voucher specimens and carry the name of collector and their number, so that their authenticity can be verified if found necessary. In many cases several diagrams of the same species have been drawn to show variations. The book includes an account of the history of orchidology of the North-Western Himalaya a detailed and critical account of the phytogeography with several maps and charts.

## **About the Authors**

**Som Deva** (b. 1926). started his career as a teacher of Botany at Dehradun, which has a long tradition of Taxonomic studies. It is situated in the foot hills of Western-Himalaya with a backdrop of mighty mountain chains. The love for nature and interest in travelling soon induced him to start collecting plants as a hobby. For many years he entered alone into the deeper recesses of Himalaya, often investing all his savings and brought back big plant collections. During the last 20 years he built a private collection of more than 15,000 specimens.

Most of his time is now taken in curating and the study of these plants, for which he maintains meticulously clear notes and draws beautiful diagrams.

**H.B. Naithani** (b. 1944) is a Research Scientist in the Forest Research Institute, Dehradun. He has travelled widely in India in connection with his official duties and is specially intrested in Himalayan Flora. He has to his credit a large number of scientific papers and is creatively involved in the study of nature.



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by Som Deva and H.B. Naithani**

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## PREFACE

John Firminger Duthie (1845-1922), Director, Botanical Department, Northern India, wrote in 1906 a fine Flora on the Orchids of the North-Western Himalaya. He gave an account of 173 species and illustrated 53 of them. Three quarters of a century have passed since the publication of this work which was based on the untiring efforts of a relatively small number of collectors, a few of whom could not even read or write and others being non-professional botanist such as civil and military officers, surgeons, surveyors and hobbyists. In many cases the collectors had to track on foot some times for several months to reach their destinations in the far flung parts of North-Western Himalaya. The area which Duthie covered now spreads over two countries, India and Pakistan. At present a net-work of roads criss-cross the whole length and breadth of this area, major rivers have been bridged and fast moving vehicular traffic regularly crosses many high passes. Besides, there are several stripes from where air-planes regularly come and go. To reach those places where months were then taken just a few hours are all that are now required. Tourists from all parts of India and many foreign countries visit these areas every year. Mountaineering parties come to climb high peaks often bringing their own botanists to collect plants on the way. The people of Himalaya have also changed with the spread of education and have become more conscious of their surroundings and natural heritage. There are at least 7 universities and numerous colleges teaching postgraduate student and conducting research in botany.

With these developments the number of botanical explorations and interest in the Himalayan plants have also increased many folds. Botanical Survey of India after its reorganisation in 1954, with a staff of 70 or more persons and faster moving vehicles at their disposal, is actively involved in exploration of this region. Teachers and students from universities and many colleges are building up their own collections. It is being thought, and rightly so, to provide India with modern Floras of different district and also of the country as a whole. Commensurate with this policy we undertook the task of revising the orchids of North-Western Himalaya and in this respect we are fortunate to be ideally located at Dehra Dun where not only almost all the recent collections including those which have been reported as new records/new species are available. We could also conveniently borrow material from other herbaria including those belonging to different universities and colleges. The work was undertaken privately without involving any Government expenditure, thus leaving the public fund free for other important works to be accomplished for which the country is anxiously waiting.

The present work includes 239 species, in fact 66 more than those in Duthie's Flora. A fresh study of all the species has been made and their line drawing sketched by the senior author. In many cases several sketches of the same species had to be drawn to show the variation. The illustrations which are obviously based on voucher specimens, carry the name of the collector, his collection number and the places where the specimens are housed so that their authenticity can be verified if found necessary in future.

We are aware that new discoveries of plants will still be made from Himalaya because we have not yet reached the final stage of exploration as is the case with many European countries where for the last one hundred years or so no major additions have been made to their flora. We do, however, hope that critical readers will tremendously benefit from the present up dated treatise not only in understanding the existing orchids of N.W. Himalaya better but will also be aided in thoroughly exploring the region further, thereby adding to the knowledge of the orchidaceous flora of the Himalaya.

We acknowledge with a sense of gratitude the help we have received from the President, Forest Research Institute, Dehra Dun and Dr. K.N. Bahadur, Forest Botanist, F.R.I. permitting the senior author to consult the rich collection of orchids available at this prestigious Institute. We offer our special thanks to Dr. U.C. Bhattacharyya, Deputy Director, Botanical Survey of India, Northern Circle, Dehra Dun for giving permission to consult their herbarium, to Mr. B.M. Wadhwa, Regional Botanist for sending photographs of some type specimens from Kew, Dr. C.L. Malhotra, Regional Botanist for help and encouragement, Prof. S.C.



Verma, Punjab University, Chandigarh for loaning of some specimens and to Dr. P.K. Hajra of Botanical Survey of India, Dehra Dun for his invaluable help in putting his material at our disposal for examination. We are extremely grateful to Mr. C.M. Arora of Botanical Survey of India, Dehra Dun for his valuable help and loan of his personal literature. Our thanks are also due to Mr B.P. Uniyal, Central National Herbarium, Howrah for sending several pieces of information and to Dr. B.S. Aswal, Central Drug Research Institute, Lucknow for loan of his orchid specimens for Lahul. We also gratefully acknowledge the help received from Dr. Y.P.S. Pangtey in loaning of Orchid specimens from the herbarium of Kumaun University, Nainital, Dr. B.S. Kalakoti, Nainital and Dr. H.S. Kirn, Jammu University, who gave permission to examine their collection from Kumaun and Punch respectively. We are also grateful to Mr. Gopal Singh Rawat for loaning us his invaluable collection from North Kumaun and for visiting, on our suggestion, Kuttியangti Valley in North Kumaun on the borders of Tibet and bringing back the specimens of those species which Duthie had collected from there almost one hundred years ago. Our thanks are due to Mr. P.C. Pande of Almora College for placing his orchid collection at our disposal for examination and also to the authorities, especially Mr. R.N. Tewari, of the herbarium of Amalgamated units of C.C.R.A.S., Ranikhet for similar action. We are especially grateful to Dr. Gunnar Seidenfaden, for his invaluable help and to Dr. Jany Renz who personally discussed with us and helped in solution of many problems. He was kind enough to critically go through our manuscript, providing latin description to new species, and giving us permission to quote his specimens from North-Western Himalaya.

The present work was scheduled to be published in 1984, but unfortunately due to certain unavoidable circumstances it was delayed. However we took this opportunity and revised the whole text and brought it upto-date once again.

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2nd October, 1986

## INTRODUCTION

The Western Himalaya extends from Kumaun to Chitral (Hook.f., 1904) and lies between 28° 45' to 36° North lat. and between 71° 30' to 80°40' E. long., and occupies roughly an area of 356310 km sq. It spreads over two countries Pakistan and India. The district of Chitral, Swat, Dir, Hazara, and North Rawalpindi are in Pakistan, while the states of Jammu and Kashmir, Himachal Pradesh and the Northern most commissioneries of Garhwal and Kumaun of the states of Uttar Pradesh are in India (Map 1).

These mountains are "the greatest physical feature of the earth" in the words of Kenneth Mason formerly a superintendent of Survey of India. They have many characteristics that are not shared by other mountains and can justly be called as the premier mountains of the world, with a landscape of incomparable scenic grandeur and are a perpetual source of wonder and veneration. A Hindu saint thousands of years ago rightly expressed "A hundred divine epochs would not suffice to describe all the marvels of the Himalayas". The West Himalaya are not a single continuous chain of mountains but a series of several more or less parallel converging ranges. As a whole this tract is extremely rugged inter-acted by enormous valleys and deep gorges cut by the mighty river system of Indus, Satluj and Ganga. The outer ranges rise abruptly from the great tropical Indo-Gangetic plain. The individual ranges generally present a steep slope towards the plains, and more gently inclined slope towards the north. The inner ranges are higher, enclosing higher and colder valleys, and surmounted still higher up by perpetual snow. The main Himalayan chain in the West Himalaya alone has many peaks above 7000 m and a few, K 2 (8611 m); Nangaparbat (8126 m), Nanda Devi (7817 m), Kamet (7756 m) and Badrinath (7138 m), are amongst the highest in the World.

The climate of Western Himalaya is as varied as its physical configuration. It depends on the aspect and altitude of the mountain ranges, the distance from the plains and from the sea which gives rise to the South-Eastern and South-Western monsoon bearing clouds. The rains are maximum in Kumaun near the eastern end and are least in Kashmir and further towards the western end. The south facing slopes near the plains catch most of the rains and mist, while lower slope behind the high ridges on the north get lesser rains, so much so that the tracts behind the great Himalayan ranges are almost dry with very little moisture. During winters the western disturbances bring some rains in the lower region but higher up they produce much snow fall. The most important factor controlling the temperature is altitude. The low valley bottoms below 600 m have a hot and moist climate. It gradually cools further up till at 2000 m, the climate is warm temperate still higher up, up to 3000 m it may be cold temperate and further up the cold increases till one reaches the snowline and the climate changes from alpine to arctic conditions.

**History:** Sir J.D. Hooker's studies of the orchids of India were published in 1890. Seidenfaden (73, 1973) has very correctly expressed that Hooker was the most clear minded taxonomist and his work stands even today a hundred years later as our main source of knowledge and his taxonomic judgements have stood the ravages of time. His coverage of orchids of the North Western Himalaya was based on the result of an extensive exploration for almost about a century.

The earliest on record to have made collection in the Garhwal Himalaya was Maj. General Thomas Hardwick in 1796. In the beginning of the 19th century William Spencer Webb an officer of the Bengal Engineers and surveyor of first rank collected plants from Jamnotri, Gangotri, Kali river on the boundary of Kumaun and Nepal. These plants were sent to Dr. Wallich, who later placed his plant collectors R. Blinkworth and Kamrup with him to collect more extensively, from Garhwal and Kumaun. William Moorcraft a veterinary officer of the Bengal Government collected along Alakhnanda river and in the Niti Valley in Garhwal and later in Rupsu and Ladakh in Kashmir. George Govan who started Saharanpur Botanic Garden made a small collection from Sirmur in Himachal Pradesh. J.F. Royle who succeeded him in 1823 made a very extensive collection in N.W. Himalaya from Kashmir to Garhwal and Himachal Pradesh. His collec-



tion of orchids was studied by Prof. Lindley. Victor Jacquemont a French traveller collected plants in Garhwal & Kashmir in 1830-31. Hugh Falconer who followed Royle at Saharanpur collected along Indus in Kashmir from 1836-38 and later in Garhwal with the help of several plant collectors. William Griffith, Thomas Thomson, M.P. Edgeworth, Maj. Nathaniel Vicary, Lt. Col. E. Madden, Werner Hoffmeister, Sir Richard Strachey, Edward Winterbottom, William Jameson, Sir. G. King, John Lindsay Stewart, Dr. Dietrich Brandis, J.E.T. Aitchison, C.B. Clarke, Col. Sir Henry Collett all made extensive collection in N.W. Himalaya (Burkill, 1965).

J.F. Duthie, Director, Botanical Department, North India, when decided to write an orchid Flora on N.W. Himalaya started making a concentrated effort and visited as far as possible unexplored areas in Himalaya. He collected in 1879 in Tons Valley and on Kedarkanta mountains. In 1883 he explored very carefully Ganga and Jamuna Valley. In 1884-86 he made extensive tours in Garhwal & Kumaun, collected on Kumari pass and along Gori and Kali rivers (Duthie, 1906 a). He collected in District Hazara now in Pakistan in 1888, and in Kashmir in 1892-93. He also motivated many military officers to collect plants and received from them especially from areas across Indus. Col. H.C.B. Tanner, Sir Francis Younghusband, Sir W. Gatacre, Lt. S.A. Harris etc. all made contribution to Duthie (Stewart, 1982). He received a complete set of plants collected by Col. Davidson in the vicinity of Nainital in Kumaun. Capt. Roberts collected near Lansdown in Garhwal. One of his friends P.W. Mackinnon made a very thorough collection for him from Mussoorie and adjacent areas of Tehri Garhwal. He discovered many orchids from which Duthie described nine new species (Duthie, 1906).

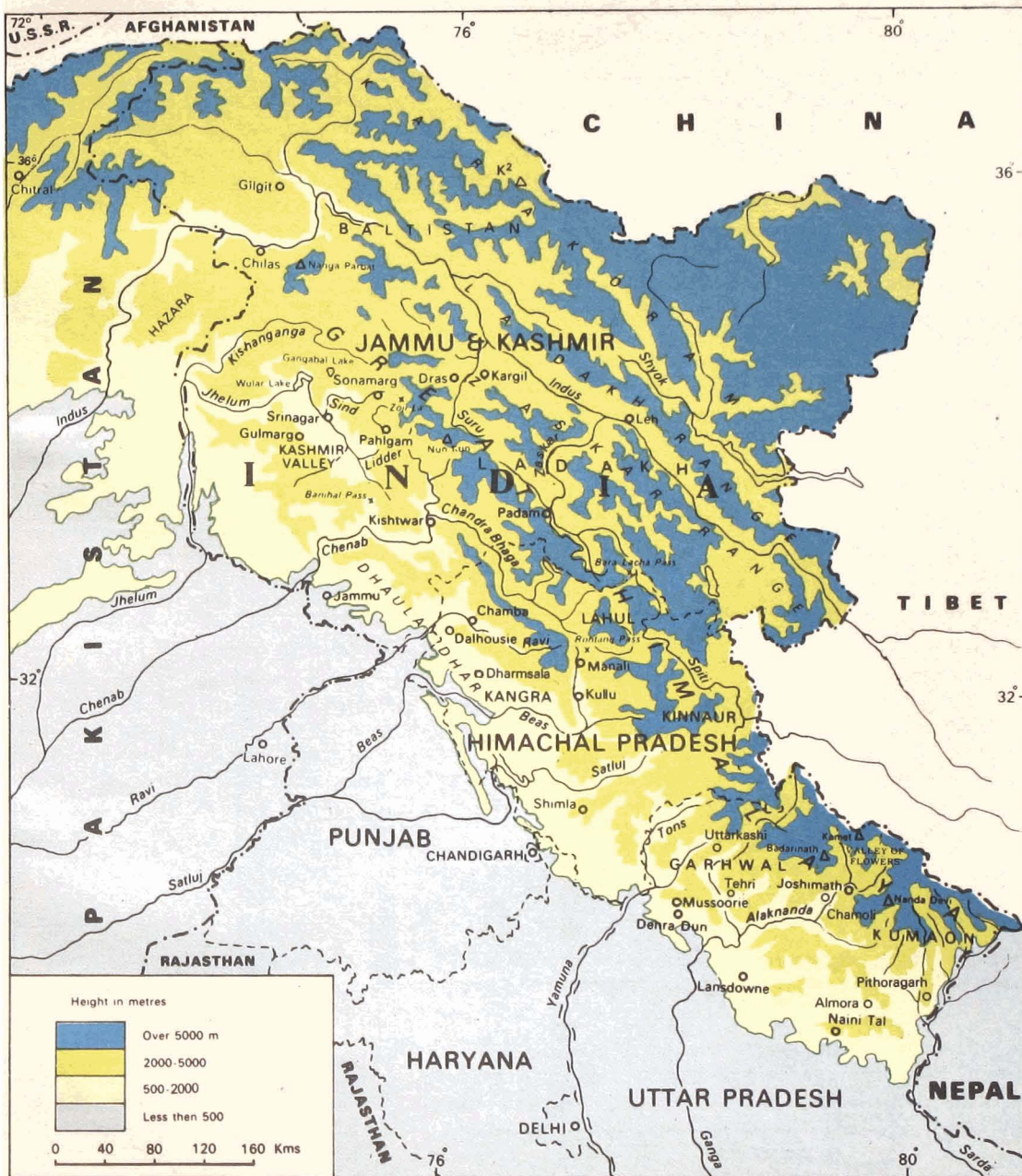
Duthie also sent several plant collectors from Saharanpur to collect in various parts of N.W. Himalaya, Munsii Inayat Ahmad Khan collected in Hazara from 1894 to 1899 and also in Kali Valley in Kumaun, including sub-Himalayan tracts of Khiri and Pilibhit District, Harsukh collected from Chamba, Dehra Dun and Pilibhit, Coora Singh collected at Ramasarai, Ramsukh collected from Nagtibba and explored area around Ranikhet in Kumaun. Durga made collections in the region of Gangotri. George Alexander Gammie and William Gollen both collected for Saharanpur Herbarium.

Many forest officers A.S. Smythie, N. Herale, William Rogers Fischer, C.G. Rogers, J.S. Gamble, J.H. Lace, B.B. Osmaston, Banwari Lal etc. from Dehra Dun collected in N.W. Himalaya and their plants were available to Duthie when he wrote his flora.

The excellence of Duthie's flora as rightly pointed out by Seidenfaden & Arora (1982) led some stagnation in floristic studies during the following decades. However, forest officers working at Dehra Dun Herbarium usually brought back few orchids whenever they went to collect in N.W. Himalaya. Rai Bahadur Keshvanand Mamgain collected in Kishan Ganga Valley (Nilam Valley) in Kashmir, C.E. Parkinson, R.N. Parker with his collector Bis Ram, A.E. Osmaston and H.G. Champion collected in Kumaun. N.L. Bor and his able collector Kirat Ram made a very thorough collection in Lahul. Many others A.K. Meebold, B.O. Coventry, Father E. Blatter, prof. Hallberg, J.R. Drummond, Frank Ludlow, Maj. George Sherriff, E.R. Johnson, N. Gill, A. Berkeley etc. also collected in N.W. Himalaya. However the most extensive collections from 1912—1956 were of R.R. Stewart who explored Himalaya from Mussoorie to Chitral and single handed collected so many plants that such a feat is difficult to repeat. Because of his efforts the flora of Kashmir and the section of N.W. Himalaya in Pakistan is better known than many other parts. Walter N. Koelz and his collector Thakur Rup Chand also made extensive collections from Bhilangna Valley in Tehri Garhwal, Kulu, Kangra and Lahul in Himachal Pradesh, Rupsu and Ladakh in Kashmir.

With the reorganisation of Botanical Survey in 1954 many botanists from Dehra Dun explored various parts of N.W. Himalayas. M.A. Rau did extensive collection in Garhwal and Himachal Pradesh. T.A. Rao collected in Kashmir, Pindari and Milam in Kumaun. Others who contributed are U.C. Bhattacharyya, N.C. Nair, C.R. Babu, K.M.M. Dakshini, O.P. Misra, K.P. Janardhanan, B.M. Wadhwa, P.C. Pant, B.D. Naithani, B.P. Uniyal, P.K. Hajra, S.K. Malhotra, C.L. Malhotra, N.P. Singh, Surendra Singh etc. The most important collection was that of C.M. Arora who collected many new records from District Pithoragarh in Kumaun. From F.R.I., Dehra Dun, K.C. Sahni made a very good collection from Tehri and Uttarkashi in Garhwal,

# Map No. 1 NORTH WESTERN HIMALAYA



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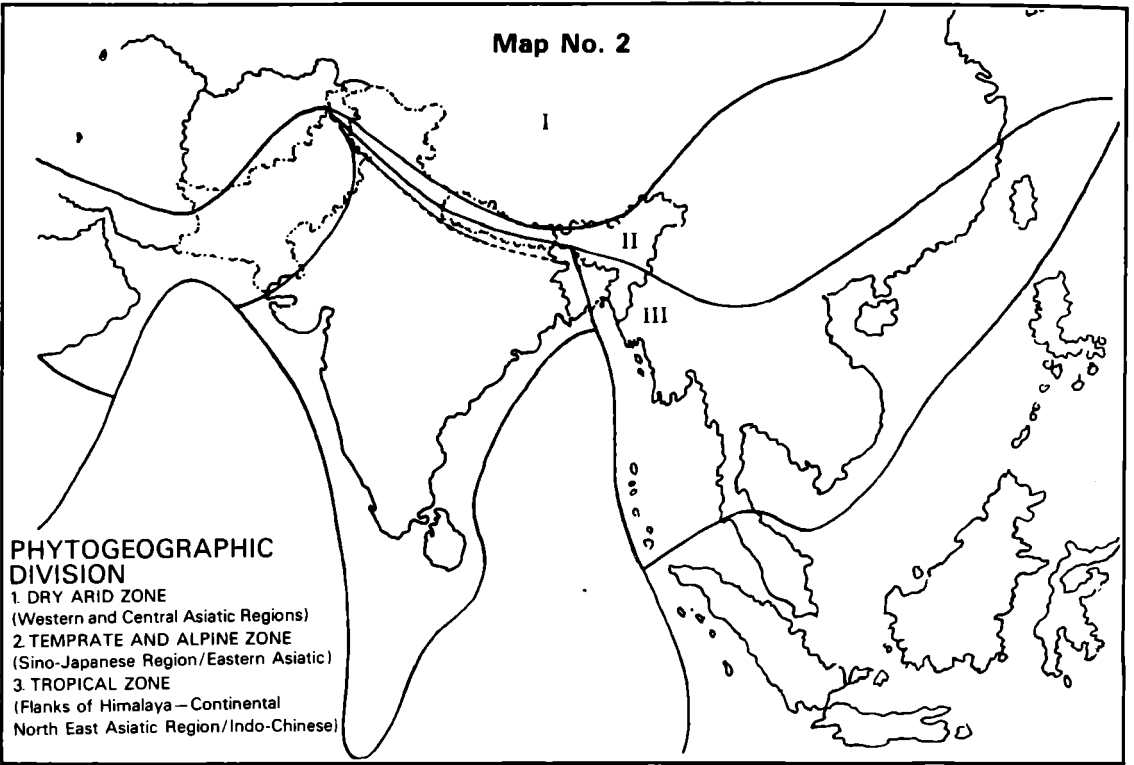
The administrative head quarters of Chandigarh, Haryana and Punjab are at Chandigarh.



Map No. 2

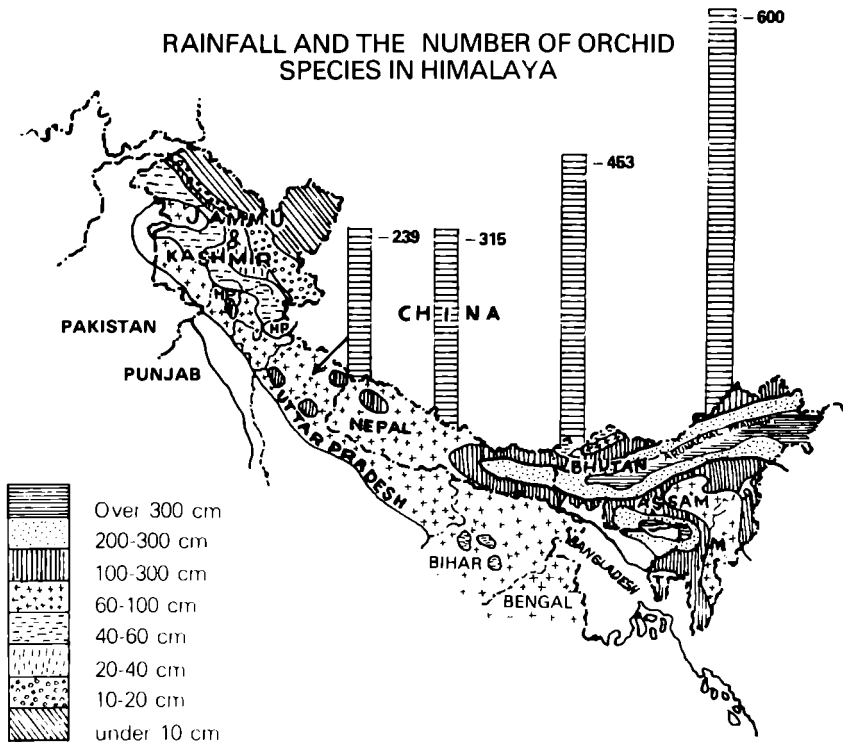
**PHYTOGEOGRAPHIC DIVISION**

- 1. DRY ARID ZONE  
(Western and Central Asiatic Regions)
- 2. TEMPRATE AND ALPINE ZONE  
(Sino-Japanese Region/Eastern Asiatic)
- 3. TROPICAL ZONE  
(Flanks of Himalaya – Continental  
North East Asiatic Region/Indo-Chinese)



Map No. 3

**RAINFALL AND THE NUMBER OF ORCHID SPECIES IN HIMALAYA**



Pindari and Panchuli in Kumaun. K.M. Vaid collected from Garhwal and Kashmir while H.O. Saxena collected from Mussoorie. M.B. Raizada left a good record of cultivated orchids in Dehra Dun.

The universities from this region did not lag behind and made extensive collections. Amar Chand Joshi made collection in Jamuna Valley, Kashyap, Vij and Verma alongwith their students of Punjab University collected orchids for cytological studies. Y.P.S. Pangtey, Gopal Singh Rawat, B.S. Kalakoti and P.C. Pande of Kumaun University collected in Kumaun. Taxonomist of Meerut University B.N. Ghildhiyal, K.N. Nautiyal made collection in District Chamoli Garhwal while H. Singh collected at Gangolihat in Kumaun. Several botanists from Kashmir University, Prof. P. Kachroo, Guru Charan Singh, U. Dhar, A.R. Naqshi, M.K. Kaul, M.K. Wali, Harbhajan Singh, G.N. Javed, B.M. Sharma, H.S. Kirn etc. made good collection in Jammu & Kashmir. R.R. Stewart (1983) gives a list of many other botanists from Pakistan Universities who made collection from Pakistan section of N.W. Himalaya. From other institutions in the region Y.K. Sarin, S.L. Kapoor, B.N. Mehrotra, D.D. Awasthi, Pandey, R.K. Issar, M.R. Uniyal, R.K. Gupta, R.L. Fleming etc. collected widely from N.W. Himalaya. F.S. Smythe stayed for six months in the valley of flowers, District Chamoli Garhwal, and made an excellent collection. More recently Dr. Jany Renz from Basel Switzerland collected extensively in N.W. Himalaya from Chitral in Pakistan to Kumaun in Uttar Pradesh. His personal collection of 15,000 specimens of orchids from all over the world has a very good representation from Himalaya.

**Phytogeography:** Sir J.D. Hooker (1855, 1904) treated Himalaya as a distinct phytogeographical division, separate from Hindustan (India). The Himalaya was divided into Eastern, Central and Western sections, and each into many provinces. The Western Himalaya included 20 provinces, the first 12 roughly coinciding with the Tropical and Temperate-Alpine zones while the remaining 8 formed parts of Dry-Arid Himalayan zone. This phytogeographical scheme remained undisputed for more than a century, and is still being followed to a great extent to describe the distributional pattern of the Indian Flora.

The recent phytogeographical treatments of Himalaya (R. Good, 1964; A. Takhtajan, 1969) have more or less followed the same scheme. However instead of dividing Himalaya into three vertical divisions Eastern, Central and Western, they have divided it into three horizontal divisions coinciding with the Himalayan climatic regions Dry-Arid, Temperate-Alpine and Tropical zones. Both these schemes are essentially similar with some differences in details about boundaries and nomenclature. The Boreal Kingdom (Holarctic) includes the Dry-Arid and Temperate-Alpine zones, while the Paleotropical Kingdom (Indo-Malayan Sub-Kingdom) includes the tropical zone. On the basis of distributions of the orchid in Himalaya we make the following observations (Map 2).

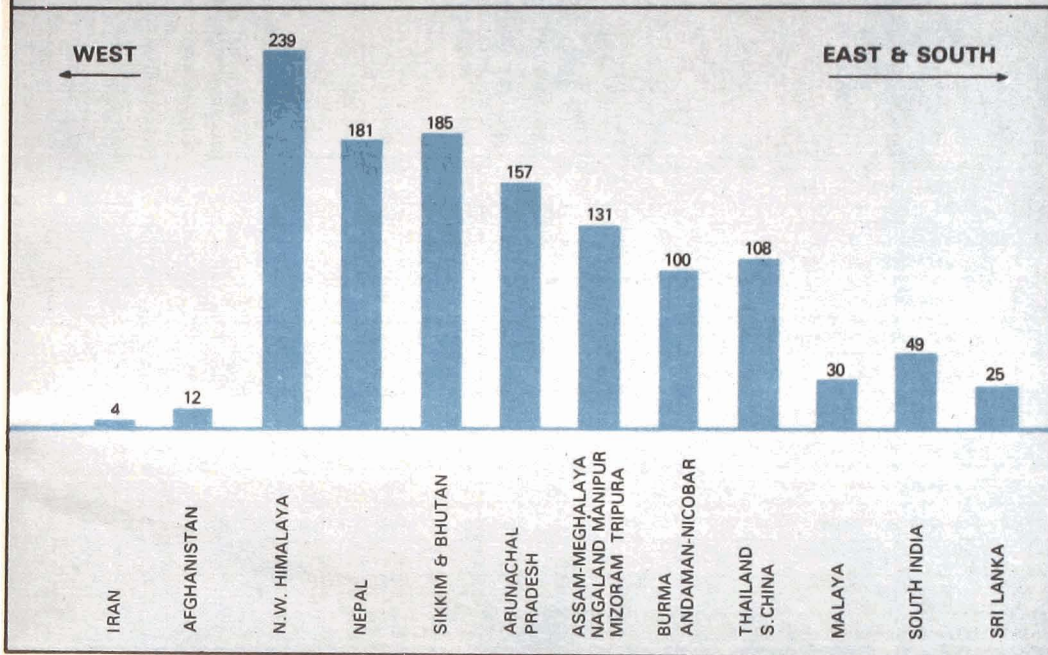
1. North Western Himalaya is an artificial division and is phytogeographically not distinct from the other sections of Himalaya. The orchid flora is also not distinct but is a continuation of the eastern region. The number of species and their density diminishes towards the west under the influence of decreased rainfall (Map3).
2. The orchids are distributed in Himalaya in three distinct zones. The innermost behind the great Himalayan ranges bordering the Tibetan plateau is the Dry-Arid zone, the Central is Temperate-Alpine zone while the outermost adjacent to the Indo-Gangetic plains is the Tropical zone.
3. The Dry-Arid zone (cf. *Western and Central Asiatic region/Irano-Turanian*) is absent from the Eastern Himalaya, but from Sikkim westwards up to Garhwal it is present in small pockets near the high passes leading from Himalaya to Tibet. Further west in Himachal Pradesh, Jammu and Kashmir it becomes continuous and wide and includes Spiti, Lahul, Rupsu, Ladakh and Karakoram ranges. This region has very few orchids (Chen and Tang, 1979).
4. The Temperate-Alpine zone (cf. *Sino-Japanese Region/Eastern Asiatic*) runs north of tropical zone all along the Himalaya from Arunachal Pradesh in the east to Chitral in Pakistan in the west. The deep

cutting of Indus river is an important barrier, for many orchids in Himalayan mountains which do not spread further west and only a very few limited number of species reach across to Chitral and other areas (Renz 7, 1978). This zone is characterised by terrestrial orchids and the number of species is much less than in the tropical zone. The boundary between the tropical and temperate zones is very irregular, the tropical zone penetrates deep in Himalaya along various river valleys and rises quite high on the ridges facing south, while the temperate zone along the ridges and peaks quite often reaches the outer ranges overlooking the plains. On the northern and cooler sides of the mountains sometimes it descends to quite low altitudes. The transitional zone between the two is fairly wide and the species of each zone quite often grow together mixed up with each, near the boundary.

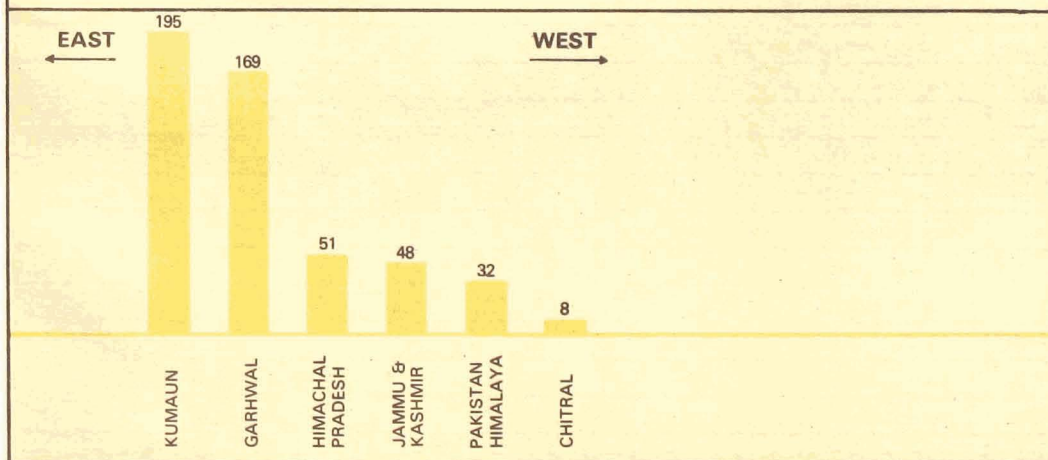
5. The Tropical zone (cf. *Flanks of Himalaya*) runs all along the Himalaya from Brahmaputra in the east, to Indus in the west. It is a zone characterised by the presence of epiphytic orchids and many terrestrial species of tropical orchids such as, *Habenaria*, *Peristylus*, *Malaxis*, *Nervilia* etc. It is very broad in the east, reaching up to fairly high altitudes (Hook. f., 173, 1855) under the influence of the high rains, but becomes narrower descending to lower altitude as it proceeds towards the west with the diminishing rain falls. The epiphytic orchids continue from east to west up to Kangra in Himachal Pradesh, but further west in Jammu & Kashmir and parts of Jhelam & Rawalpindi District of Pakistan, the tropical zone is only represented by few terrestrial orchids. In the east the tropical zone of Himalaya merges undistinguishably across Brahmaputra with floristic zone covering hills of Meghalaya, Nagaland, Manipur, Mizoram and Tripura and continues further east along Tenasserim range through Burma to Thailand, Indo-China and many areas of South China (cf. *Continental South East Asiatic region or Indo-Chinese*).



**AFFINITY  
OF  
ORCHID SPECIES OF N.W. HIMALAYA TO OTHER ADJACENT REGIONS**



**DISTRIBUTION  
OF  
ORCHID SPECIES IN DIFFERENT PARTS OF N.W. HIMALAYA**



## RANGE OF DISTRIBUTION OF ORCHIDS

SI.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA						E. HIMALAYA				MALAYA	SOUTH INDIA	SRI LANKA
				PAKISTAN		OTHER MOUNTAINS	JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAUN	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH			
				CHITRAL etc.												
1.	<i>Acampe carinatum</i> Griff.							+	+	+	+	+	+			
2.	<i>rigida</i> (Buch.-Ham. ex Sm.) Hunt								+	+	+	+	+	+	+	+
3.	<i>Aerides multiflora</i> Roxb.					+	+	+	+	+	+	+	+	+	+	
4.	<i>odorata</i> Lour.						+	+	+	+	+	+	+	+		
5.	<i>Anoectochilus roxburghii</i> (Wall.) Lindl.						+	+	+	+	+	+	+			
6.	<i>Aorchis roborovskii</i> (Maxim) Seidenf.						+	+	+	+						
7.	<i>spathulata</i> (Lindl.) Vermeul.						+	+	+	+						
8.	<i>Aphyllorchis gollani</i> Duthie						+									
9.	<i>parviflora</i> King & Pantl.						+		+	+						
10.	<i>Arundina graminifolia</i> D. Don						+	+	+	+	+	+	+	+	+	+
11.	<i>Ascocentrum ampullaceum</i> (Roxb.) Schltr.								+	+	+	+	+	+	+	
12.	<i>Brachycorchis obcordata</i> (Buch.-Ham. ex D. Don) Summerh.					+	+	+	+	+	+	+	+	+		
13.	<i>Bulbophyllum affine</i> Lindl.								+	+	+	+	+		+	
14.	<i>careyanum</i> (Hook.) Spreng.								+	+	+	+	+	+		
15.	<i>cariniflorum</i> Rchb. f.								+	+	+	+	+			+
16.	<i>helenae</i> (Kze.) J. J. Sm.								+	+	+	+	+	+		
17.	<i>hookeri</i> (Duthie) J. J. Sm.						+	+	+	+	+	+	+			
18.	<i>leopardinum</i> (Wall.) Lindl.								+	+	+	+	+	+	+	
19.	<i>polyrhizum</i> Lindl.						+	+	+	+	+	+	+	+		
20.	<i>reptans</i> (Lindl.) Lindl.						+	+	+	+	+	+	+	+		
21.	<i>triste</i> Rchb. f.							+	+	+	+	+	+	+		
22.	<i>umbellatum</i> Lindl.						+	+	+	+	+	+	+	+		
23.	<i>wallichii</i> Rchb. f.							+	+	+	+	+	+	+		
24.	<i>Calanthe alismaefolia</i> Lindl.						+			+	+	+				
25.	<i>alpina</i> Hook. f.							+	+	+	+	+				
26.	<i>brevicornu</i> Lindl.						+	+	+	+	+	+				
27.	<i>mannii</i> Hook. f.							+	+	+	+	+				
28.	<i>pachystalix</i> Rchb. f. ex Hook. f.						+		+							
29.	<i>plantaginea</i> Lindl.				+	+	+	+	+	+	+	+				
30.	<i>puberula</i> Lindl.					+	+	+	+	+	+	+				
31.	<i>tricarinata</i> Lindl.				+	+	+	+	+	+	+	+	+			



## RANGE OF DISTRIBUTION OF ORCHIDS

Sl.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA						E. HIMALAYA								
				PAKISTAN		JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAUN	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH	ASSAM-MEGHALAYA-NAGALAND-MANIPUR-MIZORAM-TRIPURA	BURMA-ANDAMAN & NICOBAR	THAILAND-S.CHINA etc.	MALAYA	SOUTH INDIA	SRI LANKA
				CHITRAL etc.	OTHER MOUNTAINS													
63.	<i>Dendrobium chryseum</i> Rolfe.							+	+	+	+	+	+	+		+		
64.	<i>crepidatum</i> Lindl.							+	+	+	+	+	+	+				
65.	<i>denudans</i> D. Don							+	+	+	+	+						
66.	<i>heterocarpum</i> Wall. ex Lindl.								+	+	+	+	+	+	+	+	+	
67.	<i>macrostachyum</i> Lindl.							+								+	+	
68.	<i>monticola</i> Hunt & Summerh.							+	+	+						+		
69.	<i>moschatum</i> (Buch.-Ham.) Sw.								+	+	+	+	+	+	+			
70.	<i>normale</i> Falc.							+	+									
71.	<i>primulinum</i> Lindl.							+	+	+	+	+	+	+	+			
72.	<i>transparens</i> Wall. ex Lindl.								+	+	+	+	+					
73.	<i>Didickea cunninghamii</i> King & Prain							+			+							
74.	<i>Diphylax griffithii</i> (Hook.f.) Kranzl.			+		+		+	+									
75.	<i>Diplomeris hirsuta</i> (Lindl.) Lindl.								+	+	+	+						
76.	<i>Epipactis gigantea</i> Dougl. ex Hook.		+	+	+	+	+	+	+	+	+	+						
77.	<i>helleborine</i> (L.) Crantz.		+		+	+	+	+	+	+	+			+				
78.	<i>persica</i> (Soo) Nannfeldt	+	+	+		+												
79.	<i>veratrifolia</i> Boiss. & Hohen.	+	+	+	+	+	+	+	+	+	+							
80.	<i>Epipogium aphyllum</i> (F.W. Schmidt) Sw					+	+	+		+	+	+						
81.	<i>tuberosum</i> Duthie				+	+	+	+				+						
82.	<i>Eria alba</i> Lindl.						+	+	+	+	+							
83.	<i>amica</i> Rchb.f.								+	+	+	+	+	+	+			
84.	<i>coronaria</i> (Lindl.) Rchb.f.								+	+	+	+	+		+			
85.	<i>graminifolia</i> Lindl.								+	+	+	+						
86.	<i>musciicola</i> (Lindl.) Lindl.								+	+	+	+	+	+	+		+	
87.	<i>occidentalis</i> Seidenf.							+	+									
88.	<i>pubescens</i> (Hook.) Lindl. ex Steud							+	+	+	+	+	+	+	+			
89.	<i>reticosa</i> Wight								+							+		
90.	<i>spicata</i> (D. Don) Hand.-Mazz.							+	+	+	+	+	+	+	+			
91.	<i>Eulophia bicallosa</i> (D. Don) Hunt & Summerh.							+	+	+	+	+	+					
92.	<i>dabia</i> (D. Don) Hochr.		+	+		+	+	+	+	+	+	+	+	+				
93.	<i>explanata</i> Lindl.							+	+				+					



## RANGE OF DISTRIBUTION OF ORCHIDS

SI.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA							E. HIMALAYA							
				PAKISTAN		JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAUN	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH	ASSAM-MEGHALAYA-NAGALAND-MANIPUR-MIZORAM-TRIPURA	BURMA-ANDAMAN & NICOBAR	THAILANDS-CHINA etc.	MALAYA	SOUTH INDIA	SRI LANKA
				CHITRAL etc.	OTHER MOUNTAINS													
94.	<i>Eulophia flava</i> (Lindl.) Hook.f.							+		+					+		+	+
95.	<i>graminea</i> Lindl.				+	+		+	+	+	+	+	+	+	+		+	+
96.	<i>herbacea</i> Lindl.							+	+	+					+		+	
97.	<i>mackinnonii</i> Duthie							+										
98.	<i>nuda</i> Lindl.								+	+	+	+	+	+	+	+	+	+
99.	<i>obtusa</i> (Lindl.) Hook.f.							+										
100.	<i>Flickingeria fugax</i> (Rchb.f.) Seidenf.								+	+	+	+	+	+	+	+		
101.	<i>hesperis</i> Seidenf.								+									
102.	<i>Galeola falconeri</i> Hook.f.							+			+	+						
103.	<i>Gastrochilus acutifolius</i> (Lindl.) Kze.								+		+	+	+					
104.	<i>calceolaris</i> (Buch.-Ham. ex Sm.) D. Don							+	+	+	+	+	+		+	+	+	
105.	<i>distichus</i> (Lindl.) Kze.							+	+	+	+	+	+					
106.	<i>inconspicuum</i> (Hook.f.) Kze.							+	+	+	+	+	+					
107.	<i>Gastrodia orobanchoides</i> (Falc.) Benth.				+	+		+	+									
108.	<i>Geodorum densiflorum</i> (Lam.) Schltr.							+		+	+	+	+	+	+		+	+
109.	<i>Goodyera biflora</i> (Lindl.) Hook.f.							+	+	+	+							
110.	<i>foliosa</i> (Lindl.) Benth. ex Clarke							+	+	+	+	+	+	+	+			
111.	<i>fusca</i> (Lindl.) Hook.f.							+	+	+	+	+		+				
112.	<i>procera</i> (Ker.-Gawl.) Hook.							+	+	+	+	+	+	+	+		+	+
113.	<i>repens</i> (L.) R. Br.				+	+		+	+	+	+	+	+	+	+			
114.	<i>viridiflora</i> (Bl.) Coll.							+	+	+	+		+		+	+		
115.	<i>Gymnadenia orchidis</i> Lindl.				+	+		+	+	+	+							
116.	<i>Habenaria aitchisonii</i> Rchb.f.		+		+	+		+	+	+								
117.	<i>arietina</i> Hook.f.								+	+	+	+	+					
118.	<i>clavigera</i> (Lindl.) Dandy							+	+	+	+	+	+					
119.	<i>commelinifolia</i> (Roxb.) Wall. ex Lindl.					+	+	+	+	+	+	+	+					
120.	<i>digitata</i> Lindl.				+	+		+	+	+		+	+	+				+
121.	<i>diphylla</i> Dalz.							+										+
122.	<i>edgeworthii</i> Hook.f. ex Coll.				+	+		+	+	+								
123.	<i>ensifolia</i> Lindl.							+	+	+	+	+	+					
124.	<i>furcilera</i> Lindl.				+	+		+	+		+	+	+	+	+		+	+

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Sl.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA						E. HIMALAYA								
				PAKISTAN		JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAUN	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH	ASSAM-MEGHALAYA-NAGALAND-MANIPUR-MIZORAM-TRIPURA	BURMA-ANDAMAN & NICOBAR	THAILAND-S.CHINA etc.	MALAYA	SOUTH INDIA	SRI LANKA
				CHITRAL etc.	OTHER MOUNTAINS													
125.	<i>Habenaria intermedia</i> D. Don				+	+	+	+	+	+	+	+						
126.	<i>latilabris</i> (Lindl.) Hook.f.				+	+	+	+	+	+	+	+						
127.	<i>longifolia</i> Buch.-Ham. ex Lindl.							+										
128.	<i>marginata</i> Colebr.				+	+	+	+	+				+	+		+		
129.	<i>pectinata</i> (J.E. Sm.) D. Don				+	+	+	+	+	+	+	+						
130.	<i>plantaginea</i> Lindl.					+	+	+	+	+	+	+						
131.	<i>pubescens</i> Lindl.							+	+	+	+	+						
132.	<i>stenopetala</i> Lindl.					+		+	+	+	+	+		+		+		
133.	<i>Hemipilia cordifolia</i> Lindl.						+	+	+	+								
134.	<i>Herminium josephii</i> Rchb.f.							+	+	+	+	+						
135.	<i>kumaunensis</i> Deva & Naithani								+									
136.	<i>lanceum</i> (Thunb. ex Sw.) Vuijk				+	+	+	+	+	+	+	+	+	+	+	+		
137.	<i>mackinnonii</i> Duthie							+	+	+	+							
138.	<i>macrophyllum</i> (D. Don) Dandy					+			+	+	+	+						
139.	<i>monophyllum</i> (D. Don) Hunt & Summerh						+	+	+	+								
140.	<i>monorchis</i> (L.) R. Br.				+	+	+	+	+	+	+	+						
141.	<i>pugioniforme</i> Lindl. ex Hook.f.					+	+	+	+	+	+							
142.	<i>Kingidium deliciosum</i> (Rchb.f.) Sweet								+		+	+	+	+	+	+	+	
143.	<i>taenialis</i> (Lindl.) Hunt							+	+	+	+	+	+	+				
144.	<i>Liparis caespitosa</i> (Thou.) Lindl.								+	+	+	+	+	+	+	+	+	
145.	<i>cordifolia</i> Hook. F.							+		+	+	+	+	+				
146.	<i>deflexa</i> Hook.f.								+	+	+	+				+		
147.	<i>glossula</i> Rchb.f.						+	+	+	+	+							
148.	<i>nervosa</i> (Thunb.) Lindl.								+	+	+	+	+	+		+	+	
149.	<i>paradoxa</i> (Lindl.) Rchb.f.						+	+	+	+	+	+	+	+				
150.	<i>platyrachis</i> Hook.f.								+	+	+	+		+				
151.	<i>resupinata</i> Ridley								+	+	+	+	+		+	+		
152.	<i>rostrata</i> Rchb.f.				+	+	+	+	+	+	+							
153.	<i>viridiflora</i> (Bl.) Lindl.							+	+	+	+	+	+	+	+	+	+	
154.	<i>Listera longicaulis</i> King & Pantl.							+			+							
155.	<i>nandadeviensis</i> Hajra							+			+							

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Sl.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA							E. HIMALAYA							
				PAKISTAN		JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAON	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH	ASSAM-MEGHALAYA-NAGALAND- MANIPUR-MIZORAM-TRIPURA	BURMA-ANDAMAN & NICOBAR	THAILANDS-CHINA etc.	MALAYA	SOUTH INDIA	SRI LANKA
				CHITRAL etc.	OTHER MOUNTAINS													
156.	<i>Listera ovata</i> (L.) R. Br.					+												
157.	<i>pinetorum</i> Lindl.								+	+	+	+	+			+		
158.	<i>tenuis</i> Lindl.								+	+	+	+	+					
159.	<i>Luisia brachystachys</i> (Lindl.) Bl.								+	+		+	+	+				
160.	<i>trichorhiza</i> (Hook.) Bl.								+	+	+	+	+	+	+			
161.	<i>zeylanica</i> Lindl.								+	+	+	+	+			+	+	
162.	<i>Malaxis acuminata</i> D. Don								+	+	+	+	+	+	+			
163.	<i>biaurita</i> (Lindl.) O. Kze								+			+	+	+	+			
164.	<i>cylindrostachya</i> (Lindl.) O. Kze.					+	+	+	+	+	+	+	+	+	+			
165.	<i>latifolia</i> J.E. Sm.								+	+	+	+	+	+	+	+	+	
166.	<i>mackinnonii</i> (Duthie) Ames								+						+			
167.	<i>muscifera</i> (Lindl.) O. Kze.					+	+	+	+	+	+	+	+					
168.	<i>purpurea</i> (Lindl.) O. Kze.								+	+		+			+		+	
169.	<i>Neottia inayatii</i> (Duthie) Beauv.					+												
170.	<i>kashmiriana</i> (Duthie) Beauv.					+												
171.	<i>listeroides</i> Lindl.					+	+	+	+	+	+	+	+					
172.	<i>mackinnonii</i> Deva & Naithiani								+									
173.	<i>microglottis</i> (Duthie) Schltr.								+	+								
174.	<i>Neottianthe calcicola</i> (W.W. Sm.) Schltr.								+	+	+	+						
175.	<i>secundiflora</i> (Hook.f.) Schltr.									+	+	+	+					
176.	<i>Nervilia aragoana</i> Gaud.								+		+		+	+	+	+	+	
177.	<i>falcata</i> (King & Pantl.) Schltr.								+		+							
178.	<i>gammieana</i> (Hook.f.) Schltr.					+	+		+		+	+						
179.	<i>infundibulifolia</i> Blatt. & McCann								+			+			+	+	+	
180.	<i>mackinnonii</i> (Duthie) Schltr.								+	+								
181.	<i>plicata</i> (Andr.) Schltr.					+		+	+		+	+		+	+			
182.	<i>prainiana</i> (King & Pantl.) Seidenf.								+	+		+		+		+		
183.	<i>Oberonia acaulis</i> Griff.								+	+	+	+	+	+	+			
184.	<i>ensiformis</i> (Sm.) Lindl.								+	+	+	+	+	+	+		+	
185.	<i>falconeri</i> Hook.f.								+	+	+	+	+	+	+	+	+	
186.	<i>griffithiana</i> Lindl.								+					+	+			

## RANGE OF DISTRIBUTION OF ORCHIDS

Sl.No	Name of species	IRAN	AFGHANISTAN	N.W. HIMALAYA						E. HIMALAYA								
				PAKISTAN		JAMMU & KASHMIR	HIMACHAL PRADESH	GARHWAL	KUMAUN	NEPAL	SIKKIM-BHUTAN	ARUNACHAL PRADESH	ASSAM-MEGHALAYA-NAGALAND-MANIPUR-MIZORAM-TRIPURA	BURMA-ANDAMAN & NICOBAR	THAILAND-S.CHINA etc.	MALAYA	SOUTH INDIA	SRI LANKA
				CHITRAL etc.	OTHER MOUNTAINS													
187.	<i>Oberonia iridifolia</i> (Roxb.) Lindl.							+	+	+	+	+	+	+	+	+		
188.	<i>mysurus</i> Lindl.								+	+				+	+			
189.	<i>pachyrachis</i> Rchb.f.							+	+	+	+	+	+	+		+		
190.	<i>prainiana</i> King & Pantl.									+	+				+	+		
191.	<i>pyrulifera</i> Lindl.								+		+	+		+				
192.	<i>Oreorchis foliosa</i> (Lindl) Lindl.					+	+	+		+	+	+		+				
193.	<i>indica</i> (Lindl.) Hook.f.						+	+	+									
194.	<i>micrantha</i> Lindl.					+	+	+	+	+	+							
195.	<i>Omithochilus difformis</i> (Wall. ex Lindl.) Scht.							+	+	+	+	+	+	+	+			
196.	<i>Otochilus lancilabius</i> Seidenf.								+	+	+		+					
197.	<i>Pachystoma senile</i> (Lindl.) Rchb.f.							+	+	+	+	+	+	+	+	+		
198.	<i>Pecteilis gigantea</i> (J.E. Sm.) Rafin				+	+	+	+	+	+	+	+	+	+	+	+	+	
199.	<i>triflora</i> (D. Don) Tang & Wang								+	+	+							
200.	<i>Pelatantheria insectifera</i> (Rchb.f.) Ridley								+		+	+	+	+	+			
201.	<i>Peristylus affinis</i> (D. Don) Seidenf.						+	+		+	+	+	+		+			
202.	<i>constrictus</i> (Lindl.) Lindl.							+	+	+	+	+	+	+	+			
203.	<i>duthiei</i> (Hook.f.) Deva & Naithani							+	+	+								
204.	<i>elisabethae</i> (Duthie) Gupta						+	+	+	+								
205.	<i>fallax</i> Lindl.							+	+	+	+	+	+					
206.	<i>goodyeroides</i> (D. Don) Lindl.						+	+	+	+	+	+	+	+	+	+	+	
207.	<i>lawii</i> Wight								+	+							+	
208.	<i>Phaius tancarvilleae</i> (L. Herit.) Bl.							+	+	+	+	+	+	+	+		+	
209.	<i>Pholidota articulata</i> Lindl.							+	+	+	+	+	+	+	+	+		
210.	<i>imbricata</i> (Roxb.) Lindl.							+	+	+	+	+	+	+	+	+	+	
211.	<i>Platanthera arcuata</i> Lindl.						+	+	+	+	+							
212.	<i>stenantha</i> (Hook.f.) Soo								+	+	+	+		+				
213.	<i>Pleione grandiflora</i> (Rolfe) Rolfe								+					+	+			
214.	<i>hookeriana</i> (Lindl.) Moore								+	+	+	+		+				
215.	<i>humilis</i> (Sm.) D. Don							+	+	+	+	+	+	+				
216.	<i>Pleione praecox</i> (J.E. Sm.) D. Don							+	+	+	+	+	+	+				
217.	<i>Poneorchis chusua</i> (D. Don) Soo						+	+	+	+	+	+						





20

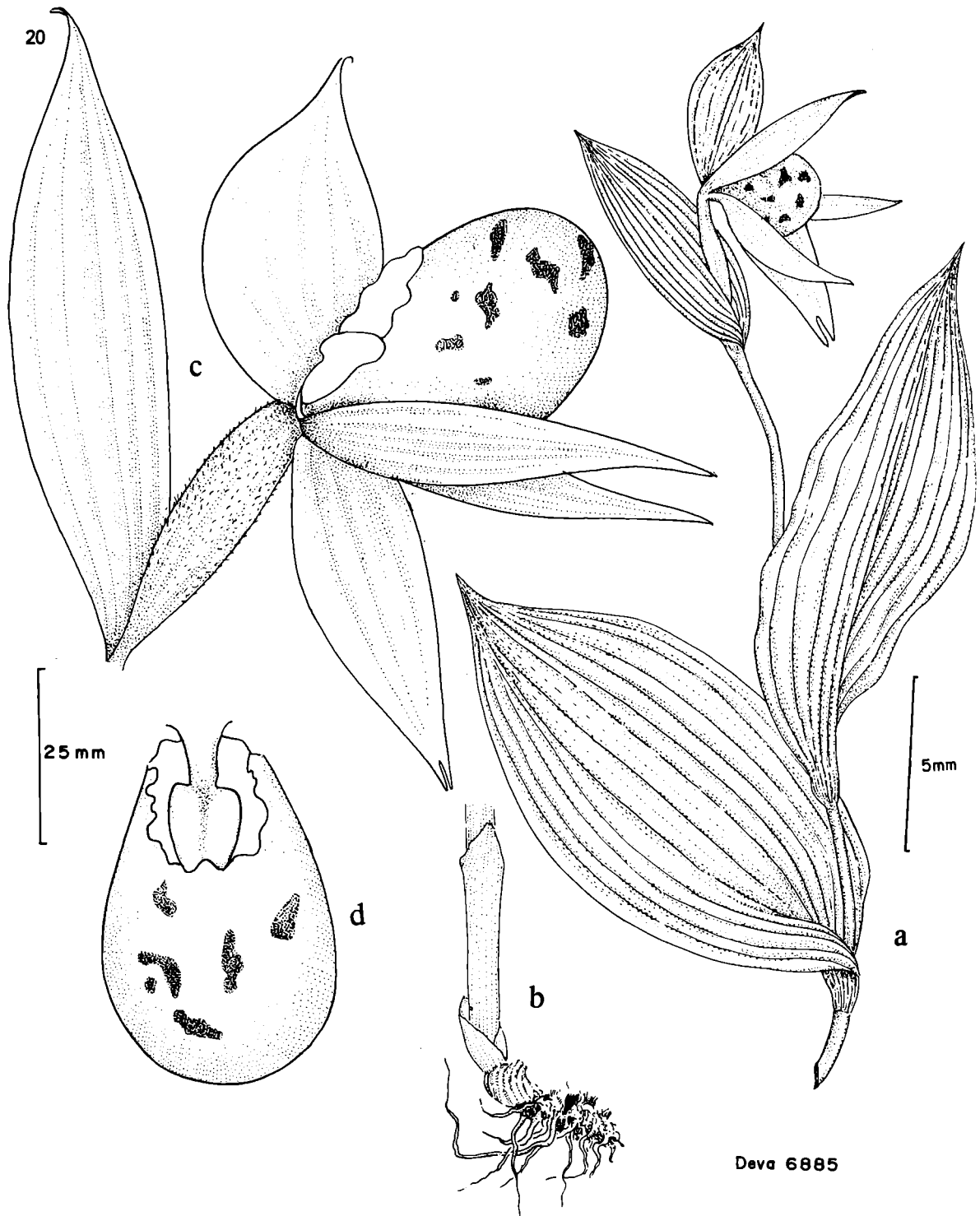


Fig. 1 *Cyperipedium cordigerum* D. Don—*a*. upper part of plant; *b*. lower part of plant; *c*. flower; *d*. column & lip.

### Key to sub-families

1. Fertile anthers two, lip slipper shaped ..... Cypripedioideae (Cypripedioideae) (Page.23 )
- + Fertile anther one, lip not slipper shaped ..... 2
2. Pollinia granular, powdery or lamellate, anthers persistent ..... 3
- + Pollinia waxy, anther deciduous ..... 4
3. Anther attached by the top, operculate ..... Neottioideae (Page 27)
- + Anther attached by its base, confluent with the column, not operculate ..... Orchidoideae (Page. 99 )
4. Pollinia with or without caudicle and gland, free or attached by their base to a single or double viscous not derived from stigma ..... ★ Epidendroideae (page. 202 )
- + Pollinia attached singly or in pair by caudicles to a gland derived from the stigma ..... ★ Vandoideae (Page. 350 )

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★ The use of key especially in the case of sub families *Epidendroideae* and *Vandoideae* may not always lead to the right genus. Therefore at the end of tribe it is advised to look carefully through the description of the genera for correct identification.

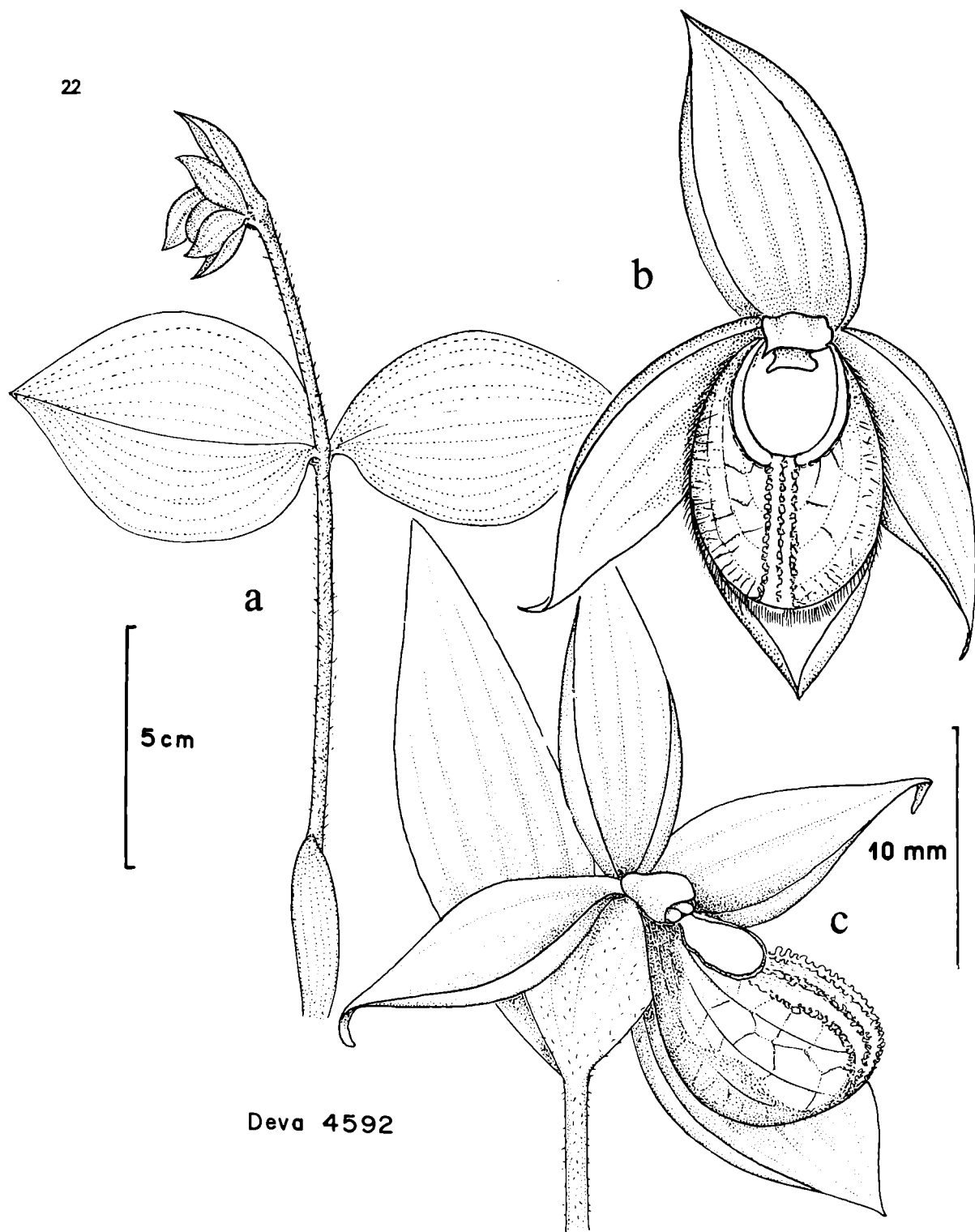


Fig. 2 *Cyperipedium elegans* Rchb. f.—a. plant; b. flower front view; c, flower side view.

### I. Sub-fam. CYPRIPEIDIOIDEAE

Terrestrial, rhizomatous herbs. *Stem* reduced. *Leaves* usually plicate. *Inflorescence* terminal. *Lateral sepal connate*, *Lip* slipper shaped. *Column* Comprising of an orbicular stigma, with 2-anthers, a shield shaped staminode; pollen in viscid masses; *ovary* uni-locular, placentation parietal.

In N.W. Himalaya Genus 1, species 3.

Tribe - **Cypripedieae**.

Sub-tribe - **Cypripedinae**

Cypripedium (3)

#### Cypripedium Linn.

Terrestrial herb, with a leafy annual stem. *Rhizome* creeping *Leaves* 2-5(-8), coriaceous, evergreen, smooth and often coloured; or membranous, deciduous and plicate. *Flower* large, usually solitary, (rarely in pairs), born at the apex of leafy stem. *Bracts* leaflike *Sepal* spreading; the dorsal erect: the lateral pair smaller, narrower and usually more or less connate under and behind the lip. *Petals* free, varying in shape, often very long. *Lip* sessile with small narrow auricle-like often inflexed side lobes and a large inflated sac-cate mid-lobe. *Column* short, terete. *Anthers* 2, subglobose. *Stigma* forming a convex often rugulose disc, deflexed and hidden by the large disciform, fleshy staminode. *Ovary* 1-celled.

#### Key to species

1. Plants up to 20 cm, leaves two, opposite, flat; flowers small; lip 1 cm long ..... *C. elegans*
- + Plants 25 to 60 cm tall; leaves 3-6 scattered on the stem, alternate, plaited; flowers large; lip exceeding 2 cm ..... 2
2. Perianth brownish-purple, darker striped, lip purple ..... *C. himalaicum*
- + Perianth greenish to yellowish-green, lip white, with some purple spots ..... *C. cordigerum*

**Cypripedium cordigerum** D. Don, Prodr. Fl. Nepal, 37, 1825; Hook. f., 6: 170, 1890; Collett, 508, 1902: Duthie, 203 t. 151, 1906; Stewart, 67. 1972; Renz, 11. 1978, et 4. 1984 (Fig. 1)

Plant 40-60 cm tall. *Stem* stout or slender, puberulous. *Leaves* 3-6 broadly ovate or almost circular, thin, 7.5-15 × 5-10 cm, margins shortly ciliate. *Inflorescence* short with one or rarely two flowers. *Flowers* greenish to pale yellow and white, 7-10 cm across. *Bracts* leaf like, 2.5-10 cm long, margins ciliate with glandular or eglandular hairs. *Sepals* green to yellowish green, ovate-lanceolate, acuminate; the laterals fused to near their top, up to 4 cm long, the margins ciliolate, with glandular hairs. *Petals* equal in length and colour to the sepal, obliquely linear to narrowly lanceolate, pilose near the base within, margins not ciliate. *Lip* with purple irregular spots on the outside towards the base, up to 3 cm long, slipper like, semiglobose, with a small opening bearing longer hairs on each side. *Staminode* 10 mm long, ovate or oblong cordate.

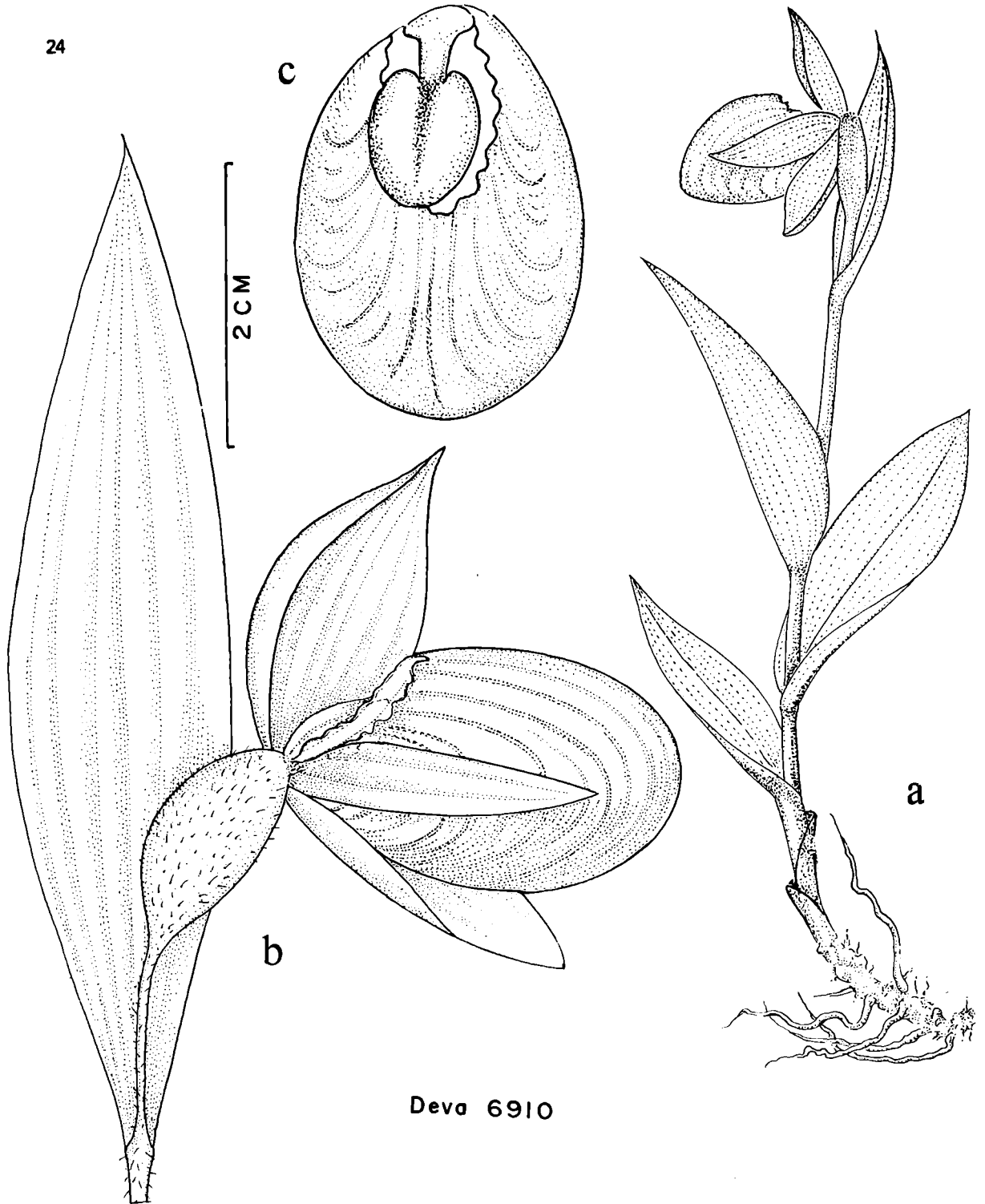
*Flowering*: June - July.

*Distribution*: Himalaya 2500-3000 m (Pakistan, Kashmir to Bhutan).

*Specimens examined*:

GARHWAL **Dehra Dun**-Jaunsar. *Fischer* 1882. **Tehri**-Nagtibba. *Gollan* 2058; Bok Hills, *Harsukh* 24153; Near Deota, *Duthie* 19846. **Uttarkashi**-Tons Valley, *Harki-Dun*, *Deva* 6885; Below Syaure, *Sahni* 24945; Janki Chatti, *Shetty* 35804; Jumnotri, *M.A. Rau* 15787. **Chamoli**-Trijugarain, *Naithani* 47985; Ghangharea, *M.A. Rau* 31744.





**Fig. 3** *Cyperipedium himalaicum* Rolfe—**a.** plant; **b.** flower; **c.** column & lip.

KUMAUN: Nainital-Lariakanta, *Davidson*. Almora-Kurrain Pass, Pindar Valley, *Strachey & Winterbottom* 56.

HIMACHAL PRADESH: Simla, *Gamble* 4340G.

JAMMU & KASHMIR: Near Gulmarg, *Duthie* 11369; Liddar Valley, *Inayat* 25398.

PAKISTAN: Kangan, Hazara, *Inayat* 23164.

**Cypripedium elegans** Rchb.f. *Flora* 69: 561. 1836; *Hook.f.*, 6: 169, 1890; *King & Pantl.* 341, t. 44. 1898; *Rau & Rao*, 425. 1960; *Rau*, 216. fig. 1 & 244. 1961.

*Cymbidium elegans* sensu *Seidenf. & Arora* in *Nord. J. Bot.* 2(1): 12, 1982. non Lindl. (Fig. 2)

Plant attains maximum height up to 10 cm. *Stem* and peduncle pubescent. *Leaves* 2, opposite, orbicular, sessile, puberulous, 7 × 6 cm. *Scape* usually shorter than the leaves, bearing a single flower. *Flower* brown with dark brown lines, 2.5 cm across. *Bracts* ovate-lanceolate, puberulous, equalling the flower. *Dorsal sepal* small, narrowly ovate; the lateral pair or synsepalum fully united and hidden at the back of lip. *Petals* concave, lanceolate, and bent on the either side of the lip. *Lip* 1 cm long, shorter than the sepals, depressed, the sides abruptly infolded, the upper surface with three parallel crenulate wavy ridges proceeding from the mouth to the apex and united there, the apical part of cavity of the lip with a fleshy plate extending from the upper to the lower wall and dividing into two loculi. *Staminode* transversely elliptic.

*Flowering*: July - August.

*Distribution*: Himalaya 2500-4000 m (Garhwal to Sikkim), S. Tibet.

*Specimens examined*:

GARHWAL: Uttarkashi-Sunapra above village Kharsli, *Deva* 4592. Chamoli-Valley of flowers, *Naithani* 1025, *Renz* 13623, *Bhattacharyya* 39082; Above Ghangaria, *Naithani* 1028, *Renz* 13624; Ghangaria, *Bhattacharyya* 39009; Bajmora, *T.A. Rao* 10286; Hemkund, *Bhattacharyya* 39047; Dibrugheta to Deodi, *Hajra* 73237 & 73789.

KUMAUN: Almora-Dugli (between Dwali and Furkia in Pindari Valley), *G.S. Rawat* 1608.

**Cypripedium himalacium** Rolfe in *J. Linn. Soc.* 29: 319, 1893; *King & Pantl.* 342, t. 448. 1898; *Duthie*, 204. 1906.

*C. macranthon* auct. non *Swartz*: *Hook. f., Fl. Birt. Ind.* 6: 170. 1890. pp.

*C. macranthon* var. *himalacium* (Rolfe) *Kranzlin, Orch. Gen. Sp.* 1: 26. 1897. (Fig. 3)

Plant 25-30 cm tall. *Stem* clothed at base with three or four loose tubular acute sheaths. *Leaves* usually 3, up to 12 × 6 cm, ovate elliptic to slightly oblong, with the middle leaf, largest of the three, puberulous. *Peduncle* pubescent, bearing a solitary flower. *Flower* brownish-purplish, 6.2 cm in diameter. *Bracts* longer than the flower, narrowly elliptic, acute or acuminate, slightly concave, many nerved. *Dorsal sepal* broad, concave, pointed; lateral pair narrower and slightly longer, connate under the lip. *Petals* oblong, longer than the dorsal sepal, spreading on either side of the lip. *Lip* purplish-tinged, almost globose, strongly many nerved, pendent, its wide mouth wavy edge. *Staminode* broadly ovate, obtuse, slightly cordate at the base.

*Flowering*: July - August.

*Distribution*: Himalaya 3000-4300 m (Himachal Pradesh, Garhwal to Sikkim).

*Specimens examined*:

GARHWAL: Uttarkashi-Above Jhala, *Duthie* 192; Tons Valley, Har-ki-Dun, *Deva* 6910. Chamoli—Valley of flowers, *Naithani* 1024, *Renz* 13622; Kedarnath. *T.A. Rao* 8703; Dibrugheta-Deodi, *Hajra* 73238 & 73788.

KUMAUN: Pithoragarh-Byans, *Duthie* 5994; above Garbyang, *G.S. Rawat* 1256(A).

HIMACHAL PRADESH: Shimla, Choor mountains, .Royle (Duthie, loc. cit.).

Dr. Renz identified a specimen from above Garbyang in Kali Valley collected by Gopal Singh Rawat No. 1256 as *Cypripedium tibeticum* King ex Rolfe. It has got two leaves arranged near the base and a single large scarlet flower. This aspect is quite different from *C. himalaicum* but J. Renz advises to make more observations before defining the status of *C. tibeticum*.

## II. Sub-fam. NEOTTIOIDEAE

Terrestrial herbs, without tubers (–with tubers). *Stem* rarely exceeding 50 cm. *Leaves* membranous plicate or flattened, green often patterned, *Inflorescence* terminal spikes or racemes, rarely a branched panicle or small terminal or lateral heads. *Lip* prominent, simple or lobed, spurless or with short spur. *Dorsal sepals* and *petals* often adnate forming a hood. *Anther* dorsal; *pollinia* in two or four pairs, usually separate, with stips and gland; *pollen* granular or powdery; *rostellum* present. *Column* short. *Stigma* single or conjoined on ventral side of the column close to rostellum.

In N.W. Himalaya 15 genera and 41 species.

Tribe	<b>Neottieae</b>	Tribe	<b>Gastrodieae</b>
Sub-tribe	<b>Limodorinae</b>	Sub-tribe	<b>Vanillinæ</b>
	<i>Cephalanthera</i> (1)		<i>Galeola</i> (1)
	<i>Aphyllorchis</i> (2)	Sub-tribe	<b>Gastrodiinae</b>
	<i>Epipactis</i> (4)		<i>Gastrodia</i> (1)
Sub-tribe	<b>Neottiinae</b>	Sub-tribe	<b>Pogoniinae</b>
	<i>Neottia</i> (5)		<i>Nervilia</i> (7)
	<i>Listera</i> (5)		
Sub-tribe	<b>Spiranthinae</b>		
	<i>Goodyera</i> (6)		
	<i>Cheirostylis</i> (1)		
	<i>Zeuxine</i> (3)		
	<i>Anoectochilus</i> (1)		
	<i>Spiranthes</i> (2)		
	<i>Tropidia</i> (1)		
Sub-tribe	<b>Epipoginae</b>		
	<i>Epipogium</i> (2)		

### Key to Genera

1. Plants leafless, saprophyte or parasite ..... 2
- + Plants with leaf ..... 6
2. Lip spurred ..... *Epipogium*
- + Lip not spurred..... 3
3. Stem branched, flowers in panicles, bright yellow ..... *Galeola*
- + Stem simple, flowers in terminal raceme, not yellow ..... 4
4. Sepals and petals united into a tube; plants tuberous ..... *Gastrodia*
- + Sepals and petals free; base of stem with close fascicle of coarse roots..... 5
5. Tip of the lip acute to acuminate ..... *Aphyllorchis*
- + Tip of the lip bilobed or if simple rounded ..... *Neottia*
6. Leaf single, appearing after the inflorescence..... *Nervilia*
- + Leaves 2-several, contemporaneous with the inflorescence ..... 7
7. Leaves 2..... *Listera*
- + Leaves many..... 8
8. Plants with decumbent base..... 9
- + Plants erect..... 12
9. Sepals connate halfway; blade of lip with fimbriate margins..... *Cheirostylis*
- + Sepals free ..... 10

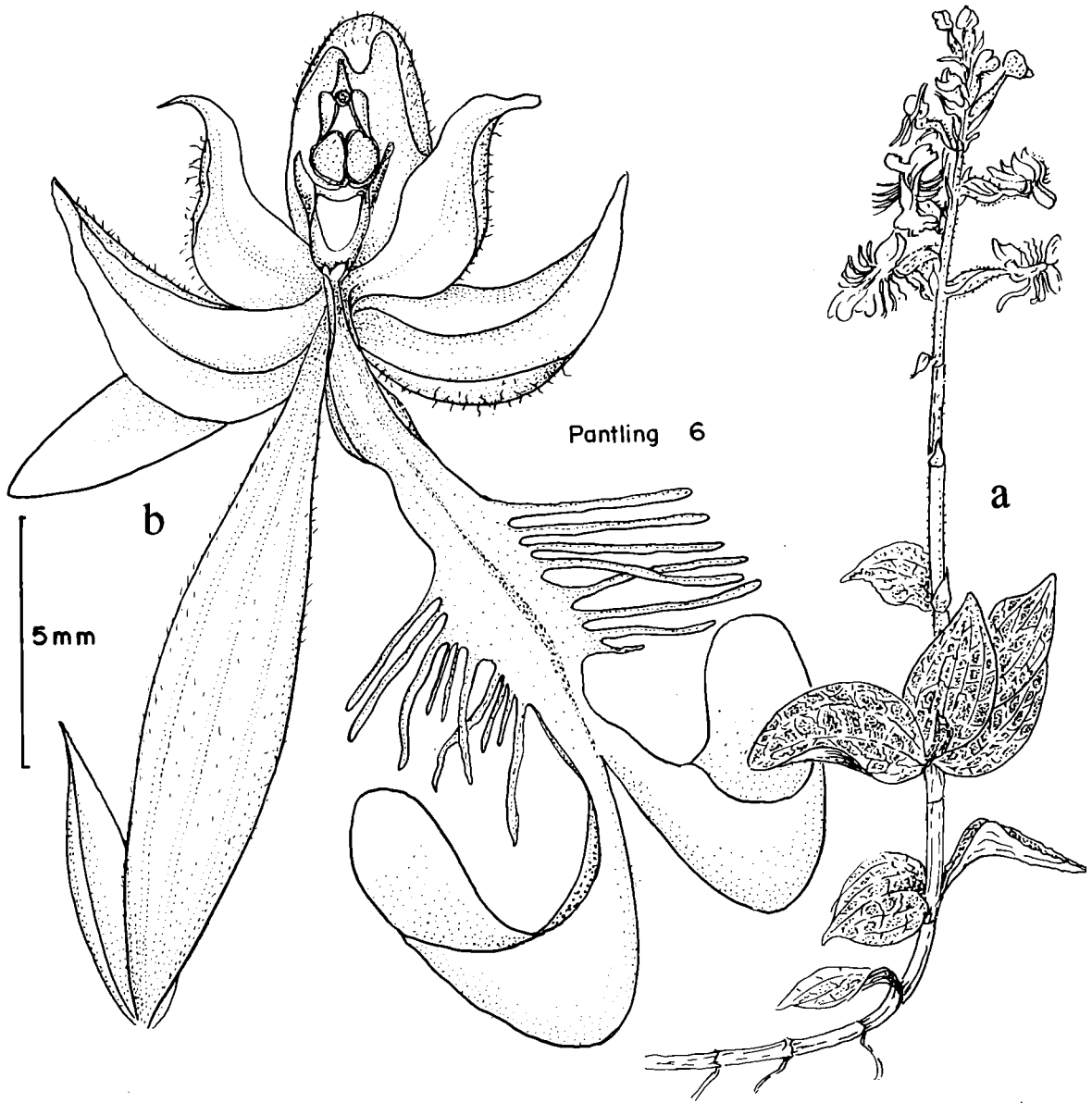


Fig. 4 *Anoectochilus roxburghii* (Wall.) Lindl.—a. plant; b. flower.



10. Margins of the lip on the claw fimbriate..... *Anoectochilus*  
 + Margin of the lip entire; lip saccate..... 11  
 11. Stigma single, sac normally tuberculate within..... *Goodyera*  
 + Stigma single, sac not tuberculate inside..... *Zeuxine*  
 12. Leaves radical; stem only with sheaths ..... 13  
 + Stem bearing normal leaves throughout..... 14  
 13. Lip without sac; flowers in the inflorescence arranged in a spiral; stigma 2..... *Spiranthes*  
 + Lip with sac; flowers not born spirally in the inflorescence; stigma 1..... *Goodyera*  
 14. Inflorescence in terminal or axillary heads..... *Tropidia*  
 + Inflorescence a long terminal raceme..... 15  
 15. Ovary with a short twisted pedicel; epichile with a pair of rounded or winged calli; sepals more or less spreading exposing the epichile..... *Epipactis*  
 + Ovary more or less sessile; epichile 4-ribbed; sepals connivent, hiding the lip..... *Cephalanthera*

### Anoectochilus Blume

Terrestrial herbs. *Stem* succulent, decumbent at the base. *Leaves* thick, green or coloured, ovate or lanceolate. *Inflorescence* spike or raceme, peduncle and rhachis glandular-pubescent. *Sepals* free, unequal, the dorsal smaller, ovate and with the beaked petals forming a hood over the column. *Lip* adnate to the end of the column by a long-toothed or pectinate rarely entire claw, saccate or spurred at the base, the sac produced beyond the bases of the sepals or quite covered by them, its interior with two tooth-like or laminar calli; terminal lobe with two large divergent lobules. *Column* short, lamellate in front. *Anther* 2-celled; rotellum triangular. *Pollinia* 2, bifid, clavate. *Stigma* 2, separated on either side of the base of rostellum.

**Anoectochilus roxburghii** (Wall.) Lindl. Gen. & Sp. Orch. 499. 1840; Hook. f., 95. 1890; King & Pantl. 293, t. 390. 1898; Collet, 494. 1902; Duthie, 169. 1906; Seidenf., 32(2): 52. fig. 30. 1978; Raizada et al. 61. 1982.

*Chrysobaphus roxburghii* Wall. Tent. Fl. Nepal, 37. fig. 27. 1826

(Fig. 4)

Plant up to 30 cm high. *Stem* decumbent at base. *Leaves* 3-5, unequal, 3-6.5 cm long, ovate or ovate-oblong, acute, glabrous, purplish-brown with a velvety lustre, tinged along the centre with yellow and pink, and veined with yellow. *Inflorescence* a raceme, peduncle glandular pubescent. *Flowers* 2-5, resupinate, pink, 2-3 cm long. *Bracts* half as long as the ovary. *Sepals* unequal, pale-pink, glandular hairy, dorsal one broadly ovate, acuminate, its apex recurved; the lateral oblong, acute. *Petals* smaller than sepals, obliquely oblanceolate, pale-pink or white, apex hooked. *Lip* adnate by its base to the face of the column, and with two prominent calli, hypochile with 6-8 pairs of fimbriate processes, terminal lobe oblong, blunt, wide spread, recurved. *Spur* conical, as long as the lateral sepals and possessing two wart like processes inside.

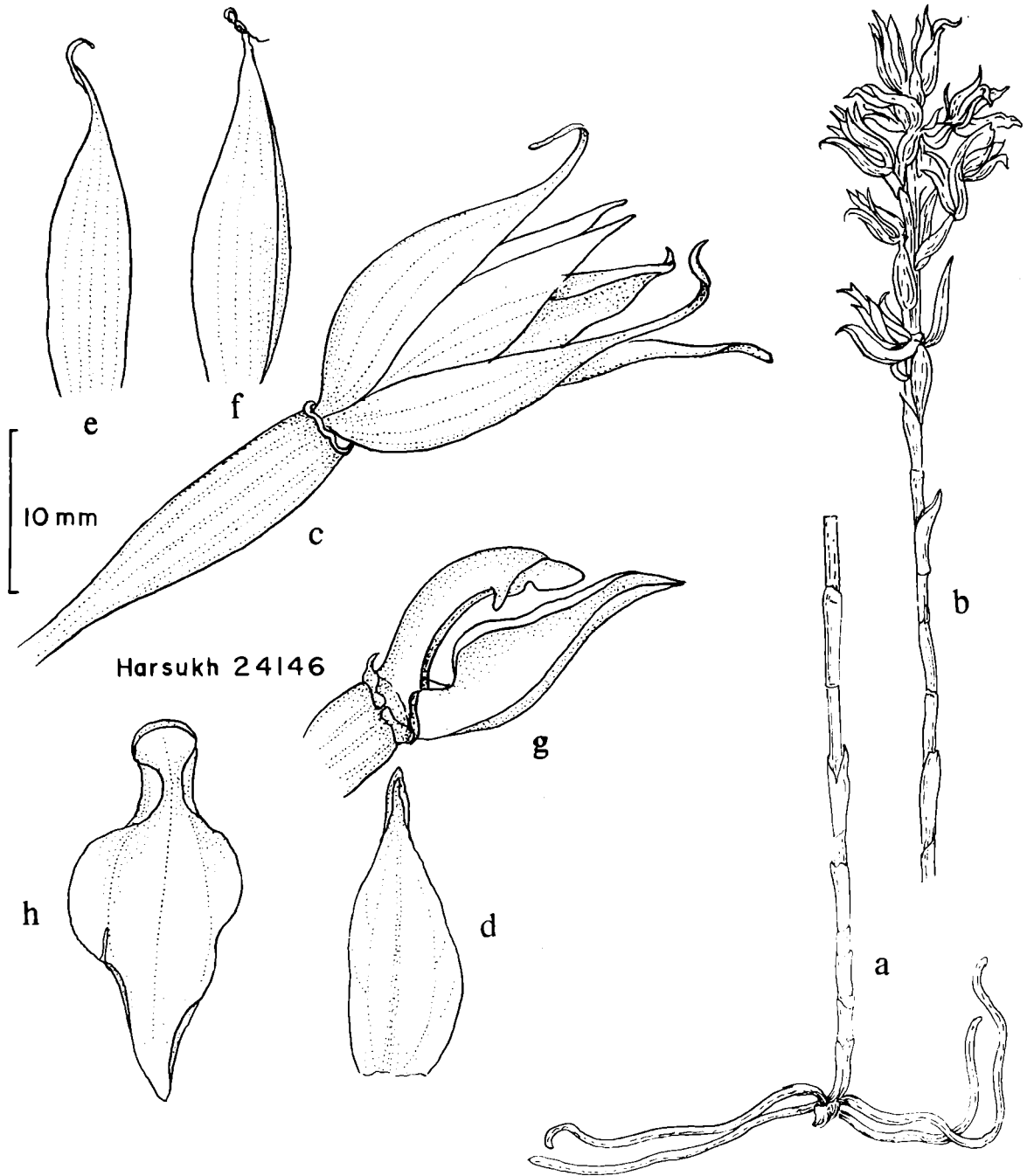
*Flowering*: July - August.

*Distribution*: Himalaya 1600 m (Himachal Pradesh, Garhwal, Nepal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram. Burma, Laos, Vietnam, China and Thailand.

We have not seen any specimen from the N.W. Himalaya and it has been included here on the authority of Duthie. Fig No. 4 is drawn from a specimen collected by Pantling from Jaldacca Valley.

### Aphyllorchis Blume

Saprophytes; rhizome short, thin, erect, with spreading thick roots. *Stem* simple, erect or spreading. *Leaves* absent. *Flowers* in raceme; brown in colour. *Sepals* sub-equal, erect or spreading. *Petals* equal or shorter than sepals. *Lip* sessil on the base of the column or attached to it by a short claw, as long as the sepals, oblong, sometimes auricled at the base, entire or 3-lobed, *Column* rather long, wingless. *Stigma* concave, ovate or oblong. *Anther* stipitate. *Pollinia* 2, powdery, oblong or clavate.



**Fig. 5** *Aphyllorchis gollani* Duthie—**a**. lower part of plant; **b**. upper part of plant with flowers; **c**. flower; **d**. petal; **e**. dorsal sepal; **f**. lateral sepal; **g**. column with lip; **h**. lip.

### Key to species

1. Plants 40-50 cm tall; flowers 4 cm or more long including the ovary; floral bracts longer than the ovary; sepals equal, 2 cm or more long; lip with a winged claw ..... *A. gollani*
- + Plants 25 cm or less tall; flowers less than 1 cm long including the ovary; floral bracts shorter than the ovary; sepals sub-equal, less than 5 mm in length; lip without a claw, with a broad base ..... *A. parviflora*

**Aphyllorchis gollani** Duthie in Journ. As. Soc. Beng. 71(2): 42, 1902; Duthie, 155. t. 122. 1906

(Fig. 5)

Saprophytic. Plant 40-50 cm tall. *Rhizome* with far-extending thick fleshy roots, not scaly, *Scape* 40-50 cm high, erect, stout with many unequal tubular sheaths. *Raceme* about 10 cm long. *Flowers* 8-10, crowded, 4 cm or more long including the ovary. *Bracts* longer than ovary, elliptic-lanceolate, acuminate, erect or deflexed. *Sepals* equal, 2 cm or more long, erect, ovate-lanceolate, acuminate, pale-green with purple nerves, midrib thickened on the back. *Lip* slightly shorter than the petals, pale yellowish green, attached to the base of the column by the concave winged claw, apical portion ovate or bluntly acuminate, margins towards the base reflexed, erose at the apex.

*Flowering*: August.

*Distribution*: Endemic in Garhwal at 2400-3000 m.

*Specimens examined*:

GARHWAL: Tehri-Nagtibba, Ramsukh 23000; Bok hill, Harsukh 24146.

**Aphyllorchis parviflora** King & Pantl. in Journ. As. Soc. Beng. 65(2): 128. 1906; King & Pantl. 262. t. 348. 1898; Hara et al. 1: 31. 1978; Bhattacharyya & Goel, 3: 588, Pl. 1. 1982. (Fig. 6)

Saprophytic pale-brown herb, 13-30 cm high; roots coralloid. *Stem* 3-5 mm in diameter, erect, leafless with 3-4 leaf sheaths. *Raceme* 4-7 cm long, dense with stout rhachis. *Flower* 4-10 mm across, pale-brown. *Bracts* ovate-lanceolate, apex acute, shorter than the ovary. *Sepals* subequal, less than 5 mm long, spreading, linear-acuminate to caudate, apex recurved. *Petals* smaller than the sepals, linear-acuminate, dorsally keeled. *Lip* 1.5-2.5 mm long with broad base, without a claw, concave with acute apex.

*Flowering*: June - July

*Distribution*: Himalaya 3600 m (Garhwal, Nepal, Sikkim) S.E. Tibet.

*Specimen examined*:

GARHWAL: Tehri-On way to Tali, A.K. Goel 72854.

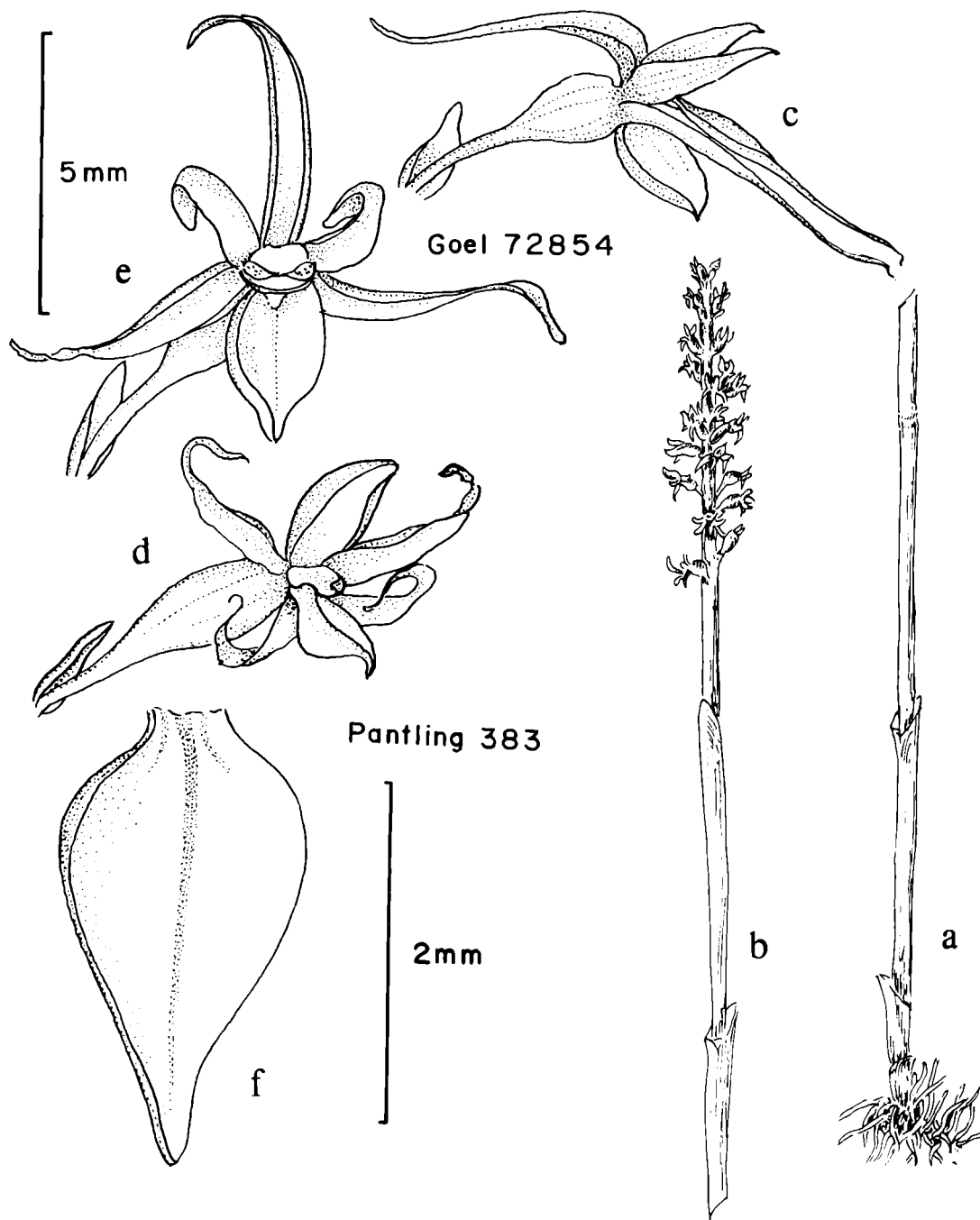
### **Cephalanthera** L.C. Rich.

Terrestrial herbs. *Rhizome* woody, creeping, with numerous roots. *Stem* erect, sometimes flexuous, leafy. *Leaves* sessile, plicate. *Inflorescence* lax or sub-dense flowered, in spikes or racemes. *Flowers* sub-erect, white or pink. *Sepals* and *petals* sub-similar, free, connivent. *Lip* shorter than the sepals or petals, adnate to the base of column, the basal (hypochile) portion concave or saccate and embracing the column; anterior portion (epichile) short and ribbed. *Column* long, erect; *stigma* large; *rostellum* short or almost obsolete. *Anther* hinged to the summit of column. *Pollinia* 2, clavate, each more or less completely divided in to longitudinal halves; *caudicle* absent. *Capsule* erect.

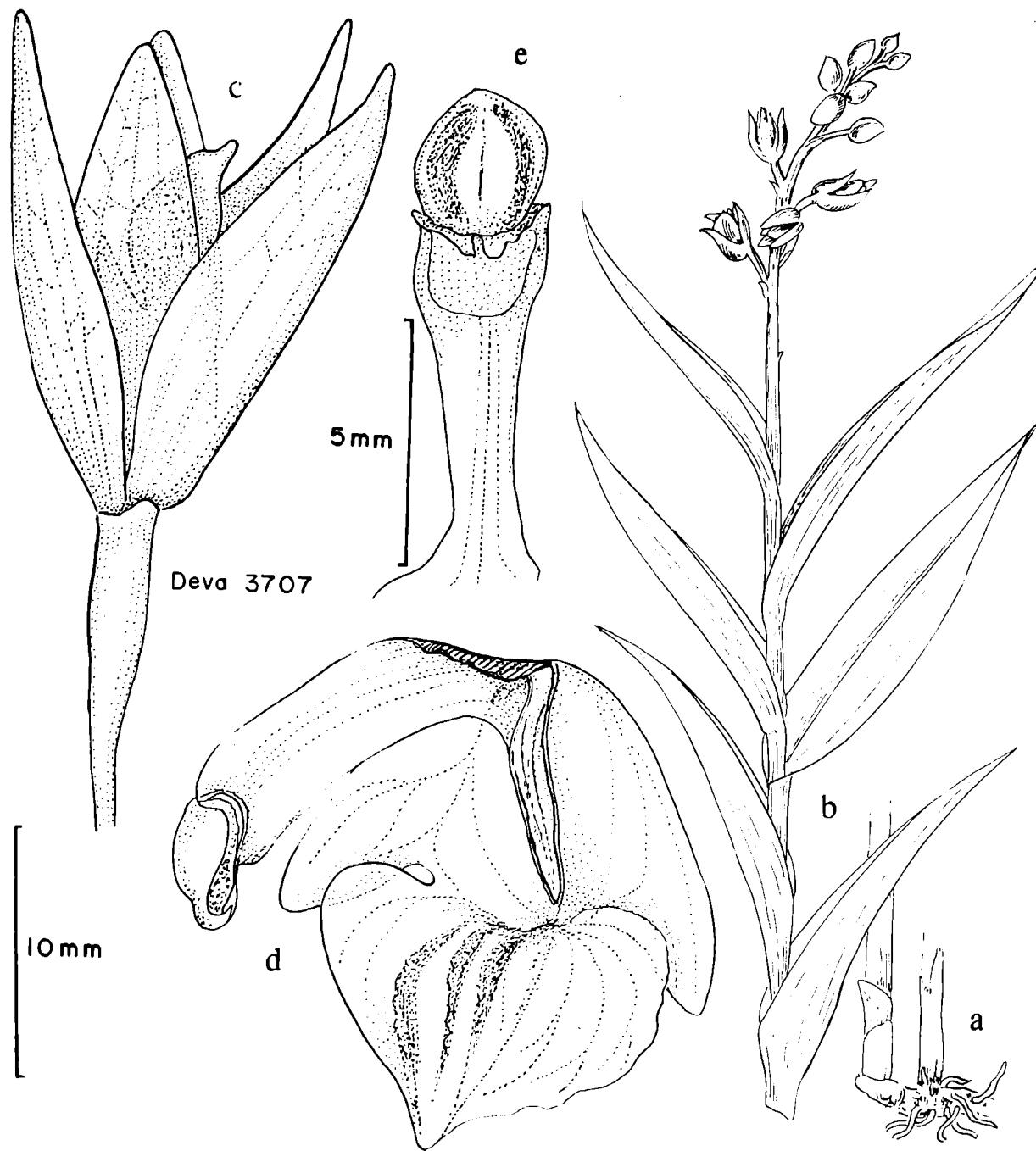
**Cephalanthera longifolia** (Linn.) Fritsch, Osterr. Bot. Zeitschr. 38: 81. 1888; Stewart, 66. 1972; Renz, 28. 1978, & 12. 1984.

*Serapias helleborine* Linn. var. *longifolia* Linn. Sp. Pl. 950. 1753.

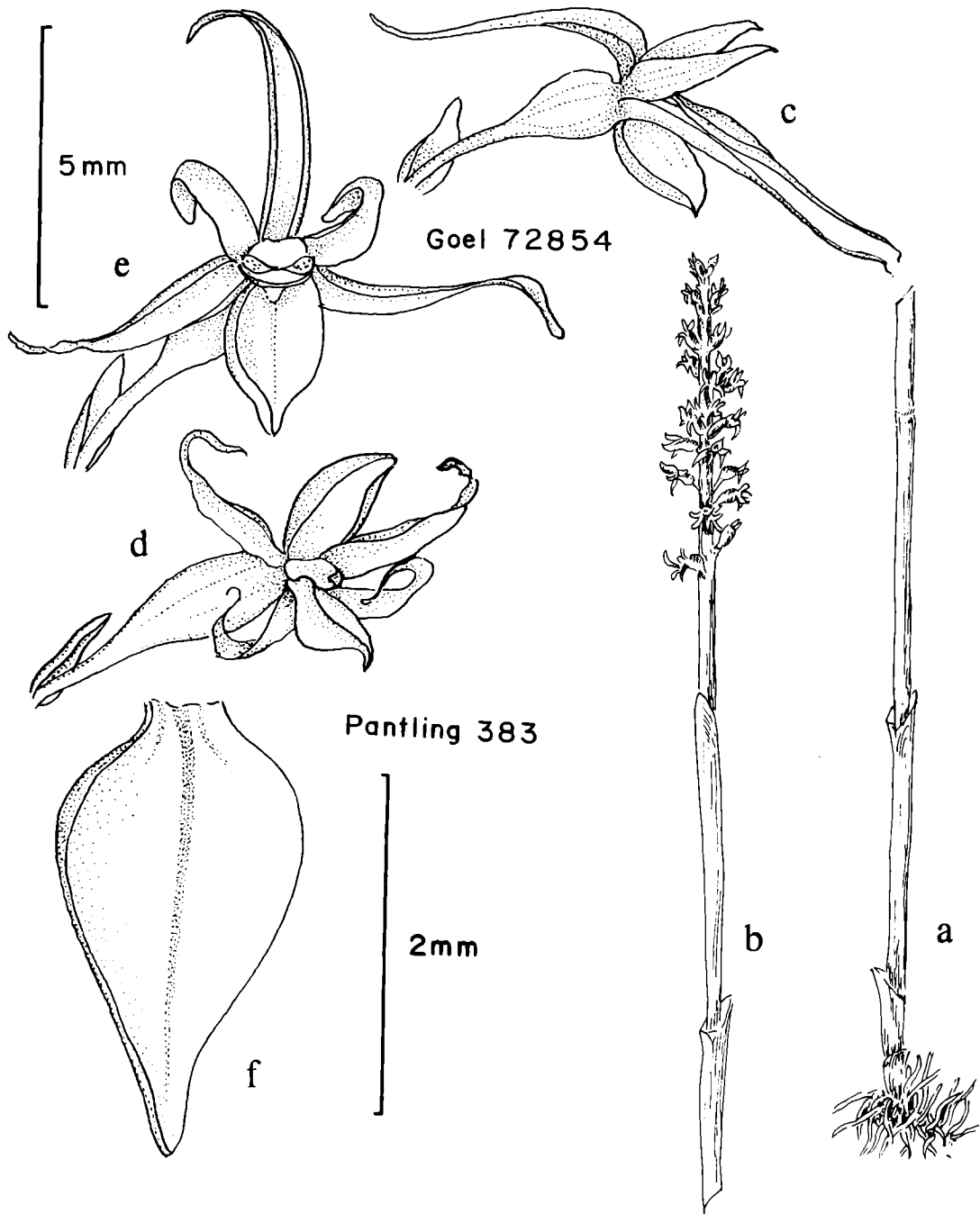
*S. longifolia* (Linn.) Huds. Fl. Angl. 341. 1762.



**Fig. 6** *Aphyllorchis parviflora* King & Pantl.—a. lower part of plant; b. upper part of the plant; c & d. side view of flower; e. front view of flower; f. lip.



**Fig. 7** *Cephalanthera longifolia* (Linn.) Fritsch—**a.** lower part of plant; **b.** plant; **c.** flower; **d.** column with lip; **e.** column.



**Fig. 6** *Aphyllorchis parviflora* King & Pantl.—a. lower part of plant; b. upper part of the plant; c & d. side view of flower; e. front view of flower; f. lip.

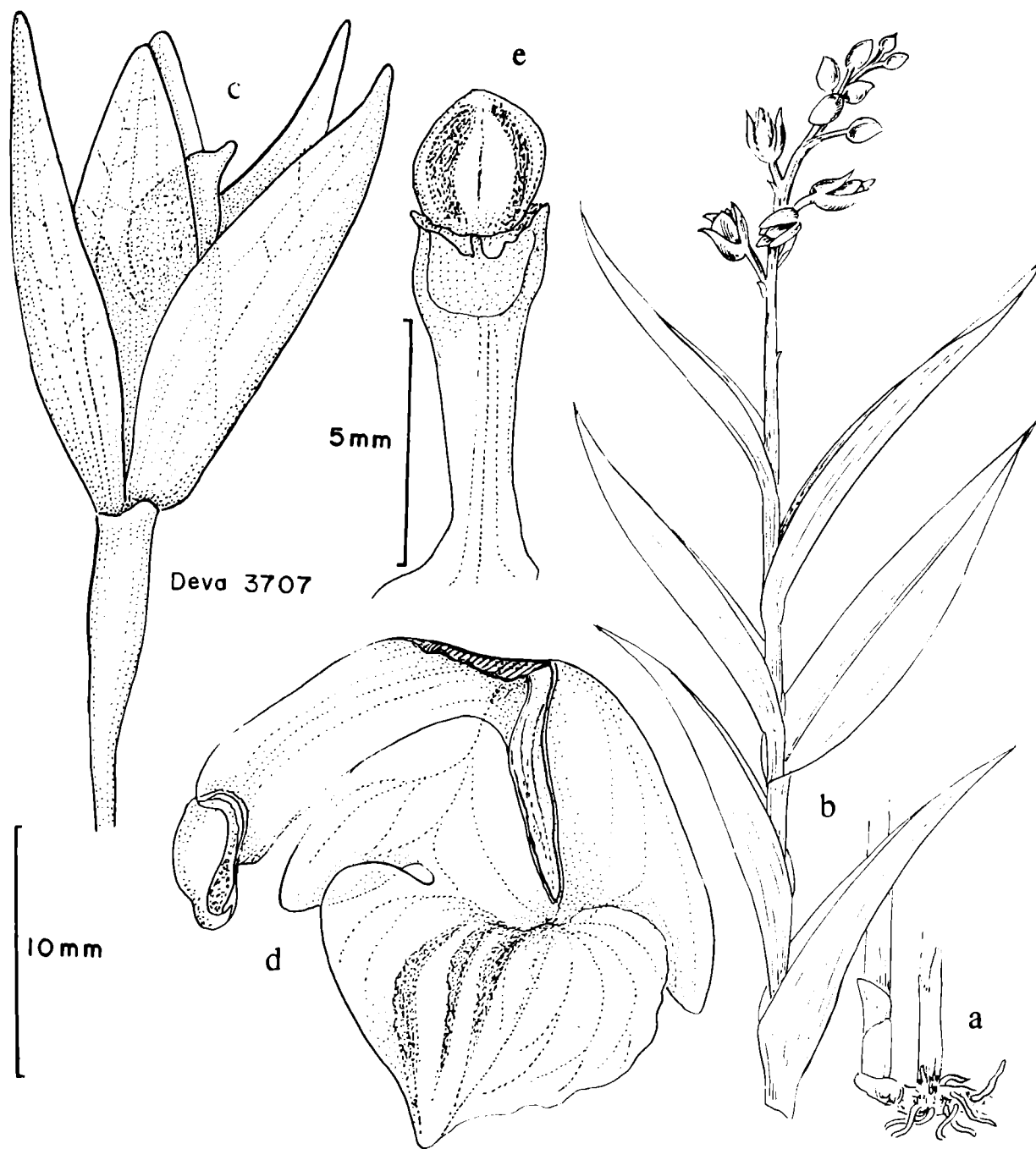


Fig. 7 *Cephalanthera longifolia* (Linn.) Fritsch—*a.* lower part of plant; *b.* plant; *c.* flower; *d.* column with lip; *e.* column.



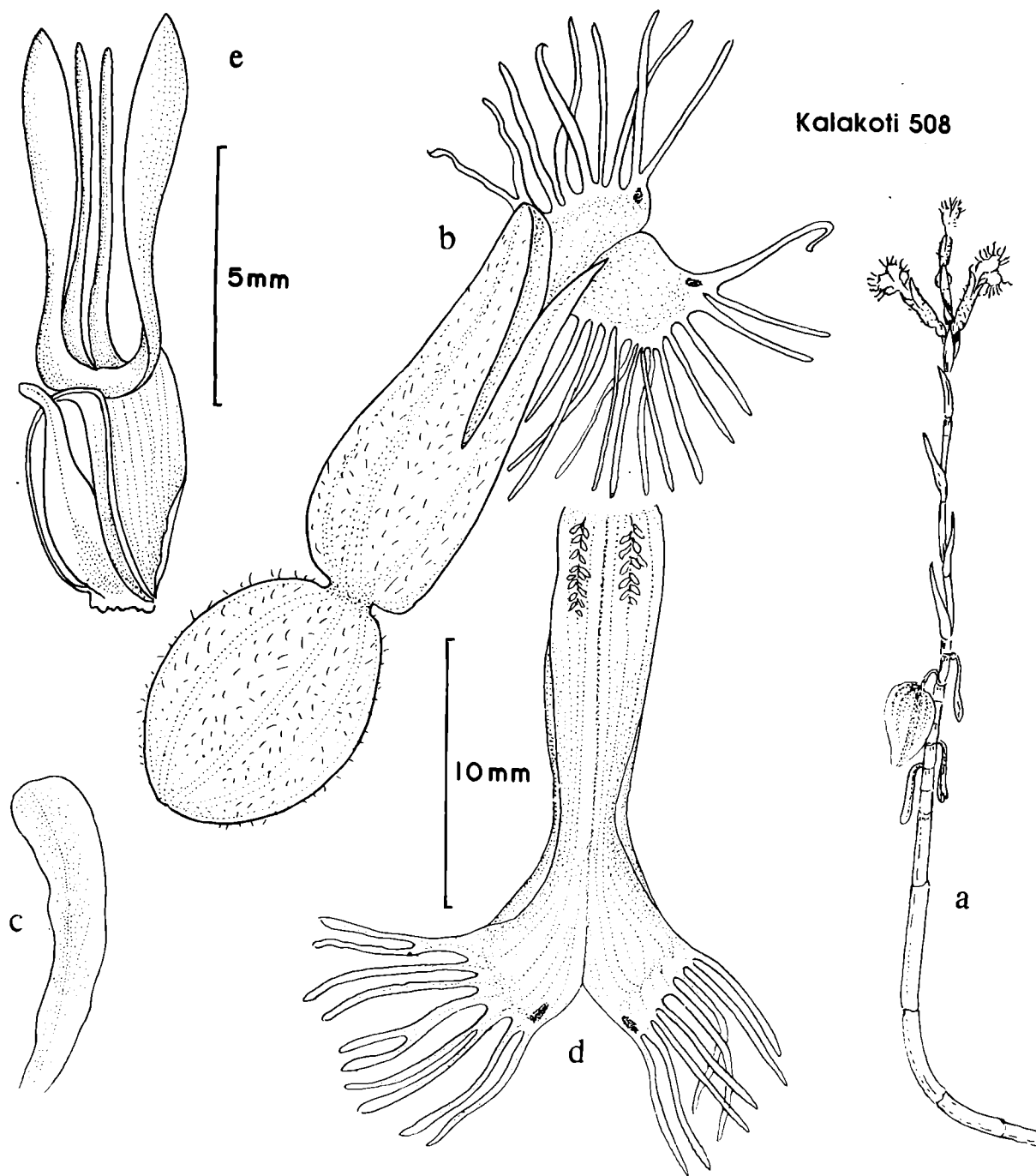


Fig. 8 *Cheirostylis griffithii* Lindl. — a. plant; b. flower; c. petal; d. lip; e. column.

*S. ensifolia* Murr. Syst. Veg. 815. 1784. *nom. illegit.*

*Cephalanthera ensifolia* Rich. Mem. Mus. Hist. Nat. Paris 4: 60. 1818; Hook. f., 6: 125. 1890; King & Pantl. 271. t. 362. 1898; Collett, 497. 1902; Duthie, 160. 1906 (Fig. 7)

Plant 10-50 cm high; *rhizome* rather short, with numerous stiff roots. *Stem* grooved, densely leafy throughout. *Leaves* alternate, sessile, lanceolate or ovate-lanceolate, spreading, often curved down-wards, mostly folded. *Raceme* few to many flowered, loose or sometimes dense. *Flowers* pure white, 12 mm long. *Bracts* ovate-lanceolate, acuminate or acute, unequal, the lowermost longer than the uppermost. *Sepals* lanceolate, acute, up to 18 mm long. *Petals* ovate, obtuse, shorter than sepals. *Lip* jointed, oblong; hypochile white, slightly concave, the side-lobes clasping the column, with an orange-yellow patch at the base; epichile white, kidney shaped, broader than long, margins somewhat erose, with 4-6 orange-yellow parallel crests, the tip orange-yellow, densely covered with papillae.

*Flowering*: May - July

*Distribution*: Himalaya 1800-2000 m (Pakistan, Kashmir to Arunachal Pradesh), Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Afghanistan, Europe, S.E. Tibet, W. Siberia, North Africa, Japan, Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Falconer, Jameson; Deva 3707*; Chakrata, Jaunsar, *Hole*; Deoban, *Parkinson 7004, 13079, Duthie 1262, Brandis 1464*. **Tehri**-On way to Nagtibba, *Naithani 1071*; Sirkanda, *Fleming's collector 444*; Dhanolti, *Falconer*. **Uttarkashi**-Jamnotri, *M.A. Rau 15716, Shetty 33193*; Between Kinani Pani and Jako pass, *Duthie 1266*; Nila Valley, *Duthie 195*. **Chamoli**-Ghangarea, *M.A. Rau 3016*; Amritganga, *Naithani 44092*; Ansuya Devi, *Naithani 44018*; Trijuginarain, *Naithani 47973*.

KUMAUN: **Pithoragarh**-Champawat, *Bhatt 20378*; Panch-Chuli, *Sahni 20442*; Primula Valley, *Thomas 20785*. **Nainital**-Nainital, *Brandis 1463, Davidson, Falconer*. **Almora**-Phurkia, Pindar Valley, *Parkinson 4399*.

HIMACHAL PRADESH: Pulga, *jain & Bharadwaja*; Parbatti Valley, Kulu, *Parkinson 3931*; Manali, *Bor 14453*; Chamba, *Lace 1564*; Mashobra, Shimla, *Gamble 4333(B)*; Near Shimla, *Watt 58*; Dodra Kanwar Jakha, *Deva 3707*.

JAMMU & KASHMIR: Pahlgam Liddar Valley, *Inayat 25401*; Gulmarg, *Duthie 11265*; Erin nala, Kheubama, Valley, *Keshavanand 953*.

PAKISTAN: Mori in Kagan Valley Hazara, *Inayat 22598*.

### **Cheirostylis** Blume

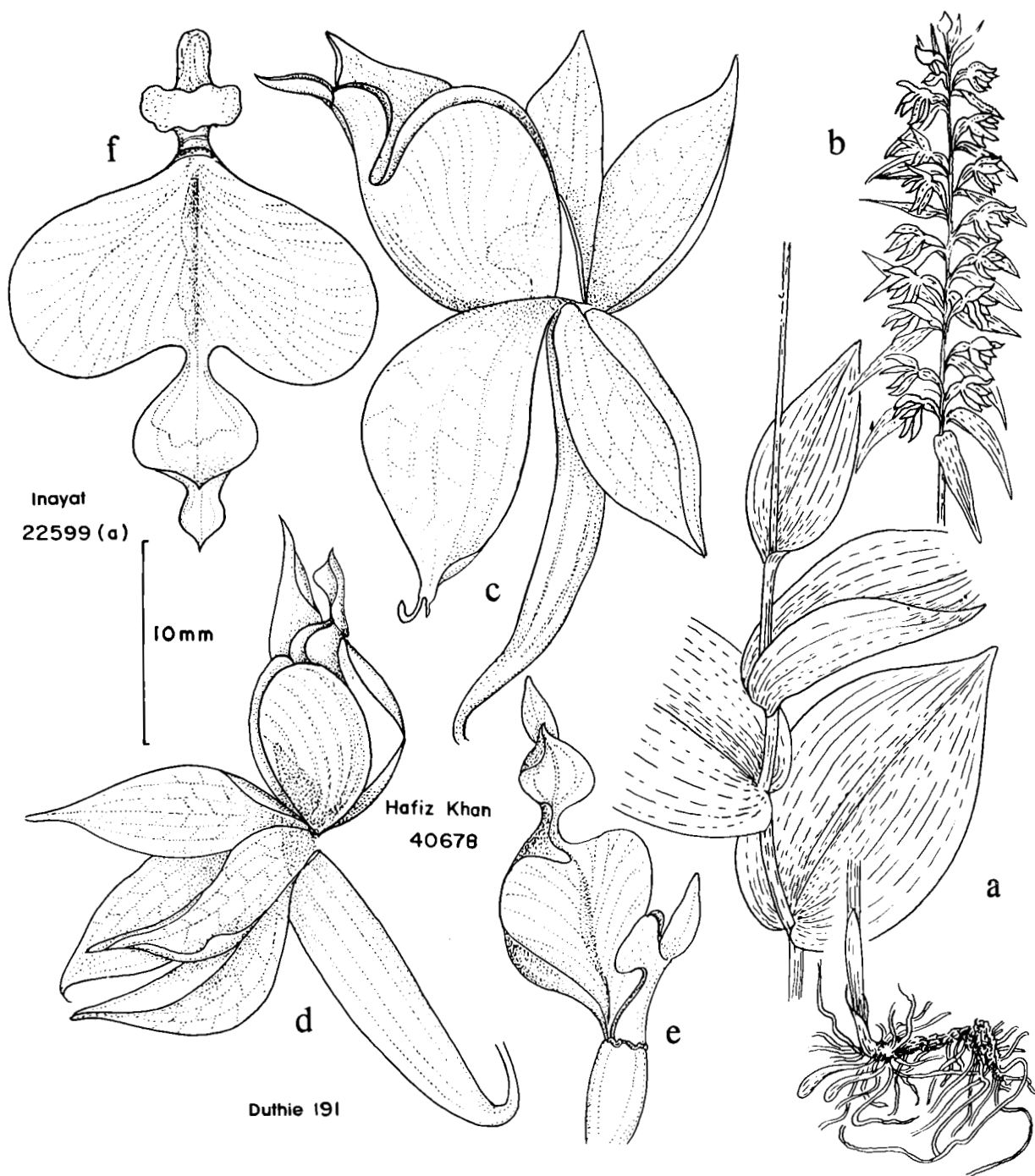
Terrestrial herbs. *Stem* decumbent and succulent at the base. *Leaves* membranous. *Inflorescence* erect with few flowers. *Sepals* joined for half their length to form a swollen tube. *Petals* shorter than sepals. *Lip* saccate or cymbiform at base, the sac with enclosed calli or setae; the anterior lobe clawed, bi-lobulate or fimbriate. *Column* thickened with two long fleshy appendages in front. *Stigma* 2, lateral. *Anther* erect; *Pollinia* 2, bipartite, inserted by a short caudicle on an oblong gland.

**Cheirostylis griffithii** Lindl in Journ. Linn. Soc. Bot. 1: 188. 1857; Hook. f., 6: 105. 1890; King & Pantl. 299, t. 397. 1898; Seidenf., 32: 65. fig. 36. 1978; Pangtey & Kalakoti, 170. 1983.

*C. macrantha* Schltr. Fedde, Repert. 2: 83. 1906.

(Fig. 8)

Plant 10-70 cm high. *Stem* Succulent, decumbent below, bearing few sheaths. *Leaves* withered at flowering time, 18-25 × 12-15 mm, ovate, sub-acute, base cuneate; petiole short. *Peduncle* as long as the stem, slender, pubescent. *Flowers* white, one or two at the apex of peduncle, about 20 mm long. *Bracts* lanceolate, acuminate, shorter or longer than ovary. *Sepals* spreading, connate to the middle in to a tube, pubescent. *Petals* narrowly oblong, falcate, acute, shorter than the sepals. *Lip* with an elongated concave base, slightly saccate, the sac with two parallel rows of short glandular setae; apical-lobe orbicular, edges coarsely fimbriate. *Column* elongate.



**Fig. 9** *Epipactis gigantea* Dougl. ex Hook. — a. plant; b. raceme; c. & d. flower; e. & f. lip with column.

*Flowering:* December.

*Distribution:* Himalaya up to 1500 m (Kumaun to Arunachal Pradesh), Meghalaya, Assam, Nagaland. Burma, Thailand, Indo-China.

*Specimens examined:*

KUMAUN: **Nainital**-Above Sattal, *Pangtey* 4302; *Kalakoti* 508 & 3328.

Stewart (1972) has reduced wrongly *Habenaria griffithii* Hook. f., as a synonym of *Cheirostylis griffithii* Lindl. Therefore the specimens quoted by Stewart (1972) belong to *Diphylax griffithii* (Hook. f.) Kranzl. (syn. *Habenaria griffithii* Hook. f.).

### Epipactis Zinn

Terrestrial herbs with horizontal or vertical, often short, rhizomes, numerous fleshy roots. *Stem* erect. *Leaves* sessile, plicate. *Flowers* racemose, drooping. *Bracts* elongating and often leafy. *Sepals* and *petals* broadly lanceolate, acuminate, strongly nerved. *Lip* adnate to the base of the column, distinctly divided into hypochile and epichile; hypochile concave or saccate, strongly deflexed; epichile more or less cordate or triangular. *Column* short, with a shallow cup at its apex; stigma large, prominent, more or less transversely oblong; *rostellum* broad, prominent. *Anther* free, hinged at the top of the summit of the column, obtuse. *Pollinia* 2, bipartite, narrow; *caudicle* absent.

#### Key to species

1. Flowers small; sepals and petals upto 10 mm long, epichile simple, not lobed, broadly cordate, margin erose, upper surface with two globular calli near the base; hypochile sub-globose almost cup shaped without any projecting free edges above its point of attachment to the epichile ..... 3
- + Flowers large; sepals and petals about 14-15 mm long; epichile trilobed, side lobes round, erect, terminal lobe lanceolate, spreading, margin entire, base cuneate, upper surface without any globular calli near the base; hypochile concave with free edges above the point of attachment to the epichile ... 2
2. Hypochile when spread out, oblong with a hastate base, 1.5-2 mm broad, less in breadth than the epichile ..... *E. veratrifolia*
- + Hypochile when spread out, obovate with a cuneate base, 14-20 mm broad, much broader than the epichile ..... *E. gigantea*
3. Stem with leaves in close succession; rostellum with a persistent globose viscid gland ..... *E. helleborine*
- + Stem in the middle portion with 3( – 4) leaves; rostellum suppressed, viscid gland lasting only for a short time ..... *E. persica*

**Epipactis gigantea** Dougl ex Hook., Fl. Bor.-Americ. 2: 202 (15. XI. 1839); Duthie 162. 1906; Renz, 44. 1978; Renz 14, 1984.

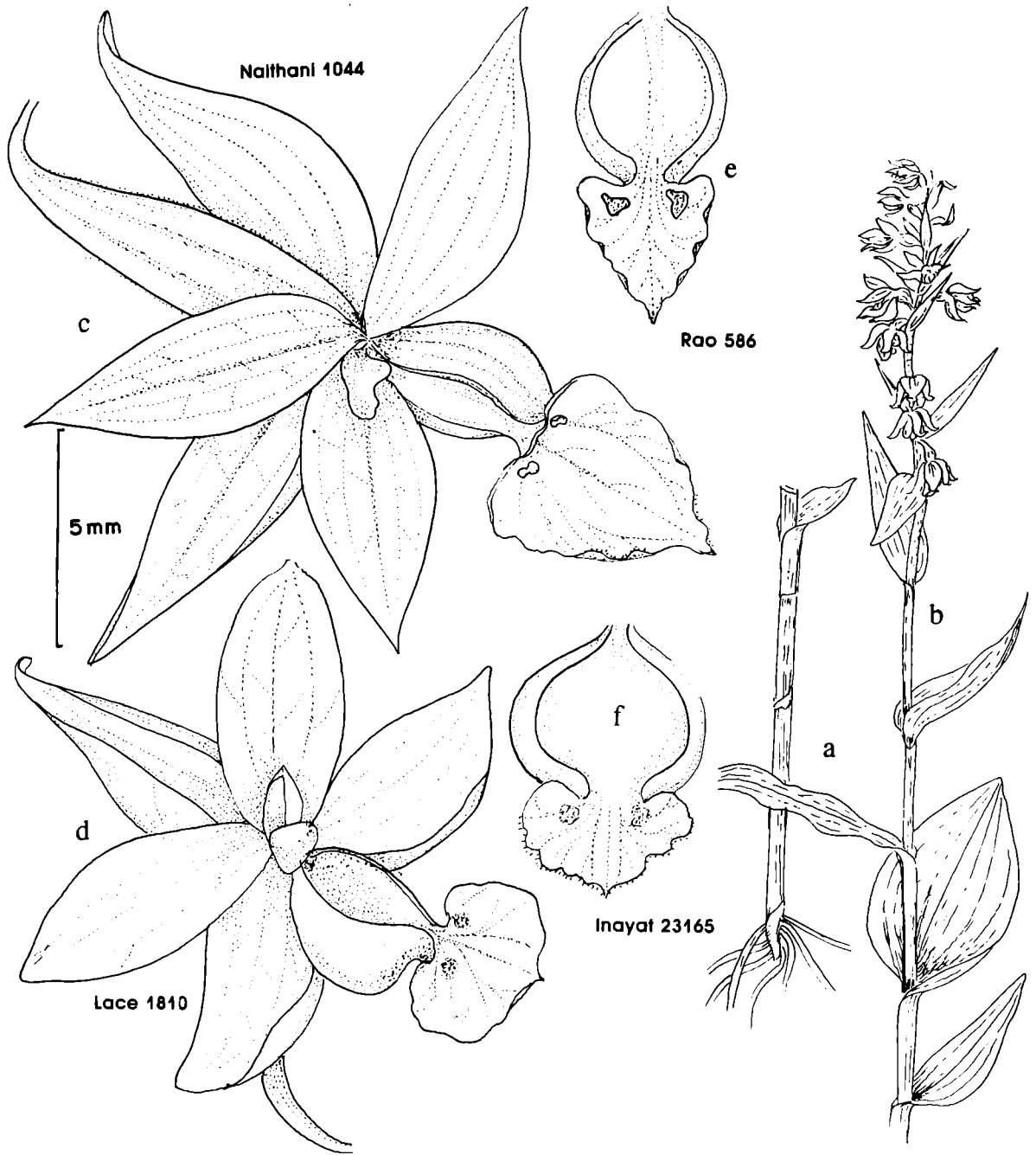
*E. royleana* Lindl. in Royle, Ill. Bot. Himal. Mount. 368 (II. 1839) *nom. nud.*; Gen. & Sp. Orch. 461. 1849; Hook. f., 6: 126, 1890; Collett, 499. 1902; Stewart, 68. 1972.

*Cephalanthera royleana* (Regl.) Boiss. Fl. Or. 5: 85. 1882.

*Helleborine royleana* (Lindl.) Soo in Fedde Repert. 24: 35. 1927.

(Fig. 9)

Plant erect, up to 90 cm tall. *Rhizome* elongated, creeping, stoloniferous with hairy roots. *Stem* glabrous, leafy, clothed at the base with broad loose sheaths. *Leaves* flat, membranous, rarely somewhat folded, ovate or ovate-lanceolate, acute or acuminate, the margins scabrous, 10-15 x 2.5-3 cm. *Raceme* 10-30 cm long, 20 to many flowered, rhachis minutely pubescent. *Flower* drooping, distant, pedicelled, 2.5 cm in diameter, green veined red and a reddish-yellow lip. *Bracts* longer than the flowers, lanceolate, acuminate,



**Fig. 10** *Epipactis helleborine* (Linn.) Crantz—**a.** lower part of plant; **b.** plant; **c.** & **d.** flower, **e.** & **f.** lip.

the lower one large and leaf like. *Sepals* spreading, ovate or ovate-lanceolate, concave, up to 20 mm long. *Petals* slightly shorter than the sepals, broadly ovate, oblique. *Lip* longer than the sepals, glabrous, hypochile obovate, ca 10 mm long, with a cuneate base, 14-20 mm broad, much broader than epichile; epichile narrowly ovate, 6-12 mm long, near the base 5-7 mm broad with two fleshy, wine-red coloured bosses.

*Flowering*: July - August.

*Distribution*; Himalaya 2500-4000 m (Pakistan, Kashmir to Bhutan). S.E. Tibet, Afghanistan, N.W. America.

*Specimens examined*:

GARHWAL: **Uttarkashi**-Ganges Valley between Bhyraunghati and Gangotri, *Duthie* 2069; Jangla in Ganga Valley, *Duthie* 191.

KUMAUN: **Pithoragarh**-Budhi, Byans, *Duthie* 6000.

HIMACHAL PRADESH: Kinnaur, *Janardhanan* 53675; Baspa Valley, *lace* 352; Manali, *Bor* 14087; Pangi, *Harsukh* 23336.

JAMMU & KASHMIR: Sind Valley, *Stewart* 21362; Pir Panjal, *Inayat* 25393; Gilgit, *Giles*, Nail Gurez, *Forests* 88.

PAKISTAN: Kangan Hazara, *Inayat* 22599, 22599 (a), *Hafizkhan* 40678; Chitral, *Harriss*.

*E. royleana* Lindl., is not distinct from *E. gigantea*. We have not been able to follow clearly the remarks of J.D. Hooker (1890), that Lindley's description is based on a very bad specimen in which the epichile is constricted in the middle, probably by accident, as this organ contracts much in drying. This condition is natural, and the epichile is always lobed. Not only in all the specimens we have examined but also the illustration Curtis Bot. Mag. 7690 shows clearly that the epichile is constricted in the middle and it is three lobed.

**Epipactis helleborine** (Linn.) Crantz, Strip. Austr. ed. 2: 467. 1769; Stewart, 68. 1972; Renz, 37. 1978. et 15. 1984.

*Serapias helleborine* Linn. Sp. Pl. 949. 1753.

*S. helleborine* var. *latifolia* Linn. Sp. Pl. 949. 1753.

*S. latifolia* (Linn.) Huds. Fl. Angl. 341. 1762.

*Epipactis latifolia* (Linn.) All., Fl. Pedemont. 2: 152, 1758; Hook. f., 6: 125. 1890; King & Pantl. 271, t. 363. 1898; Collett, 498, 1902; Duthie, 160. 1906.

*E. atrorubens* auct. non Schult. Oestreichs Fl. ed. 2, 1: 538. 1814.

*E. consimilis* D. Don, Prodr. F. Nepal 28. 1825.

*E. macrostachys* Lindl. Gen. & Sp. Orch. 461. 1840.

*Serapias consimilis* (D. Don) Eaton in Proc. Biol. Soc. Wash. 21: 67. 1908.

*Helleborine macrostachya* (Lindl.) Soo in Ann. Hist. Nat. Mus. Nation. Hungar. 26: 381. 1929.

*Epipactis latifolia* (Linn.) All. var. *herbacea* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 125. 1890; Duthie, 161. 1906.

*E. helleborine* (Linn.) Crantz var. *herbacea* (Lindl.) Mitra in Ind. For. 99: 101. 1973.

*E. latifolia* (Linn.) All. var. *thomsoni* Hook. f., Fl. Brit. Ind. 6: 126. 1890; Duthie, 161. 1906.

*E. helleborine* (Linn.) Crantz var. *thomsoni* (Hook. f.) Stewart, Fl. W. Pak. 68. 1972; Mitra, 101. 1973.

(Fig. 10)

Plants small slender or robust, up to 70 cm high. *Rhizome* very short, woody, with numerous roots. *Stem* with leaves in close succession, lower portion glabrous, the upper portion minutely pubescent. *Leaves* spreading, elliptic to ovate-lanceolate or lanceolate, lower shortened and broadened, upper decreasing and



Fig. 11 *Epipactis persica* (Soo) Nannfeldt—a. plant.



becoming narrower, the upper most bract like normally 7.5-12 × 5-7.5 cm, margin often ciliolate. *Raceme* up to 25 (-35) cm long, loose or dense, many flowered, sometimes one sided. *Flowers* green, flushed more or less intensely with red violet or yellowish-green, open bell-shaped, 1.3-2 cm across. *Bracts* lanceolate, the lower exceeding the flower, the upper about equalling the ovary. *Sepals* ovate-lanceolate, up to 12 mm long, sometimes brownish veined. *Petals* slightly shorter, ovate. *Lip* stretched forward; hypochile cup shaped, green outside, dark olive-brown, shining inside, 4-6 mm long and broad, containing nectar; epichile cordate with an acute or reflexed tip, up to 5 mm long, the margins slightly crenulate or undulate, with two smooth or slightly wrinkled bosses at the base, rostellum with a white, persistent, viscid gland.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-4000 m (Pakistan, Kashmir to Bhutan). Afghanistan, Europe, Iraq, N. Africa, Hongkong, Japan, Upper Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Renz* 13573, *Saxena* 934; Arnigadha below Mussoorie, *Banwarilal* 22721(a); near Mussoorie, *Mackinnon* 21746 (a); above barlowganj, *Renz* 13573; Chakrata, *Bhattacharyya* 16025; Deoban, *Raizada* 18221. **Tehri**-near Tal on way to Nagtibba, *Naithani* 1069; Nagtibba, *Bhattacharyya* 33752; Bok Hills, *Harsukh*; near Dhanolti, *Renz* 13640. **Uttarkashi**-Rhudughera, *Duthie* 193; Ganga Valley above Jangla, *Duthie* 513. **Pauri**-near Khirsu, *Naithani* 1050, *Renz* 13634. **Chamoli**-Chopta, *Naithani* 1044; Kanga area, *Naithani* 53977; Bhyundar Valley, *Bhattacharyya* 29582.

KUMAUN: **Pithoragarh**-Panch-Chuli, *Thomas* 20940; Dafiadhura; *Arora* 50056; Dharma Valley, *Inayat* 24090; Mushyari Gori Valley, *Inayat* 24090 (a). **Nainital**-Nainital above University, *Renz* 13585; Naina peak, *Renz* 13597; St. Loes, Nainital, *Champion* 6114; Agarpatta, *Champion*. **Almora**-Binsar, *Vohra* 58052; between Ranikhet & Chaubatia, *Renz* 13589.

HIMACHAL PRADESH: Shimla Hills, *Drummond* 708; Jako, *Raizada* 14328; near Observatories, *Gamble* 4644 (b); Manali, *Bhattacharyya* 44756; Kinnaur rakcham, *Janardhanan* 53537; Chotadorni Lahul, *Aswal* 11038; Koti, *Bor* 15524; Pangi, *Kain forest*, *Lace* 1810.

JAMMU & KASHMIR: Baisaran, *T.A. Rao* 586; Pahlgam, Liddar Valley, *Inayat* 25392.

PAKISTAN: Kund, Saran Range, Hazara, *Inayat* 23165.

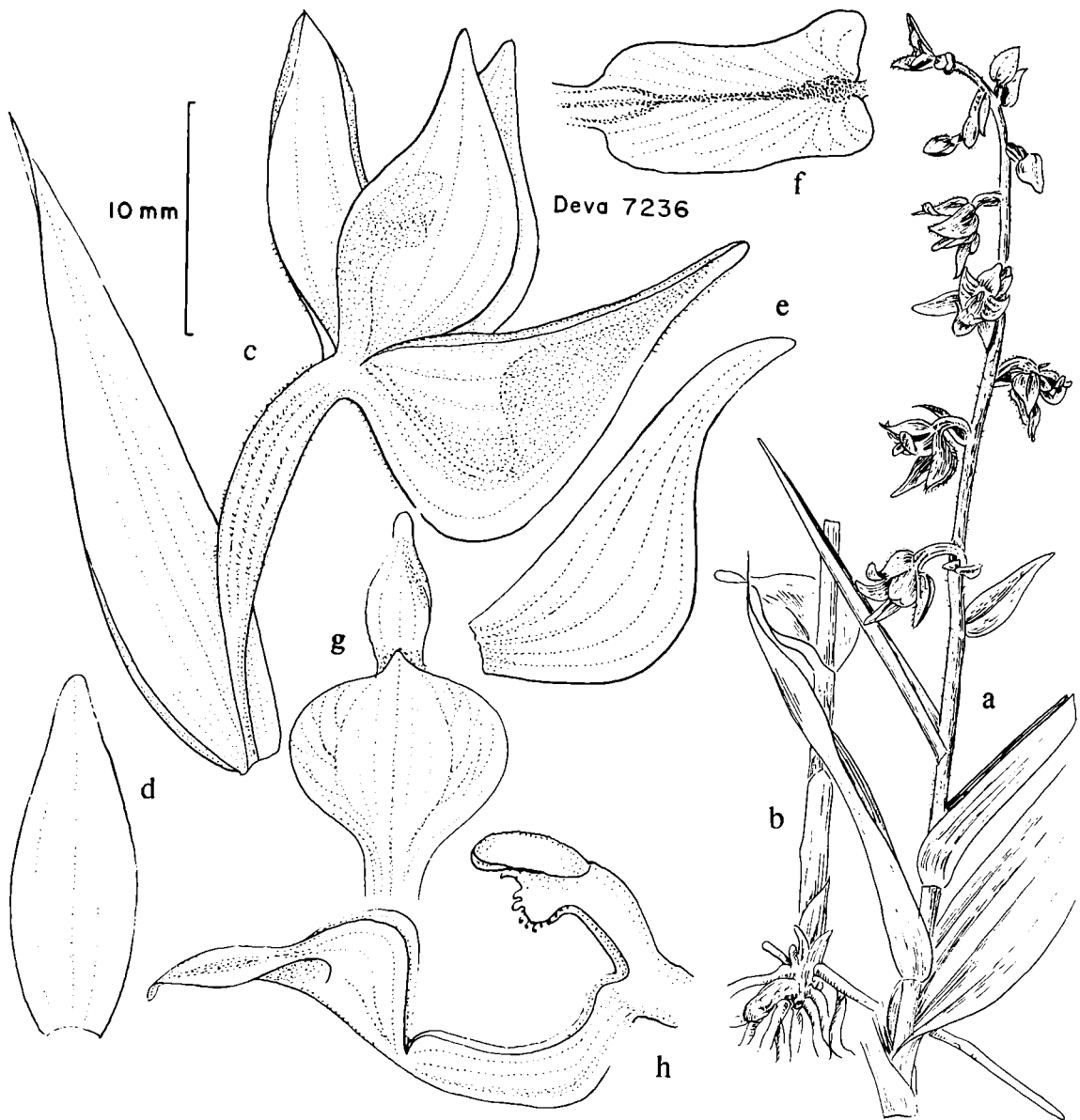
*E. helleborine* is a very variable species. Leaves ranging from orbicular to narrowly lanceolate; racemes very dense to lax flowered, often reduced to only few flowers placed at long distance from each other; epichile also varies from almost orbicular to ovate with retuse to acute or acuminate apex.

***Epipactis persica*** (Soo) Nannfeldt, Bot. Not. 1946: 11. 1946; *Renz*, 39. 1978; & 17. 1984.

*Helleborine persica* Soo, Fedde, Repert. 24: 37. 1927.

(Fig. 11)

Plant generally slender, 10-60 cm high. *Rhizome*, elongated, deep in the ground, knotted with numerous long filiform roots. *Stem* mostly thin, sometimes 3(-4) foliate. *Leaves* arranged in the mid-section of the stem, the lowest in well developed plant inserted 10-20 cm above the ground, elliptic or ovate-lanceolate, acute or apiculate, flat or folded upto 6(-8) cm long. *Raceme* more or less loosely few or many flowered, rarely 2-3 flowered, occasionally one-sided, rhachis more or less pubescent, up to 15(-30) cm long. *Flowers* spreading, rather small, green, with a campanulately spreading perianth. *Bracts* changing in size from the large leaf like lower ones to the short, lanceolate upper one, the lower up to 5 cm long, the upper more or less equalling the ovary. *Sepals* ovate-lanceolate, up to 10 mm long. *Petals* slightly shorter, ovate, pale-green. *Lip* with a cup-shaped hypochile and a triangular epichile; hypochile outside olive-green, inside deeply brownish-green, shining, containing nectar, 3-4 mm long and broad; epichile 3-5 mm long with slightly crenulate margins and two smooth bosses at the base, pale-green towards the apex and often pale rose-violet tinged towards the base; *rostellum* suppressed, with a white viscid gland which lasting only for a short time.



**Fig. 12** *Epipactis veratrifolia* Boiss. & Hohen. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. lip hypochile; f. lip epichile; g. column with lip.

*Flowering*: July - August.

*Distribution*: Himalaya (Pakistan, Kashmir). Anatolia, Iran, Afghanistan.

*Specimens examined*:

JAMMU & KASHMIR: Gilgit, *Stewart, Giles*.

PAKISTAN: Chitral, In Valle Bomboret prope Karagel, *Renz 10783*; Murree Hills Hazanra, *Renz 10806* (*Renz, loc. cit.*).

**Epipactis veratrifolia** Boiss & Hohen. in Boiss., *Diagn. Pl. Or. Nov. Ser. 1, 13: 11. 1854*; *Hunt, 24: 76. 1970*; *Renz, 40. 1978 & 14. 1984*.

*Helleborine veratrifolia* (Boiss & Hohen.) Bornm., *Beih. Bot. Centrbl. 33: 205. 1915*.

*Epipactis consimilis* Wall. ex Hook. f., *Fl. Brit. Ind. 6: 126. 1890, nom. illegit, non D. Don (1825)*; *King & Pantl. 272, t. 364. 1898*; *Collett, 498. 1902*; *Duthie, 161. 1906*.

*E. somaliensis* Rolfe in Thiselton-Dyer *Fl. Trop. Afr. 7: 189, 1897*.

*Helleborine consimilis* (Wall. ex Hook. f.) Druce in *Bull. Torr. Bot. Club 36: 547. 1909, nom. illegit*.

*Epipactis wallichii* Schltr. in *Anz. Akad. Wiss. Wien. 62: 275. 1920*; *Stewart, 68. 1972. (Fig. 12)*

Plant erect or pendent, up to 120 (– 150) cm tall. *Rhizome* short, often woody. *Stem* straight or flexuous, densely leafy, glabrous below, minutely pubescent above. *Leaves* ovate-lanceolate to lanceolate, acute or acuminate, 15-20 (– 25) × 2-2.5 cm, papery. *Raceme* 10-15 cm long, laxly flowered. *Flowers* 2-2.5 cm across, spreading greenish-purple. *Bracts* ovate to lanceolate, leaf-like, the lower much long than flowers, the upper gradually diminishing, upper most more or less equal to the ovary. *Sepals* spreading, ovate-lanceolate, minutely pubescent. *Petals* slightly shorter than sepals, outside tomentose on the mid-rib. *Lip* slightly shorter than the sepals, curved; hypochile narrowly boat shaped, oblong, 10-12 mm long, with a hastate base, 1.5-2 mm broad, less in breadth than the epichile, near the base with two small, erect triangular side-lobes; epichile ovate-lanceolate. 9-11 mm long, with somewhat erect, semi-ovate side-lobes, reddish brown with a white tip.

*Flowering*: February - July

*Distribution*: Himalaya 300-1000 m (Pakistan, Kashmir to Bhutan). Turkey, Cyprus, Syria, Lebanon, Oman, Iraq, Iran, Afghanistan, Baluchistan, Somalia (E. Africa) and China (Yunnan).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Siwaliks, Thanda Sot, *Deva 7236*; Sahashtradhara, *Duthie 10783, Aswal 6271*; Kaulagarh Tea Estate, *Raizada, Mussoorie, Saxena 1688*; Near Mussoorie, *Mackinnon 22720*; Jharipani, *Deva 2200, 3385*. **Chamoli**-Batwalchhari, *Mehrotra 3910*.

KUMAUN: **Nainital**-Hathi khund, Kalagarh Division, *Champion*.

HIMACHAL PRADESH: Manali, without name of collector.

JAMMU & KASHMIR: Poonch, *Rashid & Stewart 24852*.

PAKISTAN: Dharmyal, Rawalpindi District, *Mohindar Nath 17260*; Chitral, *Duthie's collector 16673, 16674*.

### **Epipogium** Gmelin ex Borkhausen

Terrestrial, leafless, saprophytes. *Rhizome* tuberous or coralloid, without roots. *Stem* simple, erect, sheathed, fleshy. *Scapae* erect, bearing a few sheathing membranous bract. *Flowers* few, laxly racemose. *Sepals* and *petals* subequal, free, narrowly oblong, erect connivent. *Lip* adnate to the base of the column, ovate, entire or 3-lobed, the base broad and spurred; disc with papillose ridges. *Column* short, without a foot. *Stigma* broad, prominent. *Anther* horizontal, tumid, 2-chambered. *Pollinia* 2, bifid, each with a slender curved caudicle and a small gland.

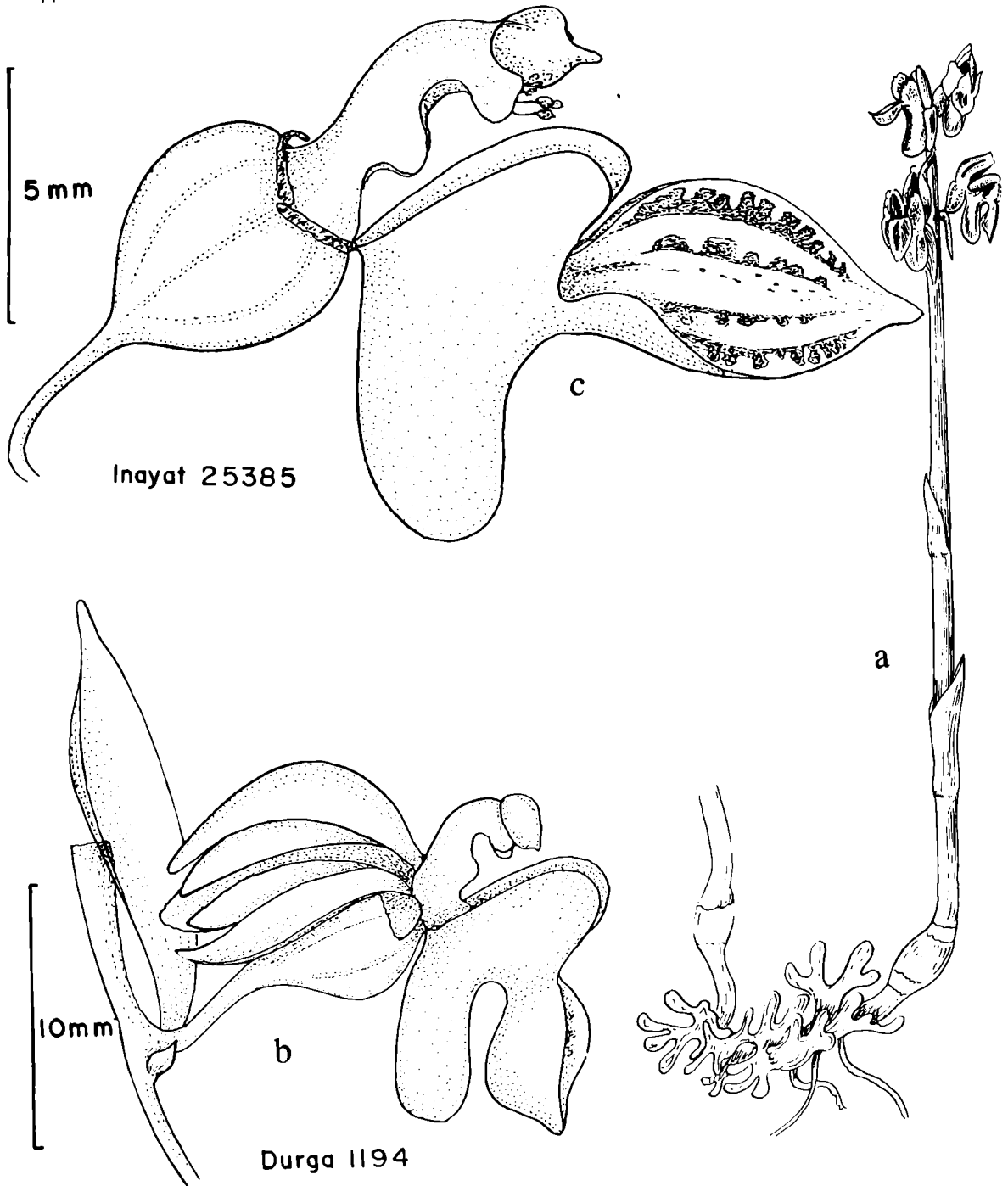


Fig. 13 *Epipogium aphyllum* (F.W. Schmidt) Swartz—*a.* plant; *b.* flower; *c.* column & lip.

## Key to species

- Rhizome coralloid; lip 3-lobed ..... *E. aphyllum*  
 + Rhizome tuberous, lip entire not lobed ..... *E. tuberosum*

**Epipogium aphyllum** (F.W. Schmidt) Swartz, Summa Veget. Scand. 32, 1814; Hook. f. 6: 124. 1890; King & Pantl. 252, t. 334. 1898; Collett, 497. 1902; Duthie, 150. 1906; Stewart, 69. 1972; Renz, 20. 1978; & 10. 1984.

*Satyrium epipogium* Linn. Sp. Pl. 945. 1753.

*Orchis aphylla* F.W. Schmidt in Mayer, Samml. Phys. Aufs. 240. 1791. *non* Forsk. (1775).

*Limodorum epipogium* (Linn.) Swartz in Nov. Act. R. Soc. Upsal. 6: 80, t. 5, f. 4 b. 1799.

*E. gmelini* L.C. Rich. Orch. Eur. Annot. 36. 1817.

(Fig. 13)

Saprophytic. *Rhizome* coralloid, branched. *Stem* up to 35 cm tall, often very stout, pale-yellowish, semi-translucent, sometimes tinged with pinkish linear markings, swollen above the base, with 1-2 short, close fitting far removed sheaths. *Leaves* absent. *Raceme* initially nodding, then becoming erect, 3.5 cm long, loosely 3-6 flowered, rarely many flowered. *Flowers* about 2 cm across, pale-yellow, partly pinkish, nodding. *Bracts* linear-oblong or ovate, membranous, spreading or bent downwards, more or less as long as the ovary. *Sepals* and *petals* equal in length, erect, connivent, narrowly oblong-lanceolate, sub-acute. *Lip* at the base with a large sack-shaped inflated spur which is tinged on the side with pale- red or violet lines and spots, trilobed; side lobes small, roundish, the mid-lobe oval, rather pointed with tubercled violet tinged, longitudinally arranged crests.

*Flowering*: September.

*Distribution*: Himalaya 2400-4000 m (Kashmir, Himachal Pradesh, Garhwal, Nepal to Arunachal Pradesh). Tibet, Europe, Siberia, China, Japan, Korea.

*Specimens examined*:

GARHWAL: **Uttarkashi**-Near Gangotri, *Durga* 1194. **Chamoli**-Ghangarea, *M.A. Rau* 31751, *Bhattacharyya* 24213.

HIMACHAL PRADESH: Above Polang, Kangra Valley, *Vaid* 24218; Kulu Rahla Forest, *M.A. Rau* 12799(A).

JAMMU & KASHMIR: Naphran nala, Liddar Valley, *Inayat* 25385.

**Epipogium tuberosum** Duthie in Ann. Roy. Bot. Gard. Calc. 9(2): 151. 1906; Rau & Rao, 3: 30. fig. 3. 1961; Rau, 171. 1964; Stewart, 69. 1972; Hegde & Rao, 599. 1982. et 386. 1983; Renz, 11. 1984.

(Fig. 14)

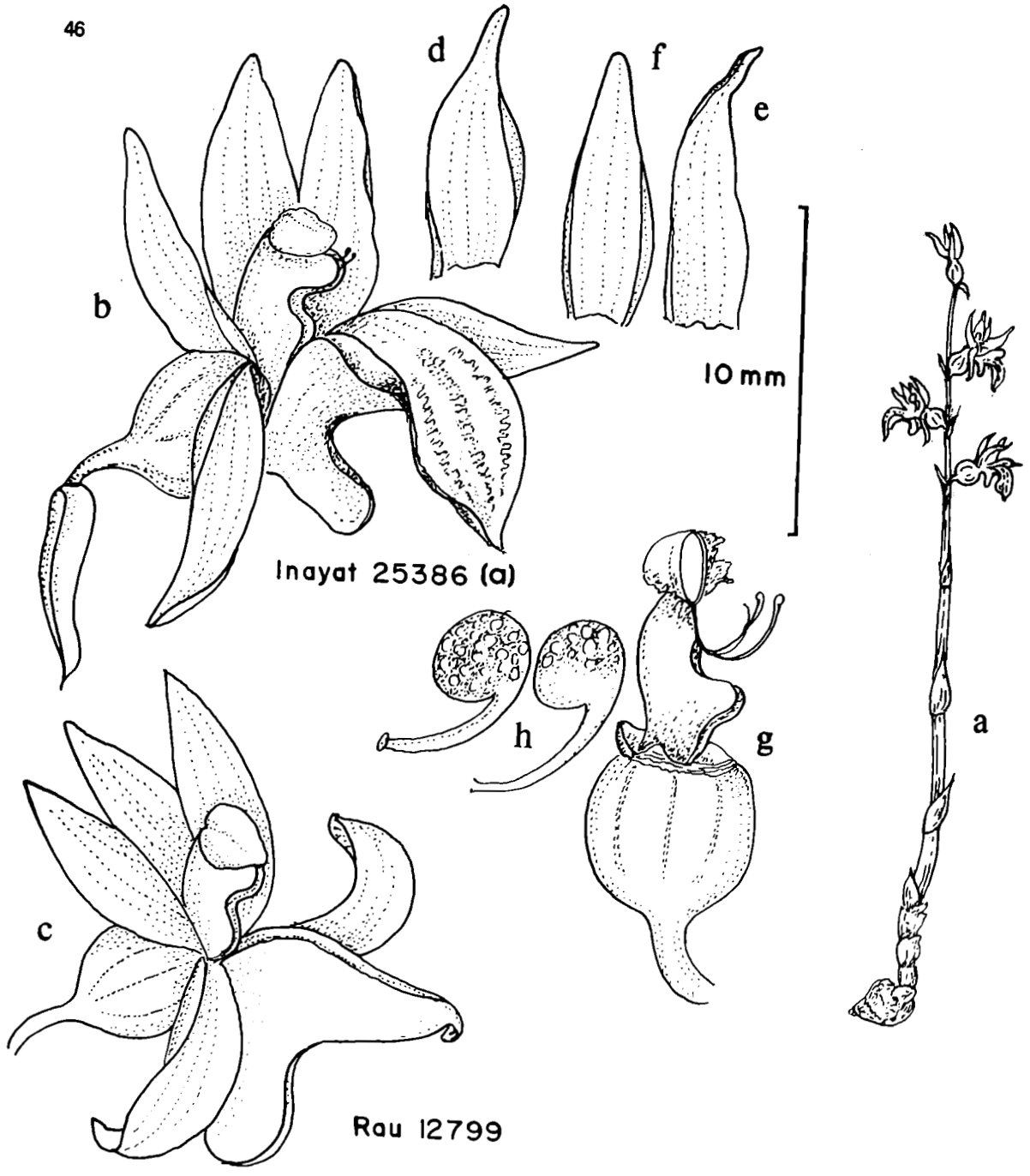
Saprophytic. *Rhizome* tuberous, not coralloid. *Stem* up to 30 cm tall, stout, pale-yellowish, semi-translucent, tinged with pinkish or brown, swollen above the base, with 1-2 short, close fitting sheaths. *Leaves* absent. *Raceme* erect, laxly, usually 8-flowered. *Flowers* whitish-pink, nodding. *Bracts* ovate-lanceolate, acuminate, membranous, spreading or bent downwards, as long as or longer than the ovary. *Sepals* and *petals* 8 mm long, broad, 3-nerved. *Lip* longer than sepals, ovate, acute, without side lobes, its upper surface with three carunculate ridges, margins not erose. *Spur* as long as the lip, slender, apex less rounded.

*Flowering*: September.

*Distribution*: Himalaya 2700 (Kashmir to Garhwal and Arunachal Pradesh).

*Specimens examined*:

GARHWAL: **Chamoli**-Ghangaria, *M.A. Rau* 31745, *Nair* 35933.



**Fig. 14** *Epipogium tuberosum* Duthie—**a.** plant; **b.** & **c.** flowers; **d.** dorsal sepal; **e.** lateral sepal; **f.** petal; **g.** column & ovary; **h.** pollina.

HIMACHAL PRADESH: Kulu-Manali, Rahla Forest, M.A. Rau 12799.

JAMMU & KASHMIR: Pahlgam, Liddar Valley, Inayat 25386(a) type.

PAKISTAN: Hazara (Stewart, L.c.).

*E. tuberosum* is a distinct species which is very similar in general appearance of *E. aphyllum*. Both these species are found above 2500 m in Himalaya, and their population grows mixed up together, both of them have also been collected from the same spot almost on the same dates. *E. roseum* (D. Don) Lindl. of most of the recent authors to is distinct from *E. tuberosum*. It is found in low hot valleys and plains, usually at much lower altitude. The flowers are in raceme and usually many more than ten, smaller and whitish-pink coloured.

There is specimen of *Davidson* without number, collected in 1876 from below Nainital deposited in DD an another by *Anderson* 1210 from Sikkim (DD), which have tuberous roots and 3-lobed lip. These plants may prove new but as they are very old and in a bad state of preservation. We have not pursued the investigation further.

#### Galeola Lour.

Terrestrial, leafless or rarely leafy, fleshy saprophytes. *Stem* long-climbing with a root and a scale-leaf at each node or short and erect from a rhizome bearing fleshy root. *Inflorescence* a terminal panicle or raceme, and also lateral in the axils of the upper scale-leaves of climbing stem. *Flowers* rather large, yellowish or brownish. *Sepals* and *petals* subequal, free, hardly spreading. *Lip* sessile, adnate to the base of the column and convolute round it, entire or 3-lobed with longitudinal ridges; spur absent. *Column* short, incurved, dilated above. *Anther* terminal, conical, 2-chambered. *Pollinia* 2, cleft, granular, without caudicle or gland. *Fruit* a fleshy indehiscent berry or a long dry capsule.

**Galeola falconeri** Hook. f., Fl. Brit. Ind. 6: 88. 1890; King & Pantl. 265, t. 353. 1898; Duthie, 156. 1906; Raizada et al. 46, 1981. (Fig. 15).

Rhizome 4-6 cm thick, branching with large fleshy triangular scales. *Stem* 1-3 m high about 7 cm thick. *Leaves* absent. *Inflorescence* a panicle, 60-80 cm long, drooping. *Flowers* bright yellow, 4 cm across, spongy, with fragrance of vanilla. *Bracts* lanceolate, concave, shorter than the ovary. *Sepals* subequal, broadly ovate, subacute, sparsely-furfuraceous. *Petals* ovate, acute, edges erose. *Lip* sessile, deeply concave, without side lobes, apex rounded, margin undulate and ciliolate, the upper surface papillose, but with a broad glabrous patch near centre.

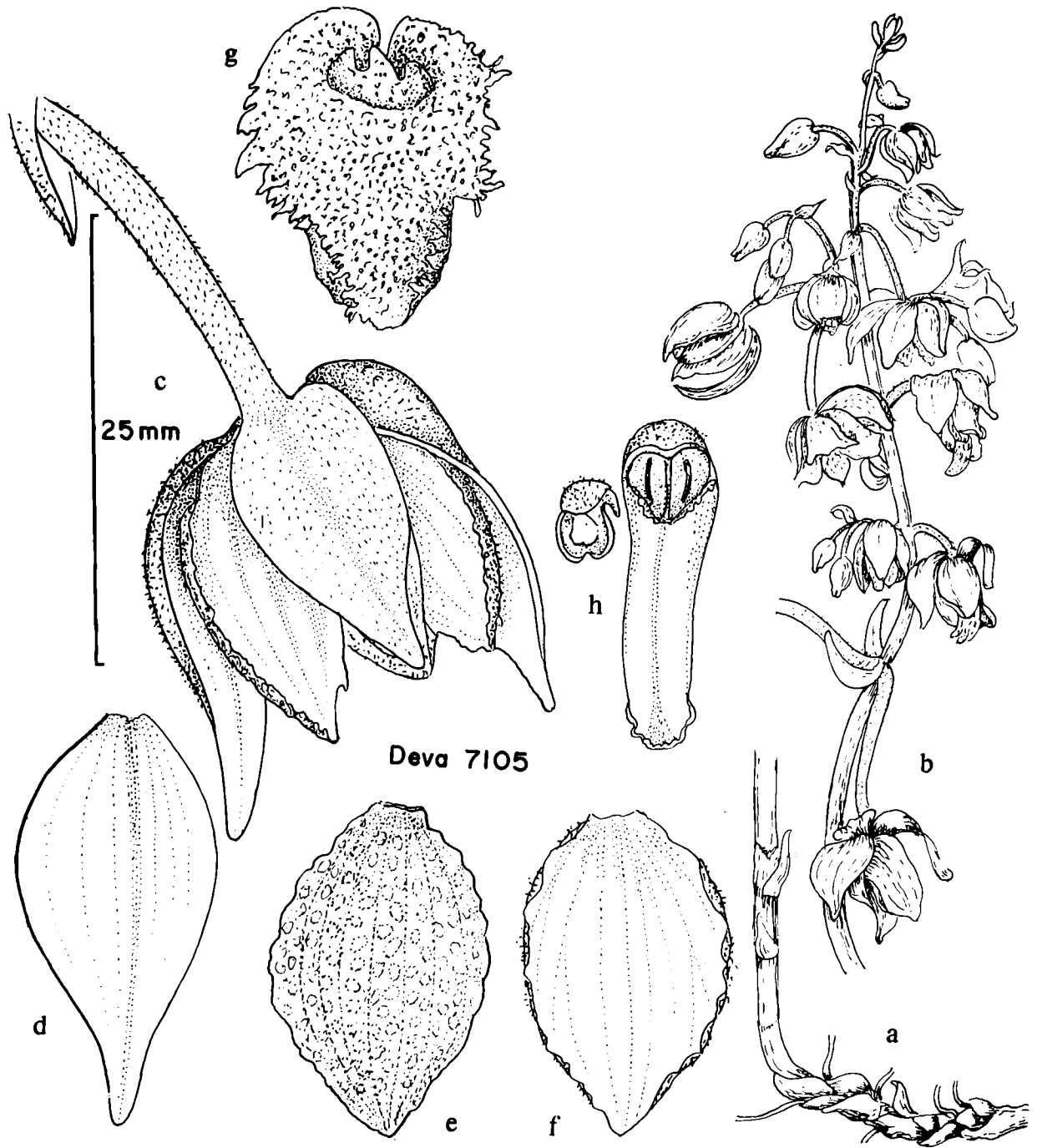
*Flowering*: July - August.

*Distribution*: Himalaya 1200-2000 m (Garhwal, Sikkim and Arunachal Pradesh).

*Specimens examined*:

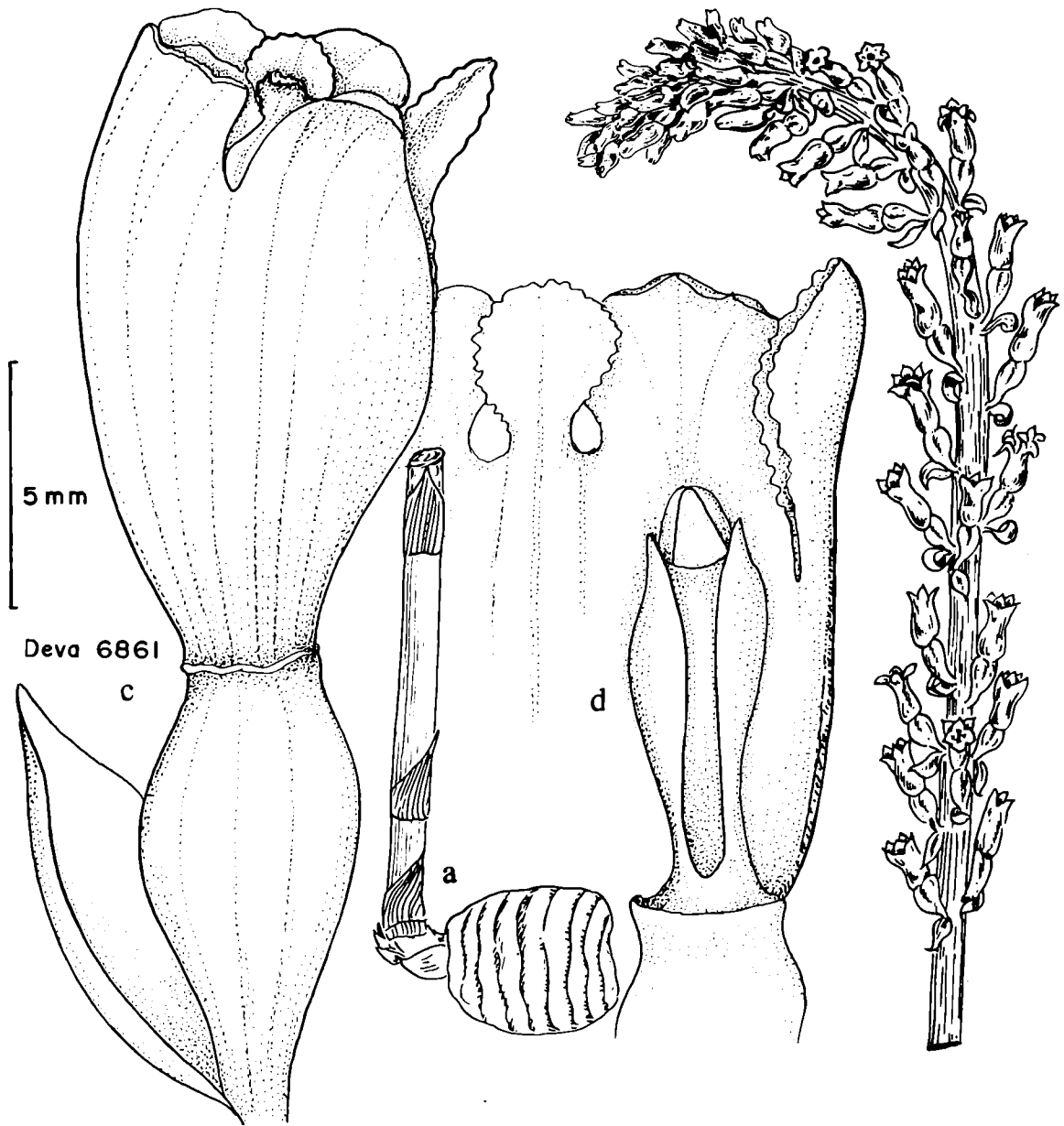
GARHWAL: Dehra Dun-Mussoorie, Mackinnon 22726. Uttarkashi-Tons Valley Purty, Deva 7105.

*G. falconeri* is one of the most elegant orchid. Another very similar orchid is *G. lindleyana* (Hook. f. & Th.) Rchb. f., which differs from this in having smaller flowers, the sepals with strong toothed wavy ribs externally and broadly papillose anthers. Tuyama (1971) mentioned it to be occurring in Garhwal, however Pradhan (1976) thinks it is present only in the east of Khasi Hills and Naga Hills. We have seen no specimen, but distinction between the two can often be difficult when sometimes the characters overlap. Deva's 7105 has sepals furfureaceous externally, and the anthers hairy, while Hook. f. (1890) describes the sepal nearly smooth, and anther glabrous. However after having seen Pantling's No. 88 and studying King & Pantling's description (1898) we are convinced about the identification of our specimens. The sepals definitely do not have strong toothed wavy ribs externally nor the anthers are papillose.

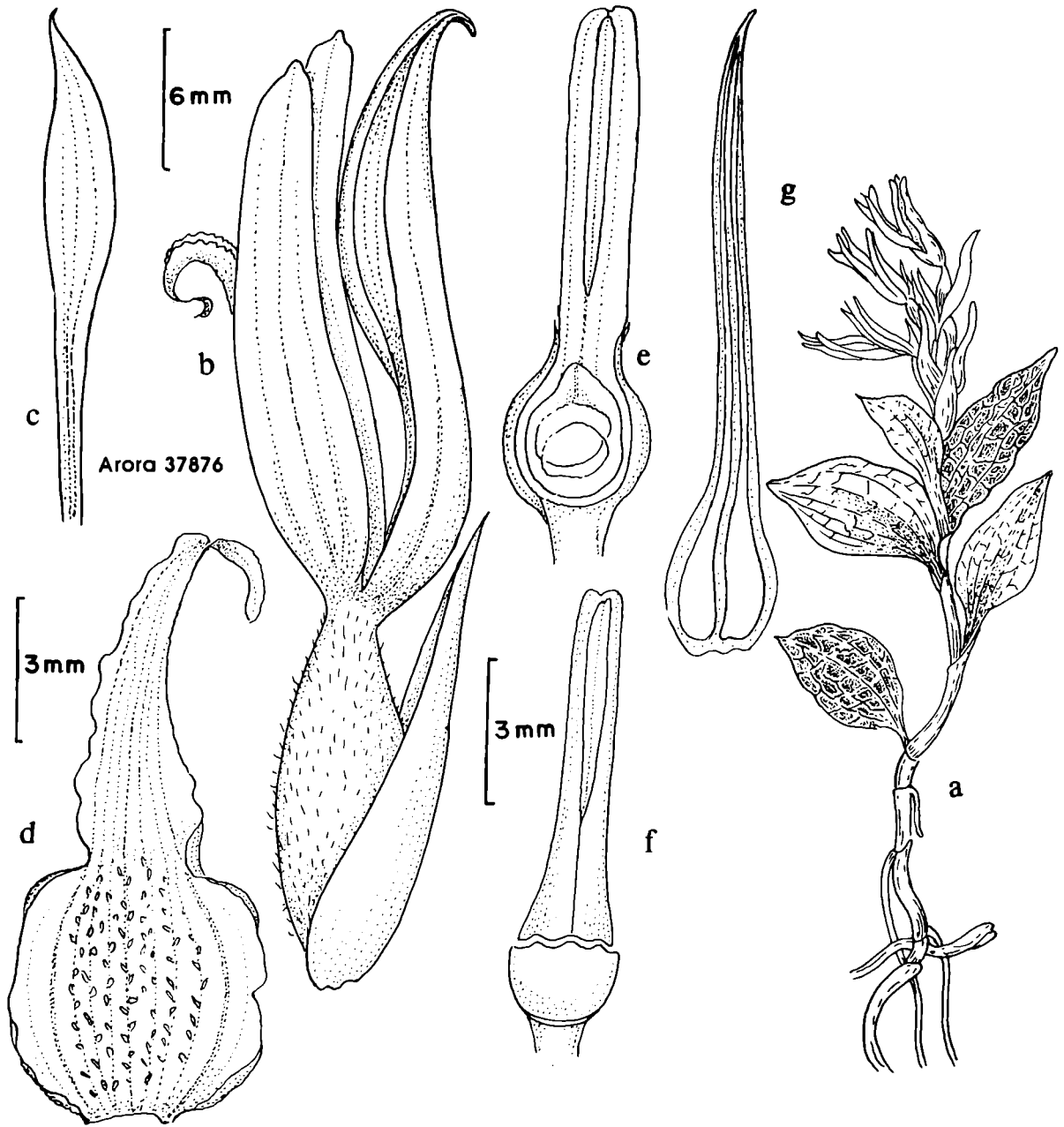


**Fig. 15** *Galeola falconeri* Hook. f. — a. rhizome; b. inflorescence; c. flower; d. lateral sepal; e. petal, outer surface; f. petal, inner surface; g. lip; h. column.





**Fig. 16** *Gastrodia orobanchoides* (Falc.) Benth. — a root tuber, b. inflorescence; c. flower; d. column and open corolla.



**Fig. 17** *Goodyera biflora* (Lindl.) Hook. f.—a. plant; b. flower; c. petal; d. lip; e. column; f. rostellum; g. anther.

**Gastrodia R. Br.**

Terrestrial leafless saprophytes. *Rhizome* horizontal, tuberous, of many short internodes. *Stem* erect, brownish. *Flowers* in a lax raceme. *Sepals* and petals joined together in to a 5-lobed tube, cleft in front between the lateral sepals. *Lip* not lobed, joined to the end of column foot. *Column* long, narrow, sides narrowly winged towards the top, base produced in to a short or long foot; *stigma* at the base of the column, large. *Anther* terminal, erect, 2-chambered., *Pollinia* 2, pyriform, of larger granules, without caudicle or gland. *Fruit* erect, sometimes on an elongated pedicel.

**Gastrodia orobanchoides** (Falc.) Benth. Gen. Pl. 3: 617. 1883; Hook. f., 6: 122. 1890, Collett, 497. 1902; Duthie, 155. t. 121. 1906; Stewart, 69. 1972; Renz, 46. 1984.

*Gamoplexis orobanchoides* Falc., in Trans. Linn. Soc. 20: 293, t. 13. 1851. (Fig. 16)

*Root* a scaly, oblong or ellipsoid, 5-6 cm long tuber. *Stem* 25-60 cm long, erect, pale yellow-brown, smooth or shining with a few, distant sheaths. *Raceme* 20-30 cm long, laxly many flowered. *Flowers* about 12 mm long, 5 mm broad, reddish brown tinged with yellow. *Bracts* linear-lanceolate, 3-nerved, often longer than the ovary. *Sepals* and petals united in to a ventricose tube. *Sepals* all equal, obtuse. *Petals* sub-orbicular, sub-acute, little shorter than sepals. *Lip* longer than the sepals, hypochile narrow, elongated and attached to the walls of the tube; epichile free, ovate with regular margin.

*Flowering*: July - August.

*Distribution*: Himalaya 2500-3000 m (Paskistan, Kashmir to Kumaun).

*Specimens examined*:

GARHWAL: Tehri-Bok Hills, *Harsukh* 24163; Nagtibba, *Ramasukh* 22984, *Harsukh* 24163(a). Uttarkashi-Tons Valley, Taluka, *Deva* 6901; Datmir, *Deva* 6861. Chamoli-Kand, *M.A. Rau* 10370.

KUMAUN: Nainital-Near Nainital, *F.W. Seers*.

HIMACHAL PRADESH: Fagoo, Shimla Hills, *Raizada*; Shimla, *Gamble* 6275(b); Below Panchot & Ramani, Upper Bashahr, *S.P. Sethi* 20308; Chamba, Ahla, *Malhotra & Nair* 27930; Kothi, *N.P. Singh* 22909; Aiwas-Satrundi Road, Kangra district, *Harsukh* 23343; Kitarwari, *Deva* 3625.

JAMMU & KASHMIR: Nil Nag, *Stewart & Nasir* 23088.

PAKISTAN: Murree (Stewart, *loc. cit.*; Renz. *loc. cit.*)

**Goodyera R. Br.**

Terrestrial leafy herbs. *Stem* erect from a creeping base. *Leaves* usually rather thick, petioled. *Flowers* small, numerous, in often twisted spikes or racemes. *Sepals* subequal, often pubescent outside; the dorsal forming a hood with the petals, the laterals free covering the sac of the lip by their bases. *Lip* sessile, erect, on the base of column, hollow or saccate, glandular or with bristly hairs, rarely smooth inside, narrowed to an acute tip which is sometimes reflexed, not lobed. *Column* short without appendages at base; *rostellum* long and deeply cleft, stigma not divided, large, in front of the column. *Anther* dorsal. *Pollinia* 2, pyriform or clavate, granular with or without a strap and a small gland.

**Key to species**

1. Sac of the lip without setae or tubercles inside ..... 2
  - + Sac of the lip setose or tuberculate within ..... 3
2. Sac of the lip smooth inside, without any ridge or callus, its base hidden in between lateral sepals or very slightly projecting beyond them ..... *G. repens*
  - + Sac of the lip with two ridges inside, its base very conspicuously projecting beyond the base of the sepals ..... *G. fusca*

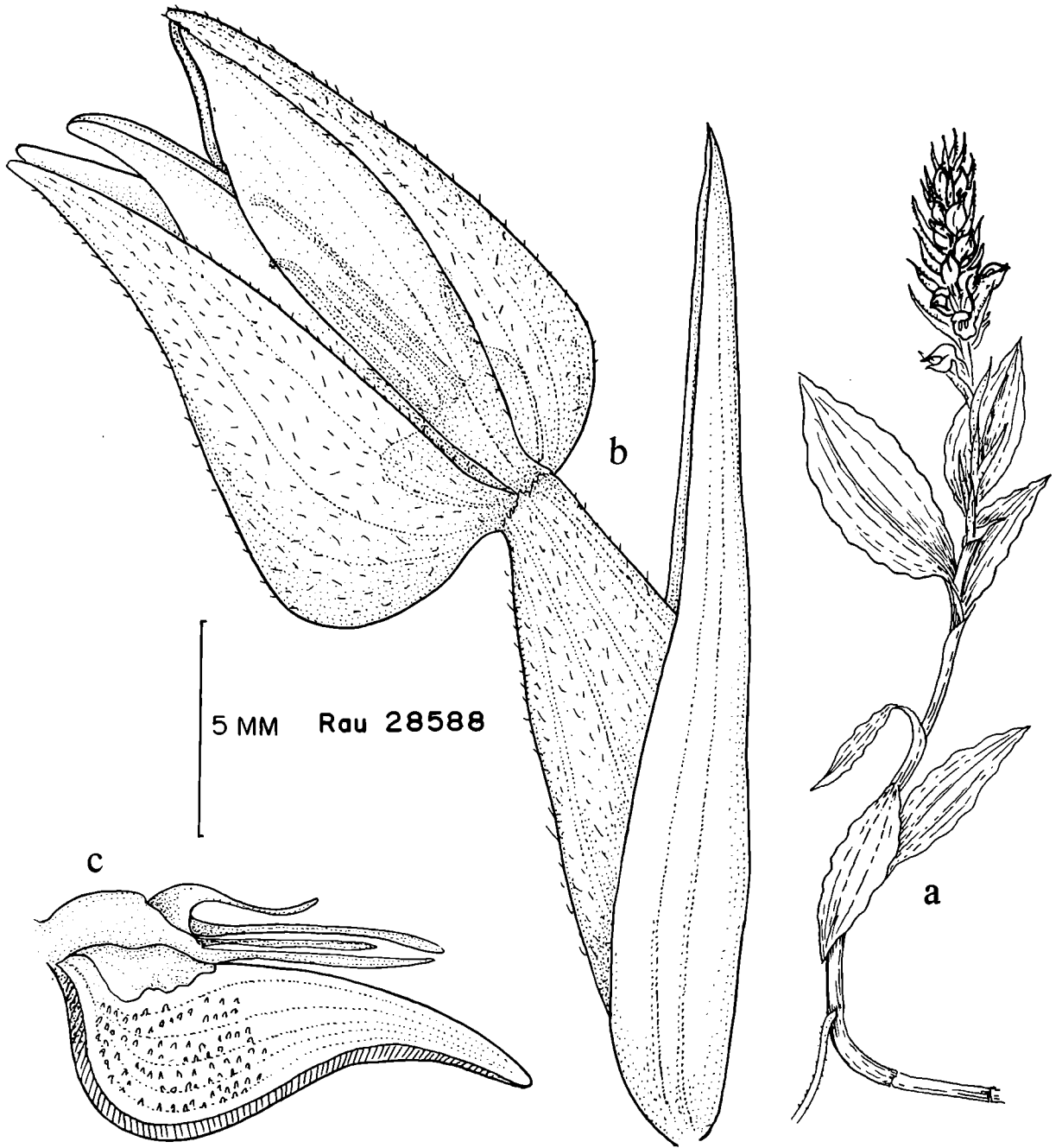


Fig. 18 *Goodyera foliosa* (Lindl.) Benth.—a. plant; b. flower; c. column and lip cut vertically.

3. Flowers small, densely crowded in the racemes: sepals less than 4 mm in length; lip with 2 oblong calli below the apex; column short, arms of the rostellum short; plant tall up to 75 cm ..... *G. procera*  
 + Flowers large, lax in raceme; sepals 6 mm or more in length; lip without any callus; column long, arms of rostellum long; plants smaller, less than 30 cm ..... 4
4. Leaves more or less distant on the stem, base cuneate to rounded but not cordate; lateral sepals not spreading; sac of the lip setose all over inside ..... 5  
 + Leaves more or less crowded above the base of the stem, base cordate; lateral sepals spreading; sac of the lip setose near the base only; raceme 4-6 flowered ..... *G. viridiflora*
5. Stem 5-7.5 cm; leaves ovate, cuneate to almost rounded; raceme 2-8 flowered; flowers large; sepals 20-25 mm long ..... *G. biflora*.  
 + Stem 15-30 cm; leaves lanceolate, base tapering; racemes more than 10 flowered; flowers smaller, sepals (-6) 8-15 mm long ..... *G. foliosa*

**Goodyera biflora** (Lindl.) Hook. f., Fl. Brit. Ind. 6: 114. 1890; Collett, 496. 1902; Duthie, 167. t. 127. 1906.  
*Georchis biflora* Lindl. Gen. & Sp. Orch. 496. 1840.

*Epipactis biflora* (Lindl.) Eaton in Proc. Biol. Soc. Wash. 21: 63. 1908. (Fig. 17)

Plant 5-7.5 cm high; roots thick, cord like. *Stem* stout, leafy upwards, tinged with red, sometimes decumbent and rooting from the nodes. *Leaves* 2.5-5 × 1.5-2 cm ovate, obtuse or sub-acute, dark bluish-green on the upper surface, finely veined with white, the lower surface pale tinged with red; petiole 6-12 mm long, dilated. *Inflorescence* a raceme 2-8 flowered, in rather dense clusters, secund, rhachis pubescent. *Flowers* large, 2.5 cm long, white flushed with yellowish and pink. *Bracts* reddish tipped with green, 2.2 cm long, puberulous, longer than the ovary. *Sepals* 20-25 mm long, narrowly lanceolate, the dorsal recurved at the apex; the laterals shorter, nearly straight, connate at the base. *Petals* linear-lanceolate, falcate, adpressed to the dorsal sepal. *Lip* white tinged with yellow, shorter than sepals, base saecate, with a long recurved beak twice as long as the sac, margins membranous, undulate, sac setose within.

*Flowering*: August.

*Distribution*: Himalaya 1500-2500 m (Himachal Pradesh to Nepal). Tibet.

*Specimens examined*:

GARHWAL: Dehra Dun-Mussoorie, Mackinnon 24164 & 25408; Mussoorie near Companybag, M.A. Rau 18285, Arora 37876; Chakrata, Kunain, Mishra 38053; Deoban, Kanjilal 653.

KUMAUN: Almora-Between Ranikhet and Chaubattia, Renz 13608.

HIMACHAL PRADESH: Shimla, Brandis 1462; Chamba to Kajiav, Nair 28642.

**Goodyera foliosa** (Lindl.) Benth. ex Clarke in J. Linn. Soc. Bot. 25: 73, 1889; Hook. f., 6: 113. 1890; King & Pantl. 281, t. 374. 1898; Duthie, 166. 1906; Raizada et al. 57. 1981.

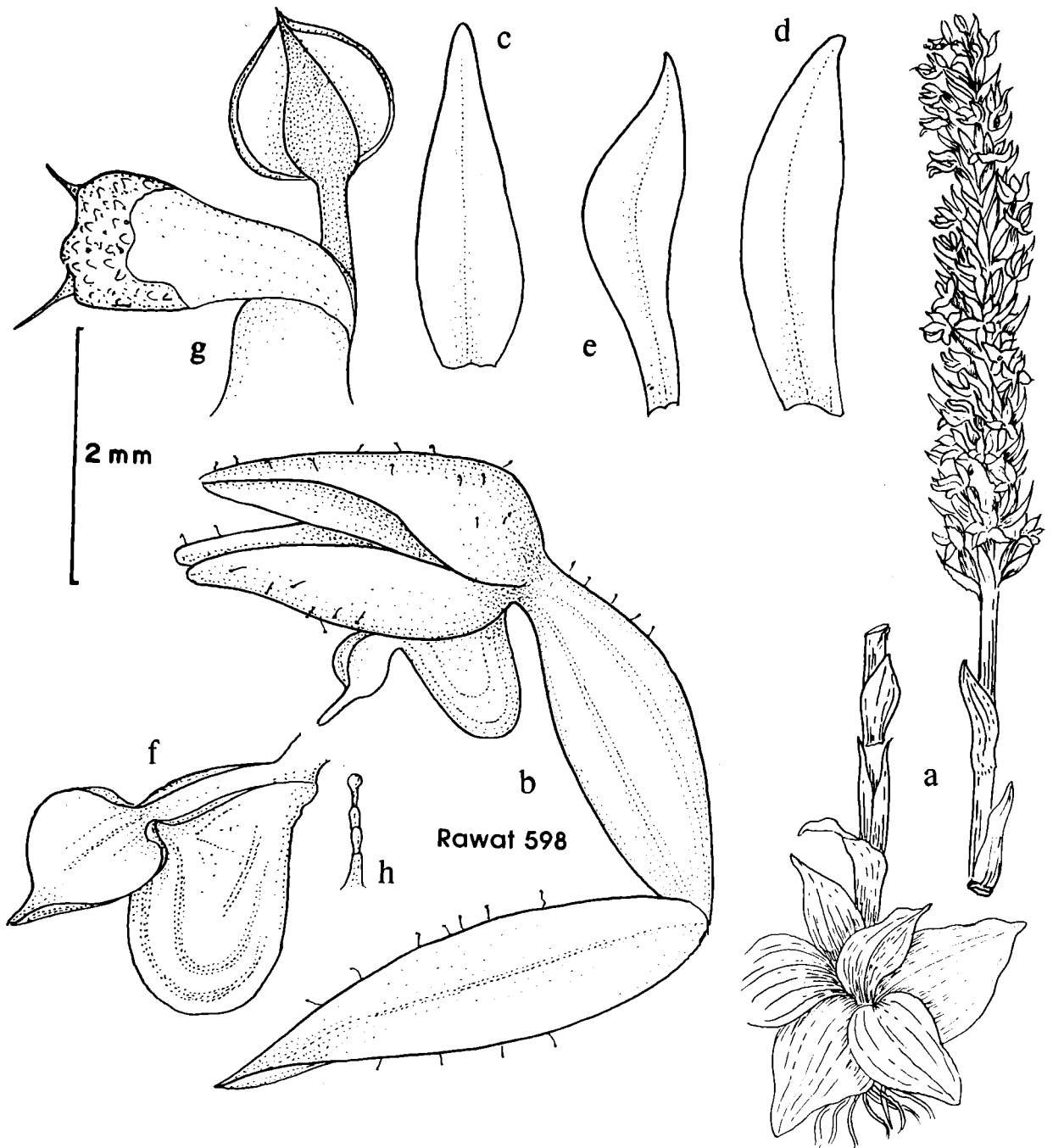
*Georchis foliosa* Lindl. Gen. & Sp. Orch. 496. 1840. (Fig. 18)

Plant 15-30 cm high. *Stem* decumbent at the base, leafy upwards. *Leaves* distant, green, lanceolate, 6-9 × 2-4 cm, often very oblique; petiole 2.5 cm long. *Inflorescence* a raceme 4-7.5 cm long, more than 10 flowered, glandular-pubescent. *Flowers* more than ten, (-6) 8-15 mm long, pink or tinged with orange. *Bracts* lanceolate, longer than flower. *Sepals* sub-equal, (-6-8) 10-15 mm long, connivent, ovate-oblong, sub-acute, connate at the base. *Petals* obliquely rhomboid, acute, clawed. *Lip* as long as the sepals, saecate at the base and tapering into the sub-acute orange and white apical lobe, sac setose all over inside.

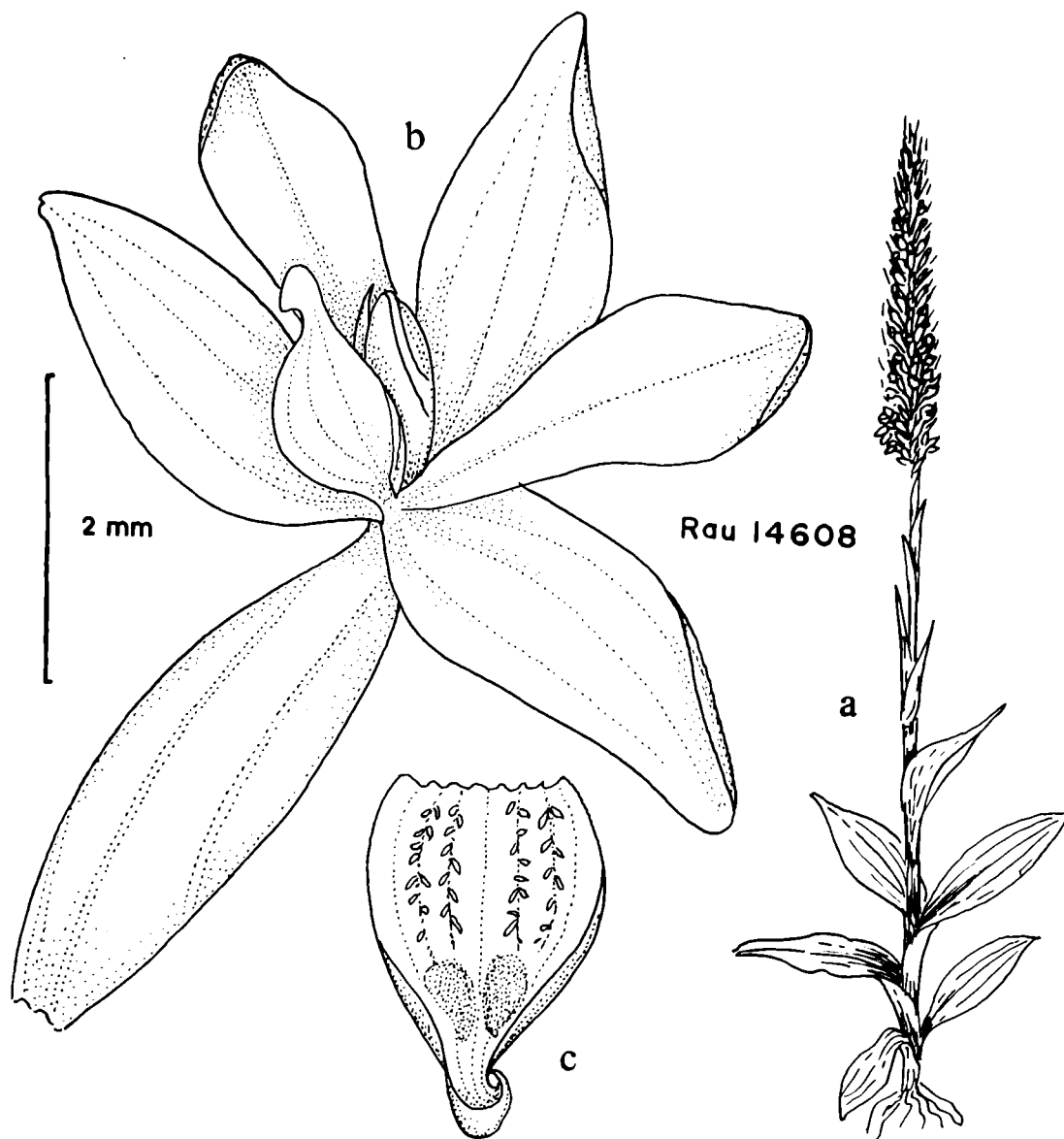
*Flowering*: October - November.

*Distribution*: Himalaya 1700-2300 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram. Tibet, Burma, China, Japan.

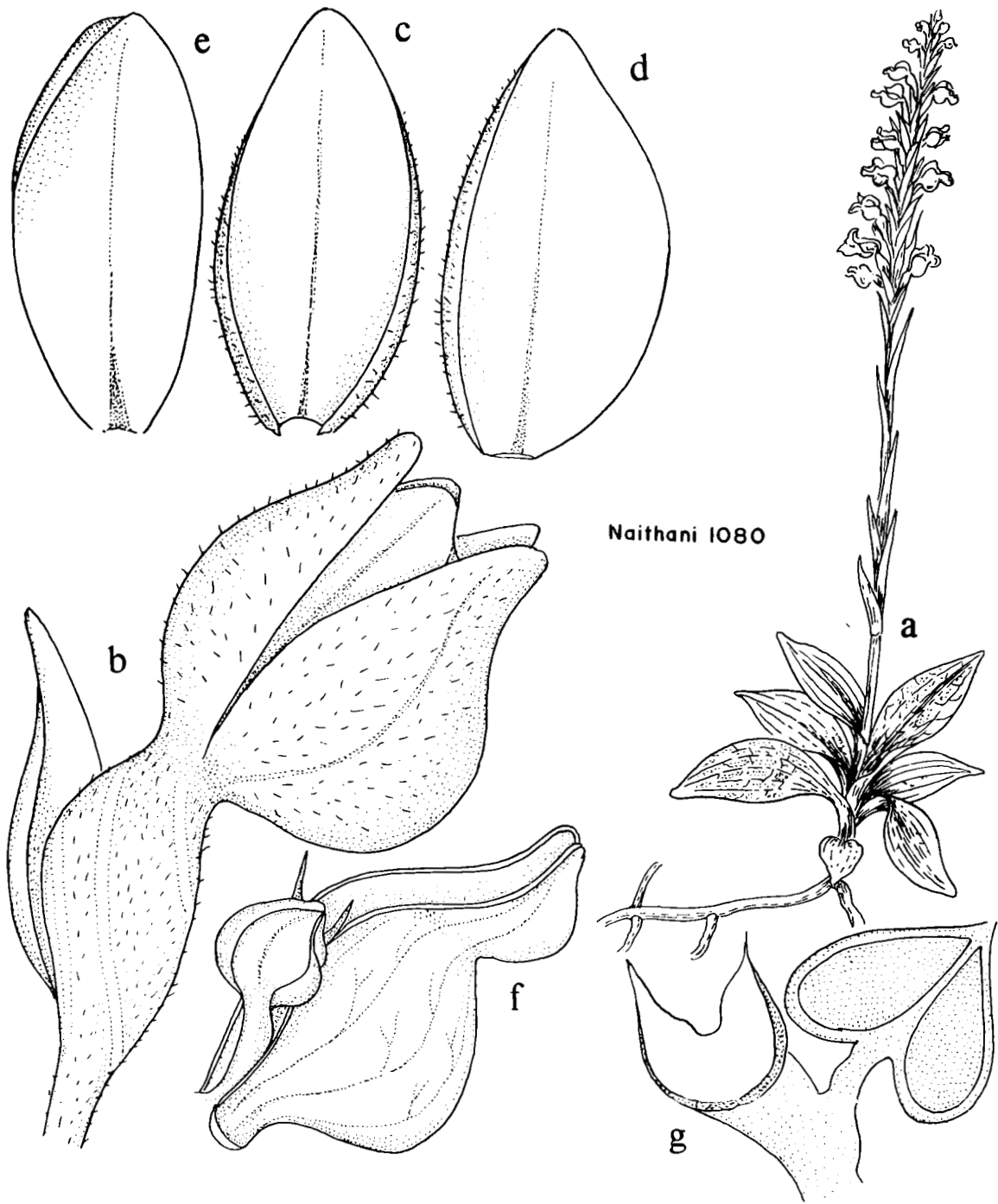
*Specimens examined*:



**Fig. 19** *Goodyera fusca* (Lindl.) Hook. f.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. column; h. glandular hair.



**Fig. 20** *Goodyera procera* (Kar-Gawl.) Hook. — a. plant; b. flower spread out; c. lip.



**Fig. 21** *Goodyera repens* (Linn.) R. Br.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column & lip; g. column



GARHWAL: **Dehra Dun**-Near Mussoorie, *Mackinnon*. **Chamoli**- Mandal-Chopta, *M.A. Rau* 28588.

KUMAUN: **Almora**-Jamia, East Almora division, *Osmaston* 1512.

**Goodyera rusca** (Lindl.) Hook. f., Fl. Brit. Ind. 6: 112. 1890; King & Pantl. 280, t. 371. 1898; Duthie, 166. 1906.

*Aetheria fusca* Lindl. Gen. & Sp. Orch. 491. 1840.

(Fig. 19)

Plant 20-30 cm high. *Stem* glabrous, with the leaves clustered near the base and bearing upwards several oblong acute leaf-like bracts. *Leaves* thick, fleshy, 2.8-3.5 cm long, 5-nerved, margins revolute; petiole broad, sheathing at the base. *Inflorescence* longer than the stem, compact, dense, pubescent, raceme many flowered, not secund. *Flowers* 5-6 mm long, white flushed green. *Bracts* cymbiform, ovate-oblong, sub-acute, longer than the ovary. *Sepals* subequal, oblong, subacute, connivent. *Petals* sigmoid, linear-oblong, sub-acute. *Lip* as long as the sepals, apical lobe suddenly narrowed in to a deflexed linear beak which is strongly ridged within, sac with two ridges inside, its base very conspicuously projecting beyond the base of the sepals.

*Flowering*: August - September.

*Distribution*: Himalaya 3600-4000 m (Himachal Pradesh to Arunchal Pradesh). S.E. Tibet, N. Burma.

*Specimens examined*:

GARHWAL: **Uttarkashi**-Sunapra, *Deva* 4683. **Chamoli**-Bhyundar Valley, *Bhattacharyya* 24336; Valley of flowers, *Bhattacharyya* 24453; Baradeoldungea, *Bhattacharyya* 31035; Kuari Pass, *Duthie* 4432.

KUMAUN: **Pithoragarh**-Dukhtun, Darma Valley, *Inayat* 24084 (a); Kalamoni Forest, *Inayat* 24084; Panchchuli, *G.S. Rawat* 598.

HIMACHAL PRADESH: Lahul, *Aswal* 11169.

**Goodyera procera** (Ker-Gawl.) Hook., Exot. Fl. 1, 3: t. 39. 1823; Hook. f., 6: 111. 1890; King & Pantl. 283, t. 378. 1898; Duthie, 165. 1906; Seidenf., 32: 22, Fig. 8. 1978.

*Neottia procera* Ker-Gawl. in Edw. Bot. Reg. 8: t. 639. 1822.

*Leucostachys procera* (Ker-Gawl.) Hoffmannsegg, Preisv. Orch. 26. 1842.

*Orchiodes procerum* (Ker-Gawl.) Kze., Rev. Gen. 2: 675. 1891.

*Epipactis procera* (Ker-Gawl.) Eaton in Proc. Biol. Soc. Wash. 21: 65. 1908.

*Peramium procerum* (Ker-Gawl.) Makino, in J. Jap. Bot. 6: 36. 1929.

(Fig. 20)

Plant 30-75 cm high. *Stem* stout, glabrous, enveloped in the wide lax leaf-sheaths. *Leaves* 6-8, elliptic or ovate elliptic, acute, 7-15 × 4-5 cm, long petioled; petiole stout and with a broadly sheathing base, 3.5-7.5 cm long. *Inflorescence* dense, with many lanceolate bracts, glabrous below, pubescent above, spike 8-20 cm long. *Flowers* white tinged with green, 4-5 mm across, subglobose. *Bracts* ovate-lanceolate, acuminate, pubescent at the edges, equalling the ovary. *Sepals* sub-equal, orbicular-ovate, sub-connivent, glabrous. *Petals* cuneately obovate, clawed. *Lip* little longer than sepals, entire, cymbiform, sac setose within, with strongly reflexed narrow apex and with 2 oblong calli below the apex.

*Flowering*: May.

*Distribution*: Himalaya 300-1500 M (Garhwal to Arunachal Pradesh), Bihar, Orissa, Bengal, Assam, Meghalaya, Manipur, Tripura, Nagaland, Mizoram, Madhya Pradesh, Tamil Nadu, Kerala, Sri Lanka, Burma, Bangladesh, China, Taiwan, Java, Borneo, Loo Choo Islands, Thailand, Laos, Vietnam, Philippines.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Bhalupani, *Raizada*; Bank of River Saila, *Raizada*; Dehra Dun, *M.A. Rau* 14608. **Chamoli**-Chamoli, *Surendra Singh* 14845.

KUMAUN: **Pithoragarh**-Askot Jauljibee, *M.A. Rau* 11627 & 35324. **Nainital**-Bhujiaighat, *Pant & Tiwari* 2.

**Goodyera repens** (Linn.) R. Br. in Aiton, Hort. Kew. ed. 2, 5: 198. 1813; Hook. f., 6: 111. 1890 p.p.; King & Pantl. 279, t: 370. 1898; Collett, 496. 1902; Duthie, 165. 1906; Stewart, 69. 1972; Tuyama, 137. 1975; Renz, 46. 1978; Hara et al. 44. 1978; Renz, 18, t. 4. 1984.

*Satyrium repens* Linn. Sp. Pl. 945. 1753.

*G. repens* var. *marginata* (Lindl.) Tang & Wang in Acta Phytotax. Sin. 1: 68. 1951.

*G. repens* subsp. *marginata* (Lindl.) Kitamura in Acta Phytotax. Geobot 22: 66. 1966. (Fig. 21)

Plant 10-20 (-35) cm high. *Rhizome* creeping, stoloniferous. *Stem* erect, stiff, glabrous or glandular hairy. *Leaves* crowded near the base, elliptic or ovate-elliptic, sub-acute, dark green, often whitish-green marbled, 1.2-2.5 cm long; petiole sheathing in lower half, more or less 1 cm long. *Inflorescence* a raceme, 2.5-5 cm long, narrowly cylindric, sub-secund, densely many flowered, rachis pubescent. *Flowers* 3.5 mm across, white flushed with brownish-pink, globular, almost right angle with the ovary. *Bracts* linear-lanceolate, equal to or longer than the ovary. *Sepals* sub-equal, ovate, acute, glandular pubescent or glabrous outside. *Petals* as long as the sepals, lanceolate, adhering on the inner margins to the dorsal sepal. *Lip* about as long as the sepals, undivided, glabrous, apical lobe short, ovate, sub-acute, concave, the edges somewhat undulate; sac smooth inside, without any ridge or callus, its base hidden in between the lateral sepals or very slightly projecting beyond it.

*Flowering*: July - August.

*Distribution*: Himalaya 3000-3700 m (Pakistan, Kashmir to Arunachal Pradesh), Assam. E. Tibet, Burma, China, Japan, Europea, N. America.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Chakrata, Deoban, *Raizada* 18237; Jaunsar, *B. B. Osmaston* 2175(a); Chakrata, *Bhattacharyya* 16004. **Tehri**-Surkanda Devi, *Pyar Singh Negi* 14; Nagtibba, *Naithani* 1080, *Mackinnon* 21750; asartal, *Vishwanathan* 55154. **Uttarkashi**-Kharsali, *Duthie* 522, *Deva* 4684; Moi, *Dwarika Prasad* 6456; Gangotri, *Naithani* 37350. **Chamoli**-Rambara, *M.A. Rau* 38645; Ghangarea, *M.A. Rau* 31776; Valley of flowers, *Naithani* 1327.

KUMAUN: **Nainital**-Lariakanta, *Champion*; Nainital, *Davidson*; Above Kumaun University towards Tif-fintop, *Renz* 13595. **Almora**-Loharkhet, *T.A. Rao* 4296.

HIMACHAL PRADESH: Chatru, Lahul Valley, *Aswal* 6334; Chail, Shimla, *Kirat Ram*; Shimla-Fagu Road, *Raizada* 10083; Narkanda, *G.S. Puri* 21003; Above Rahla, *Bhattacharyya* 40420; Sangla, *Nair* 34127; Shimla, *Drummond* 717.

JAMMU & KASHMIR: Pir Panjal, *Inayat* 25396; Baisaran, Liddar Valley, *Inayat* 25397; Rutban Pir, *Gammie*.

PAKISTAN: **Kankhola**, *Kagan Hazara*, *Inayat* 23167; Dungagali-Ayubia, *Renz* 13264.

Lindley described a species *G. marginata* from the N.W. Himalaya (Type TT 346), which he considered different from *G. repens* R. Br., because of the uniformly green leaves, the racemes longer and more compact, and the slenderly acuminate bracts much longer than the flower, sepals glabrous. Duthie (loc. cit.) was inclined to believe that it will prove to be a distinct species. *G. repens* proper which enters India from the direction of Europe, through Afghanistan to Kashmir, and is again found in Sikkim whence it extends to China, whereas *G. marginata* occupies the intermediate area of the Himalaya between Shimla and Nepal. Tuyama (146, 1975) believes that there is no basis for separation of Himalayan plants from *G. repens* proper on the degree of hairiness of the sepals. However Dr. J. Renz who examined the problem in detail informs us that he collected plants above Nainital (No. 13595) which were different from European-W. Asian

(Turkey-Iran-Pakistan) specimens. The Hazara plant from Pakistan (Renz 13264) is identical with *G. repens* (Proper). The Kurmaun plant on the other hand is generally taller, with leaves very clearly reticulate with silvery-grey (Lindley says leaves uniformly green), but the main difference is that, the sepals and the bracts are glabrous, whereas the rhachis, sepals and bracts of the typical *G. repens* are densely glandular pubescent.

**Goodyera viridiflora** (Bl.) Coll. Orch. Arch. Ind. 41. t. 9. 1854; Seidenf., 32: 20. fig. 6. 1978.

*Neottia viridiflora* Bl. Bijdr. 415. 1825.

*Georchis cordata* Lindl. Gen. & Sp. Orch. 496. 1840 (excl. hab.).

*G. viridiflora* (Bl.) F. Muell. Fragm. Phyt. Austr. 8: 29. 1873.

*Goodyera cordata* (Lindl.) Nicols. Dict. Gard. 2: 81. 1855; Hook. f., 6: 114. 1890; Duthie, 180, 1906a; Duthie, 167. t. 126. 1906. Hara et al. 1:44 1978.

*Epipactis cordata* (Lindl.) Eaton, Proc. Biol. Soc. Wash. 21: 64. 1908.

(Fig. 22)

Plant 20 cm tall, sometimes decumbent. *Stem* glabrous, except the scape and bract. *Leaves* 5-6, more or less crowded above the base, sub-radical; leaf-blades 2.5-6.5 × 2.5 cm, ovate, shortly pointed with cordate base, rather fleshy; petiole dilated, the free portion about half the length of the blade. *Inflorescence* puberulous; raceme 4-6-flowered, the lower portion bearing a pale narrow sheathing cuspidate bract. *Flowers* sub-erect, 12-15 mm across, green tinged with brownish-yellow or red. *Bracts* lanceolate, acuminate, margin papillose, longer than the ovary. *Sepals* fleshy, boat shaped, and cucullate tip; the dorsal erect, 13 mm long, lanceolate; the laterals spreading, a little shorter than the dorsal. *Petals* and dorsal sepal form an erect hood, lanceolate. *Lip* about as long as the dorsal sepal, rhomboid-ovate, sac setose near the base only, terminal lobe reflexed, triangular, acute.

*Flowering*: September.

*Distribution*: Himalaya 1500-2000 m (Garhwal to Bhutan), Assam, Meghalaya, Nagaland. China, Taiwan, Philippines, Malaya, Sumatra, Java, Borneo, Celebes, New Guinea, Thailand.

Specimens examined:

GARHWAL: Dehra Dun-Near Mussoorie, Mackinnon's collector 25409.

KUMAUN: Pithoragarh-Didihat, Pant 35114, M.A. Rau 35307.

#### Listera R. Br.

Terrestrial herbs. Rhizome more or less slender, with moderately thick or thread like roots. *Stem* erect with two almost sessile or sub-sessile, opposite rarely alternate leaves. *Inflorescence* lax or densely flowered. *Flowers* small, greenish. *Sepals* slightly campanulate-connivent. *Lip* stretched forwards or deflexed, without spur, liguliform, apex more or less bifid. *Column* short. *Anther* dorsal. *Pollinia* 2 *Rostellum* short, triangular.

#### Key to species

1. Leaves longer than broad, broadly elliptic to ovate ..... 2
- + Leaves almost as long as broad or broader, cordate, almost orbicular ..... 3
2. Plants small, 10-18 cm; leaves less than 3.5 cm long; raceme 4-8 flowered; lip cuneately obovate, bifid sinus shallow, lobules with rounded apex, upper surface near the base with a small pit.....  
.....*L. tenuis*
- + Plants tall, 30-50 (- 70) cm; leaves more than 5 cm long; raceme many flowered; lip linear-obovate, bifid sinus deep, lobules linear with sub-acute apex, upper surface near the base with an elongated basal groove .....*L. ovata*
3. Lip narrow, more than five times longer than broad ..... *L. nandadeviensis*
- + Lip broad, only 1½-2 times longer than broad ..... 4

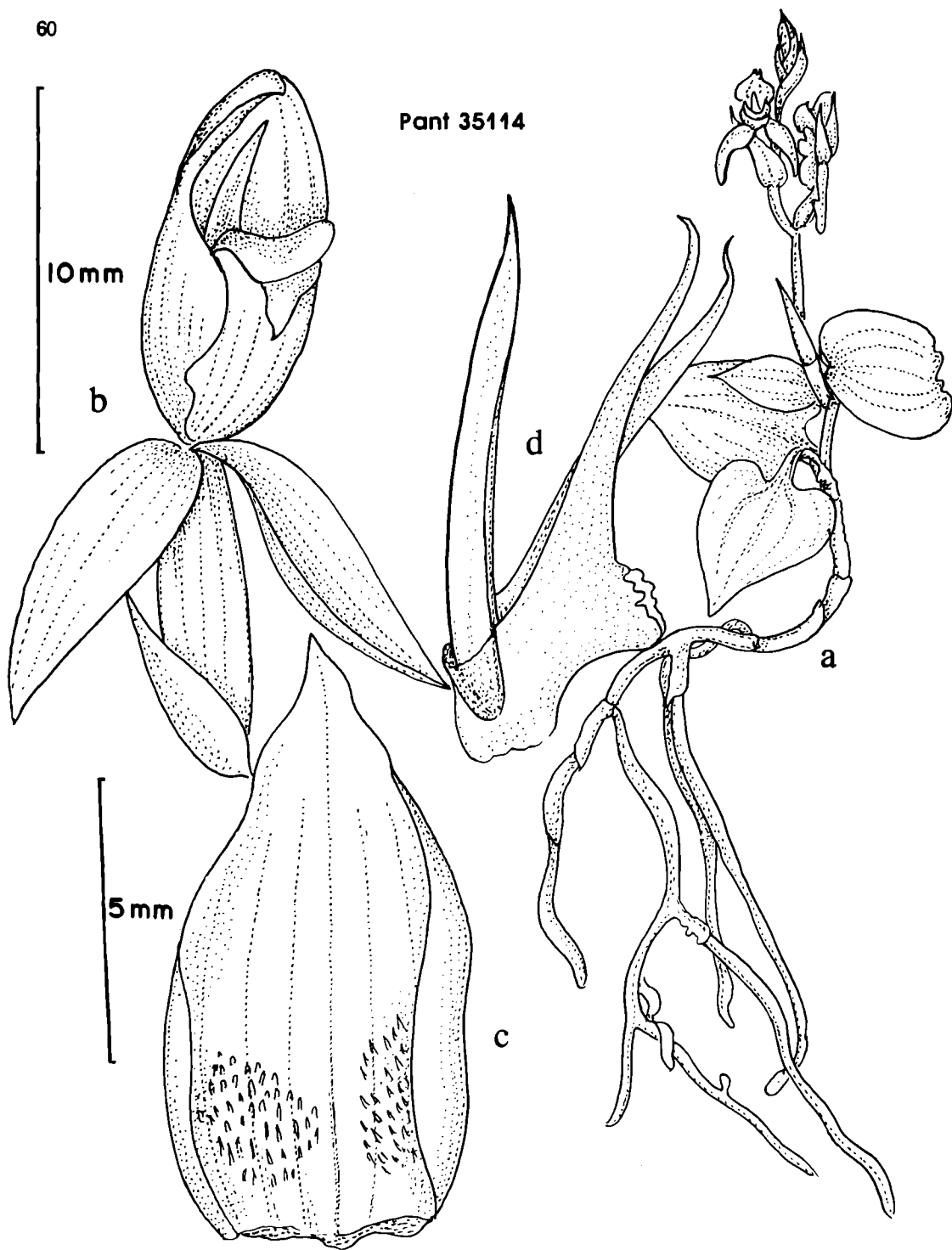


Fig. 22 *Goodyera viridiflora* (Bl.) Coll. — a. plant; b. flower; c. lip; d. column.

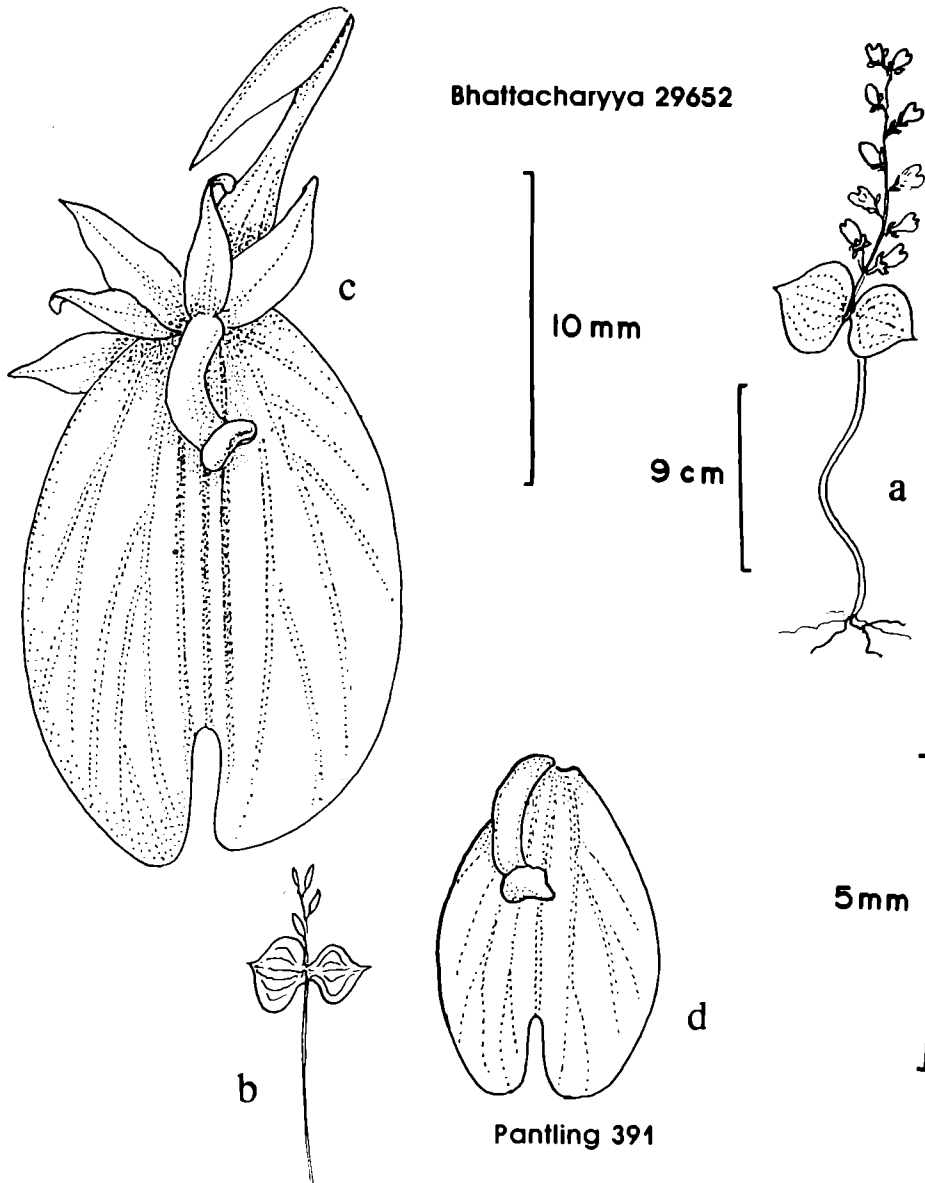


Fig. 23 *Listera longicaulis* King & Pantl.—a. & b. plants; c. flower; d. column & lip.

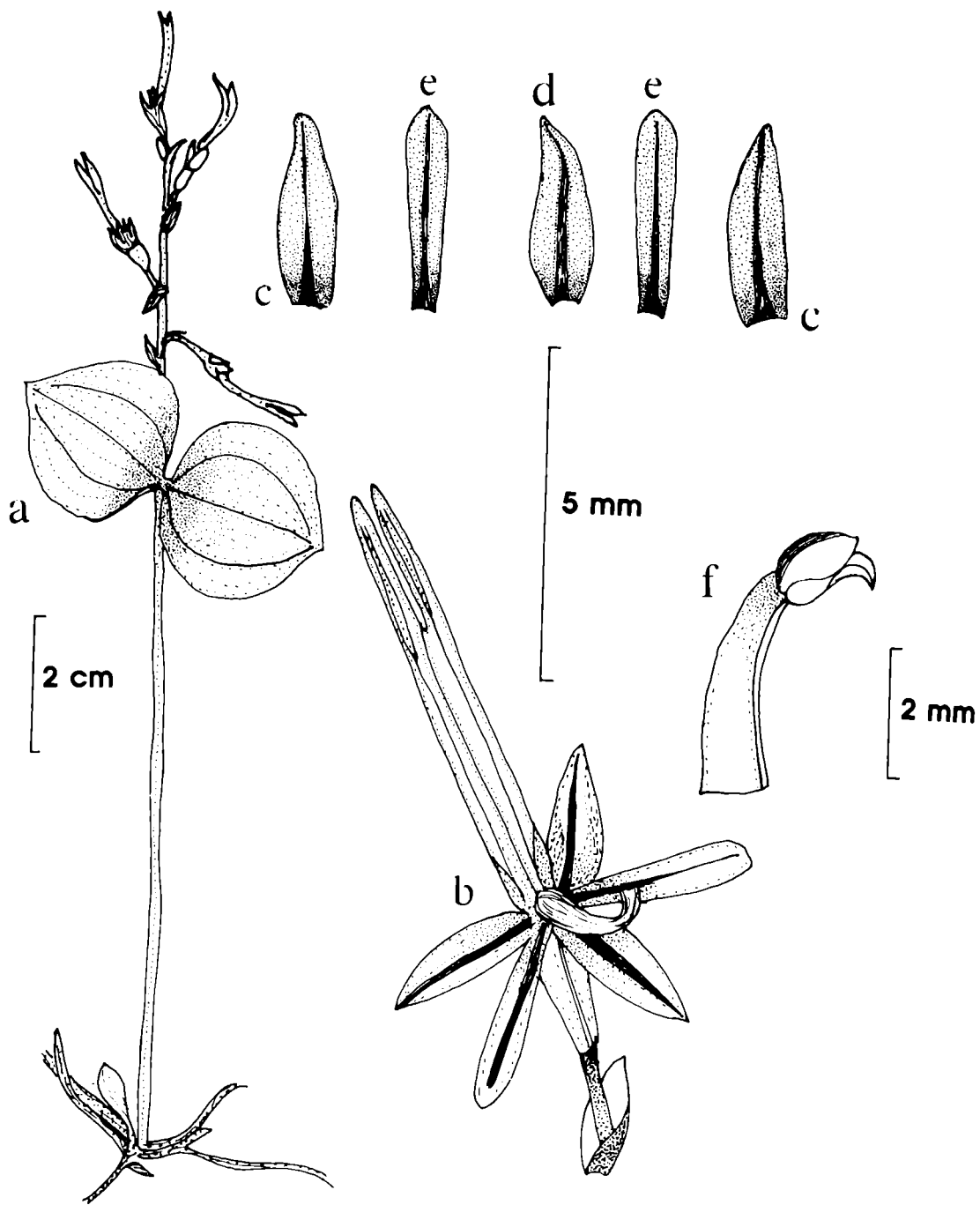


Fig. 23A *Listera nandadeviensis* P.K. Hajara—*a.* plant; *b.* flower; *c.* lateral sepals; *d.* dorsal sepal; *e.* petals; *f.* column.

4. Lip broadly obovate-oblong, broadest near the apex, upper surface with 2 small erect triangular calli near the base ..... *L. pinetorum*  
 + Lip elliptic-ovate, broadest near the centre, upper surface without any calli, nerves pubescent.....  
 .....*L. longicaulis*

**Listera longicaulis** King & Pantl. in Journ. As. Soc. Bengal 65: 126. 1896; King & Pantl., 256, t. 339. 1898; Rau & Bhattacharyya 94, fig. 1-5. 1966. (Fig. 23)

Plant 15-40 cm, of which half is the raceme and its peduncle. *Stem* stout, glabrous, without sheaths. *Leaves* at the apex of the stem, orbicular-ovate to reniform, sub-acute or blunt, 3-3.7 cm long and about as broad. *Raceme* longer than the peduncle, puberulous with 8-15 distant flowers. *Flowers* green, 10 mm across. *Bracts* lanceolate, acute, as long as the ovary. *Sepals* the dorsal ovate-lanceolate, erect; the laterals linear-lanceolate, sub-falcate, reflexed. *Petals* like lateral sepals. *Lip* 3-times longer than the lateral sepals, elliptic-ovate, broadest near the centre, apex blunt and rather deeply bifid, margins minutely ciliate, upper surface without any calli, nerves pubescent.

*Flowering*: July.

*Distribution*: Himalaya 3500 m (Garhwal & Sikkim).

*Specimens examined*:

GARHWAL: **Chamoli**-Gangharea, M.A. Rau 31778, Bhattacharyya 29652.

It is an example of discontinuous distribution, occurring in Sikkim and again in North Garhwal without being present in Nepal. It is also possible that it has not yet been found in Nepal.

**Listera nandadeviensis** P.K. Hajra in Bull. Bot. Surv. Ind. 25(1-4): 181, Fig. 1-5. 1983. (Fig. 23A)

Plant 13-20 cm high. *Rhizome* with fleshy fibrous roots. *Stem* slender, glabrous. *Leaves* 2, sessile, opposite, broadly ovate-cordate, acute, membranous, 1.5-3 cm long equally broad. *Raceme* slender, 2-6 cm long glandular-pubescent, 3-6 flowered. *Flowers* 1.5-2 cm long, green. *Bracts* elliptic to ovate, obtuse, shorter than the stalked ovary. *Sepals* subequal, ovate, subfalcate, 5-6 mm long, membranous, 1-nerved. *Petals* narrowly long, 5-6 × 1 mm, 1-nerved. *Lip* 14-15 × 1.5-2 mm, 3-nerved, apex bifid, lobes narrowly oblong, sinus about 5 mm long.

*Flowering*: August - September

*Distribution*: Himalaya 3000-3500 m (Garhwal endemic)

*Specimens examined*:

GARHWAL: **Chamoli**-Himtole, Nandadevi, National Park Hajra 73201.

This species is allied to *L. nepalensis* Balakr., but differs in its leaves being prominently 3-nerved; raceme 3-6-flowered; petals narrowly oblong; lip deeply bifid.

Found on moss covered rocks in *Rhododendron*, *Abies* and *Pinus* forest at altitude varying from 3000-3500 m.

**Listera ovata** (Linn.) R. Br. in Aiton, Hort. Kew ed. 2, 5: 201. 1813; Hook. f., 6: 104. 1890; Duthie, 152. t. 117. 1906; Stewart, 72. 1972; Renz, 17. 1978 & 8. 1984.

*Ophrys ovata* Linn. Sp. Pl. 946, 1753.

(Fig. 24)

Plant up to 30-50 (-70) cm tall. *Rhizome* short with filiform roots. *Stem* erect with two large almost opposite leaves, downy in the upper part. *Leaves* spreading horizontally, oval or nearly orbicular, 5-10 cm long. *Raceme* terete, loosely or densely many flowered, up to 25 cm long. *Flowers* green or yellowish-green, with yellowish lip, 13 mm long. *Bracts* minute, ovate, acuminate. *Sepals* campanulately connivent, ovate, 4-5 mm long. *Petals* linear, as long as the sepals. *Lip* 2-3 times longer than the sepals, linear-obovate,

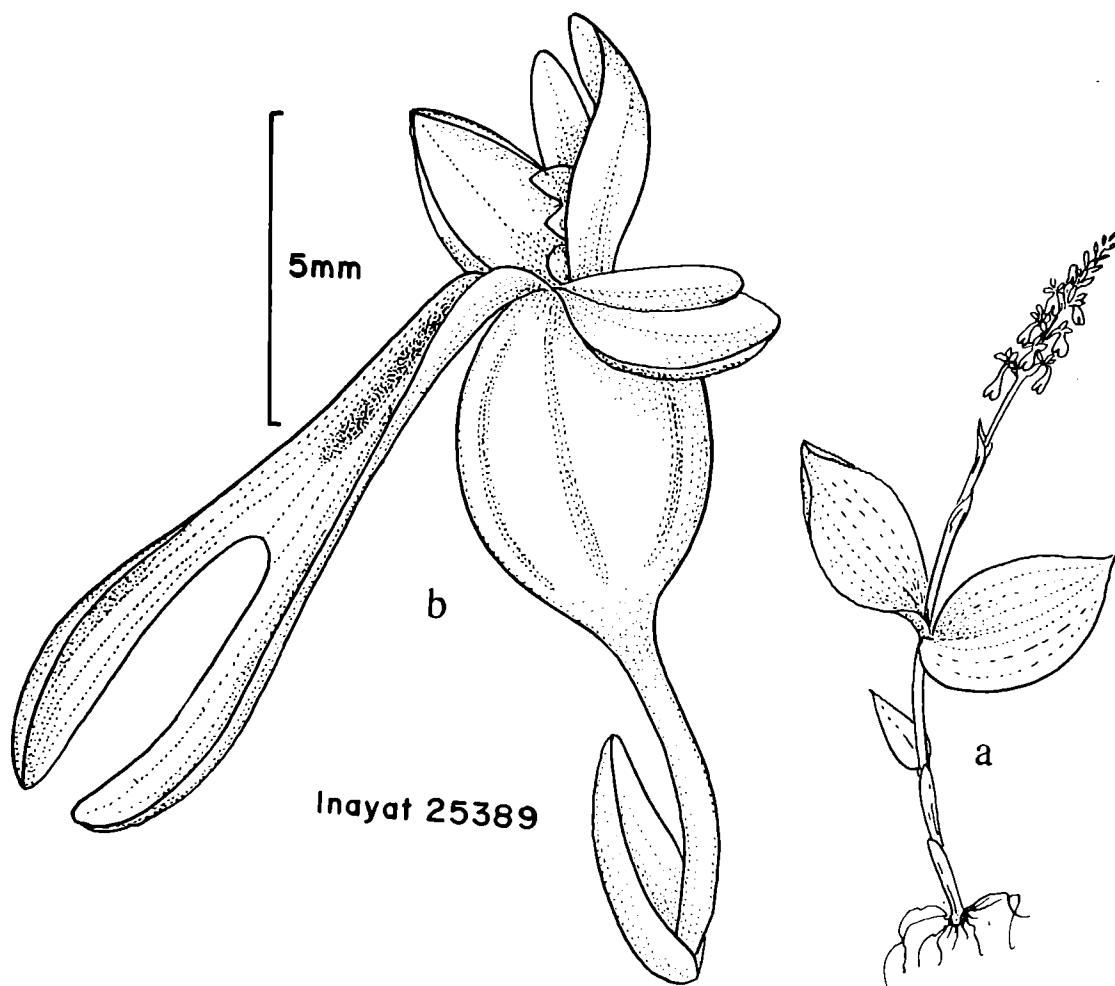


Fig. 24 *Listera ovata* (Linn.) R. Br.—a. plant; b. flower.



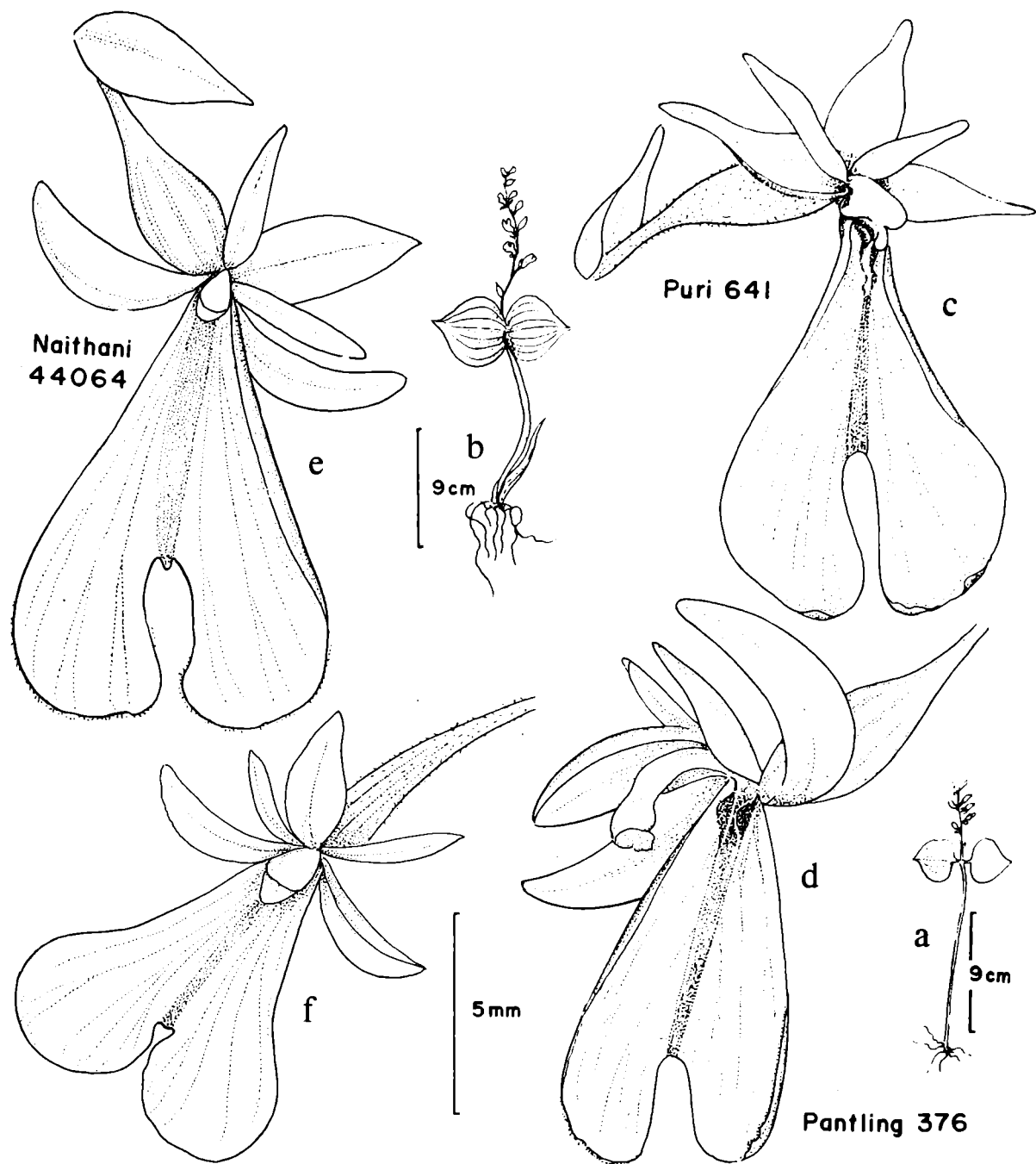
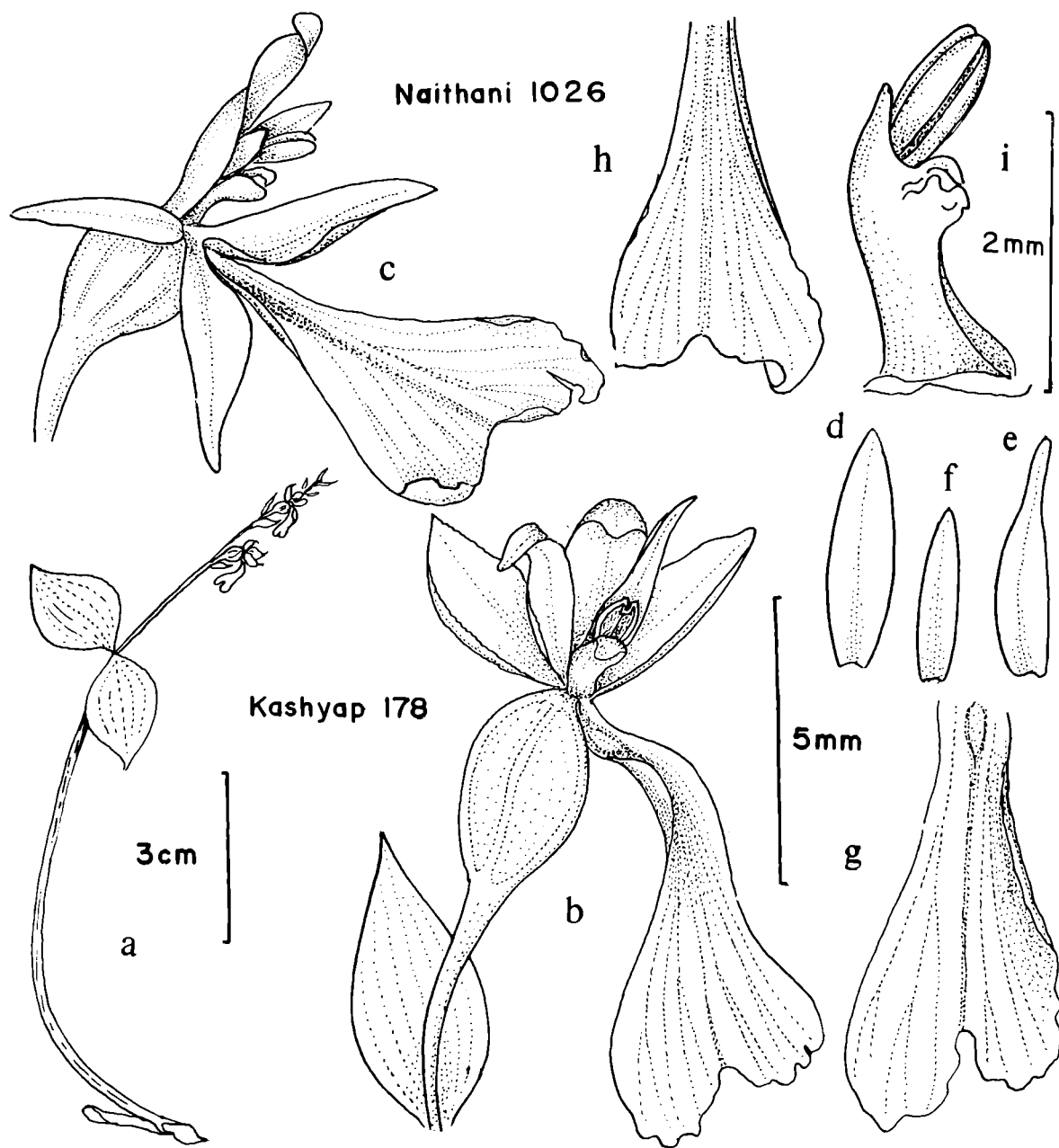


Fig. 25 *Listera pinetorum* Lindl.—a. & b. plants; c., d., e., f. flowers (f. after Panigrahi and Wood).



**Fig. 26** *Listera tenuis* Lindl. — a. plant; b. & c. flowers; d. dorsal sepal; e. lateral sepal; f. petal; g. & h. lip; i. column.

bifid, sinus deep, lobules linear with sub-acute apex, upper surface near the base with an elongated basal groove.

*Flowering:* May - July.

*Distribution:* Himalaya 2100-3000 m (Pakistan and Kashmir). West towards the Urals, Caucasus and Europe, America.

*Specimens examined:*

JAMMU & KASHMIR: Gurais Valley, *Inayat* 25389; Gund Sind Valley, *Inayat* 25389(a); Kashmir, *Royle* 2469; Village Khatoan, Mozae Juyan, Hassora, *Falconer*.

PAKISTAN: Hajara, Kaghan Valley, *Renz* 10779.

Hooker (1890) thought that Falconer's collection from Kashmir was inadvertently placed in Indian Herbarium. Later Inayat, Drummond, Blatter and Houston's collection from Kashmir proved without any doubt about its existence. There is no doubt that it is a very rare species in the N.W. Himalaya.

*Listera pinetorum* Lindl. in Journ. Proc. Linn. Soc. Bot. 1: 175. 1857; Hook. f., 6: 104. 1890; King & Pantl. 256, t. 338. 1898; Arora, 298. 1978; Hara et al. 1: 48. 1976.

*L. mucronata* Panigrahi & Wood in Kew Bull. 29: 731, fig. 1. 1974.

(Fig. 25)

Plant 12-28 cm high. *Stem* smooth with or without sheaths. *Leaves* sessile, broadly cordate or reniform, acute, 2-7.5 cm long and about equally broad. *Raceme* 4-7.5 cm long, 2-10 flowered, puberulous. *Flowers* 8-10 mm long, pale-green with brownish-red lip. *Bracts* ovate-lanceolate, acuminate, convolute, shorter than the ovary. *Sepals* sub-equal, spreading, ovate-oblong, sub-acute, *Petals* linear oblong, shorter than the sepals. *Lip* 3-times longer than the sepals, broadly obovate-oblong broadest near the apex, narrowed at the base, apex divided into two blunt slightly bilobed lobules by a narrow blunt sinus with almost parallel sides, the upper surface with 2-small erect triangular calli near the base.

*Flowering:* May - July.

*Distribution:* Himalaya 3000-3500 m (Garhwal to Arunachal Pradesh). China and Japan.

*Specimens examined:*

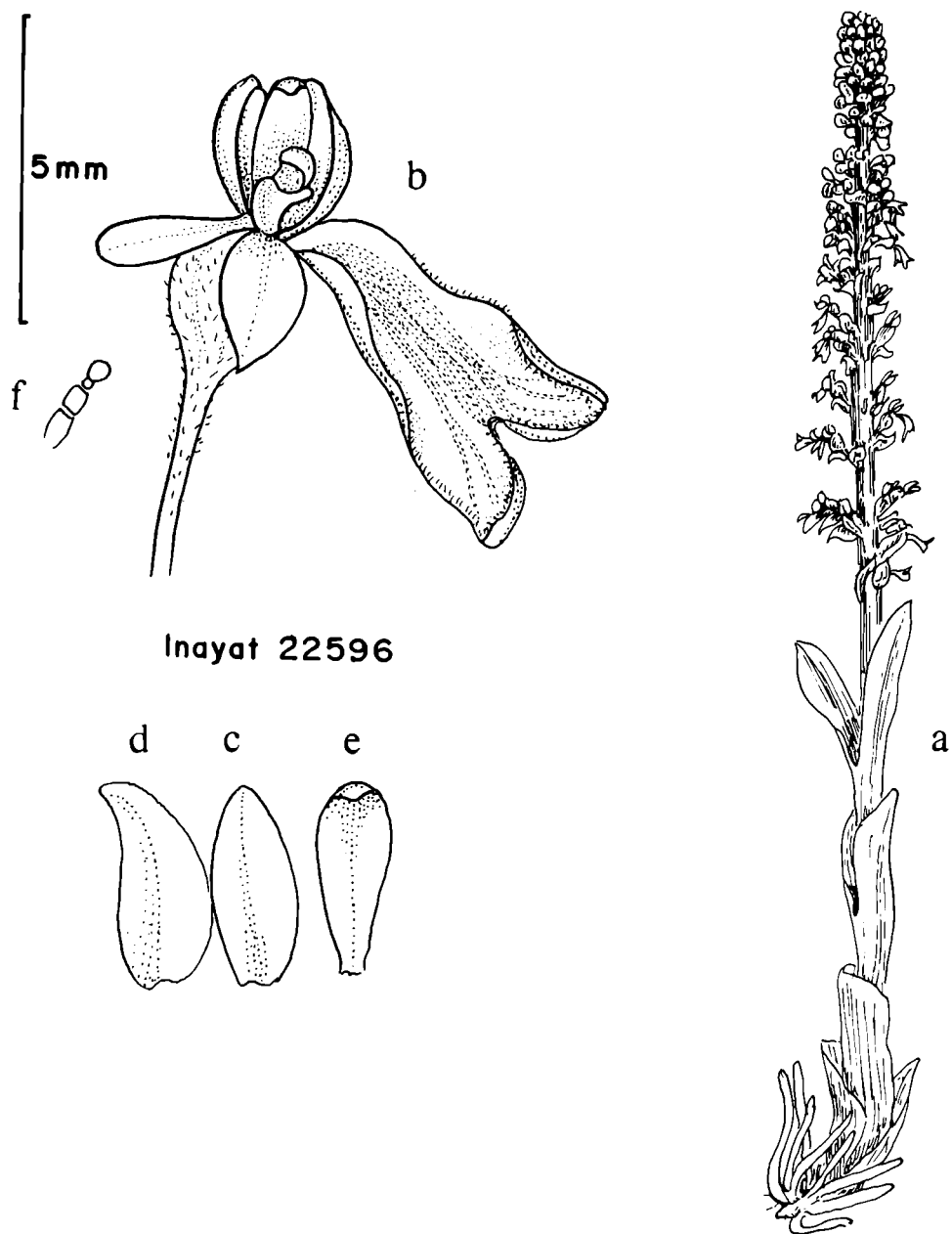
GARHWAL: Chamoli-Amrit Ganga Valley, *Naithani* 44064.

KUMAUN: Pithoragarh-Namphagadh, *Duthie* 6002(a).

Panigrahi & Wood (1974) segregated a new species *L. mucronata* from *L. pinetorum* on the larger size of the plant, the ratio of the peduncle and stem, i.e. the first flower appearing 4-7.5 cm above the leaves (in *L. pinetorum* 2.5-5 cm above) and the presence of a definite mucro in the sinus of the lip. On critical examination we found that it is not possible to maintain this as a separate species. The size of the plant is variable, Lindley 178, 1857 called it "the largest in the genus". Pantling's No. 376 is a small plant but Puri's 641 from Nepal is a big plant, but both are without a mucro. In *Naithani's* 44064, from North Garhwal quoted as paratype the first bract of the raceme is not more than 2.5 cm above the leaves.

*Listera tenuis* Lindl. in Journ. Proc. Linn. Soc. Bot. 1: 176. 1857; Hook. f., 6: 104. 1890; King & Pantl. 255, t. 337. 1898; Mehra & Kashyap, 226. 1978. (Fig. 26.)

Plant 10-18 cm high. *Stem* bearing 1-2 loose sheaths. *Leaves* elliptic-ovate, acute, sessile, 1.2-3.5 × 1-2.5 cm with oblique base. *Raceme* glandular-puberulous, ( - 2) 4-8-flowered. *Flowers* 5-6 mm long, green with pale-brown lip. *Bracts* membranous, ovate, sub-acute, shorter than the ovary. *Sepals* and *petals* connivent, oblong-ovate, acute to sub-acute. *Lip* one and a half to two times longer than the sepals, cuneately orbiculate, bifid, sinus shallow, lobules with rounded apex, the upper surface flat with a central dark line, the base with a small pit.



**Fig. 27** *Neottia inayatii* (Duthie) Beauv.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. glandular hair.

*Flowering*: July - August.

*Distribution*: Himalaya 3000-4000 m (Garhwal, Nepal to Arunachal Pradesh). Tibet.

*Specimens examined*:

GARHWAL: **Chamoli**-Valley of flowers, *Kashyap* 178; Above Ghangaria towards Hemkund, *Naithani* 1026, *Renz* 13621; Deodi to Ramani Camp, Nanda Devi National Park, *Hajra* 73294.

KUMAUN: **Pithoragarh**-Thal, 1000 m, *S.P. Singh*.

The occurrence of this species in Kumaun at Thal from an altitude of about 1000 m is doubtful. Usually the species occurs at higher altitude.

### Species imperfectly known

**Listera dentata** King and Pantling. Ann. Bot. Gard. Calc. 8: 257, Pl. 342, 1898; Pradhan 134, 1976; Seidenf & Arora 20. 1982.

We have seen no material from or area.

### Neottia Guettard

Herb erect more or less mycotrophic. *Rhizome* robust with densely crowded fleshy roots. *Stem* erect, covered with clasping sheaths. *Leaves* absent. *Inflorescence* laxly or densely many flowered. *Flowers* fleshy, glabrous, yellowish-brown. *Sepals* and *petals* similar or different. *Lip* stretched outwards, equal or longer than *sepals*, apex entire or bilobed. *Column* elongated. *Anther* sub-erect; *pollinia* 2. *Stigma* sub-rotundate-reniform.

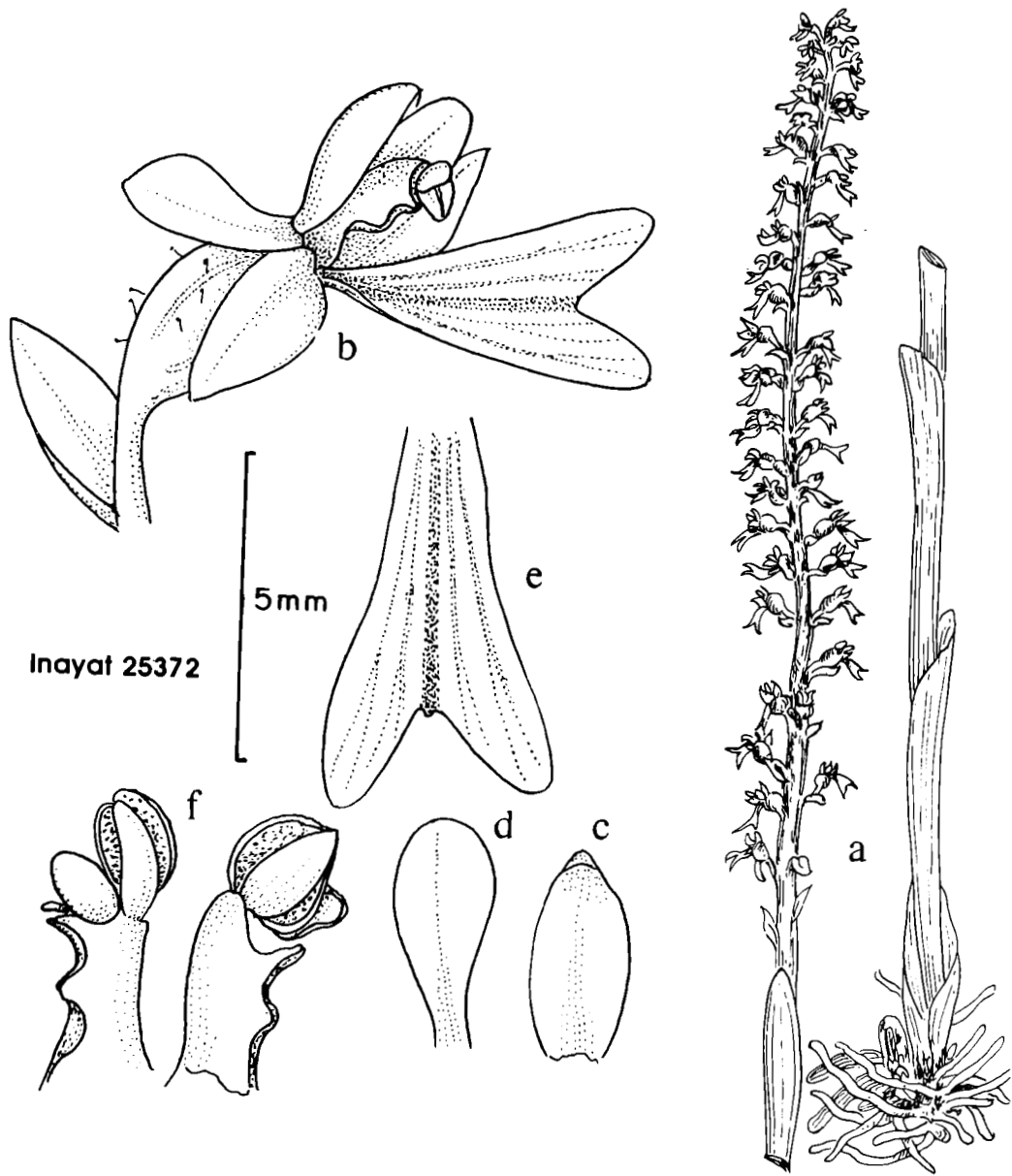
### Key to Species

1. Lip equal in length to the sepals and petals, erect.....2  
+ Lip 2-3 times longer than the sepals and petals, spreading or pendulous.....3.
2. Lip similar to the petals in shape, linear-oblong, apex entire with undulate margins *N. microglottis*  
+ Lip different in shape from the petals, obovate, the apex divided into two small divergent lobules  
..... *N. mackinnonii*
3. Petals spatulate; lip two times longer than the sepals and petals, the lobules with obtuse apex  
..... 4  
+ Petals linear, lip 3 times, rarely less longer than the sepals and petals, the lobules with acute apex  
..... *N. listeroides*
4. Petals spatulate with sub-acute apex; lip pendulous; stem with upper most pairs of sheaths opposite  
and subfoliaceous ..... *N. inayatii*  
+ Petals obliquely spatulate, rounded at the apex; lip spreading almost parallel to the much curved ovary  
and the column; upper sheaths of the stem not opposite.....*N. kashmiriana*

**Neottia inayatii** (Duthie) Beauv. in Bull. Soc. Bot. Geneve ser. 2, 17: 339, 1926; Stewart, 72. 1972; Renz, 8. 1984.

*Listera inayatti* Duthie in J. As. Soc. Beng. 71(2): 41. 1902; Duthie, 152. t. 119. 1906. (Fig. 27)

*Plant* 15-20 cm high. *Roots* fibrous, stout. *Stem* stout, yellowish-brown, bearing 4-6 large loose sheaths, upper most pairs on the type specimen sheaths opposite. *Leaves* absent. *Inflorescence* 6-9 cm, densely flowered, rhachis glandular pubescent. *Flower* yellowish-green, 8-10 mm across. *Bracts* longer than pedicel, lanceolate, acuminate. *Sepals* and *petals*, sub-equal, connivent, 2 mm long; the dorsal oval, tapering to an obtuse apex. *Petals* spatulate with sub-acute apex, as long as the dorsal sepal. *Lip* pendulous, twice as long as the lateral sepals, narrowly obovate-oblong, deeply cleft in to two slightly spreading obtuse lobes with a central elongated callus.



**Fig. 28** *Neottia kashmiriana* (Duthie) Beauv. — a. plant; b. flower; c. dorsal sepal; d. petal; e. lip; f. column.

*Flowering:* July.

*Distribution:* Endemic to the Kaghan Valley, Hazara and Kashmir at about 2500 m.

*Specimens examined:*

JAMMU & KASHMIR: Astor, Falconer, Gurez Valley, *Inayat* 25389. (Stewart, *loc. cit.*)

PAKISTAN: Hazara-Bhurj Kaghan Valley, *Inayat* 22596 (type DD).

*N. inayatii* (Duthie) Beauv., is endemic in Hazara and Kashmir. It has not been collected since 1902. A very distinct species, with opposite foliaceous upper sheaths, spatulate sub-acute petals, short and stout plant with densely flowered racemes.

***Neottia kashmiriana*** (Duthie) Beauv. in Bull. Geneve ser. 2, 17: 339. 1926; Stewart, 72. 1972.

*Listera kashmiriana* Duthie in Ann. Roy. Bot. Gard. Calc. 9: 153. t. 118. 1906. (Fig. 28)

Plant 30-35 cm. *Root* fibres, stout, crowded. *Stem* stout, enveloped by 3-4 large loose sheaths. *Leaves* absent. *Inflorescence* laxly many-flowered, rhachis minutely puberulous. *Flowers* spreading, yellowish-brown, 8 mm long. *Bracts* longer than pedicel, broadly ovate, acute, puberulous. *Sepals* and petals 2 mm long, connivent, sparsely hairy; the lateral ovate, acuminate. *Petals* obliquely spatulate, rounded at the apex. *Lip* twice as long as the sepals, spreading almost parallel with the much curved ovary and the column, divided at the apex into two divergent obtuse lobules the margins ciliate towards the tapering base, dorsal with a raised central callus projecting in to a sinus.

*Flowering:* August.

*Distribution:* Endemic to Kashmir at 3000 m.

*Specimens examined:*

JAMMU & KASHMIR: Baisaran, Lidjar Valley, *Inayat* 25372 (type DD); Near Baisarrall above Pahalgam, R.R. & I.D. Stewart 41499; Above Pahalgam, Stewart 21866(a).

Dr. J. Renz (1984) has made a critical study of the material at Kew and is convinced that this species is not distinct from *N. inayatii*. However we find that the type specimens are very distinct from each other and the structure of the flowers is also quite distinct.

***Neottia listeroides*** Lindl. in Royal, Ill. Bot. Himal. Mount. 1: 368. 1839; Gen. Sp. Orch. 458. 1840; Hook. f., 6: 103. 1890; Collett. 495. 1902; Stewart, 72. 1972; Renz, 16. 1978; 7. 1984.

*N. Lindleyana* Decne, in Jacquem. Voy. Inde 4, Bot. L 163. & Atlas 2: t. 163. 1844.

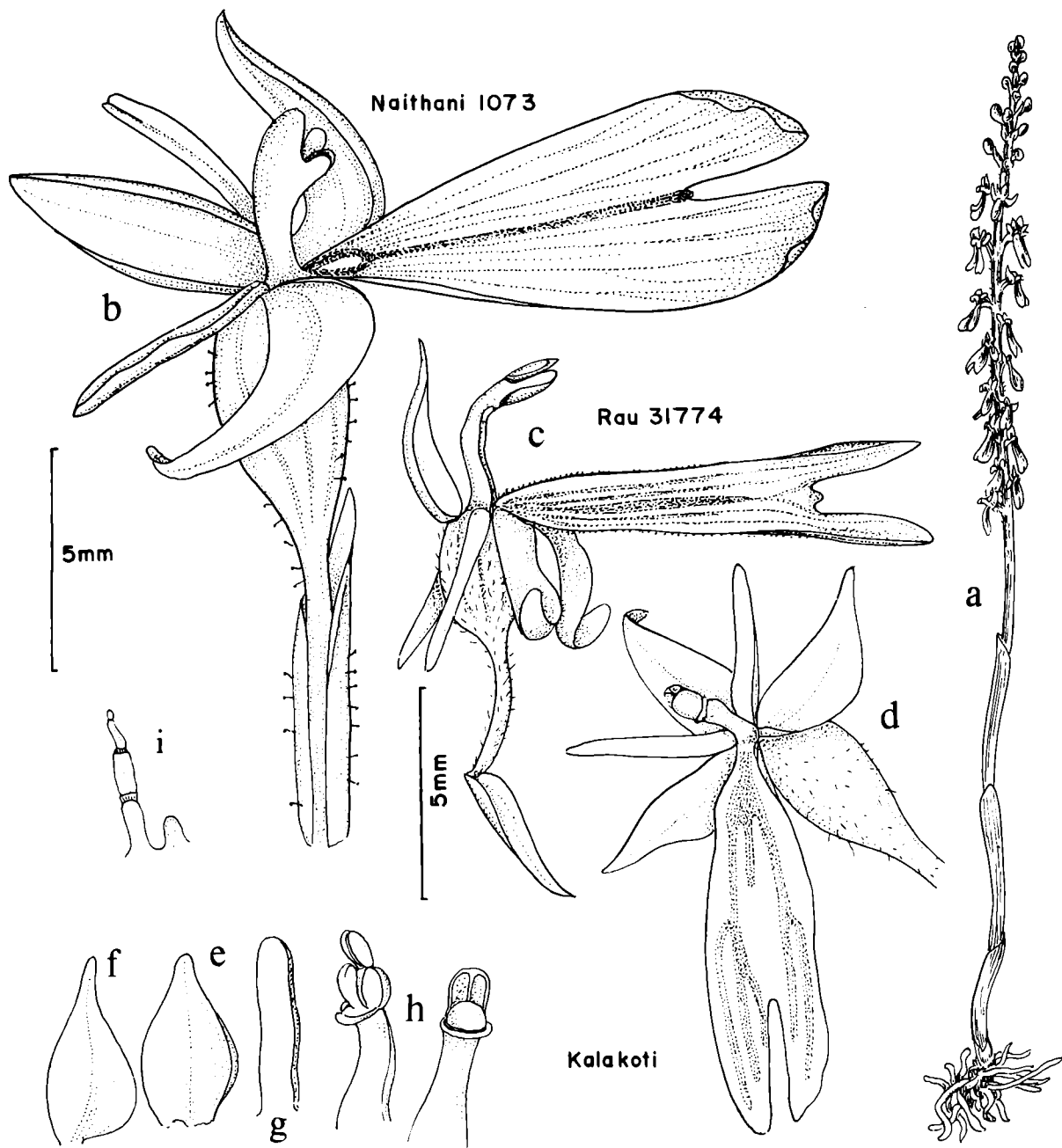
*Listera lindleyana* (Decne.) King & Pantl. in Ann. Roy. Bot. Gard. Calc. 8: 258, t. 343. 1898; Duthie, 153. 1906. (Fig. 29)

Plant up to 50 cm high. *Roots* densely crowded. *Stem* stout or slender, brownish-olive-green, bearing several loose sheaths, glabrous below, upper portion glandular-pubescent. *Leaves* absent. *Inflorescence* many flowered, up to 25 cm long, rhachis glandular pubescent. *Flower* 8-12 mm long, brownish-olive-green or dark green. *Bracts* ovate-lanceolate, varying in length. *Sepals* 5-6 mm, spreading, reflexed, ovate-oblong, the laterals some what falcate. *Petals* similar to sepals, linear, more or less falcate. *Lip* two to three times as long as the sepals, flat, stretched forwards, narrowly obovate-oblong, the apex cleft in to two oblong or lanceolate acute lobules.

*Flowering:* July - September.

*Distribution:* Himalaya 2000-3500 m (Pakistan, Kashmir to Arunachal Pradesh). Burma-Tibet frontier, S.E. Tibet.

*Specimens examined:*



**Fig. 29** *Neottia listerioides* Lindl.—a. plant; b., c., d. flowers; e. dorsal sepal; f. lateral sepal; g. petal; h. column; i. glandular hair.



Mackinnon 25426 (a)

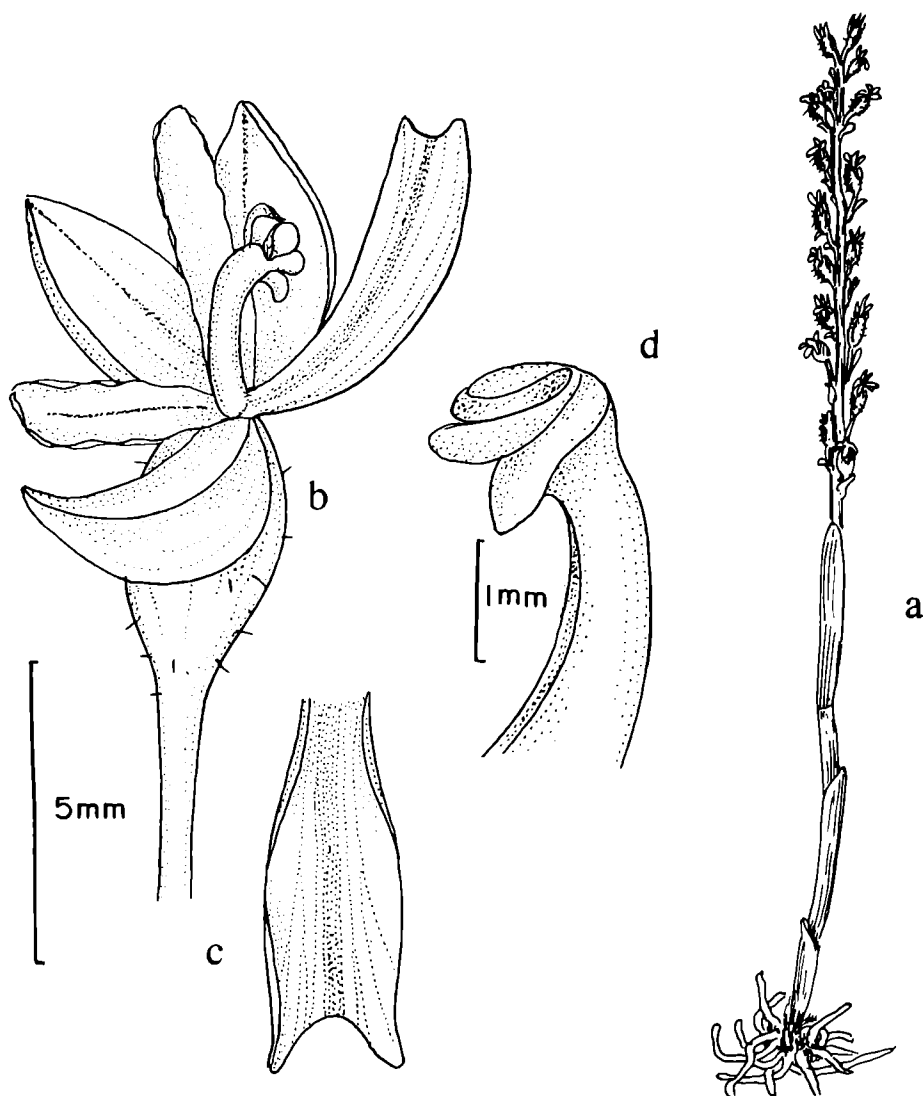
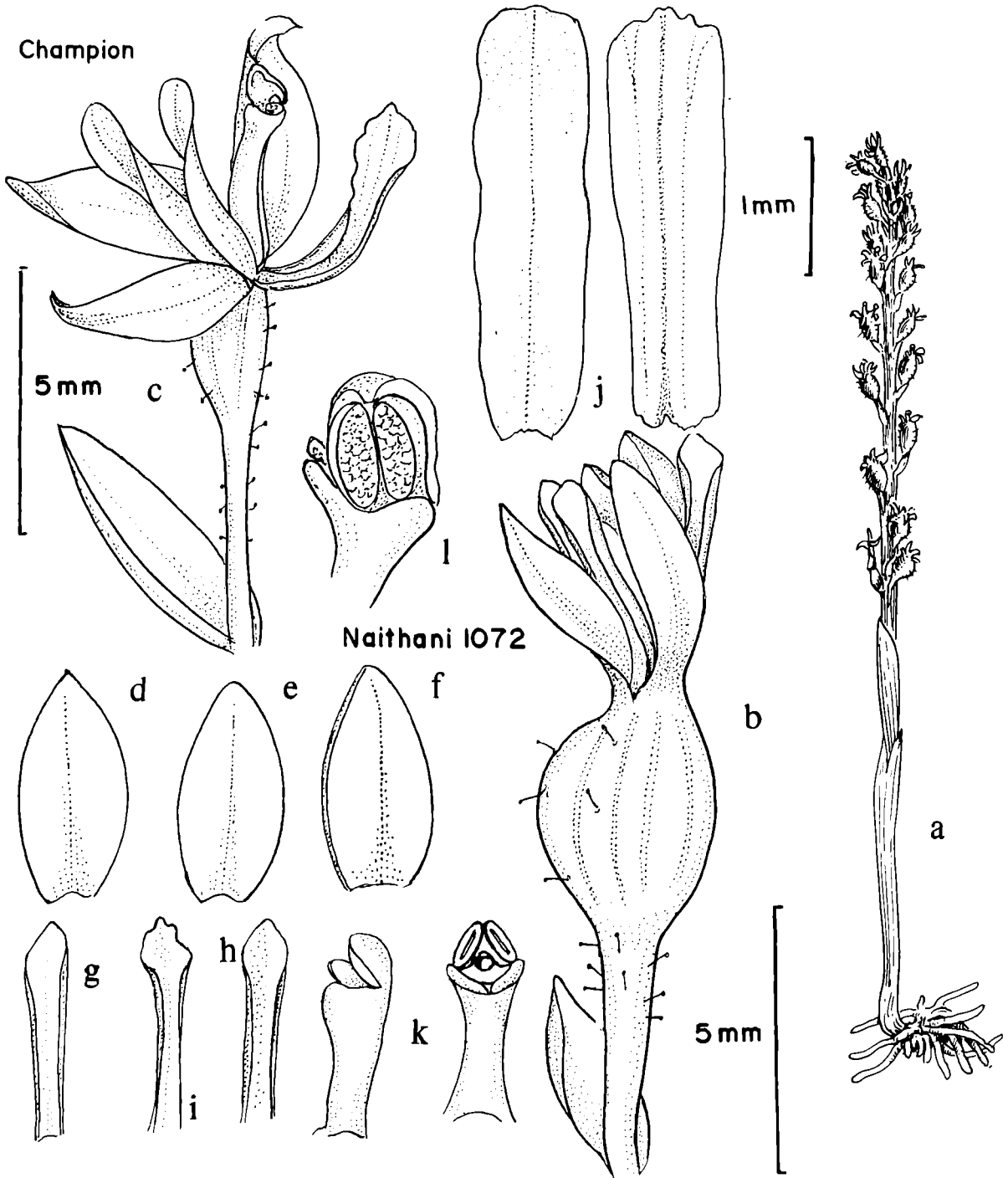


Fig. 30 *Neottia mackinnonii* Deva & Naithani—a. plant; b. flower; c. lip; d. column.



**Fig. 31** *Neottia microglottis* (Duthie) Schltr. — a. plant; b., c. flowers; d., e., f. sepals; g., h. petals; i., j. lip; k., l. column.

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 638; Deoban Chakrata, *Raizada* 18238, *Champion*. **Tehri-Nagtibba**, *Naithani* 1073; Talbirpal, *Mackinnon* 24180. **Uttarkashi**-Gangotri-Kedarganga area, *Naithani* 37374. **Chamoli**-Ghangaria, *Naithani* 1037, *M.A. Rau* 31774, *Renz* 13617. **Pauri-Khirsu**, *Naithani* 1053.

KUMAUN: **Pithoragarh**-Dhaulti Valley, *Duthie* 6004; Kali Valley, *Duthie* 6005. *Nainital*-Nainital, *Champion*, *Kalakoti*.

HIMACHAL PRADESH: Mahasu Shimla, *Gamble* 6462; Shimla *Gamble* 4779(a); Above Polang, Kangra, *Vaid* 24213; Lahul, *Bor* 15525.

JAMMU & KASHMIR: Baisaran, *T.A. Rao* 579 & 589; Pir Panjal, *Inayat* 253, *Gammie*; Gulmarg, *Inayat* 25383; Liddar Valley, *Inayat* 25384.

PAKISTAN: Chitral, Swat, Hazara, Murree (Stewart; *Renz, loc. cit.*)

*N. listeroides* Lindl. is a widely spread species in Himalaya and probably all other variations of this genus have originated from it through mutation or hybridization. Experimental approaches may help in solving the problem of origin and inter-relationship between the different taxa of the genus.

**Neottia mackinnonii** Deva & Naithani *sp. nov.*

(Fig. 30)

Affinis *Neottia microglottis* (Duthie) Schltr. a qua labello obovato, antice bilobato, lobulis parvulis, triangulis plus minusve divergentibus bene distinguitur.

Plant up to 20 cm high. *Root* fibers thick. *Stem* firm, stout and bearing 3-4 loose sheaths. *Leaves* absent. *Inflorescence* a raceme, 8-10 cm long, glandular pubescent. *Flowers* crowded, 7-8 mm across. *Bracts* oblong, sub-acute, equal or slightly longer than pedicels. *Sepals* 4 mm long, ovate, sub-acute, covered with stiff spreading hairs; the lateral pair somewhat oblique. *Petals* as long as the sepals. *Lip* obovate, equal to the size of sepals and petals, its apex is divided into two small divergent lobules.

*Flowering*: September.

*Distribution*: Tehri Garhwal, 1500-1800 m.

*Type*: East of Tehri, Tehri Garhwal, Sept. 1901, *Mackinnon* 2542 (a) (*holotype* DD).

This species was found mixed up with *Neottia microglottis* (Duthie) Schltr. Duthie, While describing *Listera microglottis* has quoted the number *Mackinnon* 25426(a) as an example of that species and it appears that this material was also used in making the illustration of the complete flower, t. 120. 1906, where the apex of the lip has been shown clearly divided in to two lobes. However the description and sketch of the lip 154, f. 5. t. 120, the apex is entire. It is thus quite clear that two different species have been involved in sketches of t. 120, but the description is that of single plant No. 25426, which was collected from Mussoorie and has the entire lip, which we now consider as the type of *Listera microglottis* Duthie, while the No. 25426 (a) is the type of new species *Neottia mackinnonii*. This species is very distinct and forms an evolutionary link between *N. microglottis* and *N. listeroides*. It has got size, shape of the petals and sepals and the small and erect nature of the earlier species, while the obovate shape of the lip with the tip divided in to two small lobules suggests affinity with the later species. It is endemic and is known only from east of Tehri at 1500-1800 m, Garhwal.

**Neottia microglottis** (Duthie) Schltr. in Engl. Bot. Jahrb. 45: 387. 1911; Raizada et al. 46. 1981.

*Listera microglottis* Duthie in J. As. Soc. Beng. 71(2): 42. 1902; Duthie, 154. t. 120. 1906; Pradhan, 1: 129. 1976.

*Archineottia microglottis* (Duthie) Chen in Act. Phytotax. Sin. 17(2): 14, fig. 1, 3, 1979. (Fig. 31)

Plant 20-30 cm high. *Root* fibres thick, pale-yellow-brown. *Stem* firm, stout, creamish-white, and bearing 2-4 loose sheaths. *Leaves* absent. *Inflorescence* a raceme, 10-20 cm long, glandular-pubescent. *Flowers* crowd-

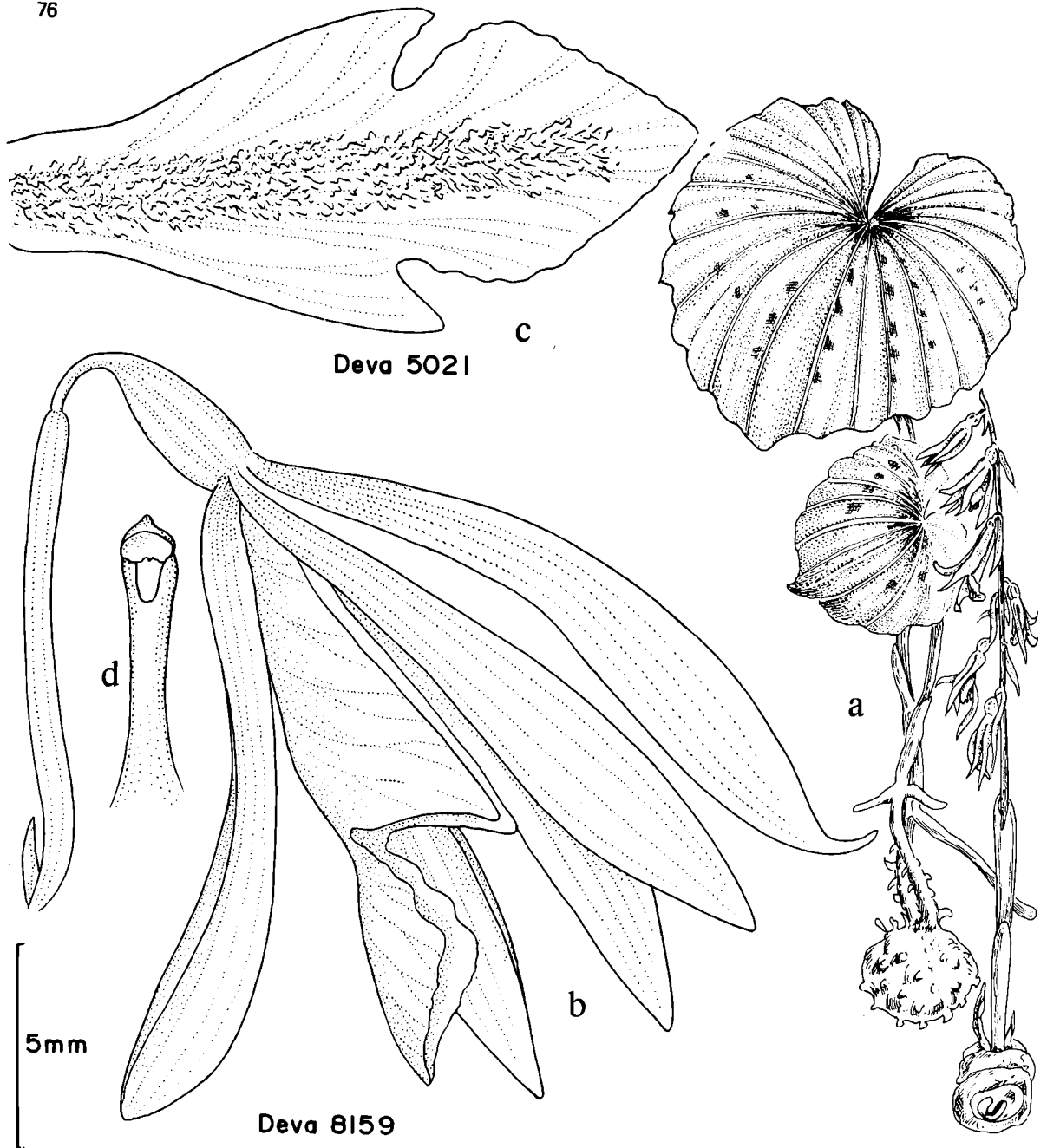


Fig. 32 *Nervilia aragoana* Gaud.—a. plant; b. flower; c. lip; d. column.

ed, pale-green, 7 mm across. *Bracts* oblong, obtuse or sub-acute, equal or slightly longer than pedicels. *Sepals* 4 mm long, ovate, sub-acute, covered with stiff spreading hairs; the lateral pair somewhat oblique. *Petals* as long as the sepals, linear-spathulate, margins reflexed. *Lip* linear-oblong, similar to the petals in shape and length, apex entire with undulate margins.

*Flowering*: August - September.

*Distribution*: Himalaya 2000-2400 m (Garhwal-Kumaun).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Below Mussoorie, *Mackinnon* 25426 (type DD); Mussoorie below Woodstock School, *Stewart* 14425. **Tehri**-Nagtibba, *Naithani* 1072.

KUMAUN: Nainital Deopatta, *Champion*.

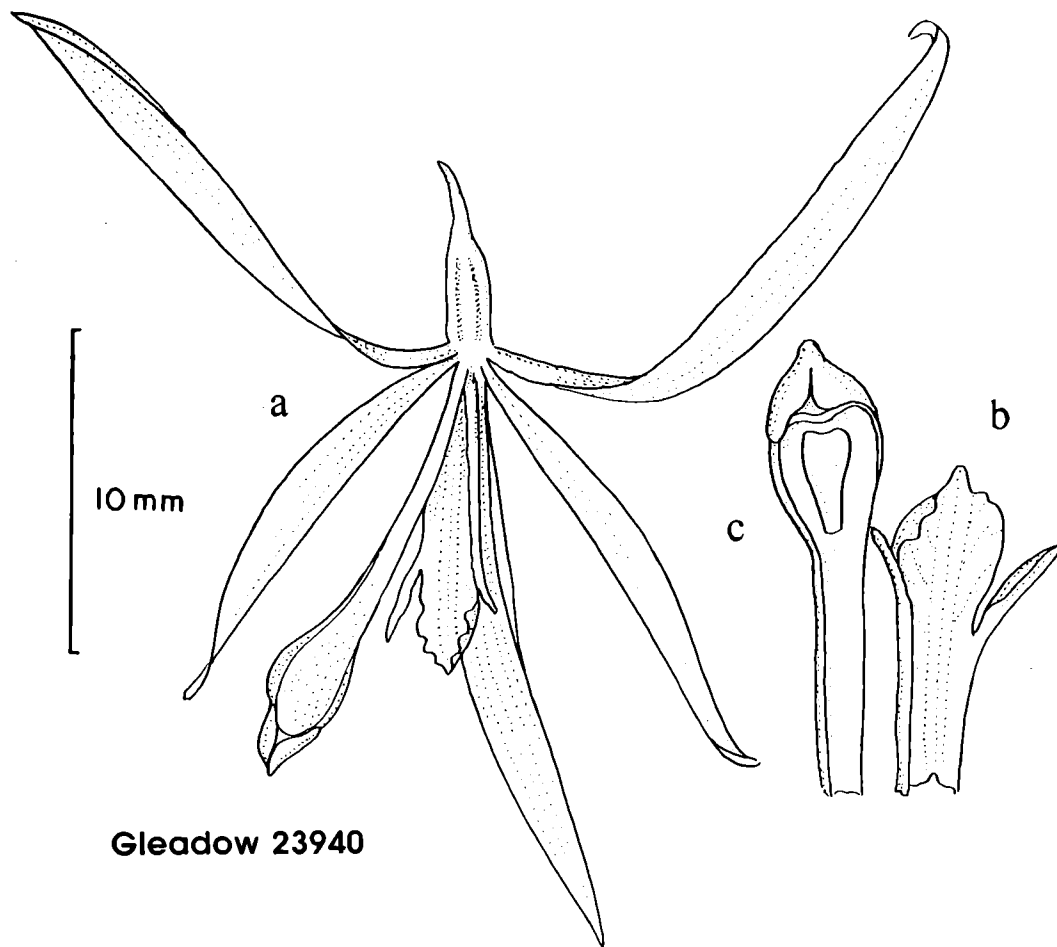
This species and the previous one are very closely allied to the Chinese species of *Archineottia gaudissartii* (Hand.-Maz.) S.C. Chen and *A. smithiana* (Schltr.) S.C. Chen respectively. With the accumulation of more material and increased knowledge it is very possible that they may prove conspecific.

#### **Nervilia** Comm. ex Gaud.

Terrestrial, growing from underground tubers, leaves produced after flowering. *Leaf* solitary, short or long petioled, broadly cordate or orbicular, strongly plicate. *Inflorescence* erect, bearing 1-2 or several flowers. *Sepals* and *petals* similar, spreading, narrow. *Lip* inferior, sometime saccate at the base, adnate to the base of the column, the lower part convolute round the column, not spurred, usually trilobed; terminal lobes flat, ovate, orbicular, entire or fimbriate. *Column* long, clavate upwards; *stigma* entire, oblong or orbicular. *Pollinia* 2 or 4, elongate, often cohering but without either caudicle or gland.

#### **Key to species**

1. Inflorescence with one flower only ..... 2
- + Inflorescence with more than one flower ..... 5
2. Mid-lobe of the lip fimbriate; side lobes rounded with entire or slightly erose edges, placed close to the apex of the mid-lobe; leaf orbicular, cordate without any distinctly differentiated apex, hairy on dorsal surface ..... *N. prainiana*
- + Mid-lobe with almost entire edges; side lobes acute to rounded, placed laterally at a distance from the apex of the mid-lobe; leaf glabrous, angular with a distinct apex ..... 3
3. Lip with hairs, two hairy ridges on the basal part and a median papillose or hairy ridge on the centre of the mid-lobe; mid-lobe orbicular to obovate, with obtuse apex ..... 4
- + Lip completely glabrous without any hairy ridge, mid-lobe narrower, much longer than broad, apex acute ..... *N. mackinnonii*
4. Column puberulous on anterior surface ..... *N. falcata*
- + Column glabrous..... *N. infundibulifolia*
5. Flowers two in the inflorescence; lip glabrous, when spread out ovate-oblong in shape, without distinct side lobes; leaf flat on the surface of the ground, ovate-cordate, hairy green or purple in colour . . . . . *N. plicata*
- + Flowers 3-20 in the inflorescence; lip hairy with distinct side lobes; leaf ovate-cordate, glabrous, born on a long petiole, rising much above the surface of the ground ..... 6
6. Flowers large, pink in colour; sepal 25 mm or more longer, 6 mm or more broader, margin of the anterior half of the mid-lobe crenulate ..... *N. gammiana*
- + Flowers smaller, green with purple veins; sepals 15-18 mm long and 2.5-3 mm broad, margin of the anterior half of the mid-lobe entire to undulate ..... *N. aragoana*



**Fig. 33** *Nervilia aragoana* Gaud.—a. flower; b. lip; c. column.

**Nervilia aragoana** Gaud. in Freycinet Voy. Bot. 422 t. 35. 1829; Seidenf., 32: 164, fig. 103. 1978.

*Pogonia flabelliformis* Lindl. Gen. & Sp. Orch. 415. 1849; Hook. f., 6: 121. 1890; Duthie, 158. t. 125. 1906.

*N. flabelliformis* (Lindl.) Tang & Wang, in Act. Phytotax. Peking 1, 1: 68. 1951 (Fig. 32)

Tuber globose, 1-2 cm across. *Leaf* appears after flowering, solitary, petiole, lamina glabrous, 5-7 cm, broadly flabellate-cordate, abruptly apiculate at tip, margin undulate. *Scape* stout, 10-30 cm high; raceme laxly 4-6-flowered. *Flowers* green with purple veins, pendulous, 20-24 mm long. *Bracts* deflexed, linear-lanceolate, acute, 3-nerved, twice as long as the ovary. *Sepals* sub-equal, 15-18 × 3 mm, linear, acute, 3-nerved. *Petals* 12-14 mm long, linear, narrowly oblanceolate-obtuse, 3-nerved. *Lip* 13 mm long, ovate, trilobed near the middle, white tinged with yellow veined with purple; side lobes erect, embracing the column, obtuse; mid-lobe ovate, obtuse, entire to undulate at margins, densely pubescent along the nerves on the upper side.

*Flowering*: June - July.

*Distribution*: Himalaya up to 1800 m (Garhwal, Nepal to Sikkim), Orissa, Meghalaya, Tamil Nadu, Karnataka, Kerala, Andaman Island. Burma, Laos, Vietnam, China, Philippines, Indonesia, Sumatra, Malaya, New Guinea, Australia.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Kansro, *Harsukh*, 24195; Asarori Siwalik, *Harsukh* 24194; Laxmansidh, *Deva* 4229, 5021, 8159; Mussoorie, Kampty fall, *Harsukh*; Near Mussoorie, *Mackinnon* 22704; Arnigadh below Mussoorie, *Banwari Lal* 22704(a); Dhobighat near Mussoorie, *Arora* 36484. **Tehri**-Below Silkiana, *Duthie* 586.

We have kept a specimen Gleadow 23940 (Fig. 33) collected from Tehri Garhwal provisionally here. The column has become abnormally long, the lip is glabrous above and is reduced to about half the normal size, leaves are not known. It may prove to be a new species.

**Nervilia falcata** (King & Pantl.) Schltr. in Engl. Bot. Jahrb. 45: 402. 1911; Seidenf. 32: 153. 1978.

*Pogonia falcata* King & Pantl in J. As. Soc. Beng. 65(2): 129. 1896 et 268, t. 357. 1898 (Fig. 34)

*Tubers* spherical, 8 mm in diameter, covered with small root-knobs; leaf and scape not contemporaneous. *Leaf* solitary, above the surface of the ground, 5 × 5 cm, base cordate, margin undulate or slightly angular with approximately rounded angles, apex acute, surface completely glabrous more or less fleshy, dark green above, nerves 7, prominently raised, and many other intermediate nerves impressed in between; petiole 4.5 cm. *Inflorescence* one-flowered, scape 5 cm tall, greenish tinged with purple, terete, nodes 2 with two loose tubular sheaths. *Flower* almost at right angle to the scape, bracteate, pedicel small, curved. *Sepals* 14 mm long, 1.5 mm at base and 2.5 mm above broad, apex acute, 3-nerved, colour greenish with tinge of brown. *Petals* very similar, 12 mm long, 3-nerved. *Lip* 14 mm long, 3-lobed, laterals acute to sub-obtuse, more or less convolute around the column forming a tube, mid-lobe 5.5-6 mm broad, obovate, centre of the lip with a ridge running from tip to the base, nerves 3, mid-nerve usually unbranched clear near the tip and again from middle to the base, lateral nerves run on both side of the ridge, branched on outer side, often the branches are broken with no clear connection giving an impression of brown patches over the surface of lip, all the nerves and the tip of the mid-nerve is of deep brownish colour, lower portion of the lip on both side of the ridge hairy, while the surface of the mid-lobe especially on the nerves papillose. *Column* about 7 mm long, the flat anterior side hairy.

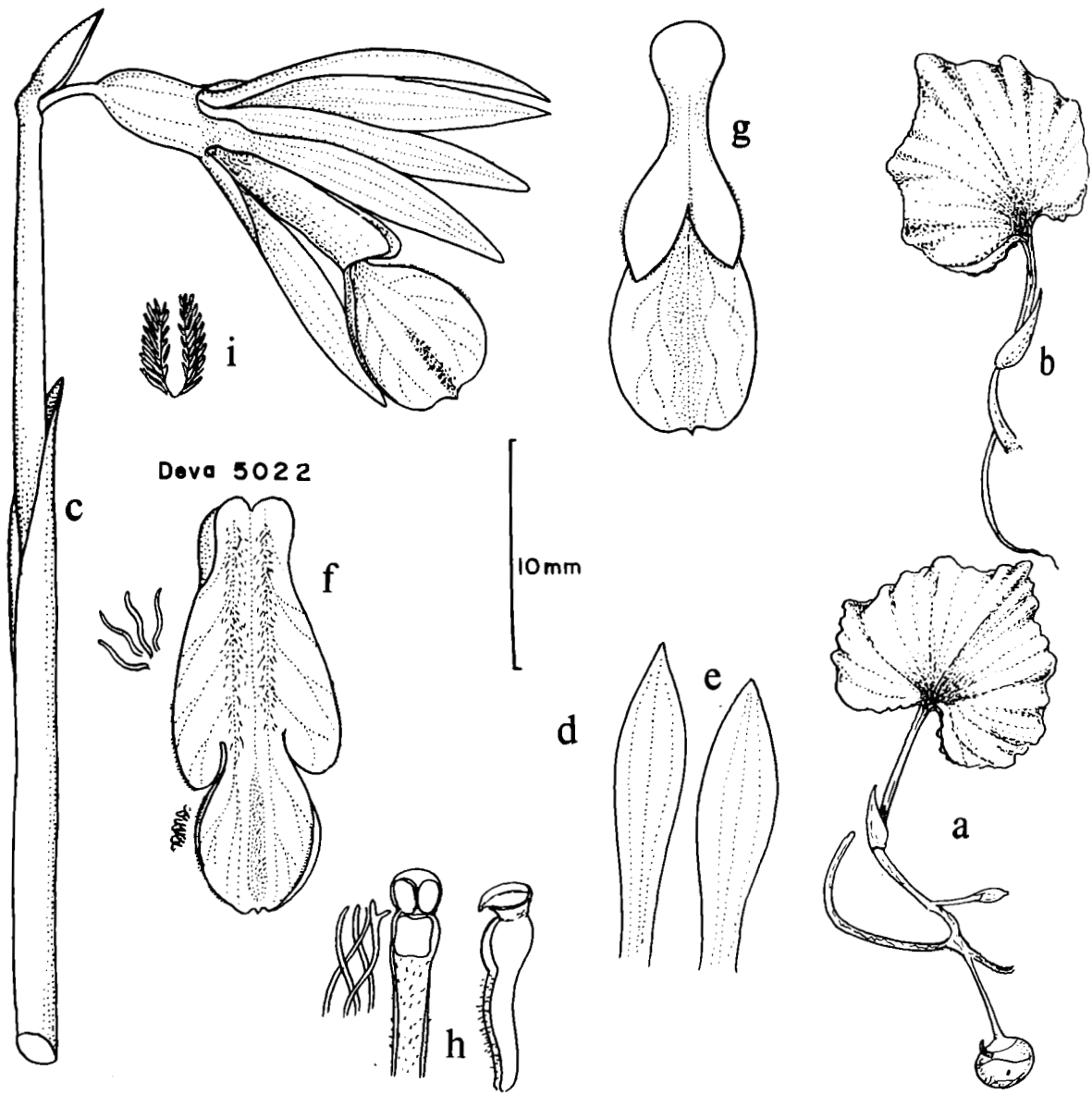
*Flowering*: May - June.

*Distribution*: Himalaya upto 800 m (Garhwal and Bhutan).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Teen pani Swamp near Chiddarwala, *Deva* 5845; Mohand Siwalik *Deva* 5022.

Our identification of the plant can be called as controversial. We have not been able to compare satisfac-



**Fig. 34** *Nervilia falcata* (King & Pantl.) Schltr. — a. & b. plants; c. flower; d. sepal; e. petal; f. & g. lip; h. column; i. pollinia.



torily our plant with the original material collected by Pantling from Doar of Bhutan east of Jaldacca river Seidenfaden (1978) has tried to locate the type, but says there is none at Kew, and from Calcutta where the type specimens should have been, they have disappeared. However we located the type at Calcutta and is represented by two plants in a bad state of preservation without any leaf and was of no help in the study of the delicate nature of the column and the lip. We in its place carefully compared our plants, with the King & Pantling's (268 t. 357. 1898) diagrams and description. The leaves were not known but flower and scape match almost exactly. The mid-lobe is obovate and blunt, with a single glandular pubescent (in our case only glandular papillose) line, the base of the lip convolute, embracing the column and the side lobes are acute. The most important resemblance is in the case of puberulous anterior surface of the column, which is not known in any other species of this group. The plant resembles also with *N. infundibulifolia* but in that case the column is glabrous. We have doubt that *N. infundibulifolia* is conspecific with *N. falcata* and agree with Seidenfaden & Arora (1982), that the further study of the whole group is necessary especially from the fresh flowers as the papillose nature of the lip is never clear in dry specimens. The difference between the two is only on the nature of the hairy ridge or ridges on the lip. In *N. infundibulifolia*, Sant. & Kapadia (1966) describe "the midnerve callus-like, white", while Seidenfaden (1978) in key p. 148. and figure 94, describe "lip with two hairy ridges on hypochile and a papillose median ridge on epichile". In *N. falcata* King & Pantling (1898) mentioned "the upper surface with a single broad thickened glandular-pubescent line from the middle to nearly the apex". They do not describe the situation of the ridge in the basal part of the lip nor the fig. 357/3 of a spread out lip shows clearly the ridge in the basal portion of the lip. In addition to these two species *N. calcicola* Kerr., as has been shown by Seidenfaden 1978, 155. fig. 96, may also prove to be conspecific. If the dots on the column of *N. calcicola* in fig. 96, d. are an indication of a hairy nature, then the two taxa might be conspecific. The leaves of all the three species mentioned above are identical in shape, and even the purple band on the upper surface of the leaf was observed in a young leaf of the plant we have now identified as *N. falcata*.

***Nervilia gammieana*** (Hook. f.) Pfitzer, Nat. Pflanzenfan, 2. 6: 56, f. 44, 106, f. 105. 1889; Stewart, 72. 1972; Seidenf., 164. fig. 102. 1978; Renz. 47. 1984.

*Pogonia gammieana* Hook. f., in Curtis Bot. Mag. 39: t. 669. 1883 et 6: 120. 1890; King & Pantl, 269, t. 359. 1898; Duthie, 158. 1906.

*Nervilia aragoana* sensu Stewart in Pak. J. Forest. 11(1): 60. 1961 non Gaud. (Fig. 35)

Tuber about 3 cm in diameter, globular, warty. *Leaf* 12-15 cm in length and breadth, reniform, abruptly apiculate, glabrous, many nerved, margin undulate; petiole about as long as the blade. *Scape* 15-20 cm high, stout, 5-8 flowered. *Flowers* 2.5 cm long, drooping, pink streaked with white. *Bracts* linear-lanceolate, acuminate, deflexed, longer than ovary. *Sepals* and *petals* sub-equal, elliptic, oblanceolate, acuminate, subconnivent, sepals about 25 × 6 mm. *Lip* pale-green, minutely saccate at the base, elliptic-obovate, the lower half convolute round the column and bearing two short triangular forward pointed side lobes; the anterior half expanded, its edges crenulate.

*Flowering*: July.

*Distribution*: Himalaya up to 1300 m (Pakistan, Kashmir, Garhwal, Nepal to Arunachal Pradesh).

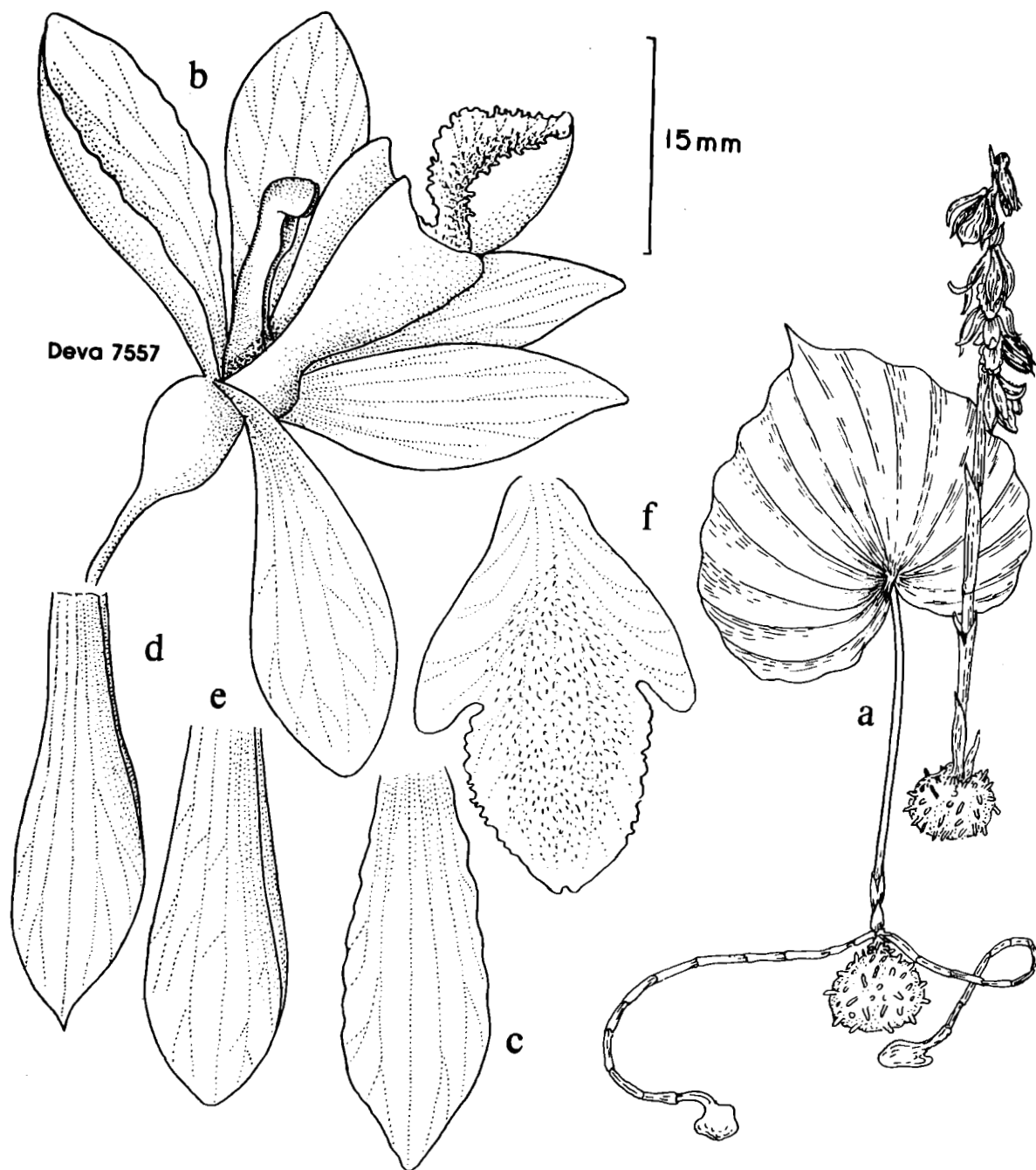
*Specimens examined*:

GARHWAL: Dehra Dun-Sivaliks, Deva 7557, Renz 13572; Lachiwala, Raizada; New Forest, Naithani & Dayal 1712; Near Kalupani, S. S. Jain; Near Mussoorie, Mackinnon 22975. Pauri-Outer Garhwal Hills, Inayat 25829.

JAMMU & KASHMIR: Nawal Nadi, Poonch, Rashid.

PAKISTAN: Panjar Rawalpindi, Renz 10788.

*N. gammieana* is a very distinct species, and one has to see it in nature with its large bright pink flowers.



**Fig. 35** *Nervilia gammieana* (Hook. f.) Pfitz. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip.

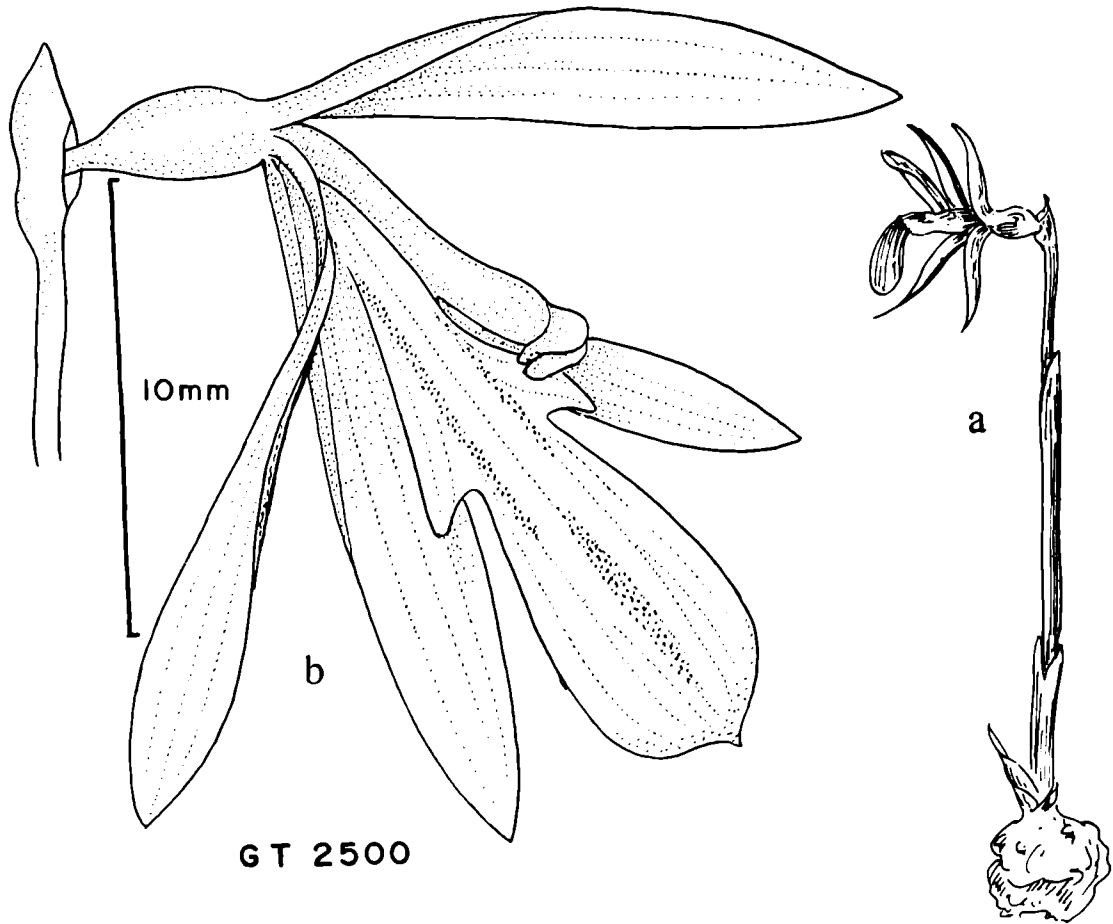


Fig. 36 *Nervilia infundibulifolia* Blatt. & McCann.—a. plant; b. flower (after Seidenf.).

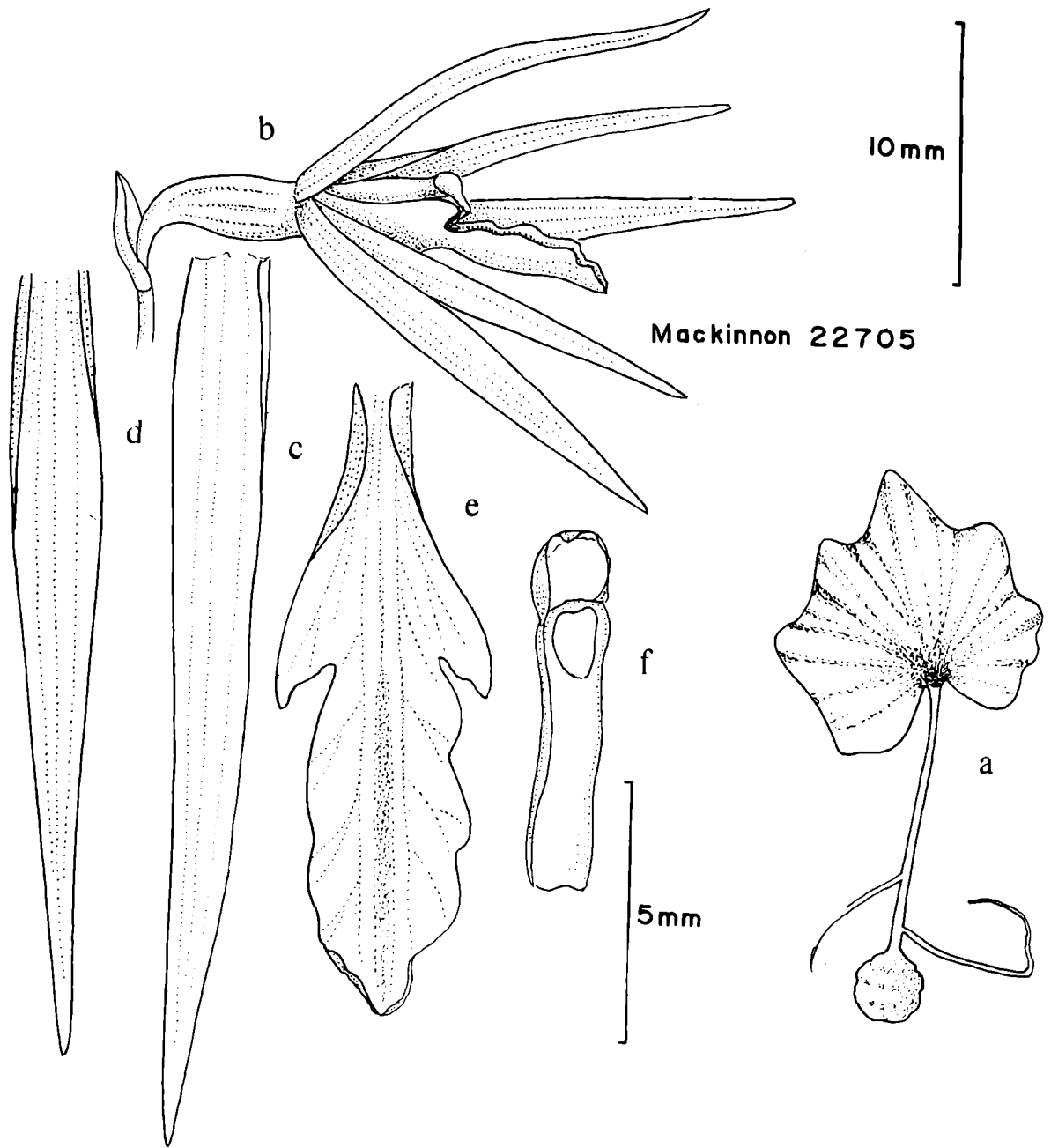


Fig. 37 *Nervilia mackinnonii* (Duthie) Schltr. — a. plant; b. flower; c. sepal; d. petal; e. lip; f. column.

It can never be confused with *N. aragoana*, a species with much smaller greenish flowers which never fully opens.

***Nervilia infundibulifolia*** Blatt. & Mc Cann, in J. Bombay nat. Hist. Soc. 35: 725. t. 3. 1932; Deva, 268. 1969; Seidenf., 53. fig. 94; Raizada et al. 49. 1981; Hedge & Rao, 388, 1983.

*N. hallbergii* Blatt. & Mc Cann, in J. Bombay nat. Hist. Soc. 35: 726. 1932. (Fig. 36)

Tuber sub-globose, dorsi-ventrally flattened, 6-12 mm across. *Leaf* flat on the ground, appears after flowering, sub-orbicular, glabrous, 5-7 lobed, chocolate coloured bands along the nerves, 2-4 cm long. *Scape* one flowered, 6-15 cm tall, pale-maroon. *Flowers* greenish purple at right angle to the scape. *Bracts* 3-7 mm long, sub-concave, ovate, 3-nerved. *Sepals* 13-15 mm long, slightly concave, linear-lanceolate, light maroon-green, glabrous, broader in the middle, 3-nerved. *Petals* similar to sepals, 12-14 mm, mid-nerve prominent. *Lip* 17 mm long, saccate at the base, gland dotted, 3-lobed; side lobes pale apple-green, acute, triangular; mid-lobe broadly obovate or sub-orbicular, rounded at apex, margin irregular.

*Flowering*: July.

*Distribution*: Himalaya up to 1000 m (Garhwal and Arunachal Pradesh), Orissa, Konkan, W. Ghats, N. Kanara, Poona. Malaya, Borneo, Thailand.

***Nevilia mackinnonii*** (Duthie) Schltr. in Engl. Bot. Jahrb. 45: 402, 1911; Seidenf., 155. fig. 97. 1978.

*Pogonia mackinnonii* Duthie in J. As. Soc. Beng. 72(2): 43. 1902 et 157. t. 123. 1906; —Duthie, 180. 1906.

*N. macroglossa* (Hook. f.) Schltr. var. *mackinnonii* (Duthie) Pradhan Ind. Orch. 1: 148. 1976. (Fig. 37)

Tuber globose, annular, warty; leaf and scape from the same tuber, but not contemporaneous. *Leaf* appearing after flowering, 5 cm long and broad, 7 lobed, cordate; terminal lobe acute, the others rounded; principal veins terminating at the ends of the lobes, with many less conspicuous intermediate ones; petiole 2.5 cm long. *Scape* 1-flowered, about 10 cm, linear-lanceolate, acuminate, light green, blotched with reddish-brown outside. *Petals* similar to sepals, but little shorter, not so acute at the apex. *Lip* glabrous, shorter than petals, oblong, 3-nerved, white tinged with green at the base; side lobes erect, acute; mid-lobe narrower much longer than broad, acute, spotted with purple.

*Flowering*: May - June.

*Distribution*: Himalaya up to 1500 m (Garhwal and Kumaun).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 21781, 22705 (type, K). **Chamoli**-Mandal, *Naithani* 43925.

KUMAUN: **Pithoragarh**-Chwopata-Maitli, *Arora* 70808. **Nainital**-Nainital, *Champion* 7750; Near Nainital, *Deva* 10078.

Pradhan (1976) treated *N. mackinnonii* as a variety of *N. macroglossa* (Hook. f.) Schltr. These two species are very distinct, the former is a much smaller plant with definite angular leaves and the lip with distinct side lobes which are about 14-15 mm and smaller than the sepals. In the latter the leaf is much bigger with undulate margins, the lip is longer than the sepals and about 23-25 mm with indistinct side lobes. *N. mackinnonii* is related more to *N. infundibulifolia*, *N. falcata* and *N. calcicola*. Unfortunately, we had very little material for the study of *N. mackinnonii* and after the collection of the type, it has been collected only once in flower in 1970 (*Naithani* 43925). The lip in dry state is completely glabrous with acute side lobes. The mid-lobe is broader than in the type and has almost an obtuse apex. Further studies with more preferably fresh material may prove clearly its relationship and its possibility of being conspecific with *N. infundibulifolia* and *N. falcata*, both of which have been discovered in the vicinity of the type locality.

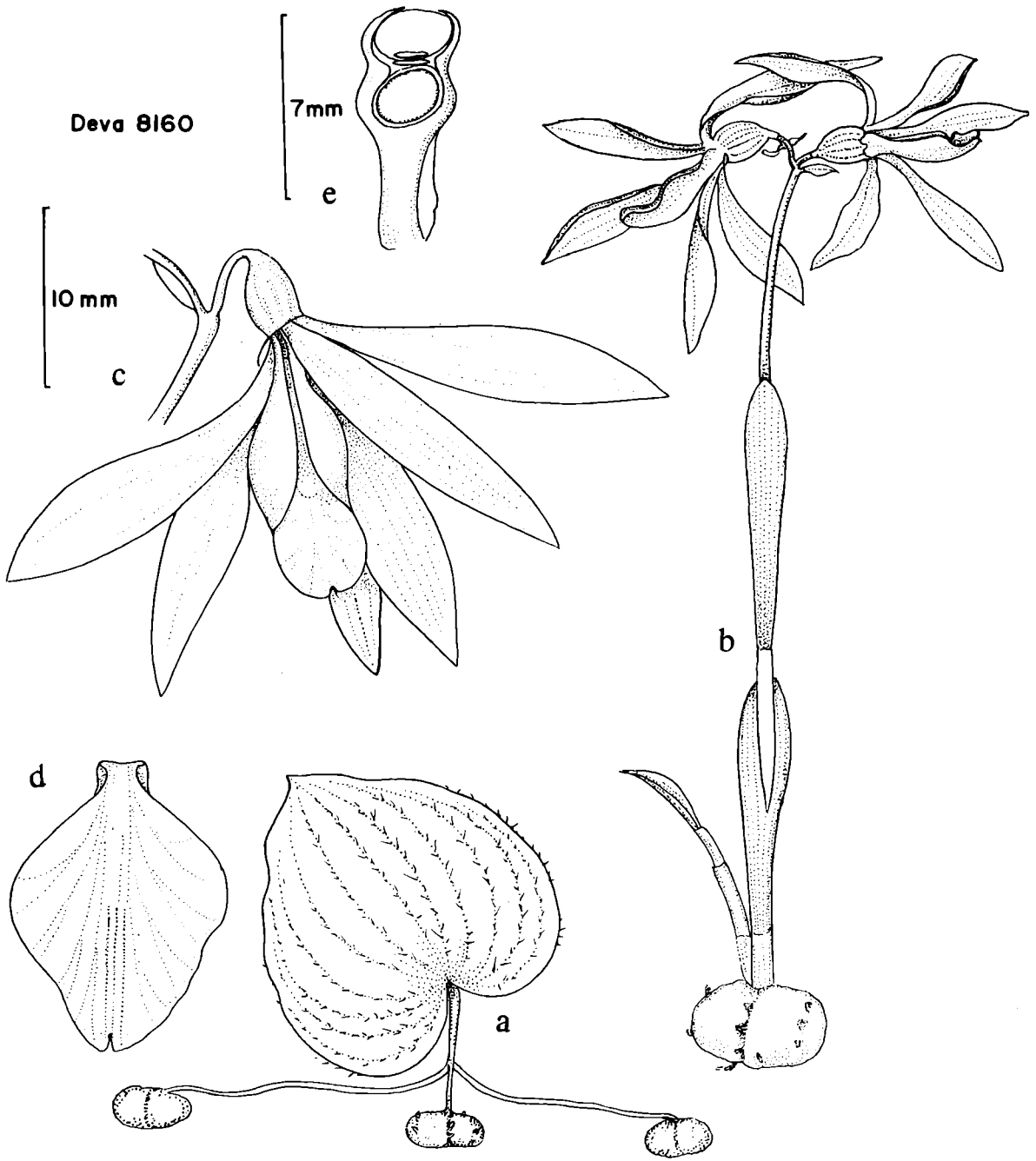


Fig. 38 *Nervilia plicata* (Andr.) Schltr.—a. & b. plant; c. flower; d. lip; e. column.

**Nervilia plicata** (Andr.) Schltr. in Engl. Bot. Jahrb. 45: 403. 1911; Seidenf., 156. Fig. 100. 1978; Seidenf. & Arora 22. 1982, Renz. 48. 1984.

*Arethusa plicata* Andr. Bot. Rep. 5: t. 321. 1803.

*Cordyla discolor* Bl. Bijdr. 417. 1825.

*N. discolor* (Bl.) Schltr. in Engl. Bot. Jahrb. 45: 403. 1911.

*Epipactis plicata* Roxb. Fl. Ind. 3: 454. 1832.

*Pogonia plicata* (Roxb.) Lindl. Gen. & Sp. Orch. 415. 1840; Hook. f., 6: 119. 1890; King & Pantl. 268, t. 358. 1898.

*P. biflora* Wt. Ic. 5(1): 22 t. 1758. 1851.

*N. biflora* (Wt.) Schltr. in Engl. Bot. Jahrb. 45: 403. 1911.

(Fig. 38)

Tuber globose, 1.5 cm across, leaf lying flat on the surface of ground. *Leaf* orbicular up to 13 cm broad, sub-seesile, cordate, entire to broadly denticulate at margin, sometimes blotched with purple and with white setaceous hairs all over and along the radiating veins. *Scape* white, 2 rarely 3 flowered, up to 12 cm long. *Flowers* erect or sub-erect, creamy white or greenish-brown with lip having violet streaks. *Bracts* ovate-lanceolate, acute, entire or finely toothed at the apex. *Sepals* and *petals* spreading, oblong-lanceolate, acute, sparsely dotted with tiny dark glands. *Sepals* 20 × 4 mm, mid-nerve prominent below; lateral sepal shorter narrower. *Lip* 15 × 10 mm, glabrous, when spread out ovate-oblong in shape, without distinct side lobes, midrib thickened and callus like for more than half its length, base slightly saccate.

*Flowering*: May - June.

*Distribution*: Himalaya up to 1500 m (Pakistan, Himachal Pradesh, Garhwal, Kumaun, Sikkim, Arunachal Pradesh), Bengal, Orissa, Karnataka, Tamil Nadu, Deccan. Burma, Malaya, Laos, Vietnam, Philippines, China Thailand and Australia.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, Kansro, *Harsukh* 24193; Laxmansidh, *Deva* 8160, 10272, 10273; Sainkot block, *Deva* 5821, 6724; Golatappar, *Deva* 5089.

KUMAUN: **Pithoragarh**-Chowpata-Maitli, *Arora* 70813.

HIMACHAL PRADESH: Kusra Valley, *W. Gollan*.

PAKISTAN: Panjar, Rawalpindi Dist., (Renz, *loc. cit.*)

The complex nomenclatural problem of the plant has been discussed by Seidenfaden, 161. 1978. The colour of fresh flowers from Dehra Dun shows greenish-brown sepals and petals; lip whitish-green below, sides pink and with a raised median band in centre of greenish-yellow colour. The leaves are of two colours, green and purple, which are often being found side by side in the forest and also maintaining the same colour under cultivation and not changing from one to another. Sant. & Kapadia (1966) on the other hand have observed that the leaves change to purple colour in sunny and to green in shady places. We have not been able to link any difference between the floral structure of these two forms.

Joseph 21, f. 11 a. 1982, described and sketched a plant which has completely orbicular leaf, it appears to us a different species altogether.

**Nervilia prainiana** (King & Pantl.) Seidenf. & Smitin. Orch. Thailand, 730. 1964; Seidenf., 149, fig. 91. 1978.

*Pogonia prainiana* King & Pantl. in J. As. Soc. Beng. 65: 129. 1896. et 267, t. 355. 1898.

*N. monantha* Blatt. & McCann in Bombay nat. Hist. Soc. 35: 724. 1932; Deva, 95: 268. 1969.

*N. crispata* sensu Malhotra, in Bull. bot. Surv. Ind. 11: 208. 1969. *non* (Bl.) Schltr. (Fig. 39).

Deva 5023

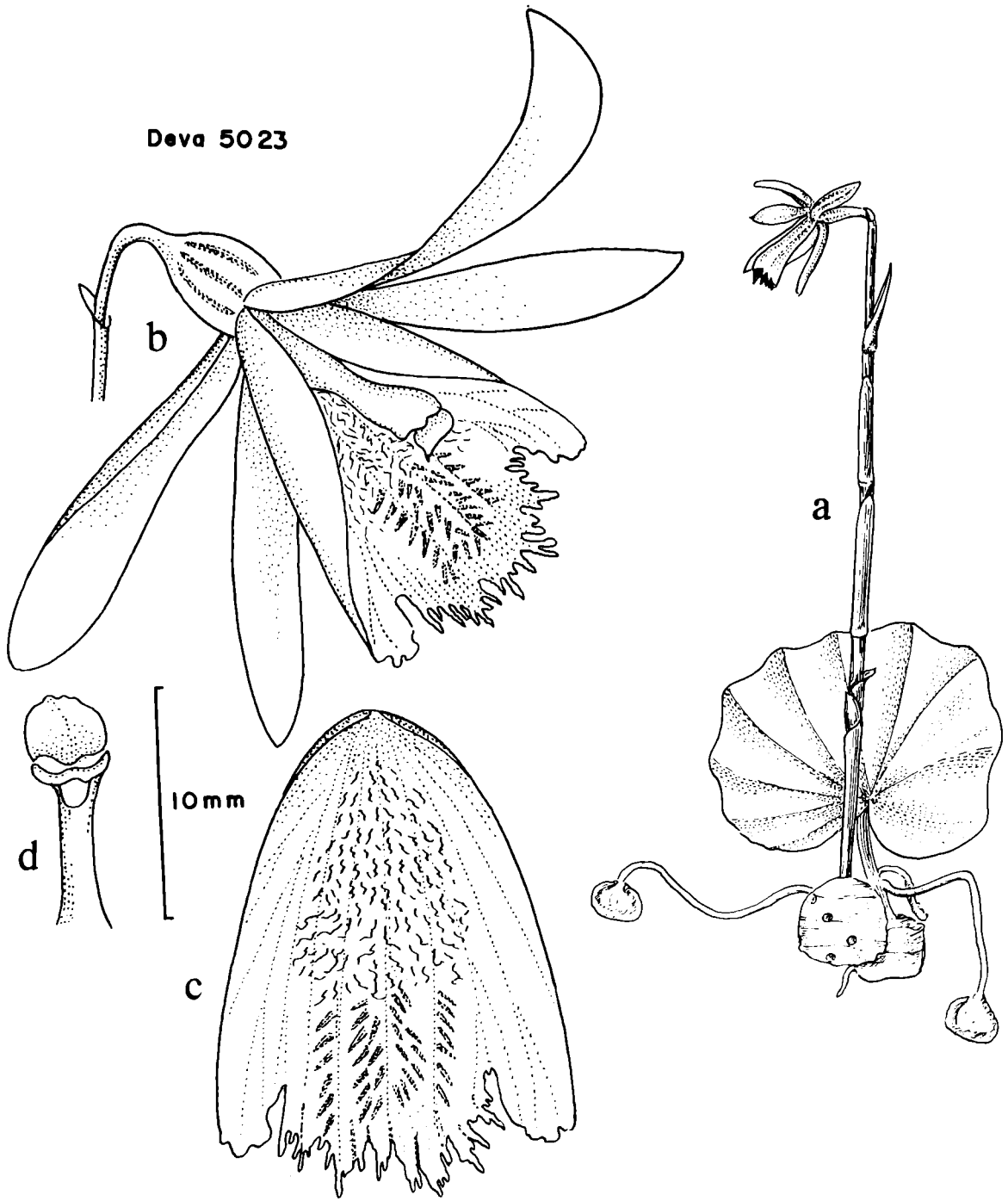


Fig. 39 *Nervilia prainiana* (King & Pantl.) Seidenf.—a. plant; b. flower; c. lip; d. column.



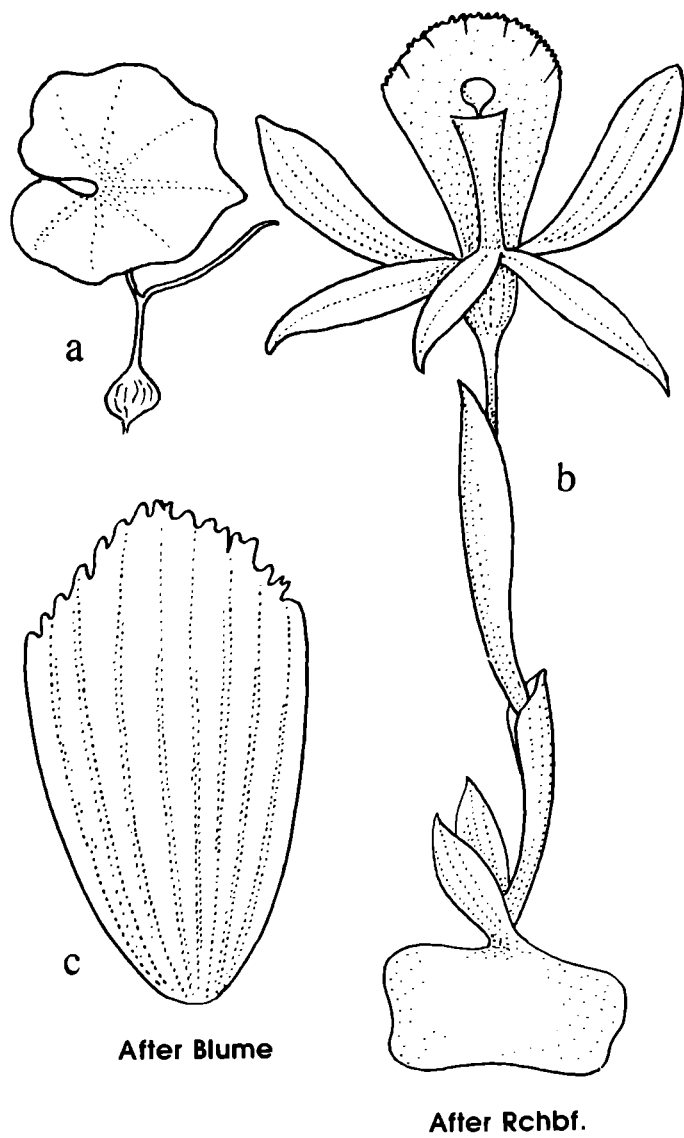
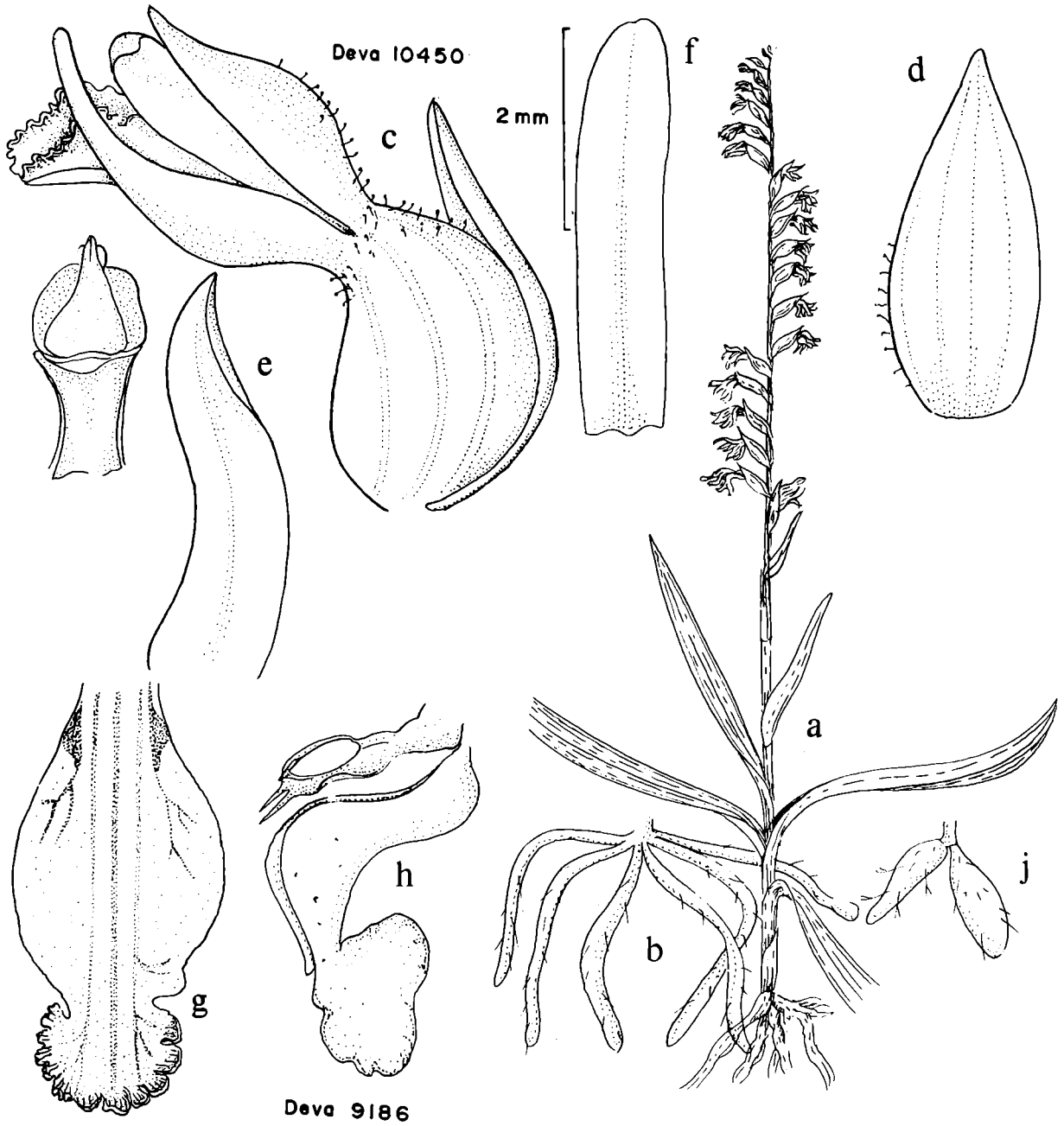


Fig. 40 *Nirvilia crociformis* (Zoll. & Mor.) Seidenf. — a. & b. plant; c. lip.



**Fig. 41** *Spiranthes sinensis* (Pers.) Ames. — a. plant; b. roots; c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. lip; h. column and lip; i. column *Spiranthes spiralis* (L.) C. Koch., j. roots.

Tuber brown, warty. *Leaves* 5-8 cm broad, appearing after flowering, at first ovoid or ellipsoid, then gradually spreading from plicate folds in to funnel-shaped, then to flabellate, at maturity to flat, orbicular-cordate shape, without any distinctly differentiated apex, hairy on dorsal surface. *Scape* erect or decumbent, one flowered, 3-9 cm long. *Flower* faintly fragrant. *Bracts* conical, about 2 mm long. *Sepals* 1-2 cm long, membranous, sub-equal, pale-green to pinkish tinged, linear-oblongate, entire, acute, 5-nerved. *Petals* similar to sepals, 3-nerved. *Lip* membranous, pink, trumpet shaped, spreading, 3-lobed; side lobes upturned, rounded with entire or slightly erose edges, placed close to the apex of the mid-lobe; mid-lobe broad, flat, fimbriate.

*Flowering*: May - June.

*Distribution*: Himalaya up to 1500 m (Garhwal, Kumaun, Sikkim), Manipur, Orissa, Madhya Pradesh, Karnataka, Bombay. Java, Philippines, New Guinea, Thailand.

*Specimens examined*:

GARHWAL: Dehra Dun-Dehradun, Gularghati, *Deva* 2634; Rajpur, *Deva* 10278; Laxmansidh, *Deva* 10266; Nakrunda, *Deva* 5023; Sainkot, *Deva* 5831; Bibiwala, *Malhotra* 38302.

KUMAUN: Pithoragarh-Chowpata-Maitli, *Arora* 70807. Nainital-Sat Tal, *Deva* 10077; *Renz* 13605.

We have carefully examined all the specimens from our area and find that the lip has distinct side lobes, moreover the leaves are regularly orbicular cordate without distinctly differentiated apex. Seidenfaden, 149-15, fig. 91, 92. 1978 has very convincingly shown that *N. crispata* (Bl.) Schltr. ex Kranzlin [*N. crociformis* (Zoll. & Mor.) Seidenf.] is a distinct species which has a lip without side-lobes and angular leaves and it has been erroneously associated with *N. prainiana*. The material from our region identified as *N. crispata* (Malhotra, 1969; Deva, 1980) is a wrong identification and belongs to *N. prainiana*. We are reproducing Seidenfaden, fig. 92 c.d.e. 1978 of *N. crociformis* for comparison (Fig. 40).

### **Spiranthes** L.C. Rich.

Terrestrial leafy herb with tuberous or cylindrical rarely fibrous roots. *Leaves* narrow, basal or fugaceous, bases sheathing or petioled. *Flowers* small, only slightly opened in spirally arranged glandular-pubescent spikes. *Sepals* sub-equal, free or sometimes cohering with the petals to form an erect hood; the lateral pair gibbous at the base. *Lip* erect, concave or saccate at the base, simple or 3-lobed, the disc bearing lamellae or calli. *Column* short, terete, with or without a foot but with a convex stigma in front. *Anthers* dorsal, erect, 2-chambered. *Pollinia* 2, deeply bipartite, powdery granular, narrowly obovoid, with their filaments coherent to a narrow viscid gland on the rostellum terminating the column.

### **Key to species**

1. Roots many, elongated, fleshy, cylindrical, tubers up to 6 cm long and usually never more than 0.5 cm thick; flowering stem with leaves at the time of flowering; leaves more or less lanceolate; flowers pink, deep red, rose-purple or white ..... *S. sinensis*
- + Roots usually 2-3, fleshy, tubers carrot shaped, 1.5-3.5 cm long, 1-1.5 cm thick; flowering stem without leaves at the time of flowering; leaves more or less ovate; flowers white or greenish white ..... *S. spiralis*

***Spiranthes sinensis*** (Pers.) Ames. *Orchid.* 2: 53. 1908; *Renz*, 51. 1978; & 43. 1984.

*Neottia sinensis* Pers. *Syn.* 2: 511. 1807.

*Spiranthes australis* (R. Br.) Lindl. in *Edw. Bot. Reg.* 10: t. 823. 1824 et. *Gen. & Sp. Orch.* 464. 1840; *Hook. f.*, 6: 102. 1890; *King & Pantl.* 278, t. 369. 1898; *Collett*, 495. 1902; *Duthie*, 164. 1906.

*Neottia australis* R. Br. *Prod. Fl. Nov. Holl.* 1: 319. 1810.

*Spiranthes lancea* auct non (Thunb. ex Sw.) Back., Back. f. & Van Steenis, in *Blumea* 6(2): 361. 1951; Stewart, 73. 1972.

*S. sinensis* var. *amoena* (Beib.) Hara in *J. Jap. Bot.* 44: 59. 1969.

*Neottia amoena* Beib. *Fl. Taur. Cauc.* 3: 606. 1819.

(Fig. 41)

Plant slender 15-45 cm tall. *Roots* fleshy, narrowly cylindrical, tubers up to 6 cm long. *Stem* erect, often slightly flexuous, leafy below. *Leaves* erect, spreading, linear or lanceolate, 3-10 cm long, apex acute or acuminate, *Inflorescence* straight or slightly flexuous, spike up to 15 cm long, rhachis densely pubescent. *Flowers* small, crowded, secund, rose purple or white. *Bracts* ovate-lanceolate, long acuminate, the lower slightly longer than ovary. *Sepals* lanceolate, acute, up to 5 mm long; the laterals more or less spreading; the dorsal forming a tube with the petals and the lip. *Petals* as long as the sepals, ligulate, adhering with the inner margins to the dorsal sepal. *Lip* sessile, obovate, 4-5 mm long, the apical section rose-purple, undulate-crispate on the margin, the basal section whitish, on each side near the column with a small roundish fleshy gland, minutely papillose in the middle.

*Flowering*: May - November.

*Distribution*: Himalaya up to 2200 m (Pakistan to Arunchal Pradesh), Assam, Nagaland, Mizoram, Tripura, Meghalaya, Manipur, Madhya Pradesh, Peninsular India. Afghanistan, Burma, Sri Lanka, Malaya, Australia, New Zealand, China, Japan, Mangolia, Siberia.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley, Chiddarwala, *Deva* 9186; Chander Bani, *Raizada*, *R. Dayal*; Ramgarh Swamp, *Deva* 9186; Mussoorie, Landour Mussoorie, *Duthie* 21784; Mussoorie, *Mackinnon* 22978. **Tehri-Nagtibba**, *Remsukh* 22999, *Naithani* 1075; Pineswar, *Vishwanathan* 54897; Near Dhakra, *Gollen* 2072; Surkanda Devi, *Deva* 10450; Bok Hill, *Duthie* 634; Ghuttu, *Naithani* 48226. **Uttarkashi**-Jamuna Valley Phulchatti, *Deva* 4556; Bhagrati Valley Harsil, *Deva* 5118 & 7802; Yamnotri, *Dwarika Prasad* 227; Har-ki-Dun, *Sahni* 21946; Above Derali, *Duthie* 518. **Chamoli**-Govindghat, *Bhattacharyya* 29330; Tirjugi Narian, *Kirat Ram* 8899; Badrinath, *Falconer*, Ghangharea, *M.A. Rau* 31747; Jangal Chatti on way to Valley of Flowers *Naithani* 1307. **Pauri-Ransi Pauri**, *Naithani* 3861.

KUMAUN: **Pithoragarh**-Girgaon, *Strachey & Winterbottom* 52; Near Garbyang Kali Valley, *Duthie* 3414; Tejam, Jankola Valley, *Inayat* 24129 (a); Munshyari, Gori Valley, *Inayat* 24129, *Pant & Naithani* 2954; Lumti, *Bhattacharyya* 21242; Maltitop, *Arora* 45618. **Nainital**-Nainital, *Davidson*; Leriakanta, *Davidson*; China S. ridge, *Champion* 7757. **Almora**-Hawabagh, *Jameson*; Gowaldam, *Bagechee*, Near Raniket, *Duthie* 5999; Loharkhet, *T.A. Rao* 4285; Dinapani, *Vohra* 57904.

HIMACHAL PRADESH: Shimla Hills, *Sobha Rani*, *Drummond* 718; Shimla, *Gamble* 1414(B); Chamba Kalatop, *Lace* 1216; Kothi, *N.P. Singh* 23055; Tissa, *Nair* 32979; Sangla, *Nair* 33078; Jeori, *Nair* 21776.

JAMMU & KASHMIR: Srinagar, *Gammie*; Dal Lake, Srinagar, *T.A. Rao* 9589.

PAKISTAN: Hazara, Kaghan, *Inayat* 22593.

This species occurs in two forms. One with white flowers (*S. parviflora* Lindl.) and the other with pink flowers (*S. amoena* Spreng.). We have examined both types of plants, but find no differences in the two except the colour of the flowers. King & Pantling (1898) believe that white and pink flowers are produced on the same plants, white in spring and pink in autumn. We think that plants growing at lower altitudes at the base of Himalaya and plains have white flowers, while those occurring in high altitude have pink to red flowers. This observation has to be confirmed.

*Spiranthes spiralis* (L.) Koch. in *Linnaea* 22: 290. 1849; Renz, 50. 1978.

*Ophrys spiralis* L. *Sp. Pl.* 945. 1753.

*S. autumnalis* Rich. *Mem. Mus. Paris* 4: 49. 1818, Hook. f.; 6: 103. 1890; *Duthie*, 164. 1906. (Fig. 41)

Plant slender, up to 30 cm tall. *Root* tuberous, carrot shaped, usually 2-3. *Leaves* produced before the flowers; radical in a rosette on side of flowering stem, ovate, spreading, 2.5-3.5 cm long, tapering and sheathing towards the base. Flowering stem straight or sometime flexuous, with several bract like, lanceolate, acuminate leaflets, glandular hairy above. *Inflorescence* up to 14 cm long, more or less densely many flowered, spirally twisted or all flowers in a single row. *Flowers* small, white or sometimes greenish-white, glandular hairy outside. *Bracts* ovate-lanceolate, acuminate, slightly longer or equalling the ovary. *Sepals* oblong-obtuse, 4-5 mm long, ca 2 mm broad; the laterals spreading. *Petals* as long as the sepals, ca 1 mm broad, adhering with the inner margins to the dorsal sepal. *Lip* ovate-oblong, 5 × 4 mm, forming a trumpet-like tube with the dorsal sepal and the petals, with two small glands at the base and a crenulate margin in front.

*Flowering*: May.

*Distribution*: Himalaya 1200-1500 m (Kumaun). Afghanistan, Persia, Many parts of Europe between Caucasus and the Atlantic Ocean.

It was collected only once from Himalaya about 140 years back by T. Thomson at Lohuaghat in Kumaun. Its existence in an isolated spot far away from its natural range of distribution proves that it could have been only accidentally introduced by the early British settlers who developed tea gardens and fruit orchards in the vicinity of Lohuaghat which was one of the earliest cantonment established after the conquest of Kumaun from Gurkhas or can this be only a case of just change of the labels by mistake.

#### **Tropidia Lindl.**

Tall leafy, terrestrial herbs; root stocks woody with rigid root fibres. *Stem* simple or branched. *Leaves* plicate, strongly veined, bases sheathing. *Inflorescence* in short and dense unbranched terminal spikes or a paniculate racemes or lateral. *Flowers* numerous, small, resupinate. *Bracts* persistent. *Sepals* the dorsal free; the laterals connate at base forming a mentum with the base of the lip. *Petals* similar to the sepals but usually smaller. *Lip* superior, sessile on the base of the column with a broad, shortly spurred or saccate base, without side lobes, the apex reflexed. *Column* short, stout; rostellum long, often bifid. *Stigma* entire. *Anther* dorsal, erect; *pollinia* 2, narrow, clavate, granular, 2-cleft, pendulous by a slender caudicle from a small gland on the tip of the rostellum.

**Trophidia pedunculata** Bl. Coll. Orch. Arch. Ind. 122. t. 40. 1858; Holttum, 142. 1964; Seidenf., 110, fig. 68. 1978.

*T. maingayi* Hook. f., Fl. Brit. Ind. 6: 93. 1890.

*T. curculigoides* sensu Deva & Arora, in Ind. For. 97: 699. 1971. (*non* Lindl.). (Fig. 42)

*Stem* 50-100 cm tall. *Leaves* many, 23 × 4-5 cm, elliptic-lanceolate, narrowed evenly to base and apex, apex with a slightly extended narrow tip. *Inflorescence* mostly terminal, if lateral inflorescence are present they have a scape of 2 cm or more, usually not completely covered by sterile bracts. *Flowers* 8 mm across, white, crowded. *Bracts* lanceolate, more or less subulate, about 7-10 mm long. *Sepals* oblong-obovate, sub-acute, upper 6-8 mm long. *Petals* obliquely oblong. *Lip* ovate-acute with 3 lamellate ribs, tip reflexed.

*Flowering*: May - June.

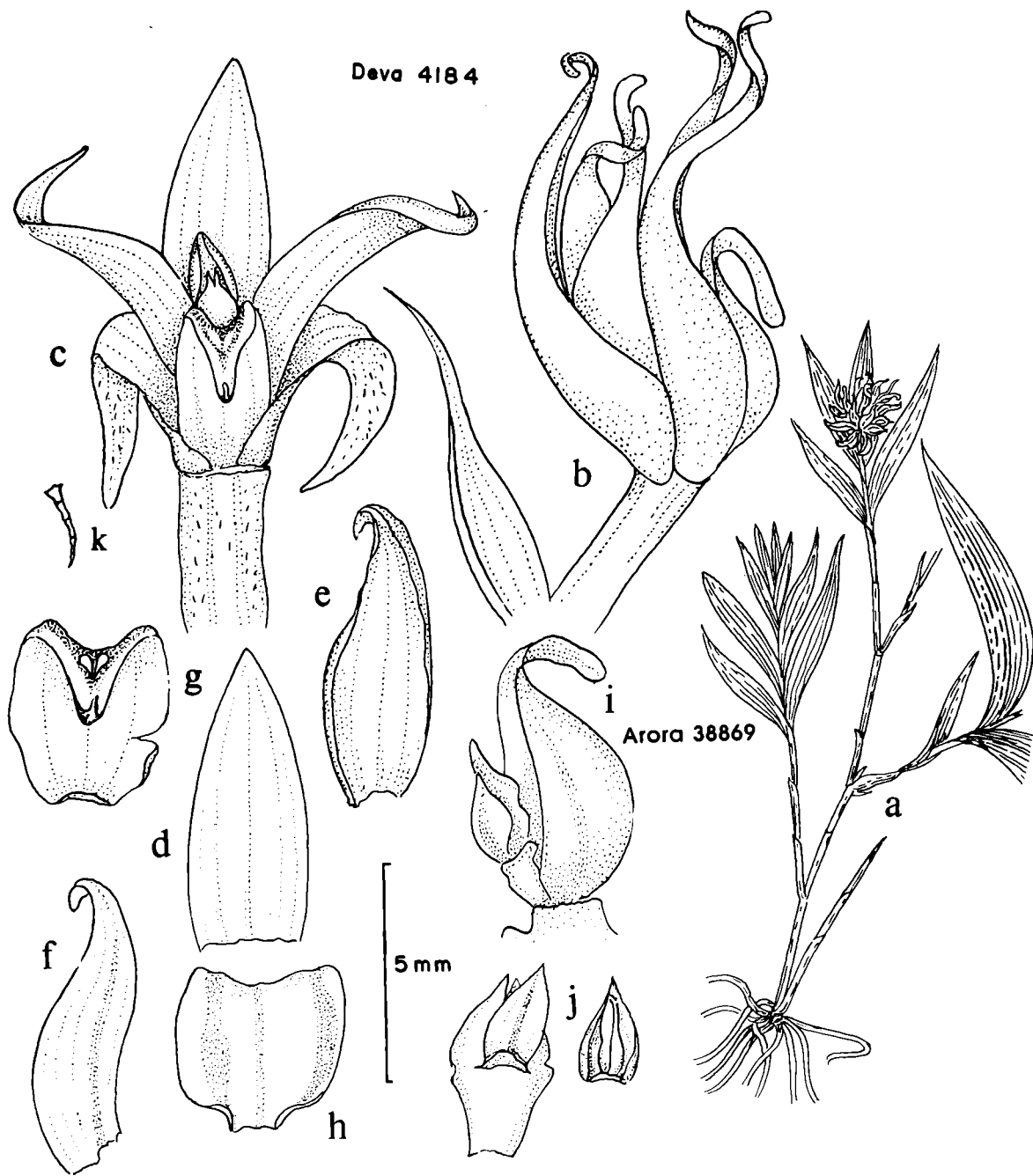
*Distribution*: Himalaya 300-700 m (Dehra Dun Valley in Swamp forest). Burma, Thailand, Malaya, Sumatra, Borneo.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Golattappar, *Deva* 4184, *Arora* 38869.

#### **Zeuxine Lindl.**

Terrestrial leafy herbs. *Stem* creeping below, glabrous. *Leaves* sessile, on a broad sheath or petiole,



**Fig. 42** *Tropidia pedunculata* Bl.—a. plant; b. flower side view; c. flower front view; d. dorsal sepal; e. lateral sepal; f. petal; g. & h. lip; i. column & lip; j. column; k. hair.

often membranous. *Flowers* small, few or many in a terminal spike, hardly opening. *Sepals* sub-equal, the dorsal one concave and forming a hood with the petals, the laterals free. *Lip* sessile, cymbiform or with a saccate base not produced beyond the lateral sepals; the sac containing 2 glands inside, more or less contracted in the middle, dilated at apex into a small entire or wing-like terminal lobe. *Column* short with or without appendages on the front; *rostellum* large, deeply divided; *stigmas* 2 on either side of the column. *Anther* dorsal on the column, 2-chambered, membranous. *Pollinia* 2, pyriform, attached by an oblong gland to the erect rostellum, with or without a caudicle.

#### Key to species

1. Leaves linear, grass like, green at the time of flowering ..... *Z. strateumatica*
- + Leaves not grass like, lanceolate to ovate, with a sheathing base, few or all withered at the time of flowering ..... 2
2. Flowers small; dorsal sepal 2-3 mm long; lip yellow in colour, lobules almost sub-quadrate with the base as broad as the apex, very divergent, forming an obtuse angle to almost a 'T' when spread out ...  
.....*Z. flava*
- + Flowers larger; dorsal sepal 6-7 mm long; lip white, lobules obovate, spatulate, with a narrow base and broad rounded apex, not much divergent forming an acute angle almost like an inverted 'V' .  
.....*Z. seidenfadenii*

***Zeuxine flava*** (Wall. ex Lindl.) Benth. ex Hook. f., Fl. Brit. Ind. 6: 108. 1890; King & Pantl.: 289, t. 386. 1898; Bhattacharyya, 164. fig. 1. 1969; Seidenf., 84. fig. 52. 1978.

*Monochilus flavum* Wall. ex Lindl. Gen. & Sp. Orch. 487. 1840; King, 319. 1882. (Fig. 43)

Plant up to 25 cm high. *Stem* 4-6 cm, pale-brown on dying. *Leaves* 3-5 × 1.5-2 cm, ovate or ovate-lanceolate with sheathing base, cuneate, few or all withered at the time of flowering. *Peduncle* rather longer than the stem, pubescent; *raceme* much shorter than the peduncle, sparsely flowered. *Flower* 2.5 mm across. *Bracts* sparsely villous, lanceolate, equal or longer than ovary. *Sepals* sub-equal, ovate-oblong, with a few lax hairs, one nerved, yellowish-green, the dorsal 2-3 mm long, very concave; the laterals rather smaller. *Petals* oblong-obtuse, white, 1-nerved, *Lip* longer than sepals, yellow, cymbiform at the base, anterior lobe with two lobules, lobules almost quadrate with the base as broad as the apex very divergent forming an obtuse angle to almost a 'T' when spread out.

*Flowering*: April - May.

*Distribution*: Himalaya up to 1500 m (Garhwal to Arunachal Pradesh), Assam, Nagaland, Meghalaya. Burma, Thailand, Malaya.

*Specimens examined*:

GARHWAL: **Chamoli**-Mandal, *Naithani* 43926, *Phata*, *Mehrotra* 3997.

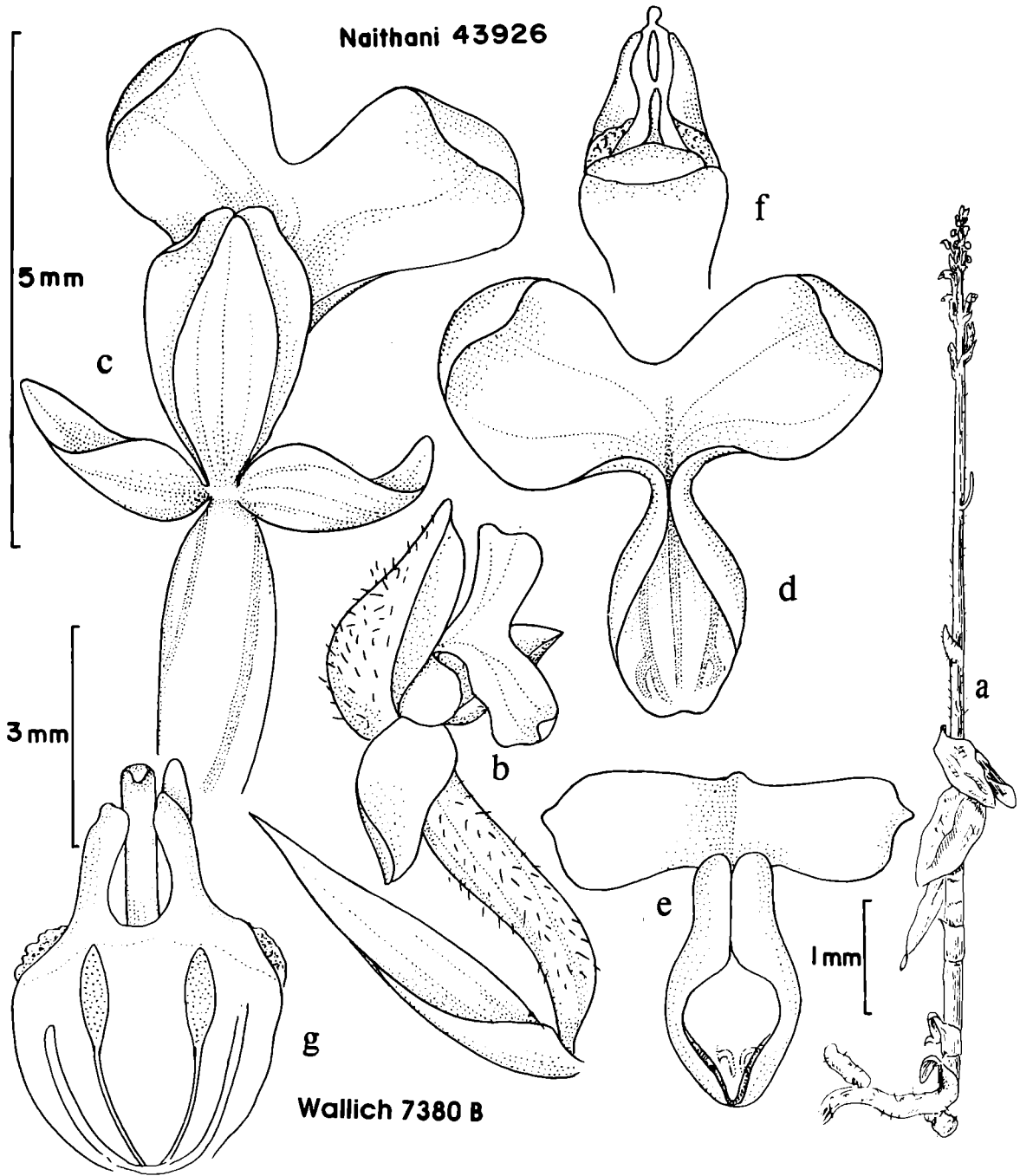
KUMAUN: **Pithoragarh**-Gori Valley, *Madhkote*, *Bhattacharyya* 21310. **Nainital**-Patwadhungar, *T.N.S. Bankoti* 35.

*Z. flava* is a very distinct species with bright yellow lip. Plants from Sri Lanka with white lip may be a different species, however there is very close resemblance between the two (Jayaweera, 323, fig 142. 1981).

***Zeuxine seidenfadenii*** Deva et Naithani *sp. nov.* (Fig. 44)

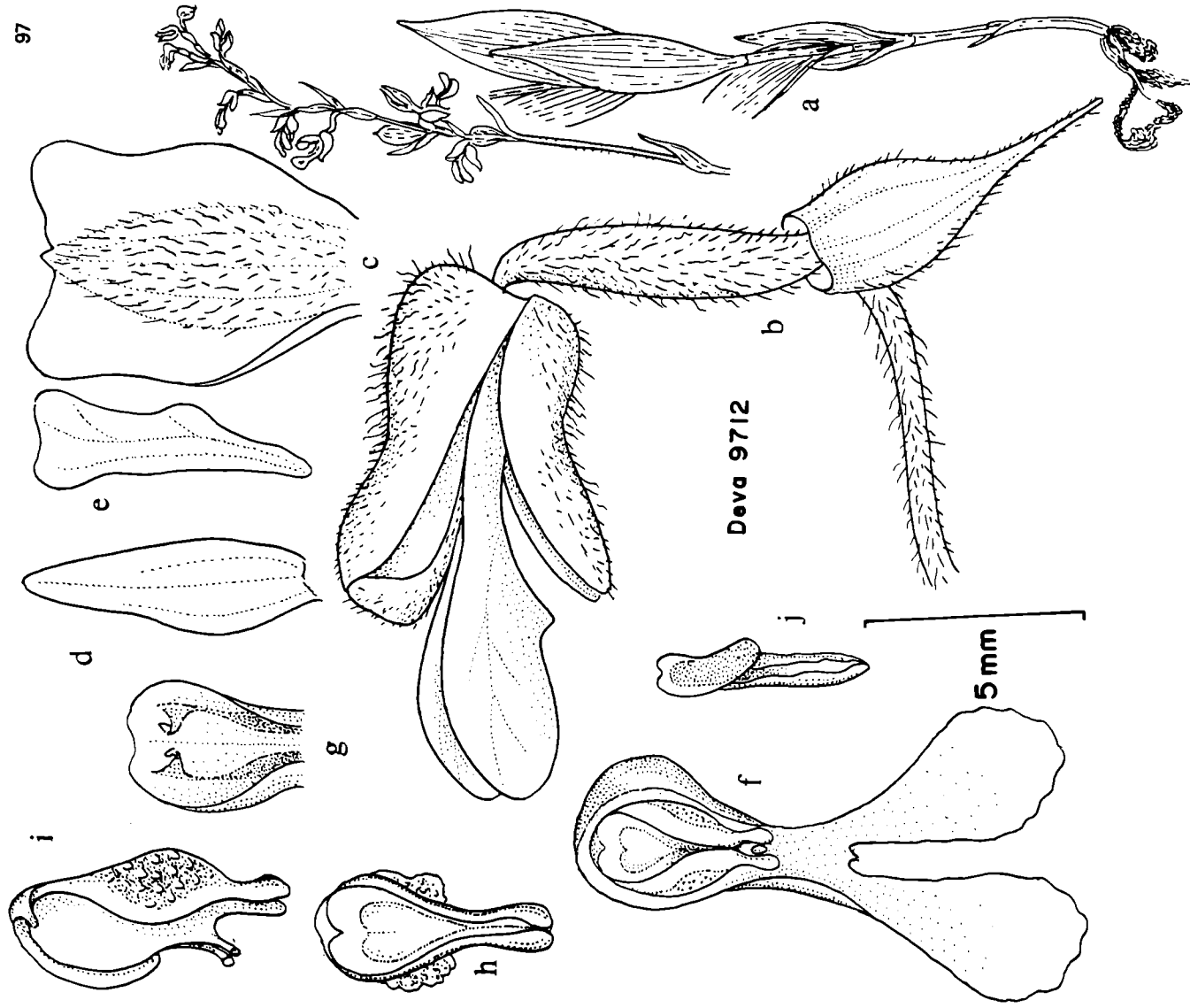
*Z. flavae* (Lindl.) Benth. ex Hook. f. *sepalis* petalisque rubello-brunneis, *labelli* lobulis non divergentibus sed sub parallelis, obovatis, apicem versus latissimis, 5-5.5 mm longis, 2.5 mm latis facile distinguenda.

Plant 12-40 cm high. *Stem* decumbent at the base, erect upwards. *Leaves* 3-6, narrowly ovate-acute, 4-6 × 1-2 cm, petiole short expanding to a broad stem clasping sheath, withered at the time of flowering. *Peduncle* 4-12 cm long, usually shorter to almost equal to the length of the stem, pubescent. *Raceme* equal,

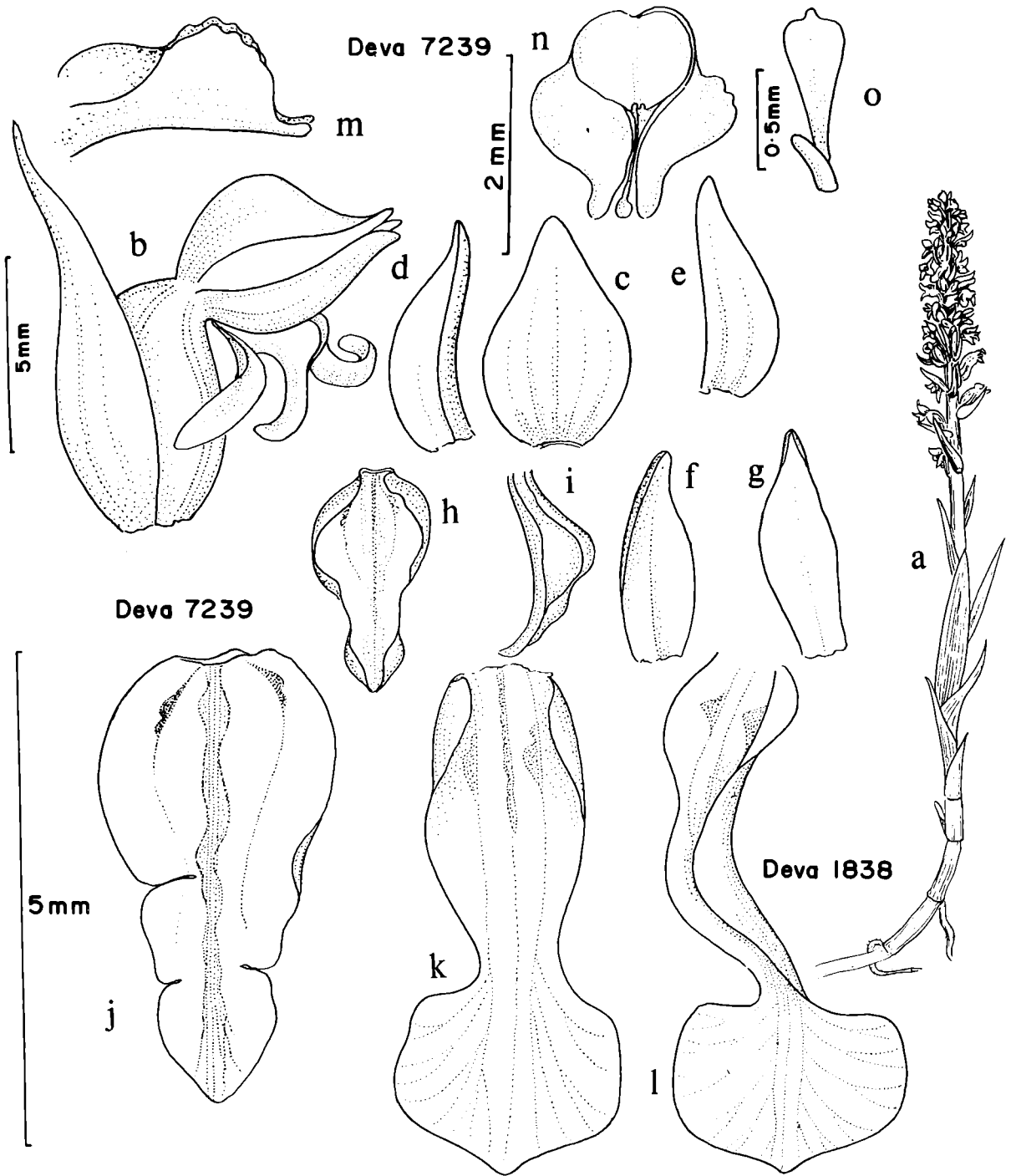


**Fig. 43** *Zeuxine flava* (Wall. ex Lindl.) Benth. ex Hook. f.—a. plant; b. & c. flower; d. & e. lip; f. & g. column; (b, e, & g. after Seidenf.).





**Fig. 44** *Zeuxine seidenfadenii* Deva and Naithani.—a. plant; b. flower; c. dorsal sepal & petal; d. lateral sepal; e. petal; f. column & lip; g. sac of lip with glands; h. & i. column; j. caudicle & disc.



**Fig. 45** *Zeuxine strateumatica* (Linn.) Schlecht. — a. plant; b. flower; c. dorsal sepal; d. & e. lateral sepals; f. & g. petals; h, i, k, & l. lip; m. & n. column; o. caudicle & disc.

shorter or longer than the peduncle, 4-25 flowered, rachis hairy, hairs pointing backwards. *Flowers* including ovary 15-17 mm long. *Bracts* ovate, long-acuminate, 8-11 mm long, much longer than the ovary, puberulous, straw coloured with purple veins. *Sepals* sub-equal, about 6-7 mm long; the dorsal ovate; laterals obliquely-lanceolate, reddish-brown, hairy out-side, 3-nerved. *Petals* broadly spatulate with lateral sides curved, apex broad subquadrate adnate to the dorsal sepal in their whole length, 2-nerved, white. *Lip* 10-12 mm long, longer than the sepals, white, basal sac provided with a single backward pointing triangular gland on each side, the middle narrowed with inrolled margins, apical portion with two obovate-spathulate lobules, each with a narrow base and broad rounded apex, not divergent, the sinus like an inverted 'V', forming an acute angle. *Column* at base adnate to the lip, with distinctly protruding obovate wings in front.

*Type*: Laxmansidh, Dehra Dun Valley, Garhwal, 22.4.1978, *Deva* 9712 (*holotype* DD); 9721 (*para type*); Ramgarh, Dehra Dun Valley, *Deva* 8130; Karuapani, Dehra Dun Valley, *Deva* 8149.

*Flowering*: April.

*Distribution*: Himalaya up to 800 m (Garhwal), Endemic.

The plant is common in Dehra Dun Valley and is found growing in shallow soil in between boulders and bushes, inside the Tropical Moist deciduous forests. It flowers in April the beginning of summer season when the floor of the forest is covered with dry leaves, and as the general colour of the plant is same as that of the dry leaves it easily escapes notice.

It is a very distinct species, and quite different from *Z. flava* which has much smaller flowers, with yellow lip having very divergent subquadrate lobules. It is also quite different from *Z. gracilis* (Breda) Bl. (see Seidenf. fig. 53, 1978), where the lobules of the lip are almost rectangular forming 'T' when flattened out. Sepal and the flowers are smaller with dorsal sepal 4-4.5 mm long, this species comes near *Z. affinis* (Lindl.) Benth. & *Z. grandis* Seidenf., but has a different structure of the hypochile and the winged column.

***Zeuxine strateumatica*** (Linn.) Schlechtner, in Engl. Bot. Jahrb, 45: 394. 1911. Stewart, 73. 1972; Seidenf., 79, fig. 48. 1978; Renz, 48. 1978; & 20. 1984; Rawat & Pangtey, 698. 1985.

*Orchis strateumatica* Linn. Sp. Pl. 943. 1753.

*Pterygodium sulcatum* Roxb. Fl. Ind. ed. 2, 3: 452. 1832.

*Z. sulcata* (Roxb.) Lindl. in Royle, Ill. Bot. Himal. 1: 368. 1839 et Gen. & Sp. Orch. 485. 1840; Hook. f., 6: 106. 1890; King & Pantl. 286, t. 381. 1898; Duthie, 168. 1906. (Fig. 45)

Plant 5-25 (- 45) cm high. *Leaves* linear, green at the time of flowering, erect, sessile, of different size, lower 2-7 cm long, upper smaller, midrib stout, margins recurved. *Raceme* 1.5-5 cm long, densely flowered. *Flowers* about 1 cm across, greenish-white or pink with yellow lip. *Bracts* ovate-lanceolate, acuminate, much longer than ovary. *Sepals* unequal, 4 mm long, the dorsal one ovate, concave, the laterals obliquely lanceolate, connivent. *Petals* oblong, obtuse, hyaline, forming with the dorsal sepal a hood over the column. *Lip* yellow, as long as the sepals, cymbiform and saccate at the base, bearing inside the sac two inward-pointing teeth and two narrow lamellae united at the mid-rib; apical lobe subquadrate, entire or bifid.

*Flowering*: February - March.

*Distribution*: Himalaya up to 1000 m (Pakistan, Kashmir to Arunachal Pradesh), Assam, Nagaland, Tripura, Meghalaya, Mizoram, Manipur, Bengal, Bihar, Orissa, Upper gangetic plain, Madhya Pradesh, Punjab, Gujarat, Karnataka, Tamil Nadu. Afghanistan, Bangladesh, Sri Lanka, Malaya, China, Japan, Philippines, Thailand, United States.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley, Tons Nallah near F.R.I., *Naithani* 1518; Mothronwala, *Deva* 838; Thanda Sot, Siwalik, *Deva* 7239; Dehra Dun *Mackinnon*; New Forest, *Kirat Ram*. **Pauri**-Satpuli, *Vohra* 11285.

KUMAUN: **Almora**-Bhikiasain, *Pangtey* 3008.

JAMMU & KASHMIR: Mankot, Poonch Pir Panjal, *Kirn* 2318; Near Dehragal, Poonch Pir Panjal, *Kirn* 3018, 3019.

PAKISTAN: Swat, Hazara (Stewart loc. cit.); Dir, (Renz, loc. cit.).

*Z. strateumatica* is a very variable, from few centimetre to 45 cm tall and with different colours of lip. However all the authors have described the apical lobe of the lip quadrate to subquadrate, including King & Pantling (1898), but their sketch of the lip fig. 3 t. 381 shows a very different structure. It resembles some what *Deva's* 7239, where the apical lobe is ovate-subacute. It is possible that we are dealing with a species complex but we are not in a position to pursue the matter any further. It is expected that examination of the material over the wide distributional range of this species will yield results.

### III. Sub-fam. ORCHIDOIDEAE

Terrestrial herbs. *Stem* reduced or elongated, with underground tubers or rhizome. *Leaves* membranous, rarely plicate. *Inflorescence* terminal, solitary or racemes. *Flowers* large and showy or small. *Lip* simple or trilobed, spurless or with short or long spurs. *Column* short. *Anther* one, with 2 loculi, caudicles or viscidia (glands) enclosed in a pouch or naked pollen granular or sectile; *rostellum* prominent or small; *staminode* rugulose, usually present close to the anther cells. *Stigma* one or two, connate or appressed to lip or standing out 2-stalked appendages.

In N.W. Himalaya 16 genera and 54 species.

Tribe       **Orchideae**  
Sub-tribe   **Orchidinae**

*Aorchis* (2)  
*Ponerorchis* (3)  
*Dactylorhiza* (3)  
*Hemipilia* (1)  
*Brachycorythis* (1)  
*Platanthera* (2)  
*Coeloglossum* (1)  
*Diphylax* (1)  
*Herminium* (8)  
*Neottianthe* (2)  
*Gymnadenia* (1)  
*Pecteilis* (2)  
*Diplomeris* (1)  
*Peristylus* (7)  
*Habenaria* (17)

Sub-tribe   **Dsinae**

*Satyrium* (2)

#### Key to genera

1. Lip erect, hood like, with 2-spurs; stigma single, broad, born above the anthers ..... *Satyrium*
- + Lip declinate, not hood like, spur single or none; stigma one or two, born below the anthers.....2
2. Lip without spur.....*Herminium*
- + Lip with a spur ..... 3
3. Plants with tubers divided into ginger like segments.....4
- + Plants with undivided tubers or with rhizomes ..... 6
4. Spur very short .....*Coeloglossum*
- + Spur cylindrical or filiform, elongated.....5

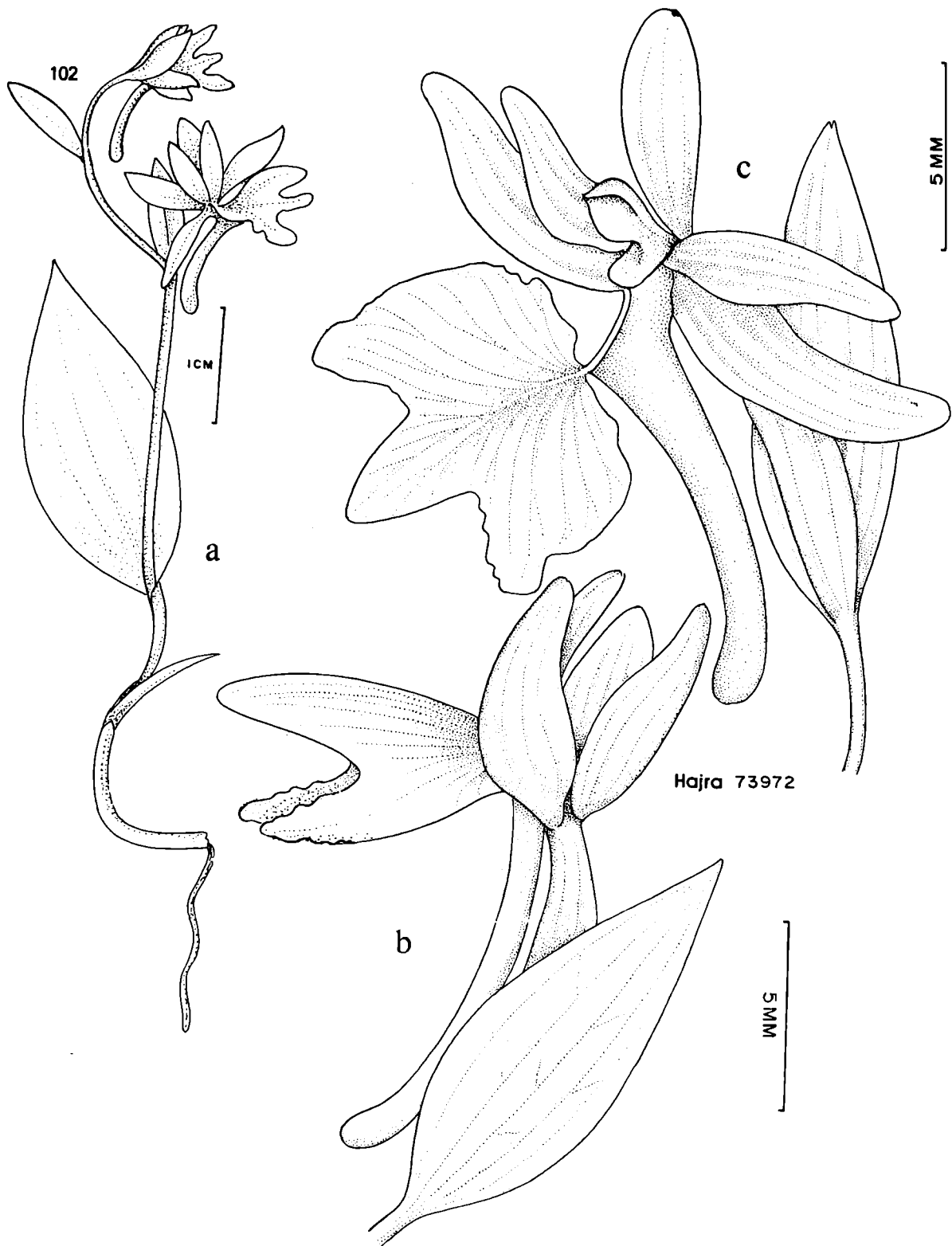


Fig. 46 *Aorchis roboroveskii* (Maxim.) Seidenf.—a. plant; b. & c. flower.

5. Spur slender, filiform, clearly longer than the ovary ..... *Gymnadenia*  
 + Spur cylindrical, more or less as long as the ovary ..... *Dactylorhiza*  
 6. Plants with rhizome ..... *Aorchis*  
 + Plants with ovoid or cylindrical or sub-globose tubers ..... 7  
 7. Floral bracts leaf like ..... *Brachycorythis*  
 + Floral bracts different from the normal leaves ..... 8  
 8. Rostellum very prominent, as high or higher than the anthers ..... 9  
 + Rostellum small, not prominent ..... 10  
 9. Leaf radical, one, broad, ovate cordate, inflorescence with few flowers ..... *Hemipilia*  
 + Leaves one to two, oblong-lanceolate; inflorescence with 1-2 flowers ..... *Diplomeris*  
 10. Viscidia (glands of pollinia) enclosed in a pouch ..... *Ponerorchis*  
 + Viscidia naked ..... 11  
 11. Stigma lobe one ..... 12  
 + Stigma lobes two ..... 14  
 12. Lip simple, undivided ..... *Platanthera*  
 + Lip three lobed ..... 13  
 13. Spur inflated; flowers pink ..... *Neottianthe*  
 + Spur cylindrical, long; flowers white ..... *Pecteilis*  
 14. Stigma lobes appressed or connate to the hypochile of the lip; spur very short, globular or ovoid  
 ..... *Peristylus*  
 + Stigma lobes on stigmatophore, not adnate to hypochile; spur usually long ..... *Habenaria*

#### **Aorchis Vermeulen**

Small alpine plants with rhizome and no tuberoids. *Leaf* solitary from the base of the stem. *Inflorescence* with 1-4 flowers. *Bracts* foliaceous, exceeding more or less the purple (rarely white) flowers. *Sepals* and *petals* forming a hood. *Lip* entire (some time faintly lobed), with spur (about half the length of ovary). *Column* short; *pollinia* 2, with caudicles and viscid-gland, the latter enclosed each in a single pouch (bursicula); *stigmata* distinctly separated; *staminodes* rather small. *Ovary* slightly twisted.

#### **Key to species**

- Lip simple, not lobed, spur about half the length of the ovary ..... *A. spathulata*  
 + Lip distinctly three lobed, spur equal to longer than the ovary ..... *A. roborovskii*

***Aorchis roborovskii*** (Maxim) Seidenf., in Nord. J. Bot. 2: 9. 1982.

*Orchis roborovskii* Maxim. Mel. Biol. 12: 547. 1886. et in Bull. Acad. Petersb. 31: 104. 1887.

*Q. stracheyi* Hook. f., Fl. Brit. Ind. 6: 128, 1890. et Ic. Pl. T. 2197 B, 1894; Duthie, 173. 1906.

*Galeorchis stracheyi* (Hook. f.) Soo, in Act. Bot. Acad. Sci. Hung. 12: 352. 1966.

*Galearis stracheyi* (Hook. f.) P.F. Hunt, in Kew Bull. 26: 172. 1971.

(Fig. 46)

Plant 6-15 cm tall, with rhizome. *Leaf* solitary, radical, 5-7 cm long, petioled, elliptic to obovate. *Scape* naked, 2-3 flowered. *Flowers* 1-1.5 cm across, purple or white. *Bracts* large, ovate-oblong, obtuse, longer than the ovary. *Sepals* oblong-obtuse, spreading. *Petals* ovoid, spreading. *Lip* longer than the sepals, broadly cuneate, distinctly 3-lobed. *Spur* equal to longer than ovary, obtuse, incurved. *Stigmata* united.

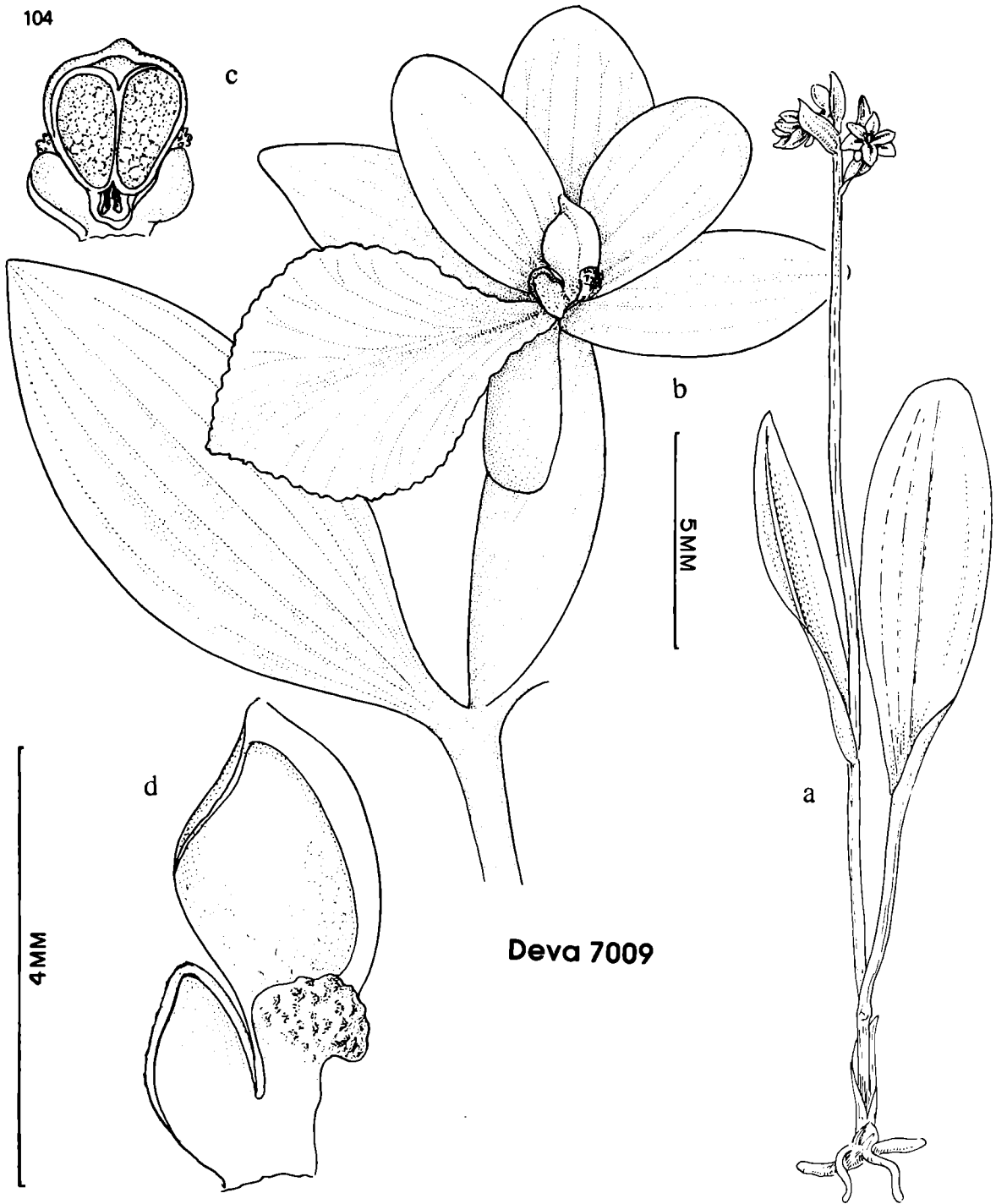


Fig. 47 *Aorchis spathulata* (Lindl.) Vermeul—*a*. plant; *b*. flower; *c*. & *d*. column.



*Flowering:* July - August

*Distribution:* Himalaya 4000 m (Garhwal to Bhutan).

*Specimen examined:*

GARHWAL: **Chamoli**-Bhujgara to Patalkhan, Nanda Devi National Park, *Hajra* 73972.

KUMAUN: **Almora**-Pindari, *T.A. Rao* 4547.

We have accepted Seidenfaden's (1982) proposal concerning the nomenclature of this taxon, at generic and specific level. It was incorrect when Hunt (1971) placed *Orchis roborovskii* Maxim in synonymy with *Orchis chusua* D. Don. The structure of stigma is not clear in dry specimens, to understand it better it should be studied in living material. Dr. J. Renz points out, if definitely proved that this species has united stigma, it will be better to place it in the genus *Galearis*.

**Aorchis spathulata** (Lindl.) Vermeul. in Jahresber. Nat. Ver. Wuppertal 25: 33. 1972.

*Gymnadenia spathulata* Lindl. Gen. & Sp. Orch. 280. 1835.

*Orchis spathulata* (Lindl.) Rchb. f. ex Benth. in Journ. Linn. Soc. Bot. 18: 355, 1880 (*non* Linn. f. 1781); Hook. f., 6: 127. 1890; King & Pantl. 301, t. 400. 1898; Duthie, 174. 1906; Katakai et al. 5: 26 1984.

*Galeorchis spathulata* (Lindl.) Soo in Act. Bot. Acad. Sci. Hung. 12: 351. 1966.

*Galearis spathulata* (Lindl.) P.F. Hunt, in Kew Bull. 26: 172. 1971.

(Fig. 47)

Plant 5-20 cm high with rhizome and fleshy roots. *Stem* with one or two loose, blunt tubular sheaths at the base. *Leaf* usually solitary at the base of the stem, with rarely a second one higher up, oval to narrow-elliptic or spatulate, sub-equal, petiolate, blade 2.5-7.5 cm long. *Scape* stout. *Spikes* short, 1-4 flowered. *Flowers* dark purple or white, 1.3 cm in diameter. *Bracts* leaf-like, lanceolate, sub-acute, longer than the flower. *Sepals* sub-equal; the dorsal ovate, obtuse, connivent with the petals to form a hood; the laterals oblong, sub-acute, spreading. *Petals* falcately elliptic, obtuse, shorter than the sepals. *Lip* equalling the sepals, broadly elliptic or obovate, simple, spotted near base, edges crenulate, upper surface slightly pubescent with many shallow grooves extending from the base nearly to the apex. *Spur* stout, obtuse, about half the length of the ovary. *Stigmas* distinct.

*Flowering:* July - August.

*Distribution:* Himalaya 3600-4800 m (Himachal Pradesh to Bhutan). E. Tibet to China.

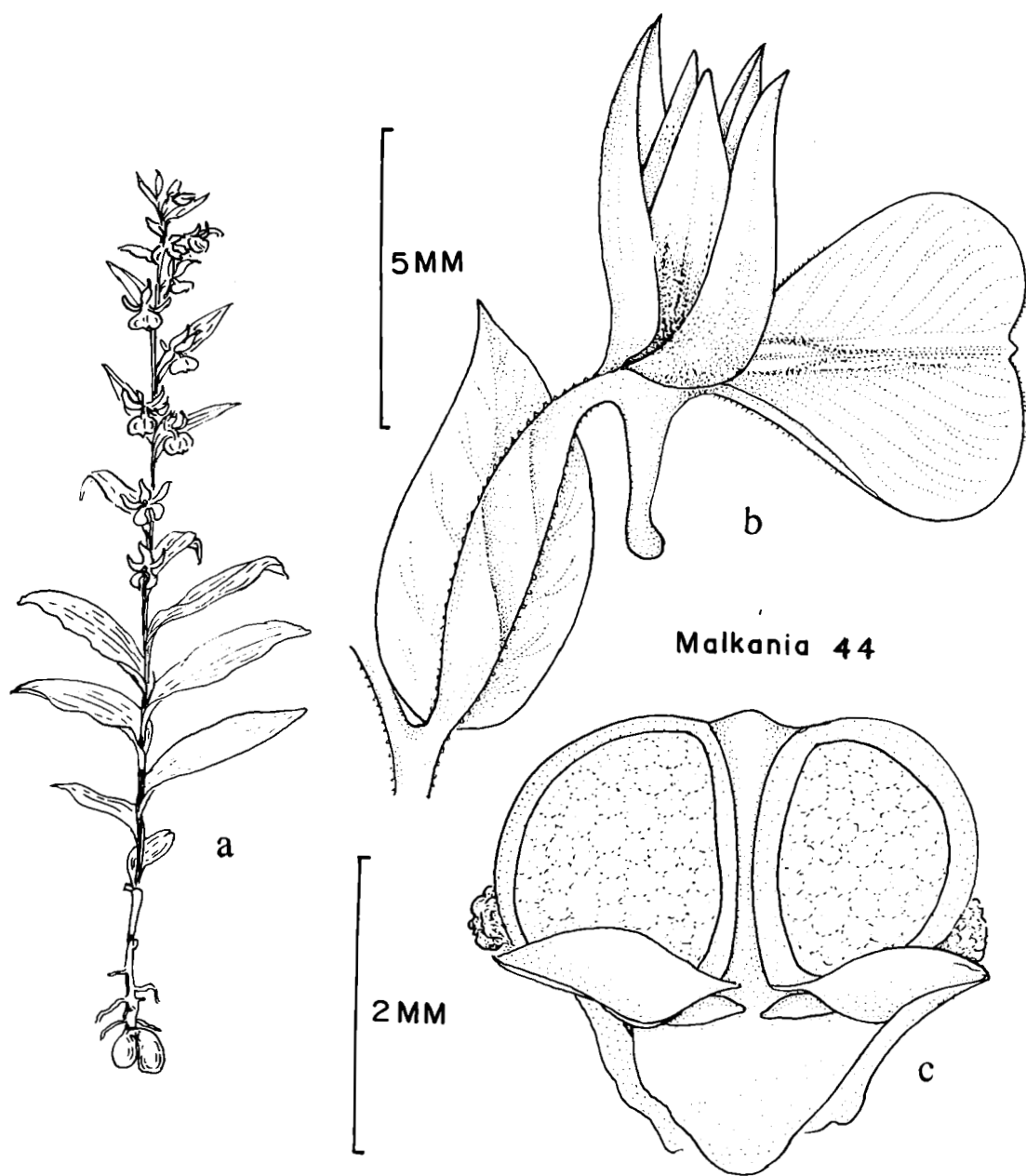
*Specimens examined:*

GARHWAL: **Uttarkashi**-Bhagirathi Valley, Ridge above Jhala, *Duthie* 194; Taulea under Srikanta, *Duthie* 515; Tons Valley, Har-ki-Dun, *Deva* 7009; Jamuna Valley, Seema, *Dwarika Prasad* 75.

HIMACHAL PRADESH: Rupin Valley, district Shimla, Dodra Kanwar Chansil Pass, *Deva* 3805, *Nair* 36118.

### **Brachycorythis** Lindl.

Plants slender to robust with tuberous roots. *Stem* densely leafy. *Inflorescence* cylindric, many-flowered, more or less dense, with leaf-like bracts exceeding the rose-pink, violet (sometimes white), darker spotted flowers. *Sepals* free; the lateral more or less spreading; the dorsal erect, forming a loose hood with the petals, which are adnate to the basal sides of the column. *Lip* with spur or only with saccate base, projecting forward, entire or clearly divided in hypochile and an entire or more or less 3-lobed epichile. *Column* slender; *pollinia* 2, with short caudicles and free viscid glands (not enclosed in a pouch); stigmata joined; *rostellum* with distinct midlobe, located between the anther cells. *Ovary* twisted.



**Fig. 48** *Brachycorythis obcordata* (Buch-Ham. ex D. Don) Summerh. — a. plant; b. flower; c. column.

**Brachycorythis obcordata** (Buch.-Ham. ex D. Don) Summerh. in Kew Bull. 1955: 243. 1955.

*Orchis obcordata* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal, 23. 1825.

*Platanthera obcordata* Lindl. Gen. & Sp. Orch. 290. 1835.

*Gymnadenia obcordata* (Lindl.) Rchb. f., Otia. Bot. Hamburg 1: 32. 1878.

*Habenaria galeandra* auct. non (Rchb. f.) Benth.; Hook. f., 6: 163. 1890; Collett, 506. 1902; Duthie, 194. t. 144. 1906.

*Platanthera galeandra* auct. non Rchb. f.; Kranz. Orch. Gen. Sp. 1: 612. 1899.

*Habenaria obcordata* (Lindl.) Fyson, Fl. Nilg. & Puln. Hill, 1: 405. 1915.

*Phyllomphax obcordata* (Lindl.) Schl. in Fedde, Repert. Beih. 4: 119. 1919.

(Fig. 48)

*Stem* 15-20 cm high, slender, usually tinged with purple. *Leaves* 2.5-5 cm long, oblong-lanceolate, obtuse, narrowed to the base and amplexicaule, dark green above usually with a bright purple band down the centre. *Inflorescence* 5-15 cm long, 12-15 flowered, loose. *Flowers* about 12 mm in diam., pale-purple. *Bracts* leaf-like, much longer than flowers. *Sepals* sub-equal, 7 mm long; the dorsal ovate; laterals lanceolate, falcate. *Petals* shorter than sepals, lanceolate, obtuse. *Lip* broad, cuneiformly obovate or obcordate, often mucronate, shortly clawed, sides erect, upper surface puberulous at the base. *Spur* stout, conical, about half as long as the ovary.

*Flowering*: August.

*Distribution*: Himalaya 1500-2000 m (Himachal Pradesh to Bhutan and Arunachal Pradesh), Central India, Meghalaya, Nagaland. Burma and China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 604, *Mackinnon* 21755, 22732, near Mussoorie, *Duthie* 2575 **Tehri-Nagtibba**, *Bhattacharyya* 33732. **Chamoli**-Govindghat, *Bhattacharyya* 29316.

KUMAUN: **Pithoragarh**- Thal, *Champion*, *Arora* 41316; Boipatu, Gori Valley, *Inayat*, Askot-Didihat, *Arora* 41383; Dafiadhura, *Arora* 70829, **Nainital**-Bhimtal, *Jameson*, *Renz* 13583; Nainital, *Davidson*. **Almora**-Maharpali, *Champion*; Almora City, *P.C. Pande* 1777, *Malkania* 44.

HIMACHAL PRADESH: Sahrahan, *Nair* 30001; Jaungatoo Rampur, *Nair* 29837.

Seidenfaden & Arora (1982) pointed out that the specific epithet *Orchis obcordata* D. Don (1825) is illegitimate as it has been antedated by *Orchis obcordata* Willemet (1796) and thus a new name must be found out. J. Renz informs us that before a new name is given it will be necessary to determine that the eastern *B. galeandra*, is not identical with the Garhwal and Kumaun plant. Reichenbach's short description of his *Platanthera galeandra* from China in *Linnaea* 25: 226 (1852) does not match very well with the Kumaun plant. We have not pursued this matter any further as there is not enough material from Eastern India and further east from China and Hong Kong at our disposal to examine.

### Coeloglossum Hartman

Rather small plants with 2-3-parted, flattened tuberoids, *Stem* with few, alternately and appr. equidistantly arranged leaves. *Inflorescence* loosely or densely many-flowered. *Bracts* foliaceous, variable in length, sometimes considerably exceeding the small greenish flowers. Ovate *sepals* and lanceolate-linear *petals* connivent. *Lip* deflexed, ligulate, 3-toothed at apex, with short saccate spur, sometimes brownish. *Column* short; *pollinia* with ribbon-shaped caudicles, each with a viscid gland, which is partly covered with a fragile membrane; stigma concave. *Ovary* sessile, twisted.

**Coeloglossum viride** (Linn.) Hartm. Handb. Skand. Fl. 1: 329. 1820; Stewart, 67. 1972; Pradhan, 1: 100. 1976; Hara et al. 1: 36. 1978; Renz. 50. 1978; & 32. 1984.

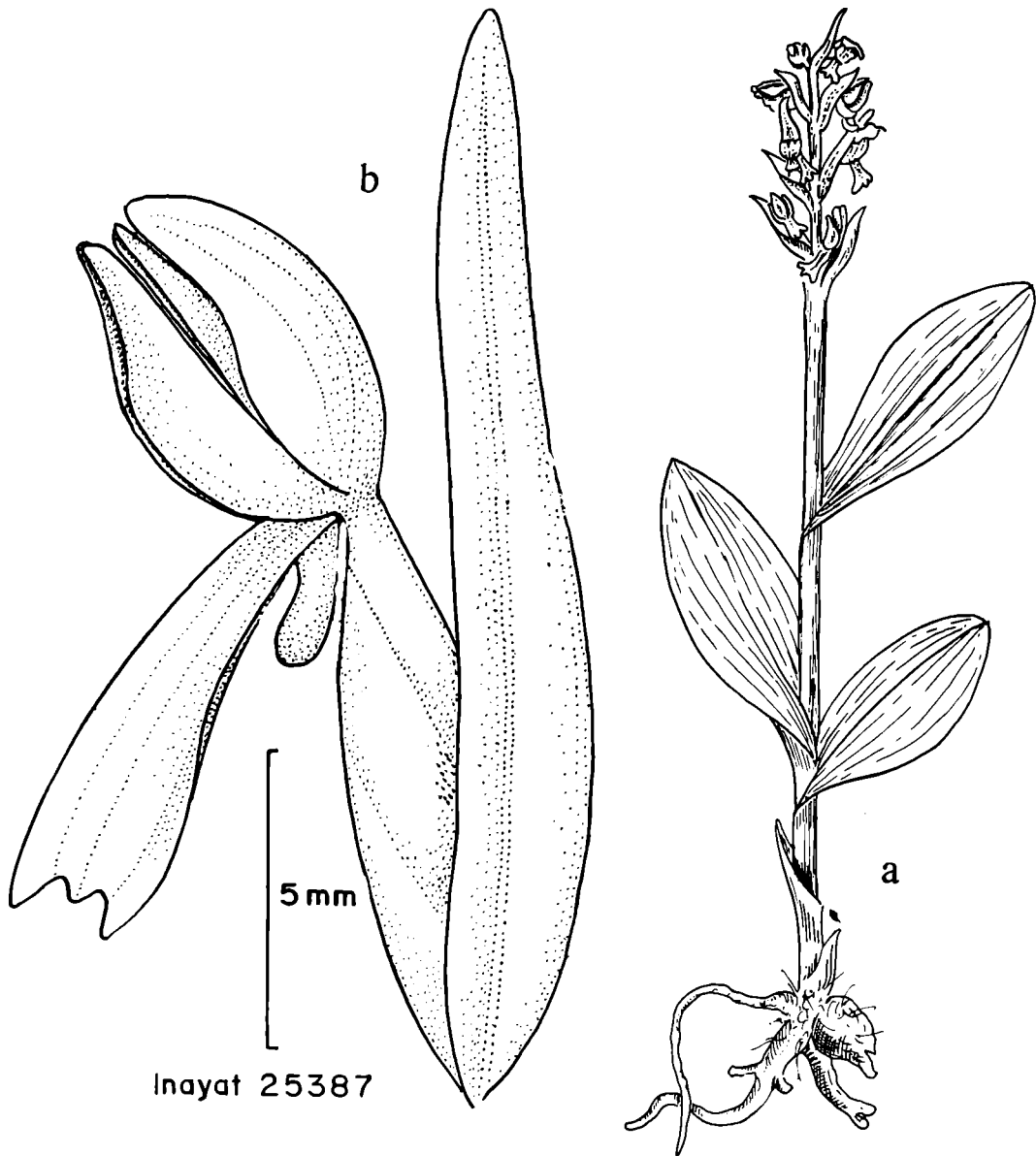


Fig. 49 *Coeloglossum viride* (Linn.) Hartm.—a. plant; b. flower.

*Satyrium viride* Linn. Sp. Pl. 944. 1753.

*Orchis viridis* Crantz, Strip. Austr. ed. 11. fasc. vi. 491. 1769.

*Habenaria viridis* (Linn.) R. Br. in Aiton. Hort Kew ed. 2, 5: 192. 1813; Duthie, 190. t. 141. 1906.

*Gymnadenia viridis* A. Rich. in Mem. Mus. Par. 4: 57. 1818.

*Platanthera viridis* Lindl. Syn. Brit. Fl. ed. I. 261. 1829.

*Himantoglossum viridis* Reichb. Fl. Germ. Excurus. 120. 1830.

*Coeloglossum kaschmirianum* Schl. in Fedde, Repert. 16: 404. 1920.

*Coeloglossum bracteatum* (Muhel. ex Willd.) Parl. var. *kashmiricum* Soo in Ann. Mus. Nation. Hung. 26: 356. 1929. (Fig. 49)

Tubers 2, each further divided into finger like segments. *Stem* leafy up to 25 cm tall. *Leaves* 3-5, elliptic-oblong, acute or obtuse, 4-6 × 1.5-2 cm. *Spike* lax or densely many-flowered, short but sometimes reaching 15 cm in length. *Flowers* 9-13 mm long, green, suffused with red-brown. *Bracts* lanceolate, normally overtopping the flowers. *Sepals* ovate, forming a hood with petals. *Petals* linear-lanceolate, equalling the sepals. *Lip* strap shaped, cuneate-ligulate, 6-8 mm long, bent downwards, tridentate, the side-teeth longer, thickened on each side near the attachment of the column, with a central longitudinal low keel running from the base towards the apex. *Spur* saccate, about 2 mm long.

*Flowering*: July - August.

*Distribution*: Himalaya 3100-3900 m (Kashmir, Nepal, Bhutan). North Europe, Siberia, S.E. Tibet, N. America and China.

*Specimens examined*:

JAMMU & KASHMIR: Nai Gund near the Kamri Pass, *Inayat* 25387.

#### **Dactylorhiza** Necker ex Neviski

Slender to robust plants with palmately divided tuberoids. *Stem* with basal leaves or leafy throughout. *Inflorescence* cylindric, mostly densely flowered. *Bracts* foliaceous, more or less exceeding the ovary. *Flowers* rose-purple, yellowish, rarely white. *Lateral sepals* spreading, the dorsal forming a loose hood with the petals. *Lip* entire or 3-lobed, spurred, with darker dots or streaks. *Column* short; *pollinia* 2, each with caudicle and viscid gland, which both are enclosed in a single pouch (bursicula), stigma slightly concave, undivided; mid-lobe of rostellum narrow-lamelliform, placed between the anther-cells. *Ovary* sessile, twisted, glabrous.

#### **Key to species**

1. Lip longer than broad; plants usually slender, leaves lanceolate or linear; inflorescence normally loose ..... *D. kafariana*
- + Lip usually almost as long as broad or broader; plants normally robust growing; leaves oblong-lanceolate, the lowest often ovate; inflorescence dense ..... 2
2. Spur cylindric, more or less straight; lip usually broader than long; leaves arranged more or less along the whole length of the stem..... *D. hatagirea*
- + Spur cylindric, curved outwards or even hooked towards the apex; lip usually as long as broad, rarely longer; leaves usually arranged in the lower part of the stem, sometimes more or less basal ..... *D. umbrosa*

**Dactylorhiza hatagirea** (D. Don) Soo (Ann. Univ. Scient. Budapest. Sec. Biol. 3: 341. 1960. *comb. illegit.*) *nom. nov.* Gen. Dactylorhiza: 4. 1962; Stewart, 67. 1972; Renz, 133. t. 53. 1978; & 25. 1984.

*Orchis hatagirea* D. Don, Prod. Fl. Nepal, 23. 1825.

Aswal 6675

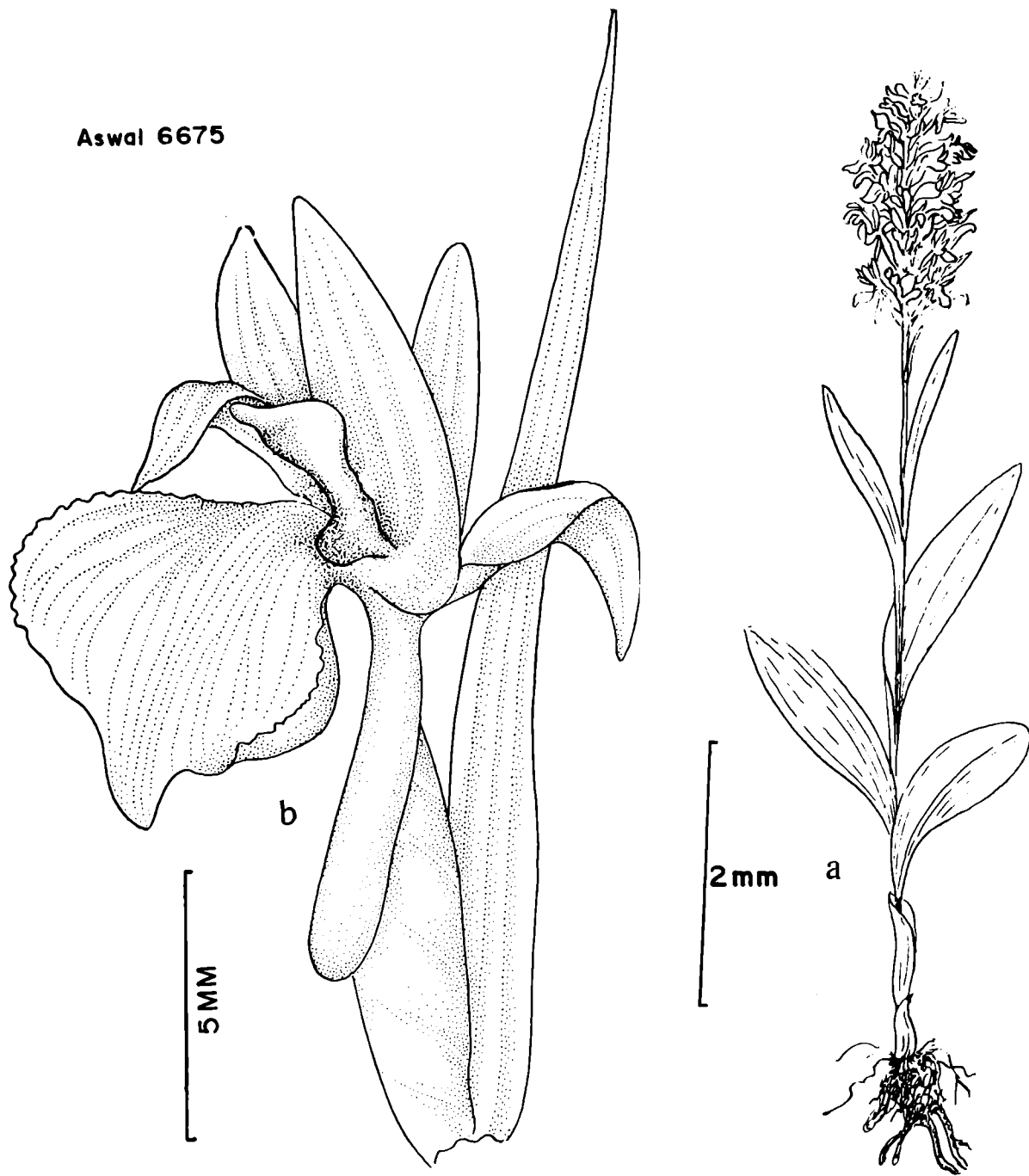


Fig. 50 *Dactylorhiza hatagirea* (D. Don) Soo—a. plant; b. flower.

*O. latifolia* auct. non Linn.: Hook. f., 6: 127. 1890; Collett, 499. 1902; Duthie, 172. 1906; Gupta, 701. 1966.  
*O. graggeriana* Soo, in Journ. Bot. 66: 15, fig. 1-4. 1928. (Fig. 50)

Plant mostly robust, up to about 60 cm tall. *Tubers* 2-4 lobed, often with elongated tips. *Stem* leafy upwards, stout, more or less fistular. *Leaves* 3-6, erect, spreading, arranged more or less along whole length of the stem, sometimes more or less appressed to the stem, broadly lanceolate or oblong-ligulate or elliptic, 6-15 × 3-5 cm, the lowest often ovate. *Inflorescence* broadly cylindric, densely many flowered. *Flower* variable in size, purplish-lilac or rose, rarely white. *Bracts* lanceolate, the lower somewhat exceeding the flowers, the upper ones shorter. *Sepals* erect, spreading, the dorsal ovate-oblong or broadly lanceolate, up to 10 mm long, the lateral obliquely ovate-lanceolate or lanceolate, slightly longer than the dorsal. *Petals* obliquely ovate or broadly lanceolate, slightly shorter than sepals. *Lip* nearly flat, mostly broader than long, oval or sub-orbicular, entire or slightly 3-lobed in front, 10-12 mm long, apex or midlobe triangular, minutely papillose above. *Spur* hanging down, cylindric, more or less straight, equalling the ovary or slightly shorter.

*Flowering*: July - August.

*Distribution*: Himalaya 3000-4000 m (Pakistan, Kashmir to Nepal), South West Tibet.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, without name and date of collection. **Tehri**-Below Dyara, *Sahni* 24892; Panwalikanta, *Naithani* 53158. **Uttarkashi**-Jamuna Bhagirhti water shed, *Joshi*; Nila Valley, *Duthie* 519; Damdar Valley, *Duthie* 520; Jamuna Valley, Seema, *Dwarika Prasad* 69; Tons Valley, Har-Ki-Dun, *Deva* 6876 & 6877. **Chamoli**-Valley of flowers, *Naithani* 1020; Pushpawati River, Valley of flowers, *Renz* 13620; Dunagiri, *Naithani* 54122; Himtoli, Nanda Devi Park, *Hajra* 73497; Gandhi Sarovar, *Mehrotra* 5141.

KUMAUN: **Pithoragarh**-Pithoragarh, *Arora* 45745; Panch Chuli, *Sahni* 20460; East Balate Glacier, *Thomas* 20897; Barpho Gori Valley, *Inayat* 24119; Palangadh Byans, *Duthie* 6008.

HIMACHAL PRADESH: Rupin Valley, Village Jakha, Shimla, *Deva* 3755; Chor, *Raizada* 13479; Shimla, *Brandis* 1471; Pulga Kulu Valley, *Parkinson* 5074, *Jain & Bharadwaja*; Pangi Chamba, *Harsukh* 23339; Koksar Lahul, *Bor* 14552, *Aswal* 11055 & 6675; Sissu, Lahul, *Bor* 12378, 12494 & 14620; Jahlma, Pattan Valley, Lahul, *Sethi & Negi* 305.

JAMMU & KASHMIR: Kashmir, A.C. *Forests* 49; Below Sonapind Pass. Kishanganga Valley, *Keshevanand* 815; Sonmarg, *Inayat* 25375; Gulmarg, *Gammie*; Gilgit, *Giles* 189; Bujiaz, Poonch, Pir Panjal, *Kirn* 3011; Ladakh, Shushal, *Walter Koelz* 2438.

PAKISTAN: Kagan Hazara, *Inayat* 23174.

Use: Tuberous roots yield 'salep' extensively used as nervine tonic, aphrodisiac and in many other drugs.

Very variable species, from slender with leaves close together towards the base of the stem when growing in open alpine moraine to very luxurious having well developed large leaves when growing on the side of the water courses. The inflorescences may be few flowered to large dense flowered spikes. We examined the isotype of *Orchis graggeriana* Soo, *Inayat* 25376 from Kashmir (Fig. 51 b.) and do not find it distinct in any way from this species. The lip is also very variable and in a specimen from Lahul (*Bor* 12378, Fig. 51 a.) it is very similar to *D. kafiriana* Renz, however in other respect it is identical with the typical plant.

**Dactylorhiza kafiriana** Renz, in Rech. f., Fl. Iran. 126: 125. t. 54. 1978, & 22. 1984. (Fig. 52)

Plant slender, sometimes rather dwarf, up to 20-35 cm tall. *Tubers* 2-4, finger like. *Stem* straight or slightly flexuous, leafy mainly towards the base. *Leaves* spreading, lanceolate or linear, acuminate, 15 × 1-2 cm. *Inflorescence* normally loosely few to many flowered. *Flowers* mainly pale rose-violet. *Bracts* nar-

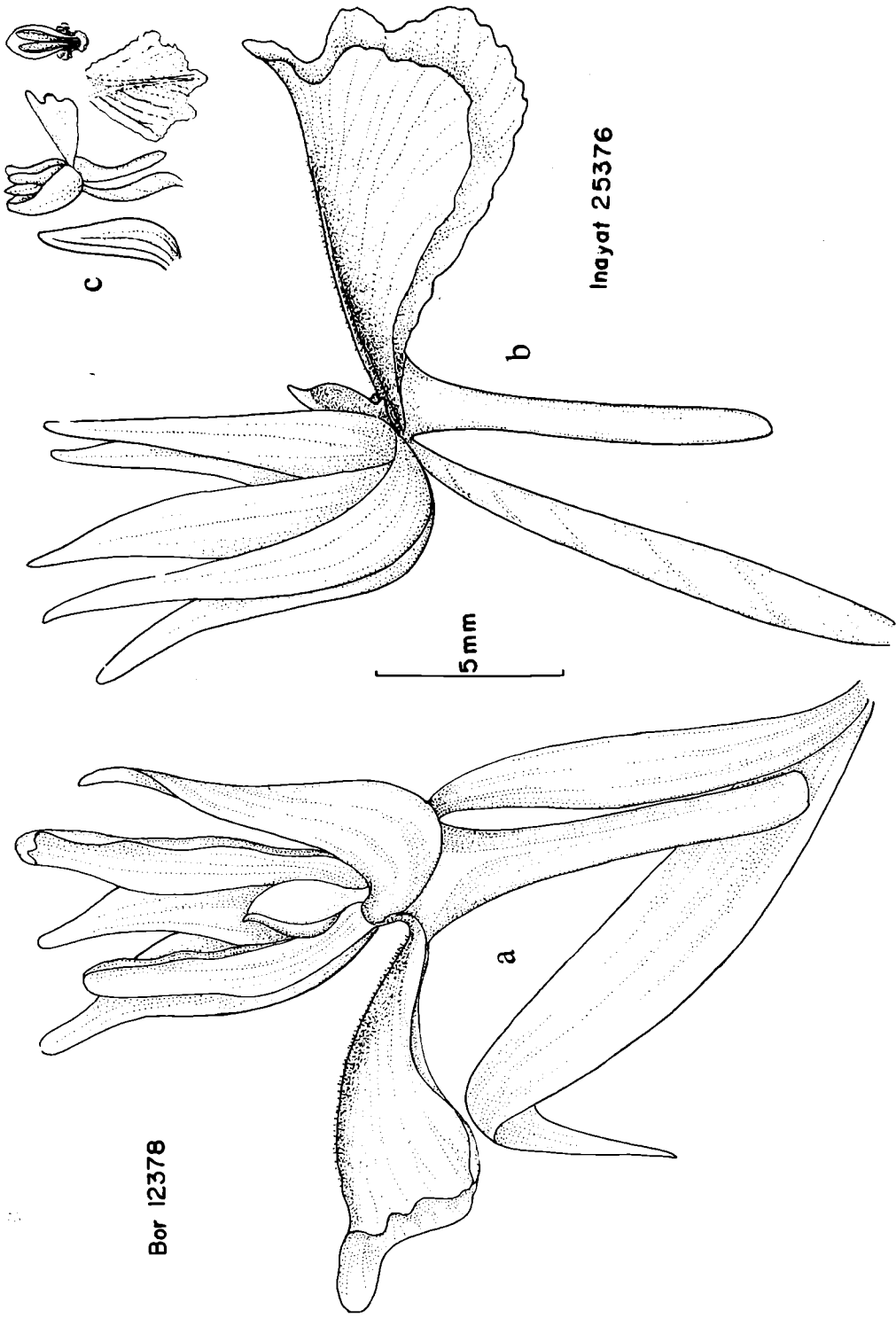


Fig. 51 *Dactylophiza hatagirea* (D. Don) Soo — a. & b. flowers (c. after Soo. Jour. Bot 66. 15 f 1-4, 1928).



Giles A 59

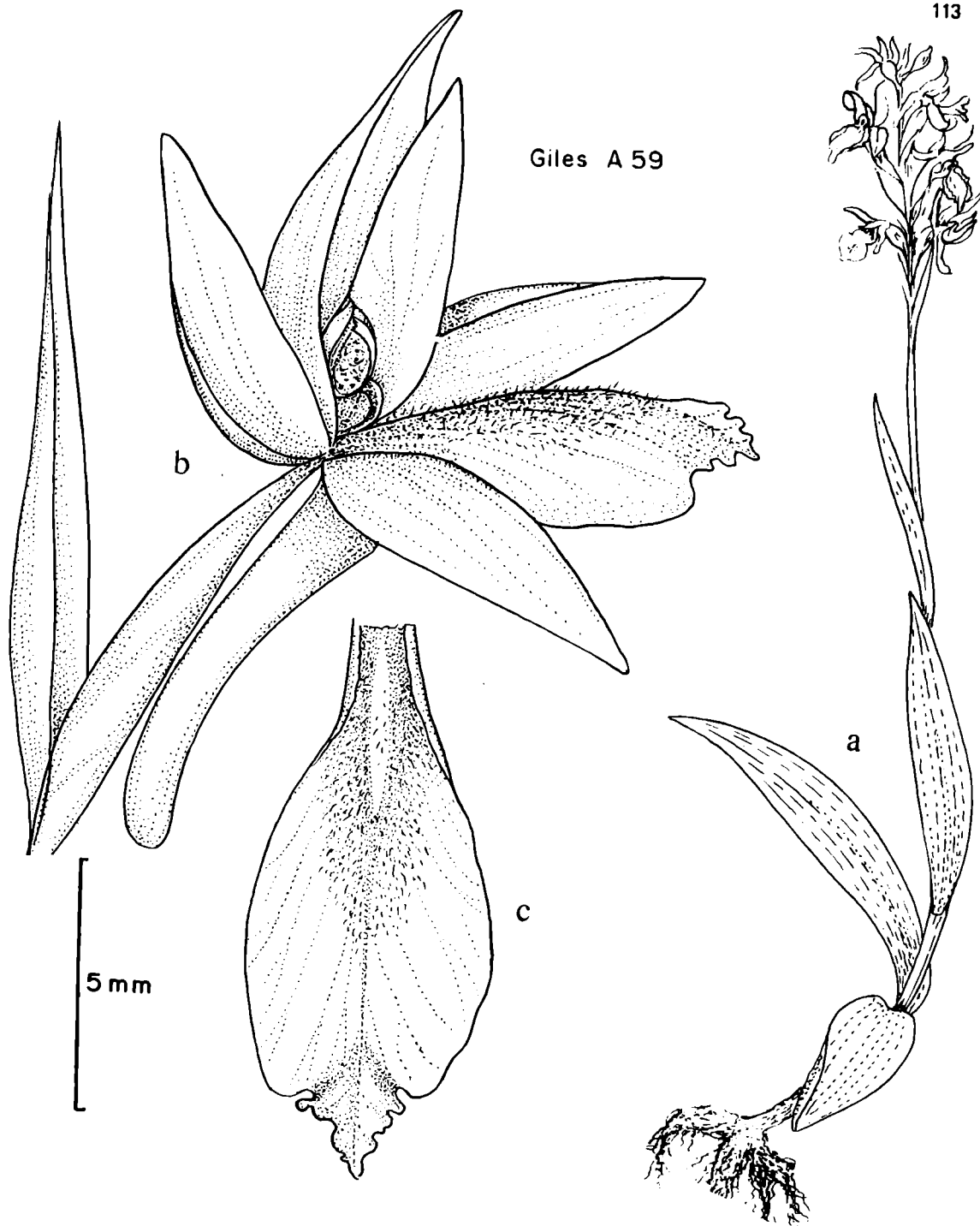
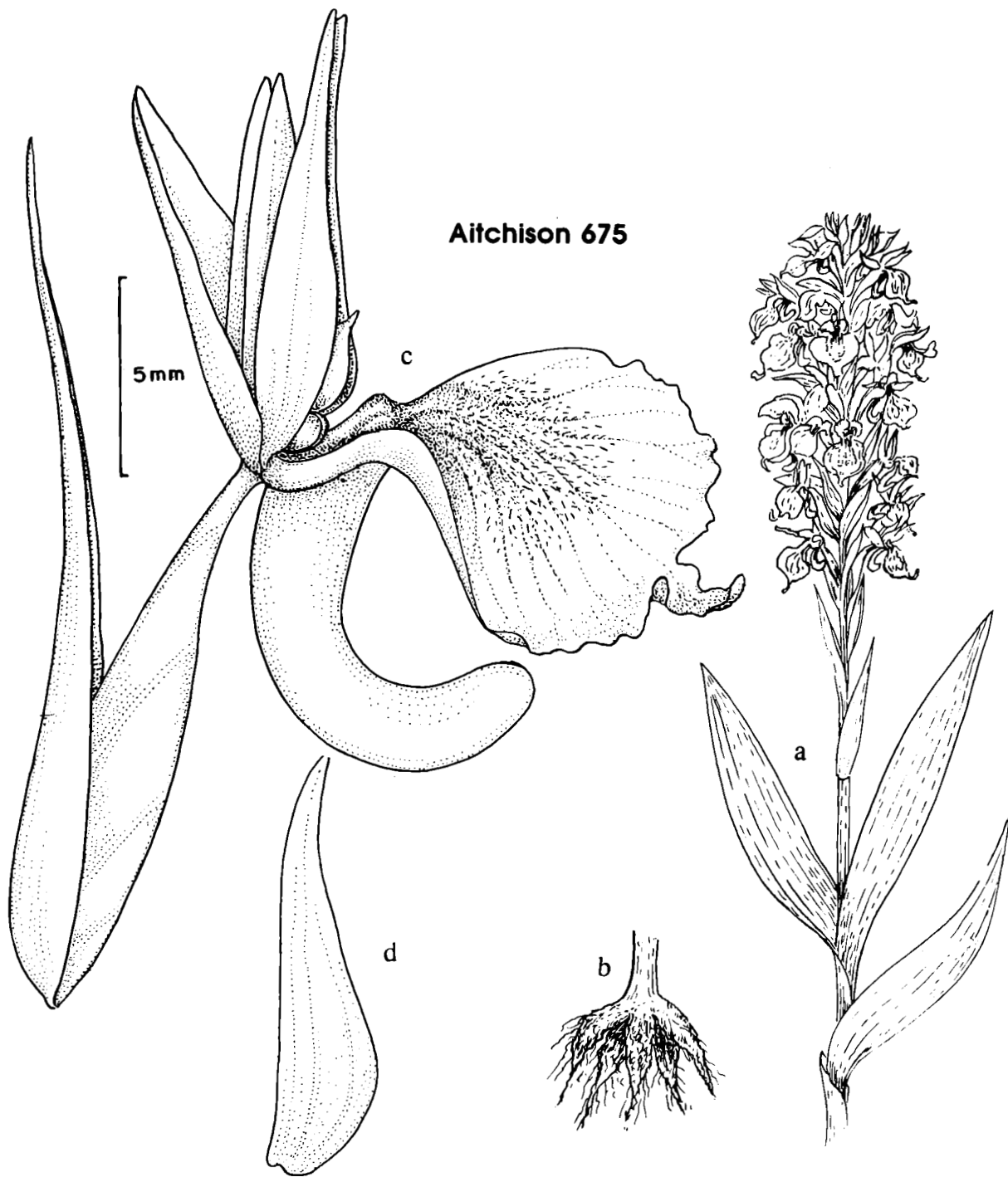


Fig. 52 *Dactylorhiza kafiriana* Renz—a. plant; b. flower; c. lip.



**Fig. 53** *Dactylorhiza umbrosa* (Kar. & Kir.) Nevski—a. plant; b. root tubers; c. flower; d. lateral sepal.

rowly lanceolate, the lower slightly exceeding the ovary, the upper equalling it. *Sepals* the dorsal converging with the petals to form a loose hood, oblong-lanceolate, up to 11 mm long; the laterals reflexed, obliquely oblong-lanceolate, acute, as long as the dorsal, often purplish spotted. *Petals* lanceolate, equalling the sepals or some what shorter. *Lip* longer than broad, 8-11 mm long, obovate or rhomboidal with an acute and somewhat elongated tip, entire or scarcely 3-lobed, with the mid lobe longest, papillose at base and centre. *Spur* cylindric more or less equalling the ovary in length.

*Flowering*: June - August.

*Distribution*: Himalaya 2000-3700 m (Pakistan, Kashmir). Afghanistan.

*Specimens examined*:

JAMMU & KASHMIR—Gilgit, *Giles* A 59 & 275; Gagangir-Sind Valley, *Gammie*.

PAKISTAN: Chitral, *Younghusband*.

The plant was originally discovered in remote wild Valleys of Kafiristan, but recent identifications show that its range extends well within Kashmir and Ladakh and it is very possible that it may also be found in Lahul. Hybridization occurs with *D. hatagirea* in areas where both grow together, giving rise to intermediate populations. We doubt that *Bor*' 12378 from Lahul (Fig. 51 a.) is such a plant.

***Dactylorhiza umbrosa*** (Kar. & Kir.) Nevski, in Acta Inst. Bot. Acad. Sci. URSS. ser. 1, 4: 332. 1937; Stewart, 68. 1972; Renz, 126. t. 52. 1978; & 23. 1984.

*Orchis latifolia* sensu Aitchison in Trans. Linn. Soc. Ser. 2, 3: 113. 1888-94. *non* Linn.

*O. umbrosa* Kar. & Kir. in Bull. Soc. Nat. Mosc. 15: 504. 1842.

(Fig. 63)

Plants normally robust, rarely dwarf in wet grounds, sometimes very robust and taller up to 80 cm. *Stem* solid or fistular in large plants, densely leafy, often with the leaves clustered towards the base or even rosetted. *Leaves* erect-spreading, lanceolate or oblong-lanceolate, sometimes broader, acute, 10-15 × 3 cm, basal leaves often short, oblong or ovate, obtuse. *Inflorescence* densely many flowered, up to 15 cm long, cylindric. *Flowers* purplish-lilac, pale-purple or flesh-coloured, rarely white. *Bracts* lanceolate, acuminate, the inferior exceeding the flowers. *Sepals* the dorsal forming a loose hood with the petals, oblong, lanceolate, slightly concave, 10 mm long; the lateral spreading or reflexed, sometimes purplish spotted, obliquely oblong or lanceolate, acute slightly larger than the dorsal. *Petals* ovate or lanceolate, acute, somewhat shorter than the sepals. *Lip* usually as long as broad, sometimes longer, flat, orbicular or reniform-rhomboidal or rarely ligulate, tapering towards the apex, up to 10 mm long, entire, sub-entire or shortly 3-lobed, side-lobes roundish, mid-lobe smaller, triangular often with an elongated apex. *Spur* cylindric, curved outwards or even hooked towards the apex, slightly shorter or equalling the ovary.

*Flowering*: June - July

*Distribution*: Himalaya 1000-3900 m (Pakistan). Afghanistan, Persia, Iraq and Central Asia.

*Specimens examined*:

PAKISTAN: Chitral, *Harriss*.

#### ***Diphylax* Hook. f.**

Slender plants with small tuberoids. *Stem* one- or few flowered. *Inflorescence* cylindrical, densely flowered, sub-secund. *Bracts* slightly shorter than ovary. *Flowers* tiny, greenish or whitish, somewhat tubular. *Sepals* and *petals* of more or less equal length, spreading at their tips. *Lip* oblong, 3-toothed at apex, shortly spurred at base. *Column* short; *pollinia* 2, with short caudicles and separate viscid glands; stigmata confluent, cushion-shaped; staminodes very prominent, erect, filiform, as long as column. *Ovary* sessile, slightly twisted.

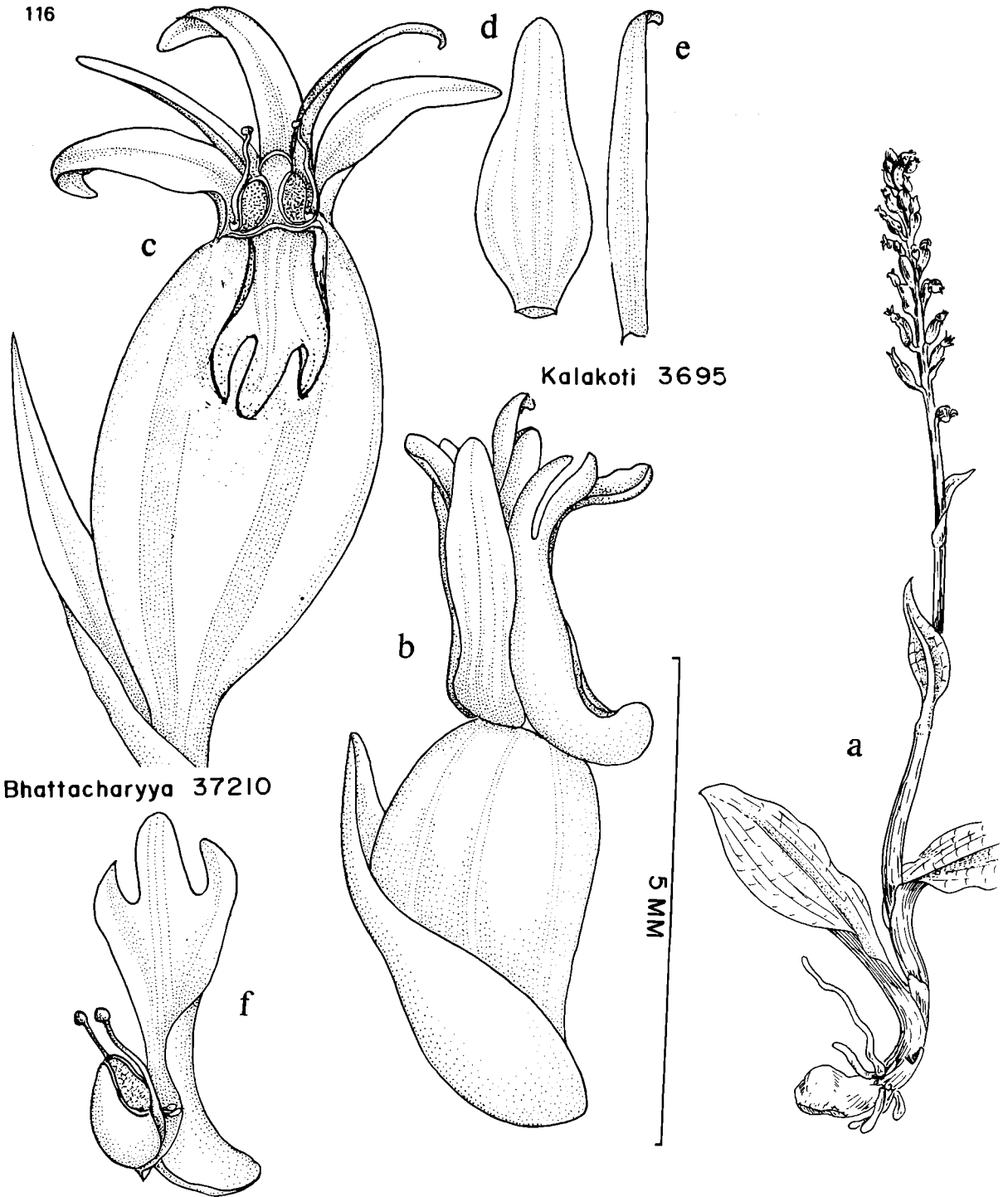


Fig. 54 *Diphylax griffithii* Kranzl.—a. plant; b. & c. flower; d. sepal; e. petal; f. column & lip.

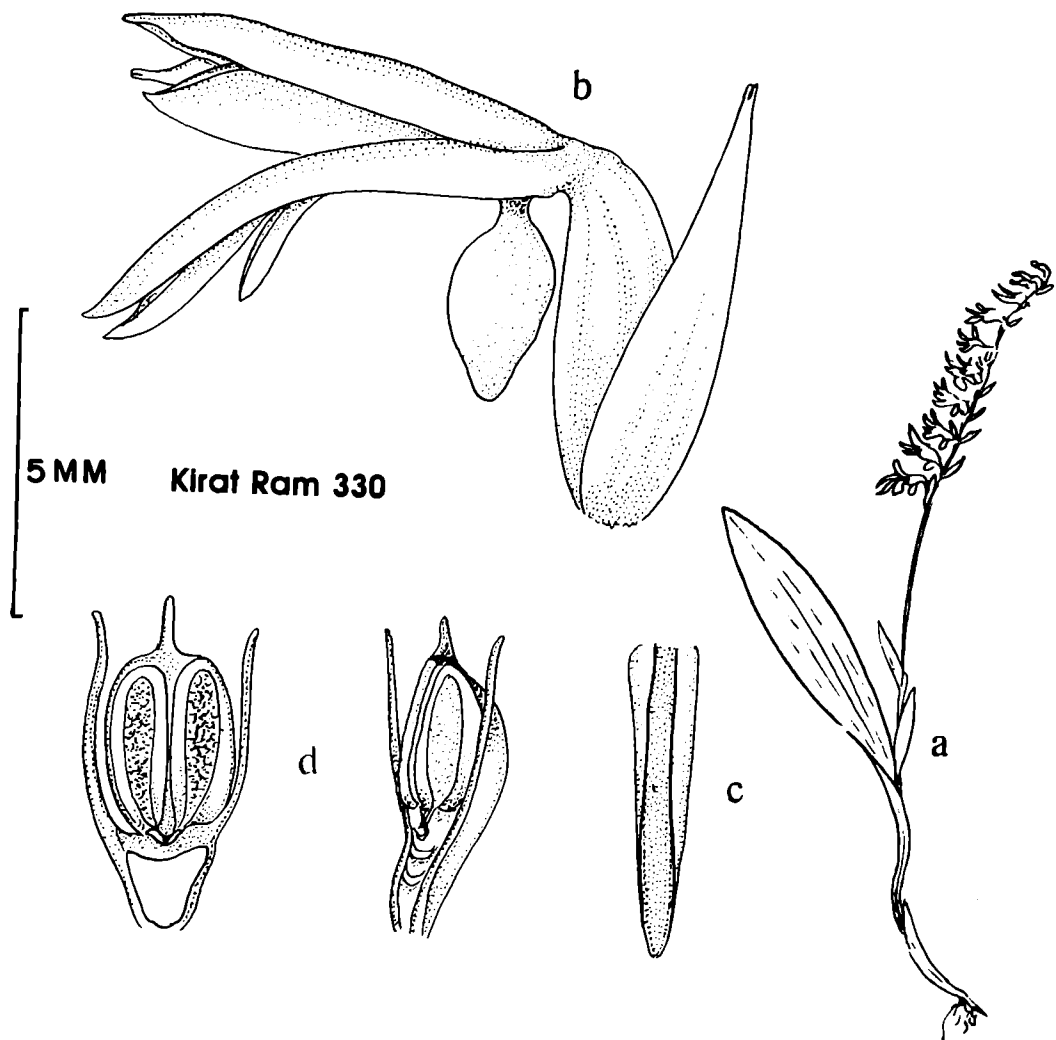
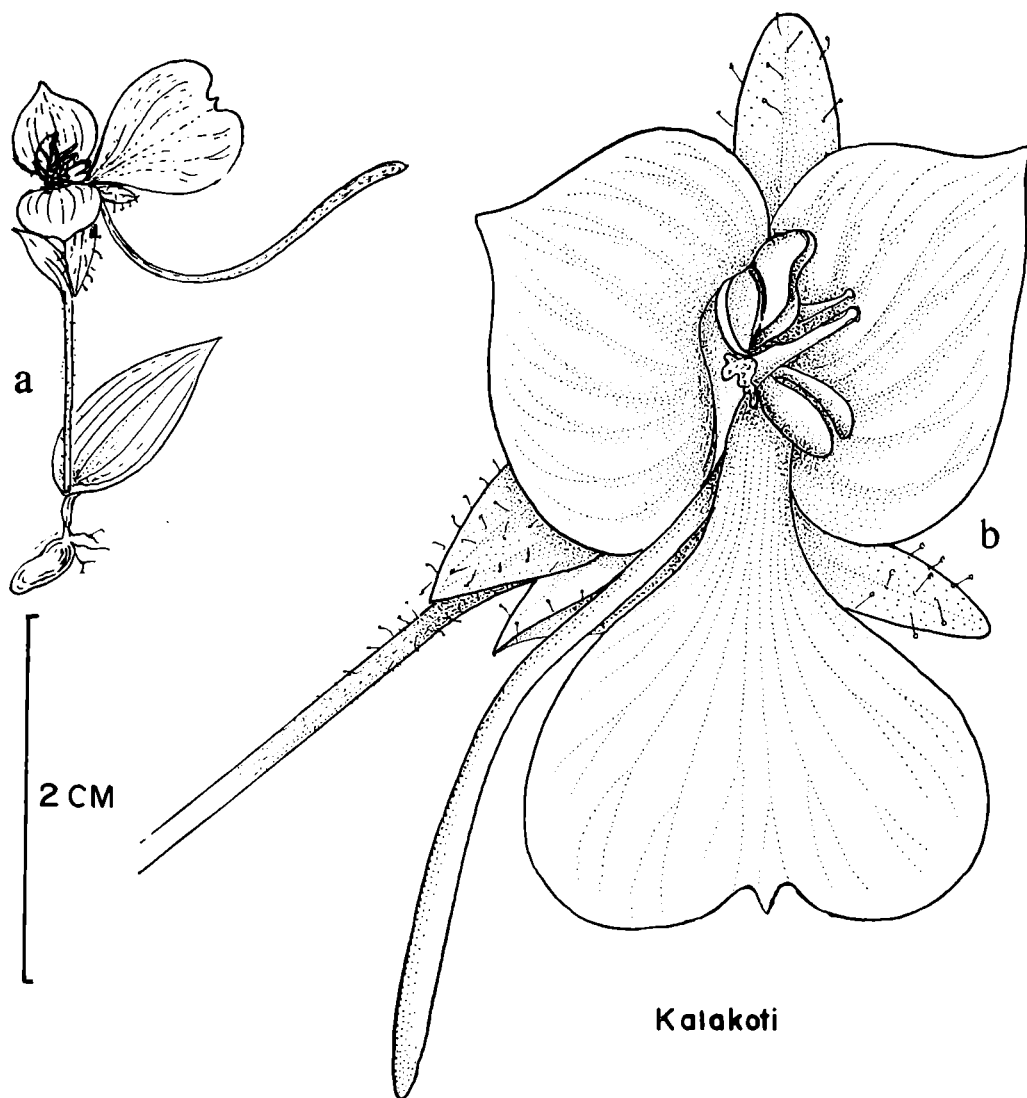


Fig. 55 *Diphyllax urceolata* (Clarke) Hook. f.—a. plant; b. flower; c. lip; d. column.



**Fig. 56** *Diplomeris hirsuta* (Lindl.) Lindl. — a. plant; b. flower.

**Diphylax griffithii** (Hook. f.) Kranzl. Orch. Gen. & Sp. 1: 599. 1901; Renz, 64. 1978; & 39. 1984.

*Orchidea herminioides* Griff. Itin. Not. 343. 1848.

*Habenaria griffithii* Hook. f., Brit. Ind. 6: 197. 1890; Duthie, 195. t. 145. 1906.

*H. deicipiens* Hook. f. Fl. Brit. Ind. 6: 165. 1890 *non* Wight.

*Cheirostylis griffithii* sensu, Stewart, Fl. W. Pak. 67. 1972. (*non* Lindl.).

(Fig. 54)

*Tuber* small, narrowly oblong. *Stem* 15-30 cm high, slender, straight or flexuous. *Leaves* few, 2.5-6 cm long, elliptic or linear-oblong, acute or obtuse, membranous. *Spike* sub-second, 2-6 cm long, loosely or densely many flowered. *Flowers* small, greenish or whitish, deflexed, some what tubular. *Bracts* ovate-lanceolate, obtuse; lateral obliquely linear-oblong. *Petals* 3-4 mm long, spreading, linear-lanceolate. *Lip* 3-4 mm long, narrowly oblong, 3-fid at apex; side lobes divaricate; mid-lobe longer. *Spur* very short 1 mm long, slightly curved outwards.

*Flowering*: March - May

*Distribution*: Himalaya 2000-3000 m (Pakistan, Kashmir, Garhwal & Kumaun).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 22733, 24170; Chakrata, Tons Valley above Thadiar, *Duthie*. **Chamoli**-Bagrigad, *Bhattacharyya* 37210.

KUMAUN: **Pithoragarh**-Pithoragarh, *Bhattacharyya* 21111; Gorighat, *Nair* 35672. **Nainital**-Khairna, *Kalakoti* 3695, 3696.

JAMMU & KASHMIR: Behramgala, Poonch, Pir Panjal Range, *Kirn* 429.

PAKISTAN: Chitral Bundai, *Harriss*.

**Diphylax urceolata** (Clarke) Hook. f. (*Habenaria urceolata* Clarke) was recorded by Duthie (1906), specimen number *Duthie* 6003, from Kumaun in Byans. We found that it was based on wrong identification. We have sketched from a specimen *Kirat Ram* 330, from Sikkim for comparison (Fig. 56).

#### Diplomeris D. Don

Small terrestrial deciduous herbs, with or without tubers. *Leaves* few, large, oblong or ensiform, hirsute or glabrous. *Flowers* 1-2, large. *Sepals* sub-equal, free, lanceolate, ovate-oblong, spreading. *Petals* much larger than sepals. *Lip* adnate to the base of the column by a long claw, its limb spreading, very broad, entire or minutely 3-lobed at the apex, with a long spur. *Column* very short; infertile stigma large, erect, membranous. *Anther* cells parallel, with very long canals extending horizontally forwards by the sides of the column and projecting in front of it, rostellum mid-lobe large, overtopping the anther. *Pollinia* sub-cylindric, curved; *caudicles* long, cylindric, curved; glands minute, discoid. *Stigma* 2, on elongated processes, oblong, parallel, projecting downwards and forwards above the claw of the lip.

**Diplomeris hirsuta** (Lindl.) Lindl. Gen. & Sp. Orch. 330. 1835; Hook. f., 6: 167. 1890; King & Pantl. 337, t. 443. 1898; Rau & Arora, 15: 138. 1973.

*Diplochilus hirsuta* Lindl. in Edw. Bot. Reg. sub. t. 1499. 1832.

(Fig. 56)

*Tuber* globose or sub-globose. *Stem* short, 1-flowered. *Leaf* solitary, radical, sessile, 5-6.5 × 2.5-3 cm, pendulous, hirsute, oblong-elliptic, base minutely cordate, *Scape* 4-5 cm. *Flowers* 4 cm across, hirsute. *Bracts* ovate, oblong, acute, pubescent. *Sepals* white, ovate-oblong, sub-acute, much smaller than petals. *Petals* white, orbicular-reniform, apex slightly acute. *Lip* shaded yellow, longer than sepals, sub-orbicular, clawed at the base, the apex broad emarginate, mucronate, upper surface smooth, the midrib broad and somewhat thickened. *Spur* long, greenish, infundibuliform at the mouth, curved, pubescent outside.

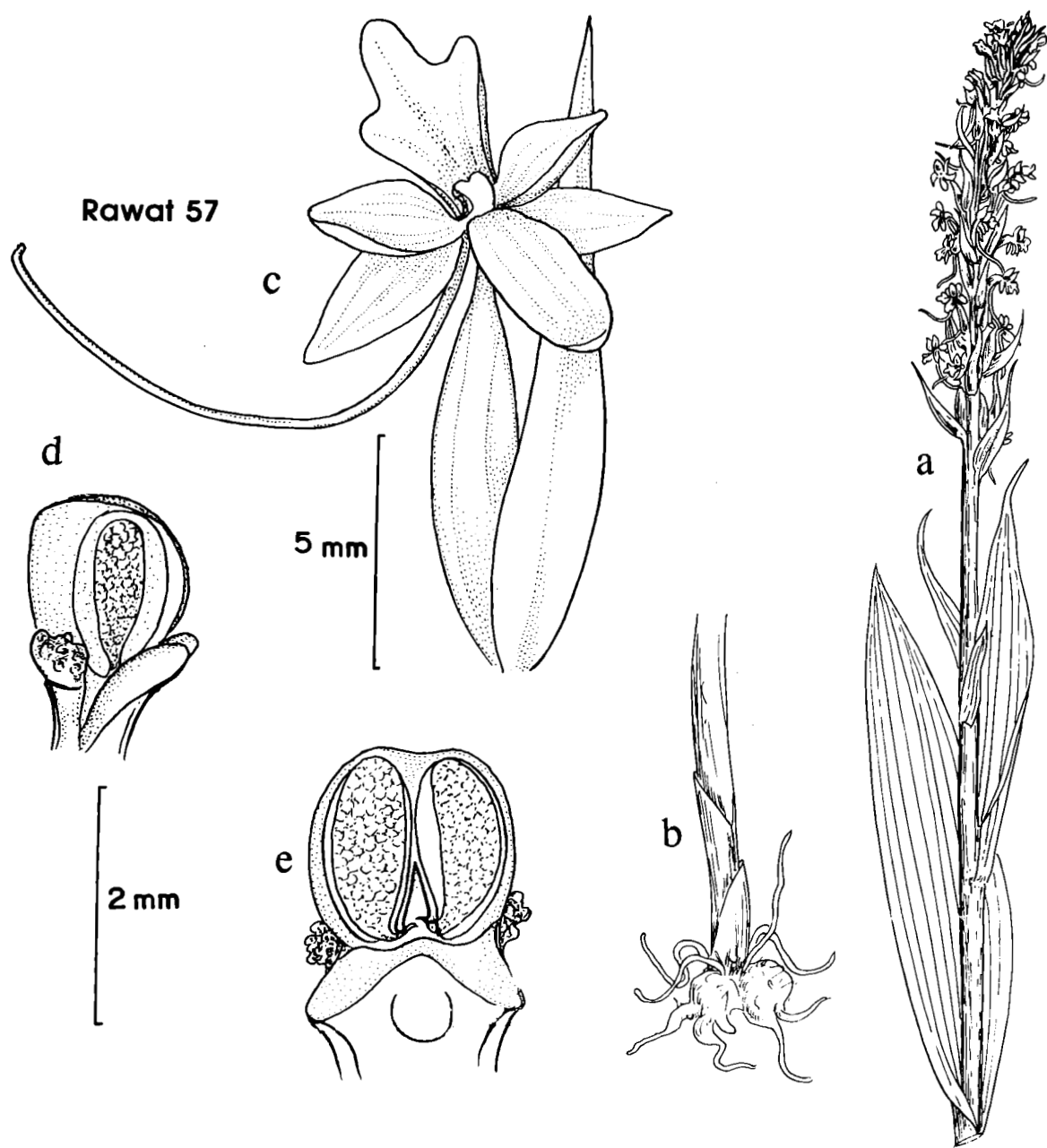


Fig. 57 *Gymnadenia orchidis* Lindl.—a. plant; b. lower part of plant; c. flower; d. & e. column.



*Flowering:* July - August.

*Distribution:* Himalaya up to 1000 m (Kumaun to Arunachal Pradesh).

*Specimens examined:*

KUMAUN: **Nainital**-Nainital Kathgodam Road 1 km down to Dogaon. *H.C. Pandey* 6121; Dogaon, near Pulia No. 110/7. *Arora* 50016 & 52434, *R.N. Tiwari* 5890, *Renz* 13580, *Kalakoti*.

In Western Himalaya it is known only from one spot.

### **Gymnadenia R. Br.**

Plants robust with palmate tuberoids, their segments often elongated. *Stem* leafy crowded near the base or leafy throughout. *Inflorescence* many flowered, cylindric. *Flowers* rather small, fragrant, rose or purplish-lilac, rarely white. *Lateral sepals* spreading, the dorsal forming a hood with the broader petals. *Lip* 3-lobed, sometimes nearly entire, with filiform spur. *Column* short; *pollinia* 2, with caudicles and each with a naked viscid gland; *rostellum* with a small mid-lobe, placed between the anther cells; stigma concave. *Ovary* sessile, slightly twisted.

**Gymnadenia orchidis** Lindl. Gen. & Sp. Orch. 278. 1835.; Stewart, 70. 1972; Renz, 27. 1984.

*G. cylindrostachya* Lindl. Gen. & Sp. Orch. 278. 1835.

*Habenaria orchidis* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 142. 1890.

*Peristylus orchidis* (Lindl.) Kranzl. Orch. Gen. Sp. 1: 515. 1898.

*Orchis habenarioides* King & Pantl. in Ann. Roy. Bot. Gard. Calc. 8: 302, t. 401. 1898; Duthie, 172. 1906; Katakai et al. 5: 26, 1984.

*O. cylindrostachya* (Lindl.) Kranzl in Fedde, Repert. 5: 197. 1908.

(Fig. 57, 58)

*Gymnadenia himalayica* Sheltr. in Feede, Repert. 16: 283. 1919.

Plant 30-50 cm high; tuber digitate. *Stem* clothed at the base with tubular sheaths. *Leaves* 4-5, scattered, sessile, 5-12 cm long, elliptic-oblong to linear-oblong, sub-acute. *Spike* 4-12 cm long, cylindric, densely flowered, *Flowers* 7 mm across, pinkish or violet, rarely white. *Bracts* longer than ovary. *Sepals* sub-equal, broadly ovate, puberulous; the dorsal forming a hood with the petals; lateral pair spreading, acute. *Petals* shorter than sepals, rhombic-orbicular, minutely apiculate, *Lip* adnate to the base of the column, apex shallowly 3-lobed, upper surface smooth. *Spur* as long or longer than the ovary, filiform, curved and slightly clavate, puberulous inside.

*Flowering:* July - August.

*Distribution:* Himalaya 2500-4500 m (Pakistan, Kashmir to Sikkim).

*Specimens examined:*

GARHWAL: **Uttarkashi**-Tons Valley, Har-ki-Dun, *Deva* 6876; Jamuna Valley, Jaki, *Dwarika Prasad* 30; Jamuna Valley Shanachatti. *M.A. Rau* 15810; Jankichatti, *M.A. Rau* 15688; Chansil, *B.B. Osmaston* 24187. **Chamoli**-Badrinath, *Falconer*; Valley of flowers, *Bhattacharyya* 24399, 29543, *Renz* 13619. *Naithani* 1021, *Mehrotra* 1721; Dunagiri, *Naithani* 45122; Kedarnath, *A.S. Rao* 58480; Nanda Devi Sanctuary. *Hajra* 73280; North of Bampa, *Naithani* 56083; Garur Chatti, *Mehrotra* 5141.

KUMAUN: **Pithoragarh**-Sabauidiyar, Ralam Valley, *Inayat* 24120; Balati glacier. *Thomas* 20783; Primula Valley, *Thomas* 20771; Bakriuidiyar, *Arora* 45745; Ralam Valley, *Pant & Naithani* 39731. **Nainital**-China Nainital, *Champion* 6125.

**HIMACHAL PRADESH:** *Pangi Chamba*, *Harsukh* 23341; Chansil Pass, Shimla, *Nair* 36091; Dhanchoo, *Malhotra & Nair* 28477; Kinnor, Rakcham, *Janardhanan* 53376.

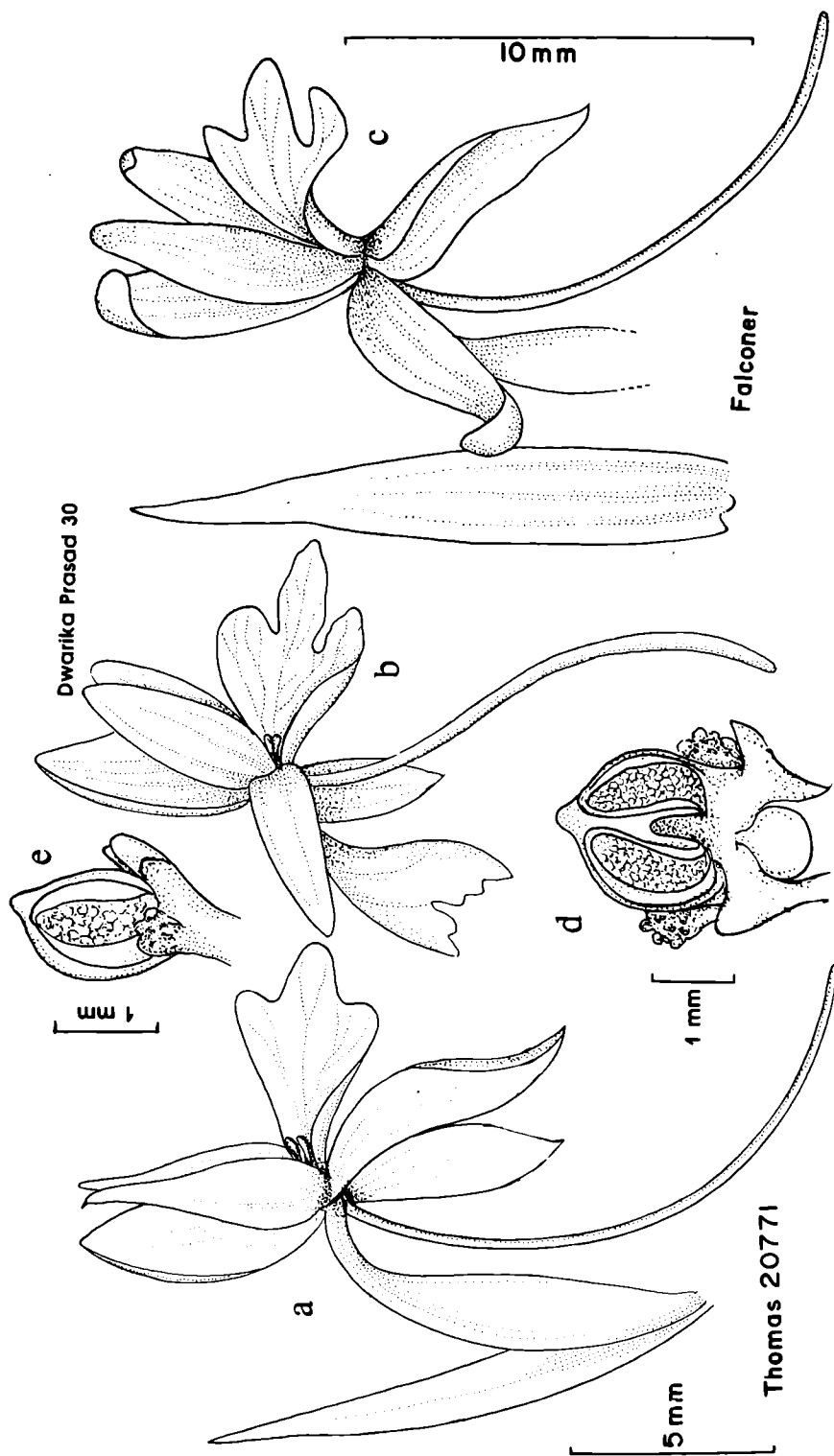


Fig. 58 *Gymnadenia orchididis* Lindl. — a., b. & c. flower; d. & e. column.

JAMMU & KASHMIR: Liddar Valley, *Duthie* 13147, 13185.

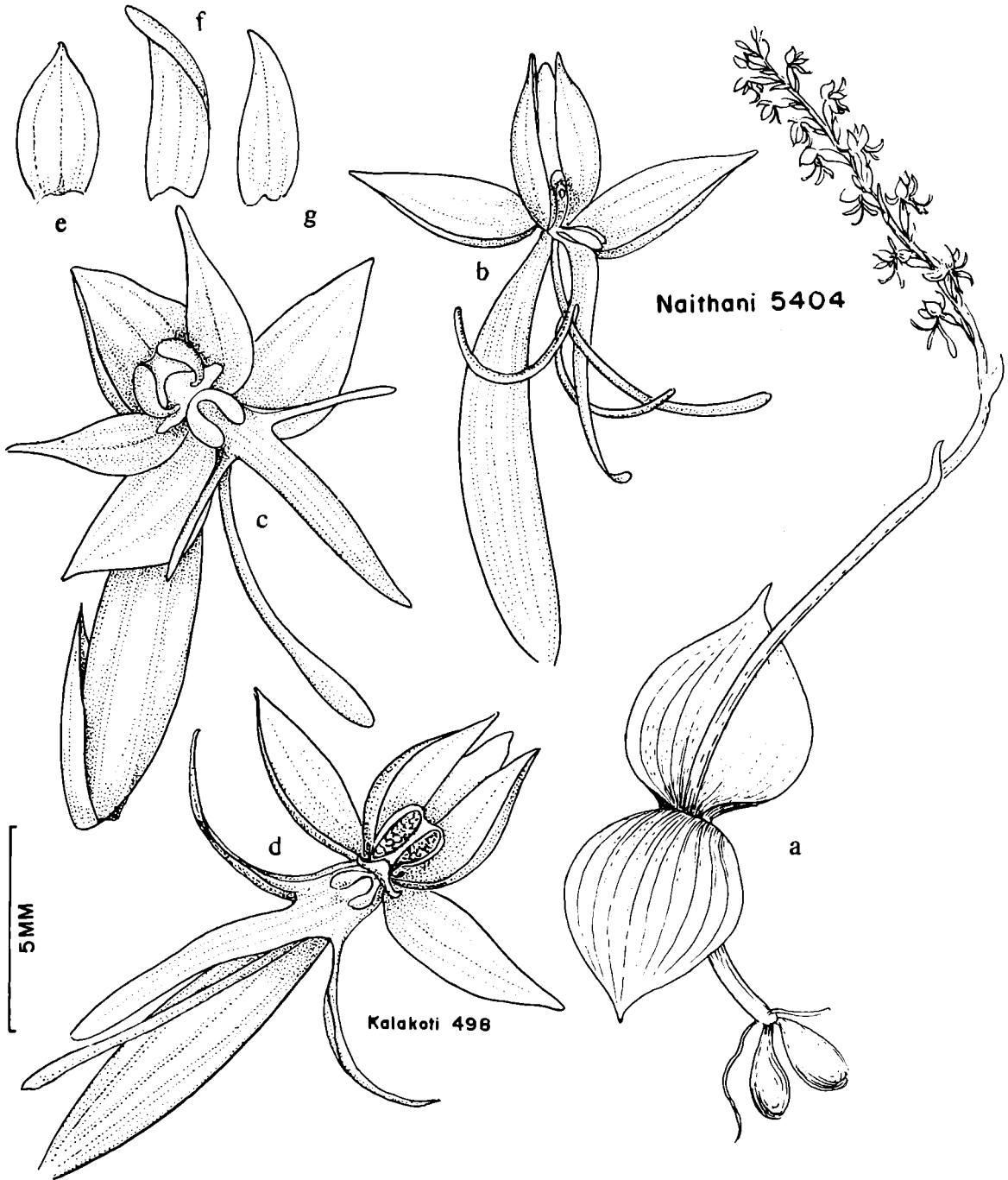
PAKISTAN: Hazara, *Duthie* 20192 (*Stewart, loc. cit.*).

### Habenaria Willd.

Terrestrial herbs with tubers. *Stem* erect with few or many leaves. *Leaves* thin, not plaited, base sheathing and not joined. *Flowers* small or large, in terminal inflorescence. *Sepals* free. *Petals* simple or deeply bilobed, often forming a hood with the dorsal sepals. *Lip* at the base with a short or much elongated spur, limb spreading or pendulous, undivided or trilobed, side lobes sometimes pectinate or fimbriate. *Column* very variable. *Anther* completely united with the column; pollinia 2, granular, with short or long caudicles enclosed in short or long often prominent tubes on the margins of the sidelobes of rostellum. *Rostellum* trilobed, the middle lobe situated between the anther-cells, side lobes longer, acting as carriers of the caudicles of the pollinia. *Staminodes* lateral. *Stigma* bilobed, more or less elongated clavate processes.

### Key to species

1. Lip trilobed or tripartite .....2
- + Lip entire.....15
2. Petals bipartite the lower (anterior) segment reduced and much smaller than the upper (posterior), or both upper and lower segments more or less equal.....3
- + Petals entire .....4
3. Petals with the lower segment reduced, smaller than the upper, and directed downwards below the point of insertion, sepals 10-12 mm long, with aristate tips often drawn out into small thread, lateral lobes of the lip smaller  $\frac{3}{4}$  -  $\frac{1}{2}$  the length of the midlobe, spur equal to or usually longer than the ovary .....*H. stenopetala*
- + Petals with both lower and upper segments equal, decurved, dorsal sepal 6 × 6 mm, the lateral 10-12 mm long. Lateral lobes of the lip little smaller or equal to the central lobe, spur shorter than the ovary .....*H. digitata*
4. Side lobes of the lip deeply lacinate into filiform segments .....5
- + Side lobes of the lip entire, not lacinate, broad or very narrow to filiform .....8
5. Flowers large, 2-6 in a raceme, distant, sepals 20-25 mm long, spur 50-60 mm, ovary 40 mm or more in length, anther canals long, stigmatic processes long, 10-15 mm long.....*H. intermedia*
- + Flowers small, usually many, crowded in racemes, sepals 15 mm or less, spur 35 mm or usually much less, ovary about 25 mm, anther canals and stigmatic processes long or short.....6
6. Petals broader than the dorsal sepal, inner margin almost straight, outer strongly curved, bulging out (gibbous) near the base, side lobes of lip with fewer segments, anther canals long, stigmatic processes long, 8 mm or lesser, spur laterally compressed, 30-40 mm long, much longer than the ovary.....*H. arietina*
- + Petals narrower than the dorsal sepal, inner and outer margins curved, nearly parallel, without any bulge (gibbous) on the outer side, side lobes of lip with many segments, anther canals short, stigmatic processes long or short .....7
7. Plants small upto 30 cm tall, stigmatic processes 4-5 mm long, dorsal sepal 8-10 mm long, midlobe of the lip longer than the sidelobes, spur stout, apex curved outwards.....*H. pectinata*
- + Plants taller, 60-70 long, stigmatic processes long, 10-12 mm, dorsal sepal 15-20 mm long, midlobe of the lip equal or shorter than the side lobes.....*H. ensifolia*
8. Side lobe of the lip broad, fan shaped, midlobe linear.....9
- + Side lobes of the lip very narrow, often filiform, midlobe of the same breadth or little broader.....10
9. Leaves linear, many grass like scattered all over the stem, spur slender, twice as long as the ovary ..... *H. longifolia*



**Fig. 59** *Hebenaria aitchisonii* Rchb. f. — a. plant; b., c. & d. flower; e. dorsal sepal; f. petal; g. lateral sepal.

- + Leaves elliptic-oblong, 3-7, sub-radical, clustered near the base of the stem, spur as long as the ovary ..... *H. plantaginea*
- 10. Leaves two, spur equal or shorter than the ovary, anther canals short.....11
- + Leaves more than two, spur equal or longer than the ovary (rarely short), anther canals long or short ..... 12
- 11. Leaves radical, more or less flattened along the surface of the soil, fleshy, yellow or pale margined, apex usually rounded rarely acute, lateral lobes of the lip filiform, with coiled tip, longer than the mid-lobe ..... *H. diphylla*
- + Leaves not radical, sub-opposite, born on stem near the base of the scape, without membranous margin, apex cuspidate to acute; lateral lobes of the lip spreading, equal to or shorter than the mid lobe. . . . . *H. aitchisonii*
- 12. Anther canals long, ovary with a long narrow beak.....13
- + Anther canals short, ovary with a very small or without any beak.....14
- 13. Lateral sepals reflexed, strongly oblique or nearly semi-orbicular with the apiculum somewhat lateral pointing upwards, spur much longer than the ovary, 4-7 cm long, lateral lobes of lip long filiform, of uniform thickness, without any notch, plants tall, 60-90 cm high, leaves scattered on the stem with a pale-white margin..... *H. commelinifolia*
- + Lateral sepals deflexed, only slightly oblique, ovate-lanceolate, spur equal to the ovary, 1.5 cm long, lateral lobes of the lip broader below and filiform upwards, with a notch in between, plants smaller up to 40 cm tall, leaves crowded towards the base of the stem, without any distinct margin..... *H. pubescens*
- 14. Inflorescence lax-flowered, flowers greenish, spur longer than the ovary, plants taller 25-45 cm high, leaves without any distinct margin..... *H. furcifera*
- + Inflorescence dense-flowered, flowers yellow to orange, spur equal to the ovary or rarely shorter, plants smaller 10-20 cm high, leaves with a distinct pale-yellow margin..... *H. marginata*
- 15. Spur upturned apical part hooked; petals yellow forming a hood with dorsal sepal; lip yellow..... *H. edgeworthii*
- + Spur deflexed; petals green spreading; lip green .....16
- 16. Spur shorter than ovary; lip with a prominent triangular tooth at its base above the spur entrance ..... *H. clavigera*
- + Spur usually longer than ovary (rarely somewhat shorter); lip without any tooth above the spur entrance ..... *H. latilabris*

**Habenaria aitchisonii** Rchb. f. apud Aitch. in Trans. Linn. Soc. ser., 2, Bot. 3: 113. 1886; Hook. f., 6: 152. 1890; Duthie, 186, t. 138. 1906; Stewart, 70. 1972; Renz, 62. 1978; Bose & Bhattacharjee 301. 1980; Renz, 34. 1984. (Fig. 59)

*H. brachyphylla* Aitch. in J. Linn. Soc. Bot. 19: 188. 1882 (non Lindl.)

*Stem* stout up to 40 cm high. *Leaves* 2, born on the stem near the base of the scape, sub-opposite, 4-7 cm long and about as wide, sub-orbicular, with cordate sheathing base, tip cuspidate. *Spike* 3-8 cm long, 15-20 (- 5-6) flowered. *Flowers* 8 mm across, pale green, fragrant. *Bracts* lanceolate-acuminate, shorter than ovary. *Sepals* dorsal erect, concave, ovate, obtuse or sub-acute, three nerved; laterals reflexed, obliquely-lanceolate, acute. *Petals* as long as the sepals, erect, ovate-lanceolate, 1-nerved, auricled at the base. *Lip* as long as the sepals or little longer, 3-partite, lateral lobes filiform, spreading, mid-lobe twice as broad, acute, deflexed. *Spur* variable in length but always shorter than the ovary.

*Flowering*: July - August.

*Distribution*: Himalaya 2000-4000 m (Pakistan, Kashmir, Garhwal to Nepal) and Afghanistan.

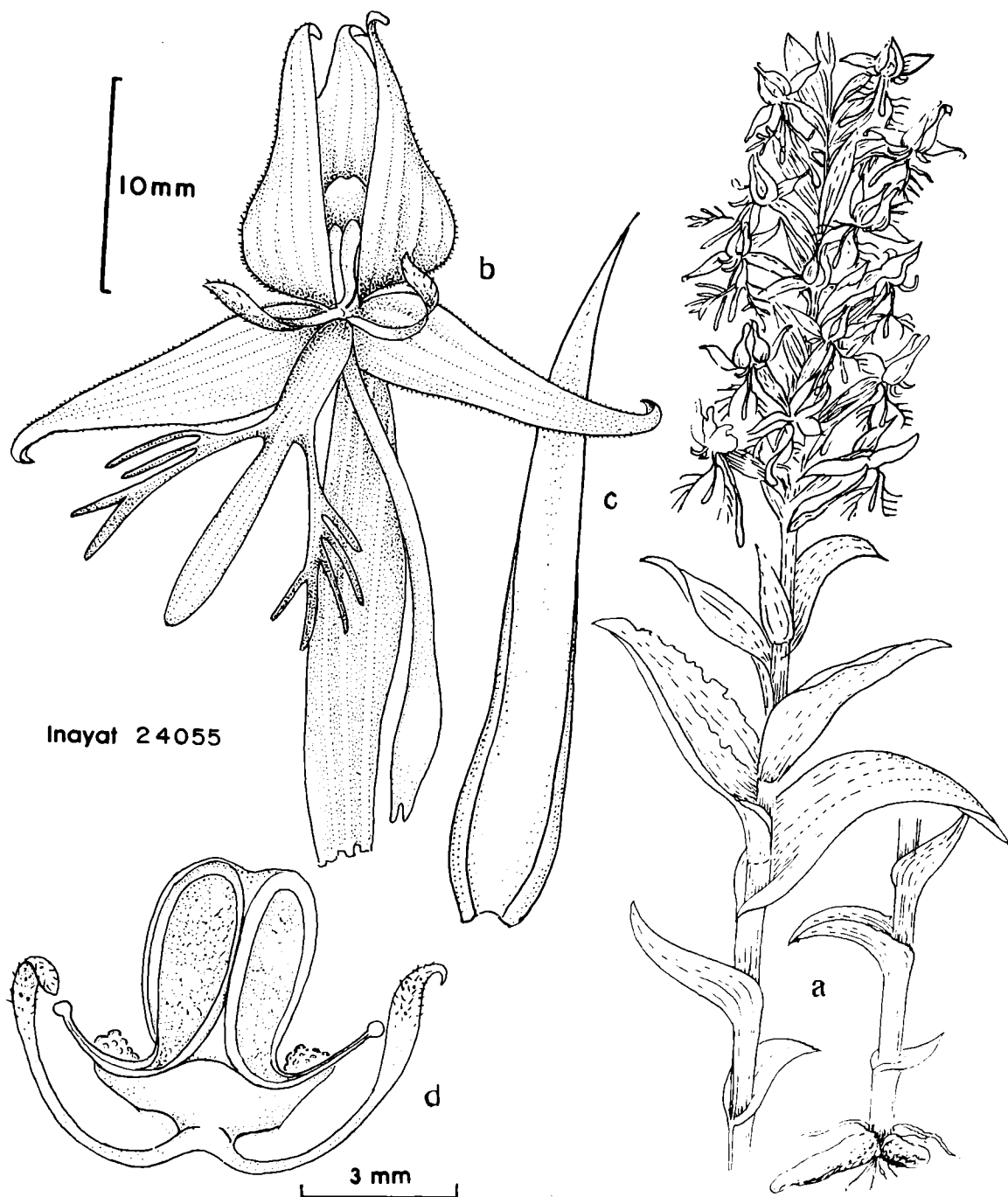


Fig. 60 *Habenaria arietina* Hook. f.—a. plant; b. flower; c. floral bracts; c. column.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 22991; Camel's back Road, Mussoorie, *Naithani* 1055 & 1182, *Renz* 13642; Chakrata Konain, *Raizada* 7276; near Deoban, *Raizada* 18247. **Chamoli**-Way to Dunagiri, *Naithani* 54041.

KUMAUN: **Pithoragarh**-Kama Mala, *Inayat* 24061; Kali Valley above Budhi, *Duthie* 3419. **Nainital**-Nainital, *Kalakoti* 498; Tiffin Peak, *Renz* 13641; China, *Champion* 7727.

JAMMU & KASHMIR: Chaihi, Poonch on Pirpanjal Range, *Kirn* 1521.

PAKISTAN: Murree, *Inayat* 25399.

Duthie 186, 1906 also included *H. atchisonii* Rchb. f. var. *josephii* Hook. f. (*H. josephii* Rchb. f.). It was based on a specimen Duthie, 6002(a) collected from Napagadh, district Pithoragarh, Kumaun. We found that this was wrongly identified and there is no other specimen from this region, *Renz* (loc. cit.) considers this species to be very distinct and suggested that the two species should be kept separated.

**Habenaria arietina** Hook. f., Fl. Brit. Ind. 6: 138. 1890; King & Pantl. 311, t. 407. 1898; Duthie, 180. 1906; Hara et al. 1: 45. 1978.

*H. pectinata* var. *arietina* (Hook. f.) Kranzlin, Orch. Gen. Sp. 1: 405. 1898; Pradhan, 1: 72 & 166. 1976.

*H. intermedia* var. *arietina* (Hook. f.) Finet in Rev. Gen. Bot. 13: 530. 1901. (Fig. 60)

*Stem* 45-60 cm. *Leaves* 4-5 × 1.3 cm, plicate, narrowly elliptic, acute-acuminate. *Raceme* 10-20 mm long, many-flowered. *Flowers* white or light greenish, fragrant, more or less 5 cm in diameter. *Sepals* narrowly oblong-elliptic, lateral pair sub-falcate, with ciliate margins. *Petals* broad, erect and adpressed to the dorsal sepal, inner margin almost straight, outer strongly curved, gibbous near the base, bluntly acuminate, puberulous. *Lip* lobed only for about  $\frac{3}{4}$  of its length; side lobes pectinate with fewer teeth; mid-lobe shorter than side lobes, linear. *Spur* laterally compressed, 3-4 cm long, much longer than ovary. *Anther* retuse and mucronate at the apex, canals long and upright. *Stigmatic processes* long, 8 mm or less.

*Flowering*: July - August.

*Distribution*: Himalaya 1800-2800 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland. W. China.

*Specimens examined:*

KUMAUN: **Pithoragarh**-Munshyari Valley, *Inayat* 24055 (a); Thakil hill, W. Pithoragarh, *Inayat* 24055.

**Habenaria clavigera** (Lindl.) Dandy in J. Bot. 68: 246. 1930.

*Platanthera clavigera* Lindl. Gen. & Sp. Orch. 289. 1835; Hara et al. 1: 54. 1979.

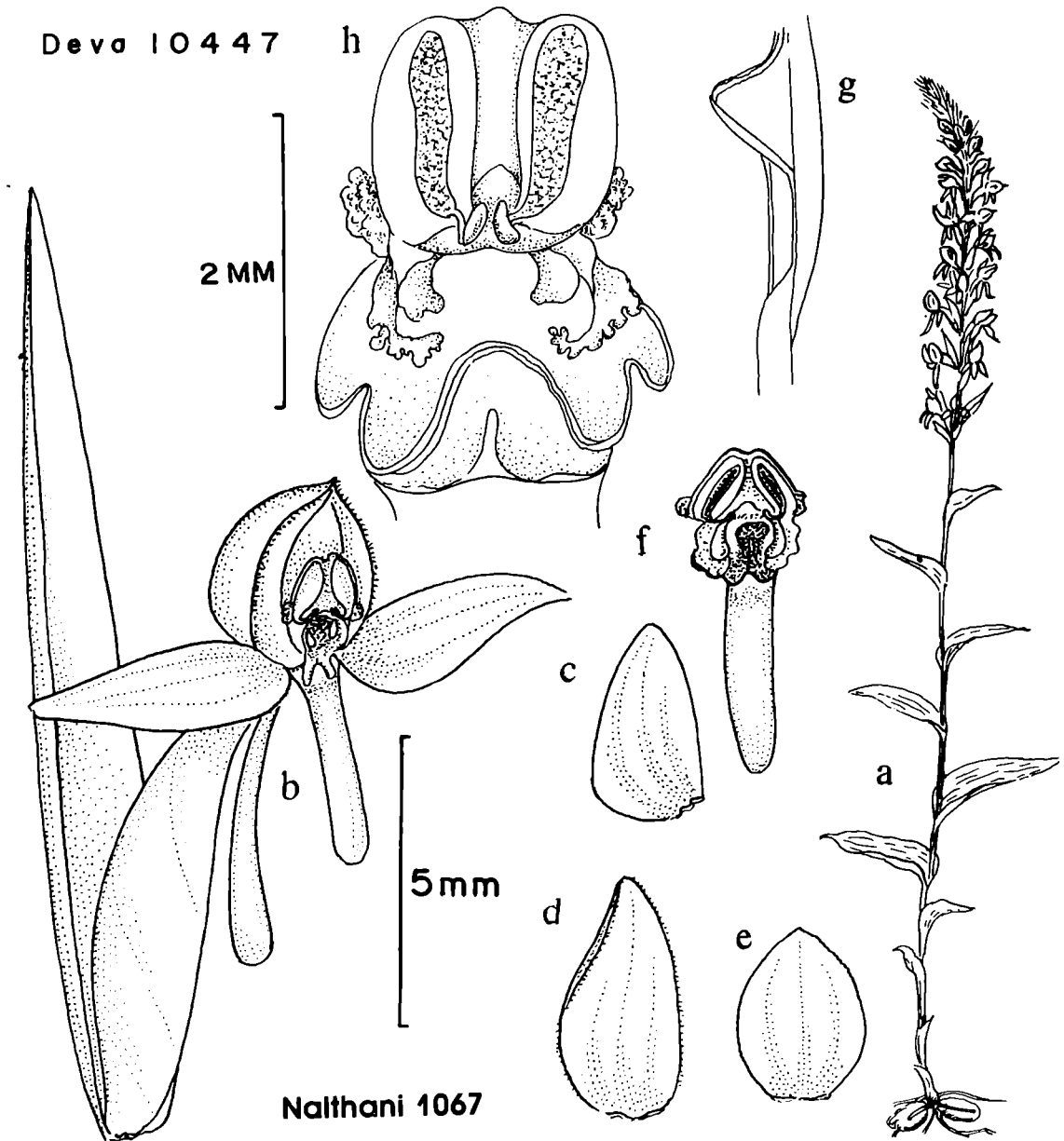
*H. densa* Lindl. Gen. Sp. Orch. 326. 1835; Hook. f., 6: 153. 1890; King & Pantl. 319, t. 420. 1898; Collett, 504. 1902; Duthie, 189. 1906; Kataki et al. 5: 29. 1984.

*Platanthera densa* (Lindl.) Freyn. Oestr. Bot Zeitschr. 96. 1896 (Fig. 61)

*Stem* stout 30-70 cm high, with few loose blunt sheaths at the base. *Leaves* many, 6-10 cm long, ovate or oblong, acuminate. *Spikes* 20-30 cm long, many flowered. *Flowers* crowded, 7 mm across, green. *Bracts* lanceolate, acuminate, ciliate, longer than ovary. *Sepals* sub-equal, ciliate, elliptic-oblong, obtuse, 3-nerved, margin almost entire to faintly erose; the dorsal erect, concave; lateral pair narrower, reflexed. *Petals* almost equal to the length of sepals, fleshy, elliptic, oblong, obtuse. *Lip* equalling the sepals with a prominent triangular tooth like callus at its base, linear, obtuse. *Spur* clavate, pendulous, compressed laterally, shorter than the ovary.

*Flowering*: July - August.

*Distribution*: Himalaya 2000-4000 m (Himachal Pradesh to Arunachal Pradesh).



**Fig. 61** *Habenaria clavigera* (Lindl.) Dandy — a. plant; b. flower; c. petal; d. lateral sepal; e. dorsal sepal; f. column & lip; g. triangular callus at the base of the lip; h. column.



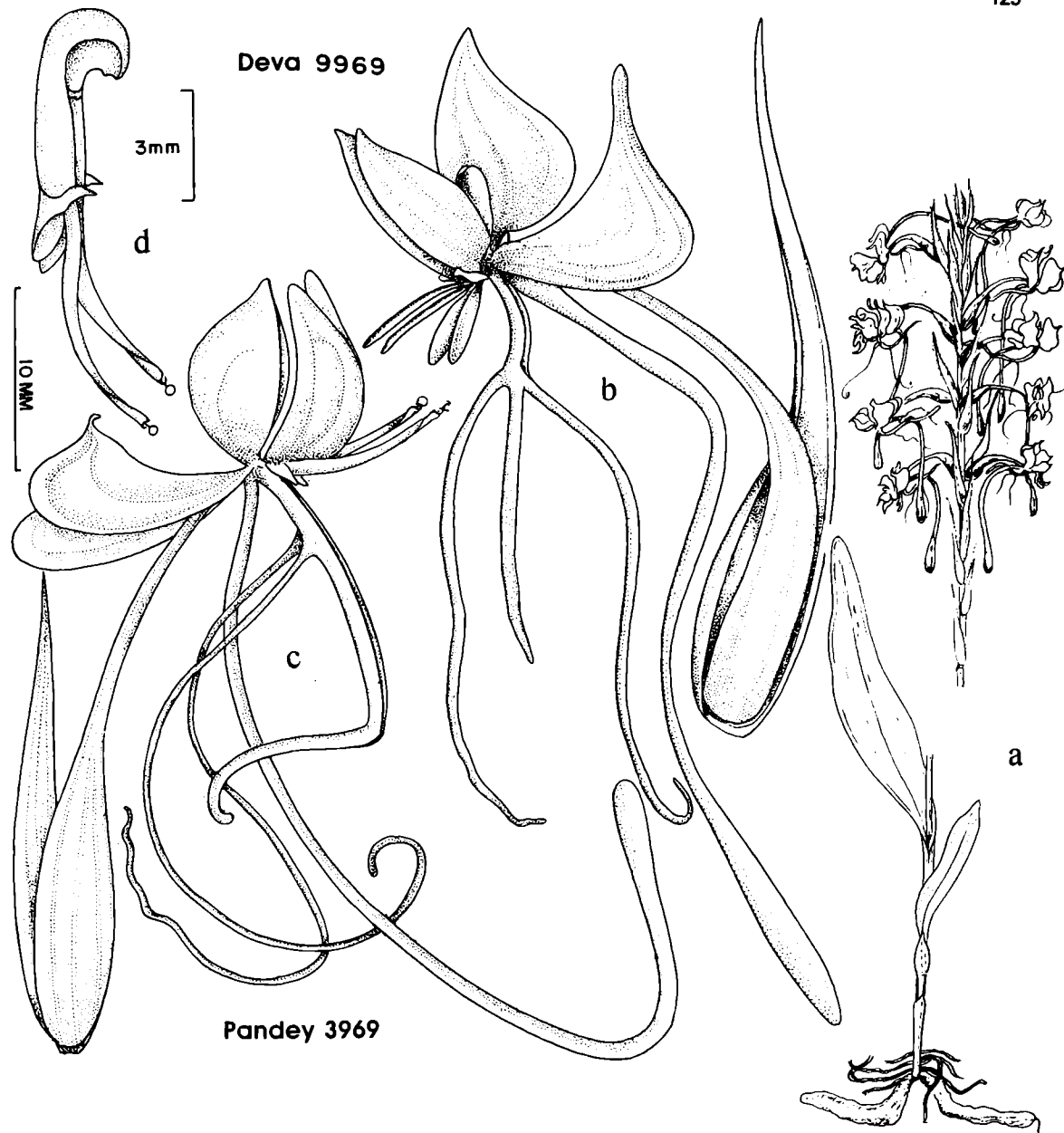


Fig. 62 *Habenaria commelinifolia* (Roxb.) Wall. ex Lindl.—a. plant; b. & c. flower; d. column.

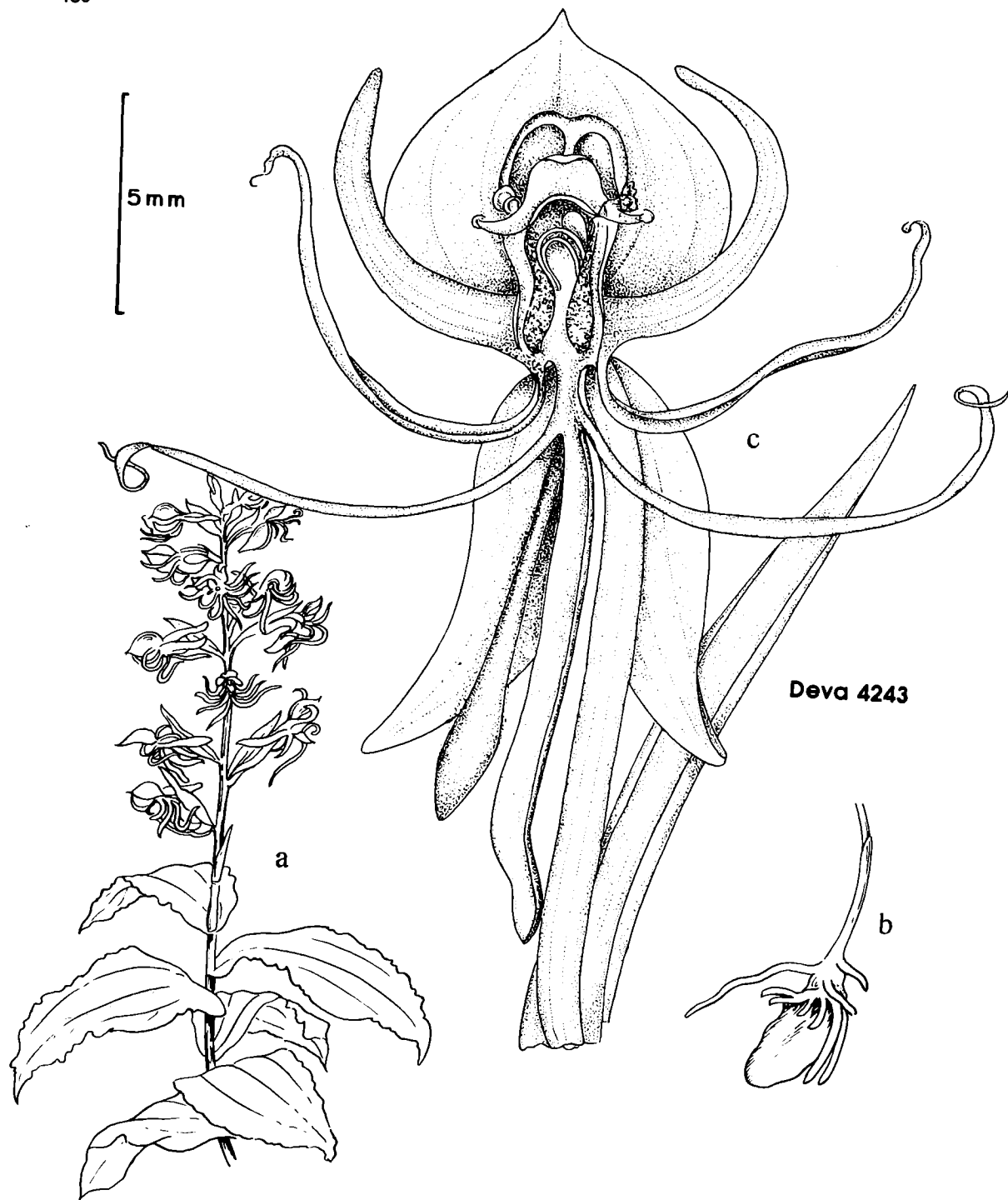


Fig. 63 *Habenaria digitata* Lindl. — a. plant; b. root; c. flower.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Near Mussoorie, *Mackinnon's collector* 24175; Chakrata, Deoban, *Raizada* 18203; Chakrata, *Raizada* 18279, *Gammie*. **Tehri**-Nagtibba, *Naithani* 1067, *Ramsukh* 22988, *Falconer*, Tehri, *Mackinnon's collector* 22410; Surkanda Devi, *Deva* 10447. **Uttarkashi**-Jamuna Valley above Bari, *Duthie* 525. **Chamoli**-Badrinath, *Falconer*.

KUMAUN: **Pithoragarh**-Bagdwar Gori Valley, *Inayat* 24070; Munshyari Gori Valley, *Inayat* 24067; Sosa Kali Valley, *Inayat* 24066; above Sosa, *Duthie* 3411. **Nainital**-Nainital, *Champion* 7741, *Kalakoti* 518. **Almora**-Basti Forest, *P. C. Pande* 2285.

HIMACHAL PRADESH: Shimla, *Meebold* 4154, 5111.

**Habenaria commelinifolia** (Roxb.) Wall. ex Lindl. Gen. & Sp. Orch. 325. 1835; Hook. f., 6: 143. 1890; Duthie, 183, t. 34. 1906 et 224. 1920; Seidenf. 89, fig. 51. 1977; Sharma and Kachroo 1: 300. 1981.

*Orchis commelinaefolia* Roxb. Fl. Ind. 3: 451. 1832.

(Fig. 62)

*Stem* 60-90 cm high; lower portion with few loose sheaths. *Leaves* scattered, 7-15 × 2-3 cm, oblong to oblong-lanceolate, acute, margins pale or white. *Spike* 10-20 cm long, many and rather laxly-flowered. *Flowers* 1.5-2 cm across, white, inodorous. *Bracts* scaberulous, ciliolate along the edges, erect, equal to the length of ovary. *Sepals* scaberulous, the dorsal saccate, small, acute; laterals sepals strongly oblique. *Petals* unequal, oblong, smaller than lateral sepals. *Lip* divided into three long slender filiform segments, 2.5 cm from its base to the top of the mid segments, 3 cm long, filiform of uniform thickness without any notch, widely spreading; mid segment channelled, scaberulous, deflexed. *Spur* 6-7 cm long, slender, curved downwards. *Anther* cells elongate, the canal long and straight. *Ovary* with long narrow beak, 3 cm long.

*Flowering*: August - September.

*Distribution*: Himalaya up to 1200 m (Jammu to Nepal), Uttar Pradesh plains, Madhya Pradesh, Bombay, Bengal, Bihar, Orissa, Burma, Indo-China, Thailand and Vietnam.

*Specimens examined:*

GARHWAL: **Dehra Dun Valley**-Mothronwala, *Kanjilal* 1077, *Dakshini* 7249; on way to *Sahashtadhar*, *Bhattacharyya* 37745; Dehra Dun, *Mackinnon* 21751, 22979, *Harsukh* 24166, *Hope* 2076; Asarori Siwaliks, *Harsukh* 24166 (a); Siwaliks near Mohan Pass, *Deva* 5882, 4854, 5096; Mansa Devi near Hardwar, *Deva* 9969. **Uttarkashi** Jamuna Valley Nandgaon, *Duthie* 521.

KUMAUN: **Pithoragarh**-Chaupata, *Arora* 50001; Askot, *Arora* 70846; Khela, Kali Valley, *Inayat* 24054. **Almora**-Khabdali Bageshwar, *Champion*, Bageshwar Udham gaon, *Arora* 37892; Baijnath, *P. C. Pandey* 3969.

HIMACHAL PRADESH: Kangra-Palampur, *M. A. Rau* 12631; Kangra to Dehra, *Murti & Prasad* 62214; Bijhari Hamirpur, *Vishwanath* 61589.

JAMMU & KASHMIR: Domel (Sharma & Kachroo, *loc. cit.*)

**Habenaria digitata** Lindl. Gen. & Sp. Orch. 307. 1835; Hook. f., 6: 134. 1890; Duthie, 177. t. 128. 1906; Stewart, 70. 1972; Seidenf. & Arora 18. 1982; Renz, 34. 1984.

*H. graveolens* Duthie, Fl. Upper Gang. Pl. 3, 2: 222. 1920; Pradhan 1: 68. 1976; Uniyal & Srivastava, 1029. 1983

(Fig. 63)

*Stem* 18-60 cm high, stout, cylindrical. *Leaves* 4-6 × 3-4 cm, crowded near the middle, broadly lanceolate or ovate-lanceolate, acuminate, 3-nerved, margin undulate. *Raceme* laxly many flowered, 7-10 cm long, elongating in fruit. *Flowers* green, 1.5 cm across, sub-second, emitting a pungent foul smell after sunset. *Bracts* narrowly lanceolate, longer than the slender ovary, margins pale. *Sepals* unequal, 6 mm or less, dorsal one erect, sub-orbicular, its apex bluntly acuminate and recurved, minutely pustulate on the back; lateral pair longer, ovate-acute, deflexed, apex acute to filiform. *Petals* bipartite, segments linear, decurv-

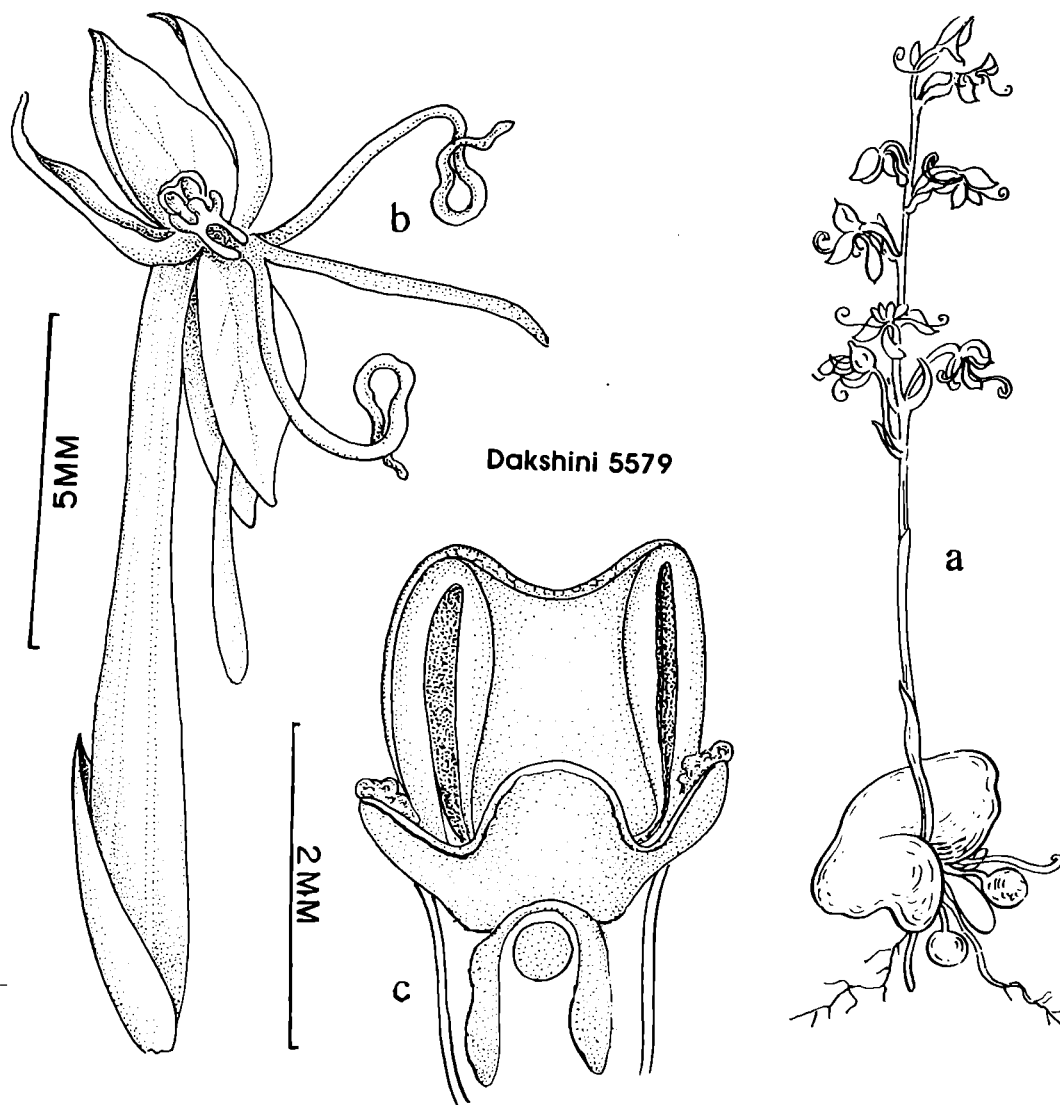


Fig. 64 *Habenaria diphylla* Dalz.—a. plant; b. flower, c. column.

ed, sub-falcate, white towards the base and with slender green tip. *Lip* 3-partite lateral lobes little smaller or equal to the mid lobe. *Spur* smaller than the ovary, laterally compressed and clavate towards the apex.

*Flowering*: July August.

*Distribution*: Himalaya up to 1500 m (Pakistan, Himachal Pradesh to Nepal & Arunachal Pradesh), Assam, Madhya Pradesh, Orissa, Bengal, Rajasthan, W. Ghats, Deccan, Mysore. Burma and Laos.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Kansrao, *Duthie* 24177, *Harsukh* 24177(a); Dehra Dun, *Mackinnon* 22728, *Mackinnon's collector* 22728(a), Bindal, *Babu* 35429; Sahashtradhara, *Deva* 2607; Rajpur Sal forest, *Deva* 2683; Siwaliks Mohand near Tunnel, *Arora* 36472, *Aswal* 40167; Mansa Devi near Hardwar, *Deva* 5058; Below Mussoorie, *Mackinnon* 21758; Mussoorie Dhobighat, *Arora* 36468; on way to Mussoorie, *Bhattacharyya* 37273; Jharipani, *Deva* 4243.

KUMAUN: **Pithoragarh**-Askot. *Arora* 70850. **Nainital**-Kurpatal near Nainital, *Champion*. **Almora**-Bageswar, *Inayat* 24063.

HIMACHAL PRADESH: Bihru, *Uniyal* 61216.

PAKISTAN: Panjar Rawalpindi; Samli below Murree (Stewart, *loc. cit.*; Renz, *loc. cit.*).

We have examined the type of *Habenaria graveolens* Duthie, (*Mackinnon's* 22728 at DD) and find it in no way different from *H. digitata*. Duthie 222, 1920, separated it on the basis that the leaves are mostly collected at about the middle of the stem; the lateral sepals are deflexed, longer with filiform tips, and the filiform segments of the 2-partite petals are recurved at the apex. These characters are not constant and even in the same raceme the flowers show variations.

**Habenaria diphylla** Dalz. in Hook. J. Bot. 2: 262. 1850; Hook. f., 6: 151. 1890; Duthie, 185. t. 137. et 227. 1920; Sant. & Kapadia 21. Pl. 6, fig. 22. 1966. (Fig. 64)

*Leaves* 2, fleshy, 1.5-4 × 0.5-4 cm, ovate-oblong or sub-orbicular, cordate, apex usually rounded, rarely acute, margin yellowish or pale, radical leaves more or less flattened along the surface of the soil. *Scape* 7-25 cm, slender, many-flowered, the peduncle with distant sheathing lanceolate acuminate bracts. *Flowers* shortly stalked, 1.25 cm across, white, tinged with green. *Bracts* ovate-oblong, much shorter than the ovary. *Sepals* sub-equal; dorsal 5 mm long, oblong, broadly ovate, concave, acute; laterals longer than dorsal, deflexed, oblong, acute. *Lip* much longer than the sepals, 3-partite, lateral lobes filiform, spreading at right angles to the mid lobe and curved upwards; mid lobe lanceolate, 6-8 mm long, equal or longer than lateral lobes, acute or semi-obtuse. *Spur* 8 mm long, shorter than the ovary, inflated towards its acute apex.

*Flowering*: August.

*Distribution*: Himalaya up to 600 m (Garhwal), Bihar, Orissa, Concan, Tamil Nadu, North Kanara.

*Specimens examined*:

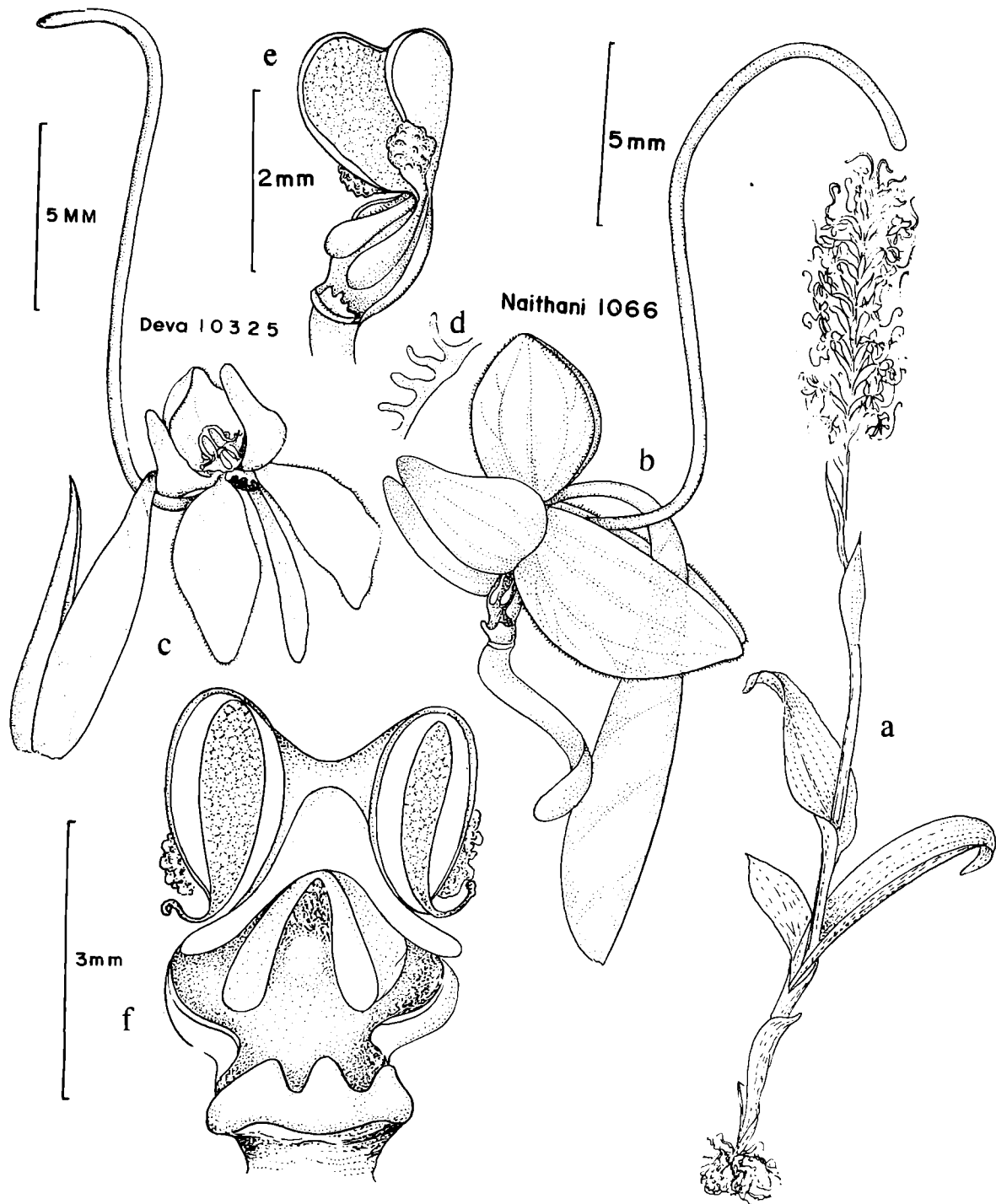
GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 25411; Raiwala Dehra Dun, *Mackinnon's collector*; Mothronwala, Dehra Dun, *Dakshini* 5579.

**Habenaria edgeworthii** Hook. f. ex Collett, Fl. Siml. 504, fig. 166. 1902; Duthie, 187. t. 139. 1906; Stewart, 70. 1972; Renz, 61. 1978; & 35. 1984.

*Platanthera acuminata* Lindl. Gen. & Sp. Orch. Pl. 289. 1835.

*P. edgeworthii* (Hook. f. ex Collett) Gupta, Fl. Nainitalensis, 349. 1968.

*Habenaria acuminata* Rao, Bull. bot. Surv. Ind. 89. 1960. non (Thw.) Trimen (Fig. 65)



**Fig. 65** *Habenaria edgeworthii* Hook. f. ex Collett—**a.** plant; **b.** & **c.** flower; **d.** margin of sepal; **e.** & **f.** column.

*Stem* 30-70 cm high, stout, leafy. *Leaves* 4-10 cm long, ovate or oblong-lanceolate, acute or acuminate, fleshy. *Spike* 8-25 cm long, many flowered. *Flowers* crowded, 1-1.5 cm across, deflexed in bud. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* green, pubescent, margin minutely ciliolate, the dorsal erect, broadly ovate or sub-orbicular, concave, lateral pairs longer, deflexed, obliquely ovate, obtuse. *Petals* yellow, erect, thick, obliquely triangular from a broad base, apex curved inwards and forming a hood with the dorsal sepal. *Lip* yellow, longer than the lateral sepals, basal part orbicular, concave, abruptly narrowing to a long strap shaped limb. *Spur* about twice the length of the ovary, yellowish-green, curving upwards with tip curved down.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-3000 m (Pakistan, Kashmir to Kumaun).

*Specimens examined*:

**GARHWAL**: **Dohra Dun**-Mussoorie, Jaberket, *Saxena* 2044(A); Mussoorie, *Mackinnon* 21761, 22730, *Duthie* 22730(a); Kyarphulli, *Pancham Singh* 10327; Company bagh, *Arora* 36463; Depot, *M.A. Rau* 3167; Charleeville Road, *Santapau* 28504; Chakarata, *O.P. Misra* 38030, 38050; Deoban, *Raizada* 18201, 18239. **Tehri-Nagtibba**, *Naithani* 1066, *Ramsukh* 22730(a), *Mackinnon* 21761(a), Melkhuli, *Bhattacharyya* 31150; Deo Prarai, *Bhattacharyya* 33673 & 33688; West of Dhanolti, *Renz* 13644. **Uttarkashi**-Jamuna Valley, *Rana, Deva* 4537; Kharsali, *Deva* 4558; Har-ki-Dun, *Sahni* 24001. **Chamoli**-Valley of Flower, *Deva* 10325; Govindghat, *Bhattacharyya* 29314, Way to Bampa, *Naithani* 56036; Gauri Kund, *M.A. Rau* 38646; Jangal Chatti on way to Valley of Flowers, *Naithani* 1012; Between Govindghat & Bhyundar, *Renz* 13614. **Pauri**-Near Khirsu, *Naithani* 1047; Kirshu, *Srivastava* 57062.

**KUMAUN**: **Pithoragarh**-Pithoragarh, *Arora* 38897; Malpa Kali Valley, *Inayat* 24080; Tejam Jankhola Valley, *Inayat* 24073; Kali Valley, *Duthie* 5993; Sarju Valley, *Inayat* 24079; Sandev, *Arora* 66286. **Nainital**-Nainital, *Champion* 6127, *Davidson*; Ramgarhm, *Jameson*; Fatehgarh, *Jameson*; Above Malli Tal, *Renz* 13588. **Almora**-Binsar, *Inayat* 24077; Almora, *P.C. Pandey* 2415; Lorakhet, *T.A. Rao* 4270; Ranikhet to Chaubatia, *Renz* 13596.

**HIMACHAL PRADESH**: Summer Hills, Shimla, *Raizada* 14357; Shimla, *Gamble* 4692 b & c; Near Manali, *Sahni* 21830; Kulu Rahla-Forest, *Nair* 12718, *N.P. Singh* 22979; Kothi, *M.A. Rau* 12712; Manali, *Bor* 15588, *Bhattacharyya* 44747 & 48565; Kinnor Sarhan, *Murty & Prasad* 61937; Rampur, *Nair* 29879; Jangtoo, *Nair* 29836; Chamba, *Lace*, Narkanda, *Brandis*.

**PAKISTAN**: Swat, *Stewart* 24365 (*Renz, loc. cit.*); Hazara Murree (*Stewart, loc. cit., Renz, loc. cit.*)

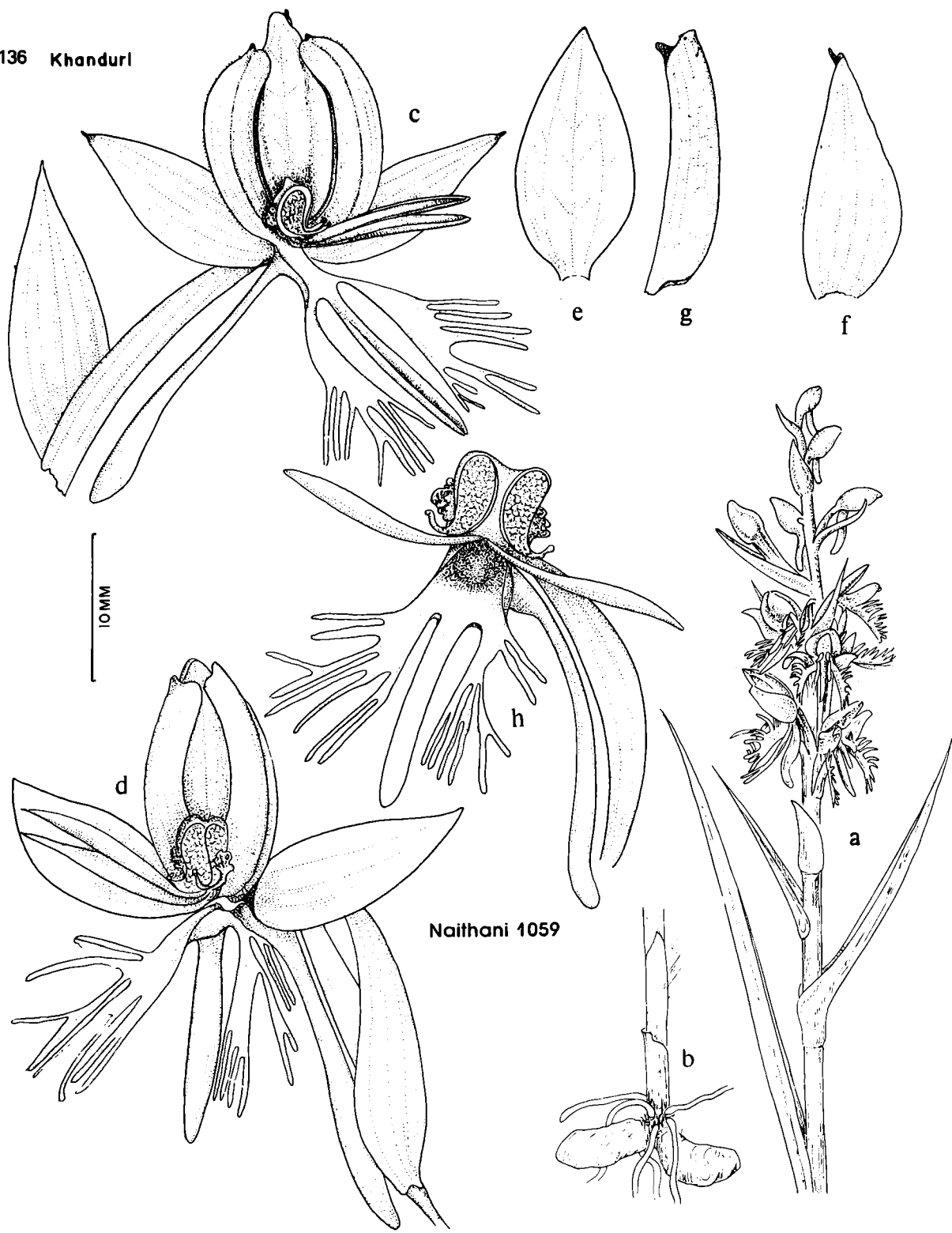
*H. edgeworthii* is distinct from *H. latilabris* under which it is quite often kept (see fig. and key). A further confusion has been caused often by using the incorrect name *Habenaria acuminata* (Thw.) Trim., which is a different species only found in Sri Lanka. Both at DD and BSD, there are separate bundles written down as *H. acuminata* and *H. edgeworthii*, which on examination it is clear that both belong to the same species.

**Habenaria ensifolia** Lindl. Gen. & Sp. Orch. 1835; Collett, 504. f. 165. 1902; Duthie, 179. 1906.

*H. pectinata* Hook. f., Fl. Brit. Ind. 6: 137, 1890 (*non* D. Don).

(Fig. 66)

*Stem* 60-70 cm high, robust. *Leaves* distributed chiefly towards the upper portion of the stem, 7-15 cm long, oblong or linear-lanceolate, acuminate, amplexicaule at the base, 3-nerved. *Racemes* 10-20 cm long. *Flower* green, 3-4 cm across. *Bracts* leaf like, linear-lanceolate, much longer than ovary. *Sepals* unequal, erect, tip recurved; the dorsal 15-20 mm long, lanceolate, laterals rather wider, sub-falcate, acute or apiculate. *Petals* forming a hood with the dorsal sepal, narrowly and falcately oblong, obtuse, acute or apiculate, pale-green, ciliolate on outer margins. *Lip* little longer than sepals, 3-lobed, pale-green, margin



**Fig. 66** *Habenaria ensifolia* Lindl. — a. plant; b. lower part of plant; c. & d. flower; e. dorsal sepal; f. lateral sepal; g. petal; h. column, lip & spur.



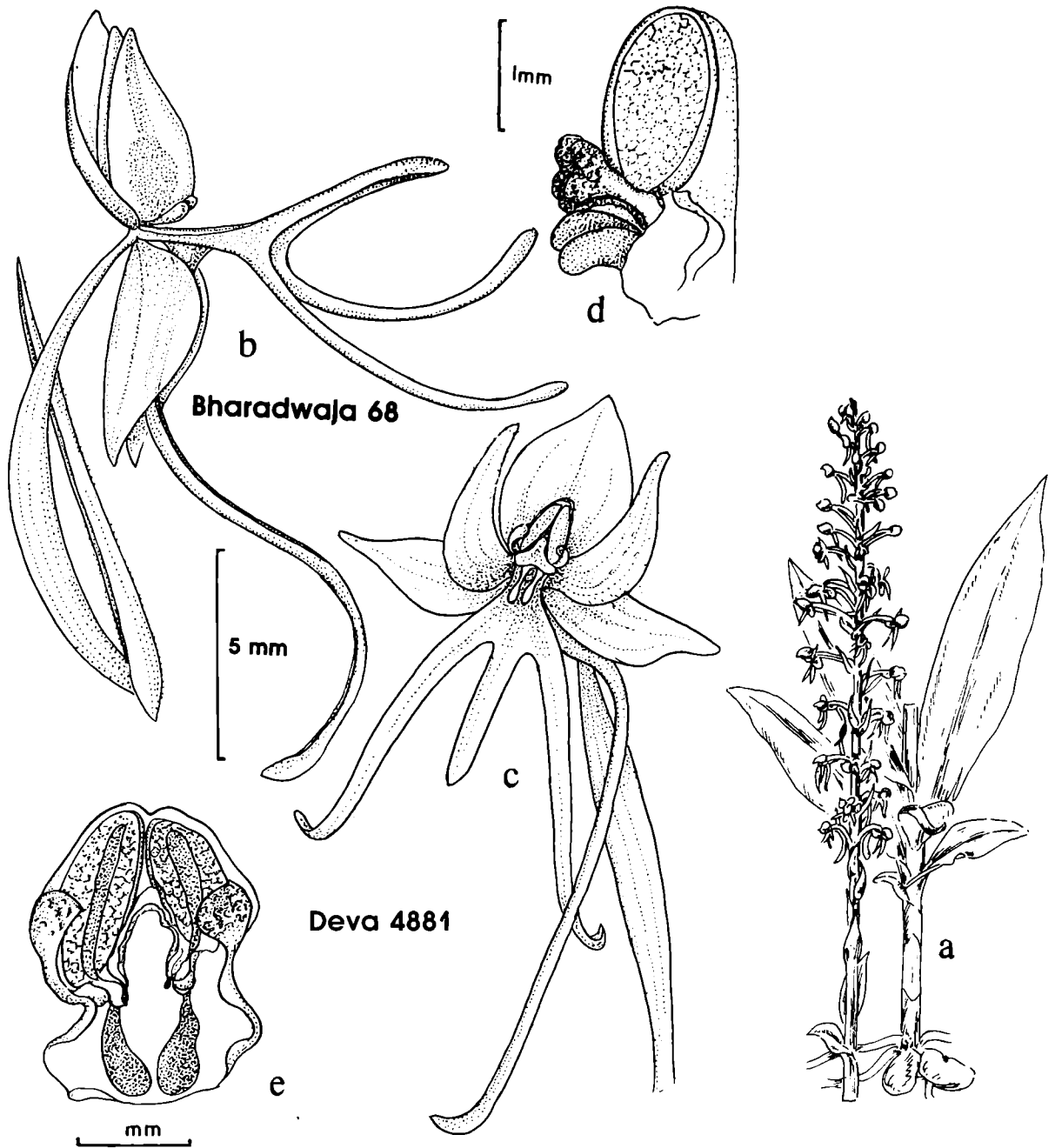


Fig. 67 *Habenaria furcifera* Lindl.—a. plant; b. & c. flower; d. & e. column.

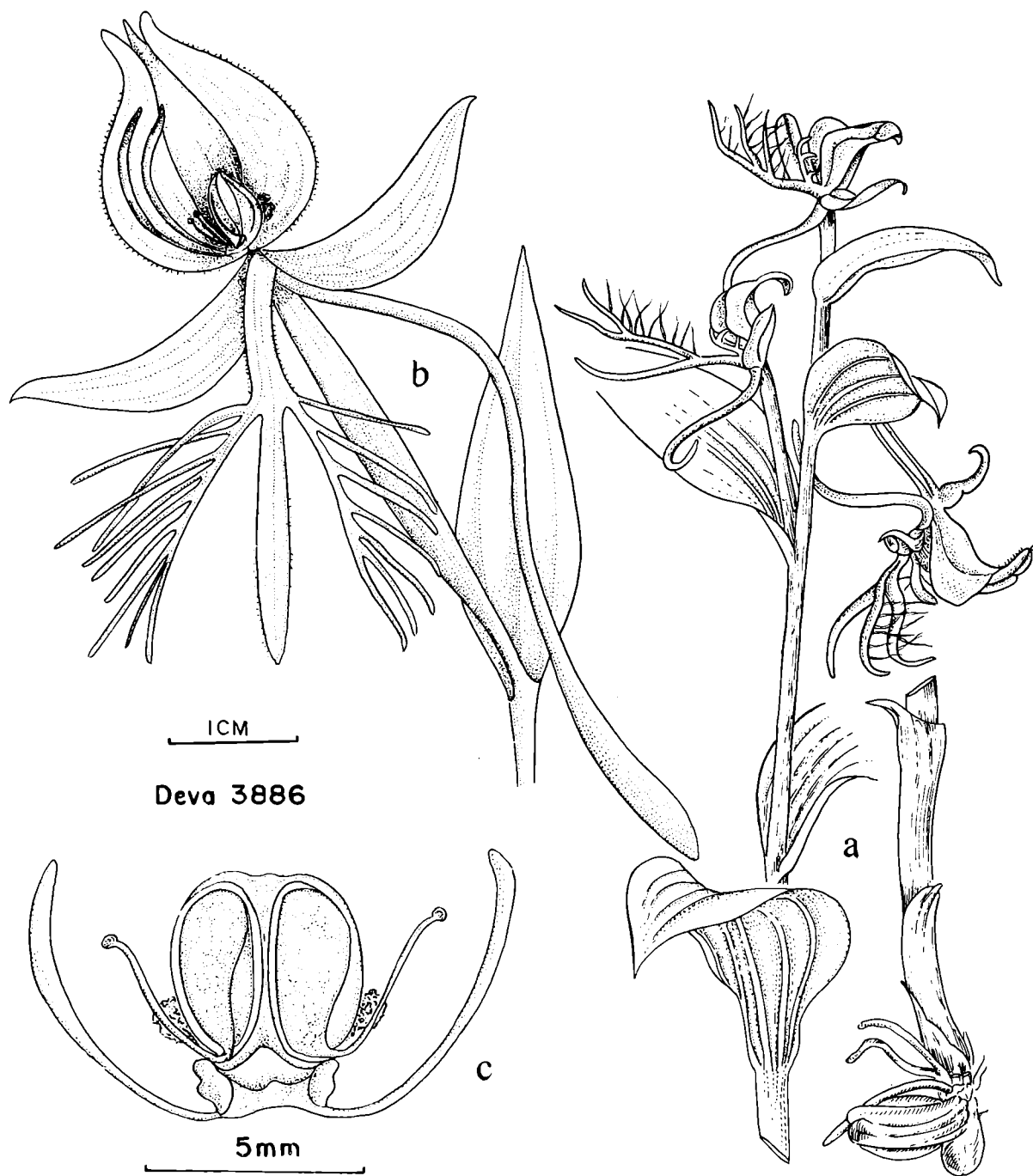


Fig. 68 *Habenaria intermedia* D. Don—*a.* plant; *b.* flower; *c.* column.

of side lobes deeply pectinate; mid lobe linear, equal or shorter than side lobes. *Spur* laterally compressed, dilated towards the apex, about as long as the ovary. *Anther cells* elongate. *Stigmatic processes* 10-20 mm long, linear, elongate, divergent.

*Flowering*: July - August.

*Distribution*: Himalaya 500-3200 m (Himachal Pradesh to Arunachal Pradesh), Meghalaya.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Harrawala Dehra Dun Valley, *Harsukh*; Mussoorie, *B.L. Gupta*, **Tehri-Nagtibba**, *Naithani* 1059; Way to Pinsuar, *Vishwanath* 54821. **Uttarkashi**-Ringali, *Sahni* 21848. **Chamoli**-Near Jangal Chatti way to Valley of Flowers, *Naithani* 1015 & 1305; Govindghat, *Bhattacharyya* 29317; Joshimath, *Khanduri*; Badrinath, *Falconer*; Gorikund, *Mehrotra* 4842.

KUMAUN: **Pithoragarh**-Between Chul Kot and Hot Spring, *Thomas* 2097; Sosa, Kali Valley, *Inayat* 24057(a); Sobala Darma Valley, *Inayat* 24057; Pangu, *Arora* 56869. **Nainital**-Nainital, *Champion* 7741; Lariakanta, *T.A. Rao* 4978. **Almora**-Gwaldam, *Bagchee*; Binsar near Ranikhet, *P.C. Pandey* 3052.

HIMACHAL PRADESH: Shimla, *Meebold* 4976; Bashahr, *Lace* 1086; Chail, *Kirat Ram*.

**Habenaria furcifera** Lindl. Gen. & Sp. Orch. 319. 1835; Hook. f., 6: 149. 1890; King & Pantl. 313, t. 410. 1898; Duthie, 184. 1906 et 3: 225. 1920; Stewart, 70. 1972; Seidenf., 118. f. 72. 1977; Renz, 36. 1984.

(Fig. 67)

*Stem* 25-45 cm high, leafy below the middle, bracteate above. *Leaves* 13-17 cm long, elliptic, acute or acuminate, narrowed to the sheathing base, without any distinct margin. *Raceme* 12-18 cm long, many but laxly flowered. *Flower* 1-1.3 cm across, green, shortly pedicelled. *Bracts* lanceolate, acuminate, equal to the length of the ovary. *Sepals* unequal, 3-nerved; the dorsal ovate-oblong, obtuse, 4-5 mm long, conjoined with the petals to form a hood; the laterals shorter, spreading, oblong-lanceolate, sub-acute. *Petals* equal to the dorsal sepal, oblong-obtuse or sub-retuse. *Lip* 6 mm long, trifurcate to nearly the base; lateral lobes filiform, pendulous, acute; mid lobe stout, oblong rounded, shorter than lateral lobes. *Spur* slender, with pointed apex, longer than ovary.

*Flowering*: July - August.

*Distribution*: Himalaya up to 1500 m (Pakistan, Kashmir, Himachal Pradesh, Garhwal, Sikkim to Arunachal Pradesh), Bengal, Assam, Orissa, Bihar, Uttar Pradesh, Punjab, Madhya Pradesh, Bombay, Eastern Ghats and Kerala. Bangladesh, Upper Burma and Thailand.

*Specimens examined*:

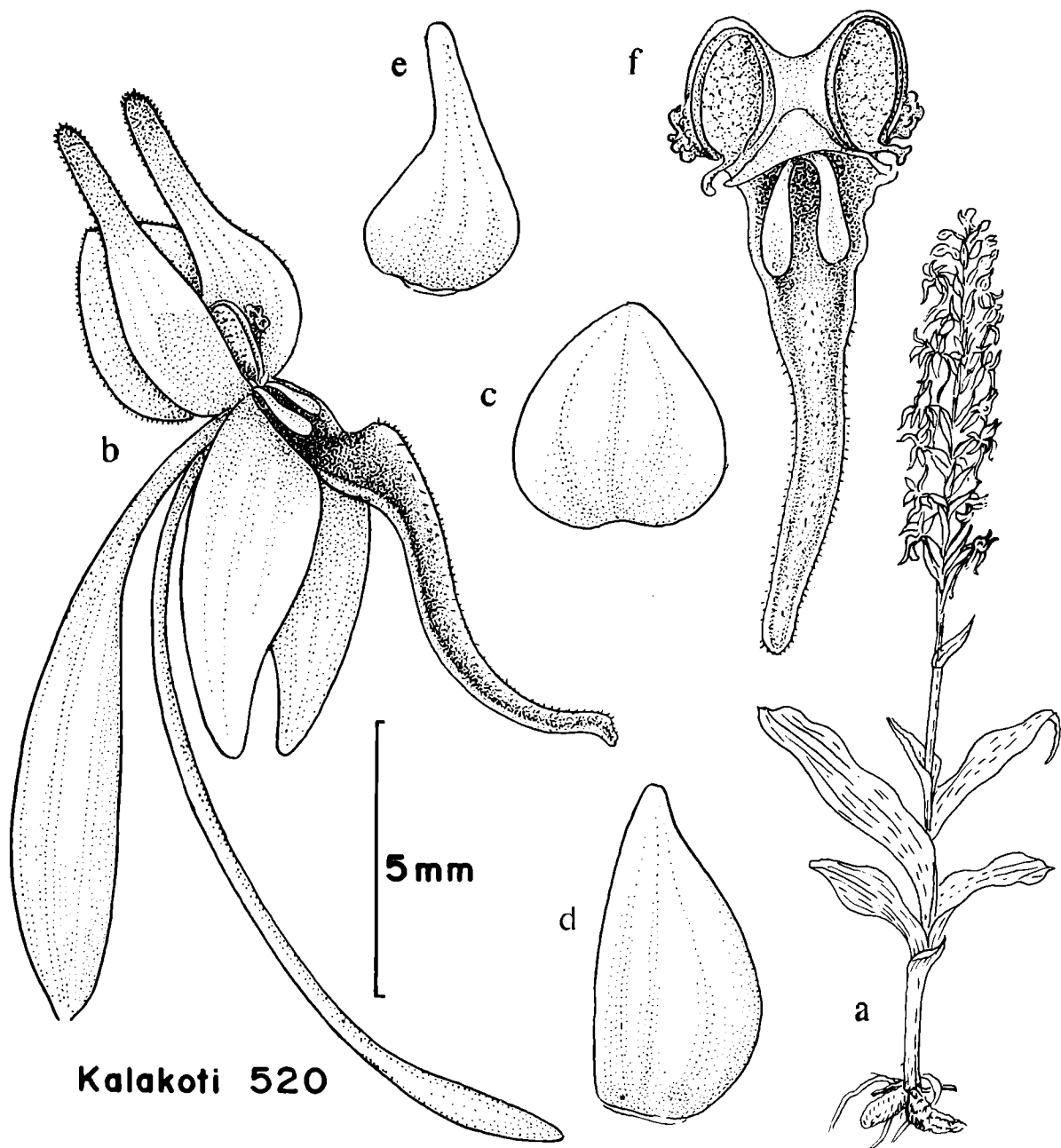
GARHWAL: **Dehra Dun**-Dehra Dun Valley, *Duthie* 2314, *Mackinnon* 21754; New Forest Dehra Dun, *Ram Dayal* 2557, *Naithani* 2466; Kalanga hills, *T.A. Rao* 3418; Bindal, *Babu* 33284 & 33405; Sahashtradhara, *Malhotra* 33954, *Deva* 1098, 4881; Siwaliks Asarori, *Harsukh* 24168; Mohand, *Deva* 4853, 4900; Mussoorie near Kamptifall, *Harsukh*; Aglar Valley Mussoorie, *Mackinnon* 2175(a); Mussoorie, *Mackinnon* 22992; Chakrata Kalsi, *Gammie*. **Tehri**-Nagtibba, *Ramsukh* 22992(a); Phakot below Agra Khal, *Bharadwaja* 68.

HIMACHAL PRADESH: Mubarakpur (*Mishra* 41660; Sikharpoh, *Mishra* 4454; both place in District. Hoshiarpur in Punjab near the Himachal Pradesh boundry).

JAMMU & KASHMIR: Nawal Nadi, Poonch (Stewart, *loc. cit.* Renz *loc. cit.*)

PAKISTAN: Panjar District, Rawalpindi (Stewart, *loc. cit.*; Renz, *loc. cit.*)

**Habenaria intermedia** D. Don. Prodr. Fl. Nep. 24. 1825; Hook. f., 6: 138. 1890; Collett. 502. f. 164. 1902; Duthie. 180. t. 131. 1906; Stewart. 70. 1972. Katakai et al. 5: 19. 1984; Renz, 36. 1984. (Fig. 68)



**Fig. 69** *Habenaria latilabris* (Lindl.) Hook. f. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column & lip.

*Stem* 25-50 cm high, terete. *Leaves* scattered, 8-18 × 2-6 cm, ovate-oblong, acuminate, 5-7 nerved. rounded or cordate at the base. *Racemes* 2-6 flowered. *Flowers* 5 cm across, white or greenish-white. *Bracts* leaf like, broadly lanceolate, acuminate, equalling or exceeding the ovary. *Sepals* persistent, 20-25 mm long, ovate-lanceolate, acute, recurved at apex. inner surface white; the laterals spreading, falcately lanceolate, acuminate, 5-7 nerved, tips reflexed. *Petals* white, overlapping at their apices, equalling to the dorsal sepal, strongly 5-nerved, margin ciliolate. *Lip* 3-lobed, longer than sepals, green except the longer white claw, side lobes deeply pectinate in filiform segments; midlobe linear 3-5 cm long. *Spur* 5-6 cm, stout, exceeding the ovary, tapering towards the apex, more or less curved.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-2800 m (Pakistan, Kashmir to Sikkim, Arunachal Pradesh?), Meghalaya. Tibet.

*Specimens examined*:

GARHWAL: **Dehra Dun**- Mussoorie-Jaberkhet. *Saxena* 2045. *Malhotra* 38303; Mussoorie, *Duthie* 635 & 22731, *Mackinnon* 21759(a); Arnigarh, *Gollen*, *Banwarilal* 22731(c); Camel back Road. *Naithani* 984, *Renz* 13575, *Malhotra* 12407; Charleevile Road, *Santapau* 24506; Companybagh, *M.A. Rau* 12602, *Arora* 36462; above Barlowgung, *Renz* 13576; Bhattafall, *T.A. Rao* 3077; Kamptyfall, *Deva* 4253; Chakrata, *Raizada* 18311, *Bhattacharyya* 19896, *Misra* 38003; Konain, *Raizada*. **Tehri**-Nagtibba, *Mackinnon* 21759; Magra, *Bhattacharyya* 31175; Suakholi, *Naithani* 1009. **Chamoli**-On way to Kedarnath. *M.A. Rau* 38644; Jangalchatti way to Valley of flowers; *Naithani* 1016; Gorikund-Rambara, *Mehrotra* 5938. **Uttarkashi**-Tons Valley Takula, *Deva* 7135; Bhagirathi Valley, way to Dodital, *Deva* 3886.

KUMAUN: **Pithoragarh**-Munshyari, *Inayat* 2407(b); Sandev, *Pant* 31899. **Nainital**-Ramgarh, *Inayat* 24071; Nainital, *Duthie* 4426, *Davidson*, *N. Gill* 48 & 620; Above Malli Tal, *Renz* 13575. **Almora**-Chukot, *Thomas* 20841; Ranikhet Chaubatia, *T.A. Rao* 4803.

HIMACHAL PRADEHS: Koti-Shimla, *Gamble* 6412(B); Shimla-Fagu Road, *Raizada* 10105; Dalhousie, *Malhotra & Nair* 27959; Chamba, *Lace* 772; Kunour, *Jameson* 780.

JAMMU & KASHMIR: Azmabad. Poonch Pir Panjal Range, *Kirn* 763.

PAKISTAN: Hazara, Murree (Stewart, *loc. cit.*; *Renz, loc. cit.*)

**Habenaria latilabris** (Lindl.) Hook. f., *Fl. Brit. Ind.* 6: 153, 1890; King & Pantl. 321, t. 423. 1898; *Duthie*, 188. t. 140. 1906; Stewart, 70. 1972; Hegde & Rao, 387. 1983; *Renz*, 37. 1984.

*Platanthera latilabris* Lindl. *Gen. & Sp. Orch.* 289. 1835; Hara et al. 1: 54. 1979; Katagi et al. 5: 29. 1984.

*Pecteilis latilabris* (Lindl.) Mitra, *Fl. Pl. Eastern India.* 1: 276. 1958. (Fig. 69, 70)

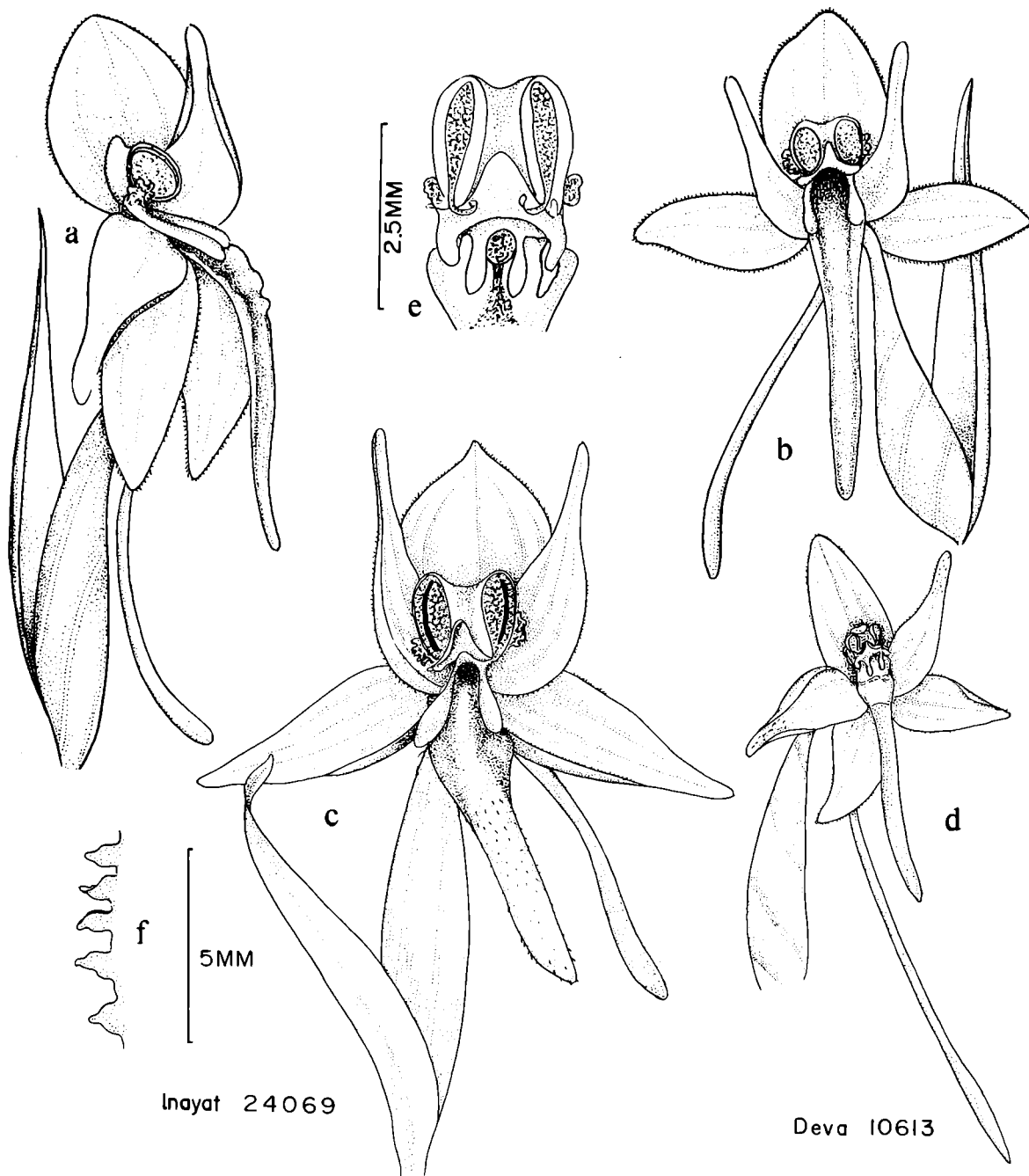
*Stem* 20-40 cm high. *Leaves* 3-5, scattered, elliptic-oblong, acute or acuminate, 5-10 cm long. *Spikes* 7.5-13 cm, laxly flowered. *Flowers* 1-4 cm across, green. *Bracts* lanceolate, acuminate somewhat longer than the ovary. *Sepals* 3-5 nerved, ciliolate at the margins, the dorsal erect, concave, broadly ovate, orbicular or oblong; lateral pair reflexed, 5 mm long, ovate to ovate-lanceolate, sub-acute. *Petals* green, equal to lateral sepals, lanceolate or linear from a broad triangular base with acuminate apices. *Lip* green, longer than petals, basal part triangular, gradually narrowing to along linear sub terete limb with inrolled margin. *Spur* longer than the ovary, turned downwards or side ways, curved, but not turned upwards.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-3000 m (Pakistan, Kashmir to Arunachal Pradesh), Mahdya Pradesh. Tibet.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 22711, *Mackinnon* 21762, *Saxena* 2008; Jabarkhet, *Saxena* 2044(B); Near Mussoorie, *Duthie* 22711/a; Camel's back Road, *Renz* 13643; Chakrata, Deoban-Kanasar Road, *Raizada* 7177; Konain, *Raizada* 7279; Chakrata, *Bhattacharyya* 13014. **Tehri**-Bok Hills, *Harsukh* 24171; Nagtibba, *Inayat* 24072(a); Deolsare, *Bhattacharyya* 83689. **Chamoli**-Bhyundar, *Bhattacharyya* 29348.



**Fig. 70** *Habenaria latilabris* (Lindl.) Hook. f.—a, b, c, & d. flower; e. column.

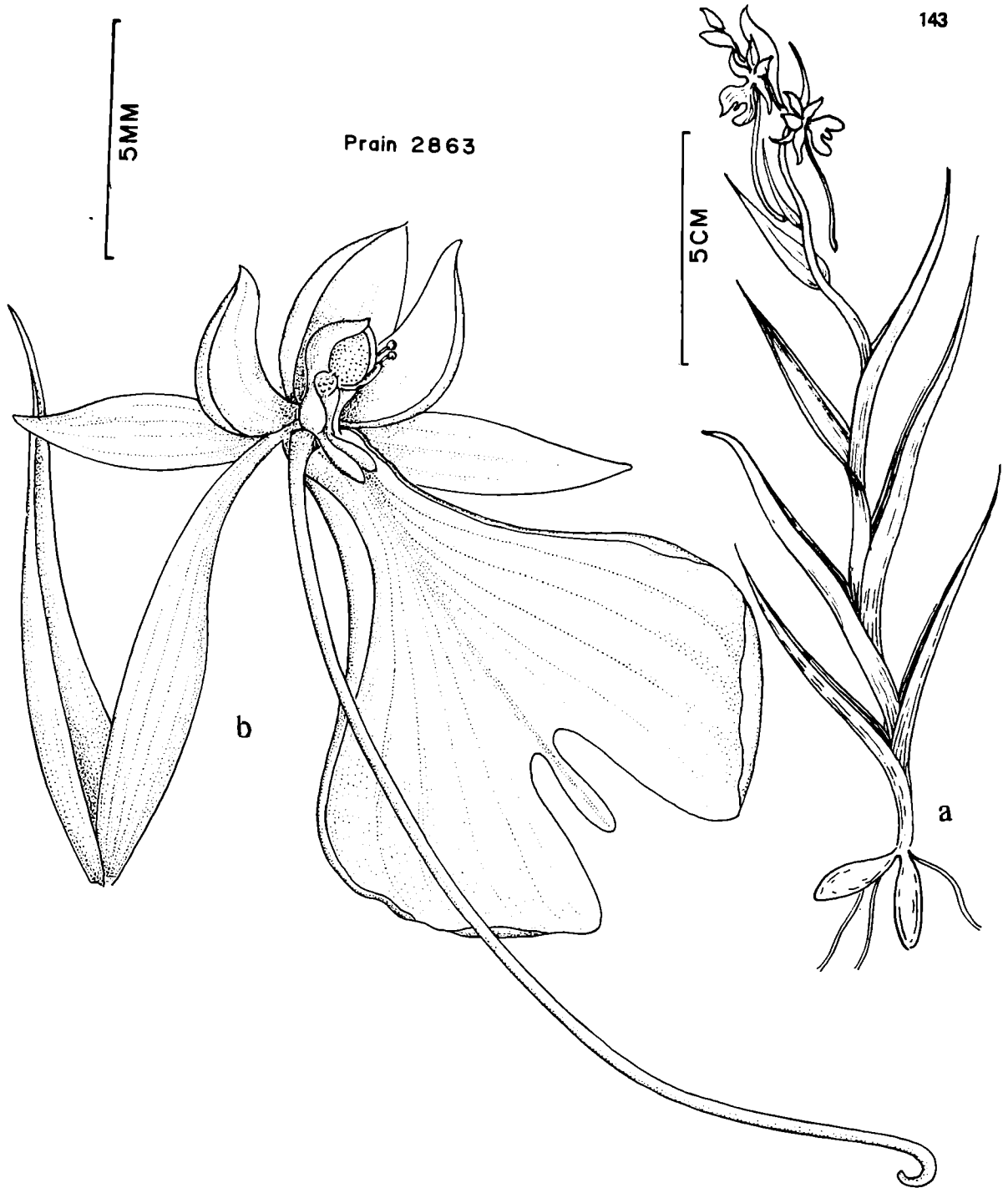
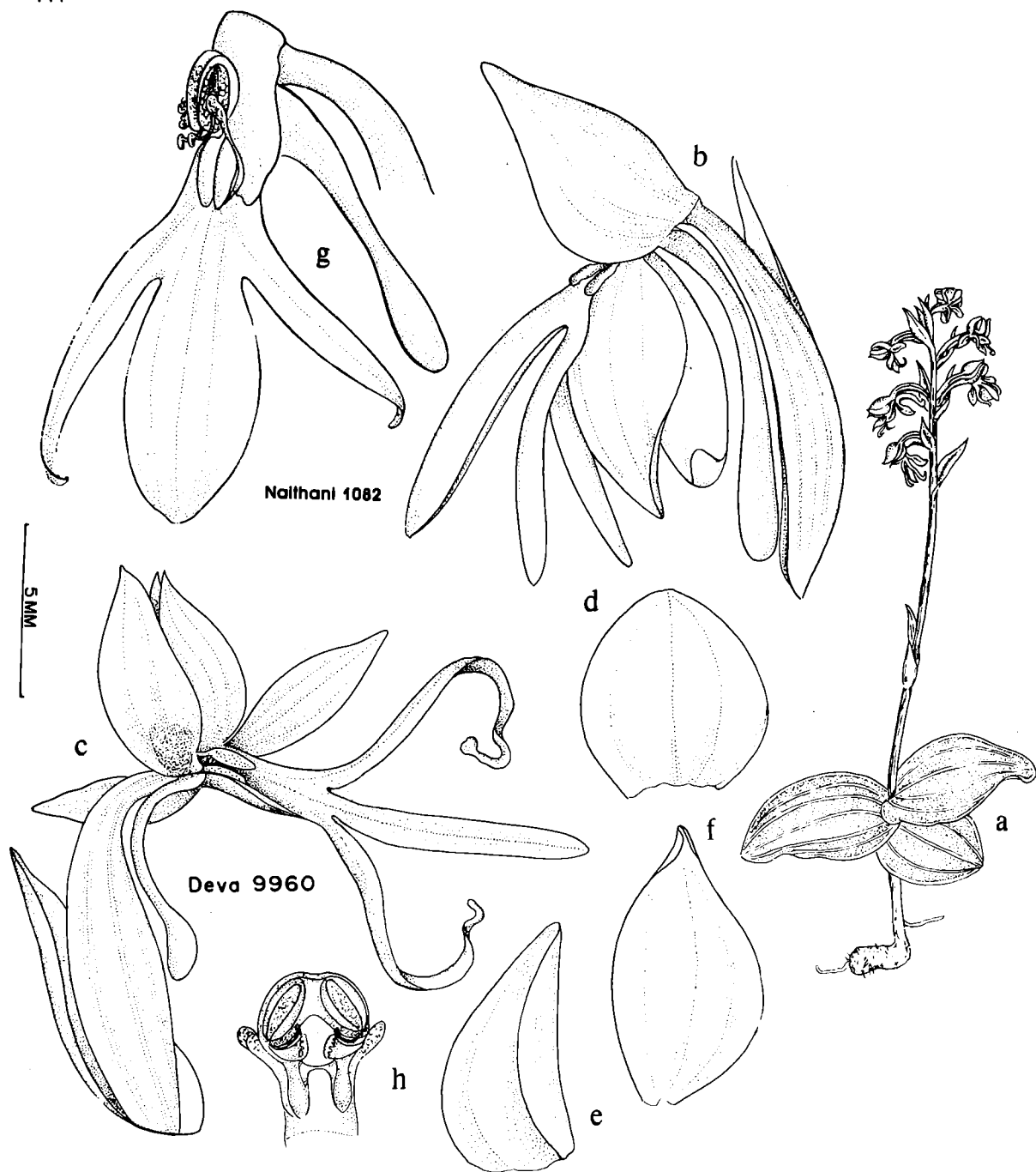


Fig. 71 *Habenaria longifolia* Buch.—Ham. ex Lindl.—a. plant; b. flower.



**Fig. 72** *Habenaria marginata* Colebr.—a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. column, lip & spur; h. column.



KUMAUN: **Pithoragarh**-Satta-Gorpatta. *P.C. Pant* 31894; Sandev, *P.C. Pant* 35605; Gori Valley, *Inayat* 24074; Bans, *Inayat* 24072. **Nainital**-Ramgarh, *Inayat* 24076; Cheena, *Duthie* 4431; Nainital, *Kalakoti* 520, 522; *Davidson*; Old road from Nainital to Garampani, *Renz* 13604. **Almora**-Almora city near I.T.I., *P.C. Pandey* 2415; Binsar, *Inayat* 24072(a); Almora, *Vohra* 58072.

HIMACHAL PRADESH: Between Dalhousie and Chamba, *Gammie* 18099; Chamba, Trela, *Nair* 32145, 32817; Kinnor Sarahan, *Nair* 30652, 30657.

JAMMU & KASHMIR: Liddar Valley, *Inayat* 25388.

PAKISTAN: Hazara, *Inayat* 24069.

**Habenaria longifolia** Buch.-Ham. ex Lindl. Gen. & Sp. Orch. 324. 1835; Hook. f., 6: 141. 1890; Duthie, 181. 1906; Haines, 1156. & 1252. 1924; Pradhan 1: 77. 1976; Seidenf. & Arora 19. 1982.

*Gymnadenia longifolia* Lindl. ex Wall. Cat. 7060. 1832. *nom. nud.*

*H. trapezoidea* Falc. Mss.

(Fig. 71)

*Stem* slender, 25-45 cm long, leafy. *Leaves* linear, scattered, erect acuminate, 7-12 × 0.2-0.5 cm, shorter upwards. *Spike* 5-7 cm long, many and laxly flowered. *Flowers* 1-2 cm across, white, *Bracts* linear, acuminate, longer than the ovary. *Sepals* small, lateral sepals 5 mm long, oblong-lanceolate, 3-nerved, little longer than the dorsal. *Petals* gibbously ovate, 3-nerved, as long as the dorsal sepal. *Lip* flabelliform, 1.3-1.5 cm long and broad; side lobes semi-circular, entire, midlobe linear, shorter than side lobes. *Spur* slender, twice as long as the ovary, green.

*Flowering*: August.

*Distribution*: Himalaya 400-1500 m (Mussoorie), Mohand Pass Dehra Dun and Bihar.

This species is included on the authority of Duthie (1906). He quotes Royle's and Falconer's specimens from this region and points out that he has not seen any living specimens. Seidenf. & Arora (1982), have a doubt about the occurrence of this species. Our fig. 71 is drawn from a specimen collected by Prain from Pusa Darbhanga, Bihar.

**Habenaria marginata** Colebr. in Hooker, Exot. Fl. 2: 17 t. 136. 1824; Hook. f., 6: 150. 1890; Collett, 504. 1902; Duthie, 184. t. 136. 1906 et 3: 226. 1920; Stewart, 70. 1972; Seidenf., 122. fig. 78. 1977; Sharma & Kachroo, 300. 1981; Renz, 38. 1984.

*H. fusifera* Hook. f., Fl. Brit. Ind. 6: 147. 1890.

*H. flavescens* Hook. f., Fl. Brit. Ind. 6: 150. 1890.

*H. aurantiaca* Rolfe ex Downie, in Kew Bull. 418. 1925.

*H. marginata* var. *marginata* f. *Flavescens* Blatt. & McCann, in J. Bombay nat. Hist. Soc. 36: 24, 1932.

*H. marginata* var. *fusifera* (Hook. f.) Sant. & Kapad., in J. Bombay nat. Hist. Soc. 56: 199. 1959

(Fig. 72)

*Stem* 10-20 cm high. *Leaves* few, 2-12 cm long, sub-radical, sessile, oblong or linear-oblong, obtuse, margins pale-yellow. *Scape* 10-25 cm long. *Spike* 5-15 cm long, densely flowered. *Flowers* many, 1.5 cm across, greenish-yellow to orange. *Bracts* semi-amplexicaule, 1-nerved, ovate-lanceolate, acute, as long as the ovary. *Sepals* unequal, pale-green, faintly 3-5 nerved, acute; the dorsal broadly ovate, 8 mm long; laterals falcately oblong-lanceolate. *Petals* 7 mm long, yellow with green tinge, 2-3 nerved, ovate, falcate, forming a hood with dorsal sepal. *Lip* longer than sepals, 3-partite, fleshy, yellow, lateral lobes narrowed and with filiform points; midlobe short and broader with reflexed margin. *Spur* stout, equalling or rarely shorter than the ovary and swollen at the apex.

*Flowering*: August.

*Distribution*: Himalaya 500-1000 m (Pakistan, Kashmir to Kumaun), Bihar, Bengal, Madhya Pradesh. Gujarat, Rajasthan, Concan, Deccan, N. Kanara, W. Ghats of Maharashtra. Burma and Thailand.

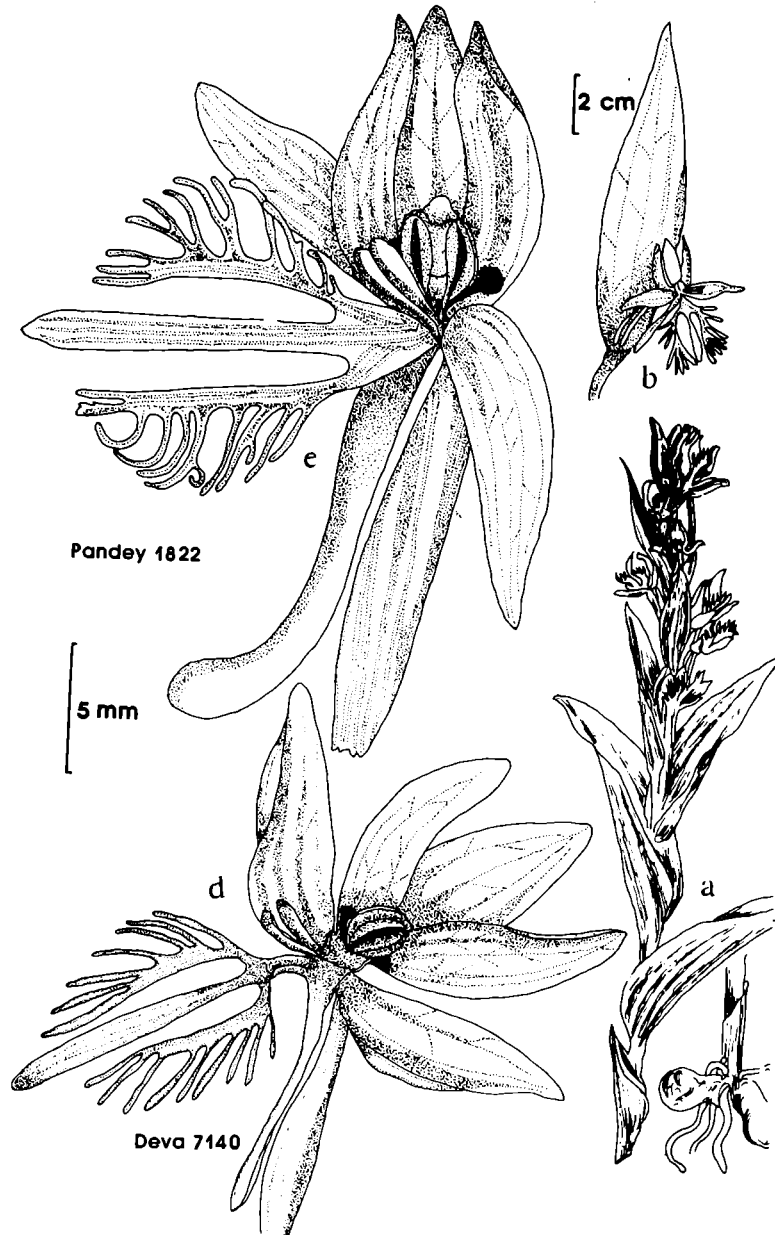


Fig. 73 *habenaria pectinata* (J.E. Sm.) D. Don—a. plant; b. flower with bract; c. & d. flower.

*Specimens examined:*

GARHWAL: **Dehra Dun** -Dehra Dun, *Harsukh* 24172; Mussoorie, *Mackinnon* 217639; Siwaliks Mohand, *Deva* 521; Mansadevi, *Deva* 9960, Mussoorie, *Flaconer, Jameson*. **Tehri** -Nagtibba, *Ramsukh* 22989; Bok hills, *Harsukh* 24172(a); Kirtinagar, *Deva* 8511; Between Thathure and Deolsari, *Naithani* 1082. **Chamoli** -Chamoli, *Bhattacharyya* 29307; Gopeshwar, *Naithani* 1301; Phata, *Mehrotra* 5961. **Pauri**-Pikhricket, *Madwal* 53716.

KUMAUN: **Pithoragarh** -Pithoragarh, *Arora* 38401; Chawopata, *Arora* 50002; Champawat, *Arora* 38471; Thal-Berinag, *Arora* 41314; Seraghat, Gori Valley, *Inayat*. **Nainital** -Bhimtal, *Champion*. **Almora** -Hawalbagh, *Jameson*; Bageshwar, *Duthie*; Almora, *Pandey* 1819; Bageshwar Doak-Danda, *Arora* 37886.

HIMACHAL PRADESH: Chamba, *Gammie*, Bijhari, Dist. Hamirpur, *Vishwanathan* 61594; Joginder Nagar, *Murti & Prasad* 61865.

JAMMU & KASHMIR: Jammu Nandani (Sharma & Kachroo, *loc. cit.*); Poonch, Mirpur (Stewart, *loc. cit.*).

PAKISTAN: Panjar Rawalpindi (Stewart, *loc. cit.*; Renz, *loc. cit.*).

**Habenaria pectinata** (J.E. Sm.) D. Don, Prodr. Fl. Nepal 24. 1825; Hook. f., 6: 137. 1890 p.p.; King & Pantl. 8: 310 (not t. 406) 1898 p.p.; Duthie, 178. 1906; Stewart, 70. 1972; Renz, 38. 1984.

*Orchis pectinata* J.E.Sm. Exot. Bot. 2: 77 t. 99 1806. *non* Thunb. (1794).

(Fig. 73)

*Stem* up to 30 cm, stout, quadrangular, angles more or less winged. *Leaves* 6-8 × 1.5-2 cm, ovate-lanceolate, acuminate, often recurved at the apex, 3-nerved. *Raceme* 10-12 cm long, secund, compact. *Flower* 2.5 cm across, greenish-white. *Bracts* leaf like, longer than flowers. *Sepals* green, margin pale; dorsal 8-10 mm long, broadly lanceolate, obtuse, 3-nerved, the laterals narrower, spreading, sub-falcate, mucronate on the back below the reflexed tips. *Petals* white, forming a hood with the dorsal sepal, falcately oblong, obtuse. *Lip* 3-partite, longer than lateral sepals, pure white, midlobe linear, longer than deeply pectinate side lobes. *Spur* stout, longer than the ovary, its apex curved outwards. *Anther* cells distant. *Stigmatic processes* 4-5 mm long, linear, clavate, stout, grooved along their upper surface.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-3500 m (Pakistan, Kashmir to Arunachal Pradesh). S.E. Tibet.

*Specimens examined:*

GARHWAL: **Dehra Dun** -Mussoorie, *Duthie* 21753; Dhobighat, *Arora* 36466. **Tehri**-Dhogaad on way to Nagtibba, *Naithani* 1057. **Uttarkashi**-Jharmola, *Deva* 7140. **Chamoli**-Jangal Chatti on way of to valley of flowers, *Naithani* 1014. **Pauri**-Lansdown, *Roberts* 3.

KUMAUN: **Pithoragarh** -Dafiadhura, *Arora* 49502; Balati glacier, *Thomas* 20898; Tajam, Jankola Valley, *Inayat* 24056(a). **Nainital**-Nainital, *Meebold* 4153, *Inayat* 24056; Bhowali & Bhim Tal, *Renz* 13591. **Almora**-Almora near I.T.I., *P.C. Pandey* 1822.

HIMACHAL PRADESH: Chamba, *Lace* 1815.

PAKISTAN: Panjar (Stewart, *loc. cit.*; Renz, *loc. cit.*).

**Habenaria plantaginea** Lindl. Gen. & Sp. Orch. 323. 1835; Hook. f., 6: 141. 1890; Duthie, 181. t. 132. 1906; Aswal & Mehrotra 322. 1979; Jayaweera, 2: 355. f. 157. 1981; Sharma & Kachroo, 1: 300. 1981

*Gymnadenia plantaginea* Lindl. ex Wall. Cat. 7053. 1832 *nom. nud.*

(Fig. 74)

*Stem* 10-40 cm high. *Leaves* 3-7, sub-radical, elliptic-oblong, 7.5-15 cm long, clustered near the base of the stem. *Scape* slender, 20-40 cm high with many lanceolate acuminate bracts. *Spikes* lax flowered, 5-15 cm long. *Flowers* white, faintly fragrant. *Bracts* lanceolate, acute or setaceous, half as long as the

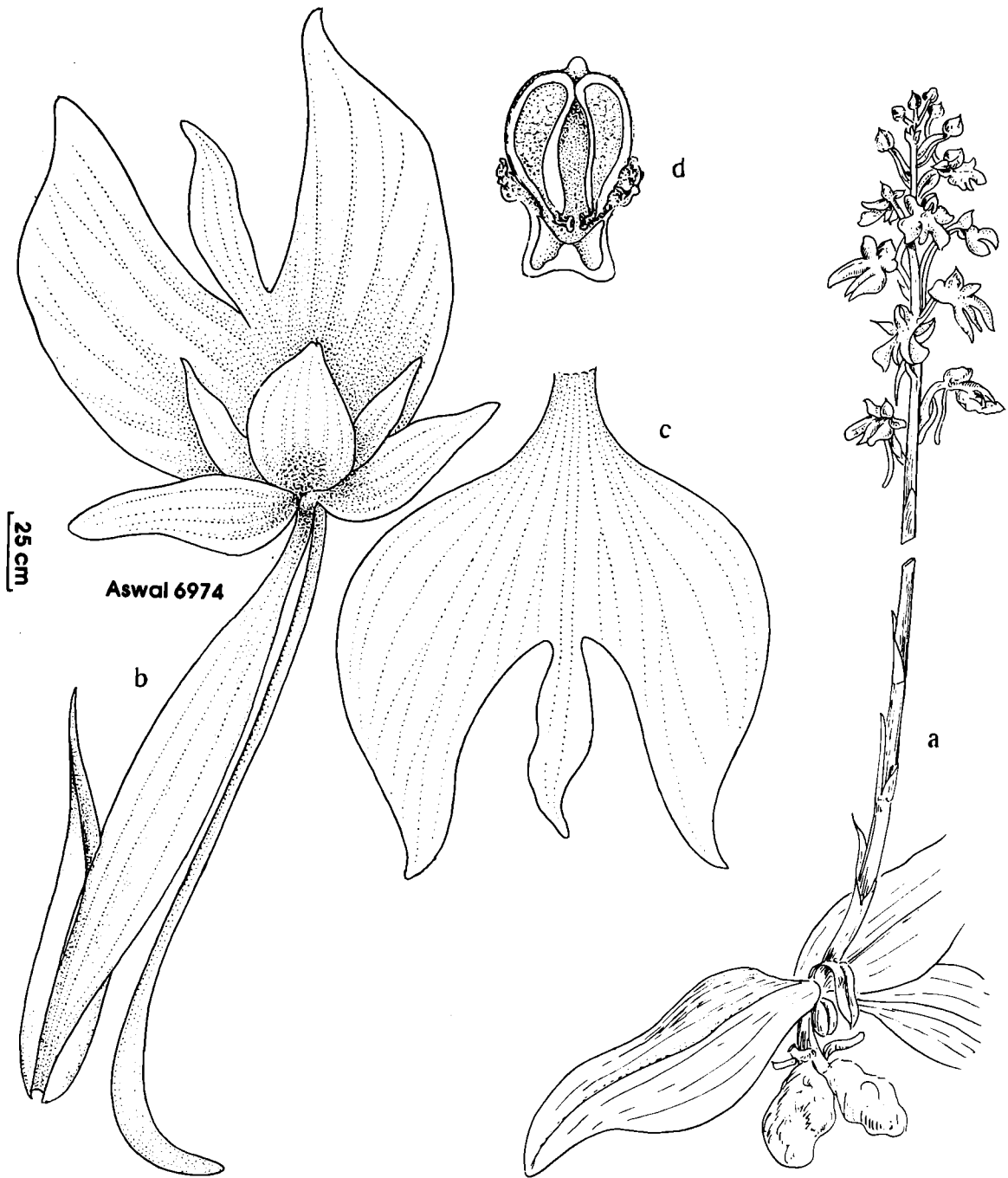


Fig. 74 *Habenaria plantaginea* Lindl. — a. plant; b. flower; c. lip; d. column.

ovary. *Sepals* sub-equal, more or less 7 mm long, 3-nerved, white tinged with green, the dorsal 5 mm long, ovate-oblong, the laterals falcately oblong-acute, 7 mm long, spreading. *Petals* white, linear-lanceolate, acute, 2 mm long, irregularly denticulate, pressed to and forming hood with the dorsal sepal. *Lip* broad, twice as long as the lateral sepal, flabelliform, 3-lobed, side lobes semi-ovate, entire or denticulate, midlobe linear-oblong, a little shorter. *Spur* about as long the ovary.

*Flowering*: September - October.

*Distribution*: Himalaya up to 1000 m (Jammu to Arunachal Pradesh), Bihar, Orissa, Bengal, Madhya Pradesh, W. Ghats, N. Kanara. Sri Lanka, Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun** Valley-Mothronwala, *Kanjilal* 1078; Kalinga Hills, *Mackinnon's collector* 25417; Nalapani, *Harsukh* 24174; Dehra Dun, *Smythis* 7654; Nakund above Dehra Dun, *Ramsukh* 23002; Sahashtradhara, *S.K. Malhotra* 23707 & 33967, *Deva* 1166; Bindal, *Babu* 34089; Gularghati, *T. A. Rao* 9937; Raipur, *Deva* 1944; Rajpur *Deva*, 2786; Lachiwala, *Deva* 4050; Gola tappar, *Deva* 10098; Chakrata Jaunsar Kalsi, *Gammie*. **Tehri**-Ganga Valley Gular, *Deva* 9039. **Chamoli**-Badrinath, *Falconer's collector*.

KUMAUN: **Nainital**-Between Kathgodam and Ranibagh, *Hope*; Road to Kaladoongee, *Davidson*; Sat tal, *Champion*; Tanakpur, *Arora* 52464.

HIMACHAL PRADESH: Rohtang-Koksar, *Aswal* 6974 (This could be a mistake it has never been found at such a high altitude); Manjuhal, *Mishra* 41542; Gurdaspur dhar, *Bhattacharyya* 39413 (both in Punjab & Siwaliks near Himachal Pradesh Border).

JAMMU & KASHMIR: Nandani and Suktar Jammu (Sharma & Kachroo, *loc. cit.*).

**Habenaria pubescens** Lindl. Gen. & Sp. Orch. 322, 1835; Hook.f., 6: 144. 1890; Duthie, 183. 1906 et 3: 225. 1920. (Fig. 75)

*Stem* 30-45 cm high, pubescent. *Leaves* crowded towards the base of the stem, 4-5, 10-15 × 4 cm long, elliptic-lanceolate, acuminate, 7-9 nerved, margin undulate, pubescent. *Raceme* with few empty leaf like bracts at the base, 13 cm long, 15-20 flowered. lax, pubescent. *Flower* 1.5 cm across, greenish-yellow. *Bracts* ovate, acuminate, pubescent, shorter than the ovary. *Sepals* the dorsal 3-nerved, erect, broadly ovate, acuminate, ciliate; laterals slightly oblique, little longer than the dorsal, reflexed, ovate-obtuse. *Petals* falcate, longer than dorsal sepal and forming an arch with it. *Lip* 3-partite, longer than the sepals lateral lobes broader below and filiform upwards with a notch in between; midlobe rather shorter with rounded apex. *Spur* as long as the ovary; ovary long beaked.

*Flowering*: July - August.

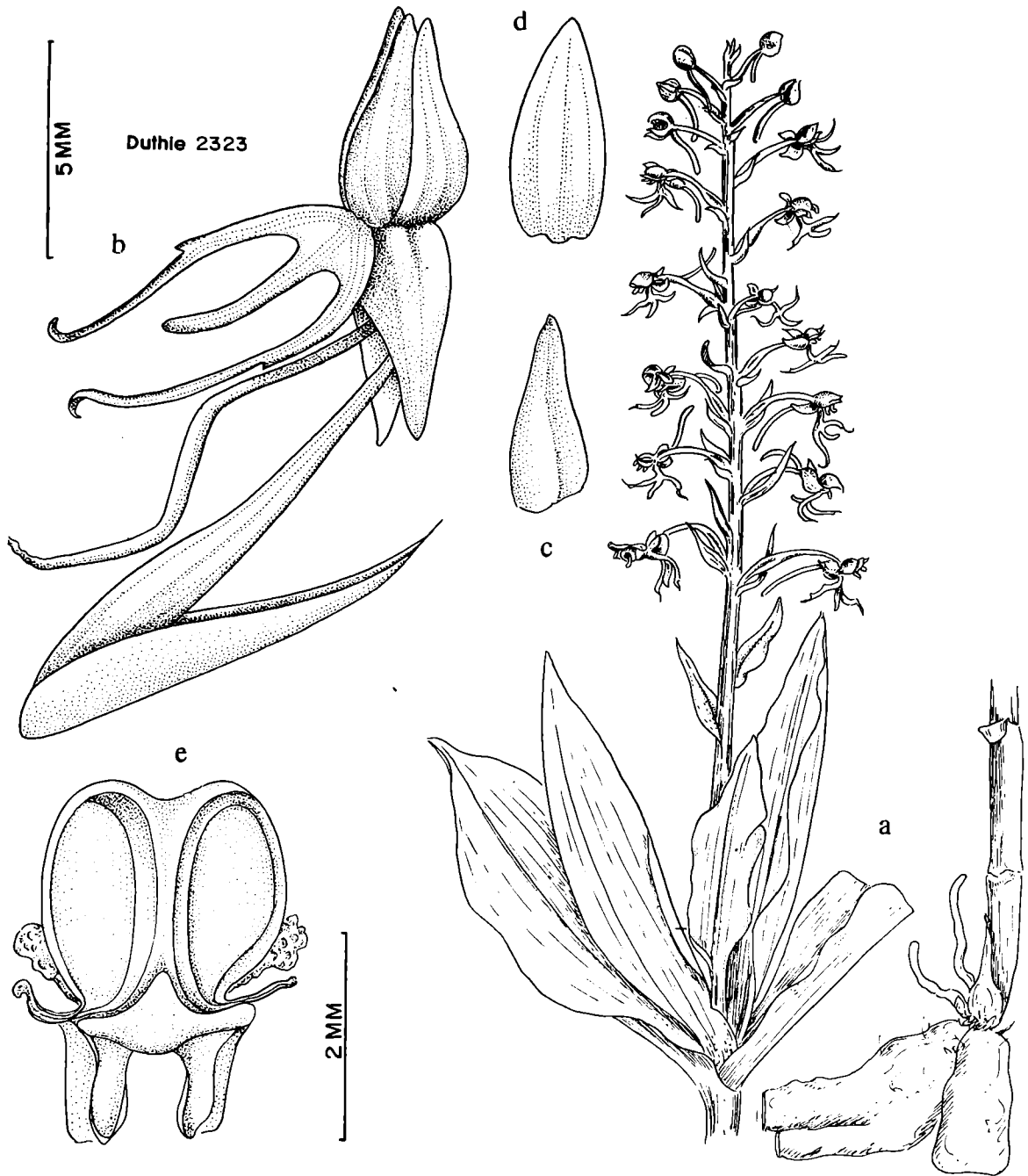
*Distribution*: Himalaya 600-1200 m (Garhwal, Nepal to Sikkim). Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 21765(a), 23001; Dehra Dun, *Duthie* 2323, *Mackinnon* 21765. **Tehri**-East of Tehri, *Mackinnon* 25418.

**Habenaria stenopetala** Lindl. Gen. & Sp. Orch. 319. non 324. 1835; Hook. f., 134. 1890; King & Pantl. 308. t. 404. 1898; Duthie, 176. 1906; Stewart, 71. 1972; Seidenf., 70. f. 37. 1977; Rao, 6: 226, 1985 (Fig. 76)

*Stem* 20-90 cm high. *Leaves* inserted on the upper two third of the stem, 15-20 cm long, oblong-lanceolate to ovate-lanceolate, acute with undulate margins, amplexicaule or sheathing. *Raceme* densely flowered, 10-25 cm long. *Flowers* arranged in a close spiral, 2-2.5 cm across, pale-green. *Bracts* lanceolate, acuminate, about as long as the ovary. *Sepals* subequal, 10-20 mm long, with aristate tip often drawn out in to small thread. *Petals* bipartite, shorter than sepals, linear, the lower segment reduced smaller than upper and pro-



**Fig. 75** *Habenaria pubescens* Lindl.—a. plant; b. flower; c. lateral sepal; d. petal; e. column.

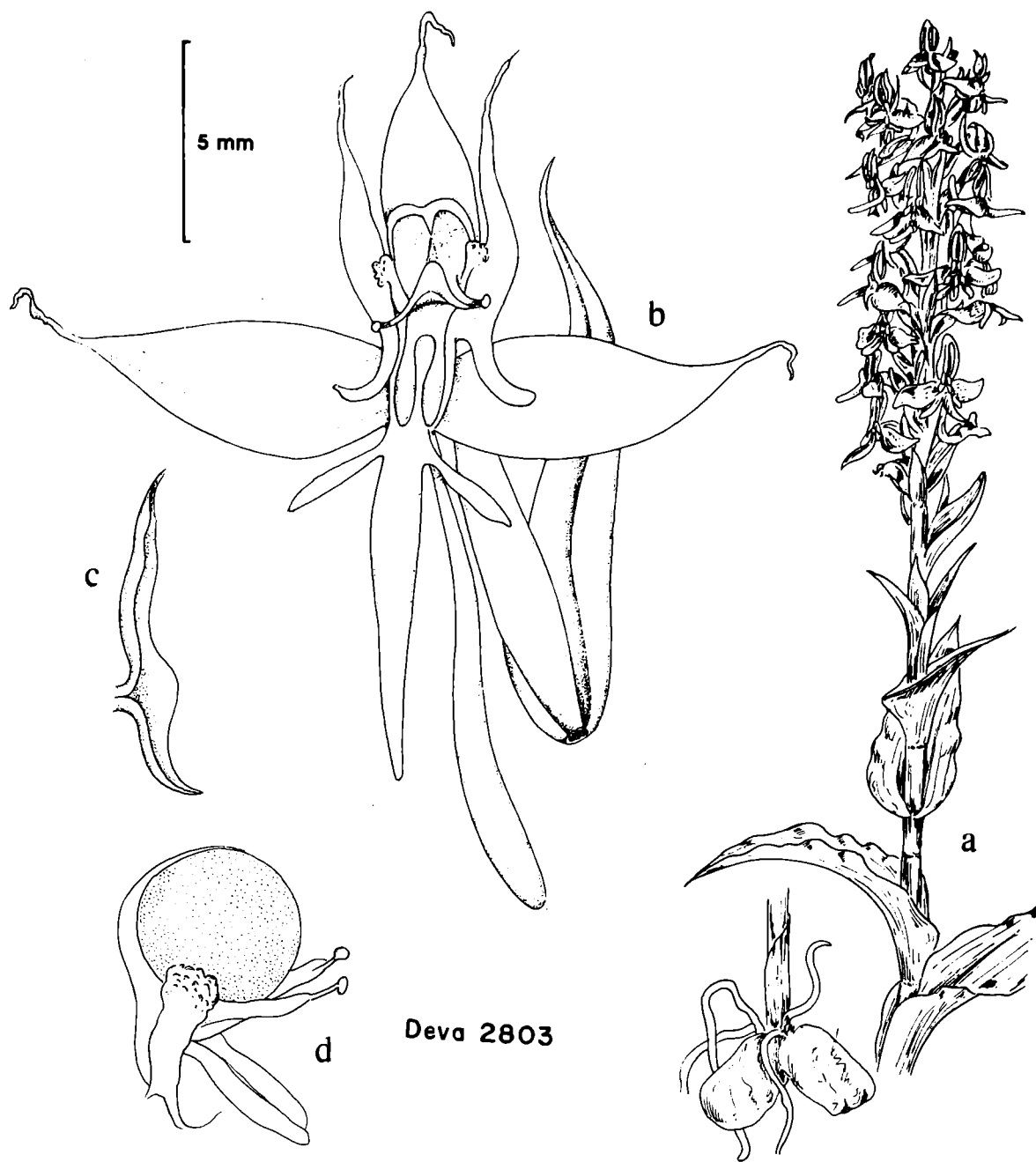
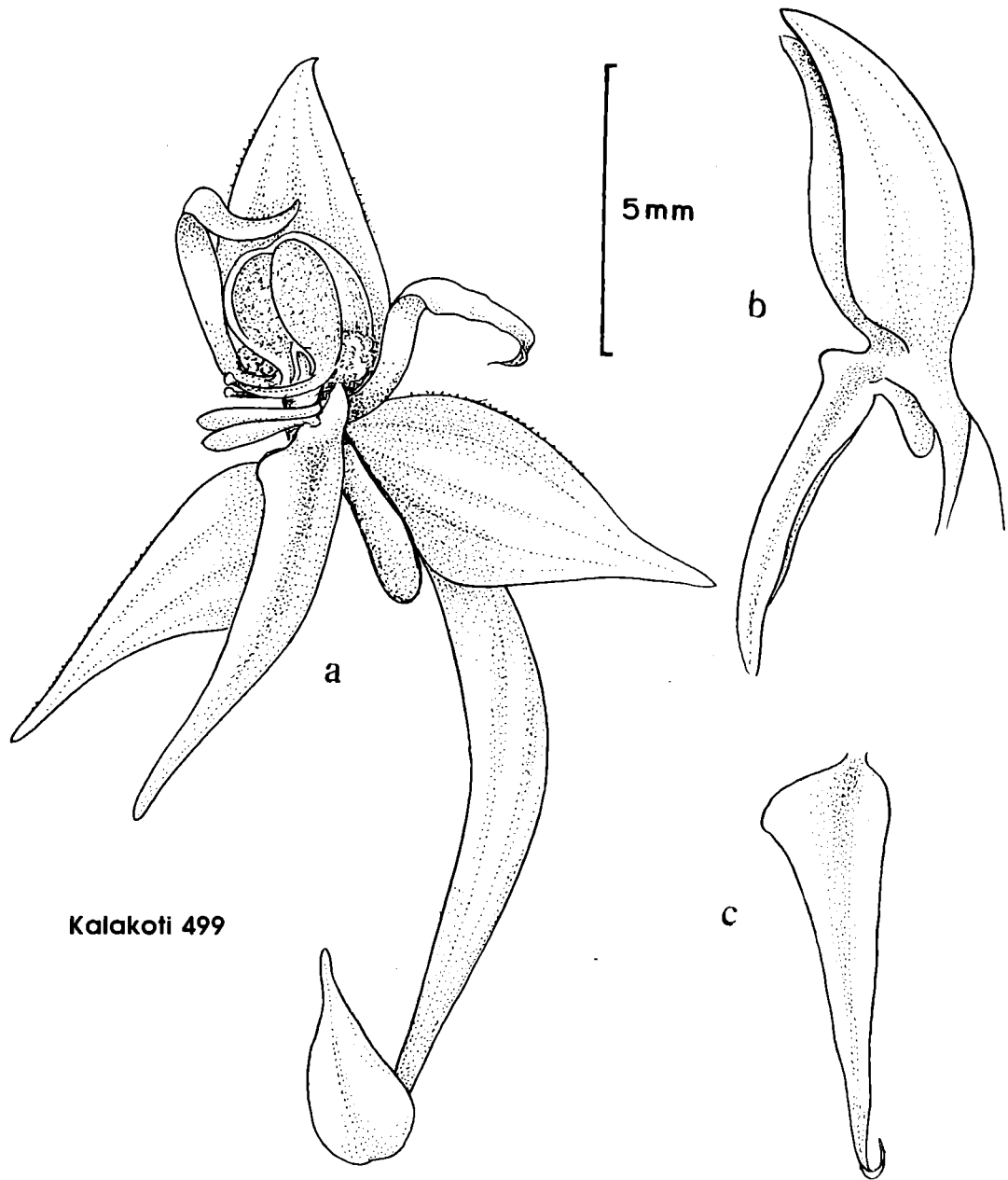


Fig. 76 *Habenaria stenopetala* Lindl.—a. plant; b. flower; c. petal; d. column.



**Fig. 77** *Habenaria* sp. (Imperfectly known species)—a. flower; b. lip, spur & sepal; c. lip.



duced downwards below the point of insertion. *Lip* brown, 3-partite, as long as the petals, lateral lobes little smaller or 3/4-1/2 the length of mid lobe. *Spur* slender, equal to or usually longer than ovary, 2-ridged, slightly curved upwards.

*Flowering*: August - September.

*Distribution*: Himalaya 1000-2500 m (Kashmir, Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Bengal, Bihar, Orissa, Bombay, Karnataka. Bangladesh, Vietnam, Phillipines, Taiwan, Thailand, Indo-China, China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley Rajpur, *Deva* 2803; Mussoorie, *mackinnon* 22980(a); Bulders hills Mussoorie, *Duthie Tehri*-Tehri way to Pineswar, *Vishwanathan* 54828. **Chamoli**-Bhyundar Valley, *Bhat-tacharyya* 29342.

KUMAUN: **Pithoragarh**-Dafiatop, *Arora* 45540. **Nainital**-Ranibagh, *Hope*.

JAMMU & KASHMIR: Pateena near Sailan, Poonch Pir Panjal, *Kirn* 1501; Bujliaz, *Kirn* 3010.

#### Species imperfectly known

**Habenaria** sp., *Kalakoti* 499, KUMAUN, **Nainital**. (Fig. 77). An incomplete specimen, looks very different from any known species of *Habenaria*. It may prove to be a new species.

#### Hemipilia Lindl.

Terrestrial, tuberous herb. *Leaf* solitary, radical, broad. *Inflorescence* racemose, laxly flowered. *Sepals* equal in length, the lateral spreading. *Petals* broadly ovate, entire. *Lip* continuous with the column, broad, obscurely 3-lobed, spreading. *Spur* trumpet shaped. *Column* very short; *rostellum* broad, projecting from between the anther cells, concave; *stigmatic processes* none. *Anther cells* diverging, tip produced in to grooves of the restellum; *pollinia* 2; *caudicles* long, glands distant, exposed.

**Hemipilia cordifolia** Lindl. Gen. & Sp. Orch. 296. 1836; Hook. f., 6: 167. 1890; Collett, 506. 1902; Duthie, 200. t. 150. 1906.

*Platanthera cordifolia* Lindl. in Wall. Cat. 7049. 1832. *nom. nud.*

(Fig. 78)

Plant 12-20 cm high, glabrous; tuber ovoid or sub-globose, *Leaf* solitary, fleshy, orbicular-cordate, obtuse, 5-10 × 6 cm, many nerved. *Raceme* lax, 3-5 flowered, 5-6 cm long. *Flowers* 1.5 cm across, purple. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* equal in length, the dorsal erect, 12 mm long, lanceolate-ovate, obtuse, tip blunt; lateral pair falcate, oblong, slightly spreading. *Petals* slightly shorter than sepals, obliquely ovate, forming a hood with dorsal sepal. *Lip* broadly 3-lobed, lateral lobes rounded and reflexed, midlobe orbicular, bluntly acuminate, sub-crenate, pubescent. *Spur* trumpet shaped, deflexed, shorter or almost equal to the ovary, tip faintly 2-lobed or not.

*Flowering*: July - September.

*Distribution*: Himalaya 1500 - 2200 m (Himachal Pradesh to Nepal).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, Landour, *Duthie* 21768(a); Mussoorie, *Mackinnon* 21768. **Uttarkashi**-Jamuna Valley, Rana, *Deva* 4527. **Chamoli**-Sonprayag - Gorikund, *Mehrotra* 5272.

KUMAUN: **Nainital**-Chena Nainital, *Champion* 6142; Way to Garampani from Snow view, *Renz* 13607; *Kalakoti*; Ranikhet Road, Below Nainital, *Duthie* 4425. **Almora**-Basti near Chaukori, *P.C. Pandey* 2276.

HIMACHAL PRADESH: Shimla - Elysium Hill, Shimla, *Gamble* 4676(A); Chail, *Ganga Singh*.

Deva 4527

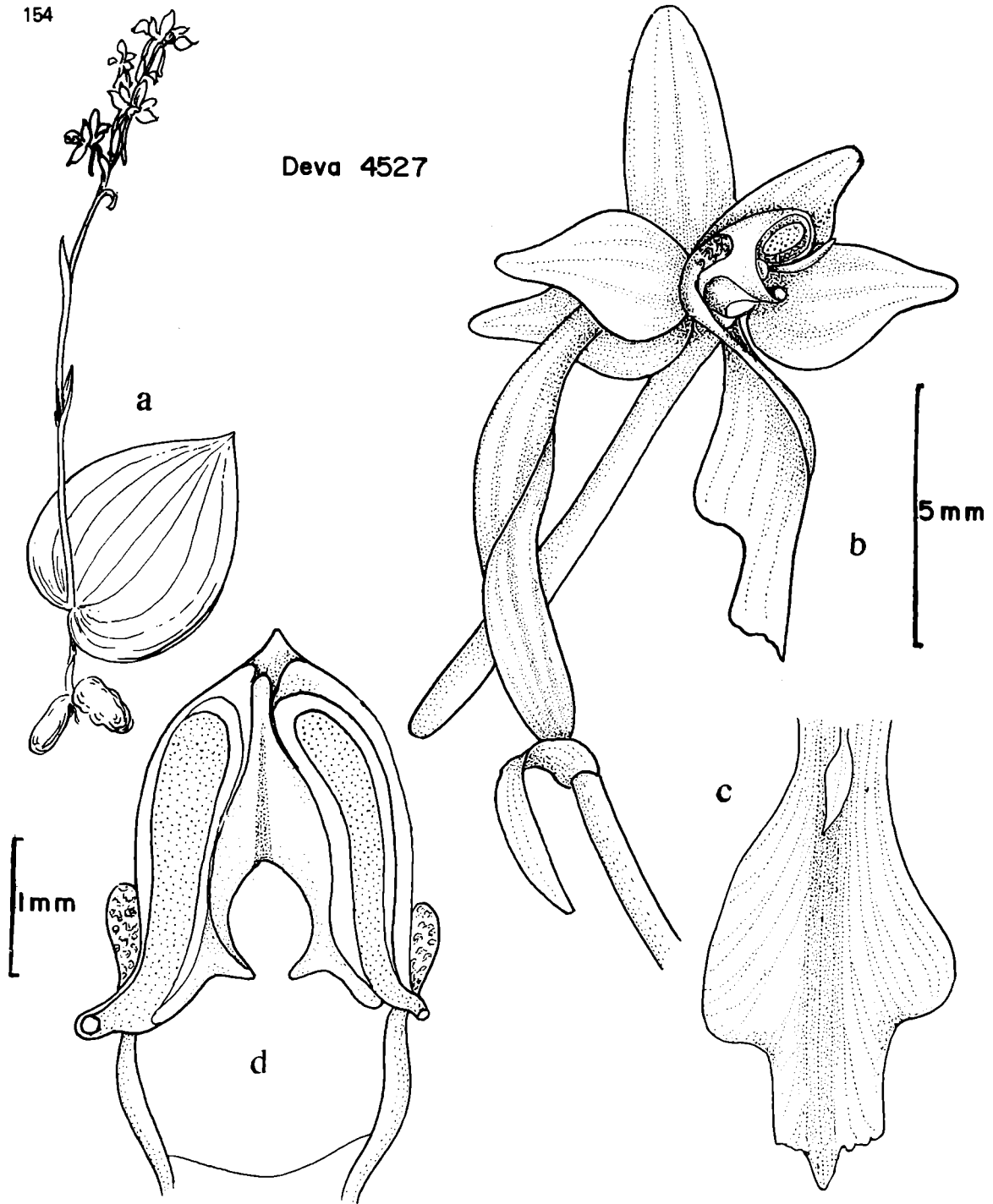
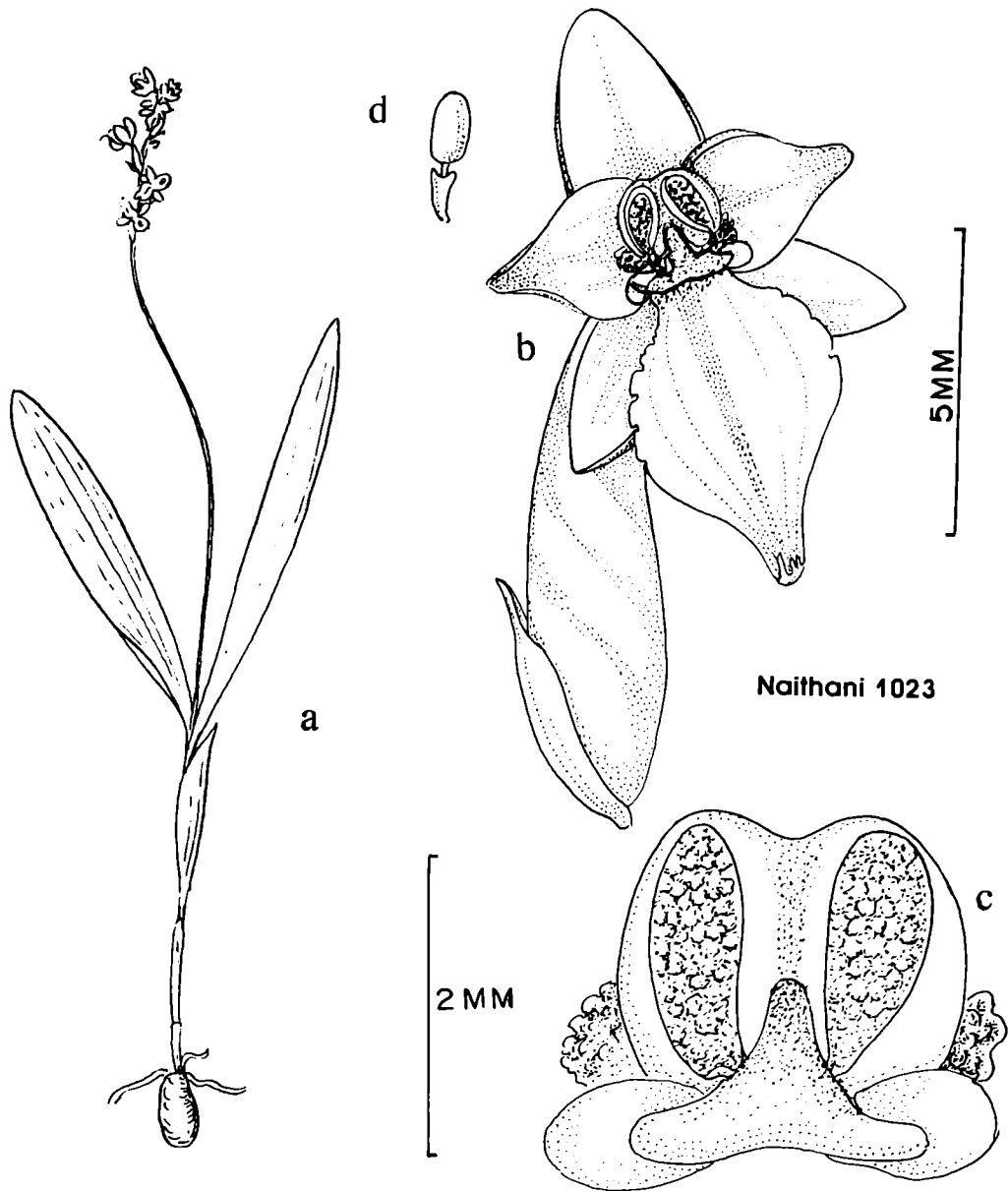
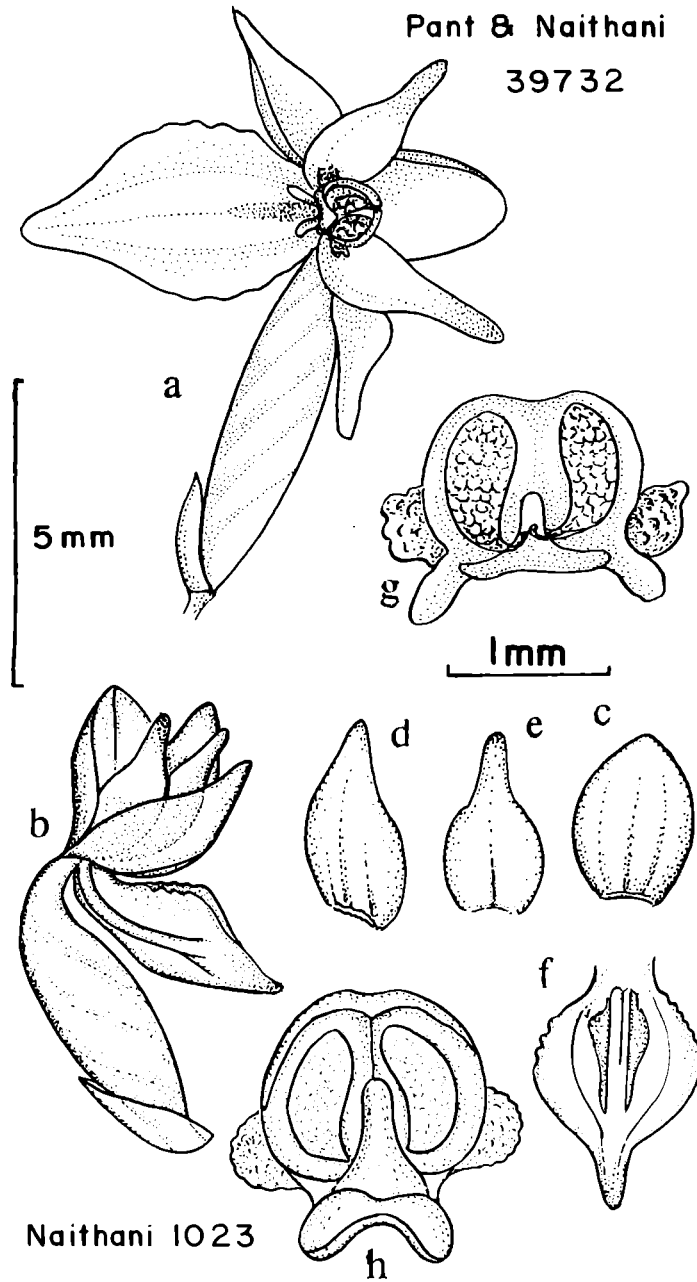


Fig. 78 *Hemipilia cordifolia* Lindl.—a. plant; b. flower; c. lip; d. column.



**Fig. 79** *Herminium josephii* Rchb. f.—a. plant; b. flower; c. column; d. pollinia.



Naithani 1023

**Fig. 80** *Herminium josephii* Rchb. f.—a. & b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. & h. column.

### Herminium Guettard

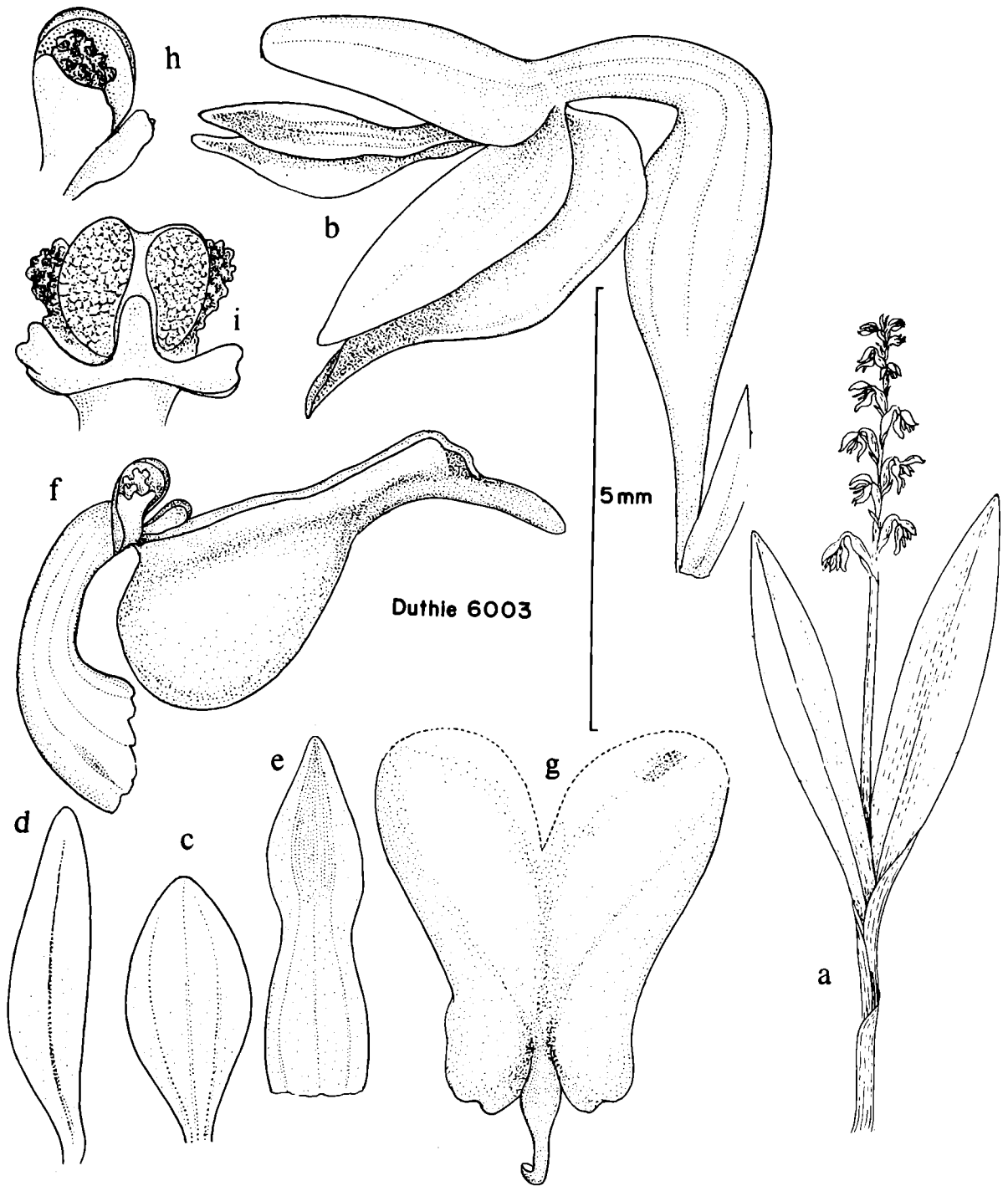
Slender alpine plants with roundish tuberoles. *Leaves* few, sometimes only 1-2, cauline or basal. *In-florescence* dense, many-flowered, thin, often elongated. *Flowers* small, greenish. *Sepals* usually somewhat longer broader and petals forming a hood. *Lip* entire, 3-lobed or 3-dentate, flattish-ligulate, spurless, occasionally with distinctly globose base. *Column* tiny; *pollinia* 2, with very short caudicles, each attached to a rather large naked viscid-gland, stigmata clearly separated, more or less cushion-like; staminodes sometimes strap-shaped. *Ovary* more or less sessile, twisted with more or less deflexed apex.

#### Key to species

1. Lip distinctly tripartite.....2
- + Lip simple.....5
2. Lip much longer than the sepals, base with a small shallow concavity, not visible beyond the base of the lateral sepals, the lateral lobes much longer than the midlobe.....3
- + Lip equal or little longer than the sepals, base with a deep concavity, clearly visible beyond the base of lateral sepals, the lateral lobes smaller to almost equal, but never longer than the midlobe.....4
3. The midlobe half to little more than half the length of the lateral lobes; ovary ovate-oblong about 3 times longer than broad; sepals and petals spreading; leaves two, oblong or linear-lanceolate; plant usually epiphytic .....*H. mackinnoni*
- + The midlobe very small, often only reduced to a knob, if little longer than much less than half the length of the lateral lobes; ovary lanceolate, about 6 times longer than broad; sepals and petals sub-connivent not spreading; leaves usually 3, linear-lanceolate, long-acuminate; plants usually terrestrial .....*H. lanceum*
4. The lateral lobes half to almost equal to the midlobe, diverging, midlobe almost of the same breadth from base to the apex, obtuse .....*H. monorchis*
- + The lateral lobes very small, not diverging, parallel to the midlobe with broad obtuse often with retuse apex, midlobe broad near the base and tapering to an acute to acuminate apex.....*H. kumaunensis*
5. Lip with a distinct globular base with crenulate margin near the centre .....*H. macrophyllum*
- + Lip with a flat or concave base .....6
6. Leaves usually two, lanceolate; lip broadly ovate, with acuminate apex, margins sub-crenulate to rarely entire.....*H. josephii*
- + Leaf one; lip with entire margins.....7
7. Leaf long, linear to narrowly oblanceolate, 6-10 or more times longer than broad; floral bracts little shorter to equalling the ovary, tapering from a broad base to long acuminate entire or trifid apex; petals linear, yellow; lip ovate, with a broad concave basal portion and a short narrow upturned apical portion .....*H. monophyllum*
- + Leaf short, oblong to linear-lanceolate, 2-2½ times longer than broad; floral bracts broadly ovate to sub-orbicular, much shorter than the ovary; petals ovate, green; lip with a dilated base with two deep oval pits, tip elongate, linear-oblong .....*H. pugioniforme*

**Herminium josephii** Rchb. f. in Flora, 55: 276. 1872; Hook. f., 6: 129. 1890; King & Pantl. 335. t. 441. 1898; Rawat & Pangtey. 171. 1983; Naithani et al. 8: 333. 1985. (Fig. 79, 80)

*Stem* 10-25 cm high. *Leaves* 2-3, from near the base, 10-12 × 1.5-2 cm, lanceolate, acute. *Spike* 2.5-10 cm long, densely flowered. *Flowers* green, 8 mm across. *Bracts* oblong, sub-acute, shorter than the ovary. *Sepals* unequal, the dorsal broadly ovate-elliptic, apex blunt, base truncate, lateral pair longer, oblong, not spreading. *Petals* triangular lanceolate, sub-acute, longer than sepals, connivent with sepals to form a hood. *Lip* flat, longer than the sepals, broadly ovate with acuminate apex, margin sub-crenulate.



**Fig. 81** *Herminium kumaunensis* Deva & Naithani—**a.** plant; **b.** flower; **c.** dorsal sepal; **d.** lateral sepal; **e.** petal; **f.** column & lip; **h.** & **i.** column.

*Flowering:* July - August.

*Distribution:* Himalaya 3000-4000 m (Garhwal to Arunachal Pradesh).

*Specimens examined:*

GARHWAL: **Chamoli**-Pushpawati river, Valley of flowers, *Naithani* 1023, *Renz* 13618.

KUMAUN: **Pithoragarh**-Garbyang, *G.S. Rawat* 1229; Ralam Valley, *Pant & Naithani* 39732.

**Herminium kumaunensis** Deva & Naithani *sp. nov.*

(Fig. 81)

Affinis *H. monorchidi* (L.) R. Br., a qua labello basi cunpuliformi-concave, antica indistincte trilobo, lobis lateralibus obtusis, lobo intermedio in ligulam parvulam, carnosam, porectam, producto, facile distinguendum.

Plants about 10 cm high. *Stem* 3 cm with 2 sheaths at the base. *Leaves* two on lower part of the stem, lanceolate, lower bigger, 6.5 × 1.25 cm, upper smaller. *Peduncle* 4 cm long without any empty bracts. *Spike* about 3 cm long condensed with many, more or less nodding flowers. *Flowers* stalked, stalk 2-2.5 mm long, born on the tip of beaked ovary, beak 2 mm long, bent at right angle. *Bracts* about 2 mm long, equal to or little smaller than the stalk, lanceolate, acute. *Sepals* spreading, the dorsal 3-nerved, 3 × 1.25 mm, ovate-elliptic, obtuse, the laterals 1 nerved, 4 × 1 mm, obliquely lanceolate, connivent with petals. *Petals* 4 × 1 mm long, spreading, oblong, constricted in the middle, 3-nerved below, upper half fleshy. *Lip* 5 mm long, with deeply saccate base, sac projecting much beyond the lateral sepals towards the apex, indistinctly 3-lobed, the mid lobe fleshy, lanceolate, sub-acute, the lateral lobes obtuse, slightly bi-lobed. *Column* 2 mm long. *Anthers-cell* almost parallel. *Staminodes* sub-globose, rugulose; *rostellum* prominent; *stigmas* 2, oblong, lying closely below the viscidia. *Ovary* 5 mm long including 2 mm long decurved beak.

**Type:** Kumaun-District Pithoragrah, Chalik Byans, 3300-3600 m, 23.7.1886, *Duthie* 6003 (*holotype* DD).

*Flowering:* July.

*Distribution:* Endemic to Kumaun.

**Herminium lanceum** (Thunb. ex Sw.) Vuijk, in *Blumea* 11(1): 228. 1961; *Seidenf.*, 31: 20, fig. 7. 1977; *Raizada et al.* 86. 1981; *Renz*, 28. 1984.

*Ophrys lancea* Thunb. ex Sw., *Kgl. Akad. Vet. Nya Handl. Stockh.* 21: 223. 1800.

*Aceras angustifolia* Lindl. *Bot. Reg. sub. t.* 1525. 1832.

*Platanthera angustifolia* (Lindl.) Richb. f., *Otia Bot. Hamb.* 1: 39. 1878.

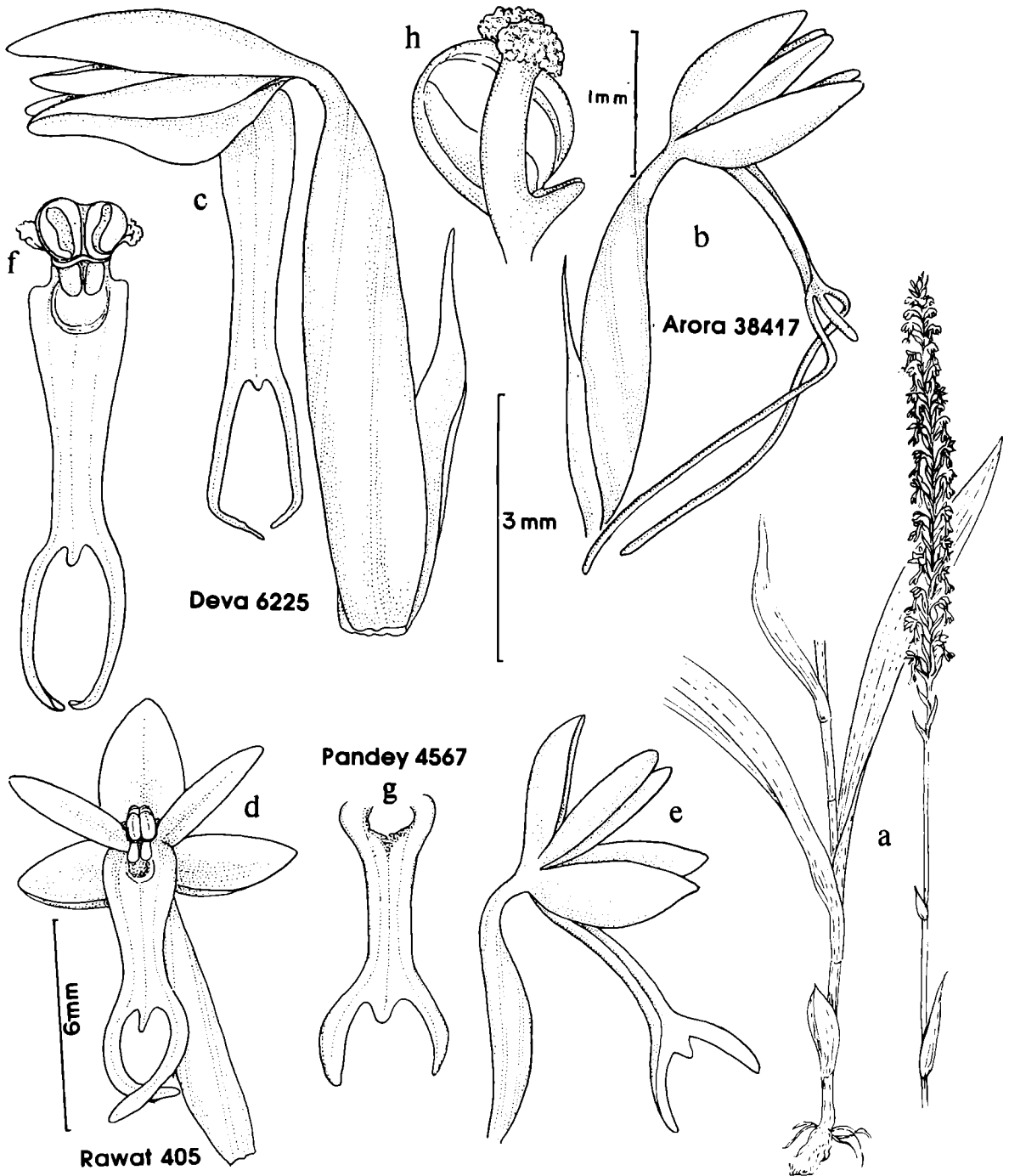
*Herminium angustifolium* (Lindl.) Benth. & Hook. f., *Gen. Pl.* 3: 622. 1880; Hook. f., 6: 129. 1890; King & Pantl. 322, t. 434. 1898; *Duthie*, 197. 1906; *Collett*, 499. 1902; *Stewart*, 71. 1972.

*Spiranthes lancea* (Thunb. ex Sw.) Backer, *Bakh. f. & Steen.*, in *Blumea* 6(2): 361. 1959 *quad comb. tantum.* (Fig. 82)

*Stem* 25-75 cm high. *Leaves* usually three, 25 × 0.5-1.5 cm, linear-lanceolate, acuminate. *Spike* cylindrical, dense, 6-25 cm long, many flowered. *Flowers* crowded, small, green. *Bracts* linear-lanceolate, shorter or equal to the ovary. *Sepals* sub-equal, oblong, obtuse; the dorsal and petal adhering to form a hood; lateral pair spreading. *Petals* narrow, linear, 1-nerved, acute, equal in length to the sepals. *Lip* 1½-3 times longer than sepals, 3-lobed, midlobe very small, often only reduced to a knob, if little longer than much less than half the length of lateral lobes.

*Flowering:* July - August

*Distribution:* Himalaya 1250-3000 m (Kashmir to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, Tripura. Burma, China, Taiwan, Korea, Thailand, Philippines, Vietnam, Malaya, Celebes, Java, Japan.



**Fig. 82** *Herminium lanceum* (Thunb ex Sw.) Vujik—a. plant; b, c, d. & e. flower; f. column & lip; g. lip; h. column.



*Specimens examined:*

**GARHWAL:** Dehra Dun-Mussoorie, Landour *Mackinnon* 21771; Hati Paon, *Saxena* 926; Camel's Back Road, *Raizada* 5524; Mussoorie Depot, *Deva* 8215; above Sahashtradhara, *Deva* 6225. Chakrata - Deoban Road, Chakrata, *Raizada* 1767; Natkangra, *B. B. Osmaston* 21771. Tehri-Nagtibba, *Ramsukh* 22994, *Bhattacharyya* 33764; Phedi, *Duthie* 2071; Way to Pineswar, *Vishwanathan* 54830. Chamoli-Trijuginarian, *Kirat Ram* 8900; Gopeshwar-Mandal, *M. A. Rau* 28487; Phata, *M. A. Rau* 6500, *Nair* 35814, 35922; Bhyunder, *Bhattacharyya* 24236; Anusuiji, *Naithani* 42056; Govindghat, *Bhattacharyya* 29318; Badrinath, *Falconer*, between Govindghat and Bhyundar, *Renz* 13613, *Naithani* 1010. Pauri-Kinkalashwar, *Naithani* 346; Khirsu Road, *A. S. Rao* 56337; between Dadakhal and Khirsu, *Renz* 13635, *Naithani* 1048.

**KUMAUN:** Pithoragarh-Kali Valley, *Duthie* 3420; Banas, *Inayat* 24108(a); Kalamuni, *Inayat* 24108(b); Shobala Dharma Valley, *Inayat* 24109(a); Dafiadhura, *Arora* 53229; Didihat, *Arora* 38417; Sandev, *Arora* 70853; Nainital, *Champion* 7842; Bhimtal, *Jameson*; Nainital above Kumaun University, *Renz* 13590. Almora-Soni, *P. C. Pandey* 4567; Ranikhet-Chauhata, *T. A. Rao* 4793; Dinapani, *Vohra* 57847; Ranikhet, *Wadhwa* 57306; Loharkhet, *T. A. Rao* 4224.

**HIMACHAL PRADESH:** Sarahan, *Murty & Prasad* 61936; Gopalpur Sarahan, Bashahr, *Raizada* 1974; between Tanedar and Nireth, *Raizada* 19666; Shimla, *Gamble* 4853(a); Chamba, *Lace* 1442.

**JAMMU & KASHMIR:** Rutten Pir, *Gammie*.

**PAKISTAN:** Hazara, Murree (Stewart, *loc. cit.*; *Renz, loc. cit.*).

It is widely distributed and a very variable species.

**Herminium mackinnonii** Duthie, in J. As. Soc. Beng. 71(2): 44. 1902. et 197. t. 149. 1906; Pradhan, 1: 50. 1976; Hara et al. 1: 46. 1978; Rawat & Pangtey 697. 1985.

*H. quinquelobium* sensu Arora in Ind. J. For. 1:298. 1978. (*non* King & Pantl.). (Fig. 83)

Usually epiphytic. *Stem* 10-20 cm long. *Leaves* 2, oblong or linear-lanceolate, 12-15 × 1-2 cm, acuminate, 3-5 nerved. *Spike* cylindric, about 10 cm long, densely flowered. *Flowers* spreading, 10 mm across, greenish-white. *Bracts* 5 mm long, broadly lanceolate, little shorter than the ovary. *Sepals* sub-erect, ovate-oblong, acute, green. *Petals* spreading, white, slightly tinged with green, linear-lanceolate, as long as the sepals. *Lip* white, trilobed, twice longer than the sepals; midlobe half to little more than half the length of lateral lobes, lanceolate, obtuse.

*Flowering:* August.

*Distribution:* Himalaya 1000-2000 m (Garhwal to Sikkim).

*Specimens examined:*

**GARHWAL:** Dehra Dun-Near Mussoorie, *Mackinnon* 22993. Chamoli-Mandal near Gopeshwar, *Naithani* 1041, *Renz* 13630.

**KUMAUN:** Pithoragarh-Dafiadhura top, *Arora* 50068, *Duthie* 3412. Almora-Jageshwar, *P. C. Pandey* 4067.

*H. mackinnonii* is closely related to *H. lanceum*, and the creditability of this being distinct from *H. lanceum* as separate species is doubtful. *Duthie's* collection number 3412, *Renz* 13630, *Naithani* 1041 are intermediate forms, with the spreading floral parts and lip of *H. mackinnonii* and narrow lanceolate ovary of *H. lanceum*. The relative length of the lobes of lip which is a main basis of distinction between these two species has been shown by Seidenfaden (1971), as a character not of great value, and in certain forms, of lips with three equal lobes exist in the material he examined. The solution of this problem is to examine material of *H. lanceum* from all its wide distributional range, and till such a project materializes it is better to leave *H. mackinnonii* as a separate species.

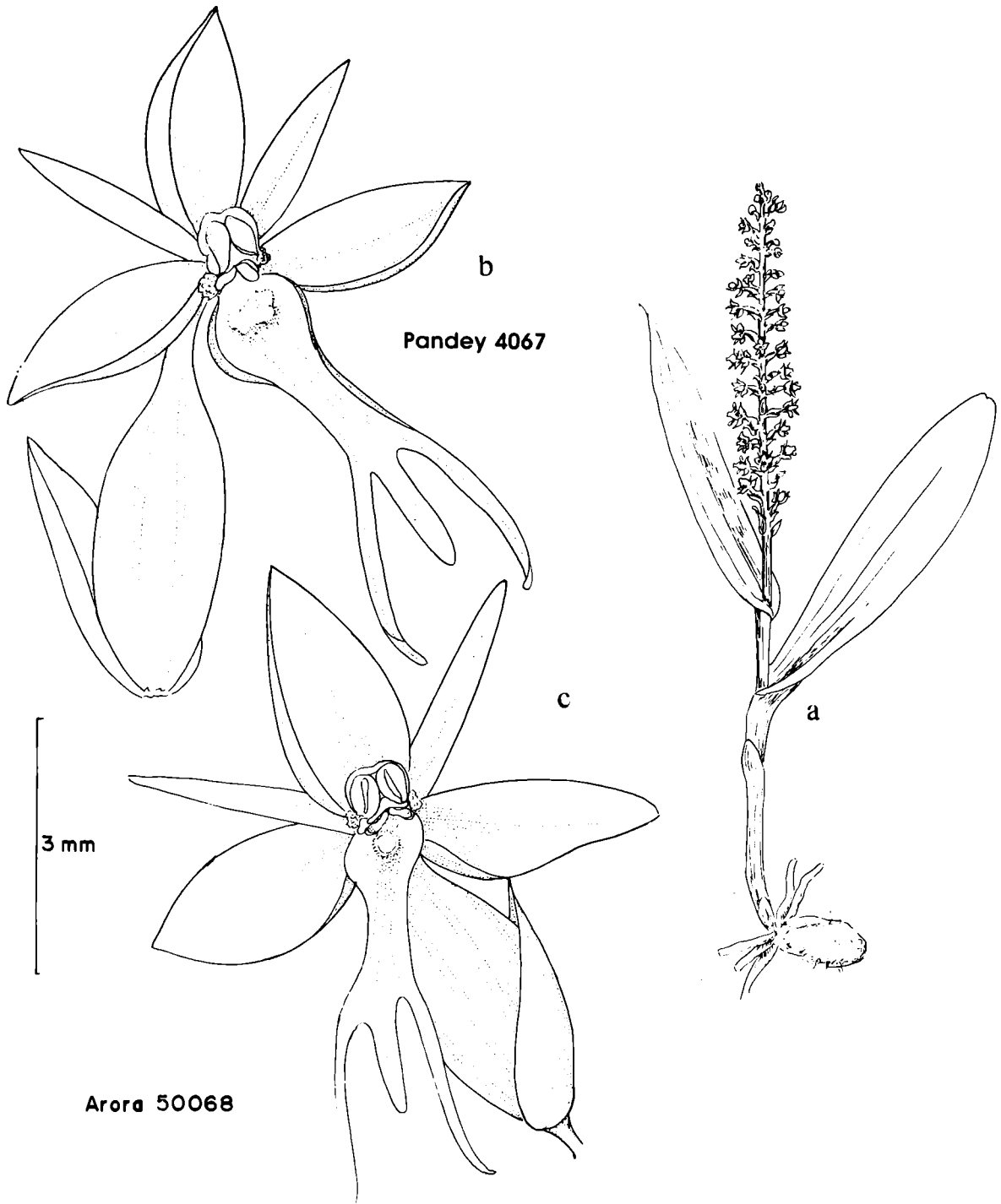


Fig. 83 *Herminium mackinnonii* Duthie—*a.* plant; *b.* & *c.* flower.

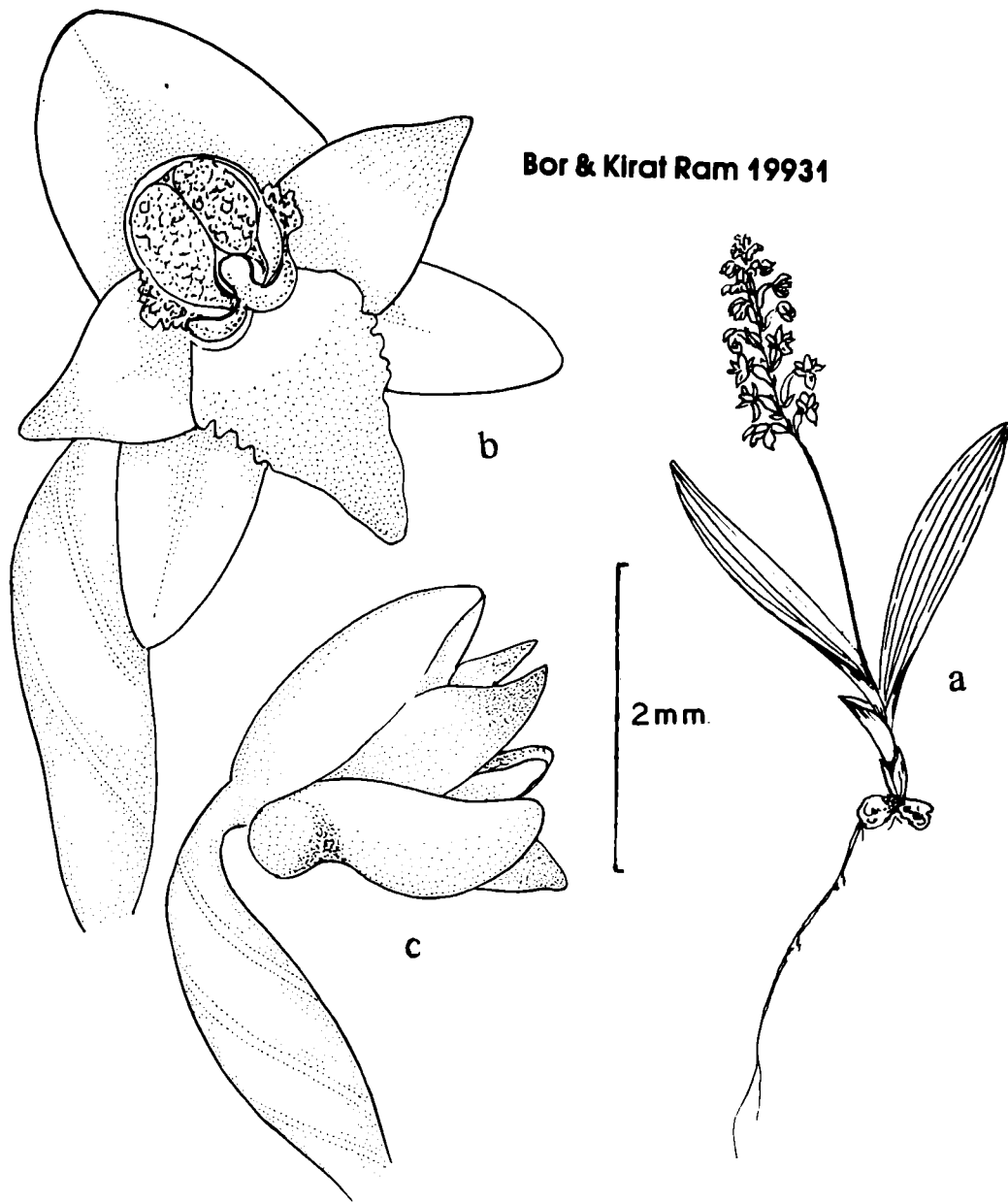


Fig. 84 *Herminium macrophyllum* (D. Don) Dandy—a. plant; b. & c. flower.

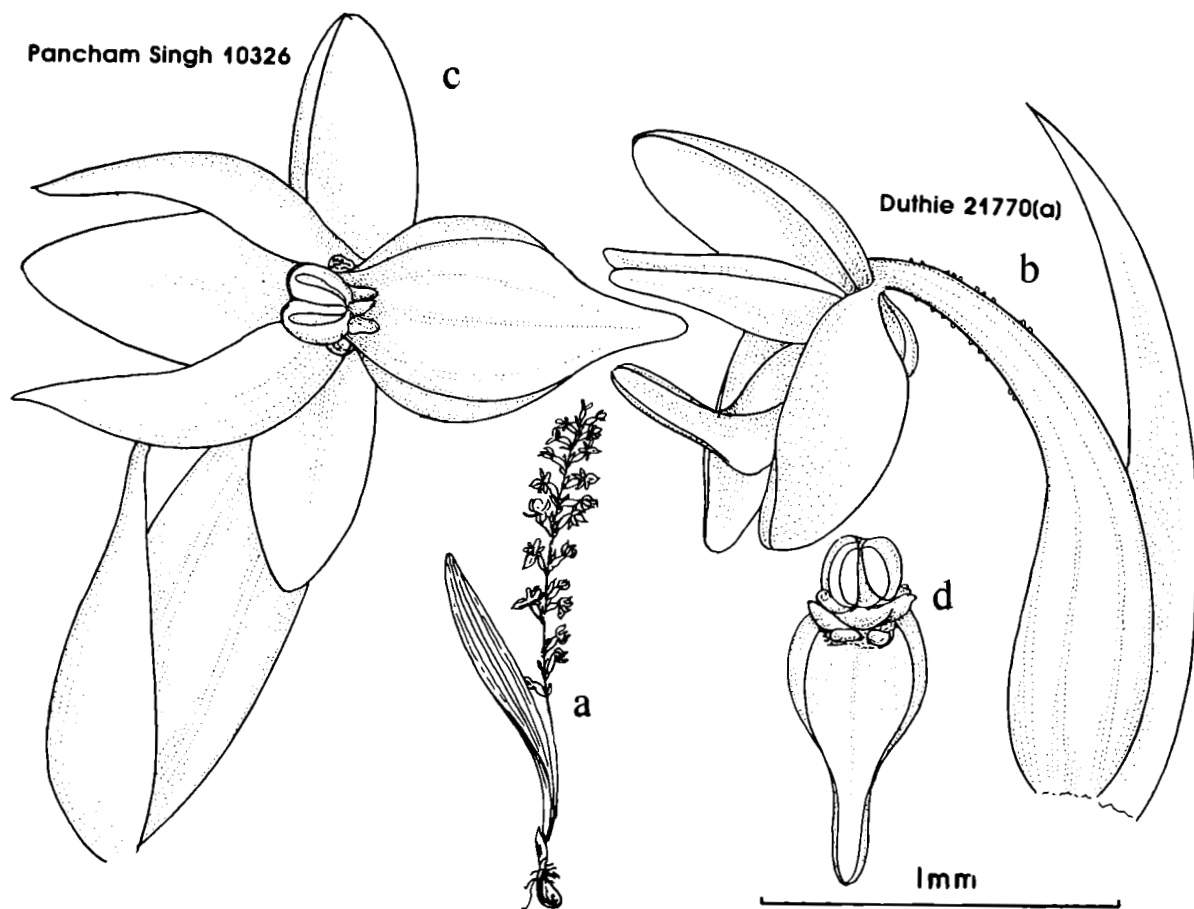


Fig. 85 *Herminium monophyllum* (D. Don) Hunt & Sumerh.—a. plant; b. & c. flower; d. column & lip.

**Herminium macrophyllum** (D. Don) Dandy in J. Bot. 70: 328. 1932; Stewart, 71. 1972; Katakai et al. 5: 20. 1984.

*Neottia marcophylla* D. Don, Prodr. Fl. Nepal, 27. 1825.

*Herminium congestum* Lindl. in Edw. Bot. Reg. 18; sub. t. 1499. 1832; Hook. f., 6: 130. 1890; King & Pantl. 8: 335. t. 440. 1898; Duthie, 198. 1906. (Fig. 84)

*Stem* 10-20 cm high. *Leaves* 2-3, near the base of the stem, 4-10 cm long, narrowly oblong-elliptic or lanceolate, sub-acute or obtuse. *Spike* narrow, 5-10 cm long, many and densely flowered. *Flowers* green, 5 mm across, drooping. *Bracts* ovate, acute, much shorter than the ovary. *Sepals* sub-equal, obtuse; the dorsal broadly ovate; laterals narrower, slightly spreading, oblong, acute. *Petals* slightly longer than the sepals, obliquely lanceolate, acute. *Lip* somewhat longer than the sepals, broad near the slightly globular inflated base, triangular, faintly 3-lobed, with crenulate margin near the centre. basal and apical portion entire.

*Flowering*: July - August.

*Distribution*: Himalaya (Kashmir ?, Kumaun to Arunachal Pradesh). S.E. Tibet.

This species has to be now excluded from the flora of North Western Himalaya. Duthie (1906) quoted two specimens. *Inayat* 24103 (DD) from Ralam Valley Kumaun and *Winterbottom* 742 (K) from Tishung Pass, Baltistan Kashmir. Both these specimens are based on wrong identification. *Inayat* 24103 was found to be an altogether different species (see Fig. 96). Dr. J. Renz informed us that *Winterbottom's* 742, 743 belong to *Herminium monorchis* (L.) R. Br. We are including for the sake of clarity, illustrations provided from a specimen collected by *Bor & Kirat Ram* from Sikkim and identified by V.S. Summerhayes.

**Herminium monophyllum** (D. Don) Hunt & Summerh. in Kew Bull. 20(1): 51. 1966; Raizada et al. 87. 1981.

*Neottia monophylla* D. Don, Prodr. Fl. Nepal, 27. 1825.

*Herminium gramineum* Lindl. Gen. & Sp. Orch. 305. 1835; Hook. f., 6: 131. 1890; Duthie, 200. t. 148. 1906. (Fig. 85)

*Stem* 5-20 cm high. *Leaf* solitary, 6-10 × 1 cm, linear to narrowly oblanceolate, acute. *Spike* 3-9 cm long, laxly may flowered. *Flowers* 2-3.5 mm across, yellow-green, secund. *Bracts* 5 mm long, subulate, little shorter to equalling the ovary, tapering from a broad base to long acuminate entire or trifid apex. *Sepals* the dorsal oblong or broadly ovate, laterals ovate, obtuse, spreading. *Petals* erect, linear, as long as the sepals. *Lip* with a broad concave base and a short narrow upturned apex, basal margins ciliate.

*Flowering*: July - August.

*Distribution*: Himalaya 800-2000 m (Himachal Pradesh to Nepal).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Sahasrtradhara, *Deva* 6200, *Malhotra* 33910; Mussoorie, *Naithani* 985, *Duthie* 17828, 21770(a), 22713, *Pancham Singh* 10326; Camel Back Road, *Renz* 13574; Chakrata, *Bhattacharyya* 16026. **Tehri**-Melkuli, *Bhattacharyya* 31143; Thathure, *Bhattacharyya* 31197.

KUMAUN: **Pithoragarh**-Dharchola, Kali Valley, *Inayat* 24107(a); Shama, Sarju Valley, *Inayat* 24107; Near Sosa, *Duthie* 5997. **Nainital**-Agapatta, *Champion*; Nainital, *Renz* 13589; Dogaon, *Renz* 13582.

HIMACHAL PRADESH: Giri-Fagu Road, Shimla, *Raizada* 14320.

**Herminium monorchis** (Linn.)R. Br. in Aiton, Hort. Kew ed. 2,5: 191. 1813; Hook. f., 6: 128. 1890; Duthie, 196. 1906; Stewart, 71. 1972; Katakai et al. 5: 20. 1984; Renz, 30. 1984.

*Ophrys monorchis* Linn. Sp. Pl. 947. 1753, err. typogr. "*Monochris*"

(Fig. 86)

Aswal 6971

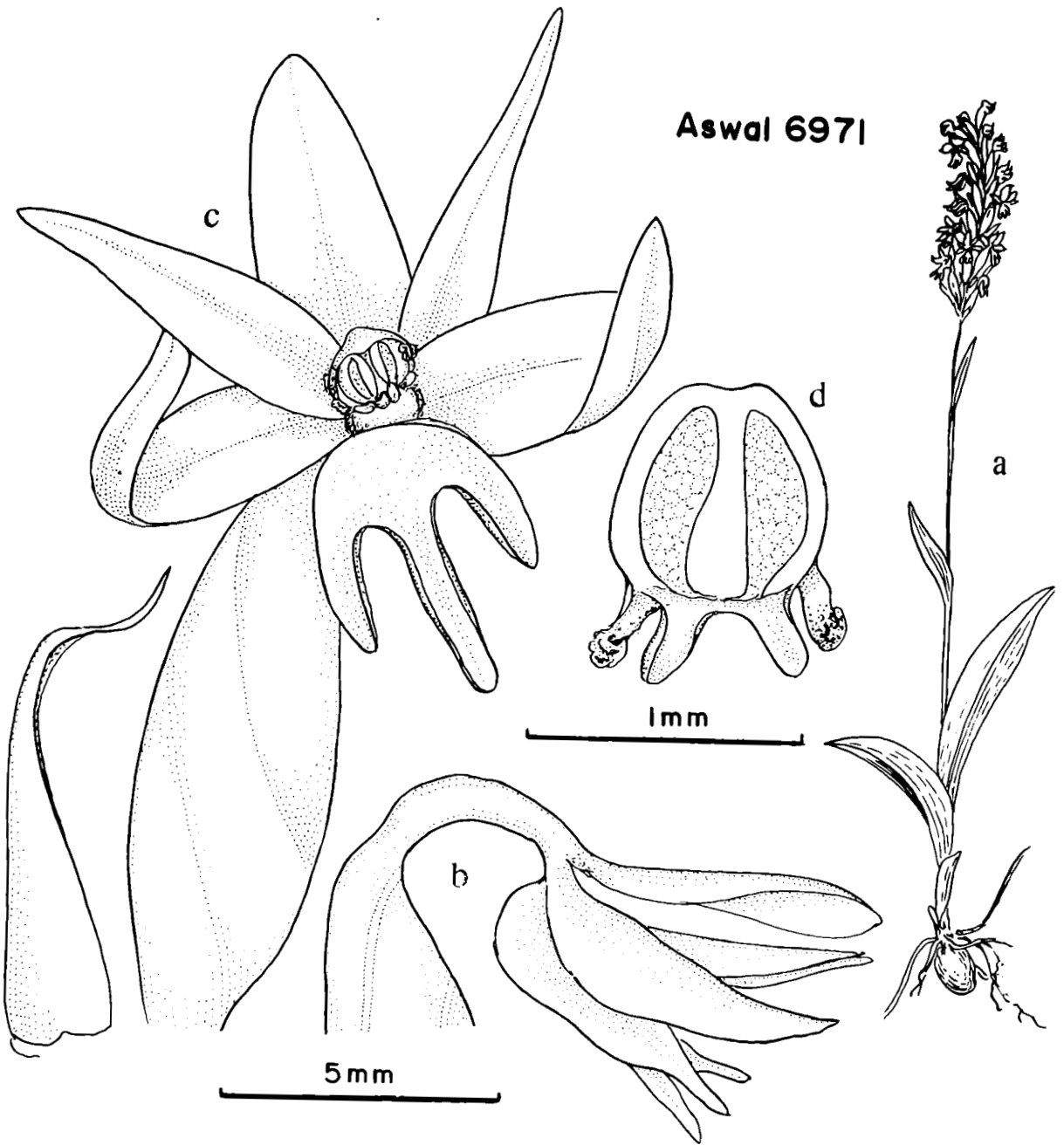


Fig. 86 *Herminium monorchis* (Linn.) R. Br.—a. plant; b. & c. flower; d. column.

*Stem* 7.5-15 cm high. *Leaves* 2-3, near the base, 2.5-10 cm long, oblong-lanceolate, acute, glossy. *Spike* 2.5-5 cm long, densely flowered, cylindrical or sub-secund. *Flowers* yellowish-green, 4-6 mm in diameter, fragrant (like musk). *Bracts* lanceolate, acuminate, short or equal to the ovary. *Sepals* 3 mm long, oblong-obtuse or sub-acute, lateral pair narrower. *Petals* connivent with the sepals and little longer. *Lip* as long as the petals concave at base, 3-lobed; lateral lobes half to almost equal to the midlobe, diverging; midlobe obtuse, almost of the same breadth from base to the apex.

*Flowering*: July - August.

*Distribution*: Himalaya 3-4000 m (Pakistan, Kashmir to Arunachal Pradesh). East Tibet, Siberia, W. & N. China, Korea, Japan.

*Specimens examined*:

GARHWAL: **Chamoli**-Valley of Flowers, *Bhattacharyya* 24322; Bampa, *Naithani* 56055; Dhauri Valley, Nanda Devi Sanctuary, *Hajra* 73399; Badrinath, *Falconer, Mehrotra* 4600.

KUMAN: **Pithoragarh**-Kutti in Byans, *Duthie* 3415; Nagling Dharma Valley, *Inayat* 24106, *G. S. Rawat* 835; Garbyang, *G. S. Rawat* 1478.

HIMACHAL PRADESH: Machu Lahul, *Bor* 16381; Rohtang slop, Lahul, *Aswal* 6971; Lahul, *Bhattacharyya* 40573; Rakcham, *Janardhanan* 52683, 53538; Pangi Chamba, *Harsukh* 23391; Spiti, *Gill* 2043; Bashar between Chitkul and Rani Kanda, *Nair* 34390.

LADAKH: Deskit (Nubra Valley), *Hajra* 74151; Chunagund, *Stewart* 21063.

JAMMU & KASHMIR: Gilgit, *Stewart*; Bagicha to Oldeng Indus Valley, *Stewart* 21004.

PAKISTAN: Hazara, Kaghan, *Inayat* 23169.

**Herminium pugioniforme** Lindl. ex Hook. f., *Fl. Brit. Ind.* 6: 130. 1890; King & Pantl. 333, t. 437. 1898; *Duthie*, 199. 1906; *Stewart*, 71. 1972; *Renz*, 31. 1984. (Fig. 87)

*Stem* 5-17.5 cm. *Leaf* solitary near the base, 2-6 cm long, two to two and a half times longer than broad, oblong to linear-lanceolate, rounded or sub-acute at the apex. *Spike* 1-5 cm long, laxly flowered. *Flowers* 2 mm across, green, few, sub-erect. *Bracts* broadly ovate to sub-orbicular, much shorter than the ovary. *Sepals* the dorsal orbicular, forming with the petals a hood; lateral pair very broad, obtuse. *Petals* ovate, green, concave, the edges crenulate. *Lip* equal in the size to lateral sepals, fleshy, base dilated and with two oval pits, apex elongate, linear-oblong.

*Flowering*: August.

*Distribution*: Himalaya 3500-4500 m (Kashmir to Sikkim). S.E. Tibet.

*Specimens examined*:

GARHWAL: **Uttarkashi**-Dudhu glacier, *Srikanta, Duthie* 517.

HIMALCHAL PRADESH: South Rotang Slopes, *Bhattacharyya* 40492.

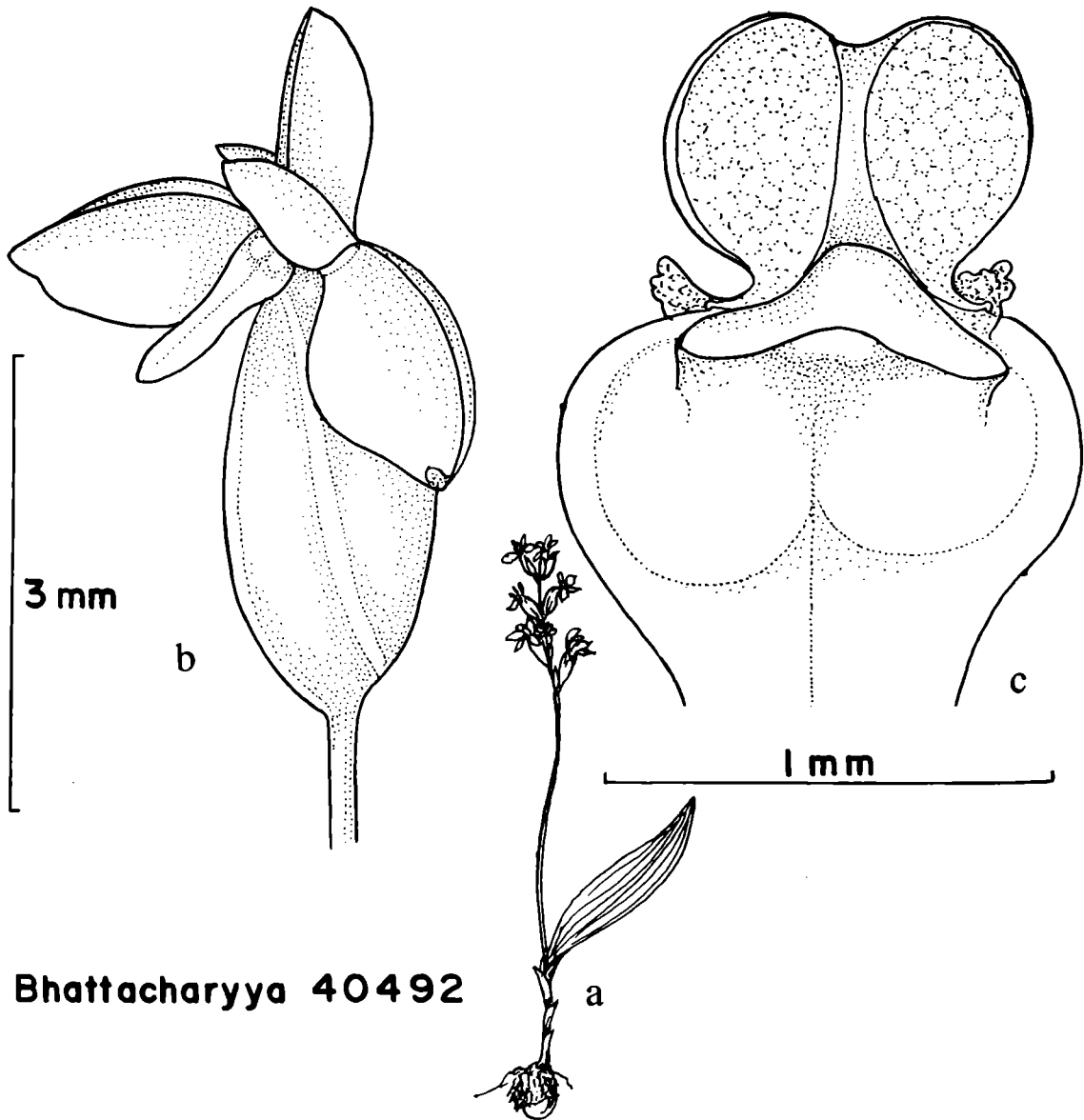
KASHMIR: Khilanmarg, Kolaloi (*Stewart, loc. cit., Renz loc. cit.*)

#### Species imperfectly known

**Herminium jaffreyanum** King & Pantling in *J. As. Soc.* 65(2): 130. 1896; King and Pantling 33, pl. 436. Haber 1898.

*Habenaria jaffreyanum* Seidenf. & Arora, *Nord. J. Bot.* 2(1): 19, 1982 (Typographical error).

We have seen no material of this taxon.



Bhattacharyya 40492

Fig. 87 *Herminium pugioniforme* Lindl. ex Hook. f.—a. plant; b. flower; c. column & part of lip.



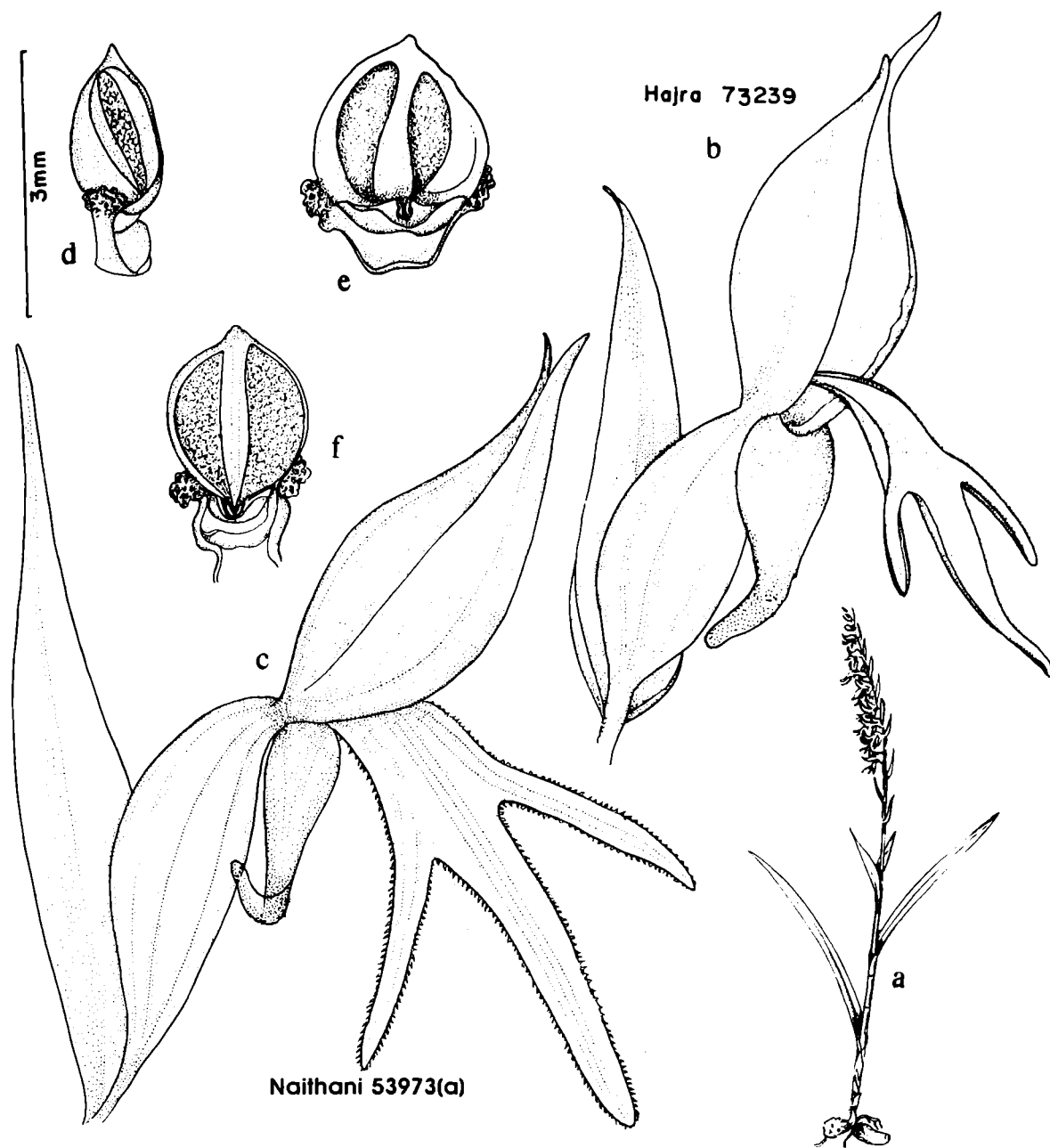


Fig. 88 *Neottianthe calcicola* (W.W. Sm.) Schlecht. —a. plant; b. & c. flower; d., e. & f. column.

Duthie 3421

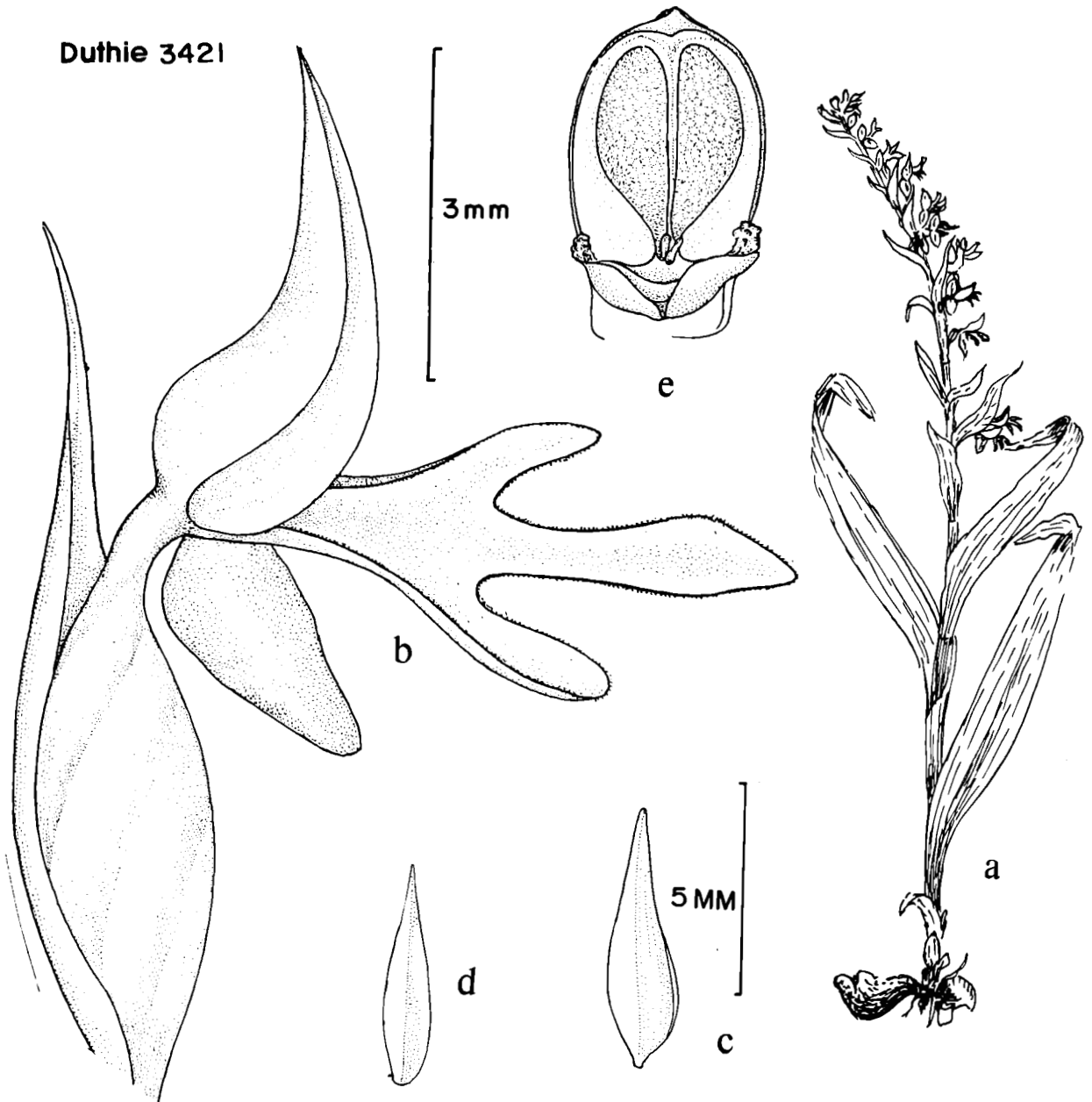


Fig. 89 *Neottianthe secundiflora* (Hook. f.) Schltr.-a. plant; b. flower; c. sepal; d. petal; e. column

**Neottianthe (Rchb.) Schltr.**

Slender plants with globose tuberoids. *Leaves* 2, basal or on lower part of stem. *Inflorescence* secund, few- to many flowered. *Flowers* pink or white. *Sepals* and *petals* loosely connivent. *Lip* about as long as sepals, apical half 3-lobed, with straight or curved spur shorter than ovary. *Column* with more or less parallel anther-cells; *pollinia* 2 with short caudicles, each with a large viscid gland; stigma concave; staminodes small. *Ovary* sessile, twisted, glabrous.

**Key to species**

1. Lip bent downwards; spur tapering downwards, faintly incurved ..... *N. calcicola*  
+ Lip boat shaped; spur conoidal curved forwards ..... *N. secundiflora*

**Neottianthe calcicola** (W.W.Sm.) Schltr. in Acta Horti. Gothoburg. 1: 136. 1924; Hara et al. 1: 49. 1978; Rawat & Pangtey, 1005. 1985.

*Habenaria secundiflora* Hook. f., Fl. Brit. In. 6: 165. 1890 p.p.

*Gymnadenia calcicola* W.W.Sm., in Notes Roy. Bot. Gard. Edinb. 88: 188. 1924 (Fig. 88)

Plant 8-12 cm long, erect or slightly curved. *Leaves* 2, lanceolate or oblanceolate to sub-linear, 4-8 × 0.5-1 cm, obtuse to acute. *Spike* 4 cm long, usually 6-12 flowered. *Bracts* ovate-lanceolate, 1-1.2 cm long, smaller than the flowers but exceeding the ovary. *Flowers* secund. *Sepals* more or less 7 mm long. *Lip* 3-lobed at the middle or near the base, lobes linear, midlobe 4 mm long, sidelobes more or less 3 mm long, bent downwards. *Spur* more or less 5 mm long, faintly incurved, apex contracted.

*Flowering*: August.

*Distribution*: Himalaya 3700-3800 m (Garhwal to Nepal, Bhutan). S. Tibet, W. China.

*Specimens examined*:

GARHWAL: Chamoli-Way to Dunagiri, Naithani 53973(a); Dibrughat to Deodi, Nanda Devi National Park, Hajra 73239.

KUMAUN: Pithoragarh-Balchhi-Dhura, G.S. Rawat 1185; Chhiyalekh, G.S. Rawat 1510.

**Neottianthe secundiflora** (Hook. f.) Schltr. in Fedde, Repert. 16: 291. 1919; Kataki et al. 5: 24. 1984.

*Habenaria secundiflora* Hook. f., Fl. Brit. Ind. 6: 165. 1890 p.p.; King & Pantl. 330, t. 433. 1898; Duthie, 194. 1906.

*Peristylus secundiflorus* (Hook. f.) Kranzl. Orch. Gen. Sp. 1: 518. 1898.

*Gymnadenia secundiflora* (Hook. f.) Kranzl. Orch. Gen. Sp. 936. 1901.

*Orchis secundiflorus* (Hook. f.) Pradhan, Ind. Orch. 1: 47. 1976 (Fig. 89)

Plant 10-25 cm high. *Stem* with a few small sheaths at the base. *Leaves* 2 or 3, distant, 5-12.5 cm long, linear acuminate. *Spike* up to 10 cm long. *Flowers* pink, secund, crowded, about 10 mm long. *Bracts* lanceolate, acuminate, margin ciliolate, longer than ovary. *Sepals* 5 mm long, sub-equal, lanceolate. *Petals* linear, sub-acute, falcate, minutely papillose, connivent with the sepal to form a hood over the column, *Lip* as long as the sepals, boat shaped, deflexed widening towards the 3-lobed apex; lateral lobes triangular, not divergent; midlobe longer, oblong, acute. *Spur* 3 mm long, shorter than the ovary, conoidal, curved forwards, *Column stigmas* united forming a horizontal band.

*Flowering*: September.

*Distribution*: Himalaya 3000-4000 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. E. Tibet.

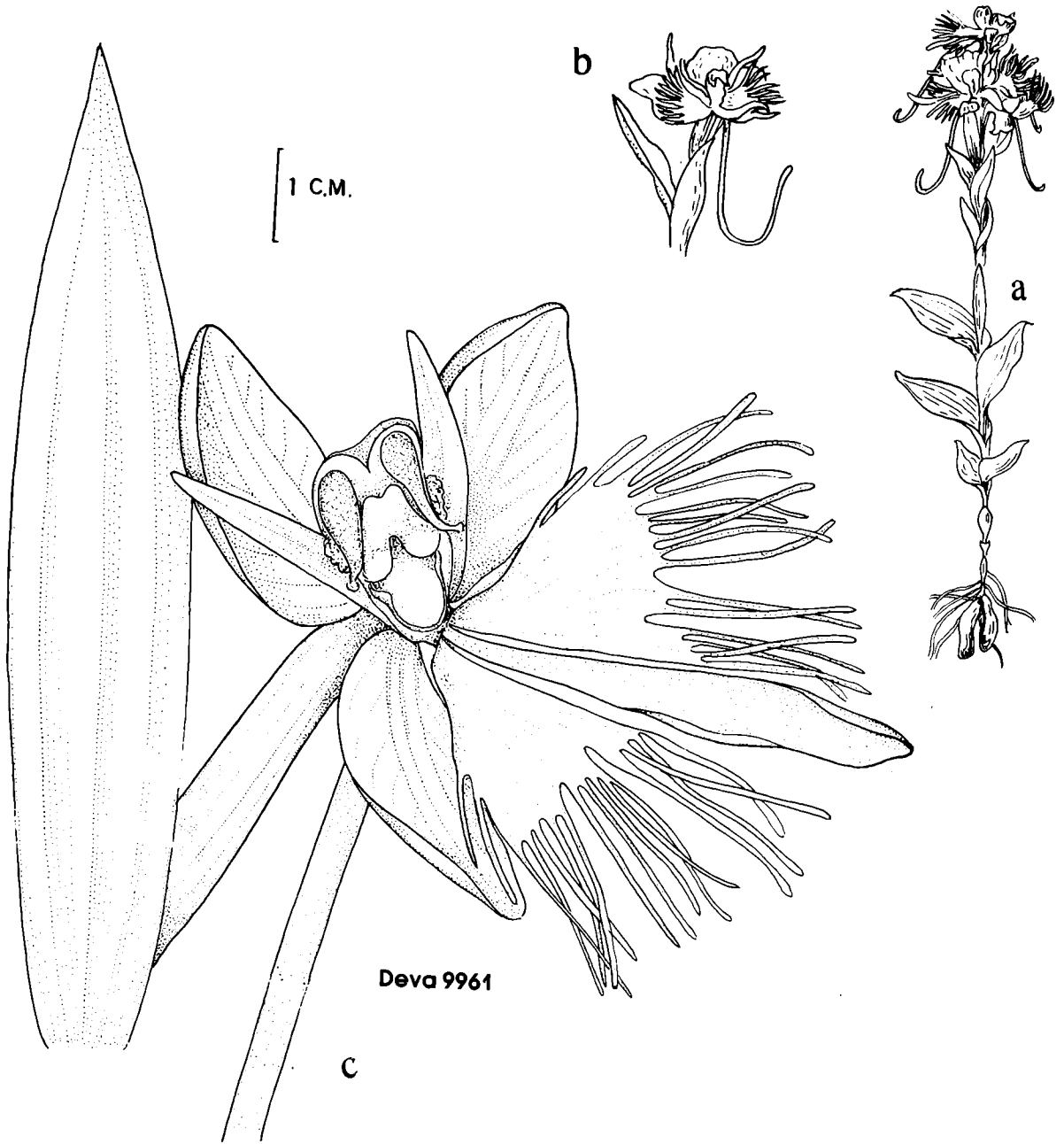


Fig. 90 *Pecteilis gigantea* (J.E. Sm.) Rafin— a. plant; b. & c. flower.

*Specimens examined:*

KUMAUN: Pithoragarh-Sosa, Duthie 3421.

**Pecteilis Rafin.**

Robust, terrestrial plants with large tuberoids. *Leaves* cauline, crowded below the middle of the stem. *In-florescence* few-flowered. *Flowers* large, white or greenish, strongly fragrant. *Sepals* sub-equal. *Petals* linear. *Lip* larger than sepals, spurred, sub-entire or 3-lobed, side lobes much larger, entire or at the outer margins lacinate, midlobe linear-ligulate. *Column* stout; *anther* with broad connective, anther cells diverging and tapering into long canals; *stigma* 2 with fleshy swellings, fused with the edges of the stigmatic cavity. *Ovary* elongated, twisted.

**Key to species**

1. Lateral lobes of the lip deeply lacinate, midlobe longer than the lateral lobes; flowers large, sepals 4-5 cm long, petals acute, spur more than twice the length of the ovary ..... *P. gigantea*
- + Lateral lobes of the lip fan shaped, entire or slightly dentate, not lacinate, midlobe shorter than the lateral lobes, flowers smaller, sepals 2 cm or less long, petals obtuse, spur equal to slightly longer than the ovary ..... *P. triflora*

***Pecteilis gigantea*** (J.E. Smith) Rafin, Fl. Tell. 2: 38. 1836; Seidenf. & Arora 2: 23. 1982; Renz, 40. 1984.

*Orchis gigantea* J.E. Smith, Exot. Bot. 2: 79, t. 100. 1805.

*Habenaria gigantea* D. Don, Prodr. Fl. Nepal 24. 1825.

*Habenaria susannae* auct. non (Linn.) R. Br. Prodr. 312. 1810; Hook. f., 6: 137. 1890; Collett. 501, 1902; Duthie, 178. t. 129; Stewart, 71. 1972.

*Platanthera gigantea* Lindl. ex Wall. Cat. n. 7052. 1832. *nom. nud.*

*P. susannae* auct. non (Linn.) Lindl. Gen. & Sp. Orch. 295. 1835; Sant. & Kapadia, 42, pl. 7. 1966.

(Fig. 90)

Stout herb, 60-120 cm high. *Stem* with many funnel shaped sheaths on its lower portion. *Leaves* 5-18 × 2-7 cm, ovate-oblong or oblong-lanceolate, acute, glabrous. *Raceme* 2-6 flowered, 16-20 cm long. *Flowers* 6-10 cm across, white, strongly fragrant. *Bracts* longer than the ovary. *Sepals* 4-5 cm long, spreading, white, entire, the dorsal one sub-orbicular, lateral pair sub-quadrately oblong, obtuse. *Petals* 3-4 cm long, linear, falcate, acute. *Lip* 5 × 9 cm, white, 3-cleft, midlobe simple, tongue like, side lobes split up in 10-16 thin long linear-filiform segments. *Spur* 8-11 cm long, pale-green, obtuse. *Column* 7 mm long, white, oblong.

*Flowering:* September — November.

*Distribution:* Himalaya up to 2000m (Pakistan, Kashmir to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Bengal, Bihar, Madhya Pradesh, W. Ghats, N. Kanara, Konkan. Burma, China, Vietnam, Campuchea, Laos, Malaya, Java, Thailand.

*Specimens examined:*

GARHWAL: Dehra Dun-Below Mussoorie, Mackinnon 22981; Saia, Chakrata, Gamble 25031; Dehra Dun Valley, Mothronwala, Deva 4834; Siwalik, Mansa Devi, Deva 9961. Tehri-Algar Valley, Duthie 1195. Uttarkashi-Between Dharsu and Dhoonda, Duthie 2066. Pauri-Ransi, Pauri, Naithani 3859.

KUMAUN: Pithoragarh-Chowkori berinag, Osmaston 1501; Khela, Kali Valley, Narayana 31, Inayat, Darchula, Inayat 24062, Kali Valley, Duthie 3410. Nainital-Ramgarh, Davidson. Almora-Near Naruwakighol, Awasthi 1429.

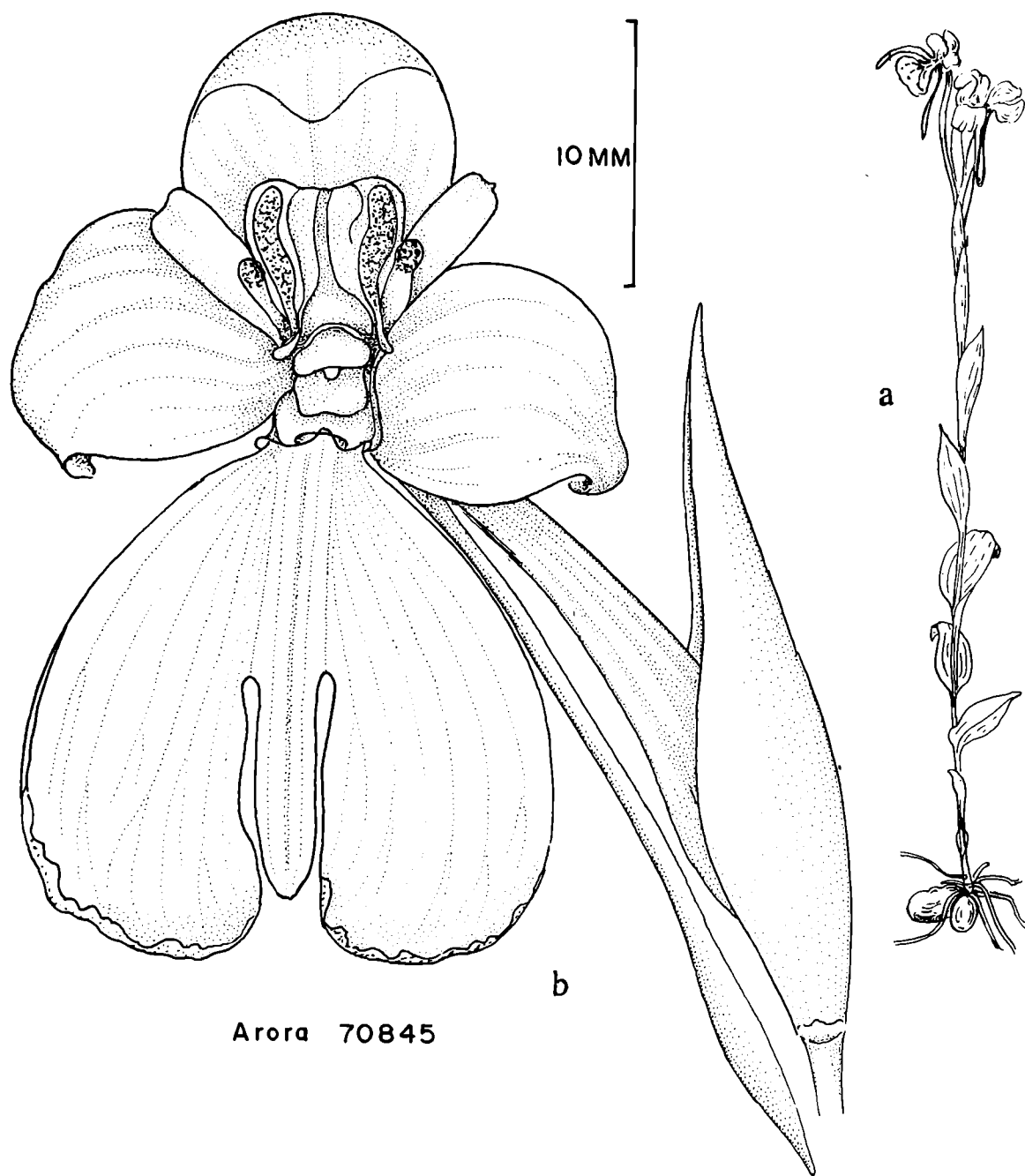


Fig. 91 *Pecteilis triflora* (D. Don) Tang & Wang—a. plant; b. flower.

HIMACHAL PRADESH: Shimla Hills, *Drummond* 715; Khreyound, Shimla, *Kirat Ram*; Hamirpur, *Vishwanathan* 61425.

PAKISTAN: Below Murree; Panjar, Rawalpindi District (Stewart, *loc. cit.*; Renz, *loc. cit.*)

*P. gigantea* is one of the most beautiful orchid from our flora. We agree with Santapau & Kapadia (1966) that it deserves a place in our gardens and it is one of the easiest plant to grow under artificial conditions. Its flowers are showy, very large and most sweetly and strongly scented.

In wild its tubers are uprooted and eaten by wild pigs.

***Pecteilis triflora*** (D. Don) Tang & Wang in Acta Phytotax. Sin. 1: 62. 1951.

*Habenaria triflora* D. Don, Prodr. Fl. Nepal, 25. 1825; Hook. f., 6: 142. 1890; Duthie, 182. t. 133. 1906.

*H. uniflora* Buch.-Ham. ex D. Don, Fl. Nepal, 25. 1825; Hook. f., 6: 166. 1890.

*Platanthera candida* Lindl. Gen. & Sp. Orch. 295. 1835.

*P. triflora* (D. Don) Pradhan, Ind. Orch. 1: 57. 1976.

*P. uniflora* (D. Don) Lindl. Gen. & Sp. Orch. 295. 1835.

*Pecteilis candida* (Lindl.) Schltr., in Fedde, Repert. Beih. 4: 120. 1919.

*Habenaria dentata* sensu Arora in Bull. bot. Surr. Ind. 14: 155. 1972. *non* (Sw.) Schltr; Subram. & Nair in Proc. Ind. Acad. Sci. B. 78: 1-5. 195. 1973. (Fig. 91)

*Stem* 30-45 cm high, leafy throughout, stout. *Leaves* 2.5-7.5 cm long, ovate-lanceolate, acute, the upper narrower and acuminate. *Flowers* 1-3, shortly pedicelled, white. *Bracts* leaf like, keeled. *Sepals* about 2 cm long, strongly veined, the dorsal ovate, rounded; lateral pair falcately lanceolate. *Petals* small, linear-obtuse, 1-nerved. *Lip* flabelliform, about 3 cm long, 3-partite about the middle, gibbous at the base, lateral lobes fan shaped, entire or slightly dentate not laciniate, base with two deltoid calli, midlobe shorter than lateral lobes, linear-lanceolate, acute. *Spur* slender, equal to or slightly longer than the ovary, slender, straight, flattened near the tip.

*Flowering*: August - September

*Distribution*: Himalaya up to 1200 M (Garhwal to Nepal), Bihar.

*Specimens examined*:

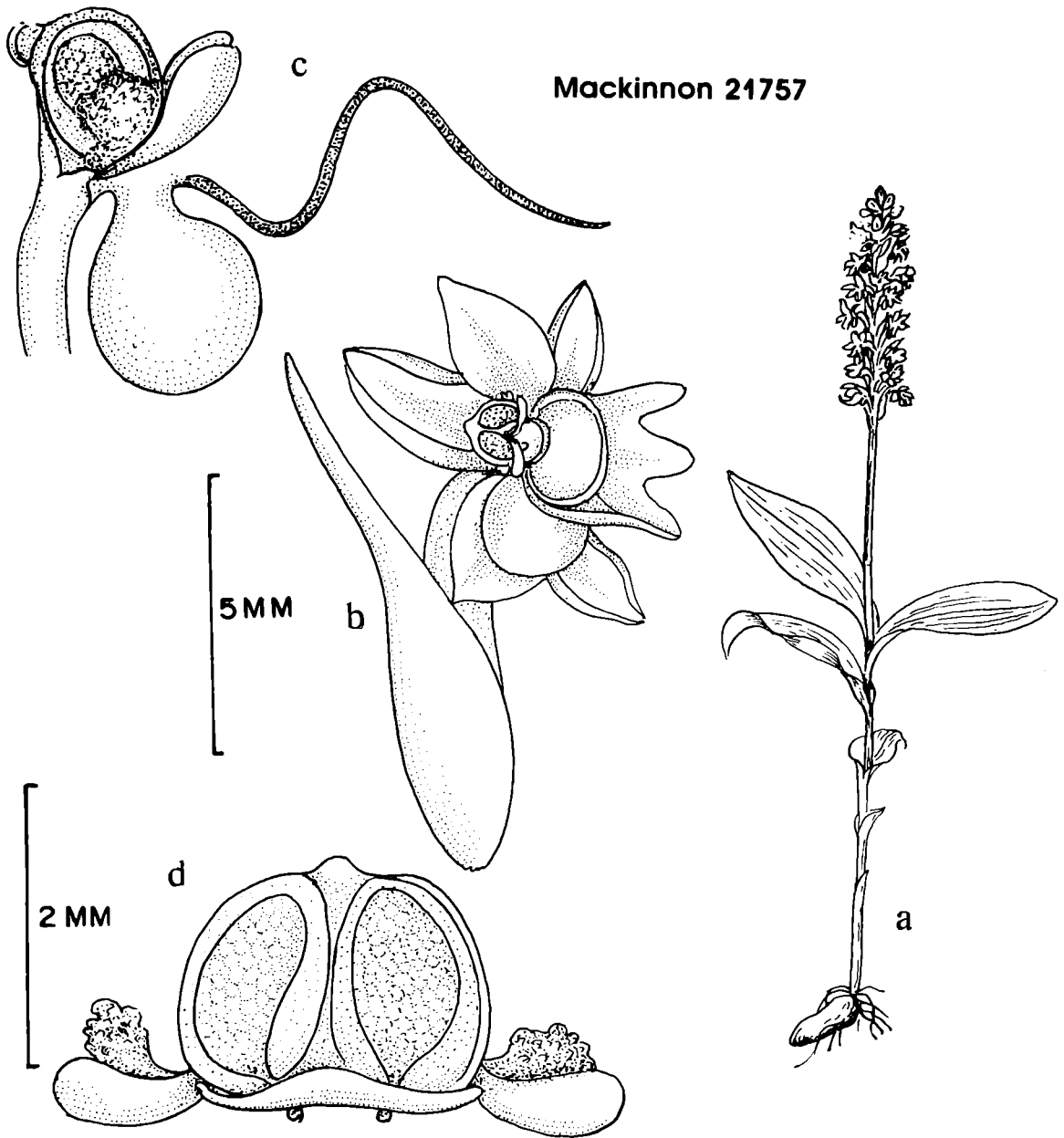
GARHWAL: **Dehra Dun**- Tons Valley, Jaunsar, *B.B. Osmaston* 23102. **Tehri-Tehri** district, *Mackinnon's collector* 25419. **Chamoli**-Badrinath, *Falconer*.

KUMAUN: **Pithoragarh**-Askot, *Duthie* 5995; Berenag to Ganai, *Parker*, Thal, *Arora* 41307; Dafiadhura, *Arora* 70845. **Almora**-Bageshwar, *Arora* 41302.

*P. Triflora* has been confused by Arora (155, f 1-5. 1972) with *Habenaria dentata*. The former is a very distinct plant with 1-3 flowers in the inflorescence while the latter has many small flowers. It is common in Nepal but has not been so far reported from our area. Plants of *H. dentata* from Nepal are very similar to the drawing in Seidenf., fig. 60. 1977.

#### **Peristylus Bl.**

Generally small terrestrial plants with entire tuberoids. *Leaves* basal or scattered evenly on the stem or crowded near the middle. *Inflorescence* many flowered, sometimes sub-second. *Flowers* small, greenish or white. *Sepals* and *petals* connivent. *Lip* shorter, equalling or longer than the sepals, entire or 3-partite, with a short (rarely longer) globose or cylindrical spur. *Column* short, anther canals short or even insignificant; stigmata separated firmly united with the edges of the base of lip and staminodes.



**Fig. 92** *Peristylus affinis* (D. Don) Seidenf. — a. plant; b. flower; c. column & spur; lip cut vertically; d. column.



## Key to species

1. Lip tripartite, with 3 distinct lobes.....2
- + Lip simple, elliptic, triangular or orbicular-ovate.....8
2. Spur globular, flowers white, leaves clustered at middle of the stem.....3
- + Spur ovate-obovate, leaf solitary or if more approximate towards the base.....6
3. Lip divided to the middle, lobules all slender almost equal, linear-lanceolate, petals 10-12 mm long, tubers hairy, plants 50-70 cm high, leaves ovate-elliptic, base much narrowed to broad petiole, inflorescence dense nearly cylindrical ..... *P. constrictus*
- + Lip divided one third of its length, lateral lobules ovate or linear-ovate broad, petals less than 6 mm. ....4
4. Tubers glabrous, leaves membranous, narrowly lanceolate or elliptic, 6-8 times longer than broad, flowers small, lateral sepal 1.5-2.5 mm, plants slender, 15-25 cm high, lip near the base with a short ciliate callus, caudicles as long as pollinia ..... *P. lawii*
- + Tubers hairy, leaves almost coriaceous, ovate or ovate-elliptic, 2-3 times longer than broad, flowers larger, lateral sepals 3-6 mm long, plants stout, 30-60 cm high, lip near the base without ciliate callus, but with a papillous area or a short triangular nectary, caudicle of pollinia almost none.....5
5. Basal half of the lip concave forming a pouch with a wide opening into the spur, a papillous area in front of entrance to spur, petals slightly broader than the lateral sepals, lateral sepals about 3 mm long, plants as compared to the next smaller in all its parts.....*P. affinis*
- + Basal half of the lip almost flat with a minute opening into the spur, a triangular nectary in front of the entrance to spur, petals much broader than the lateral sepals, lateral sepals 5-6 mm long.....*P. goodyeroides*
6. Leaf solitary, basal portion of lip flat, lateral lobes oblong, obtuse, spur 2-ribbed inside .....7
- + Leaves 2 or 3 approximate towards the base of the stem, basal portion of lip trough-shaped, lateral lobes linear, spur without ribs inside; ovary curved with a beak .....*P. elisabethae*
7. Lip equal to or slightly longer than the sepals, lateral sepals lanceolate or elliptic-lanceolate .....*P. fallax*
- + Lip shorter than sepals, about two-third of their size, lateral sepals ovate with a broad base .....*P. fallax* var *dwaikaii*
8. Lip triangular or orbicular ovate, little shorter or equal to the lateral sepals, margin entire .....*P. duthiei*
- + Lip elliptic, with almost parallel sides for 2/3 of the basal portion, longer than the lateral sepals ..*P. duthiei* var *inayatii*

**Peristylus affinis** (D. Don) Seidenf., in Dansk Bot. Arkiv. 31, 3: 48. fig. 23. 1977; Kataki et al. 5: 27. 1984.

*Habenaria affinis* D. Don, Prod. Fl. Nepal 25. 1825.

*H. goodyeroides* Hook. f., Fl. Brit. Ind. 6: 161. 1890 auct. p.p.

*H. goodyeroides* var *affinis* King & Pantl. in Ann. Roy. Bot. Gard. Calc. 8: 327, t. 430. 1898; Duthie, 193. 1906.

*Peristylus goodyeroides* var *affinis* (King & Pantl.) Cooke, Fl. Pres. Bombay 712. 1908 (Fig. 92)

Plant 30 cm high. *Leaves* clustered above the lower third of the stem, 4-8 cm long, ovate or ovate-elliptic, acute, narrowed to the base. *Spike* 15 cm long, erect, rather lax. *Flowers* 6-7 mm long, white or pale greenish-yellow. *Bracts* lanceolate, acuminate, longer than the ovary. *Sepals* unequal, the dorsal broadly ovate, lanceolate, concave, connivent with the petals and forming a hood, the lateral pair about 3 mm long, oblong, involute, mucronate. *Petals* slightly broader than the lateral sepals, trapeziform, blunt. *Lip* longer than petals, basal half concave forming a pouch, with a wide opening in to the spur also a papillous area

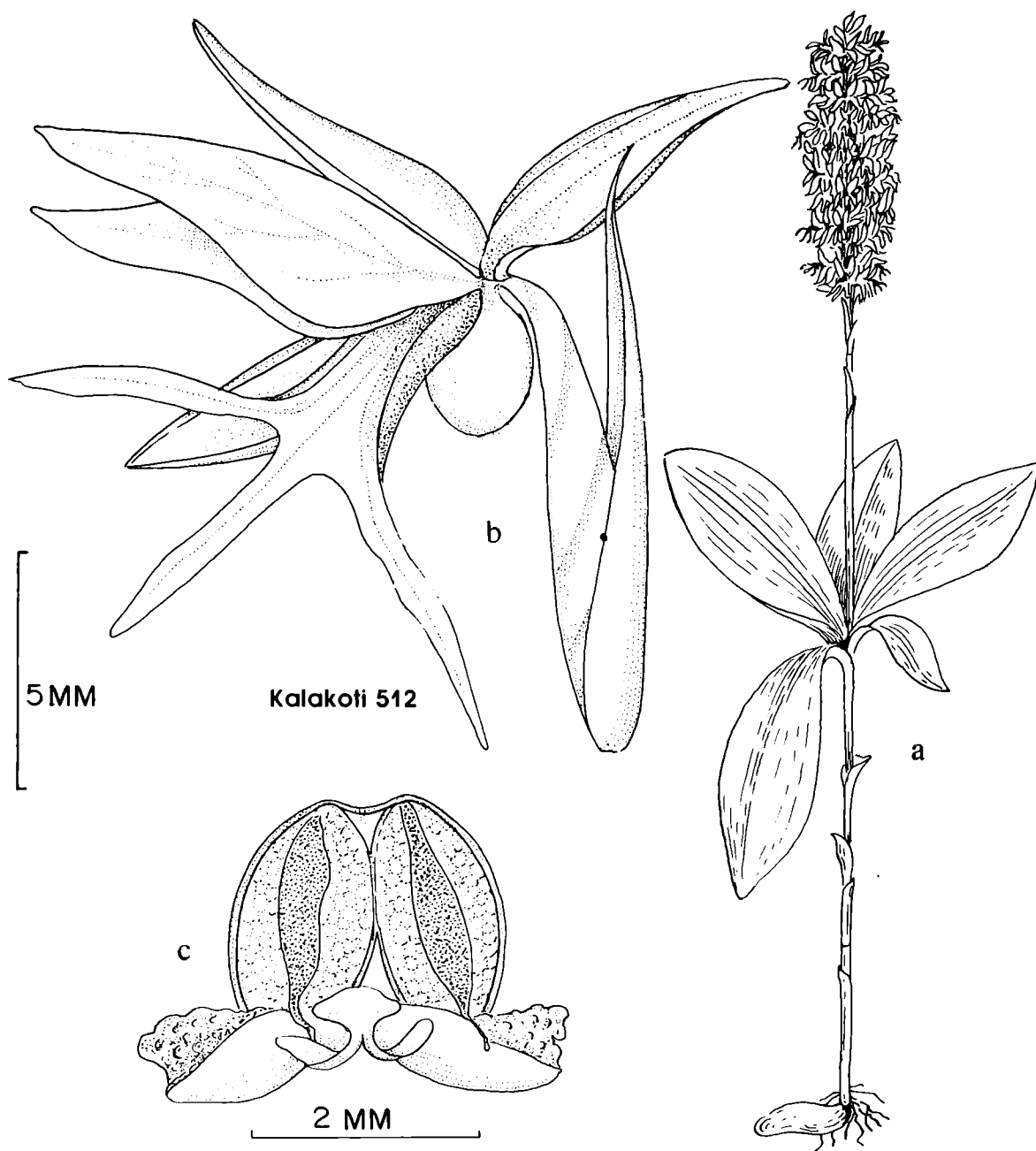
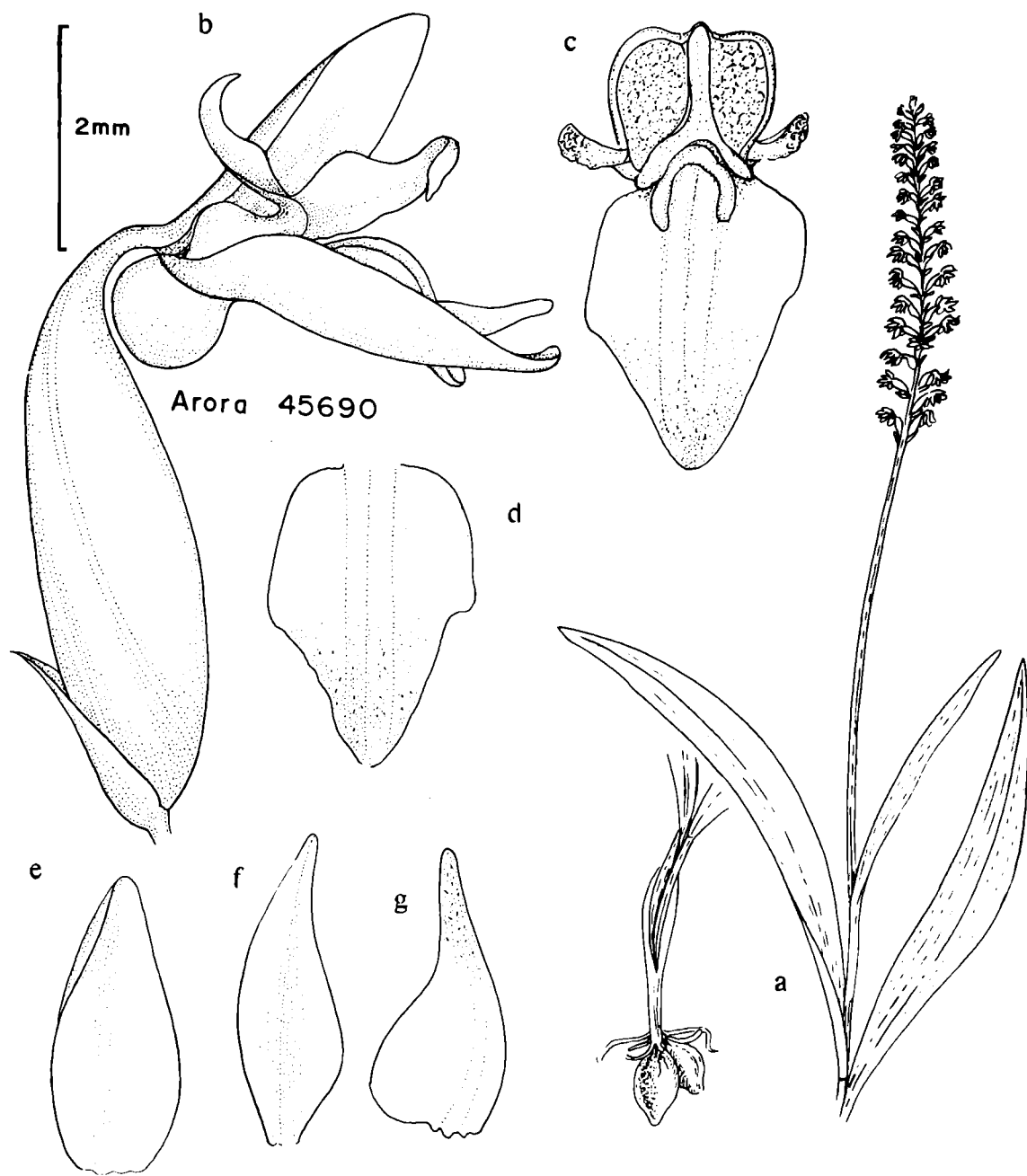


Fig. 93 *Peristylus constrictus* (Lindl.) Lindl.—a. plant; b. flower; c. column.



**Fig. 94** *Peristylus duthei* (Hook. f.) Deva & Naithani—**a.** plant; **b.** flower; **c.** column & lip; **d.** lip; **e.** dorsal sepal; **f.** lateral sepal; **g.** petal.

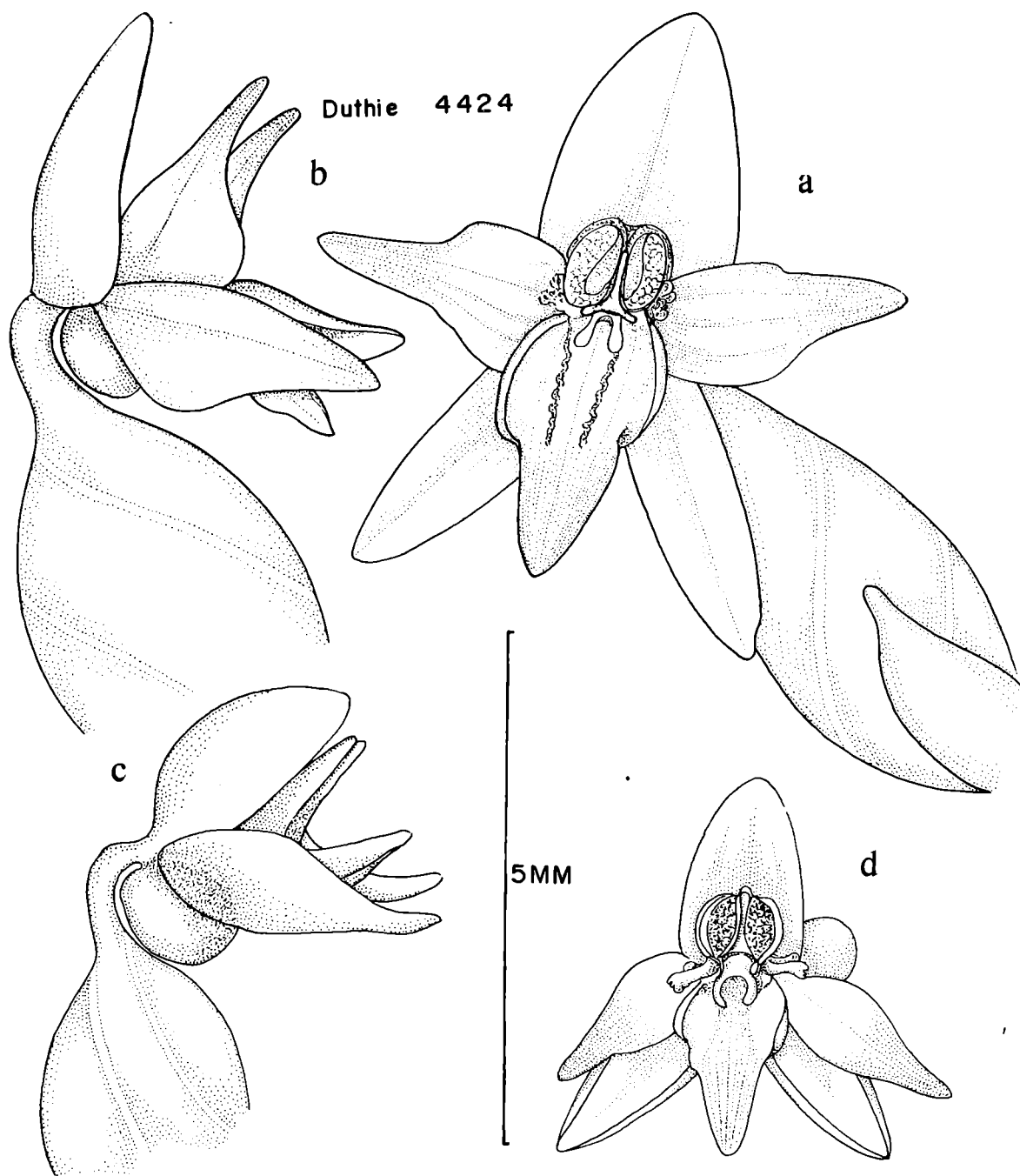


Fig. 95 *Peristylus duthei* (Hook. f.) Deva & Naithani—a, b, c. & d. flower.

in front of entrance to spur, 3-lobed, midlobe broad, blunt, laterals oblong, slightly longer than midlobe. *Spur* globular.

*Flowering*: July - August

*Distribution*: Himalaya up to 2200 m (Himachal Pradesh, Garhwal, Nepal, Sikkim, Arunachal Pradesh), Meghalaya, Nagaland, Manipur. China, Laos, Thailand.

*Specimens examined*:

GARHWAL: Dehra Dun-Mussoorie, *Duthie* 17826, *Mackinnon* 21757, 22729; Near the School house, *Jameson*.

HIMACHAL PRADESH: Chamba, Kuntha forest, *Lace* 1814.

This species is quite often treated as a variety of *P. goodyeroides* and sometimes even completely merged with it viz. Hara et al. (1978). We found it to be quite distinct like *Seidenfaden* (1977). The flowers as well as whole plant is smaller and the basal portion of the lip has a clear concave pouch with a wide opening to the spur. While *P. goodyeroides* is a much bigger plant, with larger flowers and a flat lip with a minute opening to the spur.

***Peristylus constrictus*** (Lindl.) Lindl. Gen. & Sp. Orch. 300. 1835; *Seidenf.*, 46. f. 20. 1977; *Kataki et al.* 5: 27. 1984.

*Orchis leucantha* Buch-Ham. Mss., *nom. nud.*

*Herminium constrictum* Lindl. in Edw. Bot. Reg. 18: sub t. 1499. 1832.

*Habenaria constricta* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 161. 1890; King & Pantl. 325. t. 429. 1898; *Duthie*, 193. 1906. (Fig. 93)

*Stem* 50-70 cm high. *Leaves* 5-6, clustered at the middle of the stem, 7-18 cm long, ovate-elliptic, acute or acuminate, base much narrowed to broadly petioled. *Spike* broadly cylindrical, up to 30 cm long, many and densely flowered. *Flowers* spreading, white, sweet-scented, 1.5-2 cm across. *Bracts* lanceolate-acuminate, longer than the ovary. *Sepals* equal, oblong, obtuse, ciliate, the dorsal conduplicate, lateral pairs with involute margins, spreading. *Petals* longer than sepals, 10-12 mm long, obliquely ovate-lanceolate, sub-acuminate, widely spreading and pointed upwards. *Lip* as long as the petals, oblong, 3-lobed about the middle, all lobes almost equal, linear, acuminate. *Spur* globular.

*Flowering*: July - August

*Distribution*: Himalaya up to 1200 m (Garhwal to Arunachal Pradesh), Meghalaya, Bihar, Orissa, Madhya Pradesh. Bangladesh, Burma, China, Compuchea, Vietnam, Thailand.

*Specimens examined*:

GARHWAL: Dehra Dun-New Forest, Dehra Dun, *Naithani* 1896; Dehra Dun, *Mackinnon's collector*; Asarori Siwalik Range, *Harsukh* 24176.

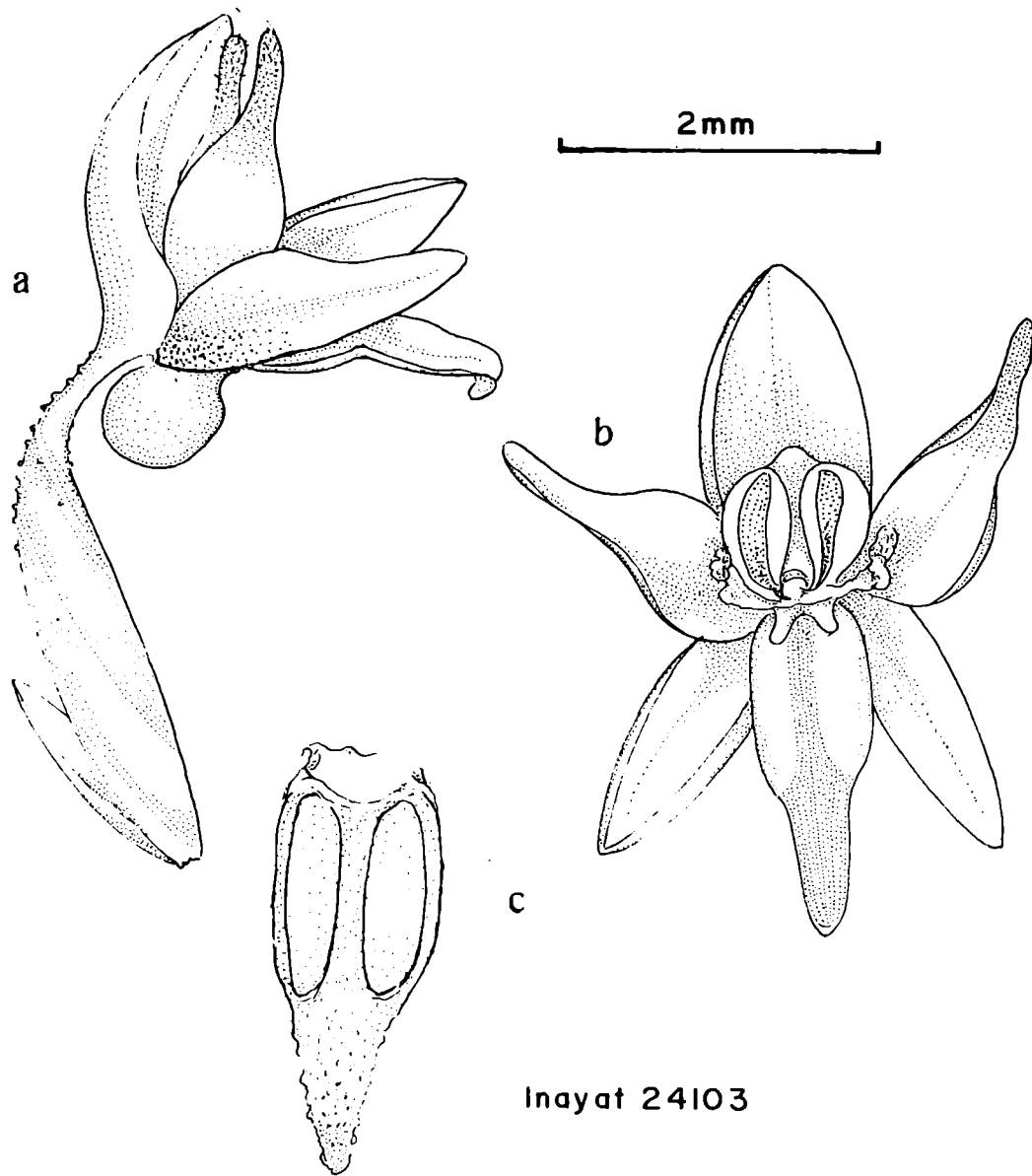
KUMAUN: Pithoragarh-Chowpata-Maitli, *Arora* 52462, 70814; Dafiadhura, *Arora* 49525; Ghat, *Arora* 38891. Nainital-Gogaon, Nainital, *Kalakoti* 512.

***Peristylus duthiei*** (Hook. f.) Deva & Naithani *comb. nov.*

*Herminium duthiei* Hook. f., Fl. Brit. Ind. 6: 130. 1890; *Duthie*, 199. t. 147. 1906; *Renz*, 40. 1984

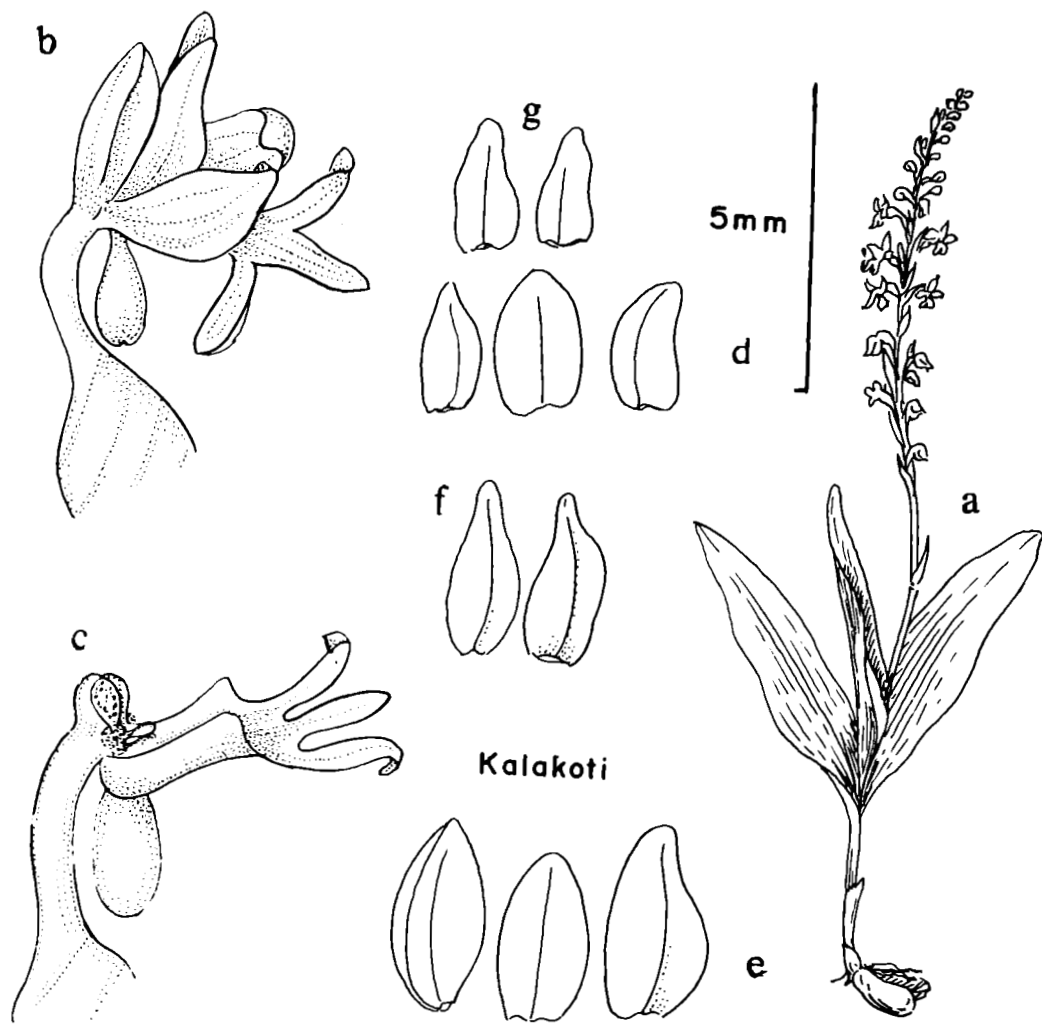
(Fig. 94, 95)

Plant 5-25 cm high. *Leaves* 2-3 from below the middle of the stem, 5-10 cm long, linear or lanceolate, acuminate. *Spike* 2.5-10 cm long, sub-secund, many flowered. *Flowers* pale-green, deflexed, 4 mm across. *Bracts* much shorter than ovary. *Sepal* obtuse, the dorsal broadly oblong, lateral pair smaller, sub-falcate.

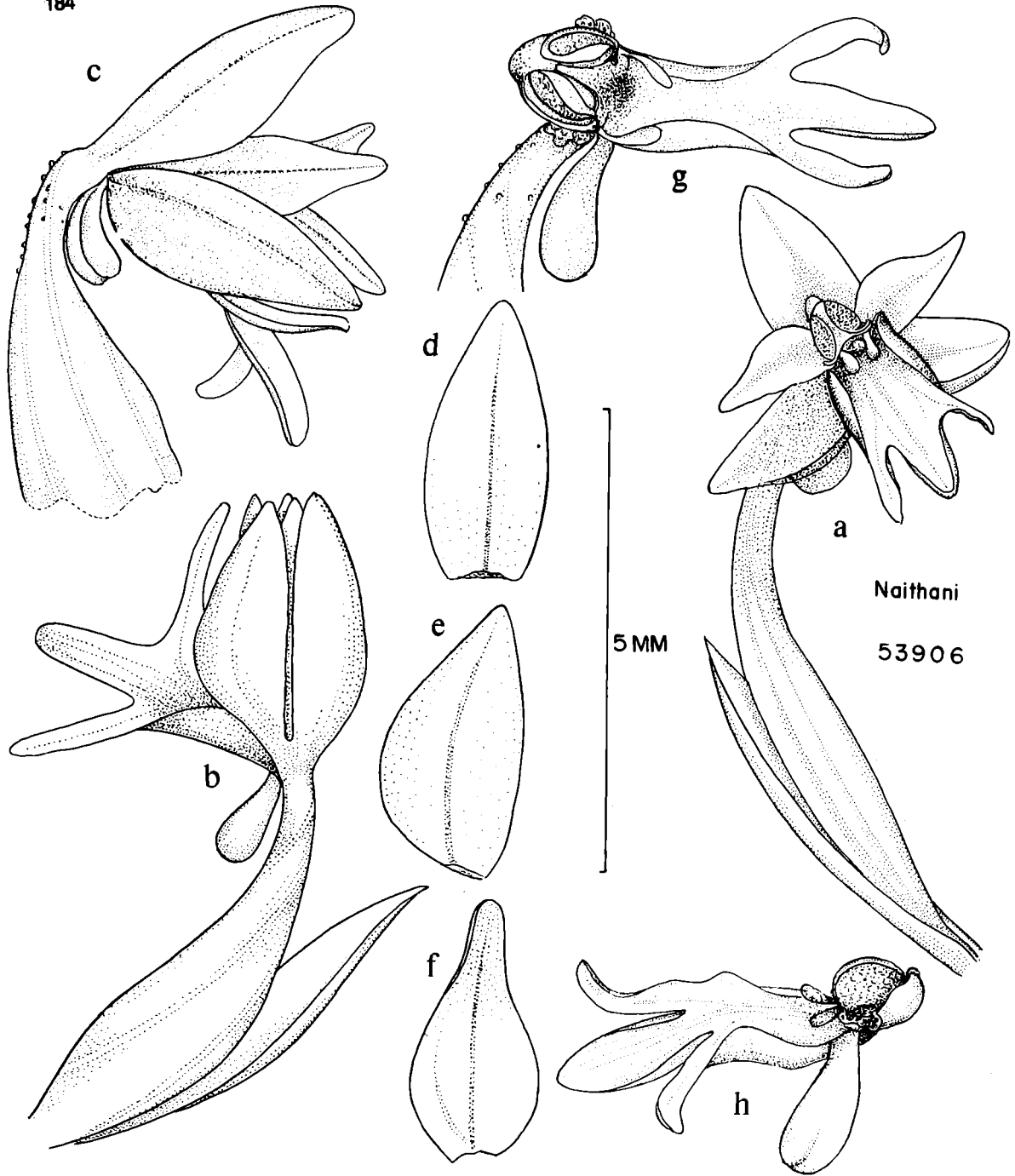


Inayat 24103

Fig. 96 *Peristylus duthei* (Hook. f.) Deva & Naithani; var. *inayatii* Dava & Naithani— a. & b. flower; c. lip.



**Fig. 97** *Peristylus elisabethae* (Duthie) Gupta—**a.** plant; **b.** flower; **c.** lip, column, spur; **d.** & **e.** sepal; **f.** & **g.** petal.



**Fig. 98** *Peristylus elisabethae* (Duthie) Gupta—*a.*, *b.* & *c.* flower; *d.* dorsal sepal; *e.* lateral sepal; *f.* petal; *f.* & *h.* lip, column & spur.



*Petals* ovate or ovate-lanceolate, acute to acuminate, fleshy. *Lip* triangular or orbicular-ovate, obtuse or sub-acute with entire margin, little shorter or equal to the lateral sepals. *Spur* small, globose.

*Flowering*: August - September.

*Distribution*: Himalaya between 2800-4000 m (Garhwal to Nepal).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie King. **Uttarkashi**-Dodital, *Dwarika Prasad. Chamoli*-Badrinath, *Falconer*, Kauari Pass, *Duthie* 4424.

KUMAUN: **Pithoragarh**-Barpha Gori Valley, *Inayat* 24105(a); Kala Moni forest, *Inayat* 24105; Budhi Kali Valley, *Inayat* 24104; Milam, Gori Valley, *Inayat* 24104(a); Kali Valley above Budhi Byans, *Duthie* 6001; Bakriudiyar, *Arora* 45690, 49708.

Hook. f. (1890) pointed out *Herminium* can be distinguished from *Habenaria* by the lip which has never a spur, only a more or less gibbous sac. *Herminium fallax* & *H. duthiei* and some other species appeared to him to be referable to either genus, but these he retained in *Herminium* due to their mountain and alpine habitats. However only eight years later King & Pantling (1898) transferred *Herminium fallax* to *Habenaria*.

The same situation exists about *Herminium duthiei* which also has a small globular but distinct spur and the column of *Herminium*; it is now being transferred to *Peristylus*. The only objection against it can be the presence of a whole simple lip which is entire, while in other species it is trilobed. However Seidenfaden (1977) has a section which includes four species which are quite similar to *Peristylus duthiei* and have only simple lip and a similar column.

Stewart (1972) records this species from Chitral Bundai 4000 m (*Harriss*) in Pakistan. Renz (1984) does not include it.

***Peristylus duthiei* var. *inayatii* Deva & Naithani var. nov.**

(Fig. 96)

Different a *Peristylus duthiei* var. *duthiei* labello quam sepalis lateralibus paulo longiore, anguste elliptico, in dimidio inferiore leniter latiore, lateribus fere parallelis.

**Type**: Sala Udiyar, Ralam Valley, Pithoragarh district (Kumaun), 19.8.1900, *Inayat* 24103 (holotype, DD).

Differs from *P. duthiei* by a narrower elliptic lip with almost parallel sides in the somewhat broader basal half, overtopping slightly the lateral sepals.

There is a single specimen at DD, which was originally identified by Duthie as *Herminium congestum*. We found it to be different.

However the material at our disposal at DD and BSD was not enough and further collections in the region may provide intermediate forms to prove the wide structural range of *P. duthiei*.

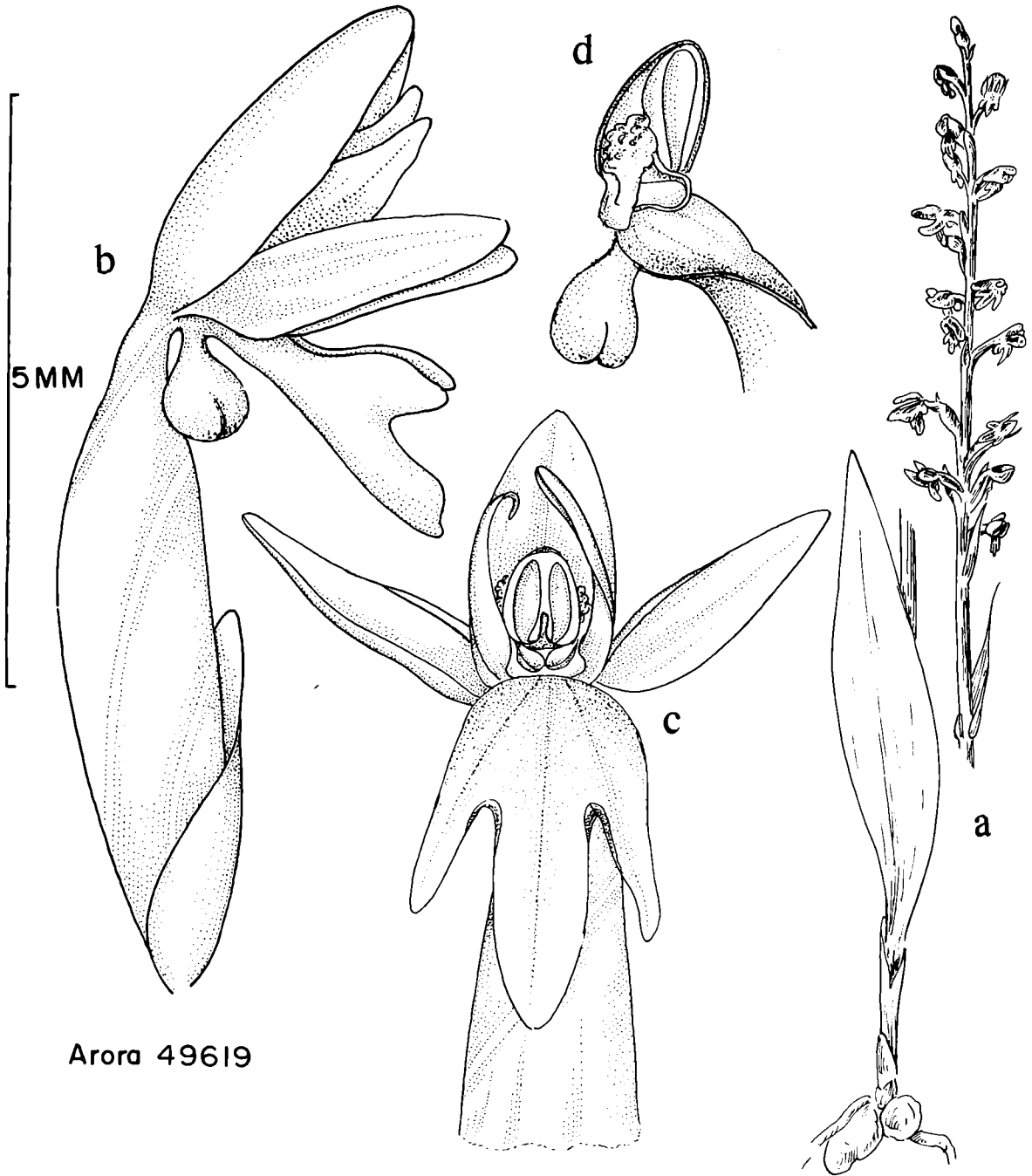
The variety is being named in honour to Khan Bahadur Inayat Ahmad Khan, Duthie's plant collector, who collected the plants in Western Himalaya from Hazara to Kumaun.

***Peristylus elisabethae* (Duthie) Gupta, Fl. Nainital. 351. 1968.**

*Habenaria elisabethae* Duthie in J. As. Soc. Beng. 72(2): 44. 1902; Collett, 505. 1902; Duthie, 191. t. 142. 1906.

*Herminium elisabethae* (Duthie) Tang & Wang in Bull. Fan. Mem. Inst. Biol. 7: 129. 1936. (Fig. 97, 98)

Plant 20-40 cm high. *Leaves* 2-3, usually towards the base of the stem, 6-12 × 1-2 cm, lanceolate, acuminate or the lowest one often obtuse, amplexicaule at the base. *Spike* 15-20 cm long. lax, up to 45 flowered. *Flowers* small, green, crowded, deflexed. *Bracts* lanceolate, acuminate, about half as long as the ovary. *Sepals* erect, connivent, the dorsal ovate, concave, lateral pair obliquely ovate, obtuse. *Petals*



Arora 49619

**Fig. 99** *Peristylus fallax* Lindl. —a. plant; b. & c. flower; d. column, spur and base of the lip.

erect, little longer than sepals, obliquely ovate, obtuse. *Lip* longer than sepals, 3-lobed in the middle, fleshy, basal portion trough-shaped, lateral lobes linear, spreading, mid lobe oblong, obtuse, equal to lateral pair but broader. *Spur* ovate or obovate, longer than broad.

*Flowering*: August.

*Distribution*: Himalaya between 2200-3500 m (Himachal Pradesh to Nepal). Tibet.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 23106, *Mackinnon* 22990. **Tehri**-Nagtibba. *Naithani* 1076, *Mackinnon* 21766, *Ramsukh* 22990(a), *Bhattacharyya* 33731; East of Tehri, *Mackinnon's collector*. **Uttarkashi**-Jamuna Valley Kharsali, *Duthie* 524. **Chamoli**-Trijuginarain, *M.A. Rau* 38747; Kanga area, *Naithani* 53906; Between Ghangaria and Bheuandar village, *Naithani* 1038, *Renz* 13625.

KUMAUN: **Pithoragarh**-Dharma Valley, *Inayat* 240109(b); way to Bogdiar, *Pant & Naithani* 39614. **Nainital**-Nainital, *Davidson, Champion, Kalakoti*; Naina Peak, *Renz* 73593. **Almora**-Loharkhet-Kathi, *T.A. Rao* 4224, *Binsar, Vohra* 58034.

Dr. J. Renz has observed that at Naina Peak, Nainital *P. elisabethae* and *P. fallax* were growing together, but only the former had the sweetly scented flowers.

**Peristylus fallax** Lindl. Gen. & Sp. Orch. 298. 1835.

*Herminium fallax* Hook. f., Fl. Brit. Ind. 6: 129. 1890.

*Habenaria fallax* (Lindl.) King & Pantl. in Ann. Roy. Bot. Gard. Calc. 8: 325, t. 428. 1898; *Duthie*, 190. 1906. (Fig. 99)

*Stem* 10-30 cm high. *Leaf* solitary, 3-15 cm long, narrowly elliptic or lanceolate, acute or acuminate. *Spike* 5-10 cm long, laxly or densely flowered. *Flowers* small, green. *Bracts* exceeding. *Sepals* equal, spreading, oblong or ovate-lanceolate, 1-nerved, the dorsal connivent with the petals form a loose hood, lateral pair erect, slightly falcate, narrower than sepals. *Lip* equal to or slightly longer than the sepals, flat, fleshy, hastately 3-lobed, side lobes oblong, obtuse, midlobe longer than side lobes, oblong, obtuse, diverging. *Spur* obovate, 2-ribbed inside.

*Flowering*: July - August.

*Distribution*: Himalaya 2000-3000 m (Garhwal to Arunachal Pradesh).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 21770. **Tehri**-Nagtibba, *Mackinnon* 21769, *Ramsukh* 22987.

KUMAUN: **Pithoragarh**-Munshyari Gori Valley, *Inayat* 24058; Betuli hills between Grigaon and Munshyari, *Awasthi* 1715; Dafiatoop, *Arora* 49619, 70816; Bakariudiyar, *Arora* 48628. **Nainital**-Nainital, *Champion* 61331, *Kalakoti* 517; Naina-Peak, *Renz* 13592.

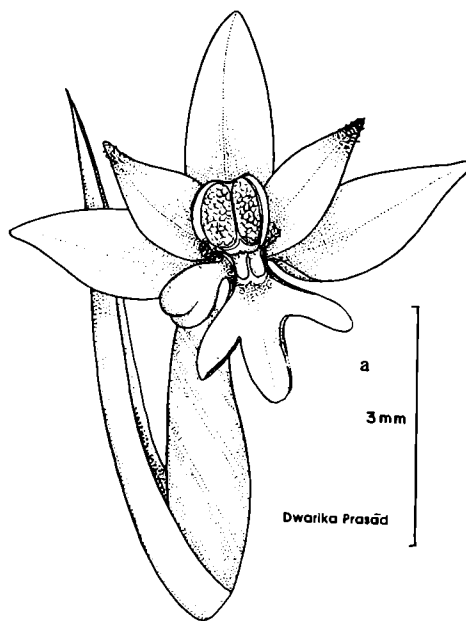
**Peristylus fallax** var. **dwarikae** Deva & Naithani var. nov. (Fig. 100)

Differ a *Peristylus fallax* var. *fallax* bracteis ovarium rostratum superantibus, labello quam sepalis lateralibus circa tertia parte brevior.

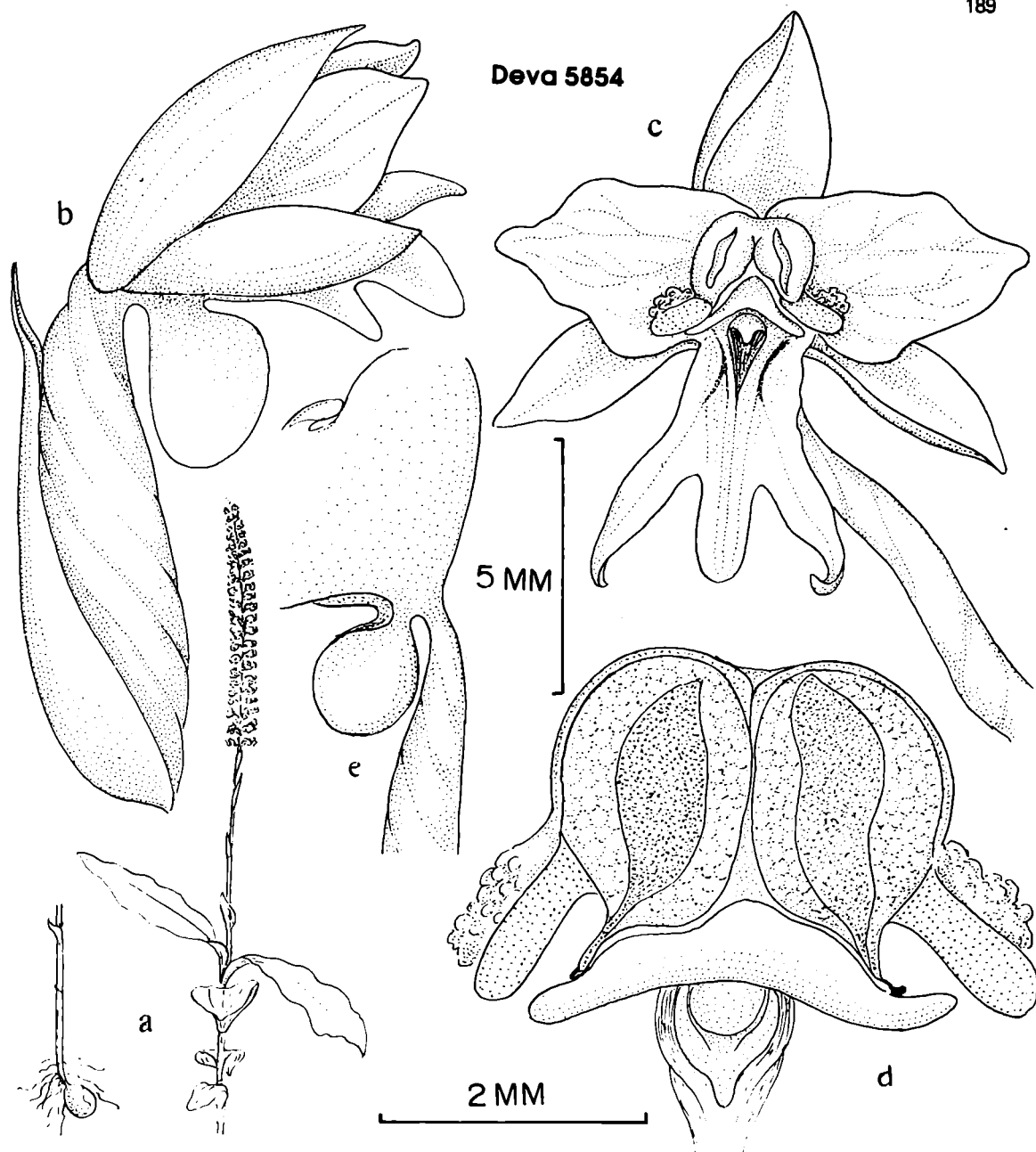
**Type**: Dodital, 3000 m, Uttarkashi, Aug. 1974, *Dwarika Prasad* (holotype DD)

Differs from *P. fallax* by having floral bracts much longer than the narrow beaked ovary; lateral sepals ovate with a broad base; lip smaller about two third the size of the lateral sepals.

The variety has been named to appreciate the efforts of Pandit Dwarika Prasad a guide for pilgrims to the holy shrine of Jomontri. He has been collecting plants for the senior author for several years in Jamuna Valley.



**Fig. 100** *Peristylus fallax* Lind. var. *dwarikaei* Deva & Naithani—*a.* flower.



**Fig. 101** *Peristylus goodyeroides* (D. Don) Lindl. — a. plant; b. & c. flower; d. column; e. spur, base of lip.

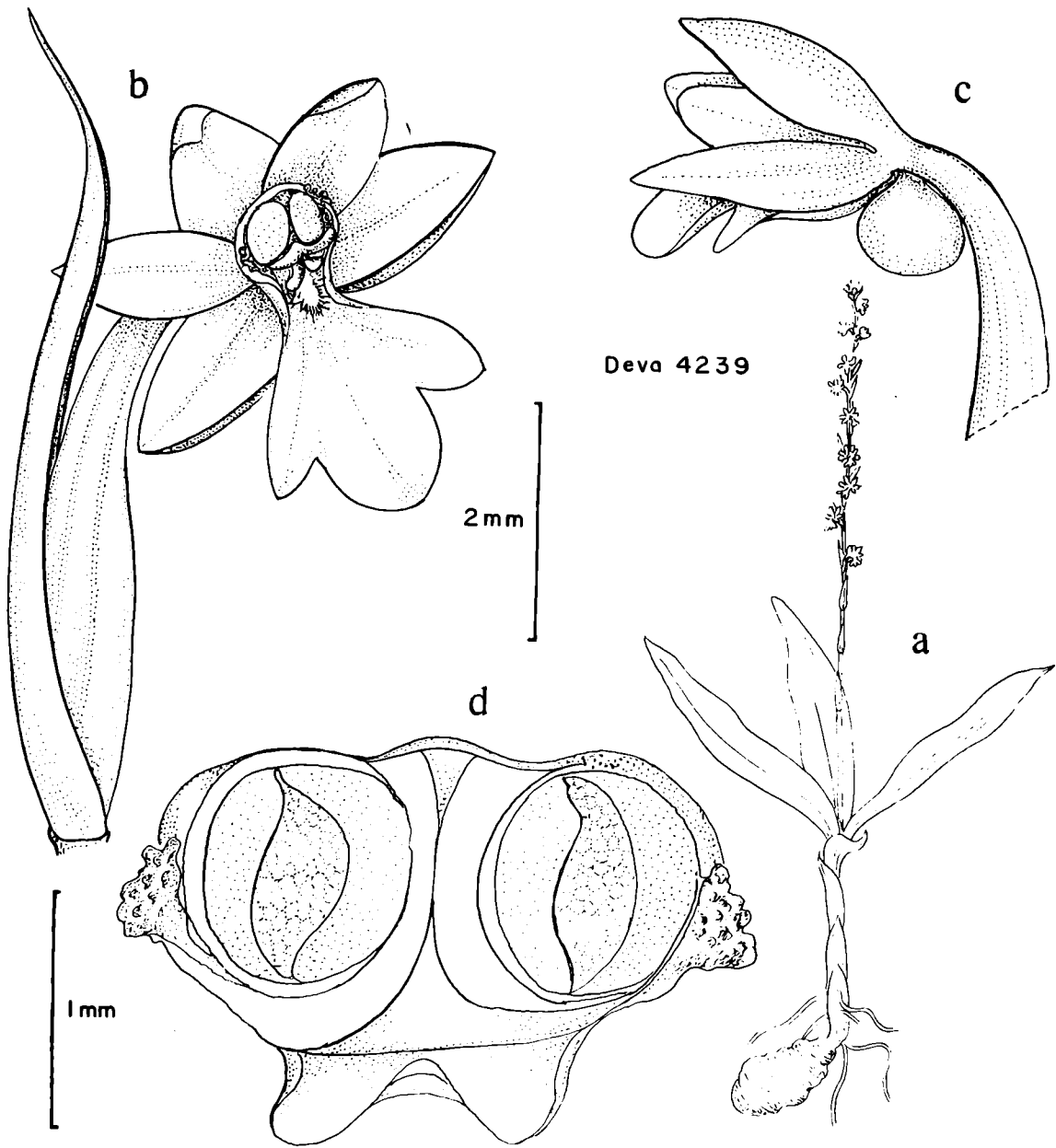


Fig. 102 *Peristylus lawii* Wight—a. plant; b. & c. flower; d. column.

**Peristylus goodyeroides** (D. Don) Lindl. Gen. & Sp. Orch. 298. 1835; Seidenf., 53, fig. 25. 1977; Katakai et al. 5: 28. 1984.

*Habenaria goodyeroides* D. Don, Prodr. Fl. Nepal 25. 1825; Hook. f., 6: 161. 1890; King & Pantl. 326, t. 430. 1898; Collett, 505. 1902; Duthie, 192. 1906.

*Hermidium goodyeroides* (D. Don) Lindl. Bot. Reg. 18. sub. t. 1499. 1832.

*Platanthera goodyeroides* (D. Don) Vidal, Phan. Cum Phil. 15. 1885. (Fig. 101)

Plant 30-60 cm. *Leaves* clustered above the one third of the stem, 5-10 cm long, ovate or ovate-elliptic, acute, narrowed to the base. *Spike* 10-20 cm long, lax, erect. *Flowers* about 10 mm across, white or pale-greenish-yellow. *Bracts* lanceolate, acuminate, longer than ovary. *Sepals* unequal, the dorsal broadly ovate-lanceolate, concave, connivent with the petals and forming a loose hood, lateral pair 5-6 mm long, oblong, involute, mucronate. *Petals* much broader than lateral sepals, trapeziform, blunt. *Lip* longer than petals, basal half almost flat with a minute opening in to the spur, a triangular nectary in front of the entrance of spur, 3-lobed, mid lobe broad, blunt, lateral pairs equalling to the midlobe. *Spur* globular.

*Flowering*: July - August.

*Distribution*: Himalaya up to 2500 m (Himachal Pradesh to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Madhya Pradesh, Konkan, N. Kanara, W. Ghats. Burma, China, Phillippines, Malaya, Indonesia, New Guinea, Indo-China, Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-New Forest, *Ram Dayal*; Mussoorie, *Duthie* 1878 & 2315, *Mackinnon* 21757; Dhobighat, *Arora* 37465; Dehra Dun Valley, Nalapani, *Deva* 8535 & 4880; Rajpur, *Deva* 5854; Sahasradhara, *Deva* 2676. **Tehri**-Bok Hills. Tehri *Harsukh* 24169; East Tehri, *Mackinnon's collector* 25413. **Pauri**-Lansdown, *Roberts* 25413(a). **Chamoli**-Badrinath, *Falconer*, Mandakni Valley, *M.A. Rau* 38616.

KUMAUN: **Pithoragarh**-Sera Ghat Gori Valley, *Inayat* 24065; Sharma Sarju Valley, *Inayat*. **Nainital**-Nainital, *Kalakoti* 513 & 514; Between Sat-tal and Bhim Tal, *Renz* 13612. **Almora**-Tikola, W. Almora, *Inayat* 24059; Parkoti between Baijnath and Gwaldam, *P.C. Pandey* 3888.

**Peristylus lawii** Wight Ic. Pl. Ind. Or. 5(1): 12, t. 1695. 1851; Sant. & Kapad. 33. Pl. 10 C-D. 1966.

*Habenaria lawii* (Wight) Hook. f., Fl. Brit. Ind. 6: 162. 1890; Duthie, 192. t. 143. 1906 (Fig. 102)

*Stem* 15-25 cm high, terete, brownish-white. *Leaves* 3-5, clustered above the middle of the stem, 5-10 cm long, narrowly lanceolate or elliptic, membranous. *Spike* 5-7.5 cm long, slender, narrow, lax-flowered. *Flowers* white tinged with greenish-yellow, small, sessile. *Bracts* lanceolate, acuminate, longer than the ovary. *Sepals* oblong, obtuse, the dorsal elliptic, lateral pair sub-falcately linear-oblong, 1.5-2.5 mm. *Petals* fleshy, similar to sepals. *Lip* as long as the sepals, with short ciliate callus near the base, broadly or obtusely 3-lobed, midlobe straight obtuse, side lobes 1 mm long, rounded, curved on the margins, sub-acute. *Spur* small, scrotiform.

*Flowering*: July - August.

*Distribution*: Himalaya below 1000 m (Garhwal and Nepal), Bihar, Bengal, Madhya Pradesh, Konkan, Karnataka.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley, Mothronwala, *Deva* 4239, *Dakshini* 5580; Dehra Dun, *Harsukh* 23101, *Mackinnon* 21767, 22727, 22727(a).

This species has been found at low altitude between 400-1000 m in the outer Himalayan ranges.

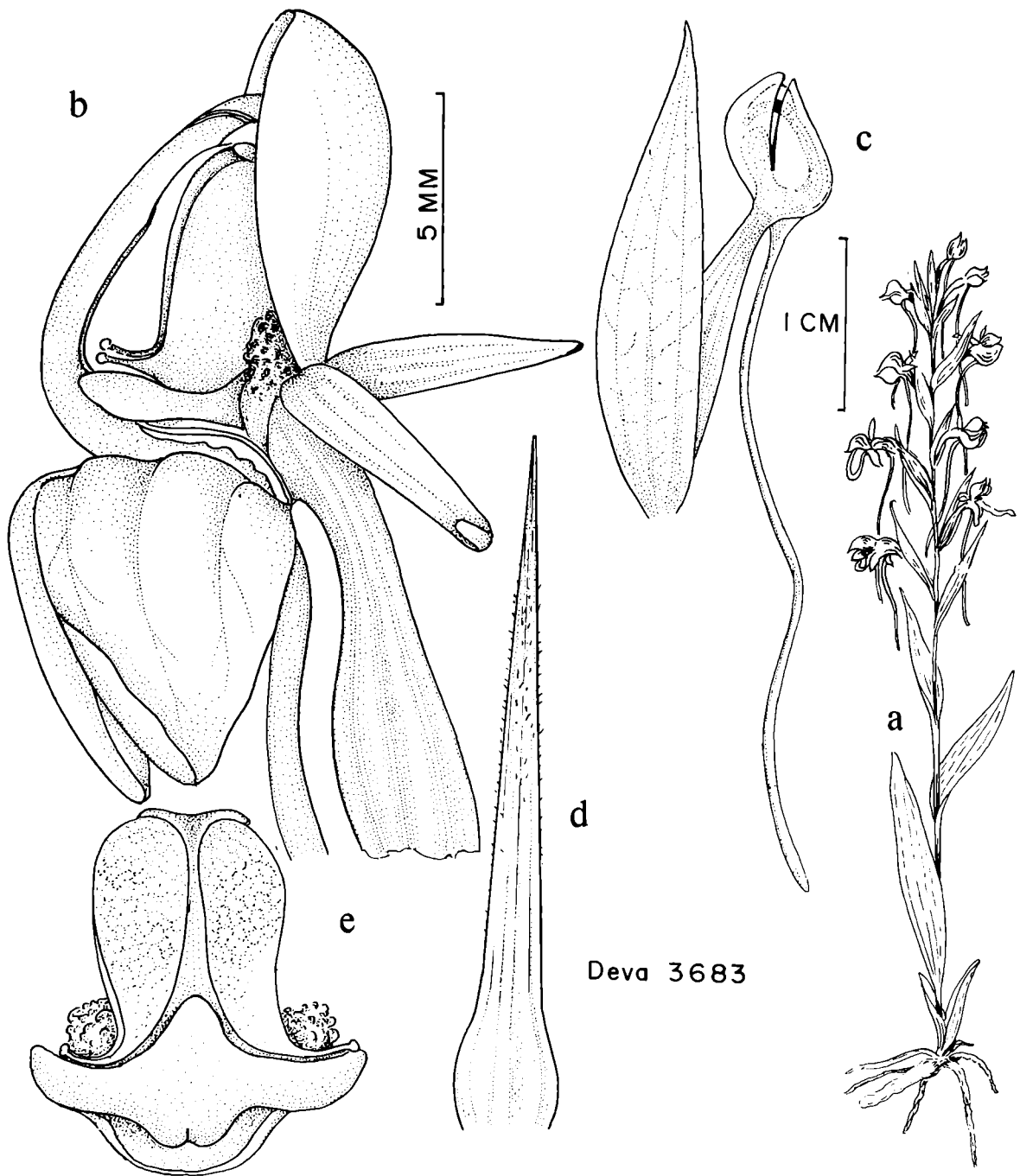


Fig. 103 *Platanthera arcuata* Lindl. —a. plant; b. flower; c. bud; d. lip; e. column.



**Platanthera** L.C. Rich.

Terrestrial plants with turnip-shaped tuberoids and 2 basal or cauline leaves. *Inflorescence* usually lax. *Bracts* foliaceous. *Flowers* white, greenish or yellowish. *Sepals* and petals more or less closely connivent, equal in length. *Lip* ligulate, slightly deflexed, entire, with filiform spur generally longer than ovary. *Column* short; anther-cells parallel or slightly diverging, without anther-canals; *pollinia* 2 with short caudicles, viscid glands naked; stigma concave. *Ovary* twisted, sessile.

**Key to species**

1. Stigma lobe conjoint forming a single plate at the base of the lip in front of the column, lip 2-3 times longer than the lateral sepals, broadest at the base, tapering to the tip, floral bracts much longer than the ovary, flowers white ..... *P. arcuata*
- + Stigma lobe conjoint forming a small transversely elliptic plate between the pollinar glands, lip longer than the lateral sepals, lanceolate, broadest above the base, floral bracts shorter or equal to the ovary, flowers green ..... *P. stanantha*

**Platanthera arcuata** Lindl. Gen. & Sp. Orch. 289. 1835; Hara et al. 1: 54. 1978.

*Habenaria arcuata* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 155. 1890; Duthie, 190. 1906.

*H. davidsonii* Gupta, Fl. Nainital. 354. 1968, non Franch., Nouv. Arch. Mus. Paris. ser. 2, 10. 86. 1888. (Fig. 103)

*Stem* very thick, leafy. *Leaves* 7-10 cm long, oblong-lanceolate, sub-acute, upper ones lanceolate or linear-lanceolate. *Spike* broad, many flowered. *Flowers* large, white. *Bracts* linear-lanceolate, much longer than ovary. *Sepals* 10 mm long, the dorsal cucullate, beaked, lateral pair oblong, obtuse, deflexed, 3-nerved. *Petals* small, linear, 1-nerved, membranous. *Lip* 2-3 times longer than the lateral sepals, broadest at the base, tapering to the tip, puberulous, margin reflexed. *Spur* 5-6.5 cm long, incurved, acute.

*Flowering*: June.

*Distribution*: Himalaya 2500-3200 m (Himachal Pradesh to Bhutan). E. Tibet.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie Range, without collectors name; Mussoorie, King 465358, 462934.

KUMAUN: **Pithoragarh**-PanchChuli Basin, above hot spring camp, Thomas 20797. **Nainital**-Nainital, Davidson.

HIMACHAL PRADESH: Shimla-Dodra Kanwar, between village Jiskun and Jakha, Rupin Valley, Deva 3683.

*P. arcuata* was considered to be endemic in Garhwal and Kumaun, but now it is known to be widely distributed in Himalaya from Himachal Pradesh to Bhutan and Eastern Tibet.

**Platanthera stanantha** (Hook. f.) Soo, in Ann. Hist. Nat. Mus. Natl. Hung. 26: 363. 1929; Katakai et al. 5: 29. 1984.

*Habenaria stanantha* Hook. f., Fl. Brit. Ind. 6: 153. 1890; King & Pantl. 314, t. 412. 1898; Duthie, 186. 1906.

*Hemihabenaria stanantha* (Hook. f.) Finet, in Rev. Gen. Bot. 13: 532. 1901. (Fig. 104)

Plant 30-60 cm high without tubers. *Stem* stout, sheathing at the base. *Leaves* 3 or more, 10-25 cm long, ovate to oblong, lanceolate, acute or sub-acute. *Spike* 12-22 cm long, laxly many flowered. *Flowers* 1.5-2 cm across, green. *Bracts* linear-lanceolate, equal or shorter than the ovary. *Sepals* unequal, 3-nerved, the dorsal erect, concave, broadly ovate, blunt, lateral pair smaller, reflexed, ovate-elliptic, sub-acute. *Petals* longer than the dorsal sepal, erect, linear, blunt, 1-nerved. *Lip* longer than the lateral sepals, lanceolate,

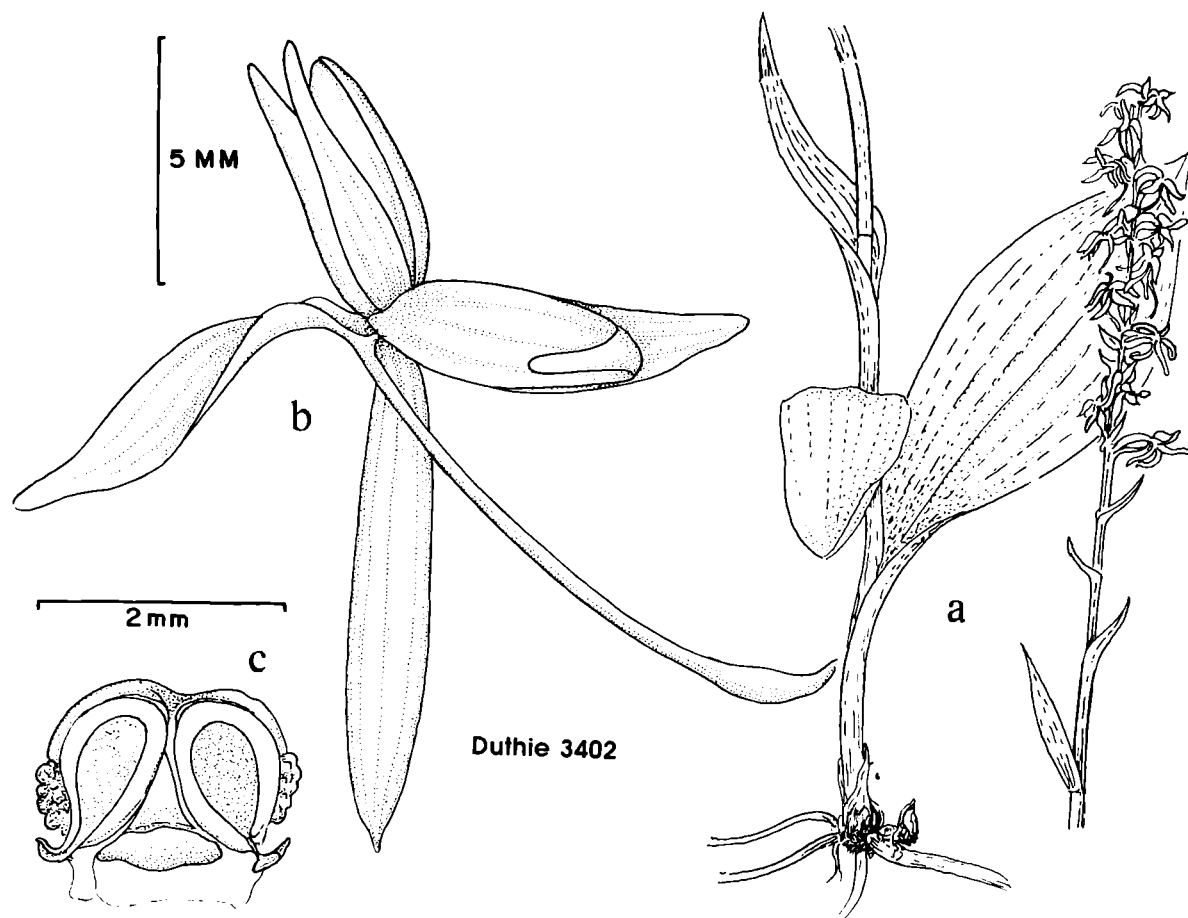


Fig. 104 *Platanthera stenantha* (Hook. f.) Soo—a. plant; b. flower; c. column.

broadest above the base, entire, 3-nerved, blunt. *Spurs* spreading, slender, cylindric, longer than the ovary, dilated towards the apex, slightly curved.

*Flowering*: July - August

*Distribution*: Himalaya 1500-3000 m (Kumaun to Arunachal Pradesh). Burma.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Forest above Sosa, *Duthie* 3402.

*Dr. J. Renz* observes that the association of *P. arcuata* and *P. stenantha* with *Platanthera*, and of *H. clavigera* with *Habenaria* is still unsatisfactory. In the strict sense they do not correspond well with *Platanthera* (sensu type of the genus *P. bifolia* (L.) L.C. Rich), nor with *Habenaria*. Further studies on living plants should bring more certainty about this problem, but for the time being and mainly for practical reasons, it is best to join *arcuata* and *stenantha* with *Platanthera* and *clavigera* (having apparently stigmatic processes, but very short anther canals are even none (?)) with *Habenaria*.

#### **Ponerorchis** Rchb. f.

Alpine plants with small entire tuberoids. *Stem* with 1-2 leaves. *Inflorescence* with several flowers. *Bracts* foliaceous, more or less equalling ovary in length. *Flowers* purple, spurred. *Sepals* spreading, the dorsal forming a hood over the column. *Lip* more or less 3-lobed. *Column* short; *pollinia* 2 with caudicles and each with viscid gland, each in a small fragile pouch; stigmata conjoint; staminodes large.

#### **Key to species**

1. Lip simple, not divided into lobes, broadly ovate, apex acute; leaves 2; spike 2-flowered ..... *P. renzii*
- + Lip divided into lobes, not simple ..... 2
2. Lip deeply 3-lobed, all lobes almost equal, lateral lobes diverging; leaves 1-3; spike one to many flowered ..... *P. chusua*
- + Lip very shallowly 3-lobed, giving appearance of a broad truncate apex with crenate margin; leaf one; flower one or two ..... *P. nana*

***Ponerorchis chusua*** (D. Don) Soo, in Acta Bot. Acad. Sci. Hung. 12: 352. 1966; Hara et al. 1: 55. 1978.

*Orchis chusua* D. Don, Prodr. Fl. Nepal, 23, 1825; Hook. f., 6: 127. 1890; King & Pantl. 303, t. 402. 1898; Duthie, 173. 1906; Katakai et al. 26. 1984.

*Ponerorchis nana* sensu Seidenf., & Arora Nord. J. Bot. 2(1): 24. 1982. *non* (King & Pantl.) Soo

(Fig. 105)

Plant 10-45 cm high. *Tuber* small, oblong, entire. *Stem* with two blunt tubular sheaths at the base, upper, portion above the leaves naked. *Leaves* one to three, 4-10 cm long, linear-oblong or linear-lanceolate, acute or acuminate, not narrowed to the sheathing. *spike* 2.5-10 cm long, one to many flowered. *Flowers* 1-1.8 cm across, white or purple. *Bracts* lanceolate, acuminate, equalling the ovary. *Sepals* oblong, obtuse, the dorsal erect; the lateral recurved. *Petals* broadly and obliquely ovoid, base truncate. *Lip* longer than the sepals, deeply 3-lobed, all lobes almost equal, oblong, obtuse, the lateral ones diverging. *Spur* stout, cylindric, equal to and lying parallel and compressed to the ovary.

*Flowering*: July - August.

*Distribution*: Himalaya 3500-4500 m (Himachal Pradesh to Arunachal Pradesh). Tibet.

*Specimens examined*:

GARHWAL: **Uttarkashi**-Tons Valley, Har-ki-Dun, *Deva* 7054. **Chamoli**-Badrinath, *M.A. Rau* 2969; Way to Duna Giri, *Naithani* 53943; *Tungnath*, *Semwal*.



Fig. 105 *Ponerorchis chusua* (D. Don) Soo—a. & b. plant; c. & d. flower; e. lip; f. column.

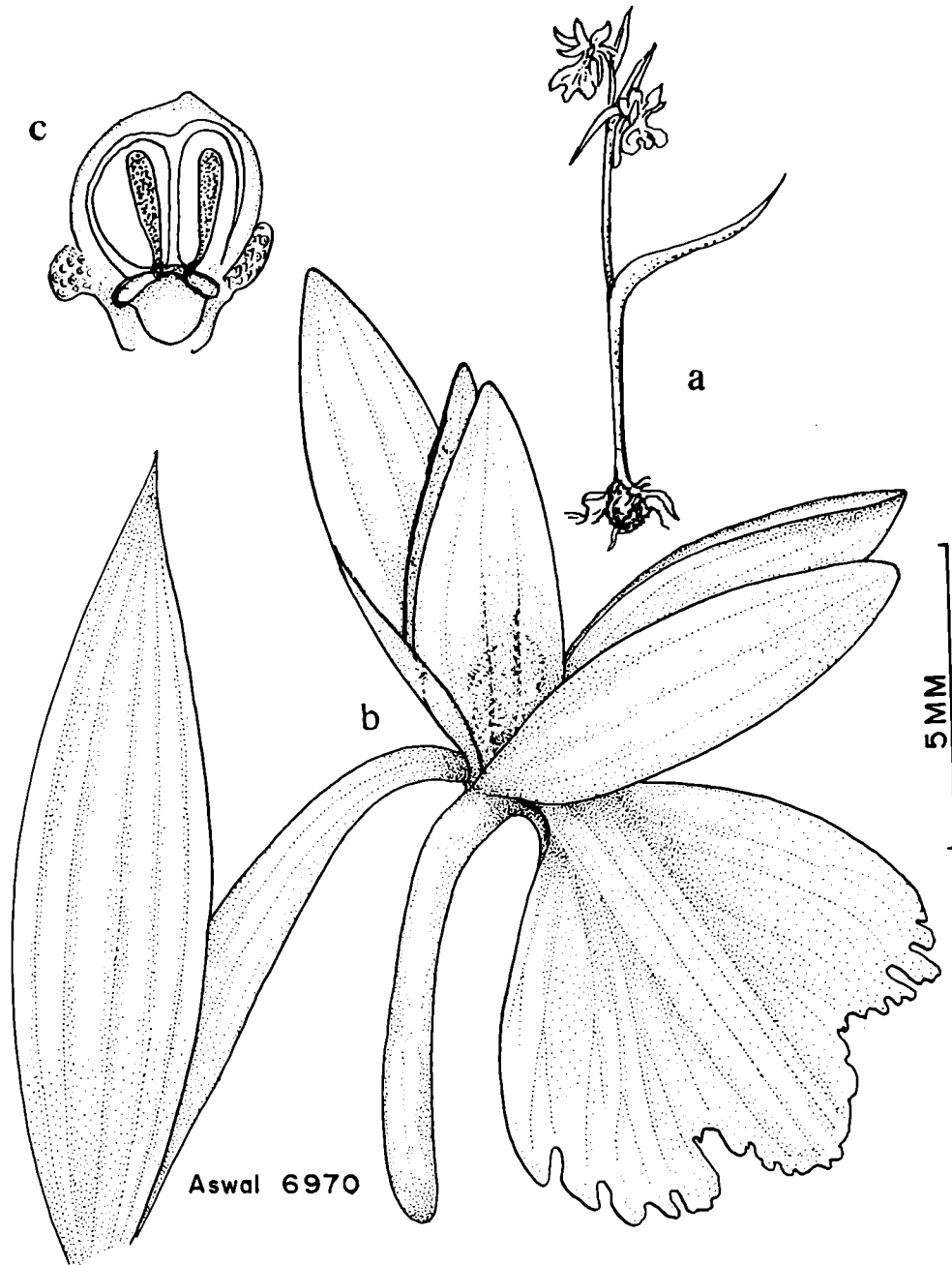


Fig. 106 *Ponerorchis nana* (King & Pantl.) Soo—a. plant; b. flower; c. column.

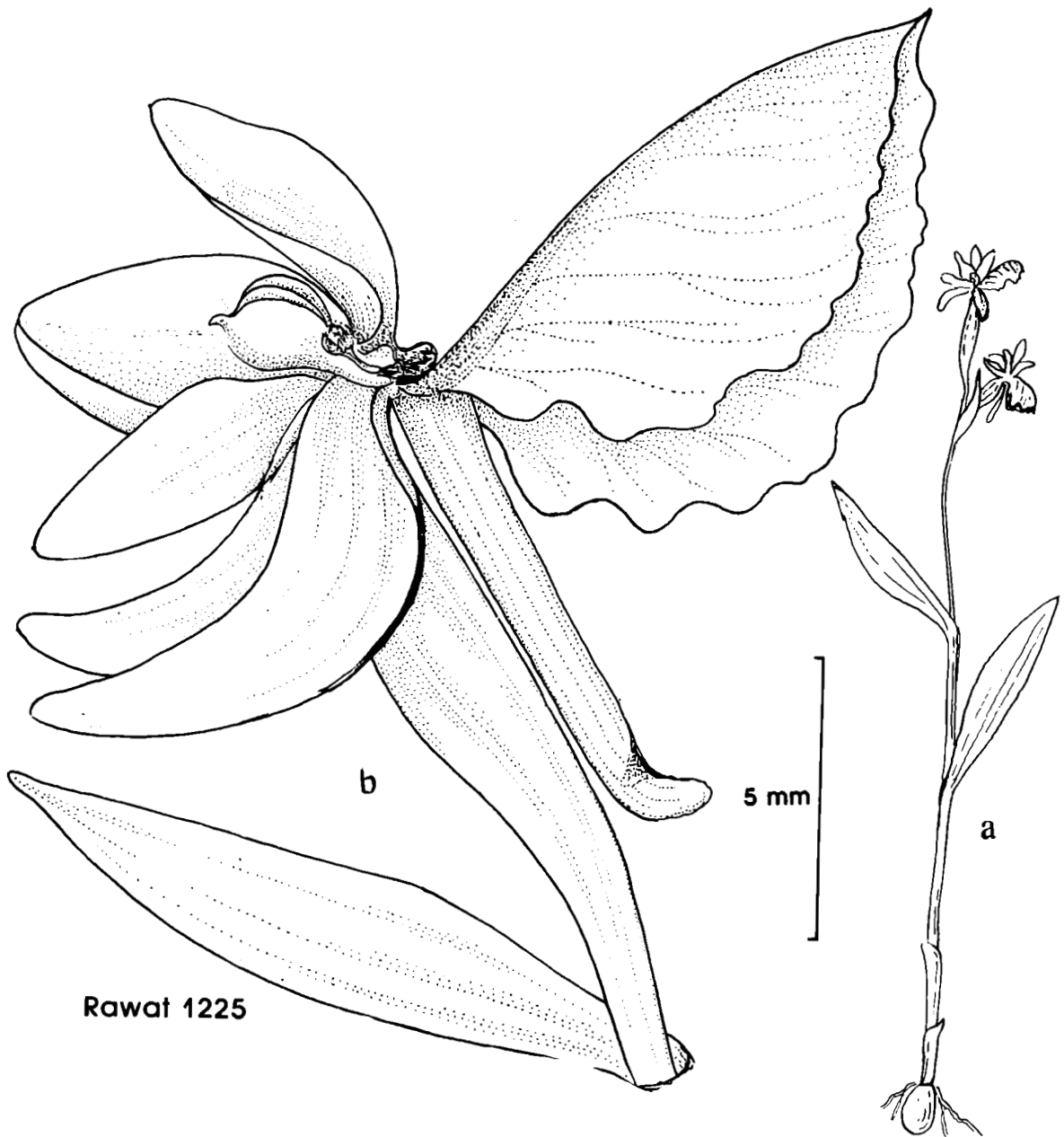


Fig. 107 *Ponerorchis renzii* Deva & Naithani—*a.* plant; *b.* flower.

KUMAUN: Pithoragarh-Palang Gadh, *Duthie* 5998; Bakriudiyar, *Arora* 49923, 29924; Tajam Hoya, *Arora* 46696; Chipla, *Arora* 49720.

HIMACHAL PRADESH: Rohtang Pass, Lahul, *Aswal* 10541; Chamba, Changa Valley, *Lace* 1992.

*Duthie* proposed a new species *Orchis lacei* based on a collection *Lace* 1992, which he never published. This specimen has a single leaf and 2 flowers. The lateral lobes of the lip are smaller and broader than in the common forms of *Ponerorchis chusua*. *Rolfe* had examined this plant and noted that it is not distinct. This plant is almost intermediate between *P. chusua* and *P. nana*.

***Ponerorchis nana*** (King & Pantl.) Soo, in Act. Bot. Acad. Sci. Hung. 12: 353. 1966.

*Orchis chusua* var. *nana* King & Pantl. in Ann. Roy. Bot. Gard. Cal. 8: 303, t. 402 A. 1898; *Kataki* et al. 5: 26. 1984.

*O. nana* (King & Pantl.) Schltr. in Fedde, Repert. 9: 434. 1911.

*Chusua roborowskyi* (Maxim) Hunt, var. *nana* (King & Pantl.) P.F. Hunt, in Kew Bull. 26: 1976. 1971.

*C. nana* (King & Pantl.) Pradhan, Ind. Orch. 2: 678. 1978. (Fig. 106).

Plant up to 10 cm. *Tuber* oblong, bilobed. *Stem* with one to two blunt tubular sheaths at the base. *Leaf* one, linear-lanceolate, acute or acuminate, grooved. *Inflorescence* single flowered. *Flower* 1 cm across, white or purple. *Bracts* lanceolate, acuminate, equalling the ovary. *Sepals* the lateral spreading. *Petals* ovoid. *Lip* very shallowly 3-lobed, giving an appearance of a broad truncate apex, margins crenate. *Spur* cylindrical, equal to the length of the ovary, not compressed to ovary.

*Flowering*: July - August.

*Distribution*: Himalaya 3000-4000 m (Himachal Pradesh and Sikkim).

*Specimens examined*:

HIMACHAL PRADESH: Rohtang slopes, Lahul, *Aswal* 6970.

***Ponerorchis renzii*** Deva et Naithani *sp. nov.* (Fig. 107)

Affinis *Ponerorchidi chusuae* (D. Don) Soo, et *P. nanae* (King & Pantl.) Soo, ab illa labello non lobato, ab hac labello antice non truncato, ab utraque labello integro, acutiusculo bene distinguenda.

Plant 15 cm high. *Tuber* small, rounded, 6 mm in diameter. *Stem* with two tubular sheaths. *Leaves* two, base sheathing, lanceolate, 3.5-4 × 0.5-0.8 cm. *Spike* 2.5 cm long, 2-flowered. *Bracts* 1-1.3 × 0.2-0.3 cm, lanceolate, acuminate, almost as long as the ovary. *Flowers* pink. *Sepals* the dorsal erect, 7 × 3 mm, oblong-obtuse, the lateral 9 × 3 mm, recurved. *Petals* ovoid, 7 × 2 mm. *Lip* simple, not divided into lobes, ovate-acute, 12 × 12 mm. *Spur* 10 mm long, cylindrical, tip curved outwards. *Column* 4 mm long. *Stigma* single, concave, tip rounded. *Staminodes* small, round, *Anther cells* parallel.

*Distribution*: Endemic.

**Type**: KUMAUN: Pithoragarh above Garbyang 3300 m, *G.S. Rawat* 1225 (*holotype* DD).

This species is named after the well known Orchidologist Dr. Jany Renz, Basel, Switzerland.

### Satyrium Swartz

Terrestrial herbs with tubers and erect leafy stem. *Leaves* sheathing, large, membranous, decreasing upwards in to the bracts. *Flowers* spicate, not resupinate. *Sepals* and *petals* sub-equal, free, spreading or reflexed. *Lip* superior, adnate to the base of the column, erect, hooded, 2-spurred or 2-saccate. *Column* much arched, terete. *Stigma* single, convex or concave, born on top of the anther. *Anther cell* dorsal or lateral, tumid, sub-parallel; *pollinia* 2; caudicles with naked gland.

Vishwanathan 54912

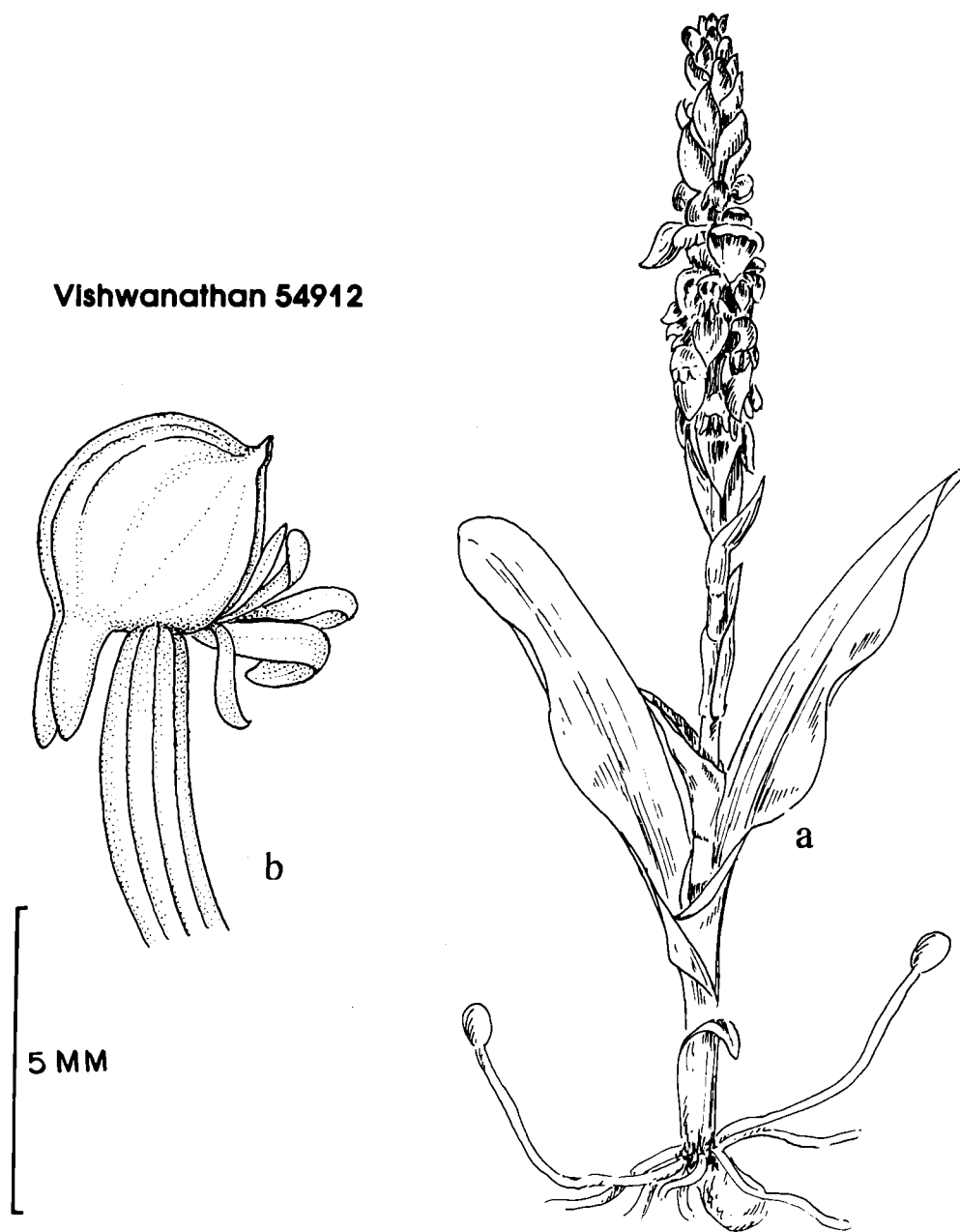


Fig. 108 *Satyrium ciliatum* Lindl. — a. plant; b. flower.



## Key to species

1. Plants tall usually more than 30 cm, spurs long equal to or longer than the ovary ...*S. nepalense*  
 + Plants smaller usually less than 30 cm, spurs very small, less than half the length of the ovary ....  
 .....*S. ciliatum*

**Satyrium ciliatum** Lindl. Gen & Sp. Orch. 341.

*S. nepalense* D. Don var. *ciliata* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 168. 1890; King & Pantl. 339. t. 444 bis. 1898; Deva, 348. 1978; Rawat & Pangtey, 697. 1985 (Fig. 108)

Plants less than 30 cm. *Leaves* 15 × 3 cm, lanceolate-oblong, 1.5 cm above the groud. Lower *floral bracts* Less than 2 cm long, reflexed, acute, acuminate. *Petals* erose. *Spur* of the lip shorter than the ovary.

*Flowering*: September - October.

*Distribution*: Himalaya 2000-3000 m (Garhwal to Arunachal Pradesh). S.E. Tibet.

*Specimens examined*:

GARHWAL: **Tehri**-Way to Kushkalyan, *Vishwanathan* 54912. **Uttarkashi**-Jamuna Valley Rana, *Deva* 4531; Kharsali near Gothani, *Dwarika Prasad* 16. **Chamoli**-Rudranath, *Bhatt* 213.

KUMAUN: **Almora**-Way to Kaphni glacier in Pindar Valley, *G.S. Rawat* 1929.

**Satyrium nepalense** D. Don Prod. Fl. Nepal, 26. 1825; Hook. f., 6: 168. 1890; King & Pantl. 338, t. 444. 1898; Collet, 507. fig. 168. 1902; Duthie, 210. 1906; Stewart, 73. 1972; Renz, 42. 1984.

*Gymnadenia camtschatica* sensu Arora & Malhortra, in Ind. J. For. 2(4): 311. 1979 *non* (Cham.) Miyabe & Kudo (1965). (Fig. 109)

Tuberous, terrestrial herbs, 40-70 cm high; tuber 1-2, ovoid-oblong. *Leaves* 2, rarely more, sub-radical, oblong, ovate-lanceolate, fleshy, 4-16 × 1-7 cm. *Inflorescence* terminal, 10-30 cm long, dense. *Scape* covered with large foliaceous bracts. *Flowers* 8-16 mm across, pink or white, fragrant. *Bracts* oblong-lanceolate, foliaceous, longer than the ovary. *Sepals* the dorsal 6 × 1.5 mm, oblanceolate-spathulate, obtuse, the laterals 5.5 × 2.5 mm, oblong-pellucid gland dotted. *Petals* the lateral 5.5 × 1.2 mm, equal to lateral sepals, more or less twisted at the mouth to the lip. *Lip* conspicuous globose, 4 mm across, hooded, keeled on the back, with two parallel spurs extending beyond the ovary. *Spur* 1-1.6 cm long.

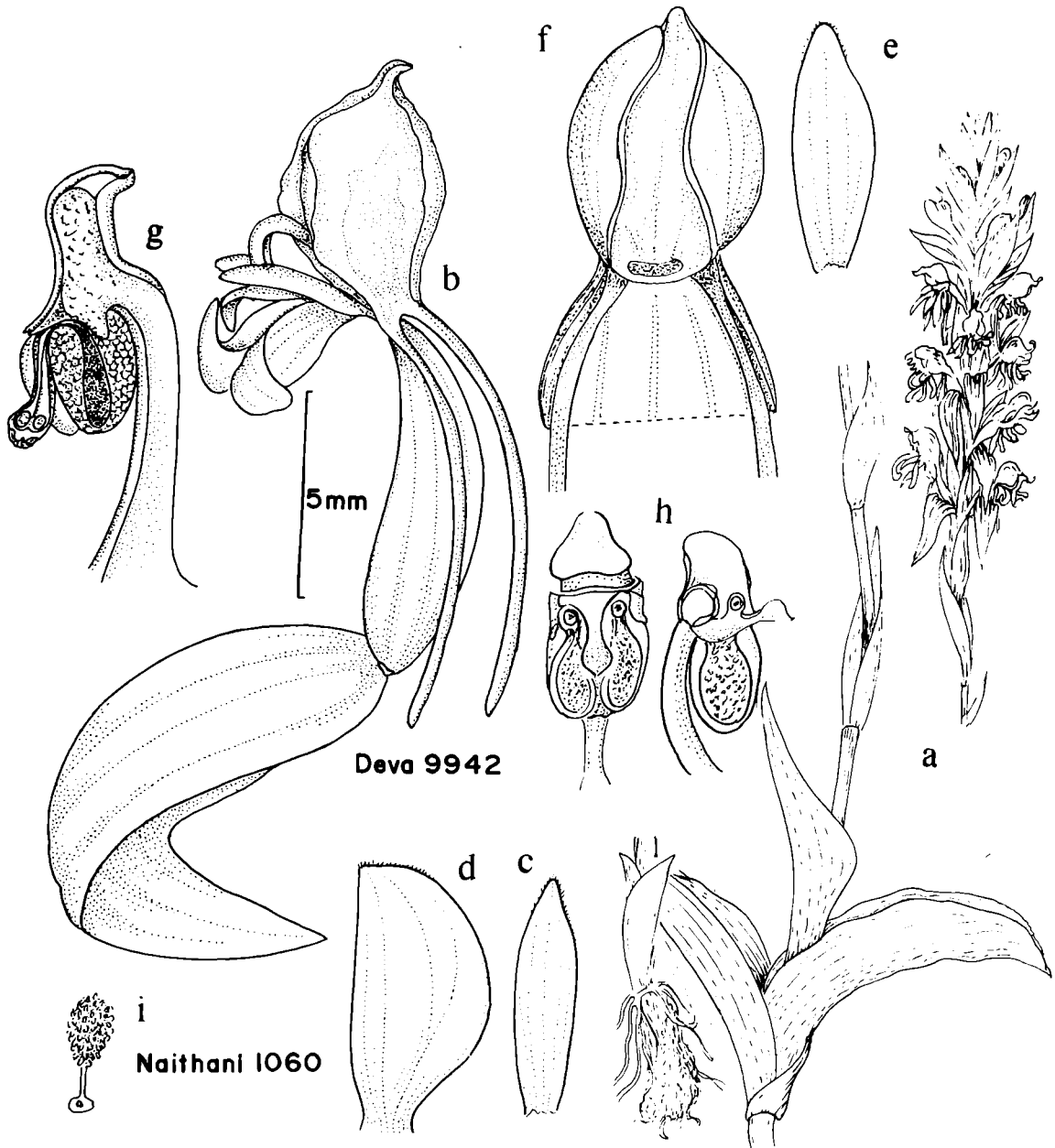
*Flowering*: September - October.

*Distribution*: Himalaya 1500-3000 m (Pakistan, Kashmir to Arunachal Pradesh), Nagaland, Manipur, Meghalaya, South India. Tibet, Burma, China, Sri Lanka.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, Landour, *Duthie* 21783; Mussoorie Depot, *Saxena* (1108(a); Chakrata, Below Deoban, *Sahni* 22629; Deoban, *Deva* 4023. **Tehri**-Nagtibba, *Deva* 9574, *Naithani* 1060 & 1061; Surkanda Devi, *Deva* 10448; Masartal, *Vishwanathan* 55153; near Dhandolti, *Renz* 13638. **Uttarkashi**-Mahidanda, *Surendra Singh* 33567; Jamuna Valley, Rana, *Deva* 4532. **Pauri**-Ransi, *Naithani* 3862; *Nagdeo*, *Deva* 9942; Khirsu, A.S. *Rao* 56336; Pauri near Inspection Bunglow, *Panigrahi* 64983; Near Bubakhal; *Renz* 13638, *Naithani* 1046. **Chamoli**-Gwaldam, *Bhattacharyya* 30815; Amrit Ganga, *Naithani* 42126; Tungnath, *Deva* 3206; Rambara, *Mehrotra* 4720; Jangal Chatti on way to Valley of flowers, *Naithani* 1306.

KUMAUN: **Pithoragarh**-Dafiatop, *Arora* 50066; Munsyari-Gori Valley, *Inayat* 24127(a); Nagling Dharma Valley, *Inayat* 24127(c); Bakriudiyar, *Arora* 45744. **Nainital**-Near Nainital, *Inayat* 24127(b); Nainital, Strachey & Winerbottom 30: Naina Peak, *Renz* 13638. **Almora**-Near Almora, *Inayat* 24128(a); Raniket, *Wadhwa* 57228; Pindari, *T.A. Rao* 4555.



**Fig. 109** *Satyrium nepalense* D. Don—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; g. & h. column; i. pollinia.

HIMACHAL PRADESH: Shimla-Fagu Road, *Raizada* 10102; Between Nireth & Thanedar, *Raizada* 19669; Rampur, *Nair* 29839.

JAMMU & KASHMIR: Poonch (Stewart, *loc. cit*; Renz, *loc. cit*)

PAKISTAN: Hazara, Murree (Stewart, *loc. cit*; Renz, *loc. cit*)

#### IV. Sub-fam. EPIDENDROIDEAE

Terrestrial, lithophytic or epiphytic, rhizomatous or pseudobulbous herbs. *Leaves* conduplicate or plicate. *Inflorescence* terminal, lateral or from the base of the pseudobulbs, erect or pendulous, with solitary, few or numerous flowers. *Lip* spurred or spurless. *Anther* erect; rostellum erect or ascending; *pollinia* waxy, 4 or 8, usually with or without caudicle and gland, free or attached by their bases to a single of double viscous, not derived from stigma.

In N.W. Himalaya 19 genera and 90 species.

Tribe	<b>Epidendreae</b>	Tribe	<b>Malaxideae</b>
Sub-tribe	<b>Thuniinae</b> <i>Thunia</i> (1) <i>Arundina</i> (1)	Sub-tribe	<b>Malaxiinae</b> <i>Liparis</i> (10) <i>Malaxis</i> (7)
Sub-tribe	<b>Bletiinae</b> <i>Pachystoma</i> (1) <i>Calanthe</i> (8) <i>Phaius</i> (1)	Sub-tribe	<i>Oberonia</i> (9) <b>Dendrobiinae</b> <i>Bulbophyllum</i> (11) <i>Didiciea</i> (1)
Sub-tribe	<b>Coelogyninae</b> <i>Coelogyne</i> (5) <i>Pleione</i> (4) <i>Pholidota</i> (2) <i>Otochilus</i> (1)		<i>Dendrobium</i> (15) <i>Flickingeria</i> (2)
Sub-tribe	<b>Eriinae</b> <i>Cryptochilus</i> (1) <i>Eria</i> (9)		
Sub-tribe	<b>Corallorhizinae</b> <i>Corallorhiza</i> (1)		

#### Key to Genera

1. Pollinia 2-4.....2
- + Pollinia 8.....15
2. Terrestrial.....3
- + Epiphytic.....6
3. Plants leafless saprophytes, rhizome densely coralloid, tip 3-lobed..... *Corallorhiza*
- + Plants with leaves, not saprophytes.....4
4. Lip with a short spur; leaf single..... *Didiciea*
- + Lip without spur; leaves one to many.....5
5. Flowers not resupinate; column very short with lateral arms..... *Malaxis*
- + Flowers resupinate; column long, winged towards the top..... *Liparis*
6. Leaves equitant, distichous, laterally much compressed..... *Oberonia*
- + Leaves not equitant.....7
7. Column produced into a foot.....8
- + Column not produced into a foot (see also abnormal flowers of *Dendrobium normale*).....10
8. Lip articulate on the foot; pseudobulbs of one internode..... *Bulbophyllum*

- + Lip not articulate on the foot; pseudobulbs/stem of several internodes.....9
9. Pseudobulbs/stem unbranched, all internodes of almost equal size..... *Dendrobium*
- + Pseudobulbs/stem branched, last leaf bearing internode longest ..... *Flickingeria*
10. Inflorescence from the base of pseudobulbs.....11
- + Inflorescence from the apex or just below the apex of pseudobulbs.....12
11. Inflorescence one rarely two flowered..... *Pleione*
- + Inflorescence three to several flowered..... *Coelogyne*
12. Pseudobulbs born in chain one above the another.....13
- + Pseudobulbs not born in chain, born side by side.....14
13. Bracts large, cymbiform, distichous; hypochile without side lobes; flowers small, less than 1 cm across  
..... *Pholidota*
- Bracts elliptic triangular; hypochile with vertical side lobes, enveloping the base of column.....  
..... *Otochilus*
14. Raceme many flowered; bracts large, overlapping, concave in two regular rows ..... *Pholidota*
- + Raceme one to many flowered; bracts smaller not overlapping and not born in two rows.....  
..... *Coelogyne*
15. Epiphyte or lithophyte.....16
- + Terrestrial ..... 18
16. Lip with spur, half as long as the ovary..... *Thunia*
- + Lip without spur.....17
17. Sepals connate into a tube..... *Cryptochilus*
- + Sepals free not connate into a tube, base of laterals adnate to the foot of the column..... *Eria*
18. Lip jointed to half or whole length of the column, spur present or absent..... *Calanthe*
- + Lip free or only slightly jointed to the base of the column.....19
19. Lip with spur, convolute.....20
- + Lip without spur.....21
20. Stem leafy with terminal inflorescence; flower white..... *Thunia*
- + Inflorescence bearing stem (scape) and leaf bearing stem separate; flowers with brownish colour.  
..... *Phaius*
21. Stem leafy, long reed like with terminal inflorescence; leaves many, contemporaneous with flowers;  
lip convolute..... *Arundina*
- + Inflorescence bearing stem (scape) and leaf bearings stem separate, a single leaf appearing after flowers;  
lip not convolute..... *Pachystoma*

#### **Arundina Blume**

Terrestrial erect herbs; stem tall, reed like, close together, elongated, rigid. *Leaves* numerous, membranous, distichous, narrow, flat, jointed on their sheathing base. *Inflorescence* terminal panicles or racemose. *Flowers* large, rose-coloured. *Sepals* free, sub-equal, spreading. *Petals* wider than sepals, spreading. *Lip* large, cucullate, convolute at the base and embracing the column; the mouth large, 2-lobed at the apex; disc lamellate. *Column* long, slender, narrowly winged, foot absent. *Anther* 4-chambered; *pollinia* 8, in two superposed unequal groups of 4, flat, the caudicles covered with granular pollen.

**Arundina graminifolia** (D. Don) Hochr. in Bull. New York Bot. Gard. 6: 270. 1910.

*Bletia graminifolia* D. Don, Prodr. Fl. Nepal 29 1825.

*Arundina bambusifolia* Lindl. Gen. & Sp. Orch. 125. 1831; Hook. f., 5: 857. 1890; King & Pantl. 113, t. 156. 1898.

(Fig. 110)

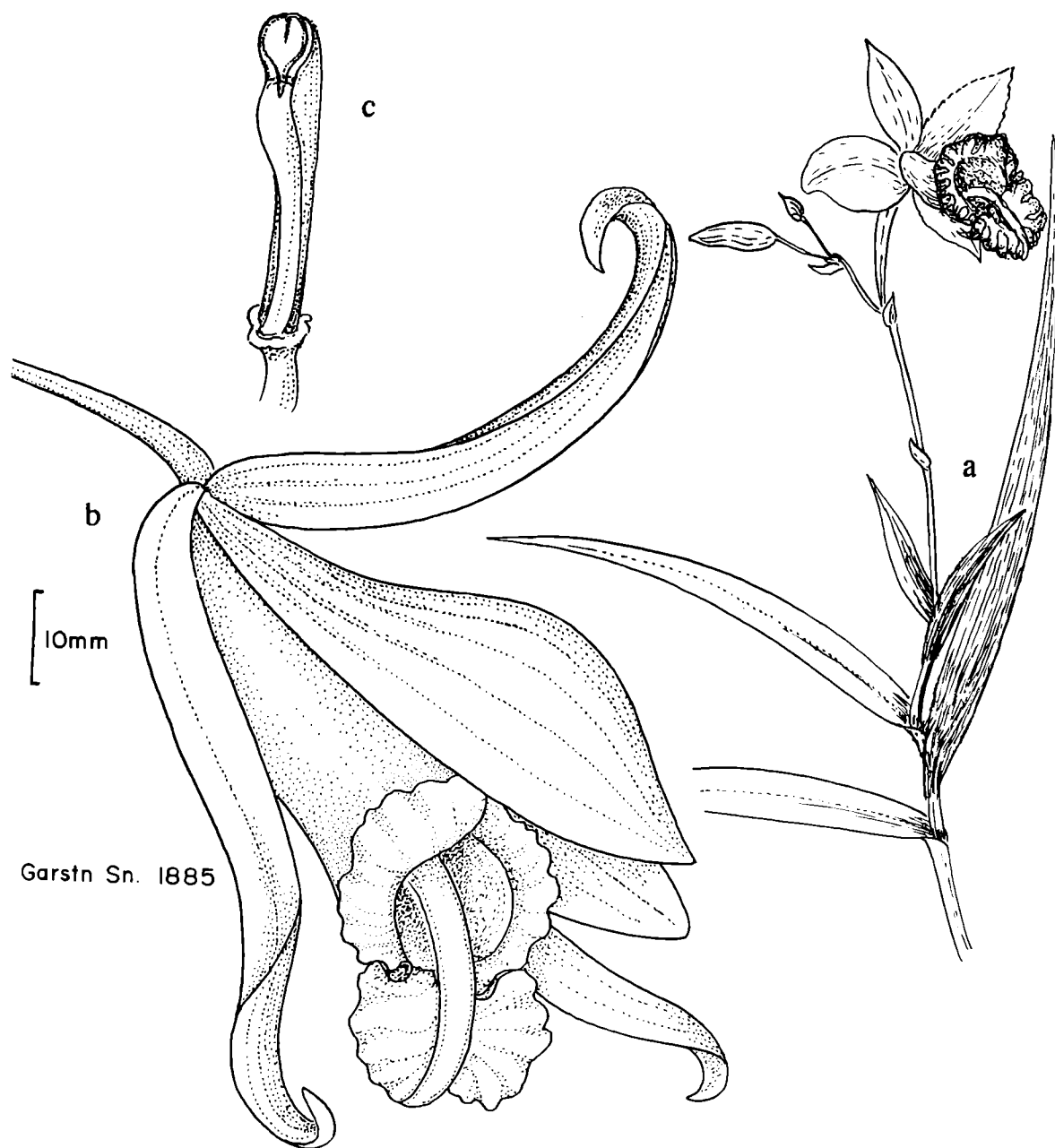


Fig. 110 *Arundina graminifolia* (D. Don) Hochr.—a. plant; b. flower; c. column.

Stem tall, woody, reed like, erect, 1-2 m long and about 2.5 cm in diameter at the base. *Leaves* many, membranous, narrowly lanceolate, acuminate, sheathing at base, 15-30 cm × 2-2.5 cm. *Inflorescence* racemose, branched, the large showy flowers located at the terminal part and opening one or two at a time. *Flowers* 6-7 cm across, rosy-purple. *Bracts* broad, acute 12 × 8 mm. *Sepals* free, spreading, sub-equal, the dorsal erect, oblong, acute, the laterals lying parallel behind the lip. *Petals* rhomboid-elliptic, acute, spreading, shorter and broader than the sepals. *Lip* cucullate, its base convolute round the column, the mouth large, expanded, 3-lobed, midlobe divided into two rounded lobules, apex irregularly toothed; keel 2-3 crested.

*Flowering*: April - October.

*Distribution*: Himalaya up to 1000 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, South India. Bangladesh. Burma, S. China, Thailand, Malaysia, Sri Lank.

*Specimens examined*:

KUMAUN: **Almora**-Near Almora, *Gastiv*.

A single specimen probably cultivated at Almora.

#### Species imperfectly known

***Bletilla striata*** (Thunb.) Rchb. f., Bot. Zeitschr. 36: 75. 1878. Seidenf. & Arora 9. 1982.

*B. hyacinthina* (J.E. Sm.) R. Br.

There is no record of a wild plant in the region. There is a single specimen at CAL collected by C. wood from Mussoorie where it was cultivated in Botanical garden. The plant is native of China and Japan.

#### **Bulbophyllum** Thouars

Epiphytic with creeping root stock and globosely or sub-globosely ovoid or ovoid-oblong pseudobulbs which are naked or clothed with the remains of old sheaths. *Leaves* one or more to each pseudobulb, coriaceous, oblong, oval or lanceolate, petiolate. *Flowers* small or large one to many in spicate, shortly racemed or umbellate, 2-8 flowered, scapes arising at the base of the pseudobulb. *Sepal*/sub-equal or the dorsal about 1/10 to half more than as long as as laterals, 5-veined, the laterals adnate to the foot of the column forming a short mentum, free or their edges more or less joined. *Petals* much smaller, very variable. *Lip* tongue shaped, hinged to the end of the columnfoot, mobile, coriaceous or fleshy, strongly recurved. *Column* short, its base produced into a long upcurved foot, winged or toothed at the top. *Anther* terminal, 2-chambered; *pollinia* 2-4, collateral, cohering by pairs by a viscid glue, ovoid or oblong, the two inner pollinia smaller.

#### Key to species

1. Pseudobulbs with one leaf each.....2
- + Pseudobulbs with 2(-3) leaves each.....9
2. Inflorescence one (rarely 2-3) flowered, scape short usually less than 1 cm.....3
- + Inflorescence with few to many flowers arranged in racemes or sub-umbel.....4
3. Pseudobulbs slender, nearly cylindrical, distant, not touching, about 7.5 cm from each other, flowers pale-green with purple stripes.....*B. affine*
- + Pseudobulbs obpyriform, crowded, close, touching each other; flowers pale-ochraceous spotted with purple ..... *B. leopardinum*
4. Inflorescence a many flowered raceme; lateral sepals spreading, their upper edge not connate...5
- + Inflorescence sub-umbellate, lateral sepal distinctly longer than the dorsal one, their edges connate partly or throughout the entire length.....7

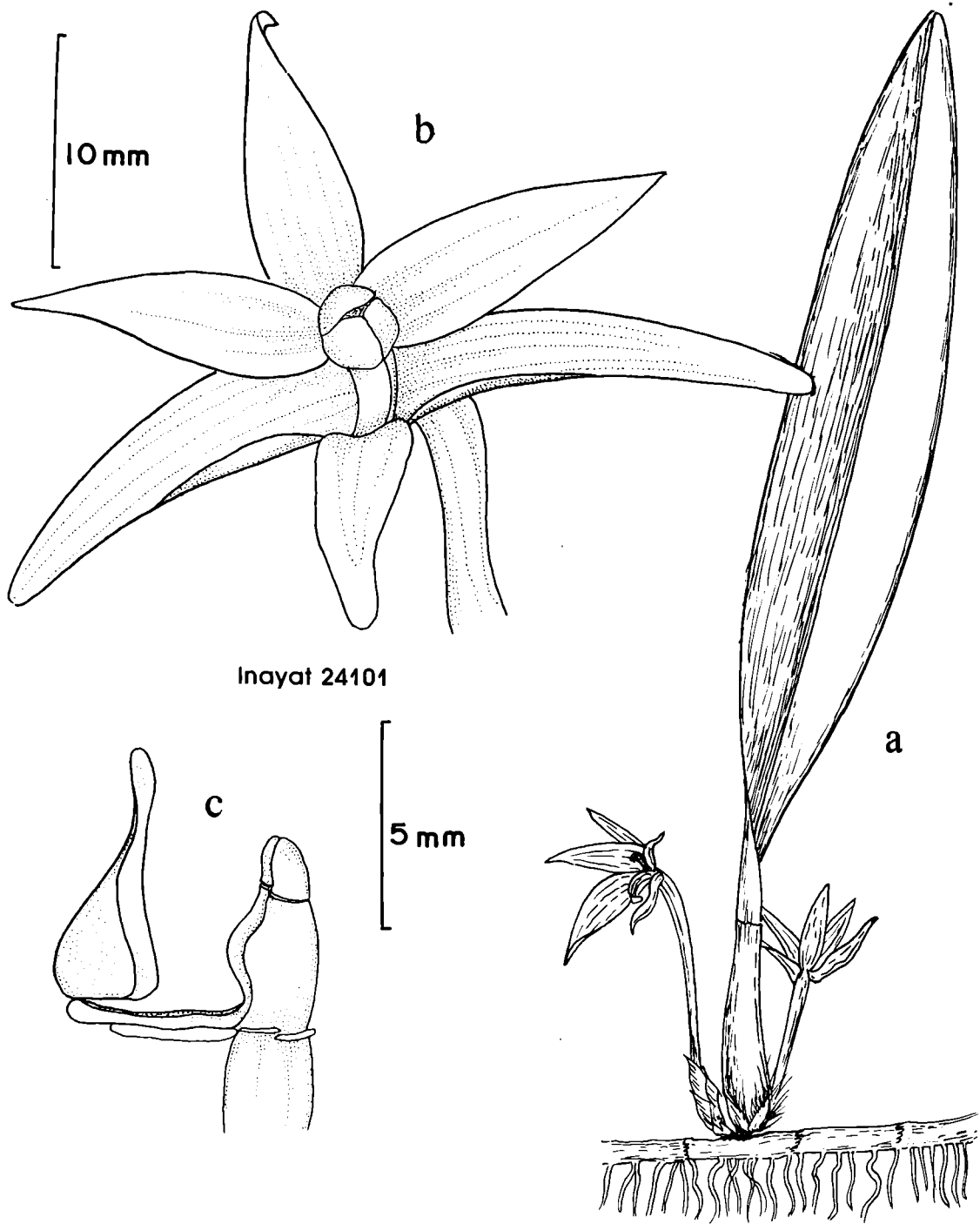
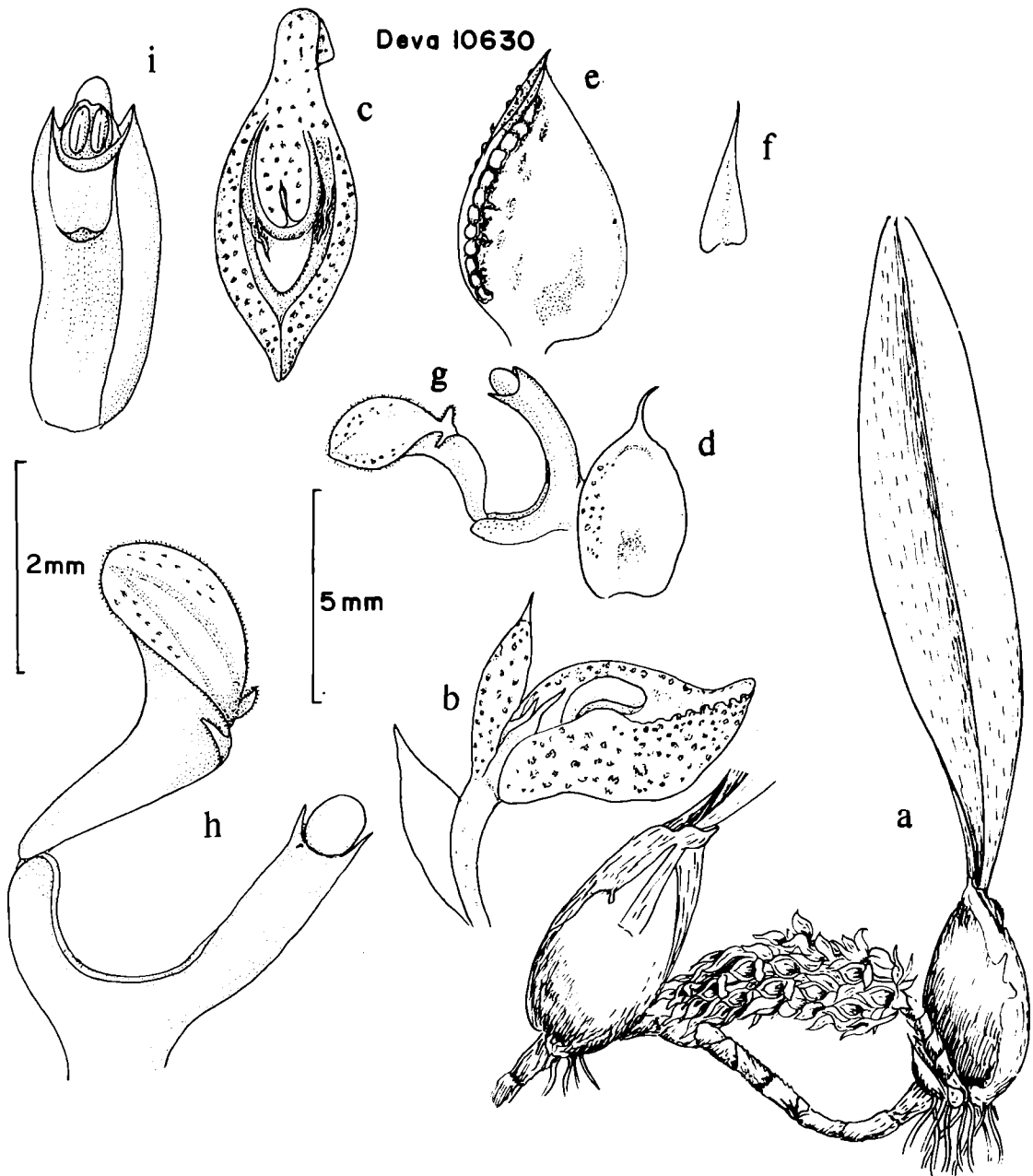
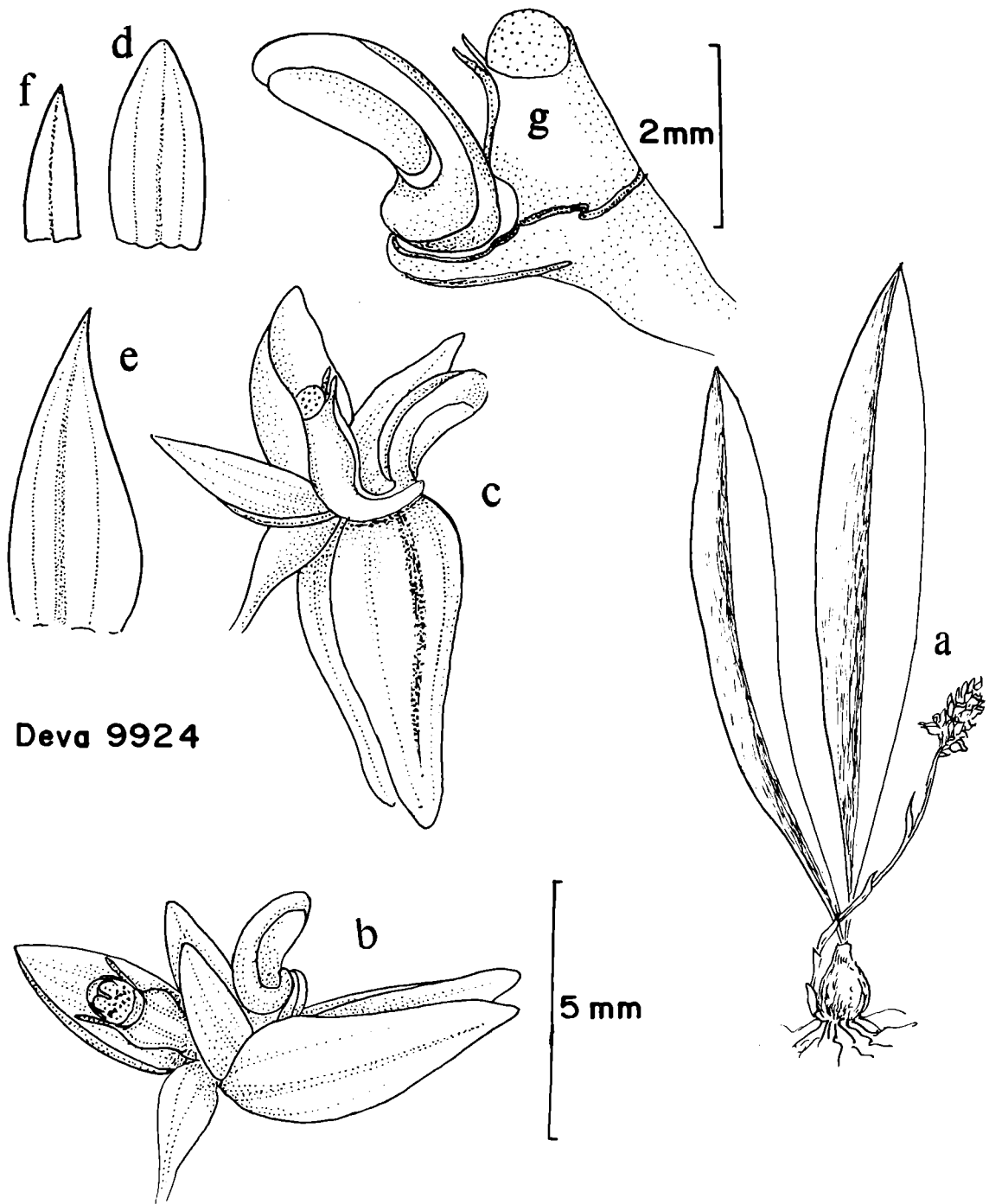


Fig. 111 *Bulbophyllum affine* Lindl. — a. plant; b. flower; c. column & lip.





**Fig. 112** *Bulbophyllum careyanum* (Hook.) Spreng. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. & h. column & lip; i. column.



Deva 9924

Fig. 113 *Bulbophyllum cariniflorum* Rchb. f. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. column & lip.

- or throughout the entire length.....7
5. Lip with definite lateral auricles near the base; flowers closely packed on dense long decurved  
receme,  
shorter than the leaves.....*B. careyanum*
- + Lip without lateral auricles; flowers distant on receme.....6
6. Pseudobulbs small (6-10 mm), globular or shortly ovoid; flowers after shedding of leaves, scape 5 cm  
or more; lateral sepals obtuse.....*B. polyrhizum*
- + Pseudobulbs large (10-20 mm), obpyriform, flower contemporary with leaves, scape smaller, lateral  
sepals acuminate.....*B. reptans*
7. Lateral sepals connate by their upper margin almost throughout the entire length.....8
- + Lateral sepal connate partially by upper margin less than half their length, their tips divergent.  
.....*B. umbellatum*
8. Scape half as long as the leaf; flowers upto 3-5 cm long; pseudobulbs 4-5 cm long; dorsal sepal and  
petals with erose to serrate margin.....*B. helenae*
- + Scape equal to or exceeding the leaf; flowers up to 2-2.5 cm long; pseudobulbs 1.5-3 cm, dorsal  
sepal and petals with entire margin.....*B. hookeri*
9. Margins of the petals hairy, hairs simple or purple, glandular, dorsal sepal about 1/10 the length of  
the lateral sepals; flowers after shedding of the leaves; anterior half of the lip glandular hairy  
.....*B. wallichii*
- + Margins of the petals without hairs, entire, dorsal half to more than half as long as the lateral sepals  
..... 10
10. Flowers yellowish-green, contemporary with leaves; petals narrow, triangular, 2.8 mm long, longer  
than column; lip orange.....*B. cariniflorum*
- + Flowers purplish after shedding of leaves; petals broad triangular, 1.4 mm long, equal to column  
..... *B. triste*

**Bulbophyllum affine** Lindl. in Wall. Cat. 1829. *nom. nud.*; Gen. & Sp. Orch. 48. 1830; Hook. f., 5; 756. 1890; King & Pantl. 67. t. 91. 1898; Duthie, 104, 1906; Seidenf., 18. fig. 3. 1979. (Fig. 111)

*Pseudobulbs* slender nearly cylindrical, 4-5 cm long; rhizome stout, simple, rooting, 7.5 cm apart, *Leaf* 7-18 × 1.5-3 cm, linear-oblong, petiole short. *Scape* short, bracteate, less than 10 mm from the sides of the base of a pseudobulb or from the rhizome between the pseudobulb, producing only a single flower. *Flower* 2-2.5 cm long, glabrous, pale-green with purple stripes. *Sepals* sub-equal, lanceolate, 5-nerved, not reflexed, the laterals falcate. *Petals* ovate-lanceolate, little shorter than sepals, 3-nerved. *Lip* lanceolate, thickened and concave at the base, edges dark purple.

*Flowering*: June - July

*Distribution*: Himalaya 1000-1500 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Laos, China, Thailand.

*Specimens examined*:

KUMAUN: *Pithoragarh*-Gori Valley, *Inayat*24101; *Gargia*-Askot, *P.C. Pant*35112; *Dafiadhura*, *Arora* 70823

**Bulbophyllum careyanum** (Hook.) Spreng, Syst. Veg. 3: 732. 1826; Hook. f., 5: 760. 1890; King & Pantl. 71, t. 97. 1898; Bhattacharyya 162, fig. 5, 1969; Senidenf., 145. fig. 98. 1979.

*Pleurothallis purpurea* D. Don, Prodr. Fl. Nepal, 33. 1825.

*Anisopetalon careyanum* Hook., Exot. Fl. 2: t. 149. 1825.

*B. neilgherrense*. sensu Arora in Ind. J. For. 1: 298. 1978 (*non*. Wight).

(Fig. 112)

*Rhizome* stout, woody, 5 mm thick. *Pseudobulbs* 4 cm long, fleshy, ovoid, ribbed and born on rhizomes at a distance of 7-8 cm. *Leaf* oblong, leathery, 12.5-25 × 2-4 cm, tongue shaped, sub-sessile. *Scape* more or less equal to the pseudobulb, stout, brown, clothed with many lanceolate bracts of the same colour, bearing at its apex a cylindrical densely flowered decurved raceme, 5-7.5 cm long. *Flowers* deep yellow with purple blotches, 6-8 mm long. *Bracts* lanceolate, longer than the ovary. *Sepals* un-equal, the lateral oblong-ovate, acute, spreading, the dorsal smaller. *Petals* fleshy, narrowly triangular, only about one third of the size of sepals, with caudate-acuminate apices and with a few projecting bristle like teeth on the edges. *Lip* 3-lobed, longer than petals, oblong, with definite lateral auricles near the base, edges minutely ciliate.

*Flowering*: October - April.

*Distribution*: Himalaya 1200 - 1500 m (Kumaun to Arunachal Pradesh), Meghalaya, Burma, Thailand.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Gori Valley, Vasavgad, *Bhattacharyya* 21254; Maitli, *Arora* 52441; Sandev, *Deva*, 10630.

Both the specimens collected by *Bhattacharyya* and *Arora* quoted above are in late fruitings stage. *B. neilgherrense* Wt., is very similar and can easily be mistaken for this species, however the disposition of flowers and size of scape is very different in both species. In *B. careyanum* the scape is short with densely imbricating flowers (even clear in fruiting specimen) while in *B. neilgherrense* the scape is longer, often as long as the leaves (Wt. l.c. t. 1650. 1851) and the racemes are lax flowered. *Arora's* specimen no. 52441 shows clearly densely imbricating pedicels on a short scape. *Abraham & Vatsala* (1981) also point out the similarity between these two species and in those form where the scape is smaller (*Sant. & Kapadia* t. 47. 1966 and *Abraham & Vatsala* fig. 74. 1981) the distinction becomes more difficult, but even then the flowers are more loosely arranged than in the case of *B. careyanum*. The plant described and sketched by *Banerji & Pradhan* 366. pl. 169, 1984, with a long scape and leafy arranged flowers is very different from *B. careyanum* and approaches *B. neilgherrense*.

***Bulbophyllum cariniflorum*** Rchb. f., in Walp. Ann. 6: 253. 1861; Seidenf., 212. fig. 155. 1979.

*B. densiflorum* Rolfe in Kew Bull. 139. 1892; *Arora*, 11: 202. 1969.

*B. viridiflorum* sensu *Mehra & Kashyap* in Taxon, 27: 226. 1978 non (*Hook. f.*) *Schltr.*, Seidenf. & *Arora*, 10. 1982 (Fig. 113)

*Rhizome* creeping. *Pseudobulbs* aggregate, ovoid to obpyriform, smooth when young, longitudinally grooved when old, 1.5-2 × 1-2 cm, often covered by scarious tubular sheaths. *Leaves* 2 or rarely 3-4 on apex of each pseudobulb, contemporaneous with flowers, subsessile, broadly cuneate at base, acute at apex, 10-17 × 2-3 cm. *Inflorescence* solitary at the base of pseudobulb. *Spike* 3-4 cm long, bent down from base, densely may flowered. *Flowers* yellowish-green, 6 mm long, spreading. *Bracts* narrowly triangular, acuminate, more or less 3 mm long. *Sepals* the dorsal ovate, acute, concave more or less 5 mm long, 3-nerved, hyaline at margins, the laterals elliptic, ovate, acute more or less 6 mm long, 3-nerved. *Petals* subulate, linear-oblong, more or less 3 mm long, 1-nerved. *Lip* mobile, more or less 3 mm long, tongue-shaped, fleshy, orange coloured, bent forward, rounded at margins, obtuse at apex.

*Flowering*: June - July

*Distribution*: Himalaya 1000-1500 m (Garhwal to Nepal and Bhutan), Meghalaya, Andhra Pradesh.

*Specimens examined*:

GARHWAL: **Chamoli**-Mandal, *Naithani* 41986.

KUMAUN: **Pithoragarh**-Gori Valley *Sherghat*, *Inayat* 24085; *Jepti-Malpa*, *T.A. Rao* 11791; *Didihat*, *M.A. Rau* 35106, *Arora* 36419, 38811, 38104, 41333; *Dafiadhura*, *Arora* 49504; *Askot*, *Arora* 37806; *Sandev*, *Deva* 9924.

**Bulbophyllum helenae** (Kze.) J.J. Sm., in Bull. Buitenz. ser. 2, 8: 24. 1912; Arora, 279. 1978; Seidenf., 157. fig. 108. 1979.

*Phyllorchis helenae* Kze. Rev. Gen. Pl. 2: 676. 1891.

*Cirrhopetalum cornutum* Lindl. Bot. Reg. 24. Misc. 138: 37, 1838; Hook. f., 5: 774. 1890; King & Pantl., 87, t. 120. 1898; Arora, 203. fig. 1-6, 1969. (Fig. 114)

*Pseudobulbs* 4-5 cm long, ovoid or columnar, born on stout rhizome at distance of 20-35 mm. *Leaf* 15-25 cm long, linear-oblong, lanceolate, fleshy; petiole 2-3 cm long. *Scape* erect, half as long as the leaf. *Flowers* 6-9, arranged in a radiating umbel, malodorous, yellow with purple spots, 3-5 cm long. *Sepals* the laterals convex, 1.5-2.5 mm long, the dorsal shorter than lateral, green and blotched with purple-brown. *Petals* green blotched purple-brown. *Lip* smooth.

*Flowering*: May - June

*Distribution*: Himalaya 1500-2000 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. Upper Burma and Thailand.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Didihat, Arora 37871; Dafiadhura, Arora 70824.

**Bulbophyllum hookeri** (Duthie) J.J. Sm. in Bull. Buitenz. ser. 2, 8: 25, 1912; Seidenf., 158, fig. 100. 1973; Pradhan 419, fig. A.D. 1979.

*Cirrhopetalum hookeri* Duthie in J. As. Soc. Beng. 71(2): 38. 1902; Duthie, 106. t. 101. 1906. (Fig. 115)

Caespitose. *Pseudobulbs* crowded 1.5-3 cm long, ovoid, obtuse, greyish-green. *Leaf* 3-4 × 1-1.2 cm, lanceolate or elliptic-oblong, shortly petiolate. *Inflorescence* an umbel of 3-10 flowers, 2-2.5 cm long, yellow. *Sepal* the dorsal 5 mm long, ovate, emarginate, concave, pale-yellow with 3-purple veins; the laterals 2 cm long, united at their bases and joined to the foot of the column, auricled at the base, acuminate, tips cucullate, yellow with three or four veins which are more prominent towards the base. *Petals* shorter than dorsal sepal, broadly or obliquely ovate, rounded at the apex, yellow tinged with purple at the base. *Lip* deflexed from about the middle, oblong, thick, fleshy, margins incurved and forming a deep furrow on the upper surface, yellow with purplish spots on raised margins of the basal portion.

*Flowering*: September - October.

*Distribution*: Himalaya 1500 m (Garhwal, Kumaun, Nepal, Arunachal Pradesh), Assam.

*Specimens examined*:

GARHWAL: **Tehri-Tehri** Garhwal, Mackinnon collector 25402.

KUMAUN: **Pithoragarh**-Dafiadhura, Arora 52437, 66188.

**Bulbophyllum leopardinum** (Wall.) Lindl. Gen. & Sp. Orch. 48. 1830; Hook. f., 5: 756. 1890; King & Pantl. 67, t. 92. 1898; Seidenf., 28. fig. 10. 1979, Hajra in Ind. For. 110: 686. 1984.

*Dendrobium leopardinum* Wall. Tent. Fl. Nepal 1: 39. t. 28. 1824.

*Sarcopodium leopardinum* (Wall.) Lindl. Paxt. Fl. Gard. 1: 155. 1850.

*Phyllorchis leopardina* (Wall.) Kze. Rev. Gen. Pl. 2: 677. 1891.

(Fig. 116)

Rhizome stout, covered with numerous fibrous sheaths. *Pseudobulbs* obpyriform, compressed, crowded, smooth, 2.5-3.5 cm, placed obliquely. *Leaves* elliptic-oblong, 8-15 × 2.5-5 cm, apex blunt but shortly mucronate, base narrowed to the short petiole. *Flowers* one to three, 2.5 cm across, from the base of the pseudobulb, pale-ochraceous, spotted with purple. *Bracts* broad, sub-spathaceous. *Sepals* ovate-lanceolate, sub-acute, 9-nerved. *Petals* smaller than sepals, 7-nerved. *Lip* shorter than petals, thick, secreting nectar profusely, decurved from below the middle, lanceolate, the base having small toothed auricles.

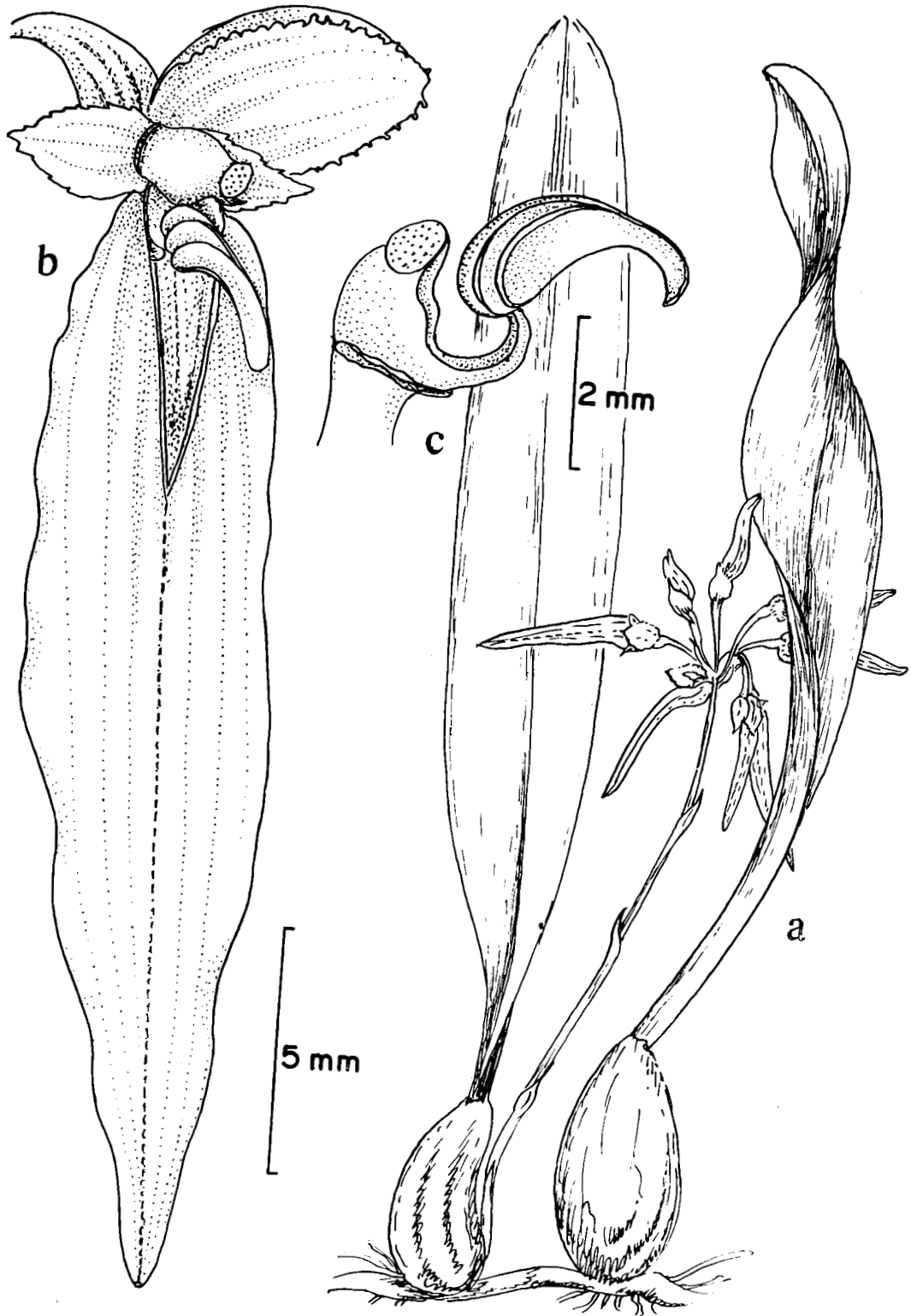


Fig. 114 *Bulbophyllum helenaе* (Ktz.) J.J. Sm.—a. plant; b. flower; c. column & lip.

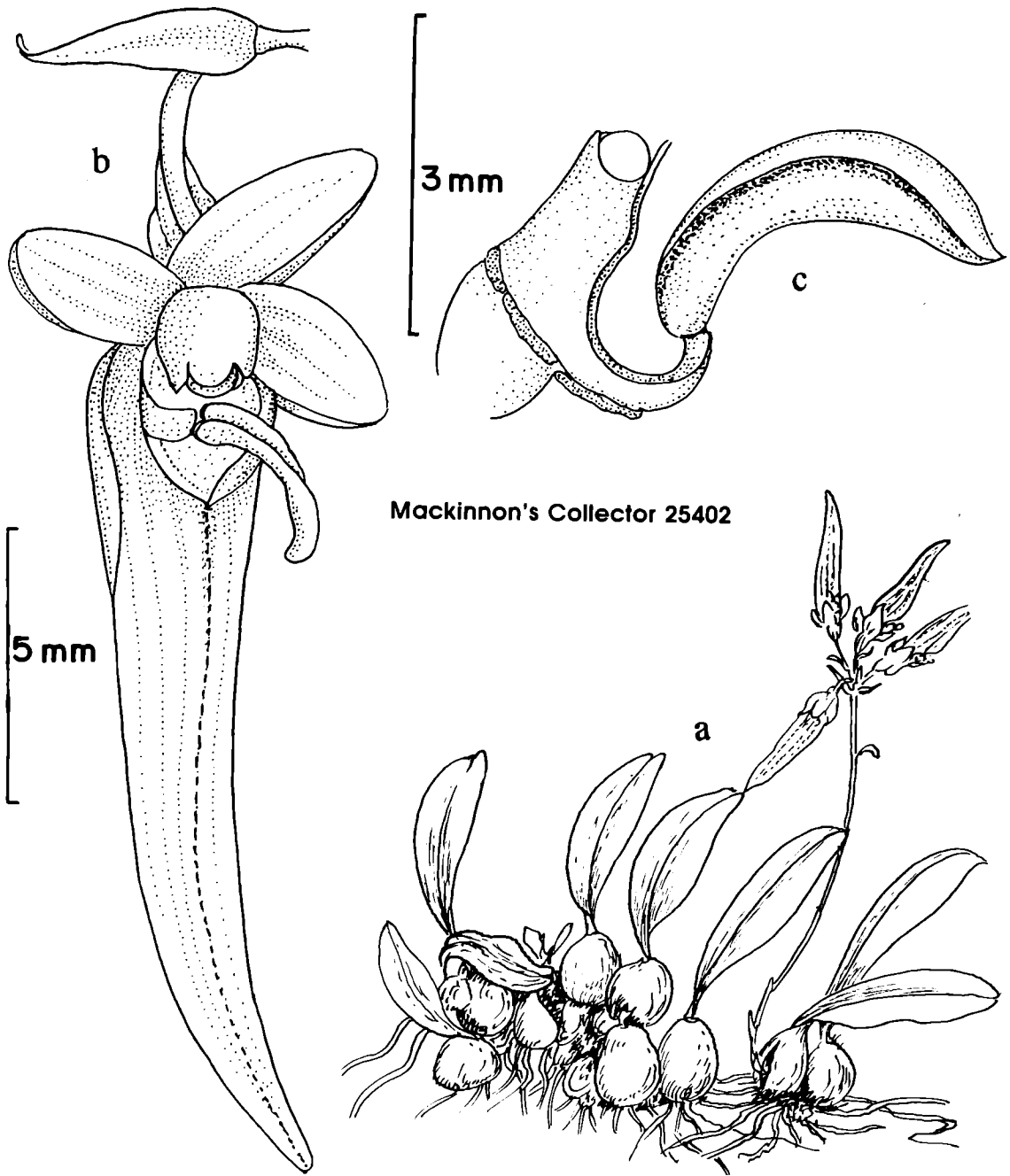


Fig. 115 *Bulbophyllum hookeri* (Duthie) J.J. Sm.—a. plant; b. flower; c. column & lip.

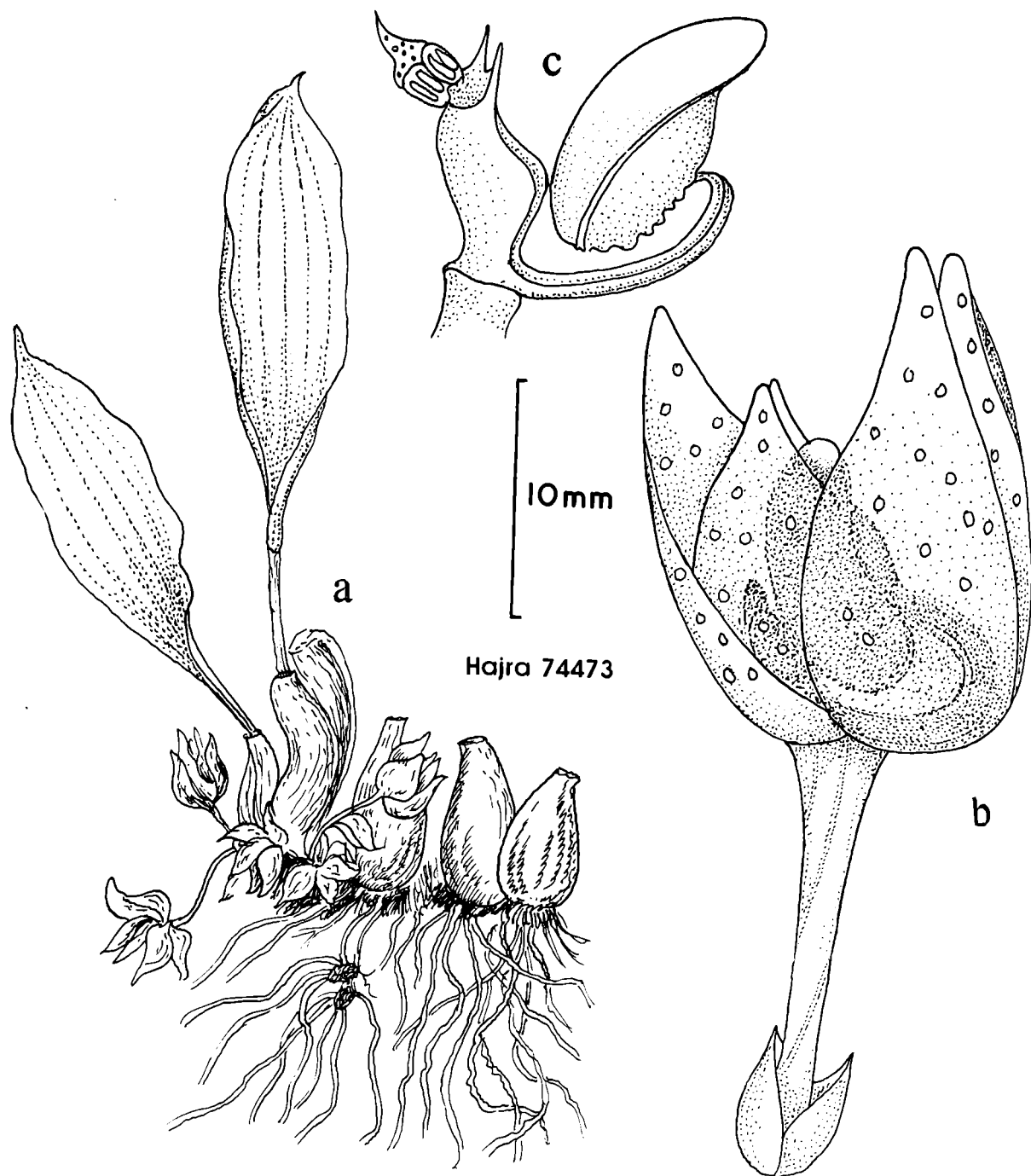


Fig. 116 *Bulbophyllum leopardinum* (Wall.) Lindl. — a. plant; b. flower; c. lip & column.



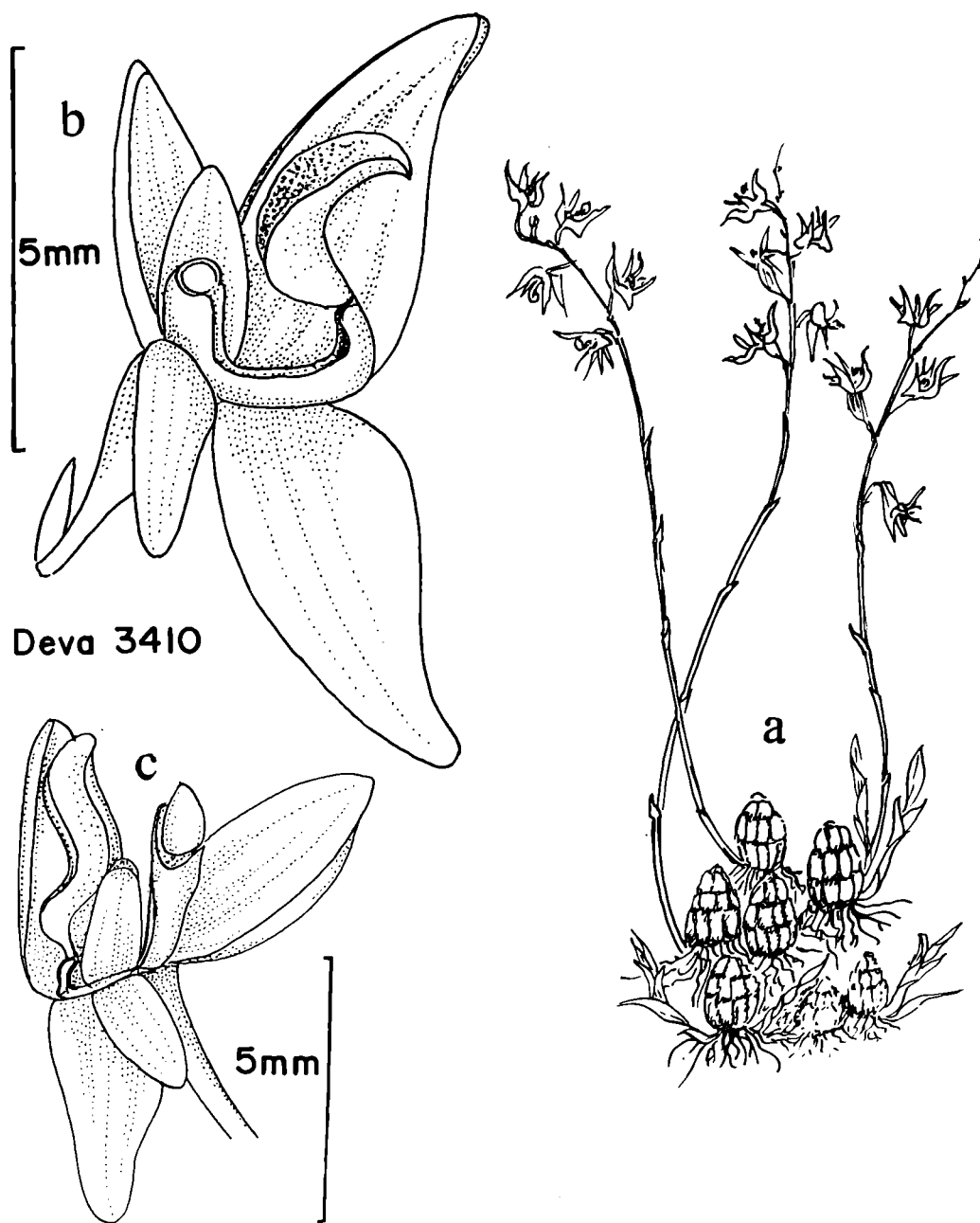


Fig. 117 *Bulbophyllum polyrhizum* Lindl.—a. plant; b. & c. flower.

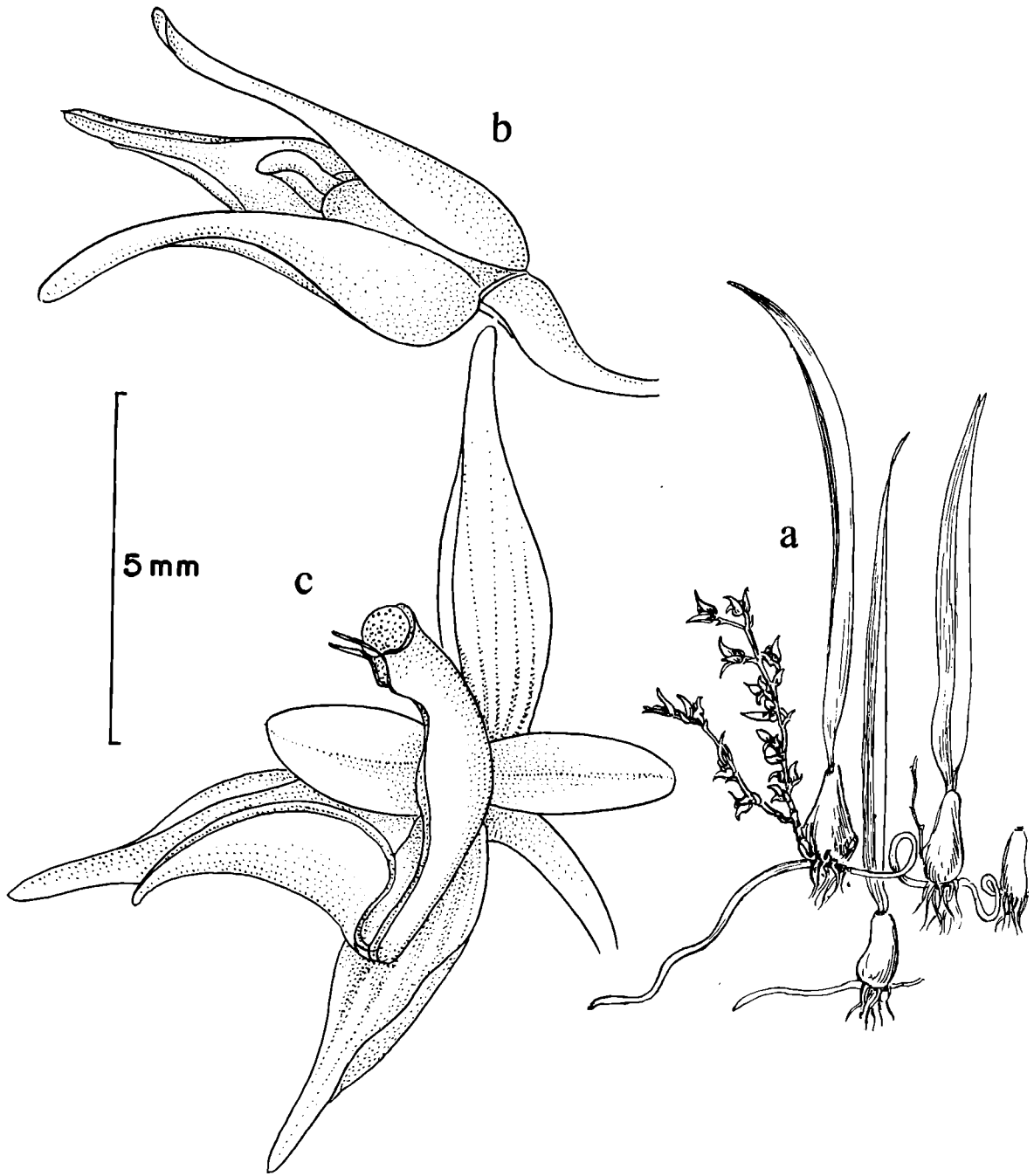


Fig. 118 *Bulbophyllum reptans* (Lindl.) Lindl.—a. plant; b. & c. flower.

*Flowering*: October - November.

*Distribution*: Himalaya at 2000 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. Burma and Thailand.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Askot to Ogla, *Hajra* 74473.

**Bulbophyllum polyrhizum** Lindl. Gen. & Sp. Orch. 53. 1830; Hook. f., 5: 767. 1890; King & Pantl 70, t. 95. 1898; Duthie, 104. 1906; Seidenf., 108. fig. 68. 1979; Hegde & Rao, 385. 1983.

*B. secundum* sensu Seidenf. & Arora in Nord. J. Bot. 2: 10. 1982 (*non* Hook. f.). (Fig. 117)

Rhizome thread like, branching. *Pseudobulbs* crowded or distant, globular or shortly ovoid, 6-10 mm long, spaced 2.5 cm apart on the rhizome. *Leaf* narrowly-oblong, sessile, 6.5 cm long, *Scape* filiform, about 5-10 cm long, it suberect peduncle longer than inclined raceme, bearing one or two minute bracts, 6-flowered. *Flowers* 8 mm long, pale-yellow, secund, after shedding of leaves. *Bracts* minute, oblong, equalling the ovary. *Sepals* spreading, the laterals obtuse, 3-nerved, the dorsal ovate, concave. *Petals* broadly ovate, acute, much shorter than sepals, 1-nerved. *Lip* without lateral auricles, oblong, scabrous, deflexed from the base.

*Flowering*: March.

*Distribution*: Himalaya 1000-1500 m (Garhwal to Arunachal Pradesh), Nagaland, Mizoram, Orissa. Burma and Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Near Mussoorie, *Mackinnon* 24147; *Rispana* near Mussoorie, *Arora* 3884, *Deva* 1714, 2708, 3388, 3410.

KUMAUN: **Pithoragarh**-Pithoragarh, *Bhattacharyya* 20392; *Vasavgad*, *Bhattacharyya* 21253; *Quitii*, *N.C. Nair* 35501; *Askot*, *P.C. Pant* 31844. *Arora* 66103 & 66103(a); *Sandev*, *Arora* 41390.

*B. secundum* Hook. f. is very distinct plant and very different from *B. polyrhizum*. It has sepals and lip with ciliate margins and the petals are distinctly hairy (Seidenf. fig. 63. 1979) while in *B. polyrhizum* the flowers are completely glabrous.

**Bulbophyllum reptans** (Lindl.) Lindl. Gen & Sp. Orch. 51. 1830; Hook. f., 5: 768. 1890; King & Pantl. 78. t. 106. 1898; Duthie, 105. 1906; Seidenf. 109. fig. 70. 1979.

*Tribrachia reptans* Lindl. Collect. Bot.: t. 41 A. 1826.

*B. clarkei* Rchb. f., Fl. 71: 155. 1888.

*B. grandiflorum* Griff. Itin. Not. 146. 1848.

*B. reptans* var. *subracemosa* sensu Arora in Ind. J. For. 1: 297. 1978 (*non* Hook. f.).

*B. raii* Arora in Bull. bot. Surv. Ind. 11(3-4): 440. fig. 1-6. 1969 syn. nov.

*B. reptans* var. *acuta* Malhotra & Balodi in Bull. Bot. Surv. Ind. 26(1-2): 110, 1984 (Fig. 118)

Rhizome slender, naked, branching. *Pseudobulbs* inverted-pear-shaped, smooth, 1-2 cm long, placed 6-6.5 cm apart on rhizome. *Leaf* linear-oblong, 9-15 × 0.6-1 cm, sub-acute, obliquely notched at the apex, shortly petiolate. *Scape* often in pair, from the base of pseudobulb, shorter or longer than leaves; raceme lax, 4-9 flowered. *Flowers* 6-9 mm long, yellowish brown with purple spots, contemporary with leaves, distant on raceme. *Bracts* of the lower flowers of the spike longer than those of the upper, oblong-lanceolate, longer than the ovary. *Sepals* subequal, lanceolate, 3-nerved, the laterals acuminate. *Petals* much shorter than sepals, oblong, blunt, 1-3 nerved, spreading. *Lip* about as long as the petals, without lateral auricles, oblong, stipitate, deflexed from the middle margins, more or less winged.

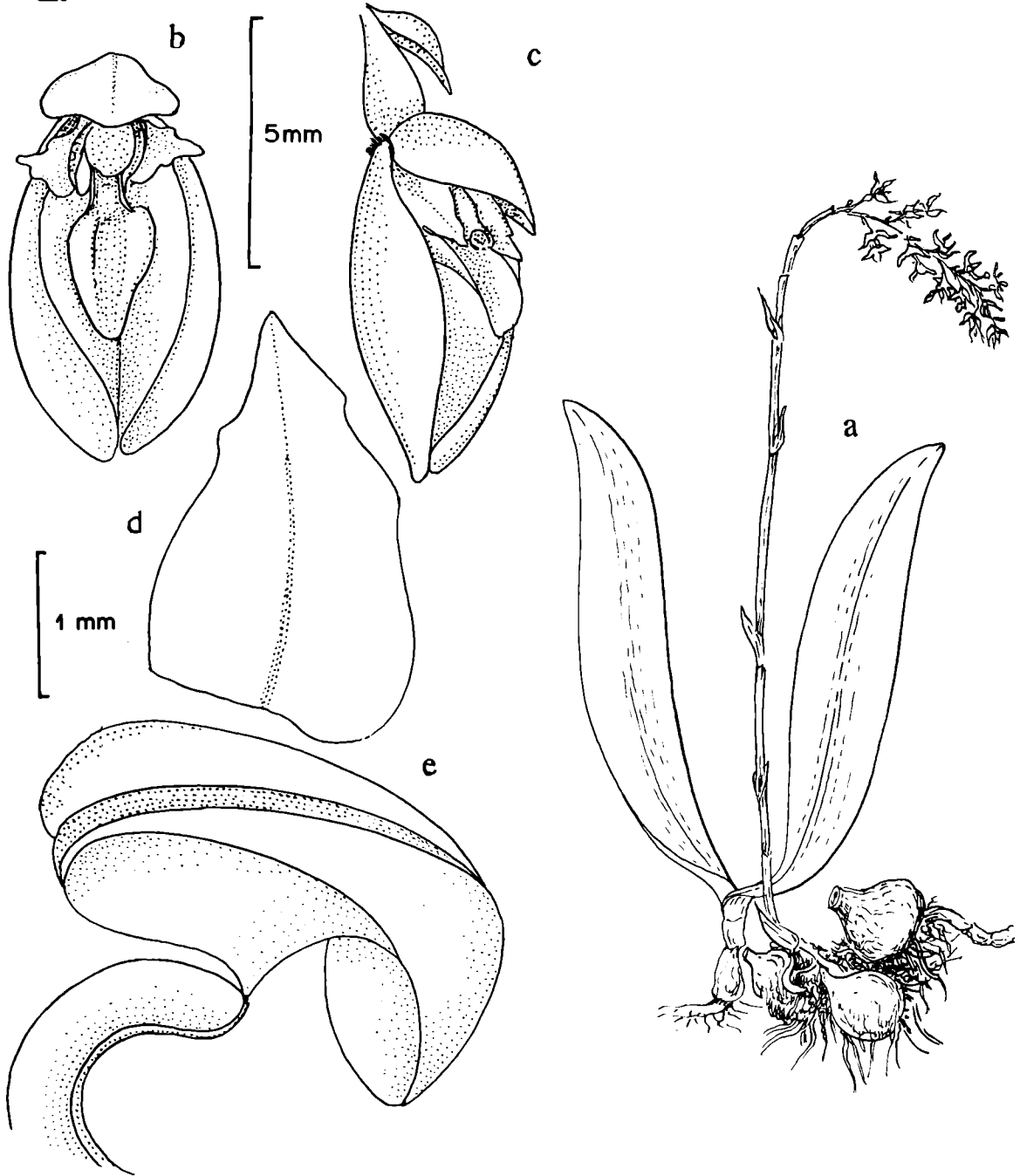


Fig. 119 *Bulbophyllum triste* Rchb. f.—a. plant; b. & c. flower; d. petal; e. lip.

*Flowering:* October - November.

*Distribution:* Himalaya 1200-1600 m (Garhwal to Arunachal Pradesh). Nagaland, Meghalaya, Mizoram, Burma, China, Thailand.

GARHWAL: Tehri-East of Tehri (Duthie, *l.c.*).

*Specimens examined:*

KUMAUN: Pithoragarh-Ghorpatta, M.A. Rau 35340; Dafidhrra, Arora 53279(A); Sandev, Arora 37802(A) & 37802(B); Dafiatop, Arora 44614.

A very common plant of Kumaun, epiphytic on Oak. Hook. f., (1890) and King & Pantling (1898) separated a variety *subracemosa* which has short and obtuse bracts, much shorter than the longer pedicelled ovary. We have not located any specimen belonging to this variety from North Western Himalaya. Arora's no. 35340 and 53279(A) have bracts longer than ovary. We have also examined carefully the holotype and isotype (37802(A) & 37802(B) of *B. rauli*. Arora 440, fig. 1-6. 1969 described it as a new species on the basis that the flowers never open; leaves and inflorescence smaller, petals 3-nerved and lip is not stipitate, without thickened margin. These specimens (holotype and isotype of *B. rauli*) were collected from Sandev in a very young bud stage and when cultivated at Dehra Dun in drier climate, buds never developed further. The leaves and inflorescence are not at all different from typical *B. reptans*. The petals can also be 3-nerved as stated by Hook. f. (1890). The callus (on column foot) of the lip in a very young bud stage lies horizontally arising from the base of the column in between the base of the petals. Arora's fig. of lip clearly shows a distance between the foot and the lip and he failed to notice that the callus is present between the two. The margin in a young bud has not thickened as yet. We consider these specimens identical with *B. reptans*.

**Bulbophyllum triste** Rchb. f. in Walp. Ann. 6: 253. 1861; Hook. f., 5: 768. 1890; King & Pantl. 73, t. 98, 1898; Rau & Bhattacharyya 94. 1966; Seidenf., 213. fig. 156. 1979.

*B. alopecurus* Rchb. f., Gard. Chron. 2: 70. 1880; Hook. f., 5: 770. 1890.

*B. micranthum* Hook. f., Fl. Brit. Ind. 5: 768. 1890.

(Fig. 119)

Rhizome thick. *Pseudobulb* 1.8-2 cm in diameter, dorsiventrally flattened, leafless at flowering time. Leaves two, narrowly oblong, 7.5-12.5 × 1.5-2 cm. *Scape* 7.5-15 cm long; spike densely many flowered, drooping. *Flowers* about 6 mm long, dull purple, foul smelling. *Bracts* minute, acute. *Sepals* the dorsal oblong-ovate, the laterals joined at the tips, with incurved margins. *Petals* ovate-oblong, triangular, 1.4 mm long. *Lip* fleshy, oblong-lanceolate, channelled, broad at the base. *Column* bearing apical subulate appendages.

*Flowering:* March.

*Distribution:* Himalaya 1000-1200 m (Kumaun, Nepal, Sikkim), Orissa, Meghalaya, Tirap district of Arunachal Pradesh. Burma, Thailand.

*Specimens examined:*

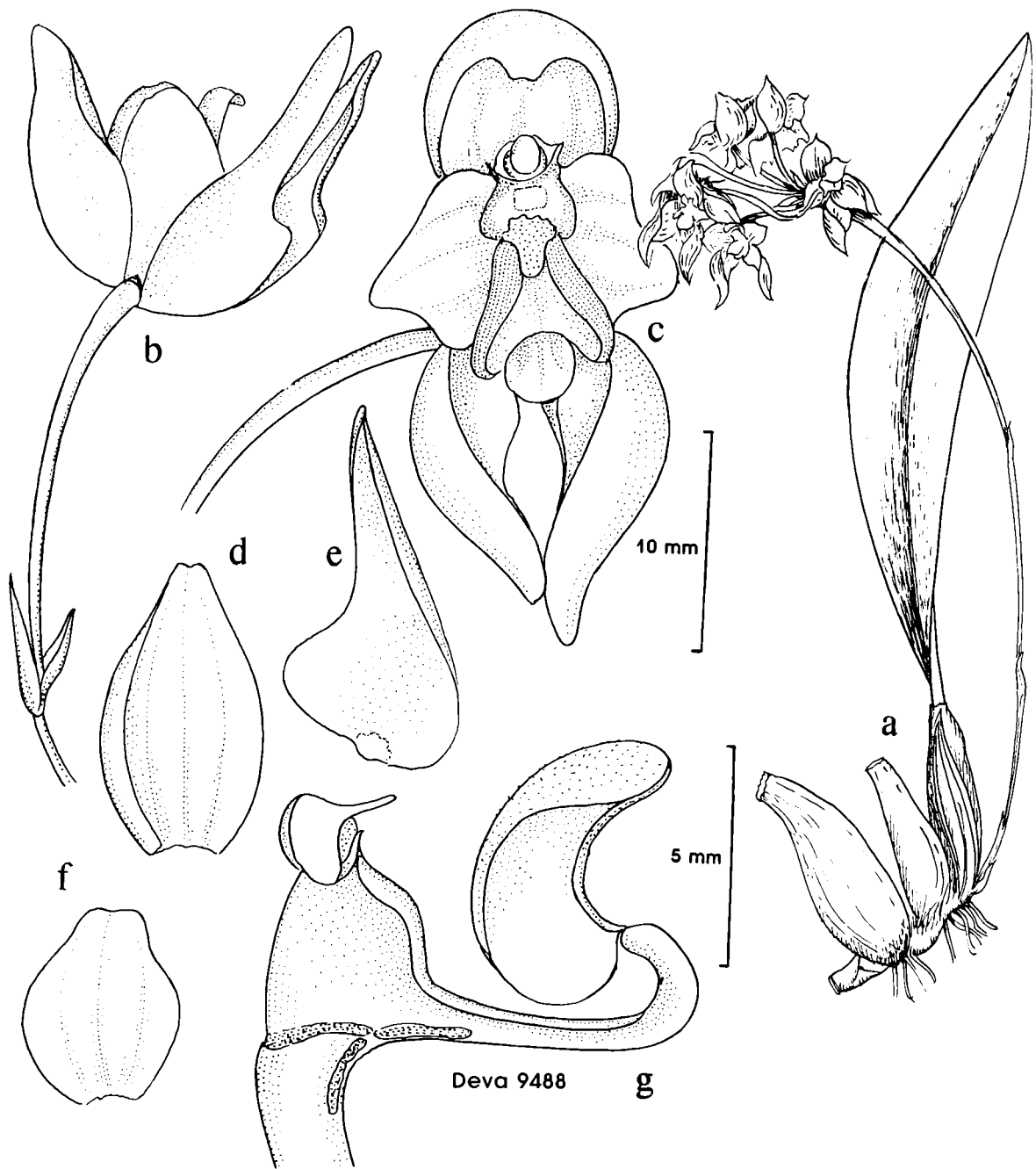
KUMAUN: Pithoragarh-Askot-Baruem, Bhattacharyya 21200, Arora 36448.

**Bulbophyllum umbellatum** Lindl. Gen. & Sp. Orch. 56. 1830; Seidenf. 178. fig. 90. 1973 et 219. 1979. *Cirrhopetalum maculosum* Lindl. in Edgw. Bot. Reg. 27, Misc. 81. 1841; Hook. f., 5: 776. 1890; King & Pantl. 95. t. 132. 1898; Duthie, 106. 1906.

*C. bootanense* Griff. Notul. 3: 297. Ic. t. 299. 1851.

*C. guttulatum* sensu Arora in Bull. bot. Sruv. Ind. 11: 437, fig. 1-6. 1969 (*non* Hook. f.).

*B. guttulatum* sensu Seidenf. & Arora in Nord. J. Bot. 2: 10. 1982 (*non* Wall. ex Hook. f.). (Fig. 120)



**Fig. 120** *Bulbophyllum umbellatum* Lindl. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. column & lip.

*Rhizome* with fibrous sheaths and many roots. *Pseudobulbs* 1.8-2.5 cm long, ovoid, 10 mm apart on the rhizome, wrinkled at flowering time. *Leaf* sessile, 10-15 × 1.5-3 cm, oblong-obtuse, notched at the apex. *Scapes* 3-8 cm, ending in an umbel of 2-5 flowers. *Flowers* 5-10 mm long, cream coloured, spotted. *Bracts* lanceolate, shorter than the ovary. *Sepals* the dorsal free at its base from the laterals, broadly ovate, acute, laterals twice as long as the dorsal, ovate, lanceolate, partially by upper margin less than half their length, their tips divergent. *Petals* broadly ovate, obtuse. *Lip* green, oblong with a broad base, tapering to the sub-acute apex, the upper surface grooved.

*Flowering*: May.

*Distribution*: Himalaya 1000-1500 m (Garhwal to Arunachal Pradesh), Assam, Orissa, Meghalaya, Nagaland, Manipur, Mizoram, Tripura. China, Vietnam, Taiwan.

*Specimens examined*:

GARHWAL: **Derha Dun**-Below Mussoorie (Duthie, *l.c.*). **Tehri**-Near Tehri, *Mackinnon's collector* 24157. **Chamoli**-Mandal, *Naithani* 43963; *Phata*, *N. C. Nair* 35919.

KUMAUN: **Pithoragarh**-Rathi-Bogdwar, *Tahl*, *Bhattacharyya* 21393; *Askot*, *Bhattacharyya* 21135; *Vasavgad*, *Bhattacharyya* 21353; *Madhkote*, *Bhattacharyya* 21352; *Sandev*, *Deva* 9488, *Arora* 41337, 70852. *Didihat*, *P. C. Pant* 31846, *Arora* 36416 & 37821.

**Bulbophyllum wallichii** Rchb. f., in Walp. Ann. 6: 259. 1861; Seidenf., 189. fig. 136. 1979.

*Cirrhopetalum wallichii* acut. non Lindl. 1830; Lindl. in Bot. Reg. Misc. 119. 1839; idem in Bot. Reg. sub T. 49. 1843.

*C. refractum* acut. non Zoll., Hook. f. 779. 1890 p.p.; King & Pantl. 87, t. 119. 1898 p.p.; Duthie, 107. 1906.

*B. refractoides* Seidenf., Bot. Tidsskr. 65: 342. 1970 (not fig. 16).

(Fig. 121)

*Pseudobulbs* about 2.5 cm long, crowded, conical with broad base, wrinkled at flowering time. *Leaves* in pairs from the apex of pseudobulb, deciduous at flowering time, 3.5-12 × 1.8-2 cm, narrowly oblong, sessile. *Scapes* erect, 10-15 cm, many flowered. *Flowers* 4-6.5 cm long, decurved, fragrant, pale-green turning to yellowish-brown with age. *Bracts* ovate-acuminate, much longer than the short sub-sessile ovary. *Sepals* the dorsal about 1/10 the length of laterals, lanceolate, apex awned, spotted purple, margin ciliate, laterals cohering except at the base. *Petals* fleshy, triangular, densely ciliate, spotted purple. *Lip* very fleshy, oblong, lower surface convex, the upper smooth, deflexed from below the middle, the basal half with up-turned edges, the anterior half with tufts of purple glandular hairs.

*Flowering*: September - November.

*Distribution*: Himalaya (Kumaun to Arunachal Pradesh), Nagaland, Meghalaya, Mizoram. Burma, Thailand and Indo-China.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Sarju Valley, *Strachey & Winterbottom* 11; *Askot*, *Arora* 38824; *Maitli*, *Arora* 45766.

#### Species imperfectly known

**Bulbophyllum yoksunense** J.J. Sm. in Bull. Buitenz. 2 ser. 8: 29, 1912; Seidenf. 61, f21, 1973; Seidenf. & Arora 10, 1982.

*Cirrhopetalum brevipes* Hook. f., Fl. Brit. Ind. 5: 777, 1890; King & Pantling, 88. Pl. 122, 1898.

We have seen no such specimen.

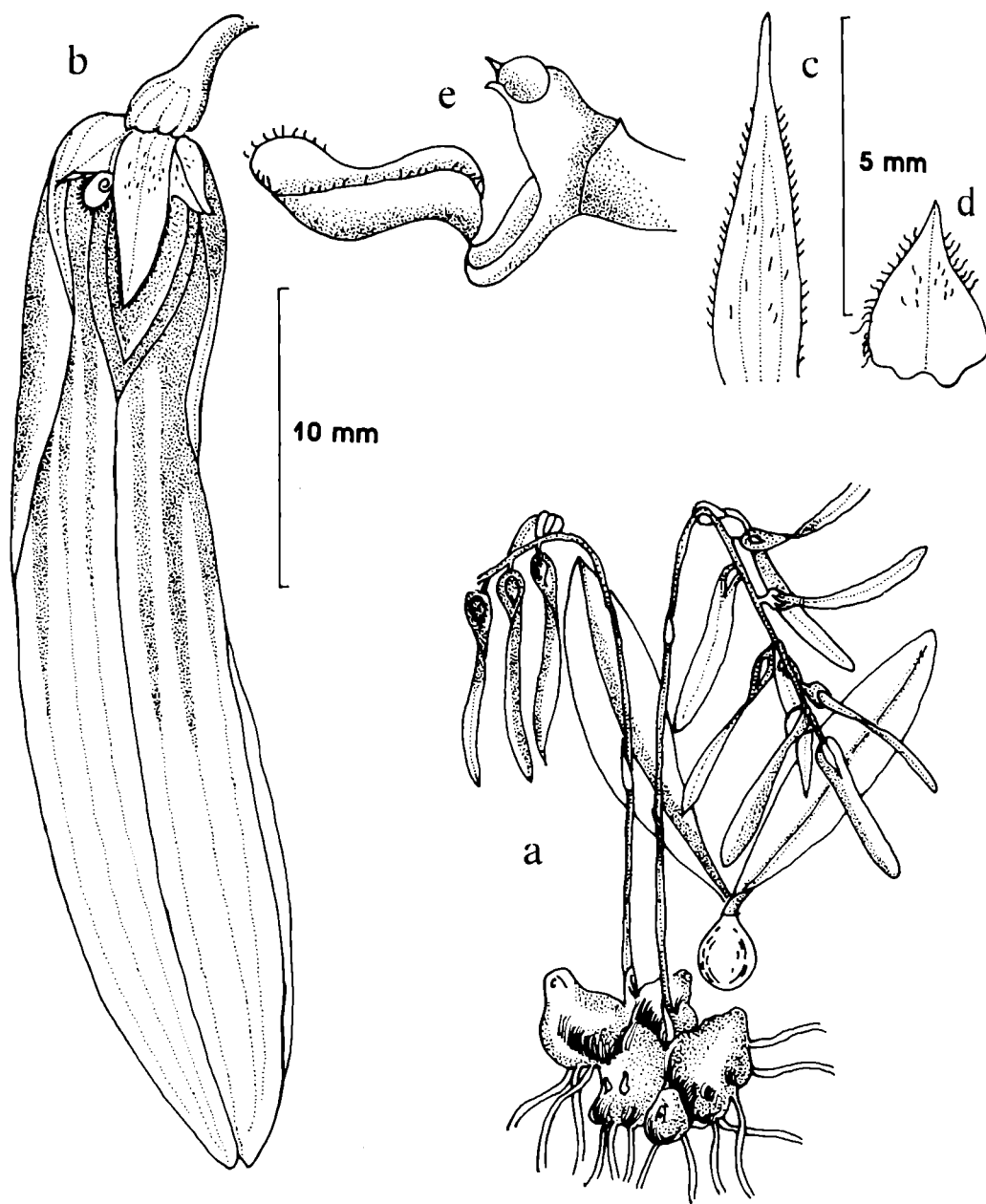


Fig. 121 *Bulbophyllum wallichii* Rchb.f. — a. plant; b. flower; c. dorsal sepal; d. petal; e. column & lip.



### Calanthe R. Br.

Terrestrial, often pseudobulbous. Corm variable in length, often tall, sometimes absent. *Leaves* plaited. *Inflorescence* axillary, terminal or lateral from the pseudobulb. *Flowers* in erect raceme, medium-sized, usually conspicuous. *Sepals* sub-equal, spreading, rarely connivent. *Petals* broader or narrower than sepals. *Lip* adnate to the column either to its base or to its whole length, usually 3-lobed, midlobe often bifid, disk lamellate or tubercled, with or without spur. *Column* long or short, sometimes dilated at the base or apex, foot absent. *Anther* conical or convex; *pollinia* 8, waxy, often equal, cohering in fours to a caudicle. *Capsule* ellipsoid, drooping.

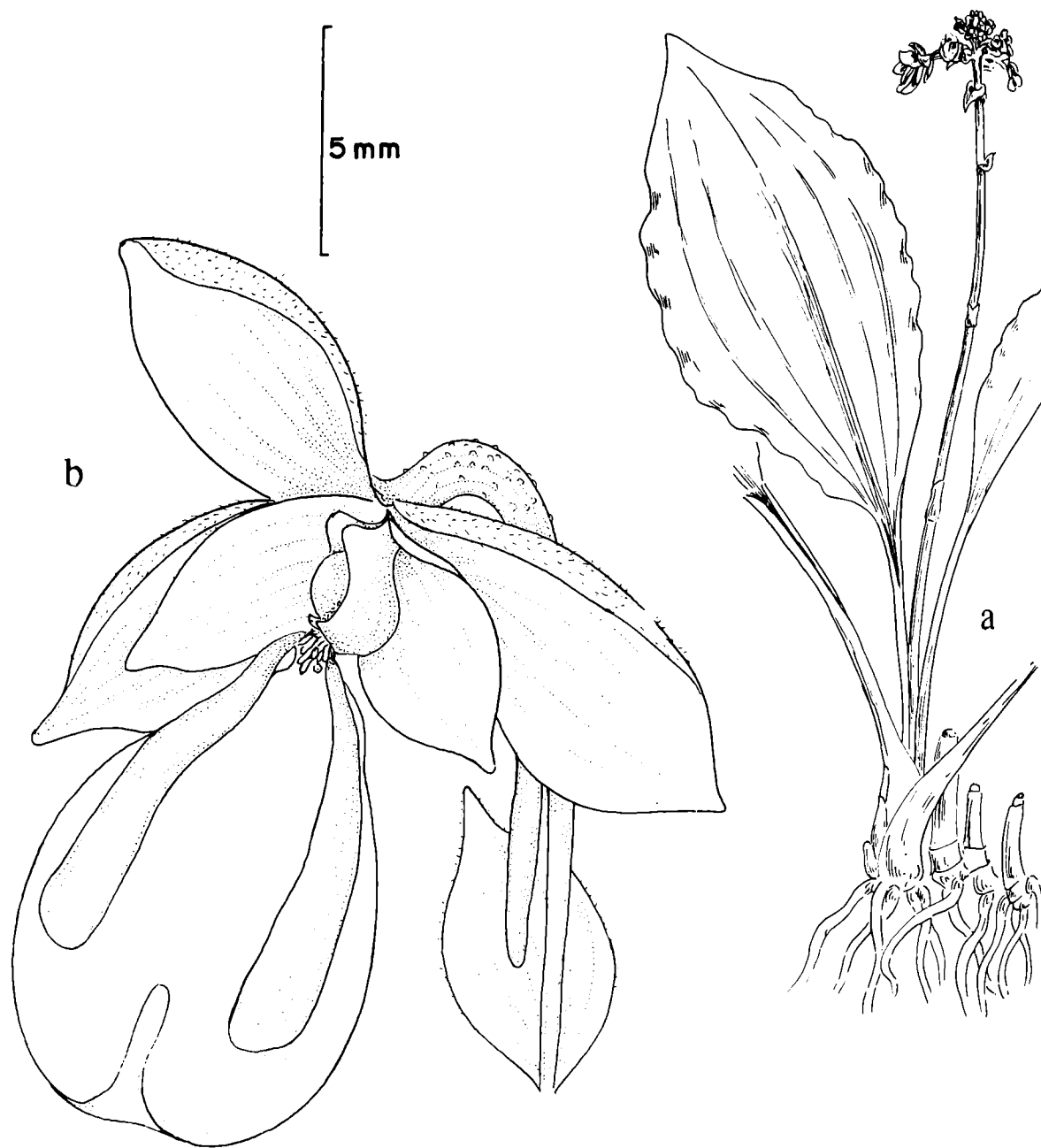
#### Key to species

1. Flowers without any spur.....2
- + Flowers with a spur.....3
2. Midlobe of the lip with 3 prominent crenulate plate like ridges, tip rounded to bifid; side lobes orbicular, spatulate, acute or sub-acute, pointing outwards, without any ridge between them; flowers greenish, edged with white outside, lip orange-red.....*C. tricarinata*
- + Midlobe of the lip without any ridge, tip long apiculate; side lobes narrow, falcately oblong, obtuse, pointing forwards with two narrow ridges between them, flowers of lavender colour...*C. puberula*
3. Lip simple no trilobed, margin deeply incised-pectinate .....*C. alpina*
- + Lip trilobed, margins entire to sometime slightly undulate, but not incised.....4
4. Spur short, conical, not exceeding 4 mm, less than half the length of the ovary.....5
- + Spur long, more than half, equal or longer than the ovary.....6
5. Flowers small, sepals 8-10 mm long, floral bracts small, about half the length of the pedicel of the ovary, column attached by its whole length to the lip.....*C. manni*
- + Flowers large; sepals 18-20 mm long, floral bracts long about half the length of the ovary, column attached by half its length to the lip.....*C. brevicornu*
6. Lateral lobes attached to the base of the lip by a narrow base, 5-6 times longer than broad, oblong-oblancoate, obtuse, resting on the terminal lobe, flowers white; spur half to little more than the length of the ovary. ....*C. alismaefolia*
- + Lateral lobes of the lip spreading, attached by a broad base not resting on the terminal lobe, spur as long or longer than the ovary .....7
7. Flowers small, crowded in the raceme, greenish-yellow, sepals 6-8 mm long, terminal lobe of the lip 2-lobulate with a deep sinus .....*C. pachystalix*
- + Flowers large, distant in the raceme, violet-white, sepals 15-18 mm long, terminal lobe of the lip not lobed, cuneately reniform, apiculate ..... *C. plantaginea*

**Calanthe alismaefolia** Lindl. *Fol. Orch. Calanthe*: 8, 1854; *Hook. f.*, 5: 849. 1890; *King & Pantl.* 170, t. 230. 1898; *Duthie.* 121. 1906. (Fig. 122)

*Pseudobulbs* thin, cylindrical, 3.5-5.5 cm long, bearing 5-6 annular rings. *Leaves* four, 12-18 × 5.5-7.5 cm, broadly elliptic, acuminate, margins undulate. *Inflorescence* about as long as the leaves, clothed with a few distant sheathing bracts, raceme corymbose, 2.5-5 cm long, puberulous. *Flowers* 2-2.5 cm long, white, all opening at a time. *Bracts* large, cordate, acuminate, shorter than ovary. *Sepals* sub-equal, sub-obicular, puberulous outside. *Petals* equal to the sepals, sub-rhomboidal, sub-acute. *Lip* obovate, adnate by its base to the whole length of the column, 3-lobed; lateral lobes attached to the base, 5-6 times longer than broad, oblong-oblancoate, obtuse, resting on the midlobe; midlobe broad with a large yellow callus at base, its apex bilobulate, the lobules broad, rounded with crenulate edges. *Spur* rarely half to usually equal or little more than the length of the ovary, cylindrical.

*Flowering*: July - August.



**Maisiwaring 24148 (a)**

**Fig. 122** *Calanthe alismaefolia* Lindl. — a. plant; b. flower.

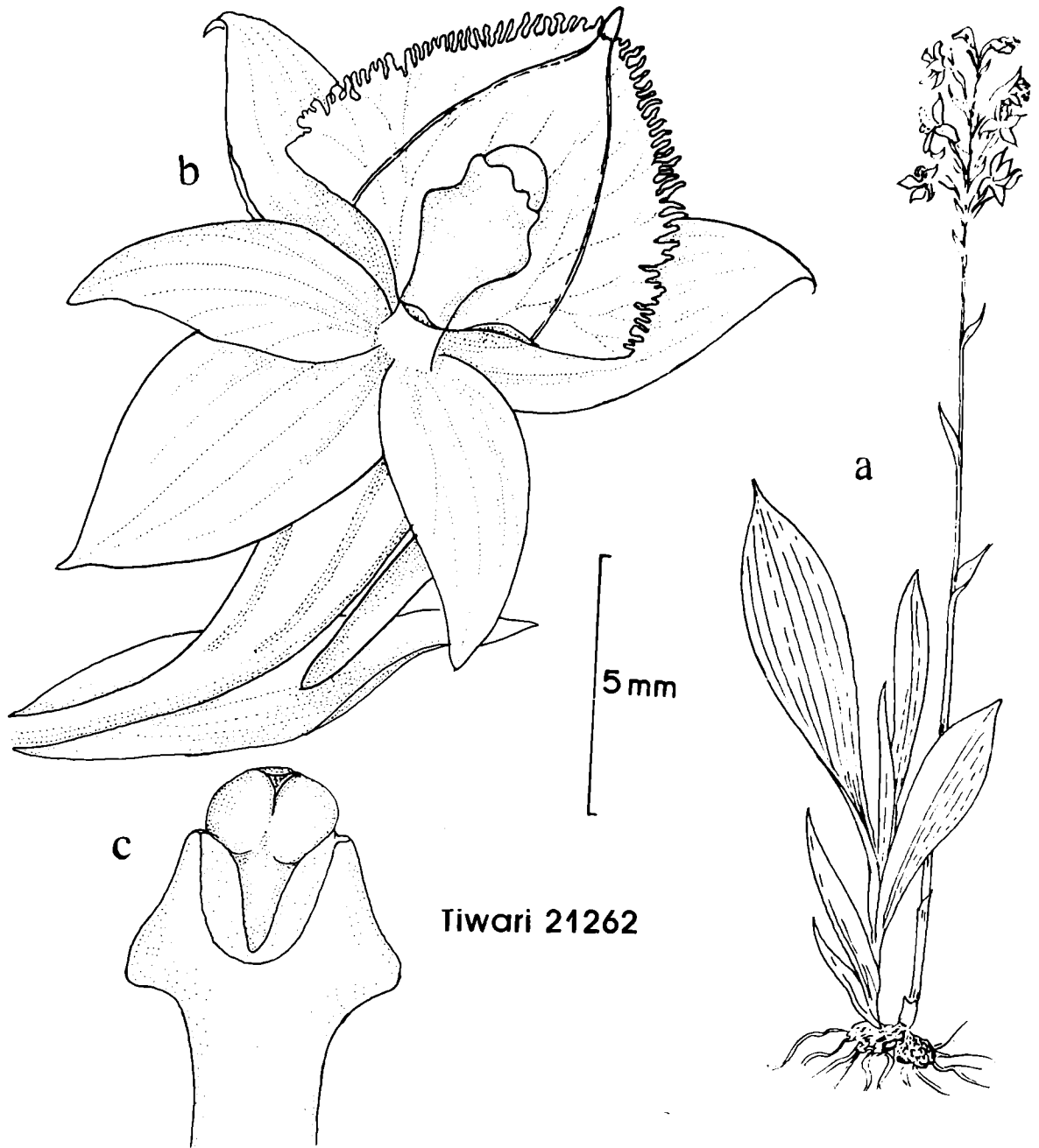


Fig. 123 *Calanthe alpina* Hook. f. — a. plant; b. flower; c. column.

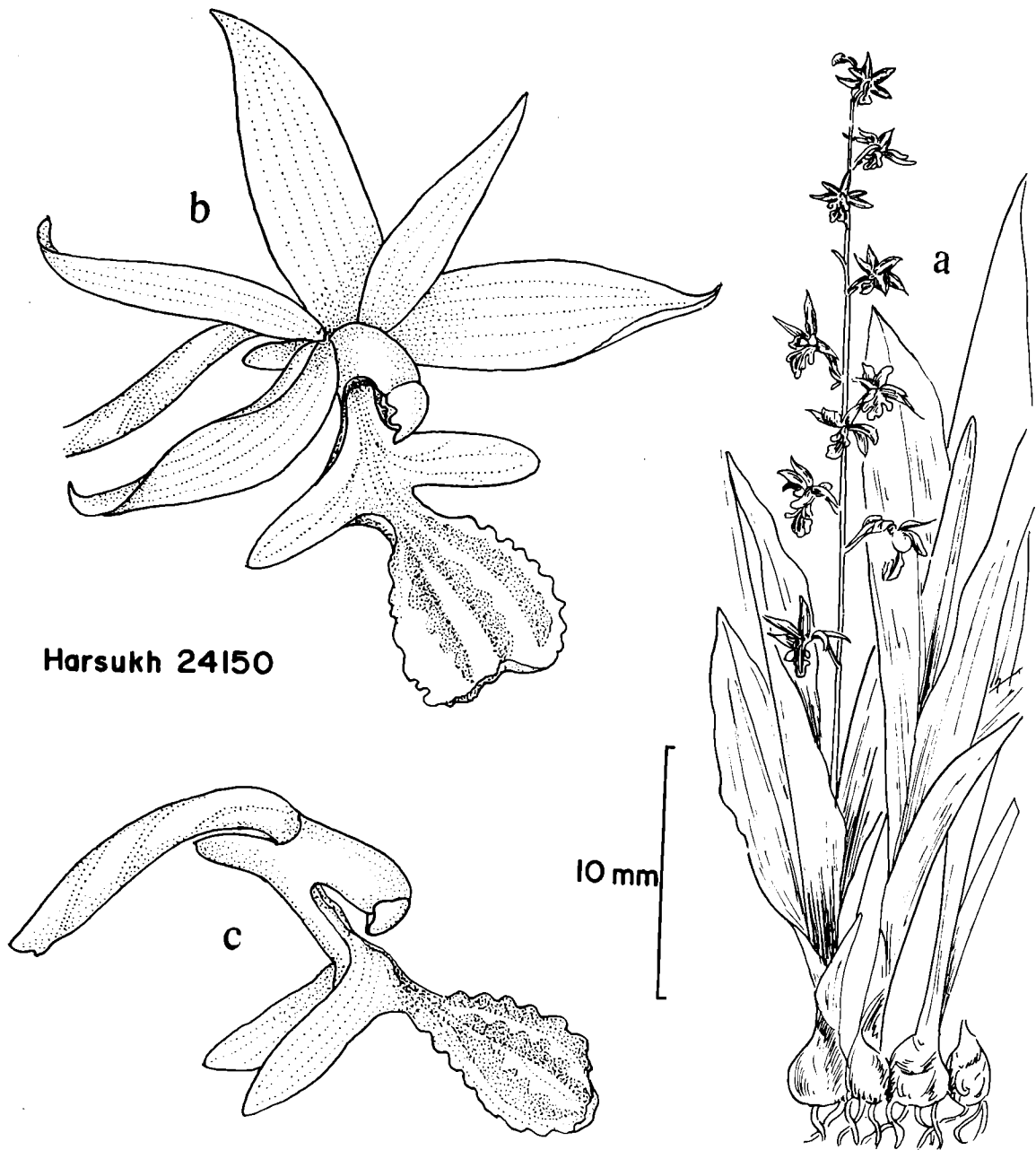


Fig. 124 *Calanthe brevicornu* Lindl. — a. plant; b. flower; c. column & lip.

*Distribution:* Himalaya 1500-2000 m (Garhwal, Sikkim, Bhutan, Arunachal Pradesh), Meghalaya.

*Specimens examined:*

GARHWAL: **Dohra Dun**-Near Mussoorie, *Fairweather* 24148, *Maisiwarig* 24148(a).

**Calanthe alpina** Hook. f. ex Lindl. F l. Orch. Calanthe: 4. 1854; Hook. f., 5: 850. 1890; King & Pantl. 170, t. 229. 1898; Raizada, 21. 1941; Hara et al. 1: 34, 1978; Soidenf. & Arora, 11. 1982; Pradhan, 49. fig. 1-6. 1982. (Fig. 123)

*Pseudobulbs* 2-2.5 cm long, sub-cylindric, tapering on both ends, with two or three annular markings. *Leaves* two to three, unequal, 15-18 × 3-5 cm, oblanceolate, sub-acute, tapering to a short petiole. *Peduncle* exceeding the leaves, 4-5 flowered, glabrous. *Flowers* partly open, about 2 cm across. *Bracts* lanceolate, half as long as the ovary. *Sepals* 10 mm long, sub-equal, ovate-oblong, acuminate, concave, white tipped with green. *Lip* dull red, shorter than sepals, with a cylindric spur nearly as long as the ovary without lateral lobes, semi-orbicular, margin incised-pectinate.

*Flowering:* July - August.

*Distribution:* Himalaya 2500-3500 m (Kumaun to Arunachal Pradesh), Nagaland.

*Specimens examined:*

KUMAUN: **Pithoragarh**-Ruigir Forest, *R.N. Tiwari* 21262. **Almora**-Dwali, *Champion*.

Pradhan (1982) states that it is vulnerable species and it is not known in cultivation; found in two area where it enjoys no special protection and is open to grazing and habitat destruction. The conservation measures he proposed are the following.

The localities where it is to be found should be screened from grazing and it should be brought in to cultivation immediately and propagated artificially from seeds.

**Calanthe brevicornu** Lindl. Gen. & Sp. Orch. 251. 1833; Hook. f., 5: 848. 1890; King & Pantl. 168, t. 227. 1898; Duthie, 120. 1906. (Fig. 124)

*Pseudobulbs* ovoid, pointed, 2.5 cm long. *Stem* 5-10 cm, stout. *Leaves* usually three, 25-30 × 7-10 cm, oblong-elliptic, acuminate; petiole appearing on maturity. *Inflorescence* longer than leaves; raceme 30 cm long, laxly 15-20 flowered; rachis ovary and outside of sepal puberulous. *Flowers* 3.5-4 cm across, dull purple, run by white along midrib. *Bracts* narrowly lanceolate, about half the length of the ovary. *Sepals* 18-20 × 5 mm long, sub-equal, oblong-lanceolate, acute. *Petals* 15 × 4-5 mm, lanceolate. *Lip* lobed; lateral lobes oblong; midlobe sub-obovate with a broad more or less emarginate apex and irregularly toothed, contracted at its junction with the lateral lobes, upper surface with three tubercled fleshy lamellae. *Spur* short, broad blunt, straight, its mouth lined with retroflexed hairs. *Column* attached by half its length to the lip, short.

*Flowering:* May - June.

*Distribution:* Himalaya 1500-2000 m (Garhwal to Arunachal Pradesh), Manipur, Nagaland, Mizoram.

*Specimens examined:*

GARHWAL: **Tehri**-Near Tehri, *Mackinnon* 24150(a); Bok Hills, *Harsukh* 24150.

**Calanthe mannii** Hook. f., Fl. Brit. Ind. 5: 850. 1890; King & Pantl. 167, t. 255. 1898; Duthie, 120. 1906. (Fig. 125)

*Pseudobulbs* short, 2.5-3 cm long. *Stem* about 8 cm long. *Leaves* two to three, oblanceolate-oblong, acute, 20-25 × 4-5 cm, tapering to a long petiole. *Peduncle* from the axil of young leaf, pubescent, about 23 cm long; *raceme* half as long as the peduncle, 10-12 flowered. *Flowers* not fully open, 13 mm long.

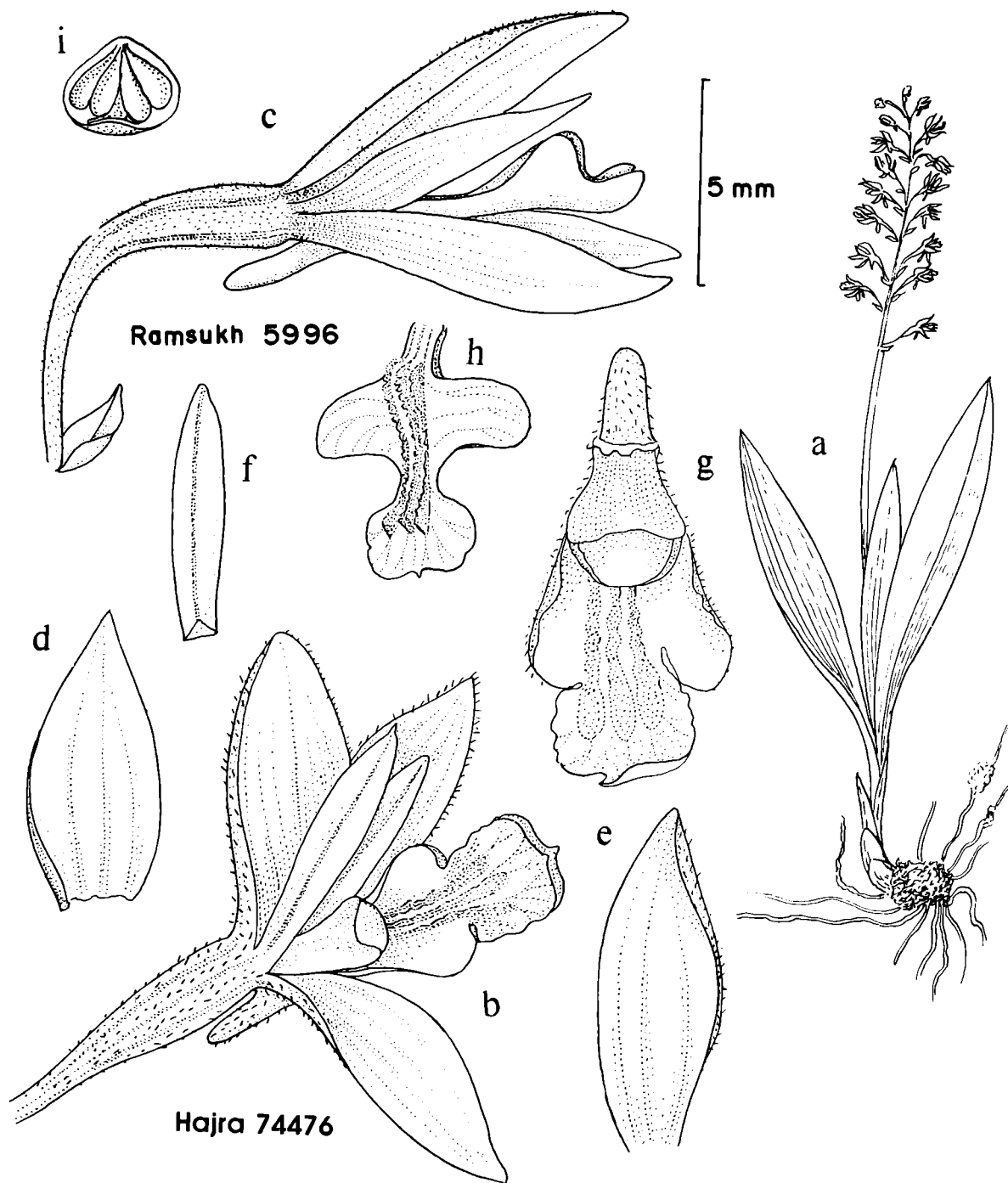


Fig. 125 *Calanthe mannii* Hook. f. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. spur, column & lip; h. lip; i. pollinia.

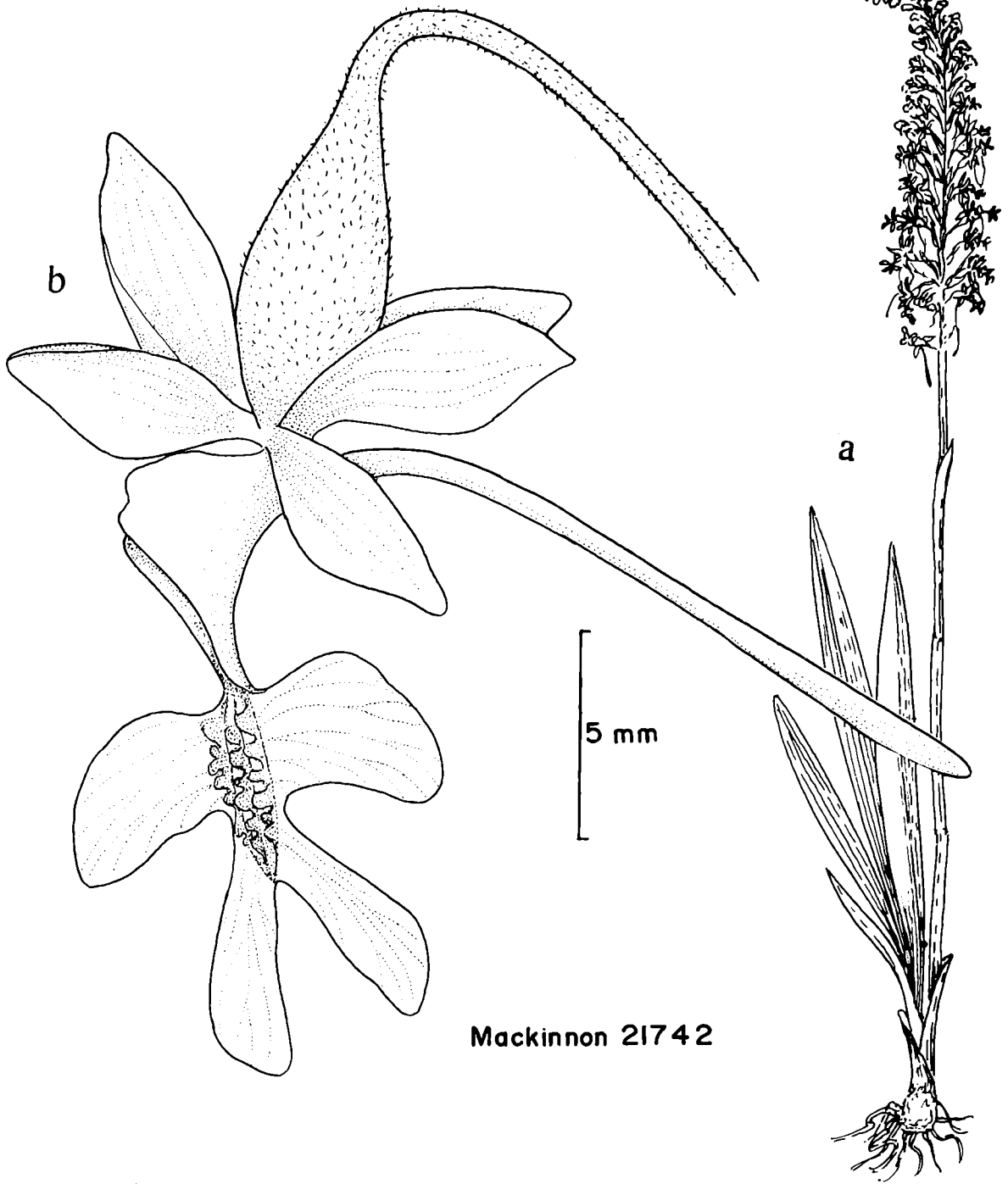


Fig. 126 *Calanthe pachystalix* Rchb. f. ex Hook. f.—a. plant; b. flower.

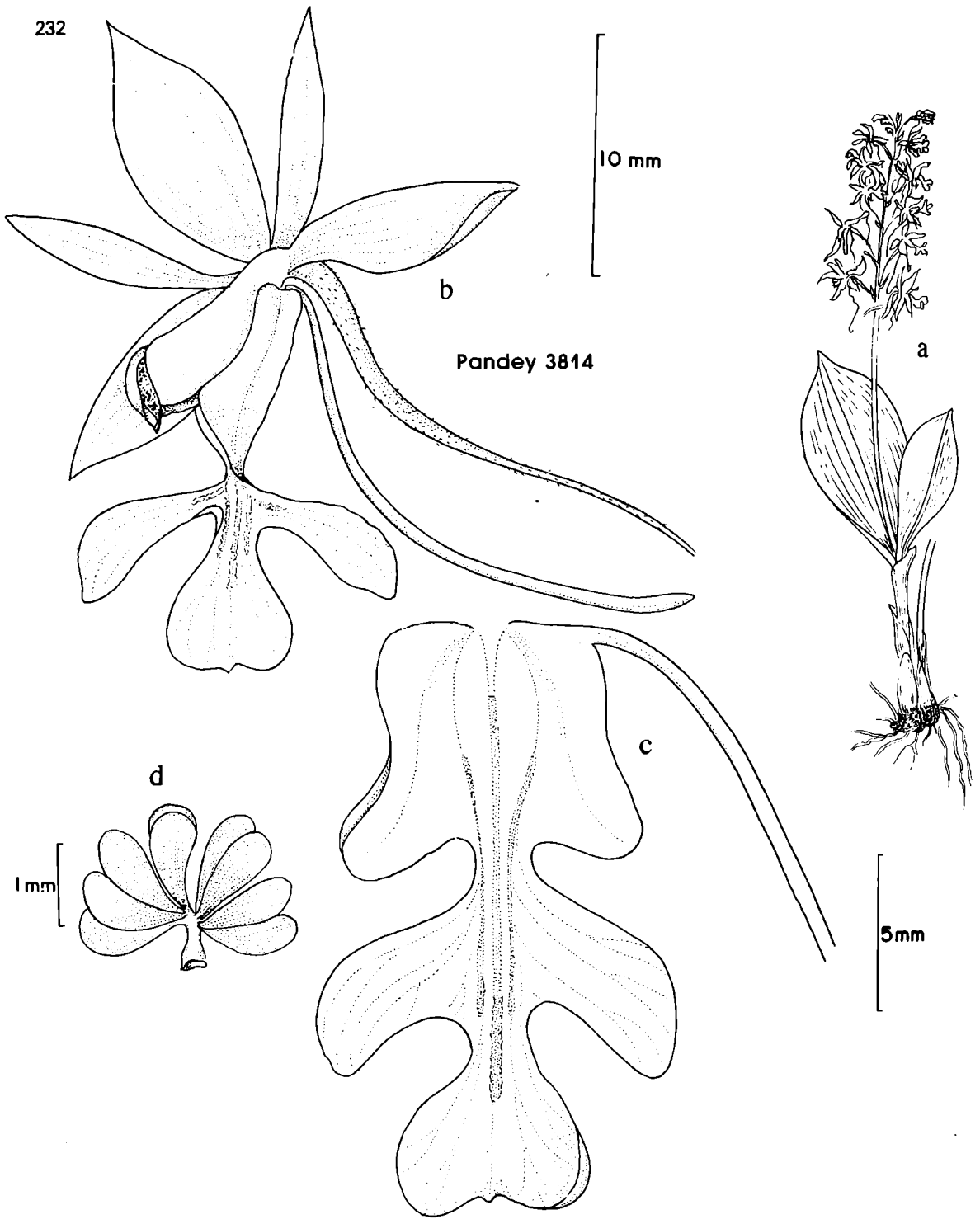


Fig. 127 *Calanthe plantaginea* Lindl. — a. plant; b. flower; c. lip with spur; d. pollinia.



*Bracts* small, lanceolate, shorter than the pedicel of ovary. *Sepals* sub-equal, pubescent, connivent, ovate-lanceolate, sub-acute, 8-10 mm long, green to dull brown. *Petals* glabrous, oblong, not spreading. *Lip* yellow with a blotch of red at the apex, 3-lobed; lateral lobes large, broad, truncate; midlobe sub-reniform, entire, 3-lamellate from base to near apex. *Spur* very short. *Column* short, attached by its whole length to the lip.

*Flowering*: May.

*Distribution*: Himalaya 1300-2200 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram.

*Specimens examined*:

GARHWAL: **Chamoli**-Near Mandal, *Hajra* 74476.

KUMAUN: **Almora**-Below Ranikhet, *Ramsukh* 5996.

***Calanthe pachystalix*** Rchb. f. ex Hook. f., Fl. Brit. Ind. 5: 850. 1890; Duthie, 12, t. 104. 1906; Seidenf., 22. 1975; Hara et al. 1: 35. 1978. (Fig. 126)

*Pseudobulbs* short, ovoid-conical. *Leaves* many, 30-60 × 2.5-3.5 cm, linear-lanceolate, acuminate, plicate, nerves prominent. *Inflorescence* from the axil of a sheath; raceme 20-30 cm long, rachis and pedicels puberulous, many flowered. *Flowers* 2 cm across, crowded, greenish-yellow. *Bracts* lanceolate, deflexed. *Sepals* 6-8 mm long. *Petals* spatulate, obtuse, 9 mm long. *Lip* adnate to the whole length of the column, obovate, 3-lobed; lateral lobes narrowly ovate, obtuse, falcate; midlobe shorter, 2-lobulate with a deep sinus, with three rows of prominent warts on its disc. *Spur* cylindrical, slightly longer than pedicelled ovary.

*Flowering*: July - August.

*Distribution*: Himalaya 2000 m (Garhwal and Nepal). Indo-China.

*Specimens examined*:

GARHWAL: **Dohra Dun**-Mussoorie, *Mackinnon* 21742; Near Mussoorie, *Mackinnon* 22714.

***Calanthe plantaginea*** Lindl. Gen. & Sp. Orch. 250. 1833; Royle, 366. 1839; Hook. f., 5: 1890; Collett, 494. 1902; Duthie, 122. t. 105. 1906; Renz, 60. 1984. (Fig. 127)

*Stem* 7.5-25 cm long, enclosed within long tubular sheath. *Leaves* usually two, 20-30 × 6-10 cm, oblanceolate or elliptic-lanceolate, tapering below in to a long petiole. *Inflorescence* stout, raceme 20-25 cm long, many flowered. *Flowers* drooping, 3 cm across, distant, violet-white. *Bracts* small, lanceolate. *Sepals* 15-18 mm long, oblanceolate, acuminate, glabrous. *Petals* similar to the sepals, smaller. *Lip* as long as the sepals, purple, the disc with 3 slender lamellae; lateral lobes rhomboid-obovate, sub-falcate; midlobe not lobed, cuneately reniform, apiculate. *Spur* very slender, equal or longer than the ovary.

*Flowering*: March - April.

*Distribution*: Himalaya 1500-2800 m (Kashmir to Arunachal Pradesh). Nagaland.

*Specimens examined*:

GARHWAL: **Dohra Dun**-Fairy Glen, Mussoorie, *Fleming* 351; Near Mussoorie, *Mackinnon* 22716; Mussoorie, *Mackinnon* 21741(a). **Tehri**-Kulni Valley, *B.B. Osmaston* 24149. **Pauri**-Lakhan, Khansar, *A.E. Osmaston*.

KUMAUN: **Almora**-Dandeshwar near Jageshwar, *P.C. Pandey* 3814.

HIMACHAL PRADESH: Shimla, *McDonnell*; Kainthle Forest, Chamba, *Lace* 1328.

JAMMU & KASHMIR: Rattanpir Poonch, *Kirn* 619(a).

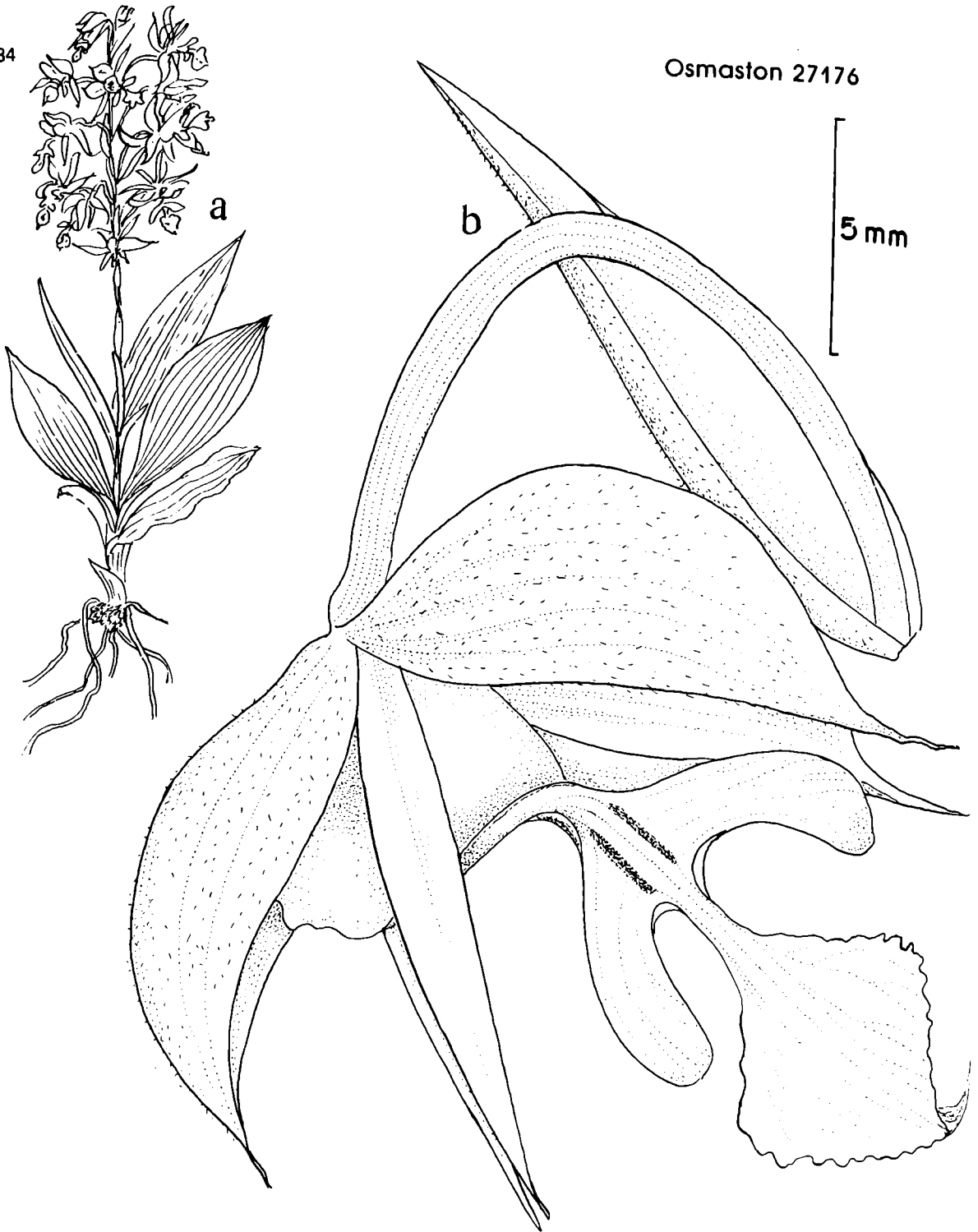


Fig. 128 *Calanthe puberula* Lindl. — a. plant; b. flower.

**Calanthe puberula** Lindl. Gen. & Sp. Orch. 252. 1833; Hook. f., 5: 847. 1890; King & Pantl. 166, t. 223. 1898; Collett, 494, 1902; Duthie, 119. 1906. (Fig. 128)

*Pseudobulbs* 2.5 cm long, conical from a broadly ovoid base. *Leaves* 5-7, unequal in size, 10-15 × 3.5-5 cm, elliptic or elliptic-oblong, acuminate. *Inflorescence* much longer than the leaves; raceme 7-15 cm long, laxly flowered, the rachis puberulous. *Flowers* lavender colour, 3 cm across, puberulous outside. *Bracts* lanceolate, acuminate, not longer than ovary. *Sepals* spreading, ovate-lanceolate. *Petals* spreading, narrowly falcate, acute. *Lip* adnate to the base of the column, shortly clawed, 3-lobed; sidelobes narrow, falcately oblong-obtuse, pointing forwards with two narrow ridges between them; midlobe without any ridge, orbicular-ovate, tip long apiculate.

*Flowering*: July - August.

*Distribution*: Himalaya 1500-2500 m (Himachal Pradesh to Arunachal Pradesh), Meghalaya, Nagaland.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Chakrata Jaunsar, *B.B. Osmaston* 21787. **Tehri**-Kangogadh, *B.B. Osmaston* 21716; Chachpur Valley, *Duthie* 21076; Kulni, *Duthie*.

KUMAUN: **Almora**-Kathi Dwali, *T.A. Rao* 4330.

**Calanthe tricarinata** Lindl. Gen. & Sp. Orch. 252. 1833; Hook. f., 5: 847. 1890; Collett, 494. 1902; Duthie, 119, t. 103. 1906; Stewart, 66. 1972; Renz, 59. 1984.

*C. pantlingii* Schlechter, in Fedde, Repert. Beih. 4: 240. 1919. (Fig. 129)

*Pseudobulbs* 2-2.5 cm long, ovoid, with distinct concentric rings. *Leaves* two to four, oblanceolate, acute, usually stalked, 25-30 × 5-7.5 cm. *Inflorescence* 3-50 cm, 8-12 flowered. *Flowers* 2-2.5 cm across, greenish-white. *Bracts* half as long as the ovary with pedicel. *Sepals* spreading, lanceolate, acuminate, 5-7 nerved, green, edged white. *Petals* clawed, lanceolate, acuminate, little shorter than sepals, green, edged white. *Lip* orange-red, united also to the whole length of column, broadly oblong, decurved, saccate at base, the mouth of the sac clothed with long white deflexed hairs, 3-lobed; sidelobes orbicular, spatulate, acute or sub-acute, pointing outwards, without any ridge between them; midlobe with 3-prominent crenulate plate like ridges, tip rounded or bifid.

*Flowering*: April - June.

*Distribution*: Himalaya 2000-3000 m (Pakistan, Kashmir to Arunachal Pradesh), Nagaland, Meghalaya, Manipur, Mizoram. South East Tibet, Japan, Taiwan, Thailand, China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Chakrata, Deoban, *Bor* 13113, *Duthie* 1265; Bodyar, *Raizada*; Deoban-Kanasar Road, *Parkinson* 7055; Deota, *Gamble*. **Tehri**-Near Kidarkanta, *Gollen* 2059; Bamsu Valley, *Duthie* 21037; Above Dakara, *Duthie* 1265; Kulni Valley, *Duthie* 23451. **Uttarkashi**-Jamnotri-Chetty, *M.A. Rau* 51626; Above Rana, Jamuna-Bhagirathi water shed, *A.C. Joshi*; Banas, *Deva* 7492; Dayara, *Sahni* 24885; Tons Valley, Osla, *Deva* 139. **Chamoli**-Trijugarain, *Naithani* 47972; Masurtal, *Naithani* 55163.

KUMAUN: **Pithoragarh**-Above Balati meadow, *Thomas* 20726; East Almora Div., *Bis Ram* 2281; Panch-Chuli, *Sahni* 20435; Hot Spring, *Thomas* 20751.

HIMACHAL PRADESH: Dalhousie, *Parker*; Manali, *Bor* 11836, 14121; Shimla, *Gamble* 4435(b); Pulga, Parbatti Valley, Kulu, *Parkinson* 4061; Chaupal, Jubbal state, *Parkinson* 7395; Kandri-khad, Bashahr, *Lace* 896; Baghi, Bashahr, *Raizada*; Narkanda, *C.R. Brown*; Below Pulga, Kulu, *Jain & Bhadradwaja*; Jiskun, *Deva* 3674.

JAMMU & KASHMIR: Rattanpir, Poonch, *Kirn* 619.

PAKISTAN: Hazara, *Inayat* 20190.

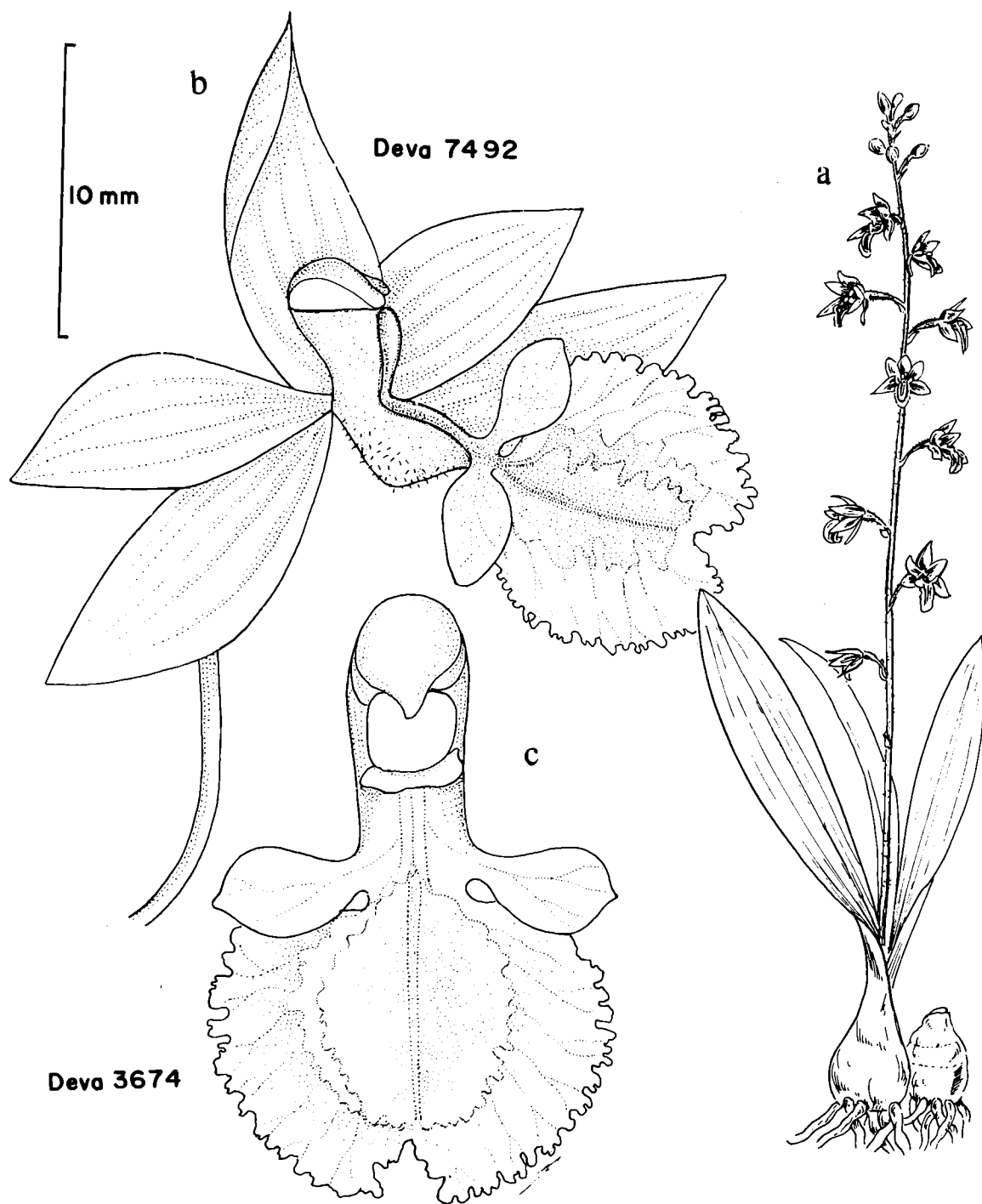


Fig. 129 *Calanthe tricarinata* Lindl.—a. plant; b. flower; c. column & lip.

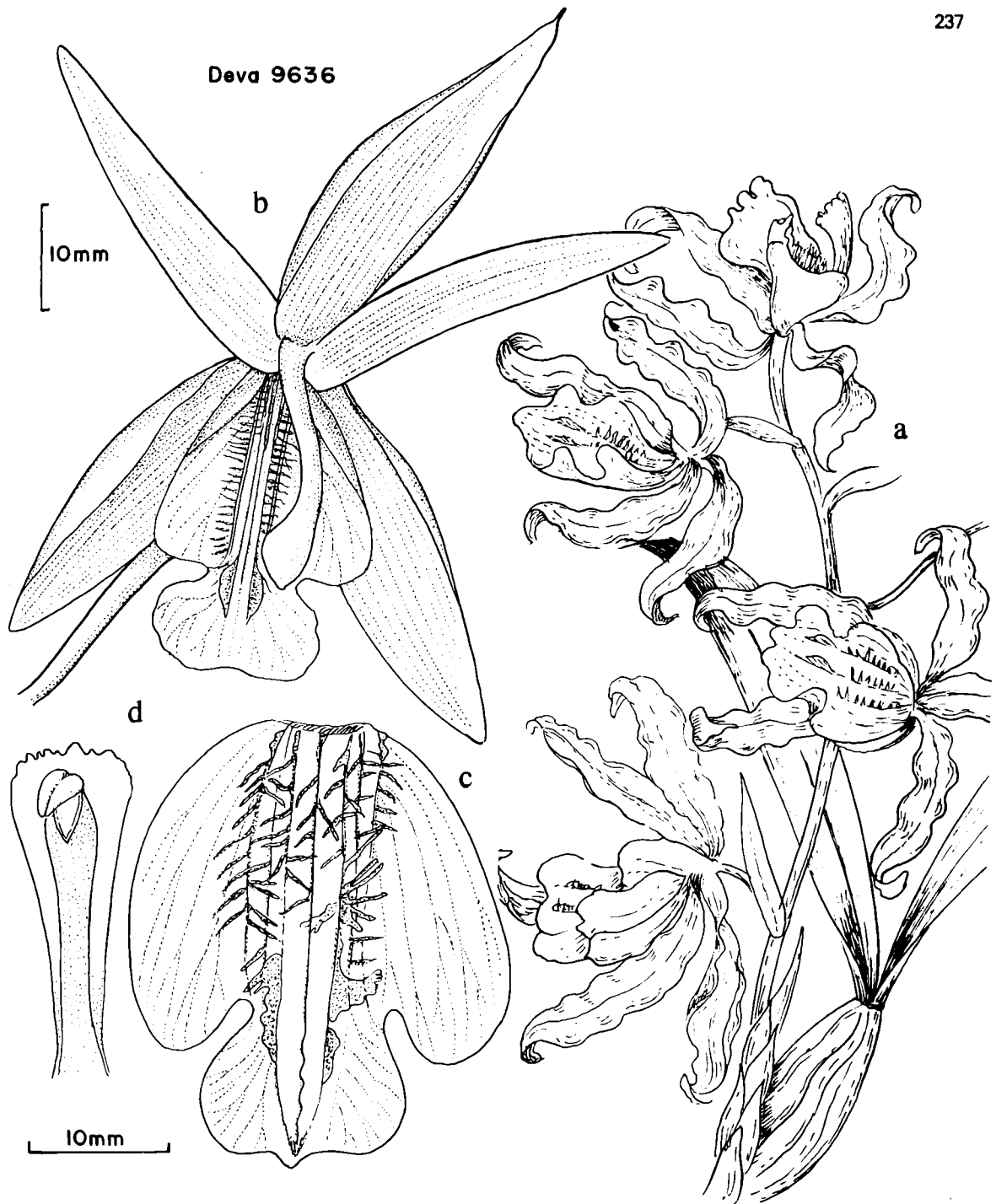
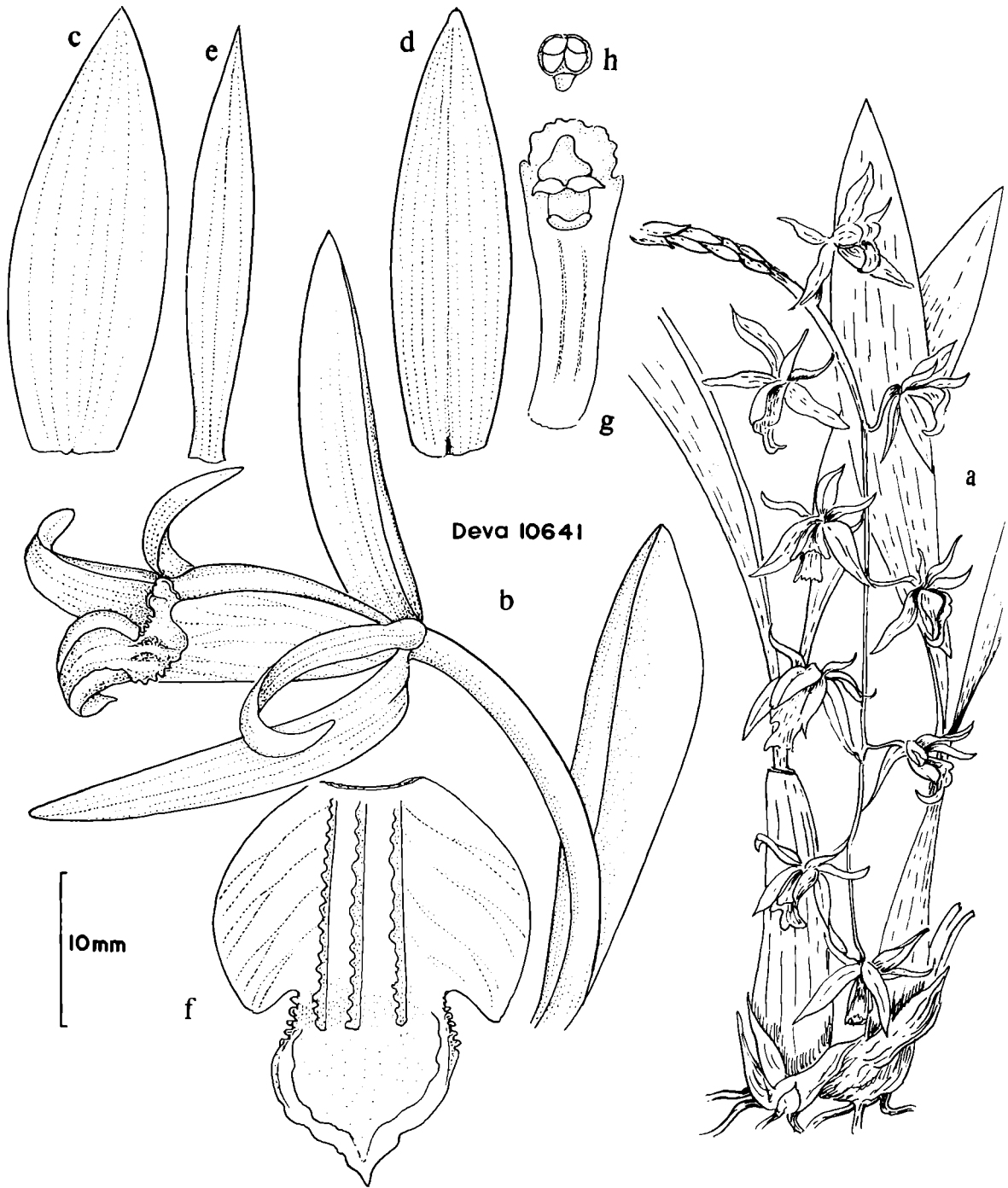


Fig. 130 *Coelogyne cristata* Lindl. —a. plant; b. flower; c. lip; d. column.



**Fig. 131** *Coelogyne flaccida* Lindl.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. column; h. pollina.

### Coelogyne Lindl.

Epiphytic. *Rhizome* covered with scales. *Pseudobulbs* ovoid to variously shaped, sheathed with scales. *Leaves* 2, rarely membranous or plicate. *Inflorescence* arising from the base or top of the pseudobulb. *Flowers* few to many, medium sized or small, white or creamy, greenish-yellow or brown. *Bracts* large. *Sepals* oblong-lanceolate to elliptic or ovate, often strongly concave. *Petals* narrower than sepals to filiform. *Lip* sessile to the base of column, concave, without spur, deeply or obscurely 3-lobed; midlobe spreading or recurved; lateral lobes clasping to the column. *Column* footless, winged. *Anther* 2-chambered or imperfectly 4-chambered; *pollinia* 4, pyriform, waxy, attached in two pairs to the granular caudicle. *Capsule* ellipsoid, ridged.

#### Key to species

1. Scape from between pairs of leaves on the apex of a fully developed pseudobulb.....2
- + Scape from the base of the mature pseudobulbs.....3
2. Flowers opening successively only one at a time; scape at the base with enveloping glumae; dorsal sepal 30 mm or more long; lip marked with blackish-brown colour, margin of midlobe long fimbriate, keels on the lip with wavy margin.....*C. ovalis*
- + Flowers all opening at the same time, scape naked from the base to just below the rachis where there are many overlapping glumae; dorsal sepal 20 mm or less; lip tinged with golden-yellow, margin of midlobe entire to slightly erose, keels on the lip crenulate .....*C. stricta*
3. Flowers large; lip 3.5 to 4.5 cm long, keels 4-5, lacinate with hair like segments, two laterals extending to midlobe forming raised plates; scape drooping .....*C. cristata*
- + Flowers smaller; lip less than 25 mm long, keels 3, with straight to wavy margins .....4
4. Flowers white, fragrant; lip with orange-red bordered eyes, keels 3, the central one very short near the base; scape semi-erect.....*C. nitida*
- + Flowers creamish-white, not pleasant smelling; lip without eyes, keels 3, all equal upto the base of the midlobe, scape long pendent.....*C. flaccida*

**Coelogyne cristata** Lindl. Coll. Bot.: sub. t. 33. (Text only). 1821; Hook. f., 5: 829. 1890; King & Pantl. 133, t. 184. 1898; Duthie, 113. 1906; Seidenf., 32: 1975; Das & Jain, 9, fig. 14 a-c. 1980. (Fig. 130)

Plant pendulous. *Pseudobulbs* arising at a distance of about 5-6 cm, ovoid-oblong. *Leaves* 2, sub-sessile, 12-30 × 1.5-3 cm, linear-oblong, acute. *Inflorescence* a raceme, 12-30 cm long, drooping, (-4) 5-8 flowered. *Flowers* 6-9 cm across, white, fragrant. *Bracts* persistent, oblong, acute. *Sepals* sub-equal, obtuse, 3.5-5.3 × 0.6 – 1.7 cm, undulate. *Petals* 3.5-5 × 0.7-1.7 undulate. *Lip* oblong, 3.5-4.5 × 2.4-4.2 cm, white, tinged with yellow, 3-lobed; midlobe distinct, rhomboid, entire; lateral lobes broadly oblong, rounded; keels 4-5, lacinate or deeply fimbriate, segments hair like, yellow, two lateral extending to midlobe, forming raised plates.

*Flowering*: April - May.

*Distribution*: Himalaya 1200-2000 m (Garhwal to Arunachal Pradesh), Meghalaya, Nagaland. Tibet, Indo-China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Chamasaree, *Falconer* 167/30; Below Dhobighat Mussoorie, *Fleming* 786; Below Jharipani, *Deva* 8851. **Tehri**-Agrakhal above Narendranager, *Deva* 9636 & 9992. **Pauri**-Nail, Khauser Patti, *A.E. Osmaston*. **Chamoli**-Mandal, *Naithani* 41977, 43982; Trishula, *Bhattacharyya* 14860.

KUMAUN: **Pithoragarh**-Didihat, *Arora* 37819 & 38815, *Rau* 35304, *Pant* 31847; Champawat, *Bhattacharyya* 20385; Kaflani, *Arora* 66245; Maitli, *Arora* 55801.

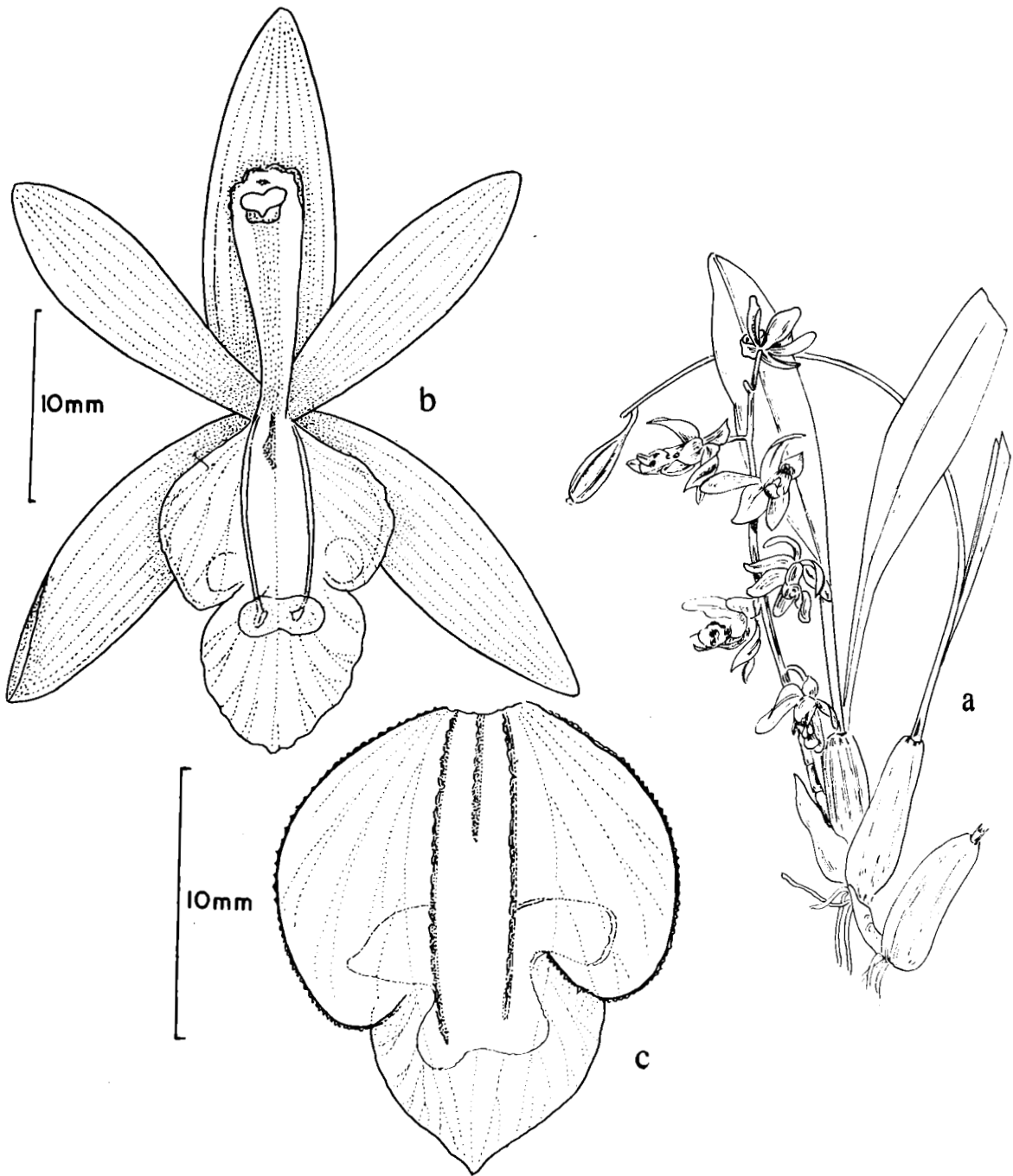


Fig. 132. *Coelogyne nitida* (Wall. ex D. Don) Lindl. — a. plant; b. flower; c. lip. (after Seidenf.)



**Coelogyne flaccida** Lindl. Gen. & Sp. Orch. 39. 1830; Hook. f., 5: 829. 1890; King & Pantl. 133, t. 183. 1898; Seidenf., 38. 1975; Das & Jain 10. Fig. 17a-b. 1980. (Fig. 131)

*Pseudobulbs* Crowded, grooved, ovoid-cylindric, 3.5-12 × 1.3-3.5 cm. Leaves 2, narrowly oblong, subsessile, 5-18 × 1-3.2 cm. Peduncle from the base of pseudobulb, pendent, 6-26 cm long. *Inflorescence* raceme with 5-12 flowers. *Flowers* creamy-white, not pleasant smelling, 1.5-4.5 cm across. *Bracts* ovate-cymbiform, acute, caducous. *Sepals* sub-equal, oblong-lanceolate, 1.5-2.6 × 0.5-1.0 cm, spreading. *Petals* 1.5-2.3 × 0.2-0.4 cm. *Lip* oblong, 1.5-2.2 × 1-1.8 cm. without eyes, 3-lobed, midlobe ovate, acute, golden-yellow at the base; lateral lobes golden-yellow at apex with 6-8 reddish-brown streaks; keel 3 all equal up to the base of the midlobe, flexuous, white, distal ends reddish-brown.

*Flowering*: March - May.

*Distribution*: Himalaya 1000-1800 m (Kumaun, Nepal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram. Burma, Laos, Thailand.

UTTAR PRADESH: (Das & Jain, *loc. cit.*).

We have examined no wild specimen from N.W. Himalaya it has been included on the authority of Das & Jain (1980), who have informed us that it is based on a single specimen collected by M.A. Rau 42954 from East Kumaun in vegetative condition and cultivated at Shillong orchidarium, where it flowered. We doubt its presence in the region and probably by mixing of the materials under cultivation it could have been replaced by mistake. Incidentally at BSD herbarium, the number 42954 is a specimen of grass collected by C.L. Malhotra from Balsanda, district Pilibhit. Fig. 130 is based on a plant cultivated at senior author's residence.

**Coelogyne nitida** (Wall. ex D. Don) Lindl. Gen. & Sp. Orch. 40. 1830. (Excl. syn. *Cymbidium nitidum* Roxb.); Seidenf. 53. fig. 20. 1975; Das & Jain 19. fig. 5a-b. 1980.

*Cymbidium nitidum* Wall. (Lindl. Coll. bot. sub. t. 33. 1821 *nom nud.*) ex D. Don. Prodr. Fl. Nepal 35. 1825.

*Coelogyne ochracea* Lindl. in Edw. Bot. Reg. t. 69. 1846; Hook. f., 5: 831. 1890; King & Pantl. 132, t. 182. 1898; Duthie, 112. 1906; Hara et al. 1/36. 1978. (Fig. 132)

*Pseudobulbs* spaced at a distance of 2-2.5 cm, 2.5-6 × 0.8-3.5 cm, oblong, sub-quadrangular. *Leaves* 2, petioled, 7-21 × 1.5-3.5 cm, narrowly oblong. *Inflorescence* a semi-erect raceme, 11-24 cm long with 4-8 flowers. *Flowers* white, fragrant, 2.5-5.3 cm across. *Bracts* deciduous, oblong, longer than the ovary. *Sepals* sub-equal, oblong-lanceolate to ovate-lanceolate, obtuse, spreading, 1.8-2.6 × 0.5-1.2 cm. *Petals* narrower, 1.8-2.5 × 0.3 × 0.7 cm. *Lip* oblong, 1.6-2.1 × 1-1.6 cm, white with orange-red bordered eyes, 3-lobed; midlobe broadly ovate, apex recurved; lateral lobes rounded, incurved with serrulate apex, orange-red tinged below the yellow eyes and streaked with brownish-orange; keel 3, the central one very short near the base.

*Flowering*: May - June.

*Distribution*: Himalaya 1500-2300 m (Garhwal to Arunachal Pradesh). Meghalaya, Nagaland, Manipur, Mizoram. Bangladesh, Burma, China, Thailand, Laos.

GARHWAL: **Tehri**: Tehri, Mackinnon (Duthie, *Loc. cit.*). **Pauri-Roberts** (Duthie, *loc. cit.*).

KUMAUN: *Edgeworth* (Duthie, *loc. cit.*).

**Coelogyne ovalis** Lindl. in Edw., Bot. Reg. 24: 91. Misc. 171. 1838; Hook. f., 5: 638. 1890; King & Pantl. 135, t. 187. 1898; Duthie 112. 1906; Seidenf., 23. fig. 6. 1975; Das & Jain, 23. 1980.

*C. fimbriata* sensu Seidenf. & Arora in Nord. J. Bot. 2(1). 11. 1982 (*non* Lindl.) (Fig. 133)

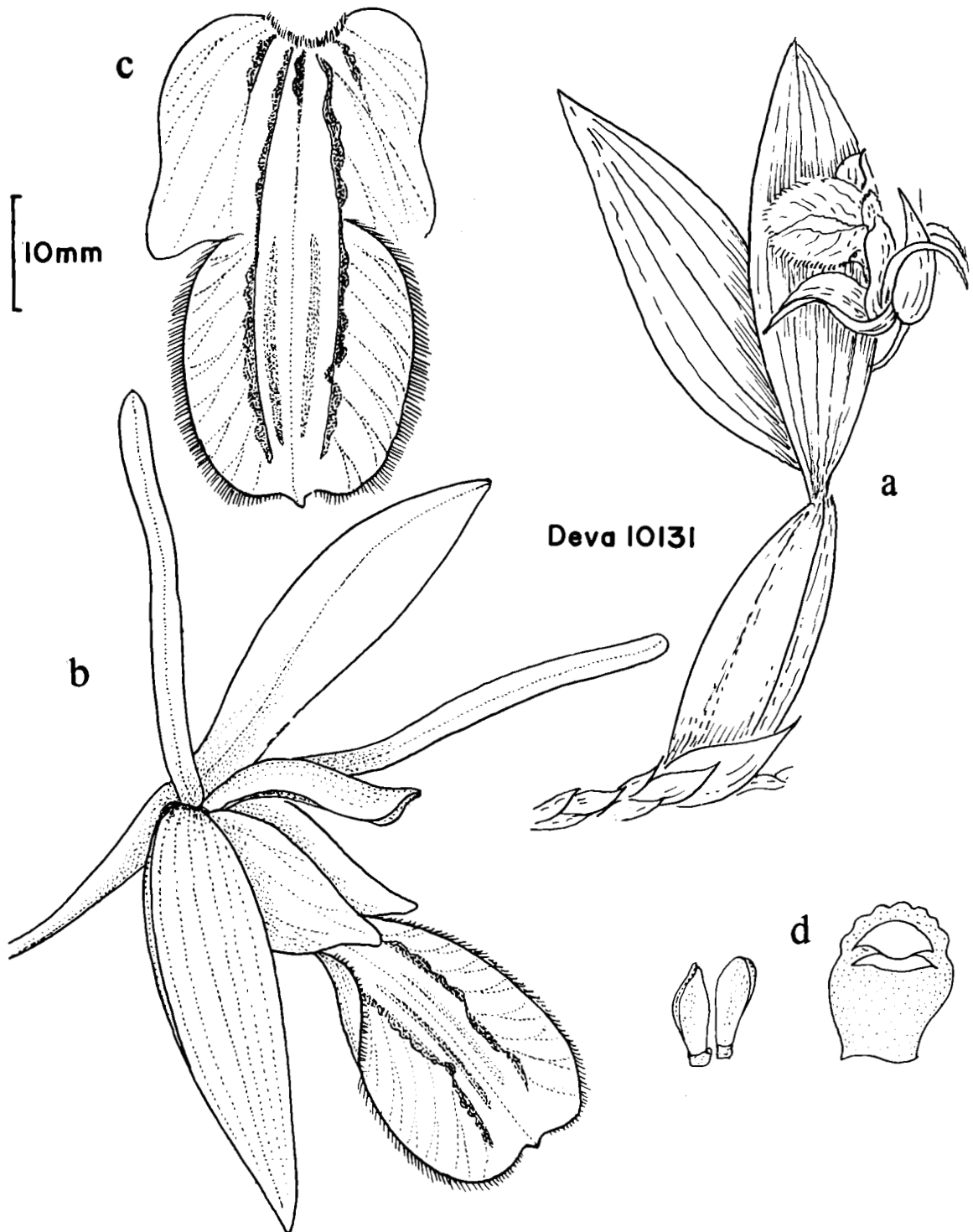


Fig. 133 *Coelogyne ovalis* Lindl.—a. plant; b. flower; c. lip; d. column & pollina

*Pseudobulbs* 3-10 × 1-2 cm, polished, ovoid fusiform, rising from a stout imbricately sheathed rhizome. *Leaves* two, 5-15 × 1.5-4 cm, coriaceous, sub-sessile, elliptic-oblong. *Inflorescence* a raceme from middle of the leaves, bearing usually 3-flowers. *Flowers* opening successively only one at a time, 3.5-5.5 cm across, lemon-yellow. *Bracts* 3 cm long, deciduous, ovate, lanceolate, convolute. *Sepals* ovate, lanceolate, faintly yellowish, 2.5-3.5 × 0.6-1.2 cm, the dorsal 3 cm or more long. *Petals* linear, blunt, 2.5-3.3 × 0.1-0.2 cm. *Lip* oblong, 2.3-3 × 1.5-2.4 cm, light yellow, tinged with blackish-brown on midlobe and at base; midlobe ovate to rotund, fimbriate at margin; lateral lobes oblong, obtuse, minutely fimbriate; keel 2 with wavy margin, dark brown on epichile.

*Flowering*: September - October (rarely Nov. & Dec.).

*Distribution*: Himalaya 1000-1400 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Tripura, Nagaland, Mizoram. Tibet, Burma, China and Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley, *Gamble*; Bhagwan village, Y.K. Sarin 5446; below Mussoorie, **Mackinnon Tehri**-Agrakhal above Narendranagar Deva 10131, 10366, *Naithani* 1083. **Pauri**-Outer Garhwal hills, *Inayat*.

KUMAUN: **Pithoragarh**-Vasavgad Gori Valley, *Bhattacharyya* 21354; Askot, *Bhattacharyya* 21385, *Arora* 36436, 41377, 66106; Dafidhura, *Arora* 52406, 45554, 45555, 55826; Chopata, *Arora* 66157; Sobala Dharma Valley, *Inayat* 24100.

*Arora* 55826, *C. fimbriata* Lindl., only with a small single flower pasted on the sterile specimen, it is not different in any way from the typical *C. ovalis* Lindl.

The flowering period of *C. ovalis* is very long starting from the month of June to December. The flowers produced early in the season are larger and those produced later in winter are usually quite small. It often causes a confusion because at this stage they superficially resemble the flower of *C. fimbriata*, however the two can still be easily differentiated, as in *C. ovalis* on the epichile there are only two keels, while in *C. fimbriata* in addition to the two keels there are also additional side keels.

**Coelogyne stricta** (D. Don) Schltr. in Feede, Repert. Beih 4: 184, 300. 1919; Das & Jain, 28. 1980.

*Cymbidium strictum* D. Don, Prodr. Fl. Nepal 35. 1825.

*Coelogyne elata* Lindl. Gen. & Sp. Orch. 40. 1830; Hook. f., 5: 838. 1890 (excl. cit. Bot. Mag. 83. t. 5001. 1857); King & Pantl. 136, t. 188. 1898; Duthie, 114. 1906. (Fig. 134)

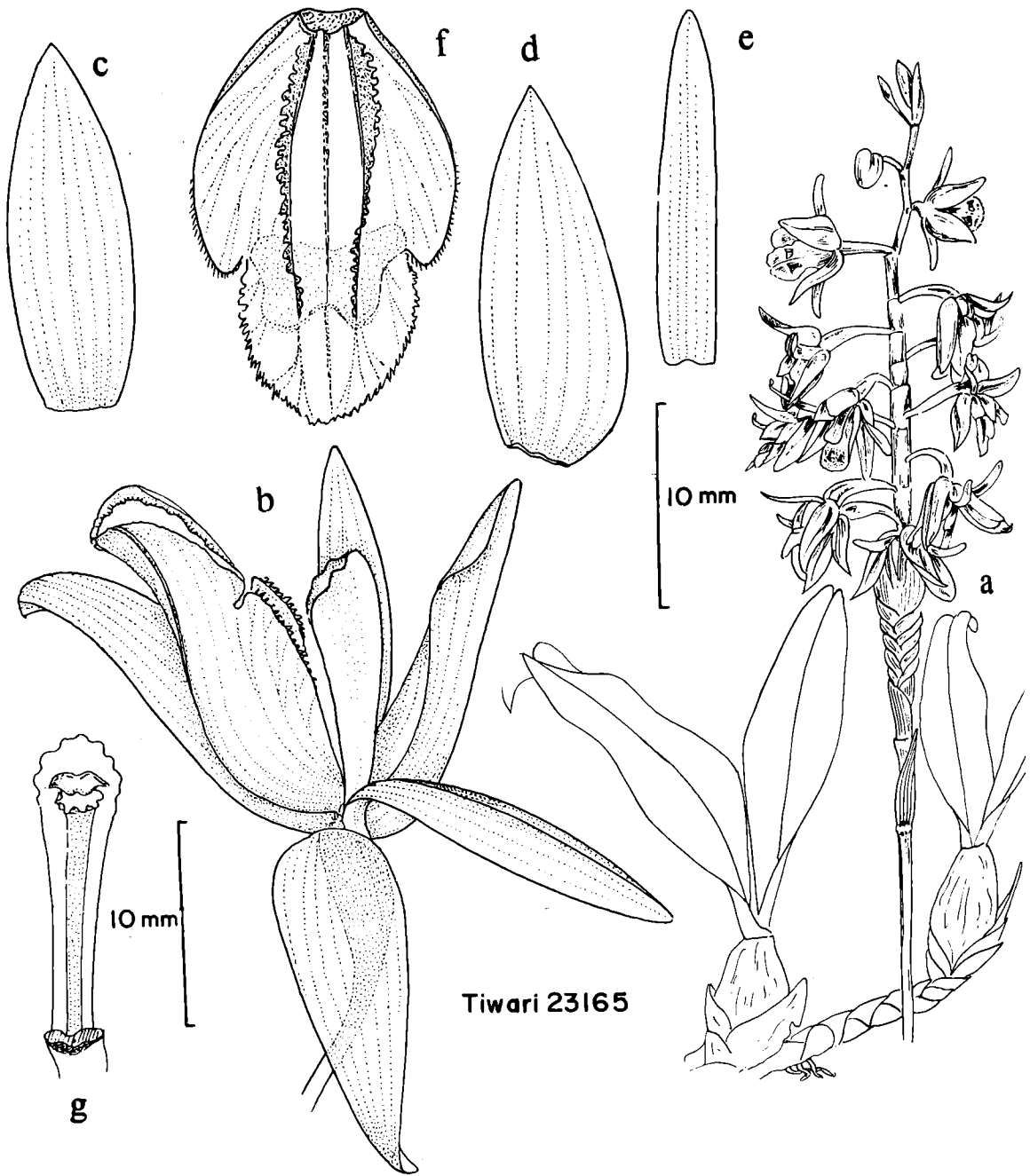
*Pseudobulbs* narrowly ovoid, arising at distances of about 5 cm, polished and sheathed at the base, 3-7 × 1-1.6 cm. *Leaves* in pairs, shortly petioled, 10-30 × 2-7 cm, narrowly elliptic-oblong, acute, thinly coriaceous. *Peduncle* from the middle of the leaves, 12-25 cm long. *Inflorescence* a raceme, bearing 5-11 flowers. *Flowers* 2-3.5 cm across, white, rather foetid, all opening at the same time. *Bracts* deciduous, ovate, acute, 2.5 cm long. *Sepals* 1.5-3 × 0.4-1 cm, oblong-ovate, acute, the dorsal 2 cm or less long. *Petals* 1.3-2.0 × 0.2-0.4 cm, linear, reflexed. *Lip* 1.4-2 × 1-1.6 cm, tinged with golden-yellow, 3-lobed; midlobe sub-orbicular, entire or slightly erose; lateral lobes narrow, minutely fimbriate at the apex; keel 2, crenulate, white, orange-red at the apex.

*Flowering*: April - May

*Distribution*: Himalaya 1200-2000 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram. Burma.

*Specimens examined*:

GARHWAL: Garhwal, *Falconer*, *Mackinnon* (Duthie, *loc. cit.*).



**Fig. 134** *Coelogyne stricta* (D. Don) Schltr. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. column.

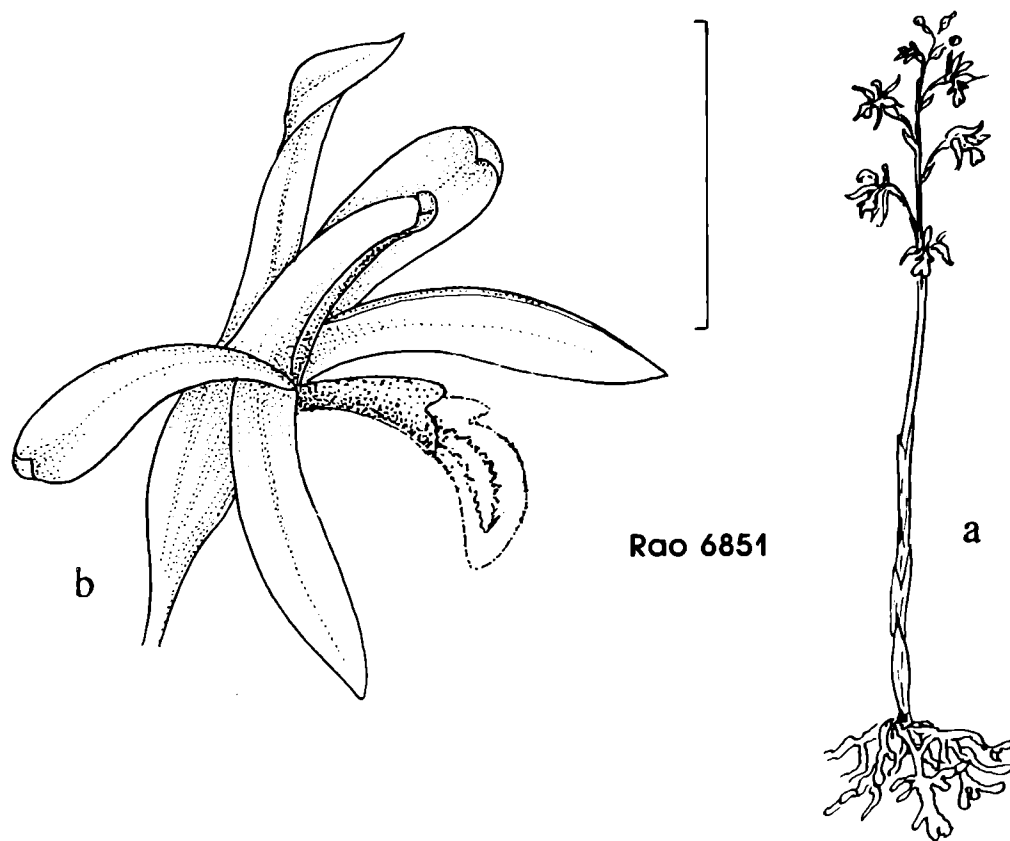


Fig. 135 *Corallorrhiza trifida* Chatel. —a. plant; b. flower.

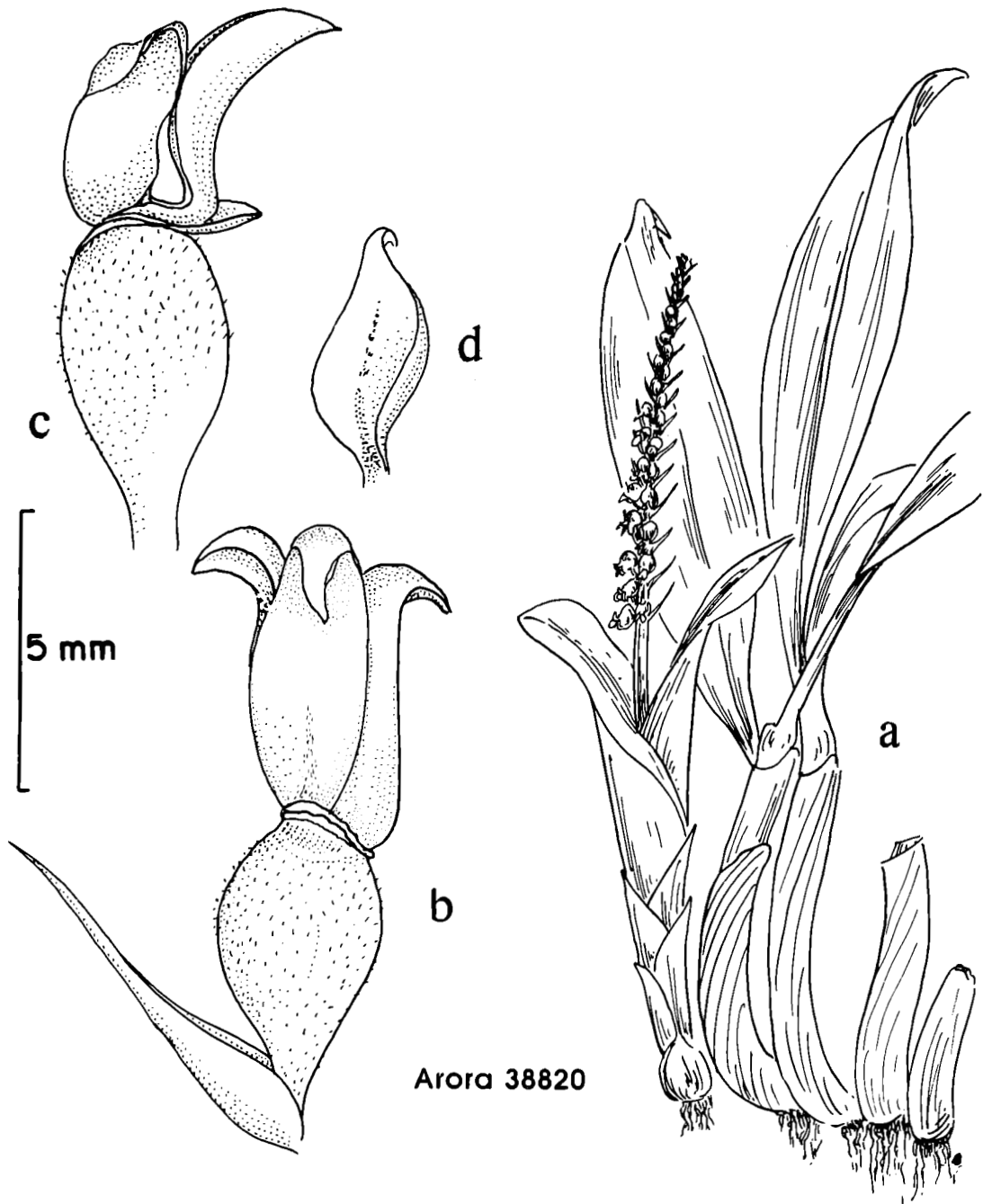


Fig. 136 *Cryptochilus lutea* Lindl.—a. plant; b. flower; c. column & lip; d. lip.

KUMAUN: **Pithoragarh**-Sherghat, *Inayat* 24132; Didihat, *M.A. Rau* 35320, *Arora* 36489, *Pant* 31849; Chorpata, *M.A. Rau* 35352; Between Munsiyari and Lilam, *N.C. Nair* 35556; Vasavgad Gori Valley, *Bhat-tacharyya* 21287; Askot, *T.A. Rao* 11596.

### **Corallorhiza** Gagnebin

Leafless saprophytic plants with coral-like much branched fleshy rhizomes. *Scape* simple with small sheathing scales. *Racemes* rather laxly few to many flowered. *Flowers* small, whitish or pale-yellow, spotted with crimson. *Sepals* and petals sub-equal, spreading, linear. *Petals* ascending, incurved. *Lip* spurless, clawed, adnate to the base of the column, erect, entire or 3-lobed. *Column* slender, erect. *Anther* terminal; *pollinia* 4 without caudicles. *Ovary* with short pedicel, pendent after anthesis.

**Corallorhiza trifida** Chatelain, Sp. Inaug. Corallorh.: 8. 1761; Stewart, 67. 1972; Hara et al. 1: 37. 1978; Renz, 57. 1984.

*Ophrys corallorhiza* Linn. Sp. Pl. 945. 1753.

*Corallorhiza innata* R. Br. Aiton, Hort, Kew ed. 2, 5: 208. 1813; Hook. f., 5: 710. 1890; Duthie, 133. 1905.

*C. corallorhiza* (L.) Karst. Deutsche Fl. Pharm. med. Bot. 448. 1853.

*C. anandae* Malhotra & Balodi in Bull. Bot. Surv. 26(1-2): 108, 1984. *syn. nov.* (Fig. 135)

Plant slender, up to 20 (-30) cm. *Rhizome* cream-coloured or pale-yellow, flattened. *Scape* 7-25 cm long, erect, slender, glabrous, yellowish-green, brown veined, with 2-4 sheathing scale; raceme lax with 4-12 flowers. *Flowers* sub-sessile, 7 mm long. *Bracts* minute, 1-2 mm long, triangular, membranous, shorter than the ovary. *Sepals* oblong-lanceolate, yellowish-green, connivent with petals. *Petals* slightly smaller, falcately oblong, with some crimson spots. *Lip* equalling to the sepals, whitish with crimson lines or spots, oblong-ligulate, with 2 small teeth like lateral lobes near the base. *Column* 3-4 mm.

*Flowering*: June - August.

*Distribution*: Himalaya 3500 m (Kashmir, Kumaun to Nepal). Europe, Siberia, N. China, N. America.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Martoli Bugyal, *T.A. Rao* 6851.

JAMMU & KASHMIR: Poonch, *Clarke* 28943.

Sometimes the lateral lobes of the lip are very small.

### **Cryptochilus** Wall.

Epiphytic; *pseudobulbs* crowded. *Leaves* two, coriaceous, usually petiolate. *Inflorescence* terminal racemose, the peduncle naked. *Flowers* yellow or scarlet, secund, in distichous spikes. *Sepals* connate in a sub-cylindric or urceolate tube, the acute apices alone free. *Petals* included. *Lip* included, adnate to the short foot of the column. *Column* erect, slightly dilated at the apex. *Anther* 2 or 4-celled; *pollinia* 8, cuneate or oblong, attached to a single gland.

**Cryptochilus luteus** Lindl. in Journ. Proc. Linn. Soc. Bot. 3: 21. 1859; Hook. f., 5: 827. 1890; King & Pantl. 163, t. 221. 1898; Arora, 174, fig. B. 1972. (Fig. 136)

Epiphytic. *Pseudobulbs* 6-7.5 × 0.8-10 mm, oblong, cylindrical, crowded. *Leaves* 1-2 on top of pseudobulb, 10-15 × 1.5 cm, oblong-elliptic, coriaceous, acute, shortly petioled. *Scape* from top of immature pseudobulb, erect, 10-15 cm; raceme densely many flowered, 5-7.5 cm long. *Flowers* in 2 rows, facing opposite direction, 8 mm across, cup shaped, yellow. *Bracts* much longer than flowers, linear-lanceolate, pubescent.

*Sepaline tube* urceolate, free at the apices. *Petals* narrowly and obliquely rhomboid, narrower at the base. *Lip* somewhat darker than the other parts, oblong, slightly expanded, grooved and thickened towards the apex, curved at the base.

*Flowering*: June - July.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur.

*Specimens examined*:

KUMAUN: Pithoragarh-Shandev, Arora 38820.

### **Dendrobium Sw.**

Epiphytes. *Stem* pseudobulbous or elongate and slender. *Leaves* sessile, coriaceous or membranous but never plaited, distichous or not. *Flowers* solitary or few, peduncle leaf-opposed or terminal on pseudobulbs. *Sepals* sub-equal, laterals obliquely adnate by their bases to the column foot, forming a mentum. *Petals* smaller or larger than sepals. *Lip* 3-lobed or entire, adnate to and incumbent on the foot of the column, concave or saccate, side lobes embracing the column. *Disc* rigid or lamellate. *Column* very short with distinct foot which is often long. *Anther* attached at the apex by a filament; *pollinia* 4 in two pairs without caudicles or viscidia free or pairs slightly adhering by a viscus.

### **Key to species**

1. Flowers densely clustered in a nearly sessile usually terminal or sub-terminal head, rarely on lower nodes, yellow marked with dull red, fleshy; lip concave; side lobes triangular; midlobe smaller, truncate; pseudobulbs clavate or fusiform, 7-45 cm.....*D. bicameratum*
- + Flowers in various inflorescence, solitary, in pairs, bunches, paniculate or racemose; pseudobulbs cylindrical, thickened uniformly or thickened at the middle base or top.....2
2. Pseudobulbs terminating in a slender inflorescence of small flowers, with or without lateral racemes, pseudobulbs conspicuously tapering from a broad base to narrow point (almost conical).....3
- + Pseudobulbs not terminating in an inflorescence; flowers usually large in lateral pairs, fascicles or racemes, rarely solitary; pseudobulbs usually uniformly thick or moderately tapering from base up or from tip below, or from centre on both sides.....4
3. Pseudobulbs small, 3-5 cm long; raceme upto 5 cm in length, single from the tip of the stem, or rarely one more additional from the upper most node, usually erect; lip with inciso-serrate edges, yellowish-green with dark purple veins.....*D. monticola*
- + Pseudobulbs 7-25 cm long; racemes upto 12 cm long, many flowered, terminal, usually with several additional racemes from lower nodes, drooping; lip with a band of radiating red lines along the edges, and with narrow lacinate side lobes; midlobe narrow, acute, much recurved.....*D. denudans*
4. Lip forming a globular or pear shaped pouch with the upturned margins (calceolar); pseudobulbs erect, tapering moderately from the middle on both sides; flowers 5-10 cm across, 8-16 on a pendulous raceme. ....*D. moschatum*
- + Lip not forming a pouch (not calceolar).....5
5. Lip not convolute, edges flat or erect towards the base but never overlapping to form a tube.....6
- + Lip convolute throughout its length or only towards the posterior portion, edges upturned and overlapping to form a short or long tube.....9
6. Flowers on a single node, 3-4, born in a raceme near the tip of the pseudobulbs; leaves linear-lanceolate, acuminate with obliquely bifid apex; lip of one colour or with a single brown patch in the centre, or orbicular with fringed margin, rarely in abnormal flowers of various shapes, orbicular to ovate-oblong to almost lanceolate, like the shape of petals, with entire, serrulate or partly fringed margins, column 3-ridged with a short foot, but rarely 6-ridged, small and round, without foot.....*D. normale*



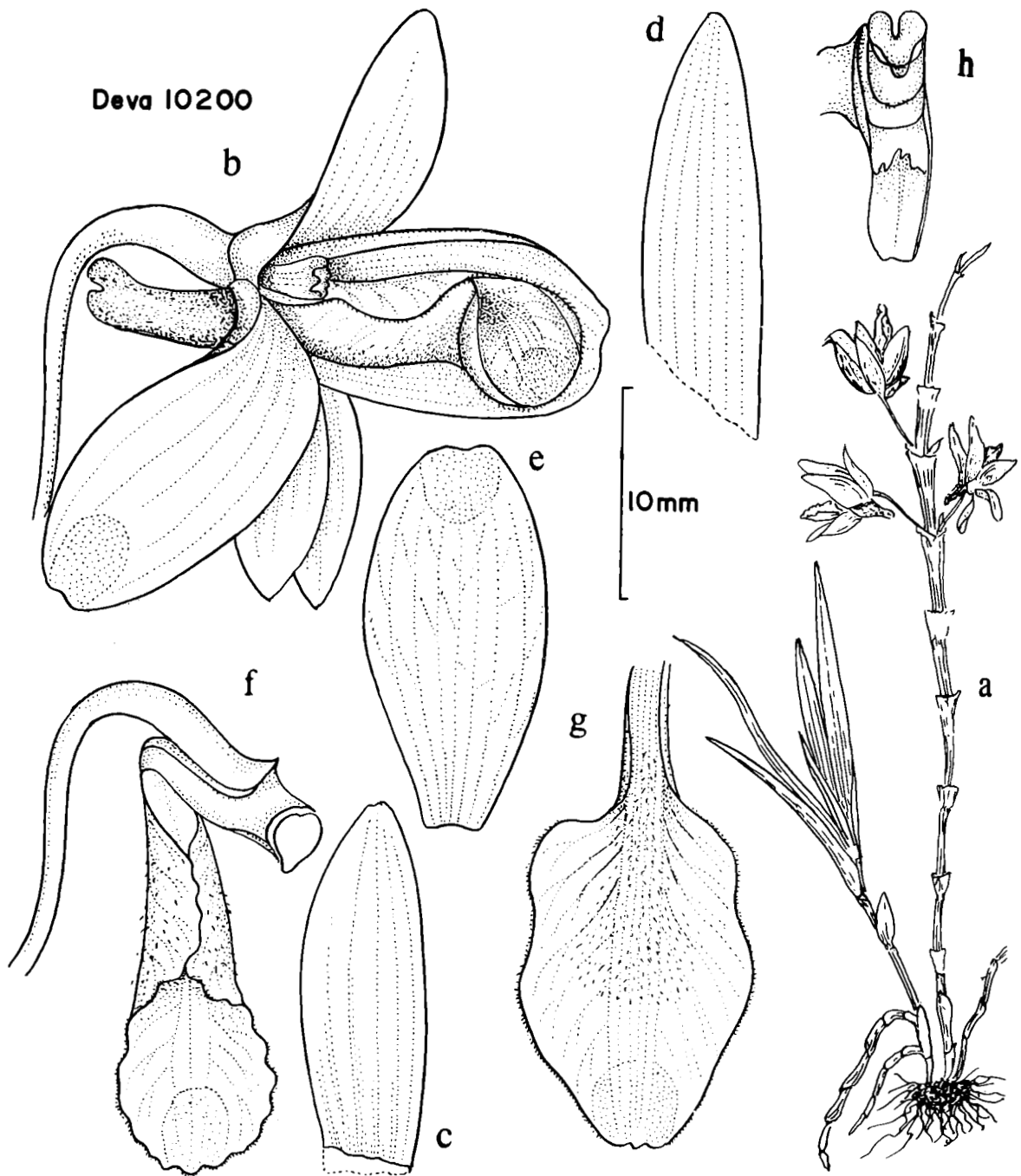
- + Flower on several upper nodes, born singly, in pairs or fascicles of 2-4 flowers.....7
7. Flowers large, 3.5 cm across, bright yellow or orange-yellow; lip orbicular-oblong or reniform, margin fimbriate, with two or a single brownish-purple spot on dorsal side; pseudobulbs pendulous, stout, tapering on both side from the middle, when in flowers with many leaves.....*D. chrysanthum*
- + Flowers smaller, 2-2.5 cm across, white, lilac or pink in colour; lip obovate or oblong-lanceolate, margin undulate to entire, not fimbriate, of one colour or with a single yellow patch on the dorsal side; pseudobulbs leafless at the time of flowering.....8
8. Lip broadly obovate, with or without a large yellow blotch, without sidelobes, pubescent, apex rounded or retuse; flowers white, tinged with lilac or pink; pseudobulbs stout usually short, pendulous, thickened upwards.....*D. crepidatum*
- + Lip oblong-lanceolate, white of one colour only, with rounded incurved side lobes, apex acute; flowers pure white; pseudobulbs slender, erect, more or less uniformly thickened.....*D. candidum*
9. Flower with lip convolute throughout its entire length giving an unopen look to the flower; flower 2 cm across, yellow in colour with reddish-purple veins; pseudobulbs slender, pendulous.....*D. macrostachyum*
- + Flower with posterior part of the lip convolute, anterior part expanded.....10
10. Lip longer than broad.....11
- + Lip broader than long.....13
11. Pseudobulbs stout, clavate; flowers yellow; lip trowel shaped, apex acute, decurved.....*D. heterocarpum*
- + Pseudobulbs slender, long, more or less uniformly thickened; flower white, tinged with purple; lip oblong, apex rounded not decurved.....12
12. Spur swollen at the apex, bracts small; lip white tinged with yellow near the base and a purple spot near the apex; pseudobulbs pendulous.....*D. amoenum*
- + Spur conical, bracts large; lip white or pink, blotched with purple down the centre, with purple line towards the base; pseudobulbs semi-pendulous.....*D. transparens*
13. Flowers yellow; lip orbicular-reniform, with a large purple blotch near the centre, margin sub-fimbriate or undulate-entire near the apex; flowers 3 or 4 on a single node, born in a raceme near the tip of the pseudobulb.....*D. chryseum*
- + Flowers white, lilac or rose to pale-purple; lip broadly oblong to sub-orbicular, margins strongly ciliate; flowers on several upper nodes, solitary or in pairs of 2-3 in clusters.....14
14. Lip strongly ciliate all along the margin, apical portion pale-yellow; flowers 5-6.5 cm, solitary or rarely two from the nodes of the pseudobulbs; petals narrower than the sepals; pseudobulbs stout, 25-45 × 1-1.5 cm.....*D. primulinum*
- + Lip ciliate on the anterior margin, apical portion pale-yellow with radiating purple streaks; flowers 3-4 cm across, 1-3 together from the swollen nodes, petals broader than the sepals; pseudobulbs slender, 60-120 × 0.5-0.8 cm across.....*D. aphyllum*

***Dendrobium amoenum*** Wall. ex Lindl. Gen. & Sp. Orch. 78. 1830; Hook. f., 5: 738. 1890; King & Pantl. 49, t. 69. 1898; Duthie, 98. 1906; Seidenf. & Arora, 13. 1982.

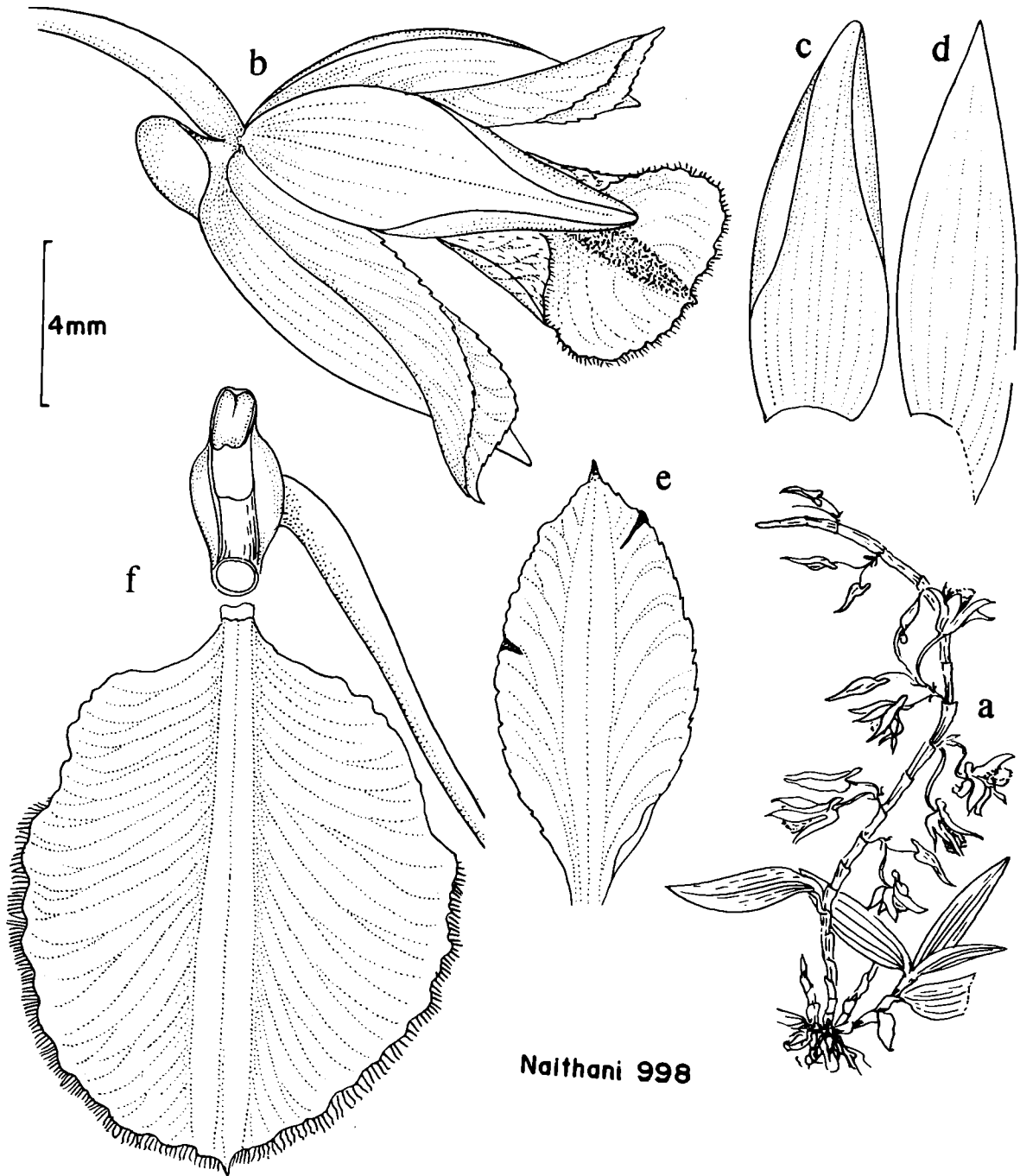
*D. normale* sensu Issar & Uniyal in Ind. For. 93: 714. 1967. (*non* Faic.).

(Fig. 137)

*Pseudobulbs* slender, pendulous, 30-75 cm high, slightly thickened at nodes, internodes 6 cm long. *Leaves* narrow, 6-10 × 0.8-1.5 cm, deciduous, linear to oblong-lanceolate, wavy, apex oblique, acute. *Flowers* fragrant, 2-3 on each node, 4 cm across, white with violet tips. *Bracts* small. *Sepals* oblong-lanceolate, obtuse, tipped with purple. *Petals* larger, ovate, obtuse, tipped with purple. *Lip* white tinged with yellow near the base and purple spot near the apex, oblong-ovate, spur swollen at apex, 3-lobed, sidelobes broad, rounded, rolled over the column; apical lobe orbicular with undulate edges, hairy on both side; spur large, upper margin erose; lower with two calli, centre occupied by a thickened line. *Column* broad at apex.



**Fig. 137** *Dendrobium amoenum* Wall ex Lindl.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column & lip; g. lip; h. column.



**Fig. 138** *Dendrobium aphyllum* (Roxb.) Fischer—**a.** plant; **b.** flower; **c.** dorsal sepal; **d.** lateral sepal; **e.** petal; **f.** column & lip.

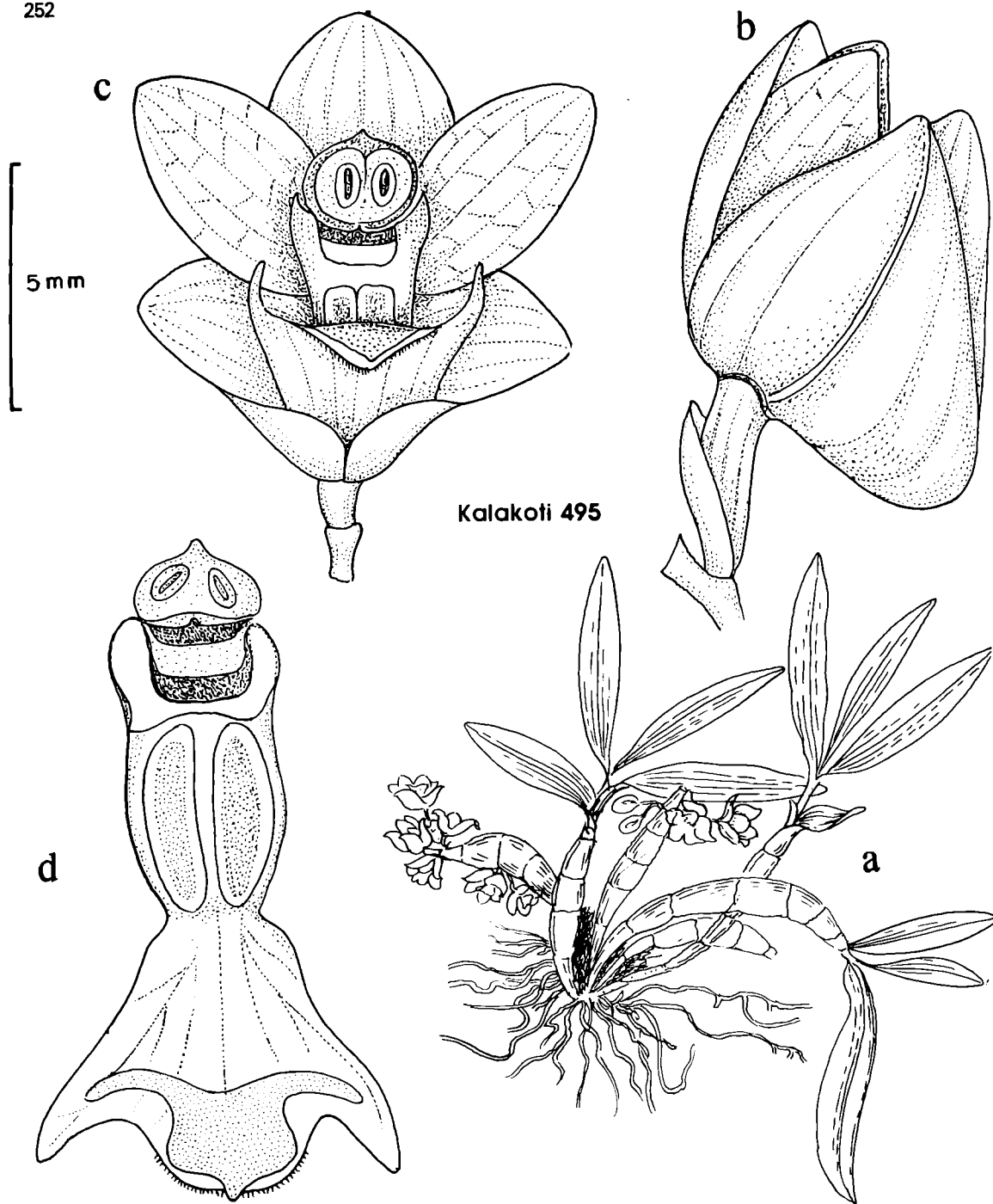


Fig. 139 *Dendrobium bicameratum* Lindl.—a plant; b. & c. flower; d. column & lip.

*Flowering:* May - June.

*Distribution:* Himalaya up to 1600 m (Garhwal to Bhutan), Assam, Meghalaya. Bangladesh, Burma.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun Valley, *Gamble*; Kalinga Hills, Nalapani, *Deva* 5016; Mussoorie, *Mackinnon* 21745. **Tehri**-Chamasaree, *Falconer*; Narendranagar, *Deva* 10190; Agrakhal, *Deva* 10200. **Uttarkashi**-Barahat, *Jameson*. **Pauni**-Outer Garhwal hills, Inayat 25484 & 25842. **Chamoli**-Phata, *Uniyal* 2523; Guptkashi, *Mehrotra* 3646.

KUMAUN: **Pithoragarh**-Above Kanali - Chinna, *Sahni* 20404; Sandev, *Arora* 66273. **Nainital**-below Nainital, *Davidson*; Patwadhanger, *Bankoti* 40.

**Dendrobium aphyllum** (Roxb.) Fischer in *Gamble*, Fl. Pres. Madras 3: 1416. 1928; *Seidenf.*, 83: 70. 1985. *Limodorum aphyllum* Roxb. Pl. Coromand. 1: 34. t. 41. 1795.

*D. pierardii* Roxb. Hort. Beng. 63. 1814, *nom. nud.* ex Hook., *Exot. Fl.* 1. t. 9. 1822; Hook. f., 5: 738. 1890; King & Pantl. 51. t. 72. 1898; Duthie, 97. 1906. (Fig. 138)

*Pseudobulbs* 60-120 × 0.5-0.8 cm, pendulous, leafy throughout, compressed. *Leaves* 5-10 × 2.5-3.5 cm, decreasing in length upwards, lanceolate, ovate-lanceolate, acuminate. *Flowers* in fascicles of 1-3, from the swollen nodes, 3-4 cm across, pale-rose, lip yellow. *Sepals* sub-equal, oblong-lanceolate, sub-acute. *Petals* much broader than sepals, elliptic, rounded, sepals and petals rose coloured. *Lip* sub-orbicular, base shortly convolute, pubescent, ciliate on anterior margin, apical portion pale-yellow with radiating streaks of purple at base.

*Flowering:* May.

*Distribution:* Himalaya (Garhwal, Nepal to Arunachal Pradesh), Madhya Pradesh, Orissa, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Bengal, Peninsular India, Andaman Island. Burma, Thailand, W. China, Malaya, Laos and Vietnam.

*Specimens examined:*

GARHWAL: **Dehra Dun**-New Forest, *Naithani* 998 (Cult.).

Eastern part of Dehra Dun in forests by the bank of Song river, *Gamble & Mackinnon* (Duthie. *l.c.*).

We have seen no wild specimen of this species from the region however it is very commonly cultivated in the gardens.

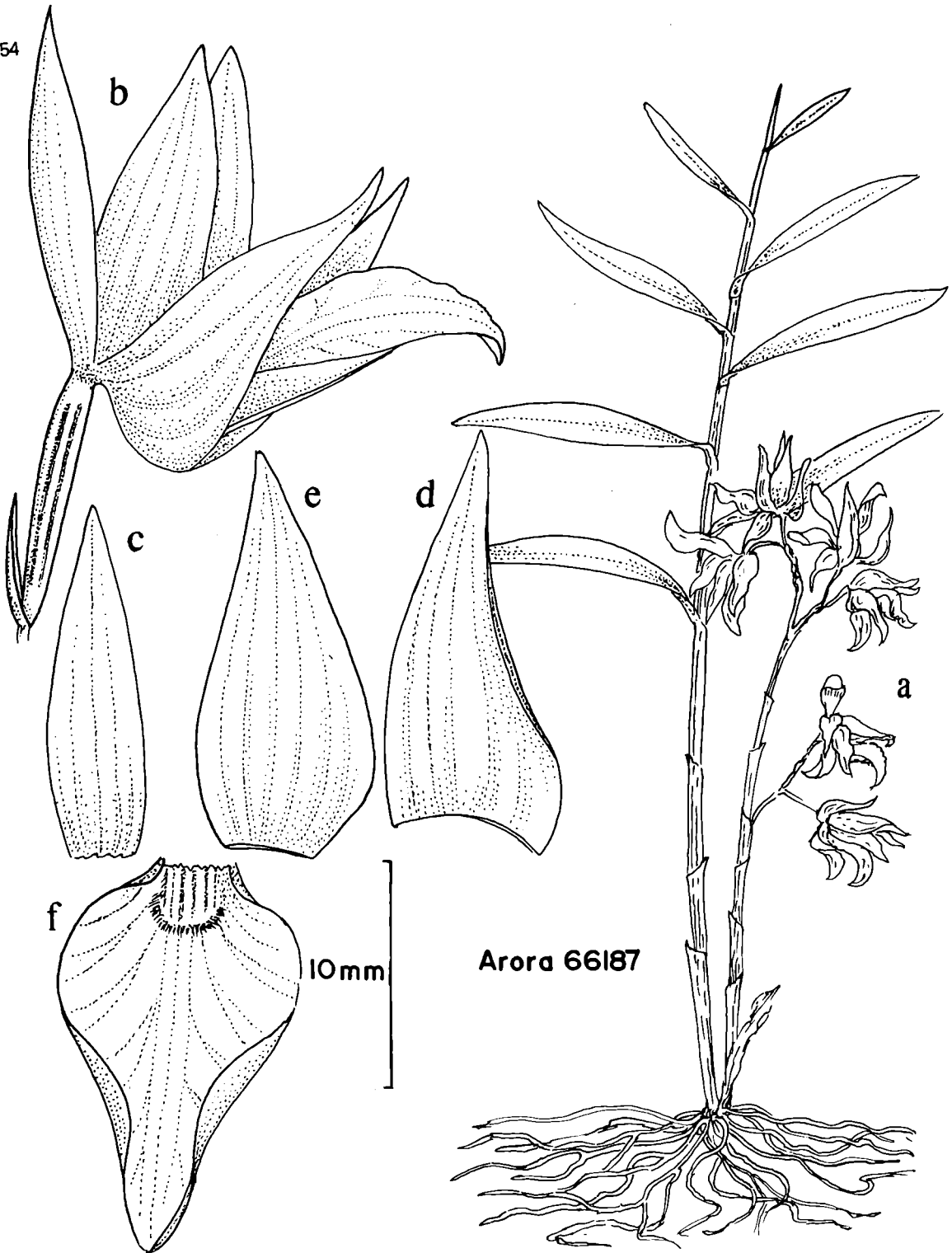
**Dendrobium bicameratum** Lindl. in *Edw. Bot. Reg.* 25: 85. 1839; Hook. f., 5: 729. 1890; King & Pantl. 42. t. 56. 1898; Duthie, 95. 1906.; *Seidenf.*, 83: 97. 1985.

*D. breviflorum* Lindl. in *J. Linn. Soc. Bot.* 3: 14. 1859. (Fig. 139)

*Pseudobulbs* clavate or fusiform, erect, 7-45 × 0.9-1.2 cm. *Leaves* elliptic-oblong to elliptic-lanceolate, 4-7.5 × 2-2.5 cm, obliquely and minutely bifid at the apex. *Inflorescence* from the apex of the pseudobulb. *Flowers* fleshy, 10 mm across, densely clustered in a nearly sessile terminal or sub-terminal head, rarely on lower nodes, yellow marked with dull red stripes. *Bracts* sheathing. *Sepals* narrow, lanceolate, acuminate, spreading or reflexed, the dorsal broadly ovate-oblong, 10 × 6 mm, laterals triangular, concave, sub-acute. *Petals* elliptic, obtuse, as long as the sepals. *Lip* small, fleshy, concave, triangular, 3-lobed, side lobes small, erect triangular, midlobe very short, truncate. *Disc* fleshy and smooth.

*Flowering:* August - September.

*Distribution:* Himalaya upto 1800 m (Garhwal to Arunachal Pradesh), Meghalaya, Nagaland, Bihar, Orissa. Burma and Thailand.



**Fig. 140** *Dendrobium candidum* Wall ex Lindl. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip.

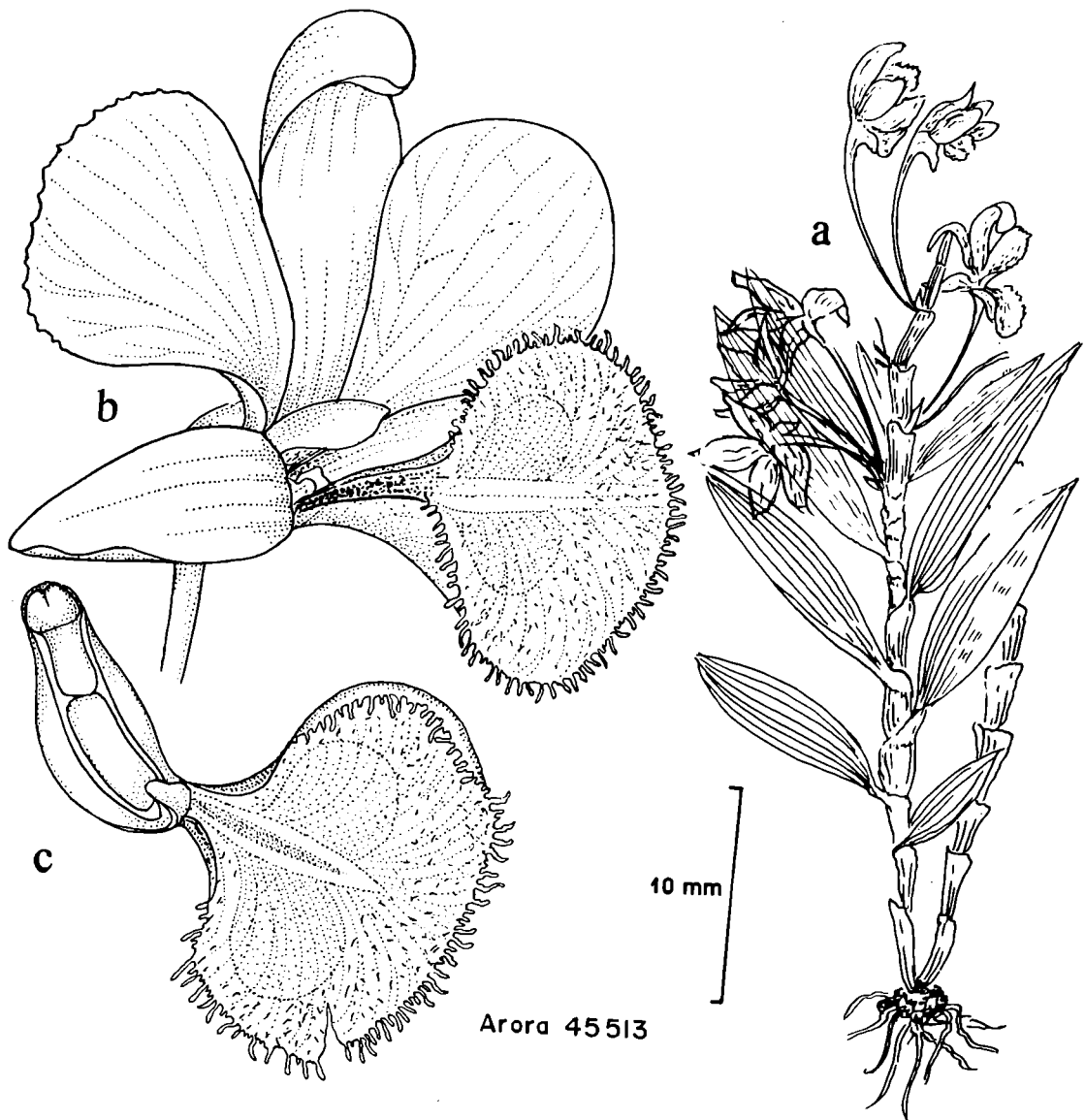


Fig. 141 *Dendrobium chrysanthum* Lindl.—a. plant; b. flower; c. column & lip.

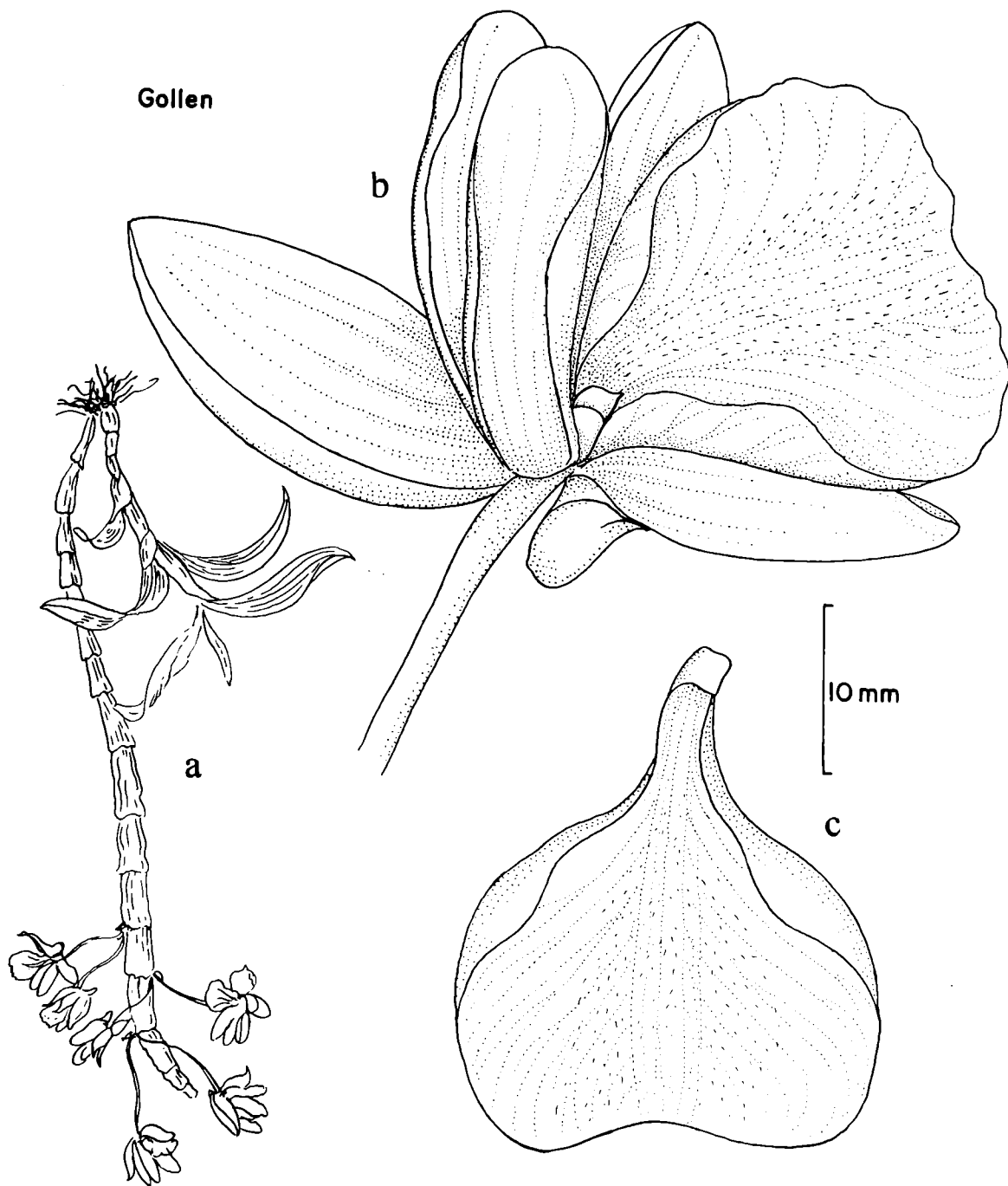


Fig. 142 *Dendrobium crepidatum* Lindl.—a. plant; b. flower; c. lip.



*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, below the park, *Mackinnon* 21744; Jharipani, *Deva* 2581.

KUMAUN: **Pithoragarh**-Thakil Hill, *Inayat* 24092; Thal, *M.A. Rau* 35332; Didihat, *Arora* 36430, 37877 & 41350; Dafiadhura, *Arora* 55833; Chaupata, *Arora* 48996, *Pant* 31866; Askot, *Bhattacharyya* 21380. **Nainital**-Khurpatal, *Kalakoti* 495.

**Dendrobium candidum** Wall. ex Lindl. in Edw. Bot. Reg. 24 Misc.: 36. 1838; Hook. f., 5: 735. 1890; King & Pantl. 49, t. 68. 1898; Duthie, 100. 1906. (Fig. 140)

*Pseudobulbs* more or less uniformly thickened, 15-30 × 0.6 cm, terete. *Leaves* 5-8 × 0.6-1.0 cm, linear-lanceolate, apex obtuse, obliquely bifid. *Flowers* 1-3 from leafless pseudobulb, pure white, 2.5-3 cm across. *Sepals* 16-18 × 4-6 mm, lanceolate-ovate, obtuse or sub-acute. *Petals* like the sepals but more acute, slightly longer and broader. *Lip* oblong-lanceolate, with an yellow spot near the base, 3-lobed, side lobes small, erect, rounded, incurved, midlobe much longer and broader, acute, entire. *Disc* between lateral lobes with an elongated keel.

*Flowering*: April - May.

*Distribution*: Himalaya upto 1800 m (Garhwal to Arunachal Pradesh), Meghalaya and Manipur.

*Specimens examined:*

GARHWAL: **Tehri**-near Tehri, *Mackinnon* 24155.

KUMAUN: **Pithoragarh**-Dafiadhura, *Arora* 66187.

**Dendrobium chrysanthum** Wall. Cat. n. 2012. 1829 *nom. nud.* ex Lindl. in Edw. Bot. Reg. 15. t. 1299. 1830; Gen & Sp. Orch. 80. 1830; Hook. f., 5: 747. 1890; King & Pantl. 55. t. 77. 1898; Duthie, 102. 1906; Seidenf., 83: 53. 1985. (Fig. 141)

*Pseudobulbs* 90 cm to 2m long, pendulous, thick in the middle, tapering on both sides towards the apex and the base, clothed with scarious white lined tubular sheaths. *Leaves* 8-15 × 2.5-4 cm, lanceolate, acuminate, base rounded, deciduous. *Inflorescence* arises from the young leafy pseudobulbs axillary racemes, usually 2-4 flowered. *Flowers* 3.5 cm across, bright yellow or orange-yellow, waxy. *Sepals* sub-equal, ovate, obtuse, concave, the laterals slightly falcate. *Petals* little longer than sepals, ovate, orbicular, concave, entire or minutely erose. *Lip* concave, orbicular-oblong or reniform, margin fimbriate, with two or a single horse-shoe shaped brownish-purple patch.

*Flowering*: August - September.

*Distribution*: Himalaya 1000-2000 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. Burma, Thailand, Laos, Vietnam and China.

*Specimens examined:*

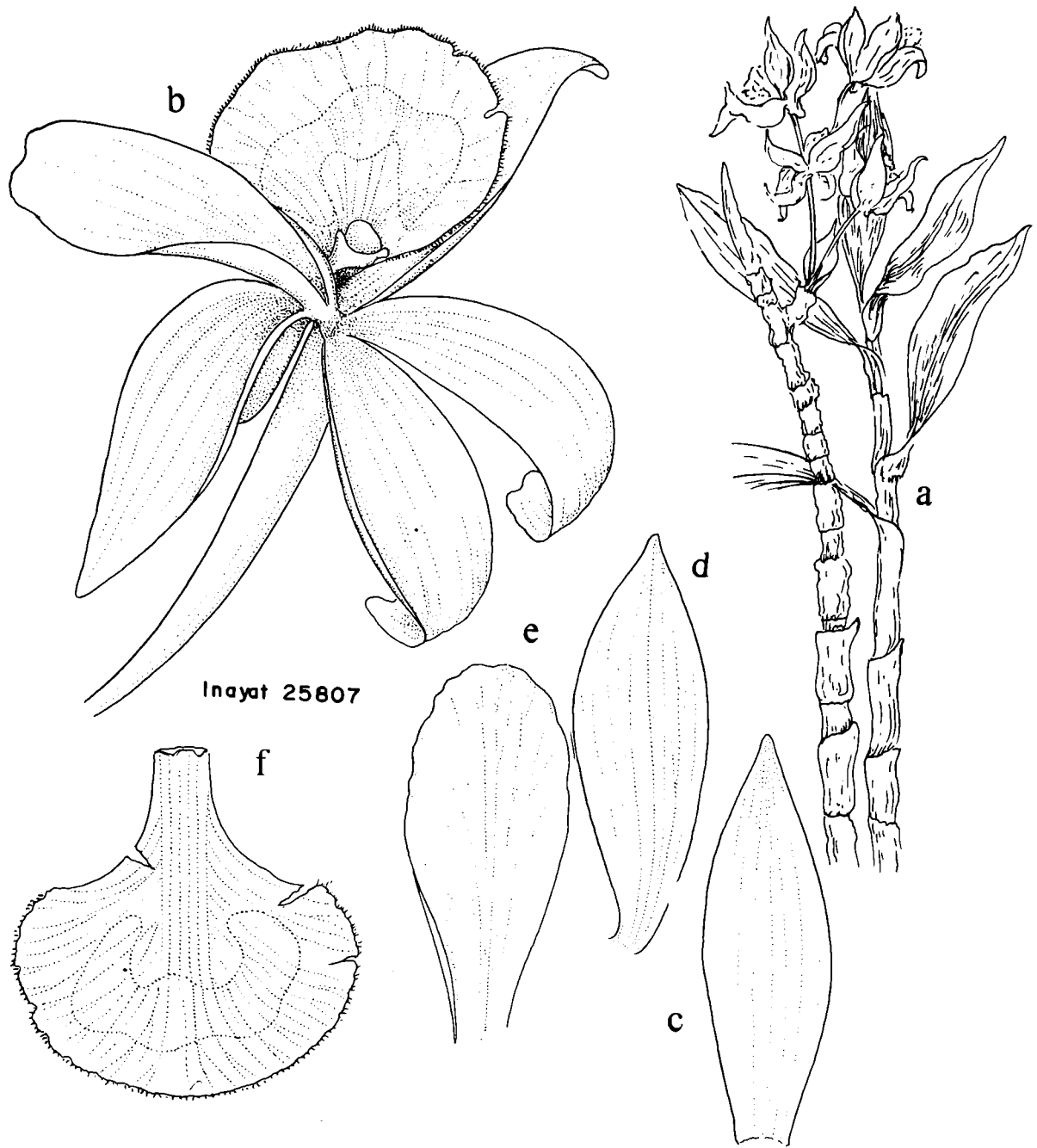
KUMAUN: **Pithoragarh**-Gori Valley, *Inayat* 24095; Ram Ganga Valley, *Duthie* 3404; Gorpata-Thal, *M.A. Rau* 35343; Thal-Berinag, *Arora* 38809; Didihat, *Arora* 41331; Askot, *Inayat* 24095(a), *Bhattacharyya* 21381, *Arora* 45513; Simli Village, *Palvi* 5682.

**Dendrobium crepidatum** Lindl. in Paxt. Fl. Gard. 1: 63. fig. 45. 1850; Hook. f., 5: 740. 1890; King & Pantl. 48, t. 66. 1898.; Duthie, 99. 1906; Seidenf., 83: 80. 1985.

*D. lawianum* Lindl. in J. Linn. Soc. Bot. 3: 10. 1895; Sant. & Kapadia 508, Pl. 25. 1966.

*D. crepidatum* var. *avista* Gammie in J. Bombay nat. Hist. Soc. 17: 33. 1906.

*D. actinomorphyum* Blatt. & Hall. in J. Ind. Bot. 2: 50. 1921. (Fig. 142)



**Fig. 143** *Dendrobium chryseum* Rolfe—**a.** plant; **b.** flower; **c.** dorsal-sepal; **d.** lateral sepal; **e.** petal; **f.** lip.

*Pseudobulbs* short, pendulous, greenish-yellow, 15-40 × 0.8-1 cm, thicker upwards; internodes 2 cm long, longitudinally striated; sheaths with distinct white stripes. *Leaves* oblong-lanceolate, acute, entire, many nerved, 4-10 × 0.5-2.5 cm. *Flowers* in pairs from the nodes of the apical part of pseudobulb, 2.5-3.5 cm across, waxy, white, tinged with lilac, pedicels purple. *Bracts* minute, scarious. *Sepals* sub-equal, oblong, obtuse, 15 × 6-7 mm, entire, tinged with lilac. *Petals* 15 × 7 mm, broadly oblong, spreading, wavy, tinged with lilac. *Lip* 17-11 × 13 mm, pubescent, orbicular-obovate, without sidelobes, white with a large yellow blotch, apex rounded or retuse.

*Flowering*: April - June.

*Distribution*: Himalaya up to 1400 m (Garhwal to Arunachal Pradesh), Bihar, Bengal, Orissa, Meghalaya, Mizoram, Manipur, Madhya Pradesh, Konkan, W. Ghat, Deccan, Bombay. Burma, Thailand, Laos, Vietnam and China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Below Arnigadh near Mussoorie, *Gollen*; Near Rajpur, *Banwari Lal* 25404.

KUMAUN: **Pithoragarh**-Between Berinag-Munkata Bagaura, *D.D. Awasthi* 1546.

***Dendrobium chryseum*** Rolfe in Gard. Chron. 1: 233. 1888; Seidenf., 83: 43. 1985.

*D. clavatum* Wall. Cat. no. 2004. 1829 *nom. nud.* ex Lindl. in Lindl. & Paxton, Fl. Gard. 2. 2104. t. 189. 1852. *non* Roxb. (1832); Hook. f., 5: 746. 1890; King & Pantl. 21, t. 60. 1898; Duthie, 100. 1906.

*D. aurantiacum* Rchb. f. in Gard. Chron. 2: 89. 1887 (*non* f. Muell).

*D. denneanum* Kerr in J. Siam. Soc. Nat. Hist. Suppl. 9: 229. 1933; Hara et al. 39. 1978.

*D. chrysanthum* auct *non* Lindl.; Duthie, 102. 1906 pp. (Fig. 143)

*Pseudobulbs* 45-75 cm long, pencil thick, pointed towards the apex. *Leaves* several, 9-12 × 2-3.5 cm, narrowly oblong, apex blunt or sub-acute. *Inflorescence* 7.5-15 cm long, single, raceme arising from the leafless stem near the tip. *Flowers* 3-4, dark-yellow, 5-7.5 cm across. *Sepals* linear, oblong, sub-acute or blunt. *Petals* broadly ovate, sub-acute. *Lip* narrower and convolute at basal part and expanded, concave, orbicular-reniform at the apex, yellow with large dark purple blotch near the centre, upper surface tomentose, spur blunt, margin pale.

*Flowering*: May - June.

*Distribution*: Himalaya 1500-1900 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Madhya Pradesh. Burma, China and Thailand.

*Specimens examined*:

GARHWAL: Garhwal, *Duthie* 25807.

KUMAUN: **Pithoragarh**- Samdhura, *T. A. Rao* 6551; Didihat, *Arora* 41365; Thalkedar, *Arora* 384321; Maitli, *Arora* 52444, Gori Valley, *Inayat* 25807.

***Dendrobium denudans*** D. Don, Prodr. Fl. Nepal 34. 1825; Hook. f., 5: 715. 1890; King & Pantl. 45, t. 62. 1898; Duthie, 96. 1906; Seidenf., 83: 148. 1985. (Fig. 144)

*Pseudobulbs* 7.5-25 × 0.6-0.8 cm, tapering towards the apex. *Leaves* 5-10 × 1-2 cm, narrowed at base, deciduous at flowering time, oblong-acute, apex obliquely notched. *Inflorescence* leaf opposed, terminal or lateral, slender, decurved, 12 cm long, 10-15 flowered. *Flowers* 1-2.5 cm long, white or pale-green with reddish veins. *Bracts* minute. *Sepals* sub-equal, partly open, linear, acuminate, 17 × 2-2.5 mm. *Petals* linear, acuminate, 12 × 1 mm. *Lip* 5-6 × 3-4 mm, decurved from base, 3-lobed, side lobes narrow, laciniate, green with radiating red lines, midlobe obdeltoid-ovate, strongly curled outwards, acute, margin serrate-crisped. *Disc* with obscurely 3-ridged flattened callus.

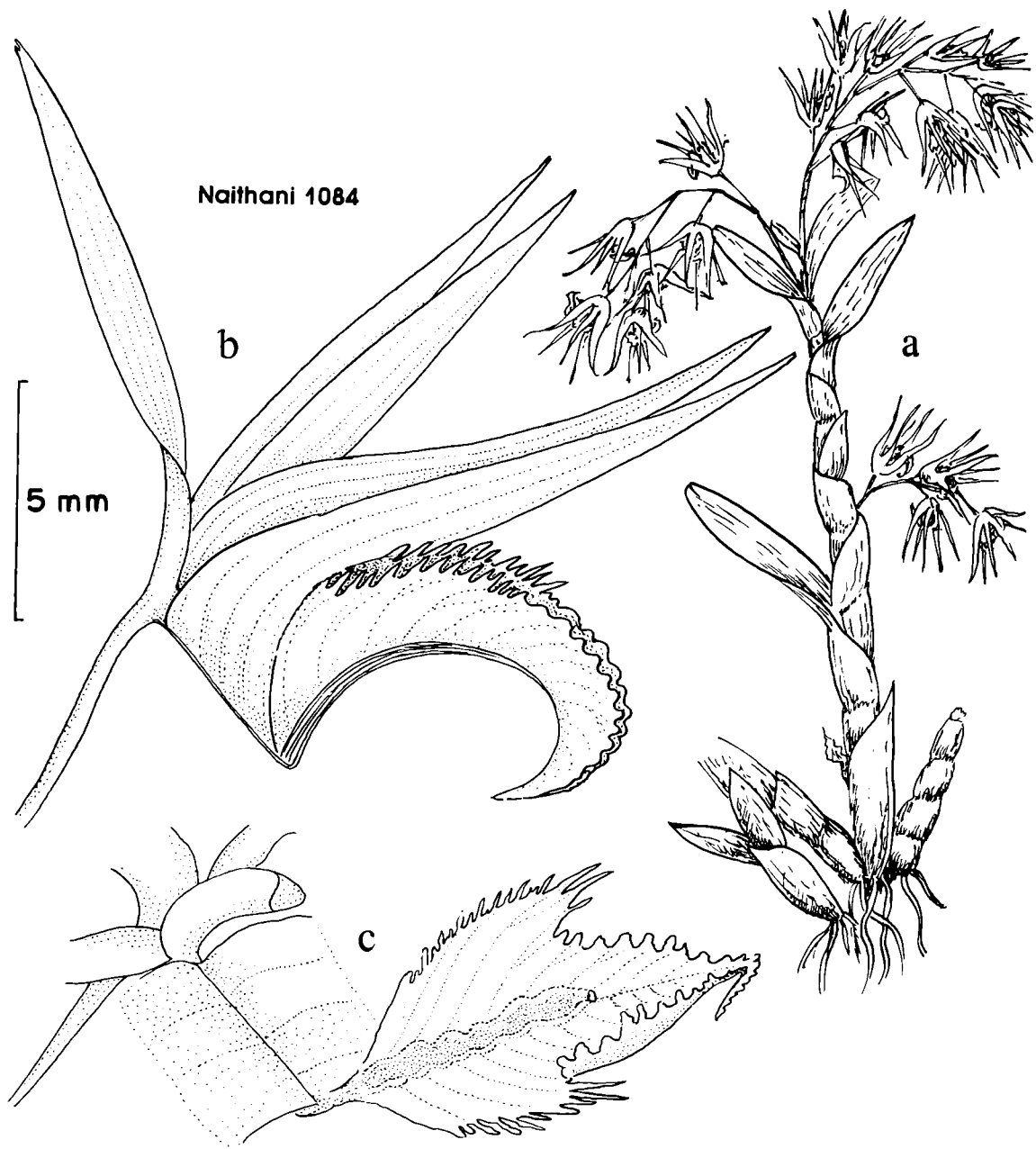


Fig. 144 *Dendrobium denudans* D. Don.—a. plant; b. flower; c. column & lip.

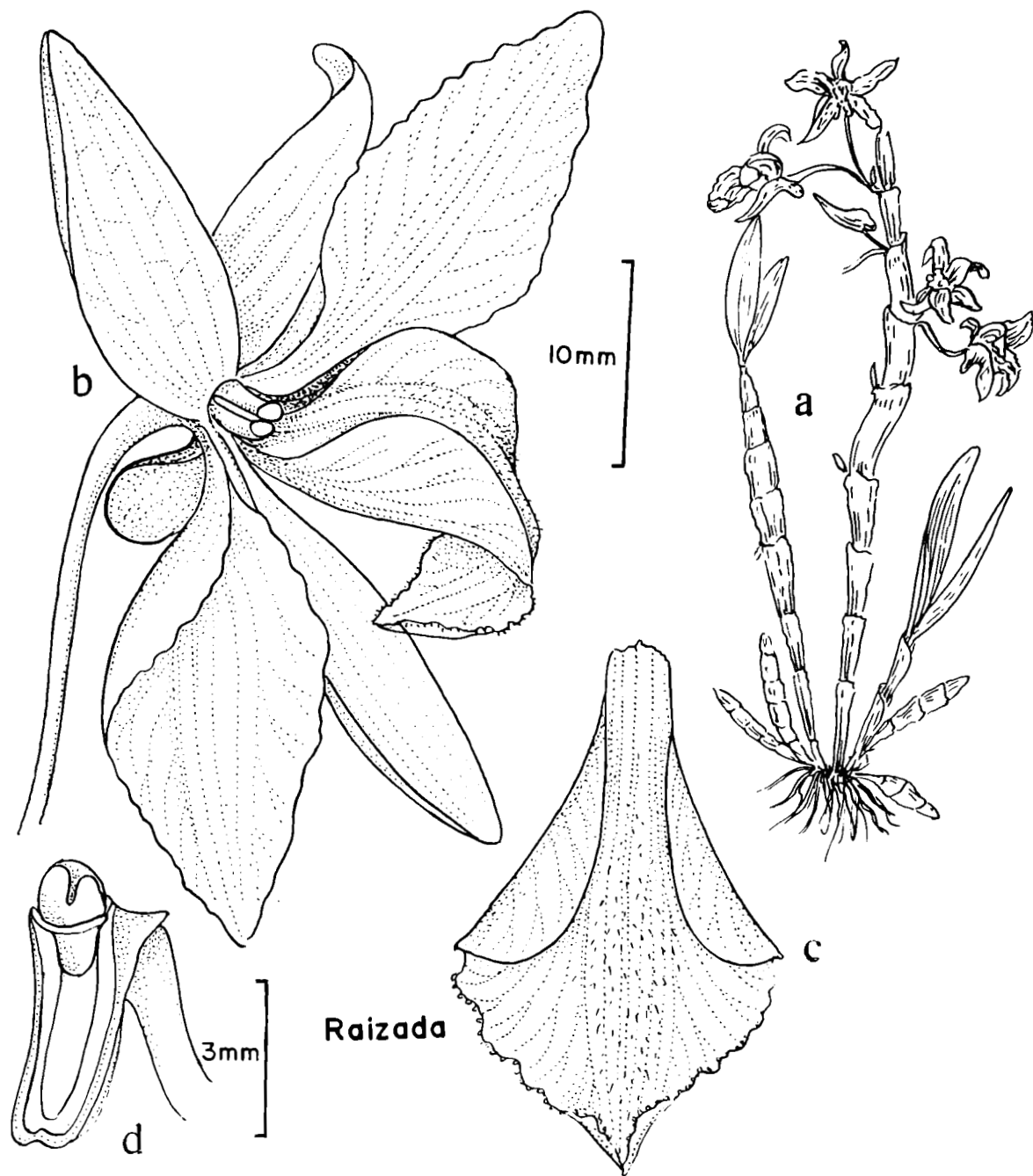


Fig. 145 *Dendrobium heterocarpum* Wall. ex Lindl. — a. plant; b. flower; c. lip; d. column.

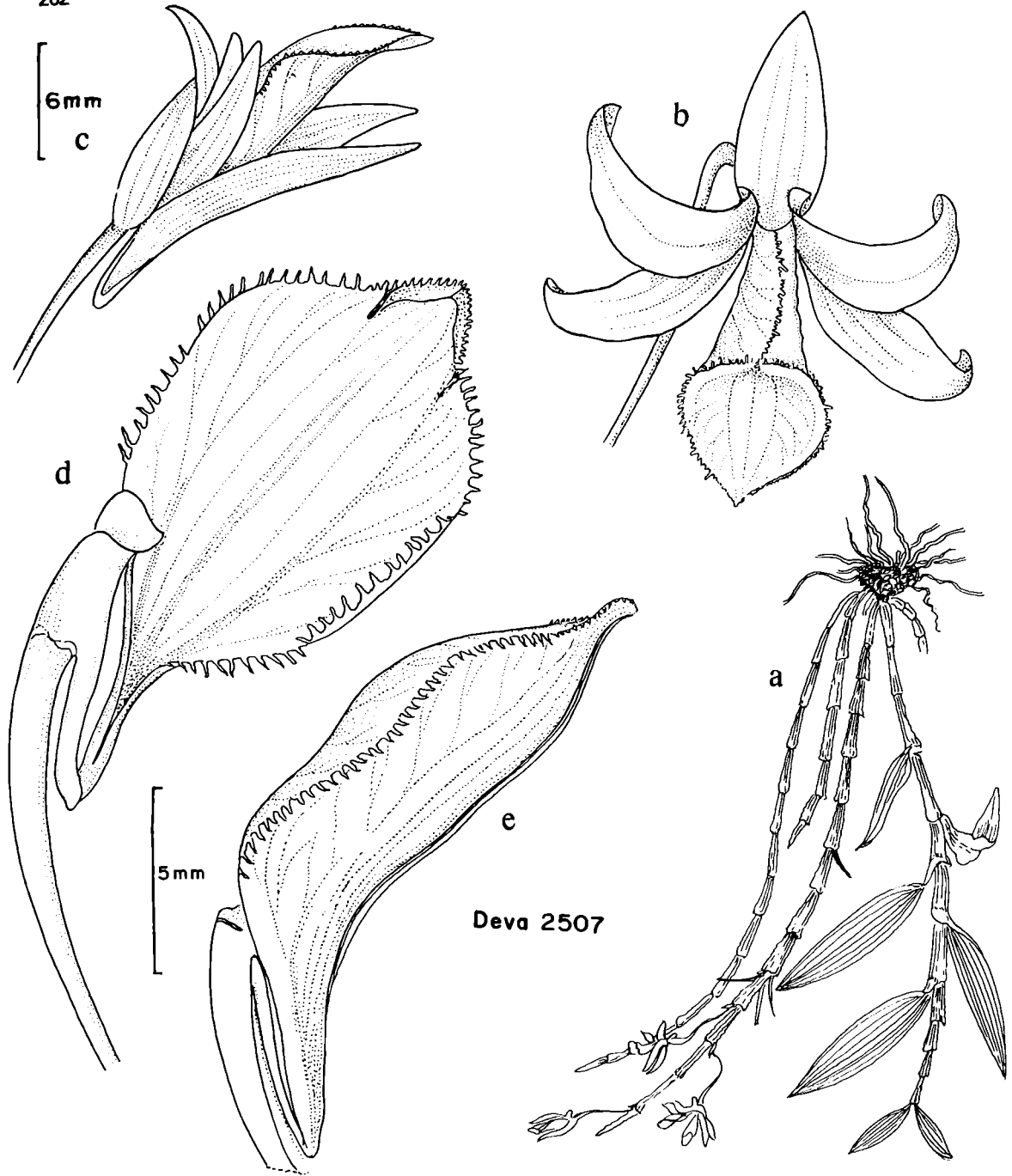


Fig. 146 *Dendrobium macrostachyum* Lindl.—a. plant; b. & c. flower; d. & e. column & lip.

*Flowering:* September.

*Distribution:* Himalaya 1400-2000 m (Garhwal to Arunachal Pradesh).

*Specimens examined:*

GARHWAL: **Tehri-Agrakhal**, *Naithani* 1084. **Pauni-Rocks** by Ram Ganga, *Duthie* 4416(a).

KUMAUN: **Pithoragarh**-Gori Valley, *D.D. Awasthi* 1746; Near Askot, *Inayat* 24094; Askot, *Duthie* 3403; Dhauli Valley, *Duthie* 5992; Chipla, *Ramsukh* 8019; Takhil hill, *Inayat* 24094(a); Gorpata near Sandev, *Pant* 31867, *M.A. Rau* 35330; Sandev, *Arora* 36415; Didihat, *Arora* 36990; Way to Lilam, *Pant & Naithani* 29570.

**Dendrobium heterocarpum** Wall. ex Lindl. Gen. & Sp. Orch. 78. 1830; Hook. f., 5: 737. 1890; King & Pantl. 53, t. 74. 1898; Bhattacharyya, 162. 1969; Jayaweera, 84. fig. 38. 1981; Abraham & Vatsala, 361. fig. 87. 1981; Seidenf. & Arora, 13. 1982; Seidenf., 83: 50. 1985.

*D. aureum* Lindl. Gen & Sp. Orch. 77. 1830.

(Fig. 145)

*Pseudobulbs* 10-30 × 1-2 cm, clavate, tufted, slender, covered with ribbed sheaths, leafless when flowering, internodes 1-2.7 cm long. *Leaves* 6-9 × 1-3 cm, oblong-lanceolate, unequally notched at the apex or emarginate. *Flowers* born on a very short peduncle, 4.5-7 cm across, 2 or 3 together arising from the several nodes of the pseudobulb. *Sepals* cream colour, 2-5 × 0.7 cm, linear-oblong, rounded, 5-7 nerved. *Petals* cream coloured, broader, 5-nerved. *Lip* trowel shaped, yellow with radiating red or purple lines, longer than broad, ovate, spur conical, 3-lobed; lateral lobes rounded, embracing the column, midlobe recurved, pubescent and ridged. *Disc* papillose-pubescent.

*Flowering:* May.

*Distribution:* Himalaya upto 1600 m (Kumaun to Arunachal Pradesh), Assam, Nagaland, Meghalaya, Mizoram, Tamil Nadu. Burma, Thailand, China, Java, Phillipine, Malaya, Sumatra, Laos, Vietnam, Celebes and Sri Lanka.

*Specimens examined:*

KUMAUN: **Pithoragarh**-Askot, *Bhattacharyya* 21382.

**Dendrobium macrostachyum** Lindl. Gen. & Sp. Orch. 78. 1830 et in Edgew. Bot. Reg. t. 1864, Misc 60. 1844; Hook. f. 5: 135. 1890; Sant. & Kapadia 96, t. 23. 1966.

*D. gamblei* King & Pantl. in J. As. Soc. Beng. 66(3): 584. 1897; *Duthie*, 99. t. 99. 1906 et 3: 188. 1920.

(Fig. 146)

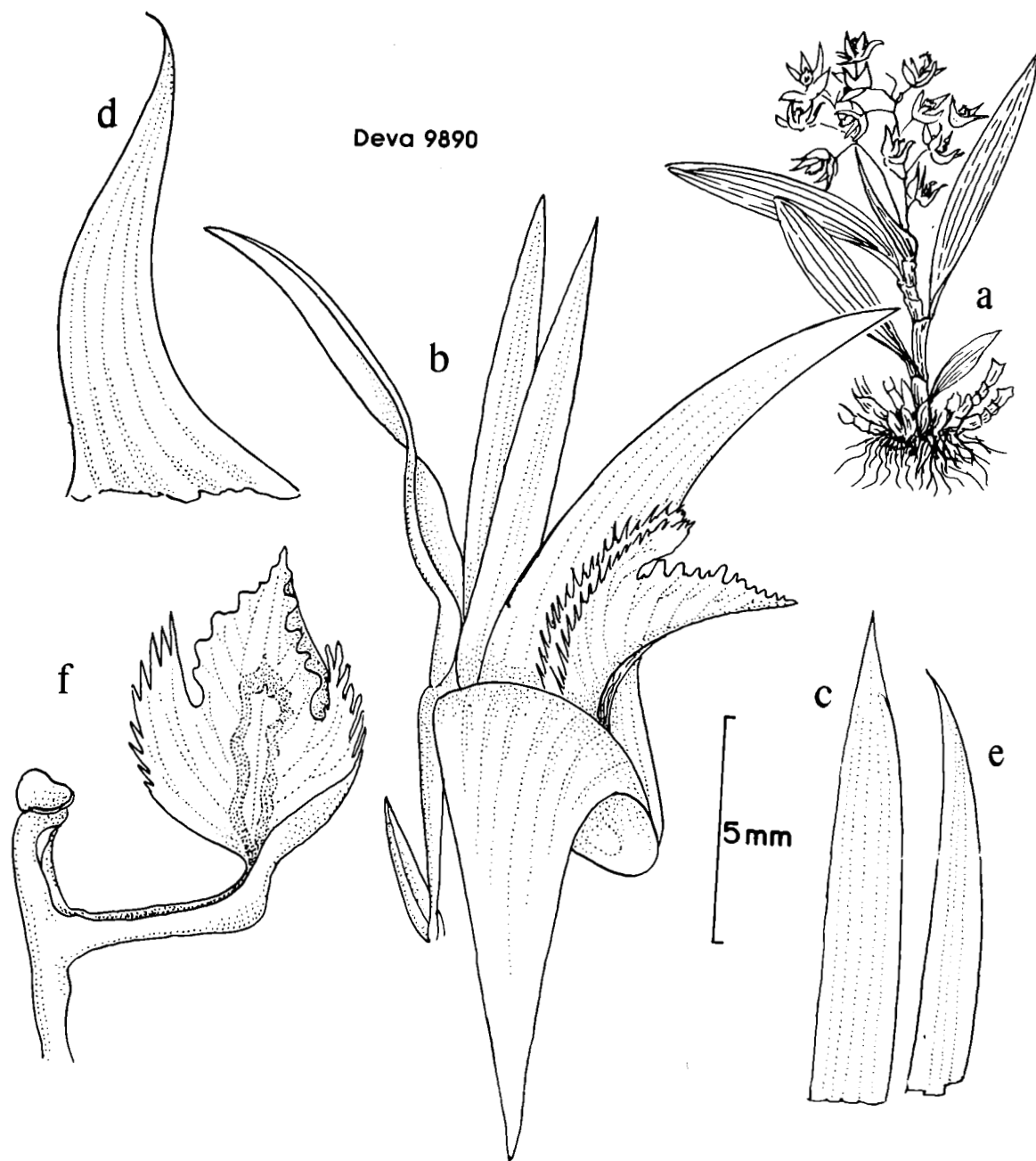
*Pseudobulbs* 30-60 cm long, slender, pendulous. *Leaves* sessile, 3-8 × 1-2.5 cm, sub-falcately ovate-lanceolate, sub-acuminate, thick, caducous. *Inflorescence* solitary or in cymes, peduncle solitary or in pair from the nodes of the leafless stem. *Flowers* 2 cm across, inodorous. *Sepals* and *petals* about equal, lanceolate, acuminate with reflexed tips, pale greenish-yellow, 5-nerved. *Lip* 2 cm long, convolute throughout its entire length, giving an unopen look to the flower, the edges fimbriate-serrate except towards the base and at the wavy apex, yellowish in colour with reddish-purple veins.

*Flowering:* June - August.

*Distribution:* Himalaya upto 800 m (Garhwal), Bihar, Orissa, Madhya Pradesh, Konkan, W. Ghats, Kerala, N. Kanara. Shri Lanka.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 22983 & 24156; Golatappar Swamp, *Arora* 38843 & 38876, *Deva* 2507.



**Fig. 147** *Dendrobium monticola* Hunt & Summerh. —a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column & lip.



We are convinced by arguments given by Sant. & Kapadia (1966) that *D. gamblei* is not distinct from *D. macrostachyum*. The distributional gap which appears so wide is not unusual as there many other examples in the flora of Dehra Dun which show such a type of distribution.

**Dendrobium monticola** Hunt. & Summerh. in Taxon 10: 110, 1961; Hunt in Kew Bull. 24: 90. 1970; Hara et al. 40. 1978; Raizada et al. 15. 1981; Seidenf. & Arora, 13. 1982; Seidenf., 83: 136. 1985.

*D. alpestre* Royle, Ill. Bot. Himal. 1: 370, t. 88. 1839 non Sw. (1799); Hook. f., 5: 715. 1890; Duthie, 96. t. 97. 1906.

*D. porphyrochilum* sensu Seidenf. & Arora in Nord. J. Bot. 2: 14. 1982. (non Lindl.). (Fig. 147).

*Pseudobulbs* 3-5 × 0.6-0.8 cm at base, tapering upwards. *Leaves* 3-5 × 0.5-1 cm, linear-lanceolate, acuminate, notched at the apex, thinly coriaceous. *Inflorescence* terminal, leaf-opposed, 3-7-flowered, slender, erect. *Flowers* 15-16 mm across, green or reddish-white. *Bracts* subulate, subpersistent, upto 8 mm long. *Sepals* the dorsal 9-10 mm, lanceolate, acuminate, erect, 3-nerved, the laterals little longer than broad, falcately lanceolate, acuminate, spreading, 5-nerved. *Petals* 7-8 mm long, acuminate linear-lanceolate. *Lip* decurved, concave, 3-lobed, lateral lobes erect, acuminate, deeply inciso-serrate, midlobe triangular, acute, yellowish-green with dark purple veins, margins undulate. *Disc* 3 lamellate.

*Flowering*: August - September.

*Distribution*: Himalaya upto 2000 m (Garhwal to Nepal). Thailand. ?

*Specimens examined*:

GARHWAL: Dehra Dun-Near Mussoorie, Mackinnon 23003; Chakrata, Jaunsar, Gammie. Tehri-Tehri, Mackinnon 24154; Ringalgarh, Sahni 21468; Hindol khal, Deva 9890. Uttarkashi-Between Betwari & Dangulla, Duthie 2063. Pauri-Chobatakhal on way to Khirsu, A.S. Rao 56343; Lansdown, P.C. Kanjilal; near Pauri, Deva 9941; Khirsu, Naithani 1054. Chamoli-Joshimath, Naithani 1303.

KUMAUN: Pithoragarh-Nakori, Arora 36877; Dafiadhura, Arora 49562, 50048 & 53228; Sobala, Darma Valley, Inayat 24093; Munshyari, Inayat 24093(a). Almora-Deorahat to Dunagiri, Wadhwa 57492; Loharkhet, T.A. Rao 4263; Almora, Kotmanya 10509.

**Dendrobium moschatum** (Buch.-Ham.) Sw., Schrad. in N. Journ. 1: 94. 1806; King & Pantl. 60, t. 84. 1898; Duthie, 103. 1906; Seidenf., 83: 43. 1985.

*Epidendrum moschatum* Buch.-Ham. in Symes, Acc. Emb. Kingd. Ava: 478 t. 1800.

*D. calceolaria* Carey ex Hook. Exot. Fl. 3: t. 184. 1826; Hook. f., 5: 744. 1890. (Fig. 148)

*Pseudobulbs* stout, erect, tufted, 90-180 × 1-2 cm, tapering moderatley from the middle on both sides. *Leaves* several, alternate, 10-15 × 3-5 cm, ovate to lanceolate-ovate, acute or faintly notched. *Inflorescence* from near the apex of leafy or leafless pseudobulb, 10-30 cm long, 8-16-flowered. *Flowers* 5-10 cm across, fragrant, pale to pinkish-yellow. *Sepals* 3 cm long, broadly ovate, obtuse. *Petals* larger than sepals, broadly ovate, obtuse. *Lip* shorter than petals, forming a globular or pear-shaped pouch with the upturned margins (calceolar); anterior part very hairy, base with two dark maroon blotches.

*Flowering*: June - July.

*Distribution*: Himalaya 1000-1200 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura. Bangladesh, Burma, Thailand, Laos and Vietnam.

KUMAUN: Strachey & Winterbottom 9 (Duthie, l.c.).

Commonly cultivated in gardens at Dehra Dun.

**Dendrobium normale** Falc. in Proc. Linn. Soc. 1: 14, 1839. emend. Deva & Naithani; Hook. f., 5: 748. 1890; Duthie, 101. t. 100. 1906.

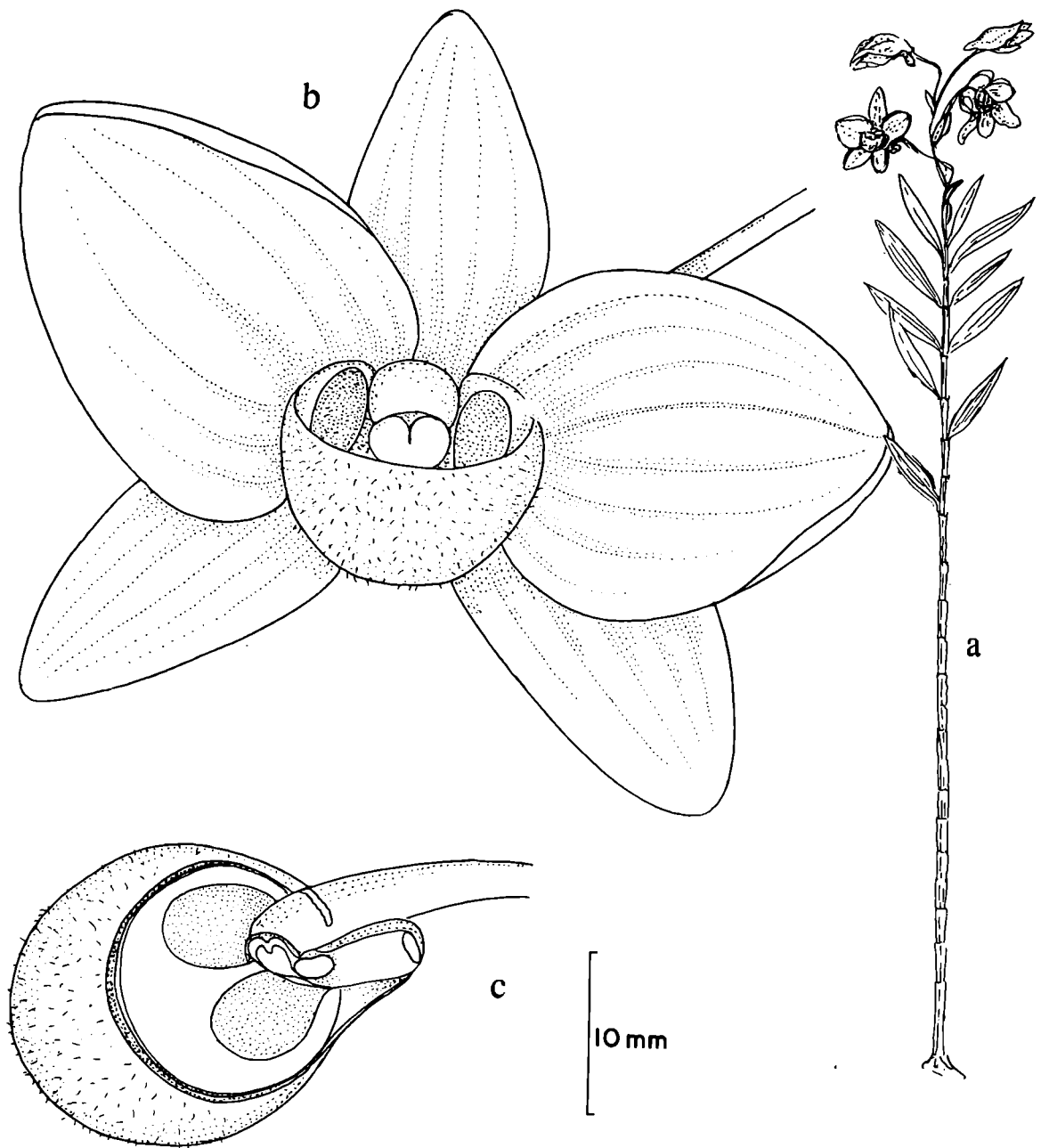


Fig. 148 *Dendrobium moschatum* Sw. — a. plant; b. flower; c. column & lip.

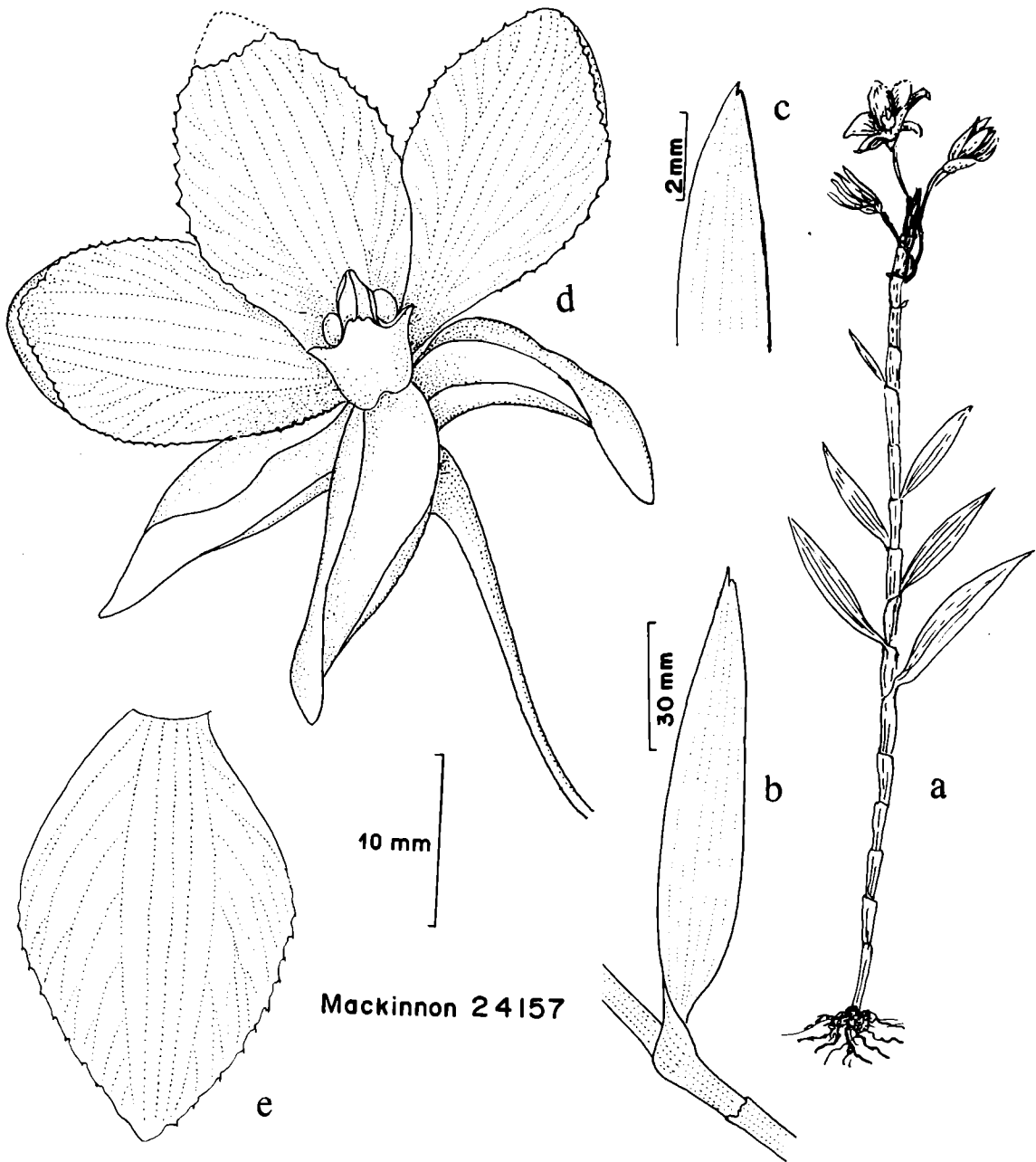


Fig. 149 *Dendrobium normale* Falc. —a. plant; b. leaf; c. leaf tip; d. flower; e. lip.

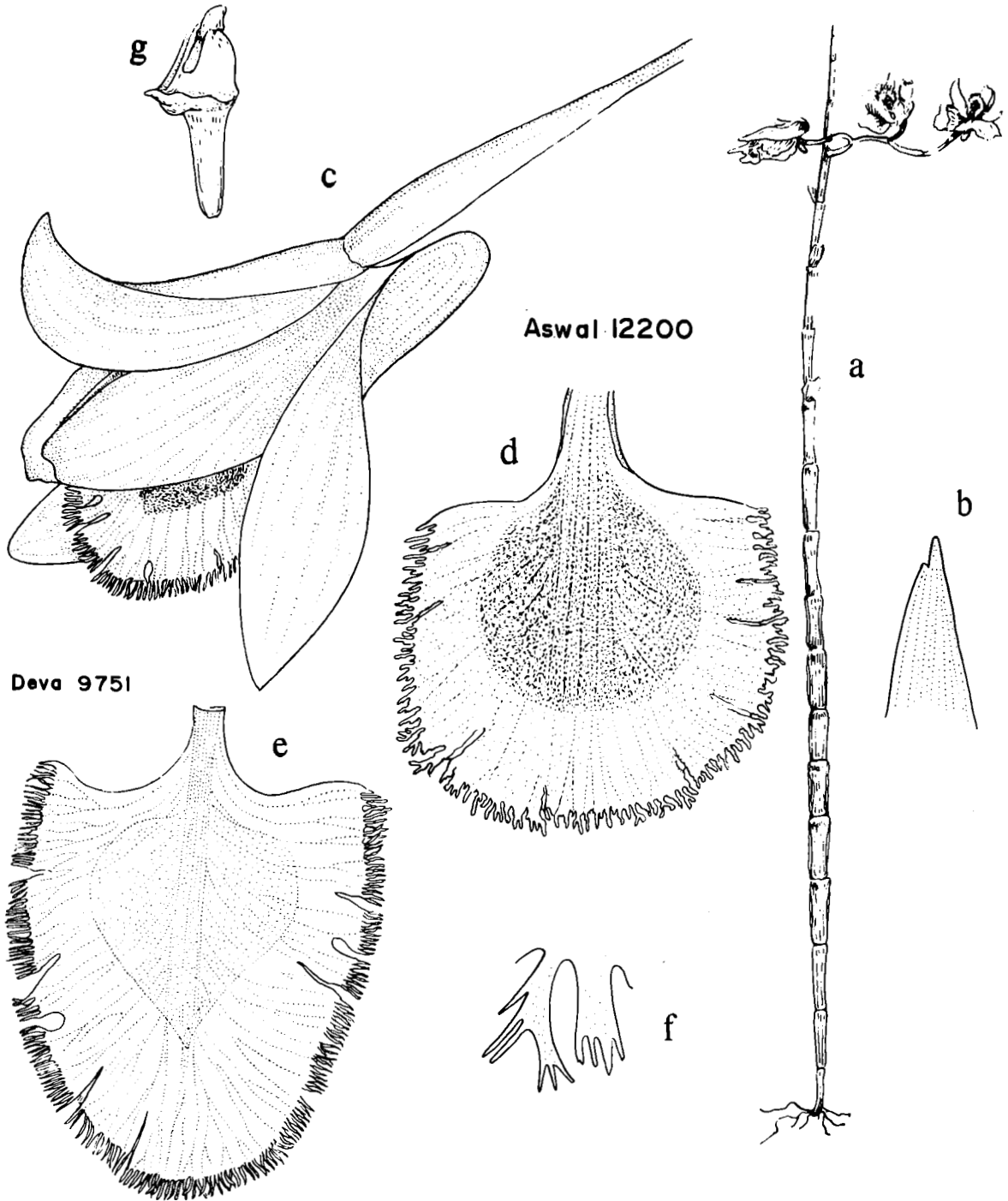


Fig. 150 *Dendrobium normale* Falc.—a. plant; b. leaf tip; c. flower; d. & e. lip; f. margin of lip enlarged; g. column.

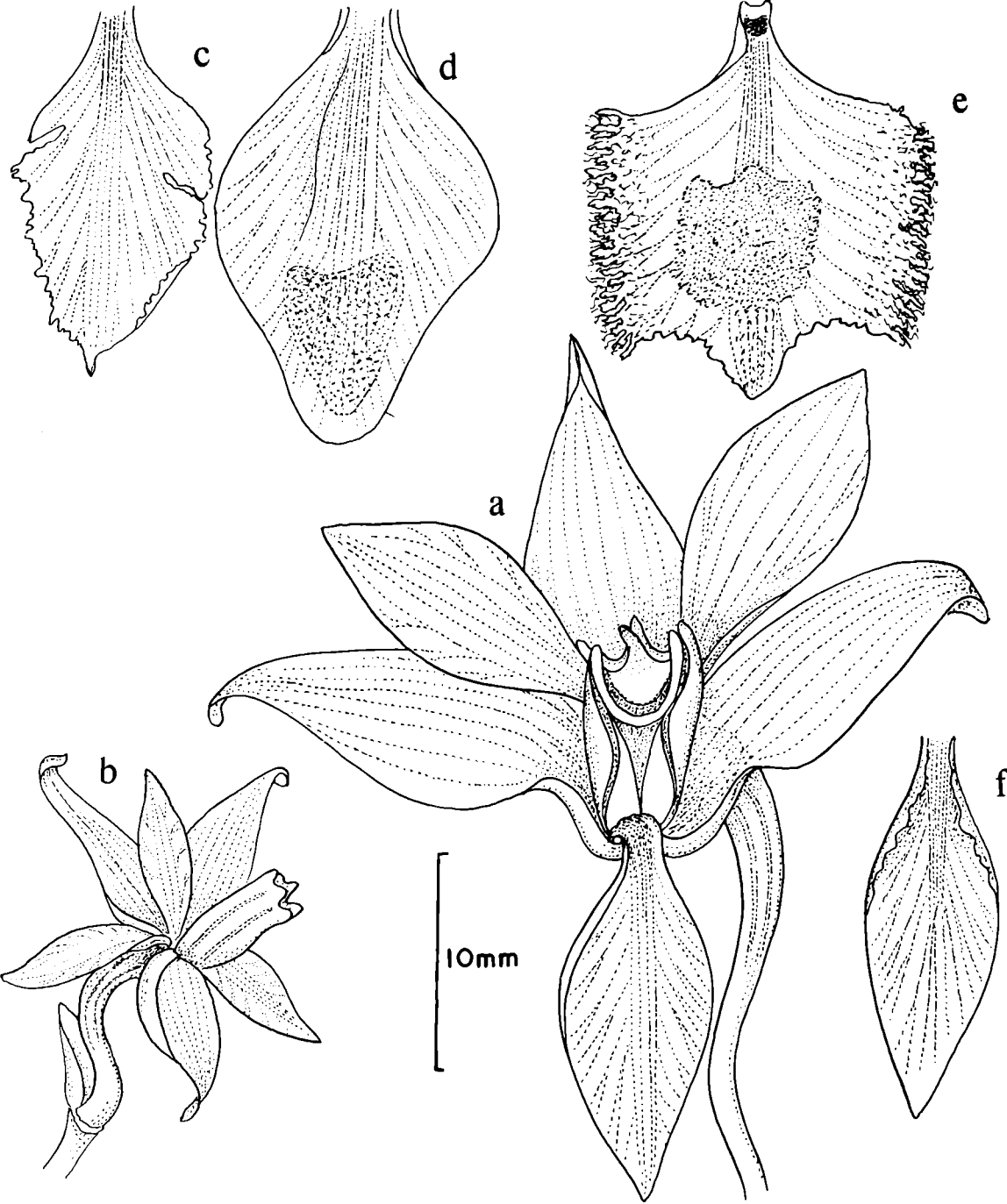


Fig. 151 *Dendrobium normale* Falc. —a. & b. flower; c., d., e. & f. lip.

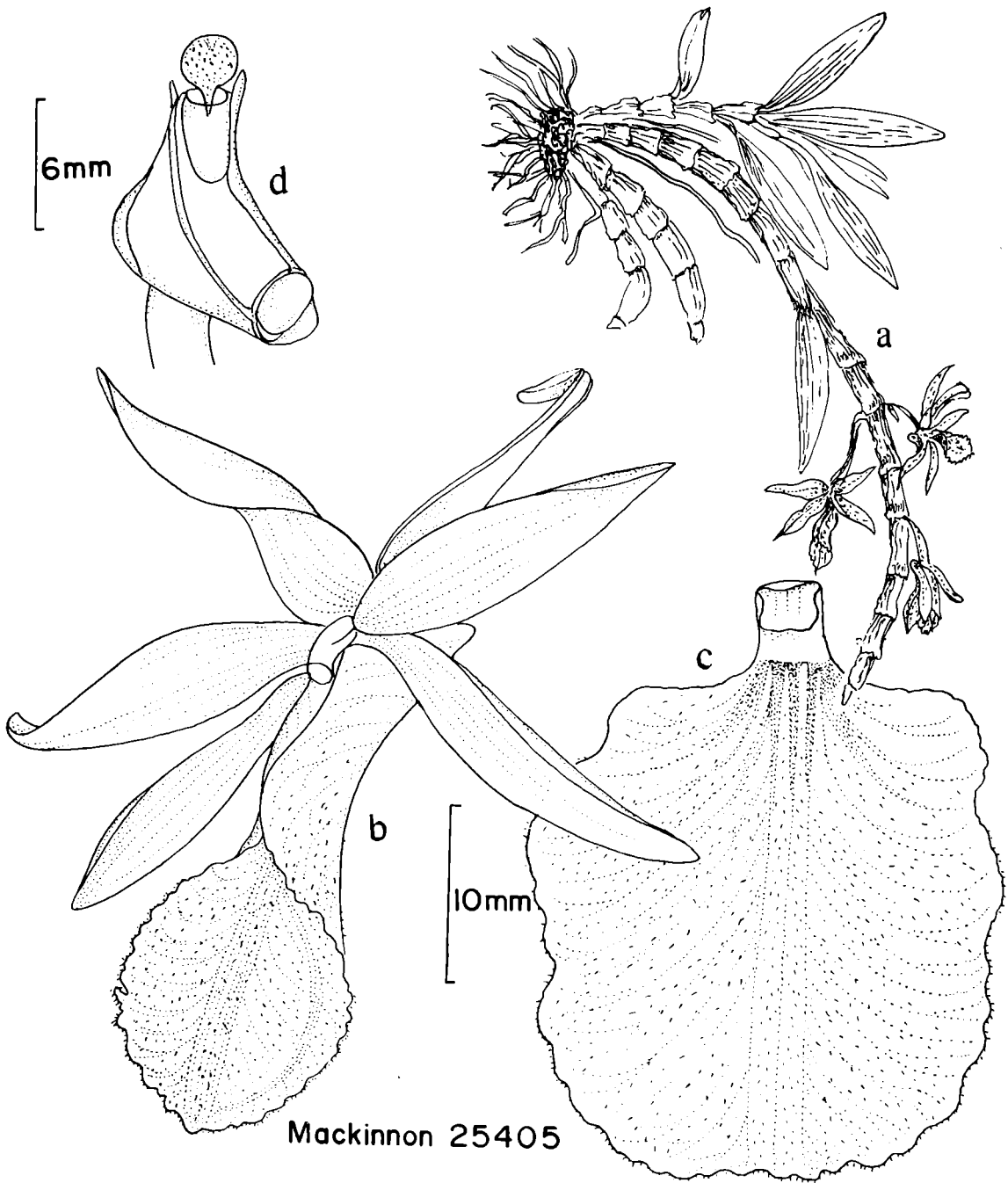


Fig. 152 *Dendrobium primulinum* Lindl.—a. plant; b. flower; c. lip; d. column.

*D. fimbriatum* Duthie, in Ann. Roy. Bot. Gard. Calc. 9(2): 102, 1906 (excl. descr.) (non *D. fimbriatum* Hook. f. Exot. Fl. t. 71. 1832).

*D. fimbriatum* sensu Duthie var. *oculata* sensu Duthie in Ann. Roy. Bot. Gard. Calc. 9(2): 102. 1906 (excl. descr. (non *D. fimbriatum* var. *oculata* Hook. 71: t 4164, 1845) (Figs. 149, 150, 151)

*Pseudobulb* 20-40 cm long, erect, terete; internodes 2.5 to 3.5 cm long. *Leaves* several, linear-lanceolate, 7.5-12.5 cm long, thin, apex acuminate, obliquely bifid, sheath tubular, leafless or with few leaves at the time of flowering. *Flowers* (-1 or 2) 3-4, born in single rarely two lateral raceme, 2.5-3.5 cm long near the tip of the stem. *Flowers* 4.5-6.5 cm in diameter, yellow or golden-yellow. *Bracts* minute. *Sepals* broadly oblong, margin entire. *Petals* broader than the sepals, margin entire to slightly erose, rarely serrulate. *Lip* orbicular with an undulate fringed margin, the base shortly clawed, the dorsal surface usually with or some times without a dark brown patch in the centre. Rarely abnormal flowers are produced, where the lip is metamorphosed to various shapes ranging from shapes exactly like petals with entire to serrulate margin to almost near normal shape of lip with entire to partly or completely fringed margin. *Column* in normal flowers short with a small foot, in abnormal flowers of different shapes, divided at the apex into 3 or 6 division, with or without a foot, but always sterile.

*Flowering*: May - June

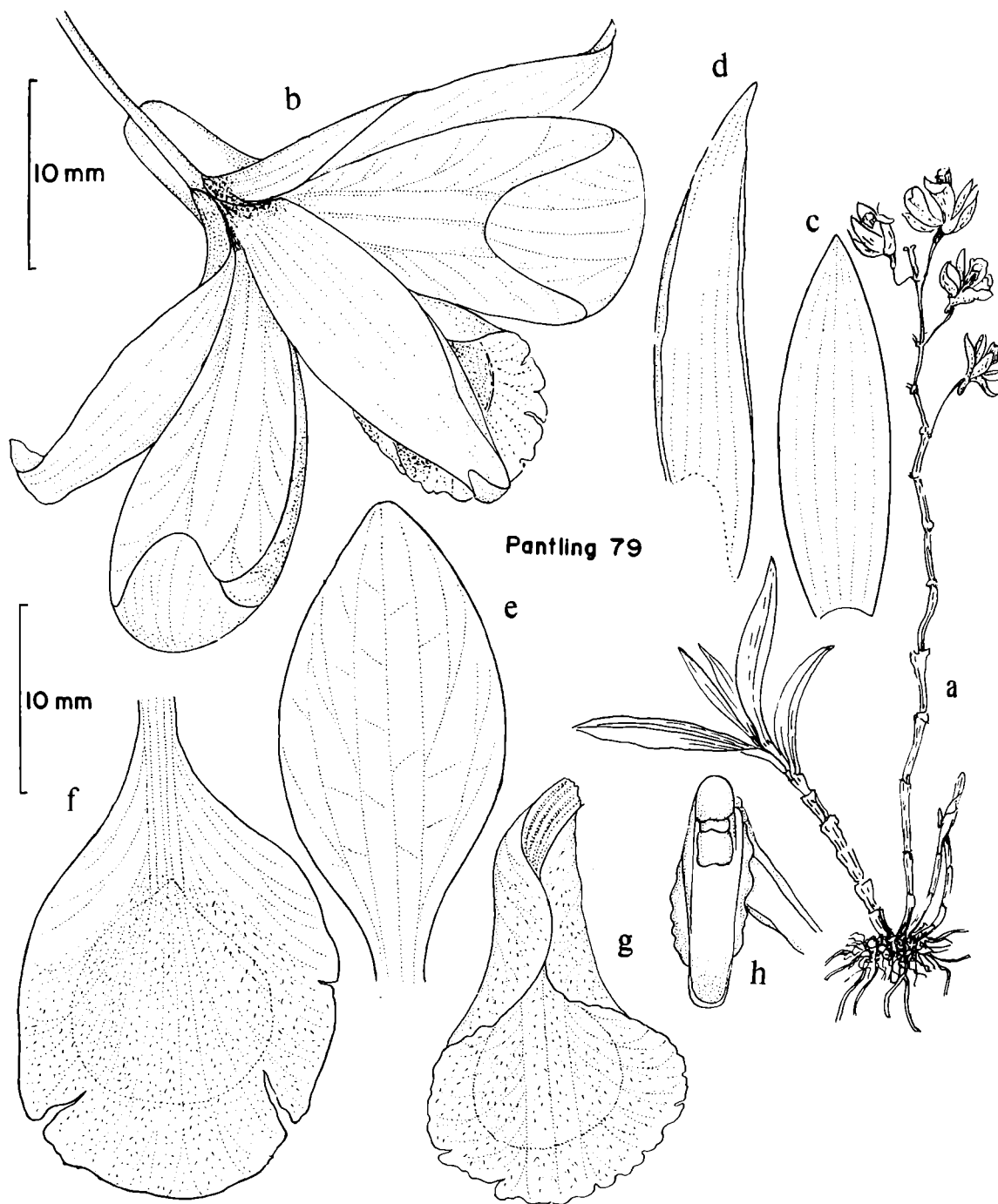
*Distribution*: Endemic to Garhwal and Kumaun Himalaya between 900-1800 m. Common.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, below Mussoorie, *Mackinnon's collector* 22707 & 24157; Chamasuri, *Falconer*. **Pauri**-near Pauri *T. Thomson*; Khirsu, *Aswal* 55316.

KUMAUN: **Pithoragarh**-Sandev, *Arora* 41389, 37870 & 38852; *Deva* 4751, 9751, *Maitl*., *Arora* 52443. **Nainital**-Sat-tal, *Pangtey*.

*Dendrobium normale* Falc. is a confusing species because its description is based on the abnormal flowers produced occasionally in *Dendrobium* sp. (*D. fimbriatum* sensu Duthie). In a big population there are sometimes few plants which produce flowers different from the normal. The lip exhibits various shapes and sizes, ranging from near normal to almost to that of the shape similar to petals. Sometimes in such flowers two columns may fuse to form a single double column. Occasionally very small flowers are produced where the size of the sepals is only 5 mm as compared to the size of the normal sepals which are about 20 mm long. Falconer (1839) studied such an abnormal flower of *Dendrobium* sp. (*D. fimbriatum* sensu Duthie) where the lip had metamorphosed to the shape which was similar to those of the petals and the two columns had fused to form a single double column, and named it *Dendrobium normale*, usually these abnormal flowers are never similar and show several types of variations in different combinations. Another abnormal flower studied showed a normal column about which he said "Column sliced off in front as is usual in *Dendrobium*". The lip was also not similar to the petals but had a spur. This he thought to be a variety of *D. normale*. It will be interesting to examine all the flowers collected by various botanist at different time and to compare their structure. Unfortunately all such records are very old and in a bad state of preservation. At DD Falconer's sheets are without any flowers. The other two sheets both by Mackinnon have only one flower each. The column in one is double. While in other it is normal. We have collected such abnormal flowers from a single population and found various shapes of lips and columns (Fig. 151); Duthie (1906) studied several specimens of this species of *Dendrobium* and confused it with *D. fimbriatum* Hook. and *D. fimbriatum* var. *oculata* Hook. He failed to notice that these are those plants the abnormal flowers of which have been described as *D. normale* by Falconer. This was true also about all previous botanists including Hook. f. (1890) but there always existed a doubt about the true nature of *D. normale* and it was considered as " . . . . . a state of some better known plant" or " . . . . . a peloriate state of variety of some allied species".



**Fig. 153** *Dendrobium transparens* Lindl. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. & g. lip; h. column.



At present there seems to be no record of the true *Dendrobium fimbriatum* Hook. from the region of this flora. All those specimens quoted by Seidenf. 36. 1985. as an example of this species belong to *D. normale* except "Dehra Dun (Gamble 26919 k)" which is a true *D. fimbriatum* cultivated in Forest School garden without any knowledge of the place of origin.

It appears that a similar situation occurs in *D. crepidatum* Lindl., where certain accidental variation produce a flower, which has a short column without foot and the lip is similar to the petals. Lindley described these plants as a distinct species *D. lawianum* however most authors recognised that this is an abnormality and included it under *D. crepidatum* (Hook. f. 740. 1890). Santapau & Kapadia (102, 1966) consider it a distinct species. Pradhan (801, 1979) not only considers it distinct but has created a new section, *Actinomorpha* to accommodate it. If so then the forms of *D. normale* with abnormal flowers should also be kept here.

**Dendrobium primulinum** Lindl. in Gard. Chron. 1858: 223. 1858; Hook. f., 5: 735. 1890; Duthie, 97. t. 98. 1906; Seidenf., 83: 69. 1985. (Fig. 152)

*Pseudobulbs* 25-45 × 1-1.5 cm, pendulous. *Leaves* deciduous, 10-12 × 2.5-3 cm, lanceolate, upper one smaller, broadly oblong, coriaceous, apex obliquely shortly lobed. *Flower* solitary or rarely two from the nodes of the leafless pseudobulb, shortly pedicelled, 5-6.5 cm across, white to pale-rose. *Bracts* minute. *Sepals* narrowly lanceolate, acuminate, spreading or reflexed, pale rose-purple. *Petals* rather narrower, linear-lanceolate, acute, erect or spreading, pale rose-purple. *Lip* suborbicular, strongly ciliate all along the margins, with short convolute base and a wide spreading blade of pale primrose-yellow run with purple streaks.

*Flowering*: April.

*Distribution*: Himalaya 500-1500 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Burma, Laos, Vietnam, China and Thailand.

*Specimens examined*:

GARHWAL: Dehra Dun-Nalapani, Mackinnon 25405; Bhagwanpur village, Y.K. Sarin 5447. Pauri-Outer Garhwal Hills, Inayat 25841.

KUMAUN: Pithoragarh-Askot, Bhattacharyya 21140, 21141 & 21348; Thal, M.A. Rau 35330; Gorpat-ta, P.C. Pant, 31869; Didihat, Arora 38856.

**Dendrobium transparens** Wall. ex Lindl. Gen. & Sp. Orch. 79. 1830; Hook. f., 5: 738. 1890; King & Pantl. 50. t. 70. 1898; Duthie, 98: 1906. (Fig. 153)

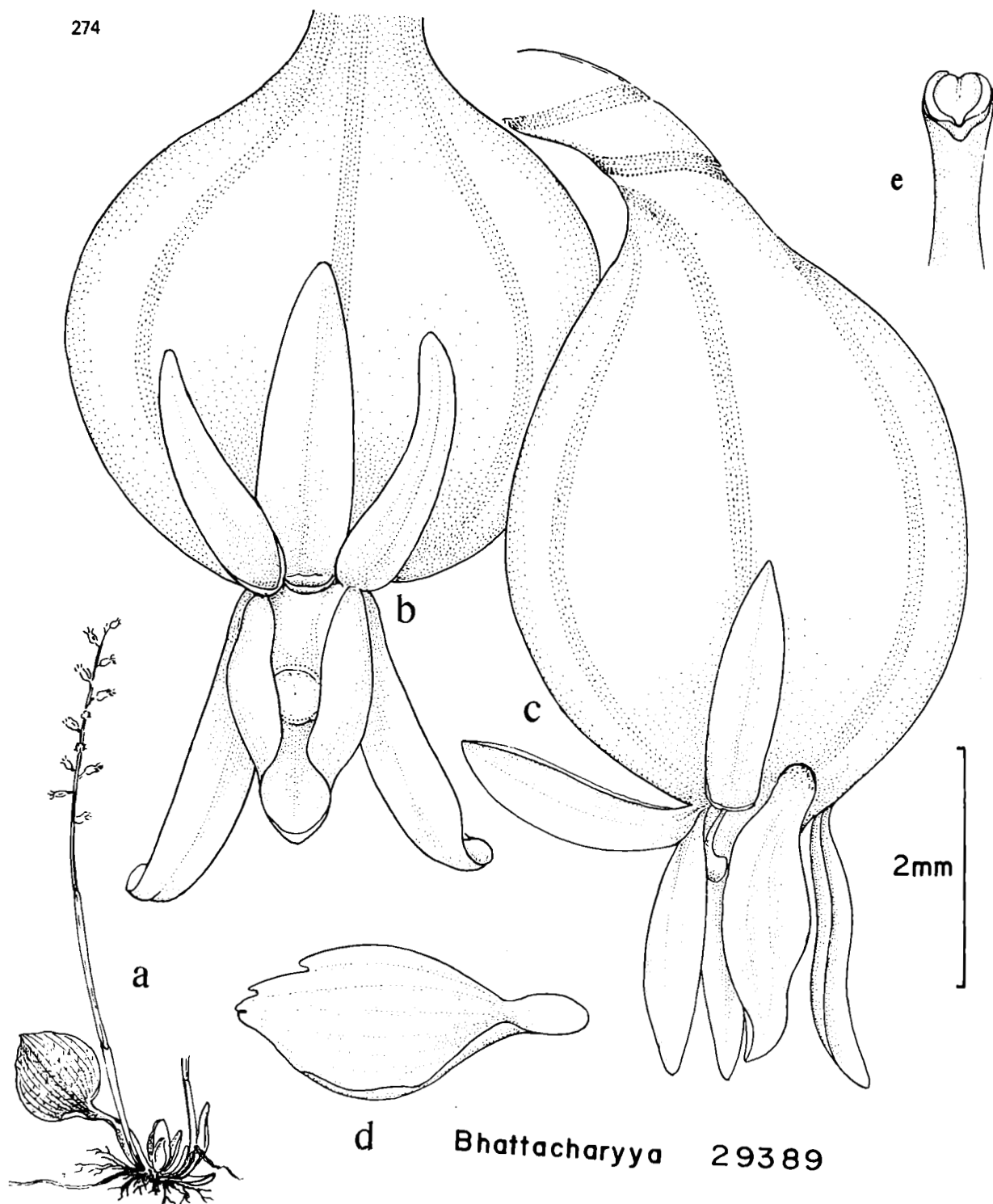
*Pseudobulbs* slender, 30-60 cm long, slightly thickened at nodes, ash coloured, subpendulous. *Leaves* linear-lanceolate, 7.5-10 × 0.8-1 cm, apex oblique and acute. *Peduncle* arise from the older leafless pseudobulbs. *Flowers* two to three, about 3.5-4 cm across, fragrant, white, tinged purplish-rose towards tip. *Bracts* broadly lanceolate. *Sepals* lanceolate, acute, tinged with purple at tips. *Petals* similar, elliptic-oblong, acute, tinged with purple at tips. *Lip* clawed, oblong, margin tattered, obscurely 3-lobed; lateral lobes emarginate and rolled over the column; midlobe orbicular, obovate, rounded, white with large pink blotch with purple down and centre.

*Flowering*: May.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh), Orissa, Assam, Nagaland, Meghalaya, Manipur, Tripura, Mizoram.

KUMAUN: Nainital-Near Nainital (Duthie, l.c.)

Fig. 153 drawn from Pantling collection no. 79 from Eastern Himalaya.



Bhattacharyya 29389

Fig. 154 *Didiciea cunninghamii* King & Prain ex King & Pantling — a. plant; b. & c. flower; d. lip with spur.

### Didiciea King & Prain

Terrestrial herb with small corm. *Leaf* solitary, petioled, with ovate blade. *Peduncle* with few small stem-clasping sheaths. *Raceme* laxly many-flowered. *Flowers* small greenish. *Sepals* and *petals* sub-equal. *Lip* adnate to base of column, as long as the sepals, somewhat fleshy, entire, concave, the base with a short spur-like concavity. *Anther* 2 celled, terminal; *pollinia* 4, waxy, without caudicles and viscid gland.

**Didiciea cunninghamii** King & Prain in J. As. Soc. Beng. 65: 119. 1896; King & Pantl. 37, t. 50. 1898; Rau & Bhattacharyya, 8: 94, fig. 1-7, 1966. (Fig. 154)

*Pseudobulb* small, 10 mm long, bearing a solitary leaf. *Leaf* broadly ovate, 4 × 2.5 cm, 3-nerved, sub-acute, slightly narrowed at the base to the narrow channelled 15 mm long petiole. *Inflorescence* erect, 12-22.5 mm long, ending in a raceme, 25-40 mm long. *Flowers* lax, 2.5 mm long. *Bract* minute, triangular, shorter than ovary. *Sepals* free, sub-equal, spreading, narrow. *Petals* like the sepals. *Lip* concave, equal to the length of sepals, ovate-oblong, blunt.

*Flowering*: July.

*Distribution*: Himalaya 2000-25000 m (Garhwal and Sikkim).

*Specimens examined*:

GARHWAL: Chamoli-Gangharea Forest Rest House, Bhattacharyya 29389, M.A. Rau 31777.

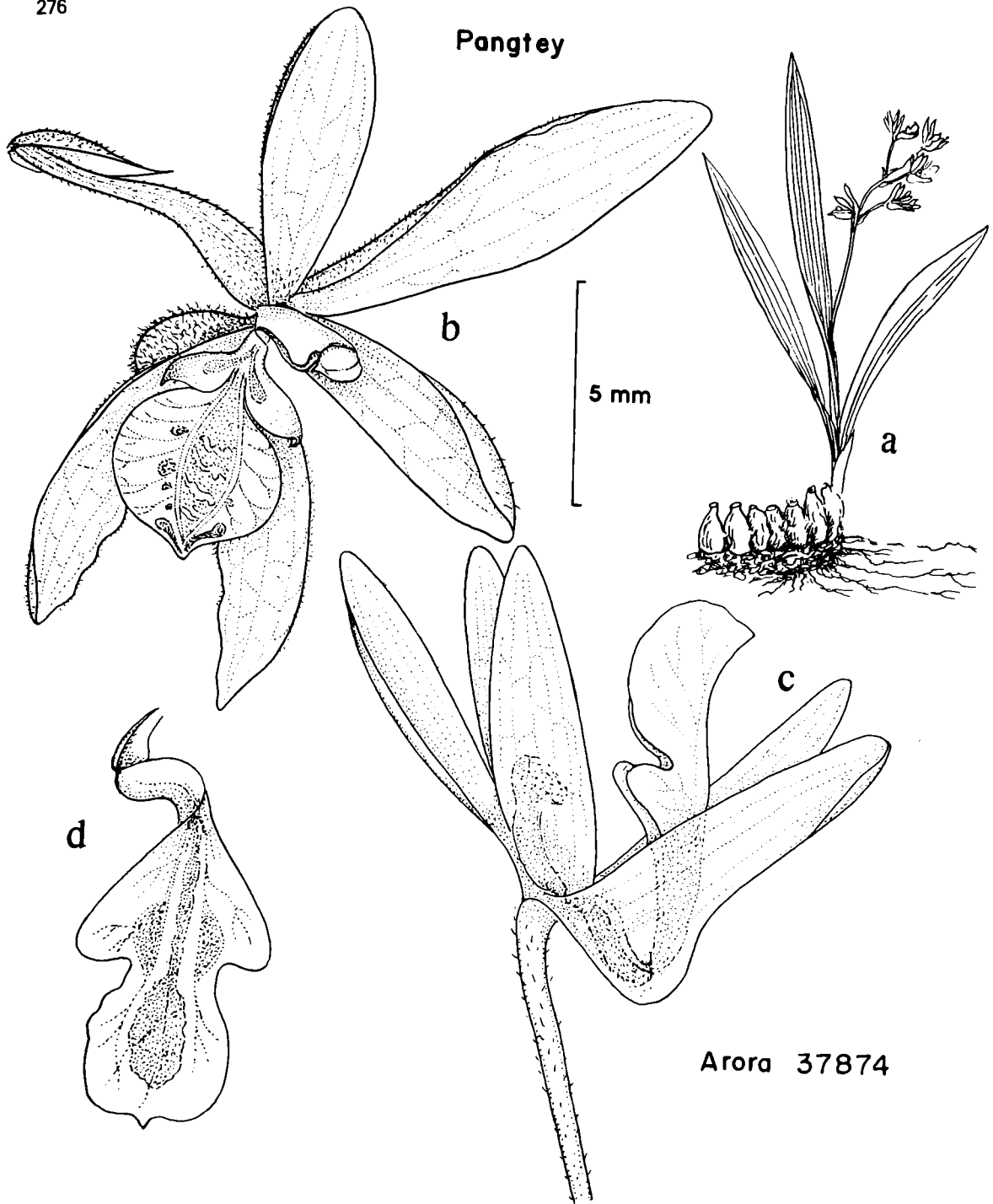
### Eria Lindl.

Epiphytes with erect branching stems or with pseudobulbs which are tufted or crowded on creeping root stock. *Leaves* membranous or coriaceous, sessile or petiolate. *Inflorescence* lateral or apparently terminal with one to many flowers, hairy or without hairs. *Sepals* sub-equal, the laterals adnate to the foot of the column forming a saccate mentum. *Petals* linear or oblong. *Lip* sessile on the foot of the column, entire or 3-lobed. *Column* long or short. *Anther* imperfectly 4 or 8 chambered; *pollinia* 8, with caudicles in two groups all together attached to a viscus by their narrow bases.

### Key to species

1. Plants small; pseudobulbs less than 1 cm high, close together with one to few flowers.....2
- + Plants large; pseudobulbs 3 cm to usually much more in height ..... 3
2. Flower solitary, 2-3 cm in diameter born terminally on a scape; floral bracts white, orbicular-cordate, mucronate; lip 3-lobed, disc with 2-yellow ridges.....*E. reticosa*
- + Flowers 2-6 in a raceme, 6 mm in diameter, floral bracts green, lanceolate, acuminate; lip entire, lanceolate, without side lobes, with two calli at the base.....*E. muscicola*
3. Plants developing stem like pseudobulbs with a single node, slender, cylindrical of the same thickness throughout ..... 4
- + Plants developing distinct pseudobulbs with several internodes, ovoid, conical, ellipsoidal or clavate in shape, compressed or terete ..... 5
4. Leaves two, sheaths only at the base of the flowering stems, raceme single; flowers 4-6, 3-3.5 cm across, midlobe of the lip orbicular with 5-7 crenate ridges.....*E. coronaria*
- + Leaves 3-6, sheaths all along the stem; racemes many flowered; flowers 15-20 in each raceme, 1.25 cm across, mid lobe of the lip orbicular with 1-3 ridges.....*E. graminifolia*
5. Pseudobulbs on a creeping rhizome, well spaced, ovoid; flowers and rachis on outside with a tomentose felt like covering; racemes from the base of the pseudobulbs; flowers distant, greenish-yellow; lip with mid lobe rounded to oblong, tip acute to apiculate.....*E. pubescens*
- + Pseudobulbs usually close together, flower and rachis glabrous to hairy outside, but not tomentose;

Pangtey



Arora 37874

Fig. 155 *Eria alba* Lindl.—a. plant; b. & c. flower; d. lip.

- racemes arise from pseudobulbs in middle and above the axil of sheaths or upper leaves, or sometimes terminal..... 6
6. Column foot hollowed at its upper side, upwards curved, distally and firmly connected without a geniculate bend or a distinct joint to base of the short clawed lip; flowers sub-globose, small; sepals 5 mm or less in length; mid lobe of the lip small about 1 mm long.....7
- + Column foot narrowly attached in an acute angle to the lip, a joint usually clearly visible; flowers larger; sepals 8 mm or more in length; mid lobe of the lip 2-3 mm, as long as broad.....8
7. Flowers many in dense-flowered racemes, one to several in the axil of upper sheaths of leaves; mid lobe of the lip not bilobulate, tapering to a point or broad truncate..... *E. spicata*
- + Flowers 7-10, in lax-flowered single racemes; midlobe of the lip slightly notched in centre, bilobulate..... *E. occidentalis*
8. Pseudobulbs elongate-clavate, deeply furrowed, 10-15 cm long; racemes 6-10-flowered, from the axil of sheaths below the leaves; floral bracts longer than the long stalked ovary, deflexed; column hollow with 2-horn like processes..... *E. amica*
- + Pseudobulbs ovoid, tapering at both ends, not elongate, about 3 cm long; inflorescence 4-6 flowered, arising in between the leaves; floral bracts erect, equal to little shorter than the short stalked ovary; column hollow without any horn like process..... *E. alba*

**Eria alba** Lindl. Gen. & Sp. Orch. 67. 1830; Hook. f., 5: 795. 1890; Duthie, 110. t. 102. 1906.

*E. excavata* sensu Arora, in Bull. bot. Surv. Ind. 11: 430. fig. 1-4, 1969 (*non* Lindl.) (Fig. 155)

*Pseudobulbs* about 3 cm long, crowded, ovoid, tapering at each end, not elongate, marked with many distinct vertical lines and a few concentric scars. *Leaves* 3-5, overtopping the flowering spikes, 15-20 × 1-2.5 cm, oblanceolate, acute, strongly nerved. *Inflorescence* 4-6 flowered, arising in between the leaves. *Flowers* white, sweet-scented. *Bracts* lanceolate, acuminate, equal or shorter than pubescent ovary. *Sepals* 1-1.2 cm long, ovate-lanceolate, 3-5 nerved, glabrescent. *Petals* a little shorter than the dorsal sepal, linear-oblong, acute, 3-nerved. *Lip* oblong, broadly clawed; side lobes pointed forwards, rounded, tinged with reddish-purple; mid lobe orbicular, apiculate, yellow and red. *Disc* with 2 ridges between the lateral lobes.

*Flowering*: June - July.

*Distribution*: Himalaya 1400-2000 (Himachal Pradesh to Bhutan).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 22982; Near Mussoorie, *Mackinnon* 21747. **Tehri**-Ghuaria & Chamba Road, *Harsukh* 23345; Agrakhal above Narendranagar, *Devā* 9730. **Pauri**-Pauri, *A. S. Rao* 62817. **Chamoli**-Satal, *M.A. Rau* 10161.

KUMAUN: **Pithoragarh**-Maitli, *Arora* 53440; Dafiadhura, *Arora* 52459. **Almora**-Loharkhet, *T.A. Rao* 4229; Juni, *Pangtey*.

*E. excavata* Lindl. is very similar to *E. alba* Lindl., King & Pantling thought it to be only a variety of *E. alba*. The only difference is a short foot of the column, however *Arora*'s specimen number 37874 (cultivated at Dehra Dun) has a long foot of the column and does not differ from the typical *E. alba*.

**Eria amica** Rchb. f., Xen. Orch. 2: 162, t. 168, fig. III, 6-9. 1870; Hook. f., 5: 800. 1890; Seidenf. & Arora, 2: 14. 1982; Seidenf., 62: 115, fig. 71. 1982.

*E. confusa* Hook. f., Ic. Pl. t. 1850. 1889; Hook. f., 5: 797. 1890; King & Pantl. 122, t. 169. 1898.

*E. andersonii* Hook. f., Fl. Brit. Ind. 5: 795. 1890. (Fig. 156)

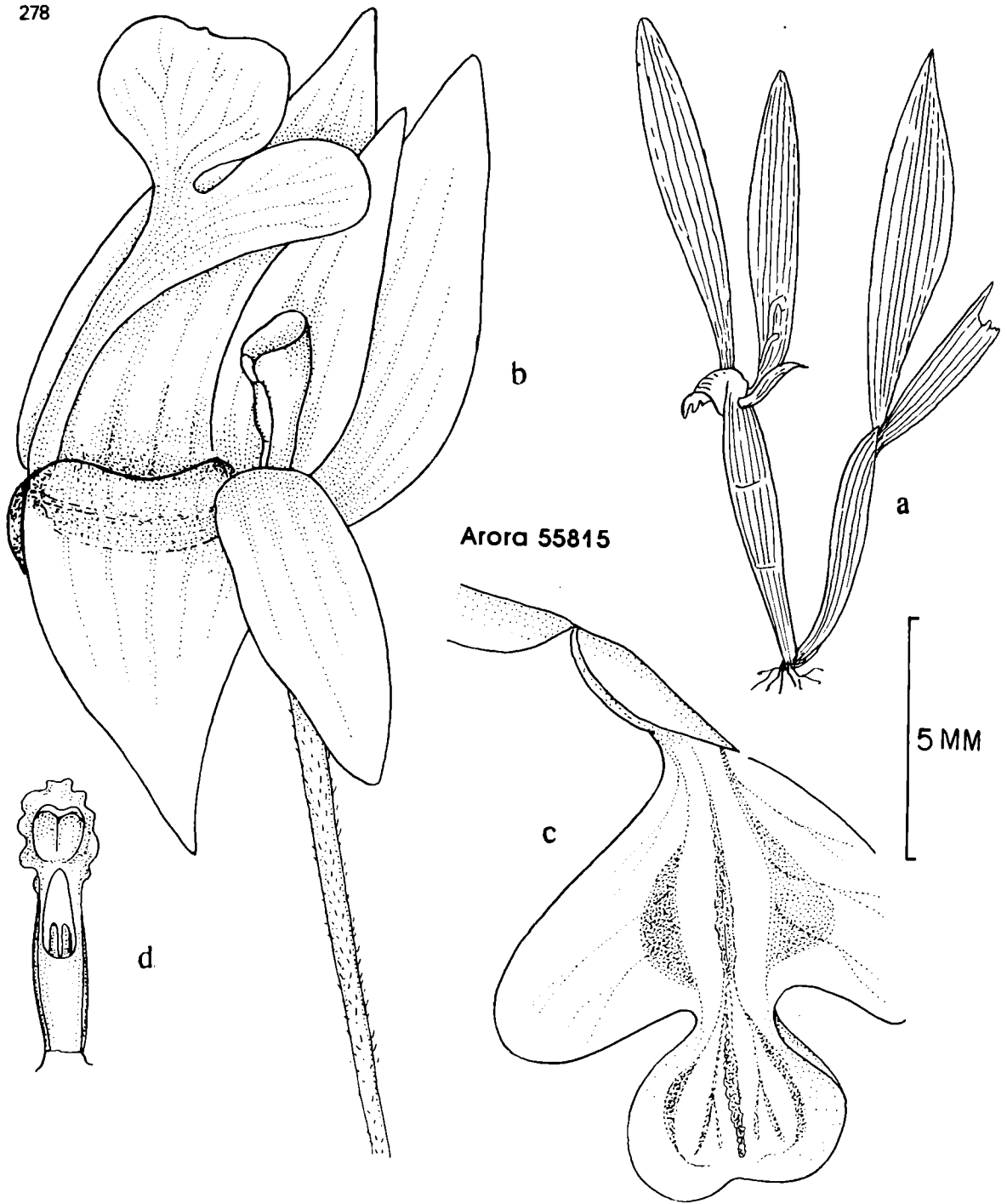


Fig. 156 *Eria amica* Rchb. f.—a. plant; b. flower; c. lip. d. column.

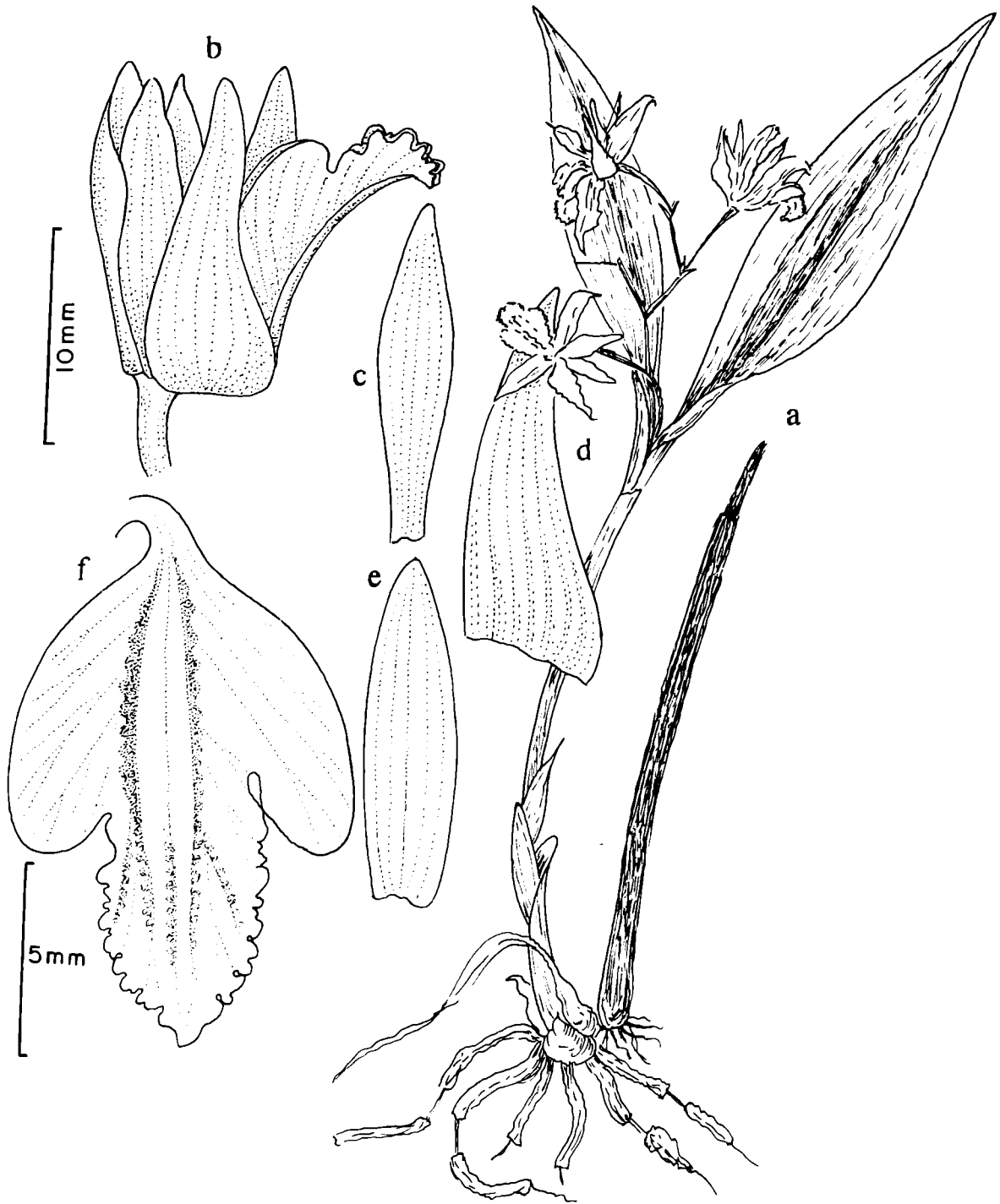


Fig. 157 *Eria coronaria* (Lindl.) Rchb. f. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip.

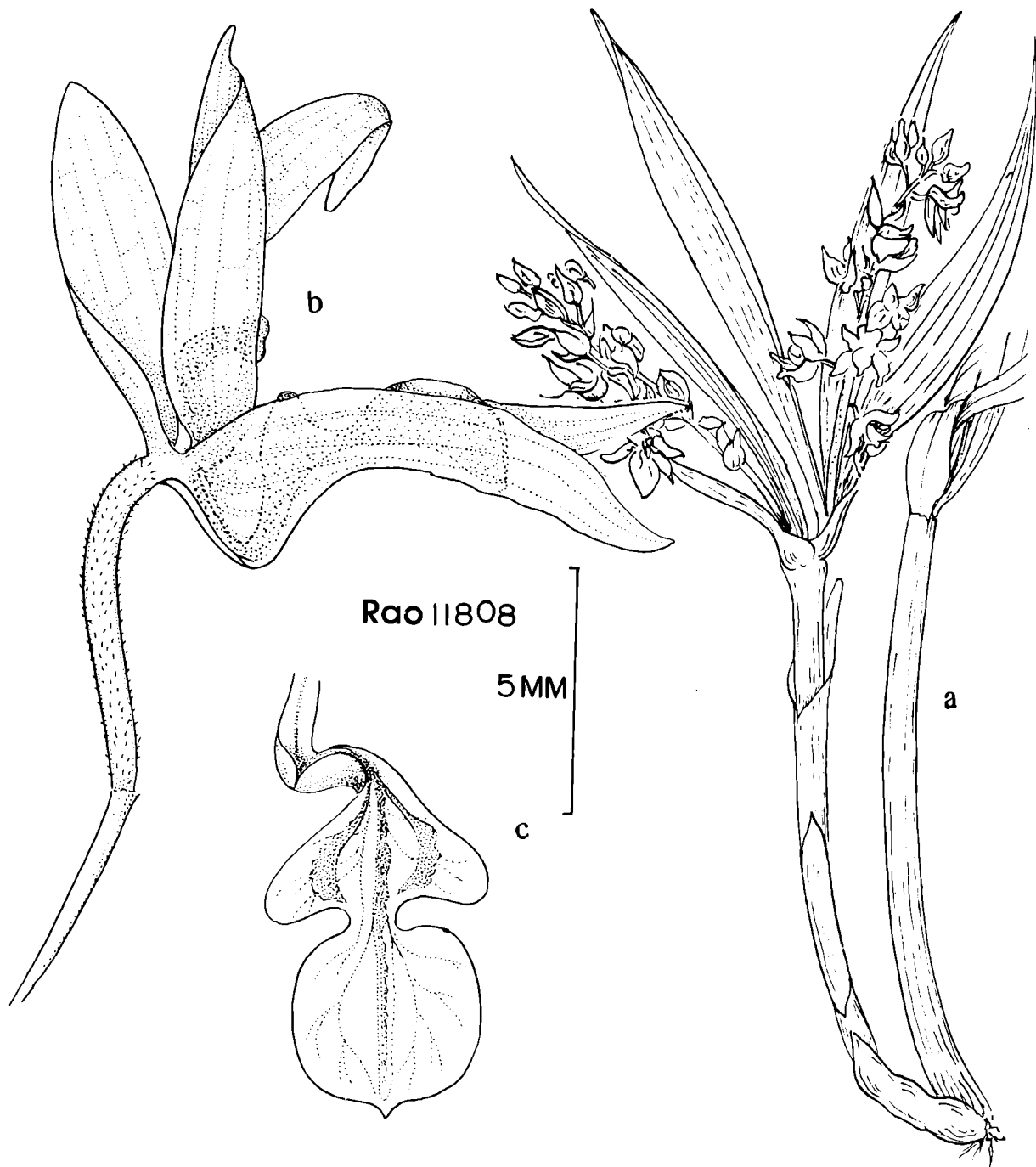


Fig. 158 *Eria graminifolia* Lindl. — a. plant; b. flower; c. lip.



*Pseudobulbs* elongate-clavate, deeply furrowed, 10-15 × 1.2-1.5 cm, sheathed. *Leaves* usually 3, oblong-lanceolate, sub-acute, 10-12 × 1.5-2 cm. *Inflorescence* a raceme, 6-10 flowered. *Scapae* two, 5-7.5 cm long from the nodes, rachis puberulous. *Bracts* longer than the long stalked ovary, deflexed. *Flowers* 6-7 mm across, dull yellow with brownish-red nerves. *Sepals* broadly ovate-oblong, obtuse, 5-nerved, pubescent. *Petals* elliptic-lanceolate, 3-5 nerved. *Lip* 3-lobed, lateral lobes broad, rounded, erect; mid lobe transversely reniform, decurved. *Column* hollow with 2-horn like processes.

*Flowering*: March - April.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram. Burma, Laos, Vietnam, Thailand, Taiwan and China.

*Specimen examined*:

KUMAUN: **Pithoragarh**-Maitli, *Arora* 55815.

***Eria coronaria*** (Lindl.) Rchb. f., in Walp. Ann. 6: 271. 1861; King & Pantl. 124, t. 172. 1898; Seidenf. & Arora, 2: 14. 1982; Seidenf., 62. 40, fig. 18. 1982.

*Coelogyne coronaria* Lindl. in Edw. Bot. Reg. 27: 178, misc. 83. 1841.

*Trichosma suaveis* Lindl. in Edw. Bot. Reg. 28: t. 21. 1842; Hook. f., 5: 827. 1890 et 6: 193. 1890. (Fig. 157)

*Pseudobulbs* with single node, slender, cylindric, 10-15 × 0.5-0.7 cm, enclosed in large tubular basal sheath. *Leaves* 2, terminal, 10-15 × 3-4 cm, elliptic, lanceolate, acuminate. *Inflorescence* 4-6 flowered, raceme terminal. *Flowers* 3-3.5 cm across, white flushed purple externally, sweet-scented. *Sepals* the lateral ovate-lanceolate. *Petals* oblong. *Lip* 3-lobed; lateral lobes large, erect, rounded, having dark purple streaks; mid lobe small, orbicular, revolute, margins undulate and having 5-7 crenate ridges on the surface. *Disc* yellow.

*Flowering*: October - November.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram. China and Thailand.

*Specimen examined*:

KUMAUN: **Pithoragarh**-Maitli, *Arora* 66208.

***Eria graminifolia*** Lindl. in J. Proc. Linn. Soc. Bot. 3: 54. 1859; Hook. f., 5: 794. 1890; King & Pantl. 119, t. 164. 1898; Pradhan 2: 363. 1979; Seidenf. & Arora, 2: 14. 1982. (Fig. 158)

*Pseudobulbs* with single node, cylindric, 10-15 × 0.8-1 cm, sheathed. *Leaves* 3-6, crowded at the end of the stem, 10-15 × 0.8-1.8 cm, sessile, linear-lanceolate, acuminate. *Inflorescence* dense raceme, 15-20 flowered. *Scapes* 1-3, rachis pubescent. *Flowers* 13 mm across, white. *Sepals* the lateral ovate-lanceolate, 3-5 nerved. *Petals* linear-lanceolate, acute, mentum rounded. *Lip* 3-lobed; lateral lobes oblong, erect, truncate, incurved, enclosing 3 stout keels, the two lateral ones ending at the junction of mid lobe in two rounded fleshy calli, the middle keel ending in an oblong fleshy callus of the mid lobe; mid lobe orbicular, with 1-3 ridges, faintly bilobulate.

*Flowering*: May - August.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh).

*Specimen examined*:

KUMAUN: **Pithoragarh**-Didihat, *T.A. Rao* 11808.

***Eria muscicola*** (Lindl.) Lindl. in J. Linn. Soc. Bot. 3: 47. 1859; Hook. f., 5: 789. 1890; King & Pantl. 117, t. 159. 1898; Seidenf. & Arora, 2: 15. 1982; Seidenf., 62: 32. fig. 13. 1982.

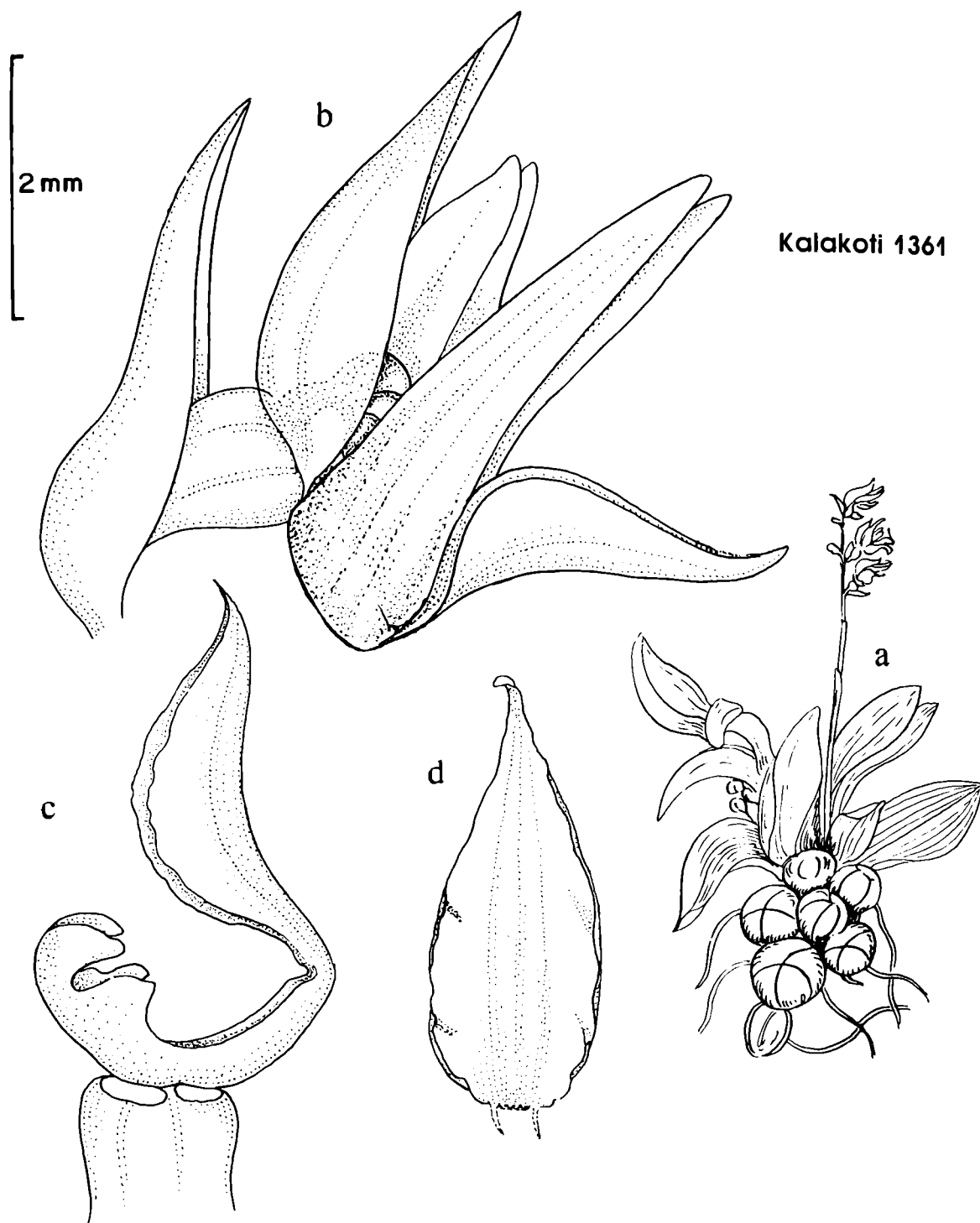


Fig. 159 *Eria musicola* (Lindl.) Lindl. — a. plant; b. flower; c. column & lip. d. lip.

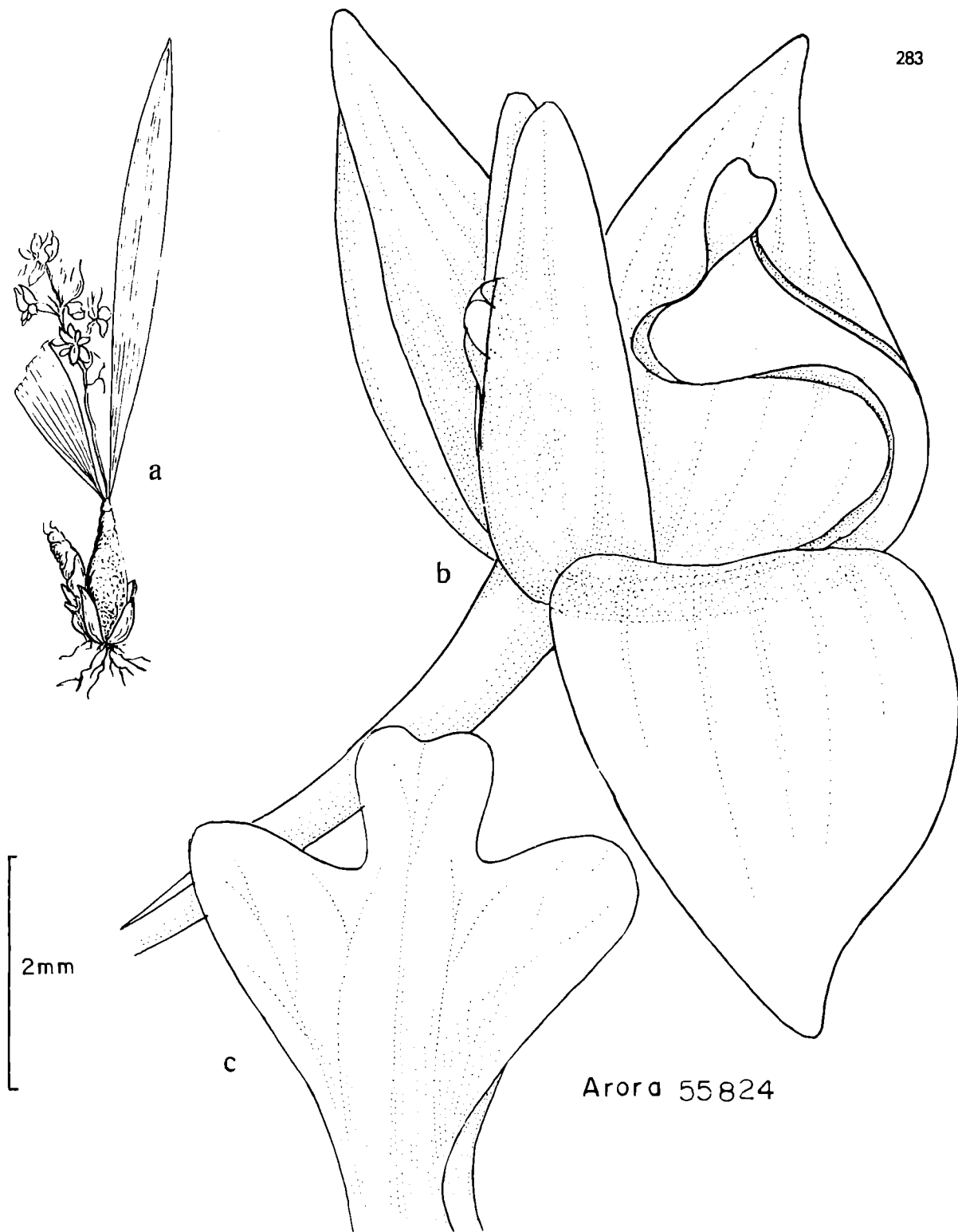


Fig. 160 *Eria occidentalis* Seidenf.—a. plant; b. flower; c. lip.

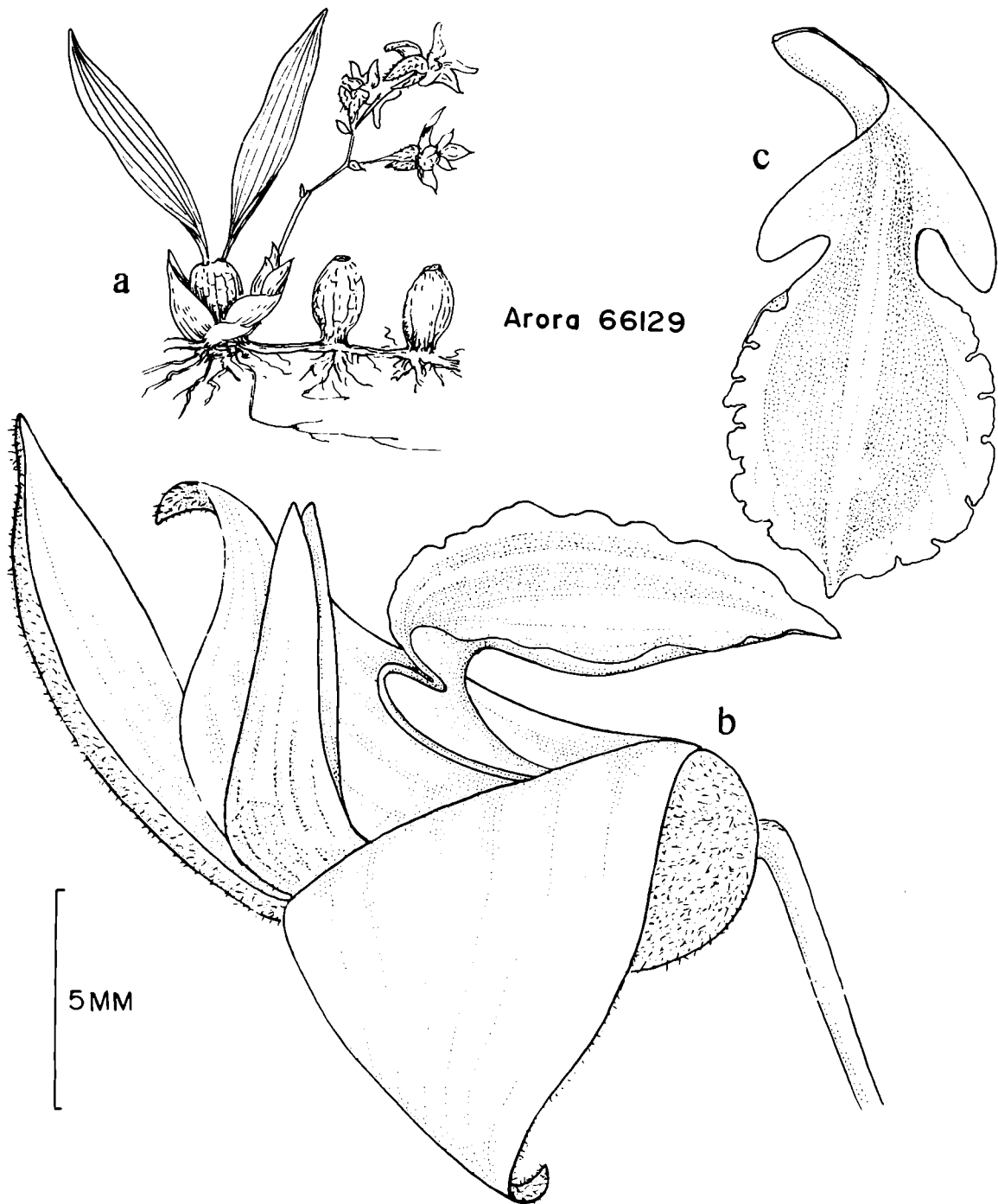


Fig. 161 *Eria pubescens* (Hook.) Steud—**a**. plant; **b**. flower; **c**. lip.

*Dendrobium muscicola* Lindl. in Wall. Cat. 2017 *nom. nud.*; Gen. & Sp. Orch. 75. 1830. (Fig. 159)

*Pseudobulbs* dorsi-ventrally flattened, globose, reticulate, 4-6 mm across. *Leaves* 2-4, from the top of pseudobulb, 1.5-3 × 0.5-0.7 cm, oblanceolate. *Inflorescence* erect, 2 to 6 flowered raceme. *Bracts* green, 2-3 mm long, lanceolate, acuminate. *Flowers* 6 mm in diameter, pale-green. *Sepals* nearly equal, lanceolate, acuminate, the laterals falcate. *Petals* narrowly lanceolate. *Lip* not lobed, lanceolate, concave, wider and deflexed about the middle, apex erose and minutely 3-lobulate. *Disc* with 2 calli at the base.

*Flowering*: August - September.

*Distribution*: Himalaya 1400 m (Kumaun to Arunachal Pradesh), Bihar, Meghalaya, Nagaland, Mizoram. Burma, Laos, Vietnam, Thailand, China and Sri Lanka.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Askot, Jauljibi Bridal Path, *Arora* 70847. **Nainital**-Sat-tal, *Kalakoti* 1361.

*Eria occidentalis* Seidenf. in Nord. J. Bot. 2: 15. fig. 1. 1982. et 2: 121. 1982 (Fig. 160)

*Pseudobulbs* narrow, conical, 3-4 × 1-1.5 cm, when young covered with large sheaths. *Leaves* 2-6, lanceolate, acuminate-acute, 8-10 × 1-1.2 cm, tapering towards both ends. *Inflorescence* erect, sub-terminal from young developed pseudobulbs, often two together. *Scape* more or less 2.5 cm, rachis about 3 cm, thinly stellate-hairy, lax, above 7-10 flowers. *Sepals* the dorsal 4 mm long dull white; laterals broad triangular, 4.5 mm broad at base. *Petals* like sepals, light green or with pinkish tinge. *Lip* 4.5 mm long; lateral lobes broad orbicular, light pink; mid lobe 1 mm long, shortly bilobulate, yellow.

*Flowering*: July - August.

*Distribution*: Himalaya 1200-1500 m (Garhwal & Kumaun). Endemic.

*Specimens examined*:

GARHWAL: **Chamoli**--Ukhimath, *M.A. Rau* 38785.

KUMAUN: **Pithoragarh**-Between Chowpata and Maitli, *Arora* 70806; *Dafiadhura*, *Arora* 55824.

Flower of *E. occidentalis* is similar to *E. spicata*, however it is a smaller plant with a lax-flowered erect inflorescence, with only 7-10 flowers. Can this be an extreme ecological variant of the variable species *E. spicata*? There are many intermediate forms between the two and only experimental taxonomy can solve this problem.

*Eria pubescens* (Hook.) Lindl. ex Steud. Nomencl. Bot. 2. ed. 1: 566. 1840; Hara et al. 1: 42. 1978; Seidenf., 62: 60. fig. 29. 1982.

*Dendrobium pubescens* Hook. Ex. Fl. 2: t. 124. 1825.

*E. flava* Lindl. Gen. & Sp. Orch. 65. 1830; Hook. f., 5: 801. 1890; King & Pantl. 126, t. 175. 1898; Duthie, 111. 1906. (Fig. 161)

*Pseudobulbs* with several internodes, on a creeping rhizome, ovoid, laterally compressed or terete, ellipsoidal or clavate. *Leaves* 3-5, shortly petioled, 15-20 × 2-4 cm, lanceolate-oblong, acute-acuminate. *Inflorescence* a stout 7-12-flowered raceme, from the base of pseudobulbs and enclosed in imbricate sheaths, covered densely with soft white tomentum. *Flowers* well spaced, 1.2-1.3 cm long, greenish-yellow. *Sepals* tomentose externally; the dorsal small, lanceolate; laterals spreading, acute, much longer than dorsal, triangular. *Petals* elongated-oblong, parallel to the column. *Lip* 3-lobed, lateral lobes short, truncate, with 2 calli in between; midlobe rounded to oblong, tip acute to apiculate.

*Flowering*: April - June.

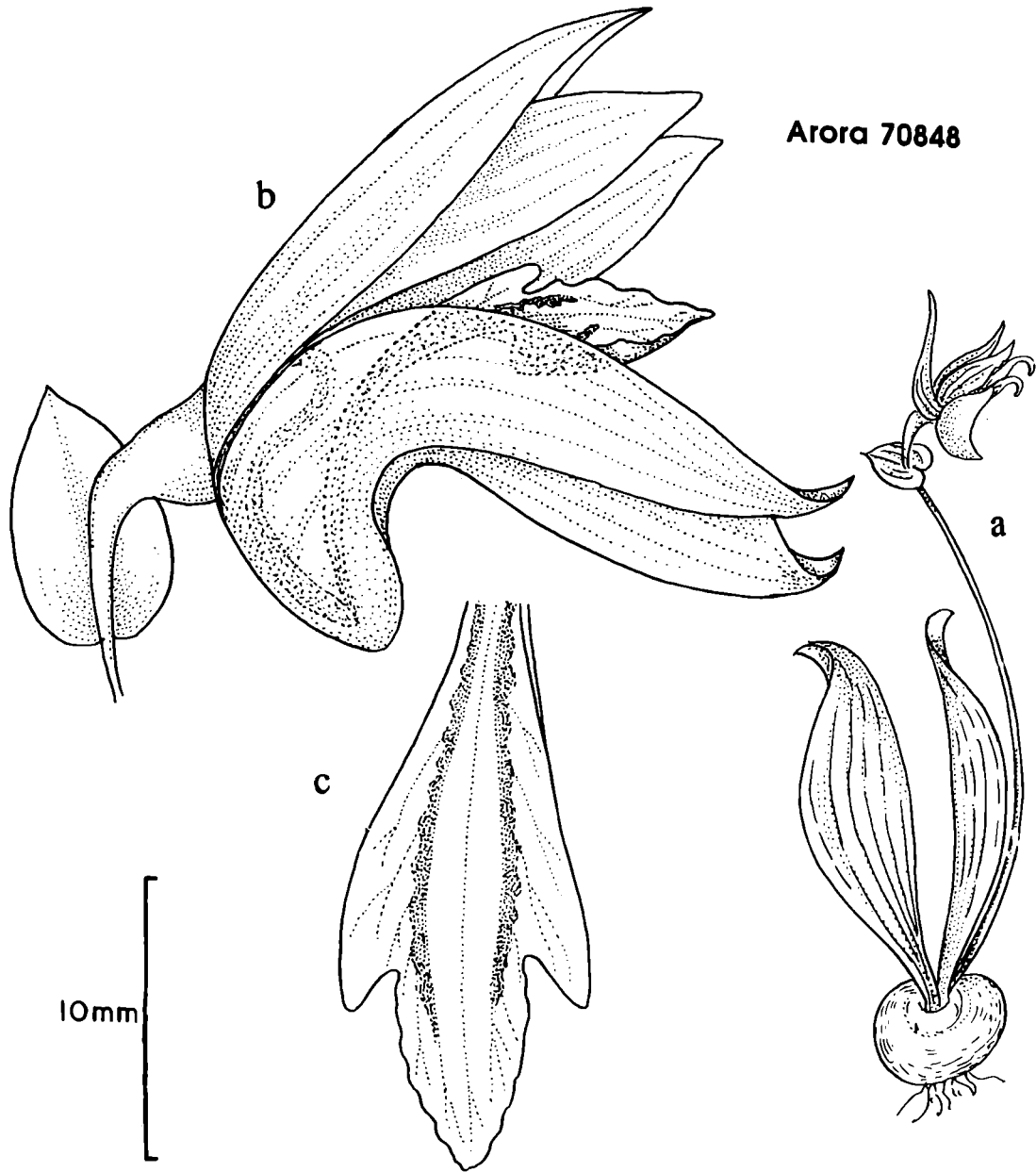


Fig. 162 *Eria reticosa* Wight—*a.* plant; *b.* flower; *c.* lip.

*Distribution:* Himalaya 1300-1600 m (Garhwal to Arunachal Pradesh), Bihar, Bengal, Assam, Meghalaya, Manipur, Mizoram, Nagaland, Burma, Thailand, Laos, Cambodia, Vietnam and China.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 24158, *Jameson*. **Pauri**-Outer Garhwal hills, *Inayat* 25804.

KUMAUN: **Pithoragarh**-Didihat, *Arora* 38851; Askot, *Arora* 66129; Dafiadhura, *Arora* 37200; Maitli, *Arora* 55819; Quiti, *Nair* 35705; Gori Valley, Gargia Baram, *Bhattacharyya* 21199; Samadhura-Tejam, *T.A. Rao* 6589; Milam, *T.A. Rao* 6601.

**Eria reticosa** Wight, *lc. t.* 5(1): 4, t. 1637. 1851; Hook. f., 5: 787. 1890; Seidenf. & Arora, 2: 15. 1982. *E. braccata* Dalz. & Gibs., *Fl. Bombay.* 262. 1861 (*non* Lindl. 1859). (Fig. 162)

*Pseudobulbs* discoid, green about 1 cm high, enclosed in reticulate sheath. *Leaves* 2, from the top of pseudobulb, simultaneous with flower, 3-5 × 1-2 cm, ovate to oblong-lanceolate, acute. *Inflorescence* single flowered. *Scape* slender, 2 cm long. *Bracts* prominent, white, orbicular, cordate, mucronate, about 9 mm long. *Flowers* solitary, white, 2-3 cm in diameter, strongly scented. *Sepals* 2-3 cm long, white flushed pink, oblong-lanceolate; laterals falcate. *Petals* about equal to sepals, oblong-lanceolate. *Lip* 3-lobed, lateral lobes narrowly oblong, acute or rounded, entire, margins red and with two orange-yellow keels from the base to near apex; mid lobe oblong, rounded or tapering towards the apex, crenulate. *Disc* with two yellow ridges, pubescent. *Foot* marked with magenta.

*Flowering:* August - September.

*Distribution:* Himalaya 1500 m (Kumaun), Tamil Nadu and Karnataka.

*Specimen examined:*

KUMAUN: **Pithoragarh**-Askot, Jauljibi-Bridal Path, *Arora* 70848.

*E. reticosa* Wight is a very distinct plant. It will require a phytogeographical explanation that the species wide spread in Konkan, W. Ghats and Nilgiri hills having been found in an isolated spot in Himalaya. This is the only example in the genus *Eria*, which has such a peculiar distribution, however there are several other examples when a wide spread Himalayan plant is also discontinuously distributed in South India.

**Eria spicata** (D. Don) Hand.-Mazz., *Symb. Sin.* 7: 1353. 1936; Hara et al. 42. 1: 1978; Seidenf., 62: 126, fig. 78. 1982.

*Octomeria spicata* D. Don, *Prodr. Fl. Nepal* 31. 1825.

*E. convallarioides* Lindl. *Gen. & Sp. Orch.* 70. 1830; Hook. f., 5: 791. 1890; King & Pantl. 118, t. 161. 1898; Duthie, 110. 1906.

*E. convallarioides* var. *major* Lindl. in *Edw. Bot. Reg.* 33: t. 63. 1847; Hook. f., 5: 791. 1890. (Fig. 163)

*Pseudobulbs* 7-20 × 2.5-3 cm, flattened, densely and loosely sheathed. *Leaves* 4-6, oblanceolate, acute, 10-17 × 3-5 cm, subcoriaceous, many nerved, not plicate. *Inflorescence* a dense-flowered raceme, one to several in the axil of upper sheaths of leaves. *Flower* 7 mm across, white to pale-yellow. *Sepals* 5 mm or less in length, broadly ovate, obtuse; laterals concave. *Petals* oblanceolate-oblong, spreading, as long as the sepals, but narrower. *Lip* obscurely 3-lobed, tinged yellow, bilobulate, tapering to a point or broad truncate. *Disc* without lamellae.

*Flowering:* August - September.

*Distribution:* Himalaya 1000-1800 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, Burma, Thailand, Cambodia, Laos, Vietnam and China.

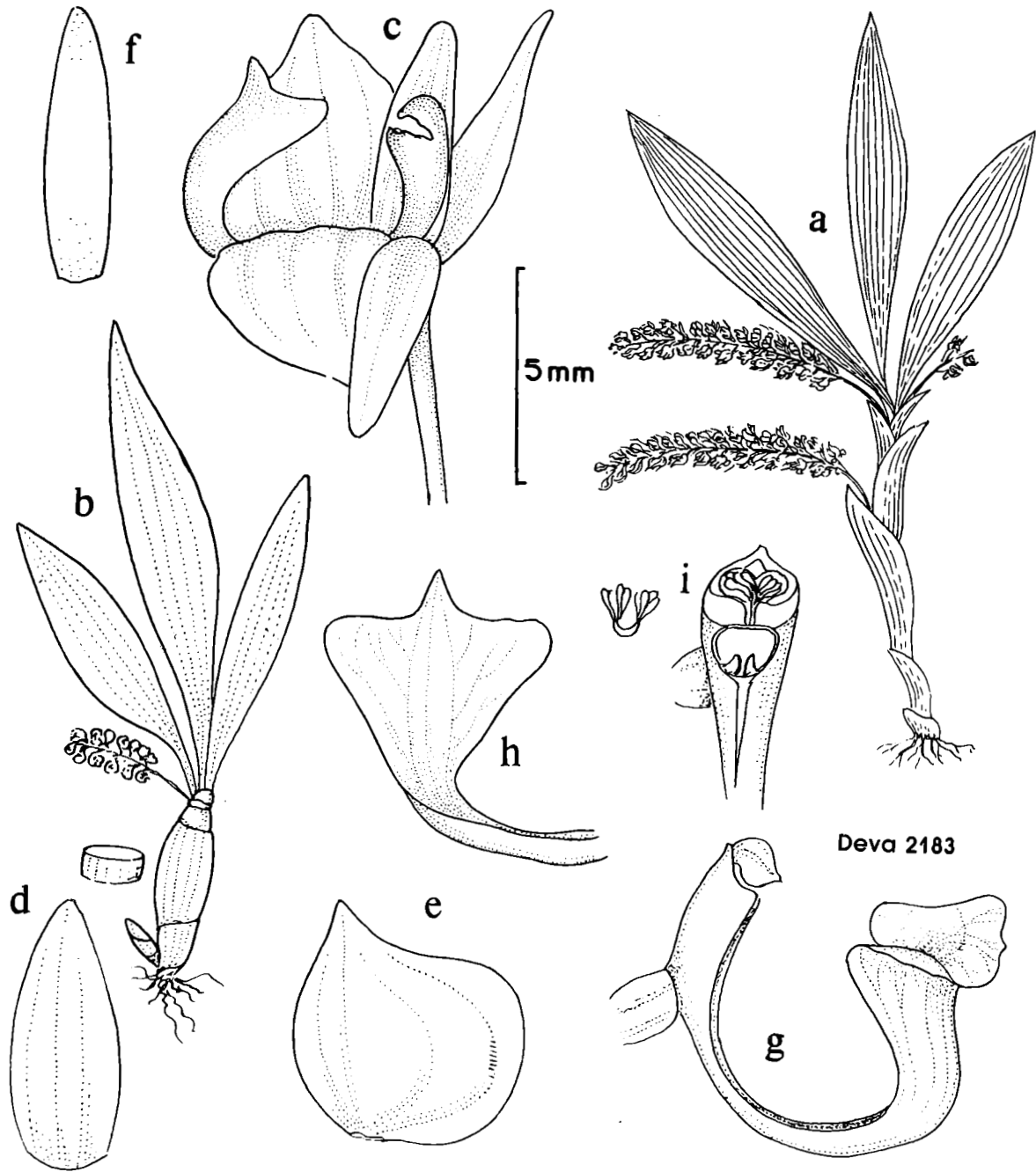


Fig. 163 *Eria spicata* (D. Don) Hand.-Mazz. — a. & b. plant; c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. column & lip; h. lip; i. column & pollinia.



*Specimen examined:*

GARHWAL: Dehra Dun-Dehra Dun, *Falconer* 167-61, *Jameson*; Sahashtradhara, *Deva* 2183; Nemboowala, *Inayat* 25813. Pauri-Lansdown, *Roberts* 25406. Chamoli-Batwalchari, *T.A. Rao* 6448; Phata, *Nair* 35918, *Mehrotra* 3910; Vishnuprayag-Joshimath, *M.A. Rau* 10637.

KUMAUN: Pithoragarh-Dafiadhura, *Arora* 49508, 55821, 70825 & 70827; Thal, *Arora* 36406; Askot, *Inayat* 24087(a), *Bhattacharyya* 21157, *Arora* 36471; Didihat, *M.A. Rau* 35316, *Arora* 38406, 41334 & 41378; Maitii-Chowpata, *Arora* 70835; Madhkote, *Bhattacharyya* 21343; Kali Valley at Balwakot, *Inayat* 24087(b); Boipatu, Gori Valley, *Inayat* 24086; Gori Valley below Askot, *Duthie* 5990.

*E. spicata* is a very variable species. The pseudobulbs are small, conical, cylindrical in young specimens to large oblong flattened in fruiting specimens. The number of racemes ranging from one to many. However many small globose flowers densely packed on the inflorescence axis appears to be a constant character. The mid lobe of the lip is also variable, it ranges from a triangular shape with an acute apex (King & Pantl. t. 161. 1898) to rectangular shape with truncate slightly notched apex to entire. The floral bracts can be erect or reflexed.

**Flickingeria Hawkes**

Epiphytes with pendulous branched stems, and the terminal internode of each branch developed into an oblong, flattened pseudobulb with one coriaceous leaf, new branches usually arising at the base of a pseudobulb; peduncle short, enveloped by papery scale-leaves with 1-3 flowers on top of the pseudobulb, from a tuft of bracts below the leaf. *Flower* fragile, lasting less than a day. *Sepals* and *petals* lanceolate, lateral sepals adnate to the foot of the column. *Lip* 3-lobed; hypochile rising on either side of the column; epichile long, varying in shape, recurved, crenulate, sub-quadrate, 2-3 keeled. *Column* short, toothed at the apex foot short and broad with a well developed mentum. *Anther* terminal, 2-chambered; *pollinia* 4 in two pairs without caudicles.

Seidenfaden (1980) observed that he has dealt with no other genus with so complicated taxonomy and with much confusion. His results are far from satisfactory and there is still a long way before the full knowledge of the genus is obtained.

**Key to species**

1. Epichile of the lip bilobulate, margins almost entire, not plicate, lobules 1-1.5 mm across, narrow, when spread out about 7 mm broad from tip to tip, less in breadth than the hypochile; mesochile short but distinct, 1-1.5 mm long, upper surface with a thick yellow callus extending in the centre of the epichile forming a triangular patch; hypochile with large side lobes, triangular in outline, without any coloured spots, 10-12 mm across tip when flattened out front edges straight with entire margin, keels 3, yellow, terminating at the base of the epichile, lateral keels much raised distally, sepals cream coloured (in fresh flower) with dark brown spots on the outer side ..... *F. hesperis*
- + Epichile of the lip with its proximal edges strongly plicate, broad, orbicular, almost truncate, when spread out 8.5 mm across, broader than the hypochile with rounded side lobes and with reddish spots, when spread out 6 mm or less across, front edges curved, keels 2, tapering to the centre of the epichile, wavy in distal half, sulphur yellow to purple in colour..... *F. fugax*

*Flickingeria fugax* (Rchb. f.) Seidenf. in Dansk Bot. Arkiv. 34(1): 46. fig. 17. 1980; Seidenf. & Arora 16. 1982; Katakai et al. 5: 17. 1984.

*Dendrobium fugax* Rchb. f. Gard. Chron. 1257. 1871; Hook. f., 5: 752. 1890.

*D. macraei* auct. non Lindl.: King & Pantl. 61, t. 86. 1898

(Fig. 164)

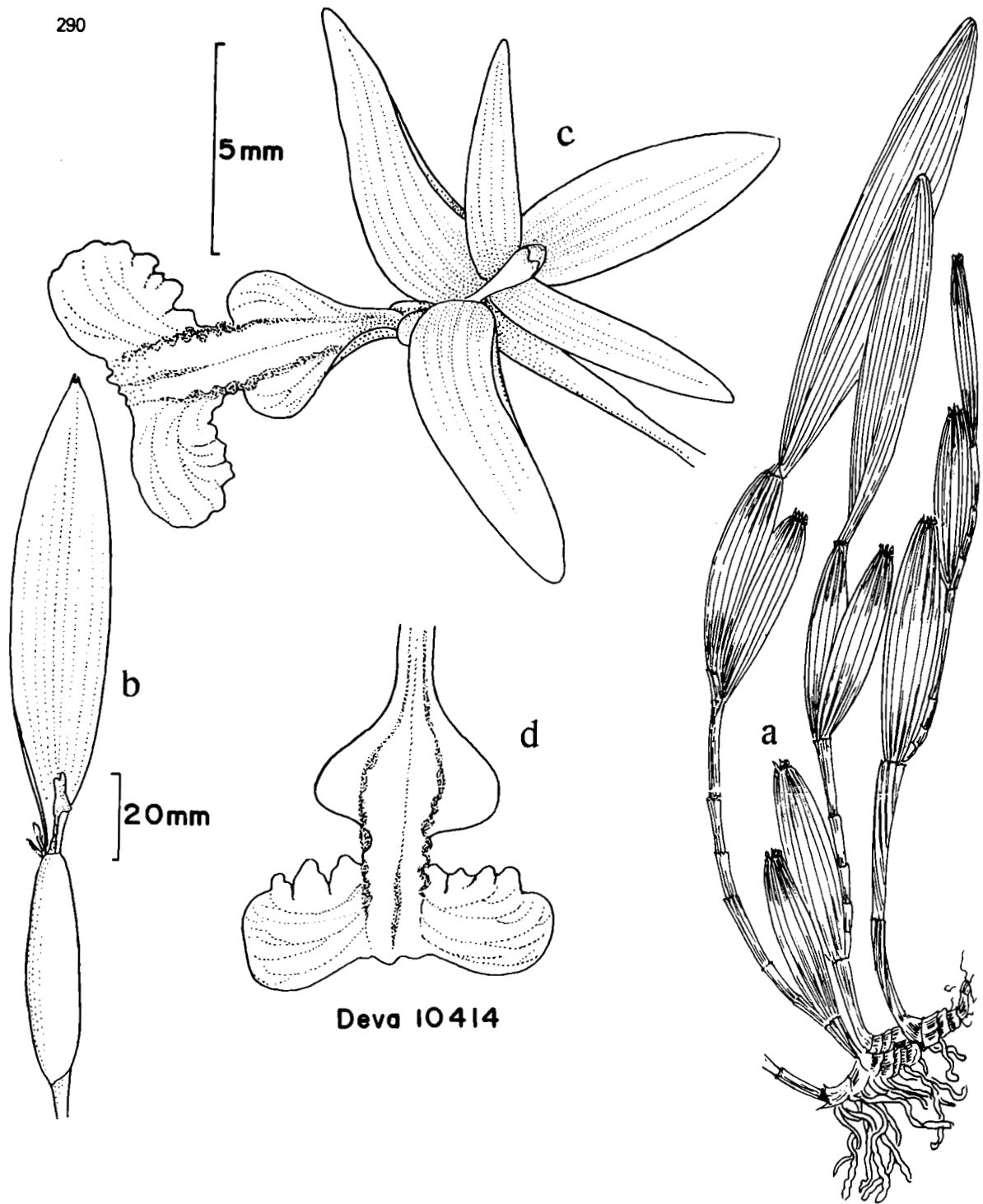


Fig. 164 *Flickingeria fugax* (Rchb. f.) Seidenf. — a. plant; b. pseudobulb with leaf and flower; c. flower; d. lip.

Rhizome creeping, annular, *Stem* pendulous, polished, 20-40 cm or more long. *Pseudobulb* 2.5-5 × 0.7-2 cm, rather flat, green shining, grooved. *Leaf* one to each pseudobulb, terminal, linear-oblong or lanceolate, obtuse, 4-14 × 1.2-4.5 cm, sessile. *Inflorescence* 1-2 flowered, appearing from near the base of leaf. *Flowers* white. *Sepals* elliptic-oblong, sub-acute, spreading, the dorsal 10.5-11 × 3.5-3.8 mm; laterals 10-11 × 4-4.5 mm, obliquely-oblong, adnate to the foot of the column. *Petals* narrower than sepals, lanceolate, acute. *Lip* 3-lobed; eupichile with its proximal edges strongly plicate, broad, orbicular, almost truncate, when spread out 8.5 mm across, broader than hypochile; mesochile indistinct with wavy margins; hypochile with rounded side lobes and with reddish spots, when spread out 6 mm or less across, front edges curved, keels 2, tapering to the centre of the epichile, wavy in distal half, sulphur yellow to purple in colour.

*Flowering*: May.

*Distribution*: Himalaya 1500-2000 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Tripura, Mizoram. Burma, Thailand.

*Specimen examined*:

KUMAUN: Pithoragarh-Maitli, Arora 70858.

The existence of this species in North Western Himalaya has to be confirmed. It appears to be common in North Bengal and North Eastern India, and the plants when cultivated in Dehra Dun flower profusely, the colour of the keels appears to be variable and in the material we examined it was of purple colour.

Fig. 164 drawn from a specimen cultivated at 13 Balbir Avenue, Dehra Dun.

**Flickingeria hesperis** Seidenf. in Nord. J. Bot. 2(1): 16, fig. 2. 1982.

*Dendrobium macraei* sensu Arora in Ind. J. For. 79. 1980 (non Lindl.).

(Fig. 165)

Stem many, 30-60 cm high. *Pseudobulbs* 2.5-4 cm long. *Leaf* 8.5-11.5 × 1.4-2.5 cm, minutely bilobulate, mid-vein terminating in a short flat-obtuse mucro in sinus. *Inflorescence* one-flowered, appearing both in the axil of the leaf and abaxil at its base. *Flower* small. *Sepals* cream coloured with dark brown spots on the outside, the dorsal about 10 mm long; the laterals oblique, triangular, acute, about 14-15 mm long. *Petals* white, linear-lanceolate, nearly as long as the dorsal sepal. *Lip* cream coloured, 3-lobed; epichile bilobulate, margins almost entire not plicate, lobules 1-1.5 mm across, narrow, when spread out about 7 mm long from tip to tip, less in breadth than hypochile; mesochile short, distinct, 1-1.5 mm long, its upper surface with a thick yellow callus extending in the centre of epichile forming a triangular patch; hypochile with large side lobes, triangular in outline., without any colour spots, 10-12 mm across when flattened out, front edges straight with entire margin; keels 3, yellow, terminating at the base of the epichile, lateral keels much raised distally.

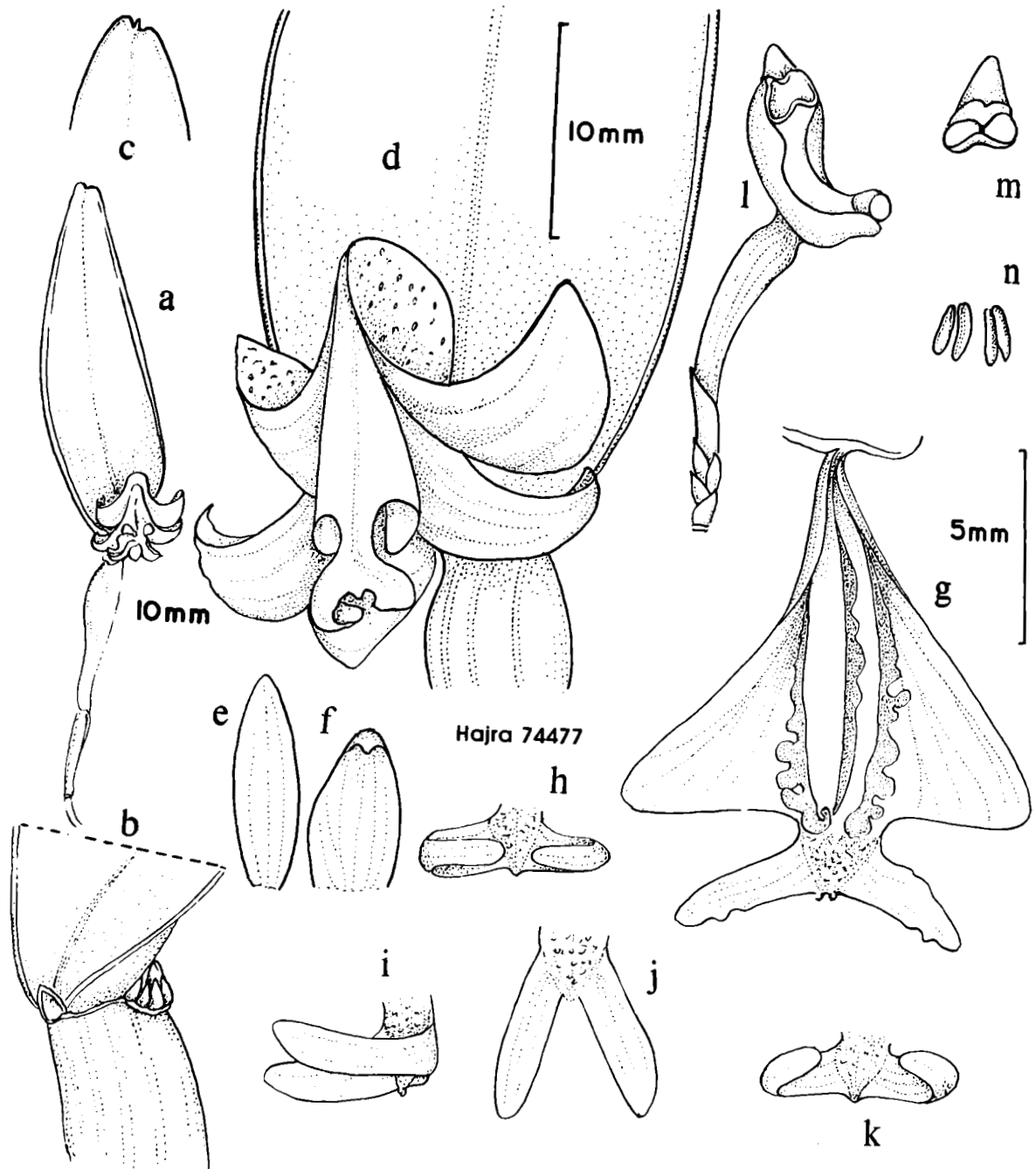
*Flowering*: June.

*Distribution*: 1500-2000 m, endemic in Kumaun Himalaya.

*Specimen examined*:

KUMAUN: Pithoragarh-Askot, Ogra Road, Arora 66130; Tejam-Girigaon, Rao 6598; Askot, Hajra 74477.

*F. hesperis* Seidenf., is a very distinct species, it can be easily distinguished from other species of the genus by its very broad triangular hypochile, and a bilobulate narrow epichile on a short neck which when spread out is less in breadth than the front edge of the hypochile. In its vegetative condition the plant resembles very closely with *F. macraei* (Lindl.) Seidenfaden. The oblique pseudobulbs, the presence of a flat caducous ariasta, and the leaves being quite often as 25 mm are very similar. However the flowers are very different. It is so far known from a very small area of Kumaun, but is expected to be more widely distributed.



**Fig. 165** *Flickingeria hesperis* Seident. -a. plant with pseudobulb and flower; b. pseudobulb & leaf joint; c. leaf tip; d. flower; e. dorsal sepal; f. lateral sepal; g. lip; h., i., j. & k. epichile of lip; l. column; m. & n. pollinia.

**Liparis Rich.**

Terrestrial or epiphytic herb with or without pseudobulbs. *Leaves* one or more, membranous and continuous with the sheath or coriaceous and jointed on the sheath or pseudobulb. *Inflorescence* terminal, erect or pendulous, many flowered, small or medium sized. *Flowers* small. *Sepals* and *petals* erect or reflexed, margin recurved or revolute, lateral sepals or sometimes petals placed under the lip. *Lip* inferior, adnate to the base of column, not 3-lobed, usually bent at or below the middle, often cleft at apex. *Column* slender, incurved, often winged towards the top. *Anther* terminal, incumbent; *pollinia* 4, free cohering by a viscid appendage.

**Key to species**

1. Plants terrestrial; leaves usually membranous of thin texture, continuous with the leaf sheaths; sepals 3-or more-nerved..... 2
- + Plants epiphytic; leaves usually coriaceous jointed to the sheath; sepals 1-nerved..... 7
2. Leaf solitary..... 3
- + Leaves two, rarely three or more..... 4
3. Leaves rounded-ovate, almost as long or little longer than broad, 5-12.5 × 3.5-10 cm; floral bracts triangular, minute, about 1/10 of the length of the ovary; lip obovate, deltoid (obtriangular) with almost truncate apex, margin crenulate..... *L. cordifolia*
- + Leaf oblong or linear-oblong, 2-4 times longer than broad, 5-10 × 1.5-2.5 cm; floral bracts linear, half or more than half the length of ovary; lip oblong, apex broad rounded, margin ciliate to crenulate..... *L. glossula*
4. Leaves 2, sub-opposite; petals linear with one unbranched vein only..... 5
- + Leaves two or rarely three, alternate, 12-15 × 2.5 cm, elliptic-lanceolate; petals spatulate with three veins from the base, lateral veins further branched; lip obovate with two teeth like calli near the base, apex broad, emarginate, crenulate-erose to almost entire..... *L. paradoxa*
5. Lip without callus, broadly obcordate, apiculate, margin crenulate; column with two knob like protuberances near the base..... *L. rostrata*
- + Lip with two teeth like calli near the base..... 6
6. Leaves two; floral bracts lanceolate, deflexed, about half as long as the ovary; lip flat, orbicular-reniform, with crenulate margin except near the base..... *L. deflexa*
- + Leaves 4-5; floral bracts ovate, deflexed, minute at the base of the ovary with a broad base; lip oblong, concave with entire margin..... *L. nervosa*
7. Leaf solitary, 3 cm or less long; pseudobulbs ovoid, flowers minute, lip without callus or rarely with obscurely thickened edges near the base, recurved, quadrate-oblong, tip truncate-entire or slightly crenulate, rarely apiculate..... *L. caespitosa*
- + Leaves two to three or more..... 8
8. Leaves two, 7.5-15 cm long, pseudobulbs cylindric, 7.15 cm long; inflorescence shorter or little longer than leaves, erect; lip without callus, recurved, apex rounded entire, shortly apiculate or not.... *L. viridiflora*
- + Leaves three or more, rarely two; pseudobulbs short, ovoid, 4 cm or usually much less in length; inflorescence much longer than leaves; lip with prominent calli..... 9
9. Scape terete; lip broadly oblong or ovate, sagittate with lobes pointing outwards, apex broad, slightly triangular at apex; column front with triangular wings and each with a filiform downwards turned process..... *L. resupinata*
- Scape interruptedly winged; lip quadrate, oblong, lobes at base pointing upwards, apex broad, truncate to rounded with a short apiculus at its centre; column front triangular, wings without filiform process..... *L. platyrachis*

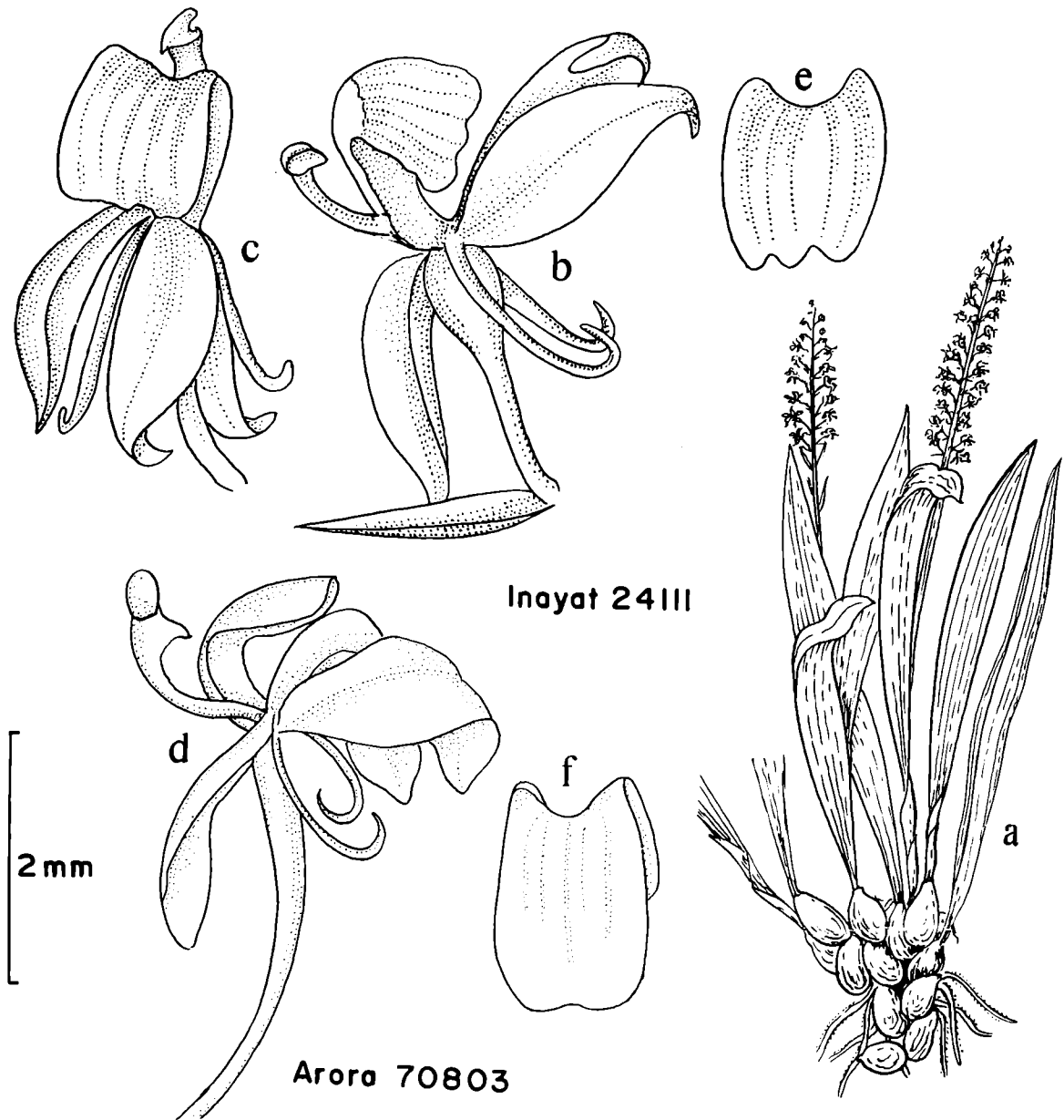


Fig. 166 *Liparis caespitosa* (Thou.) Lindl.—a. plant; b., c., & d. flower; e. & f. lip.

**Liparis caespitosa** (Thou.) Lindl. in Edgew. Bot. Reg. 11, sub. t. 882. 1825; Seidenf. 61. fig. 38. 1976; Pradhan, 232. 1979.

*Malaxis caespitosa* Thou. Orch. ill. Afr. t. 89. 1822.

*L. pusilla* Ridl. in J. Linn. Soc. Bot. 22: 294. 1886; Hook. f., 5: 701. 1890; King & Pantl. 32, t. 41. 1898.

*L. prainii* Hook. f., Fl. Brit. Ind. 5: 700. 1890.

*L. duthiei* Hook. f., Ic. Pl. t. 1857 B. 1889 et 701. 1890; King & Pantl. 32, t. 42. 1898; Duthie, 93. 1906.

(Fig. 166)

Epiphytic. *Pseudobulbs* ovoid, 8-12 mm long. *Leaf* solitary, linear-lanceolate, tapering to the base, 4-17 × 0.8-1 cm. *Inflorescence* 4-10 cm long, raceme bearing numerous flowers. *Flowers* 3 mm long, pale-green. *Bracts* linear-lanceolate, equal to or exceeding the ovary. *Sepals* elliptic-oblong, blunt, reflexed. *Petals* linear, recurved, longer than sepals. *Lip* without callus or rarely with obscurely thickened edges near the base, recurved, quadrate-oblong, tip truncate entire or slightly crenulate, rarely apiculate. *Column* slightly curved, rather long, obscurely winged, not thickened at the base.

*Flowering*: August.

*Distribution*: Himalaya 1000-1400 m (Kaumaun to Arunachal Pradesh), Assam, Meghalaya, Mizoram, Nagaland, Tamil Nadu. Burma, Malaya, Thailand, China, Indo-China, Sri Lanka. Wide Spread from Africa to the Pacific.

*Specimens examined*:

KUMAUN: Pithoragarh-Girigaon, Inayat 24111; Gori Valley, Inayat 24111(a); Maitli-Chaupata, Arora 70834; Askot, Arora 70803.

*Liparis pusilla* and *L. duthiei* both Himalayan species are treated here as synonym of *L. caespitosa*, a wide spread species from Africa to Pacific. Hooker (1890) separated the former two as in the first the lip has at base two auricles, while in the second the lip is hardly auricled of the base. The calli in both are absent. On the other hand King & Pantling (1898) mentioned that the base of lip in both is without auricles, but the lip in the first species without any basal calli, while in the second there are two small basal calli. These statements are contradictory. *L. prainii* from Nagaland which also has been treated here conspecific with *L. caespitosa* has been shown by Hooker. f. (1890), to have obscurely 3-nerved sepals. We have not attempted to solve these problems and followed Seidenfaden (1976) in accepting the nomenclature proposed by him.

**Liparis cordifolia** Hook. f., Ic. Pl. 19. t. 1811. 1889 et 692. 1890; King & Pantl. 24, t. 28. 1898; Duthie, 90. 1906; Seidenf., 11. 1976; Hegde & Rao, 77. 1984. (Fig. 167)

Terrestrial, uniform deep-green. *Pseudobulbs* much crowded, compressed, ovoid, pointed, 3-4 cm long. *Leaves* rounded-ovate, almost as long or little longer than broad, 5-12 × 3.5-10 cm, cordate, acuminate, nerves distinct. *Raceme* 2.5-5 cm, 10-25 flowered, peduncle elongate, ebracteate. *Flowers* apple-green, 1.5 cm long. *Bracts* triangular, minute, ca 1/10 of the length of ovary. *Sepals* linear-lanceolate, acute, 3-nerved. *Petals* linear, spreading. *Lip* obovate-deltoid, triangular, flat with concavity at base, almost truncate apex, margin crenulate. *Column* knob-like, apex with two short rounded wings.

*Flowering*: October.

*Distribution*: Himalaya up to 1800 m (Garhwal, Nepal to Arunachal Pradesh), Meghalaya.

GARHWAL: Dehr Dun, Royle (Duthie, l.c.).

The plant was last collected from Garhwal, Dehra Dun by J.F. Royle and since then for almost 150 years there has been no collection from any where in North Western Himalaya.

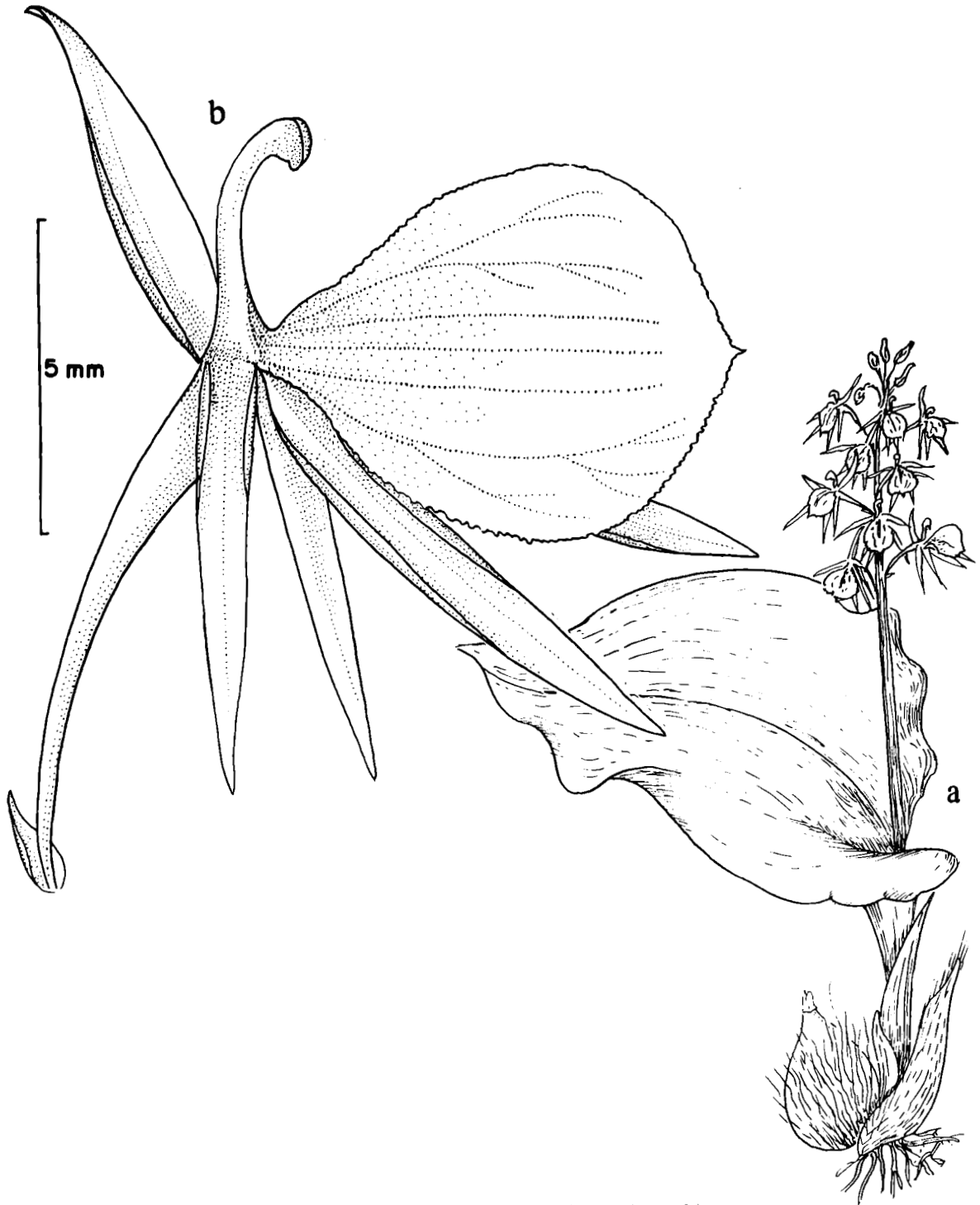


Fig. 167 *Liparis cordifolia* Hook. f.—a. plant; b. flower (after Hook. f.)



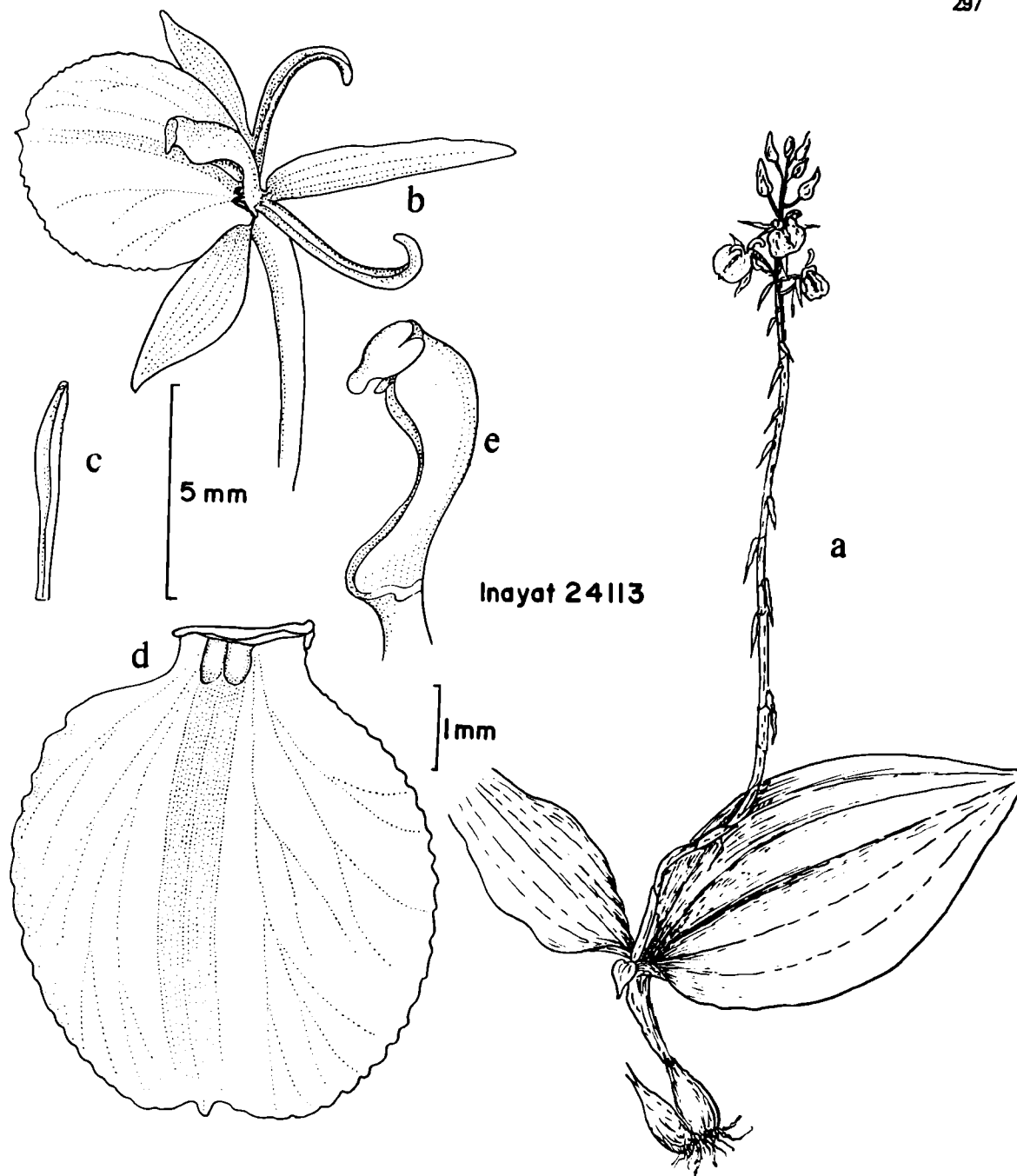


Fig. 168 *Liparis deflexa* Hook. f. — a. plant; b. flower; c. petal; d. lip; e. column.

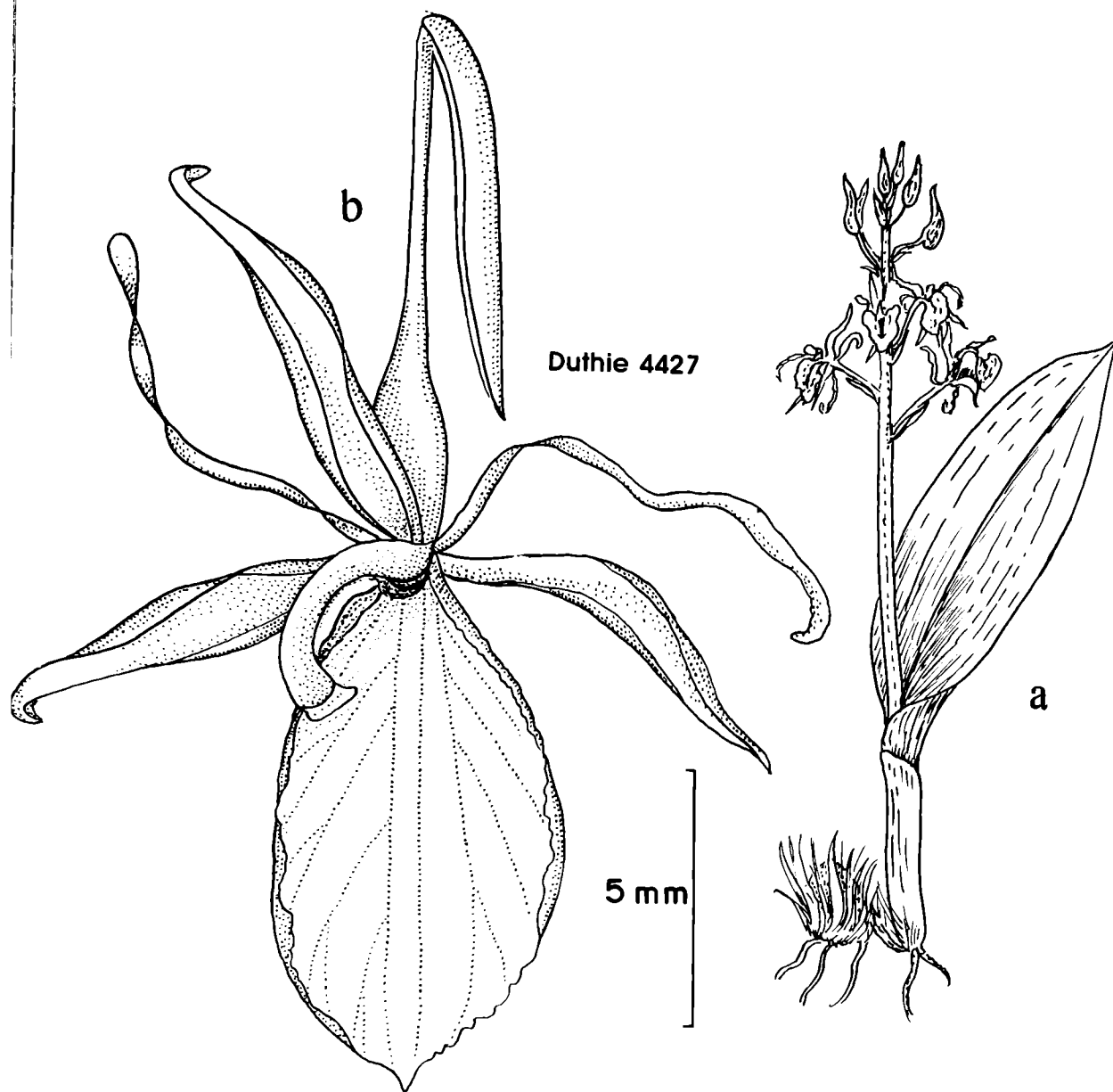


Fig. 169 *Liparis glossula* Rchb. f. — a. plant; b. flower.

**Liparis deflexa** Hook. f., Fl. Brit. Ind. 5: 697. 1890; King & Pantl. 25, t. 31. 1898; Duthie, 90. 1906; Seidenf., 27. fig. 15. 1976.

*L. prazeri* King & Pantl. in J. As. Soc. Beng. 66(2): 582. 1897.

(Fig. 168)

Terrestrial. *Stem* short, 2-7 cm long with a pseudobulbous base, sheaths few. *Leaves* two, membranous, plicate, petiolate, ovate-oblong, 7-nerved, 15-18 × 6 cm. *Inflorescence* bracteate, 15-25 cm long, 7-12 flowered. *Flowers* 8-10 mm across, yellow. *Bracts* about half as long as the ovary. *Sepals* 3-5 nerved, obtuse, the laterals oblong; the dorsal longer, oblong-lanceolate. *Petals* with one vein, narrowly oblong, like the sepals, reflexed and with recurved margins. *Lip* flat, orbicular-reniform, margin crenulate except near the base, apex broad, mucronate, basal calli two. *Column* bearing narrow rounded apical wings and having a swollen base.

*Flowering*: August.

*Distribution*: Himalaya 1400 m (Kumaun to Sikkim), Karnataka.

*Specimen examined*:

KUMAUN: **Pithoragarh**-Khela, Kali Valley, *Inayat* 24113.

Sant. & Kapadia (1966) have examined the type specimen of *L. prazeri* and concluded that the two species certainly seem to be identical.

**Liparis glossula** Rchb.f. in Linnaea 41: 44 1876; Hook. f., 5: 693. 1890; King & Pantl. 26, t. 33. 1898; Duthie, 91. 1906; Seidenf., 11. 1976.

*L. nepalensis* Strach. & Winter., in Atkin. Gaz. N.W. Front, Prov. 594. 1882; Watson, 385. 1882. (*non* Lindl.).

*L. petiolata* sensu Seidenf. & Arora in Nord. J. Bot. 2: 20. 1982. *non* (D. Don) Hunt & Summerh.

(Fig. 169)

Terrestrial. *Pseudobulbs* oblong or ovoid, tufted, 3.5-5 cm long. *Leaf* solitary, oblong or linear-oblong, 2-4 times longer than broad, 5-10 × 1.5-2.5 cm. *Raceme* erect, ebracteate, longer than leaf, 7-10 flowered. *Flowers* 18-20 mm long, green with purple lip. *Bracts* linear, half or more than half the length of ovary. *Sepals* oblong-lanceolate, acute. *Petals* linear, reflexed. *Lip* oblong, purple, broad rounded, margin ciliate to crenulate. *Column* with two short wings near apex.

*Flowering*: August.

*Distribution*: Himalaya 1800-2200 m (Himachal Pradesh to Sikkim). Also in South Tibet.

*Specimens examined*:

GARHWAL: **Dohra Dun**-Mussoorie, *Mackinnon* 21772 & 22734, *Harsukh* 24179, *Duthie*. **Chamoli**-*Duthie* 4427(a).

KUMAUN: **Nainital**-Cheena, *Duthie* 4427, *Davidson*; Tonnochy Road, *Champion*; Naina Peak, *Renz* 13594. **Almora**-Ranikhet to Chaubatia, *Renz* 13609.

HIMACHAL PRADESH: Shimla, Chail, *Raizada* & *Kirat Ram*.

Inclusion of *L. nepalensis* and *L. petiolata* is based on wrong identification.

**Liparis nervosa** (Thunb.) Lindl. Gen. & Sp. Orch. 26. 1830; Seidenf., 30. fig. 16. 1978; Seidenf. & Arora, 20. 1982.

*Ophrys nervosa* Thunb. Fl. Jap. 27. 1784.

*L. bituberculata* (Hook.) Lindl. in Edw. Bot. Reg. 11: sub. t. 882. 1825; Hook. f., 5: 696. 1890; King & Pantl. 28, t. 35. 1898; Duthie, 92, 1906.

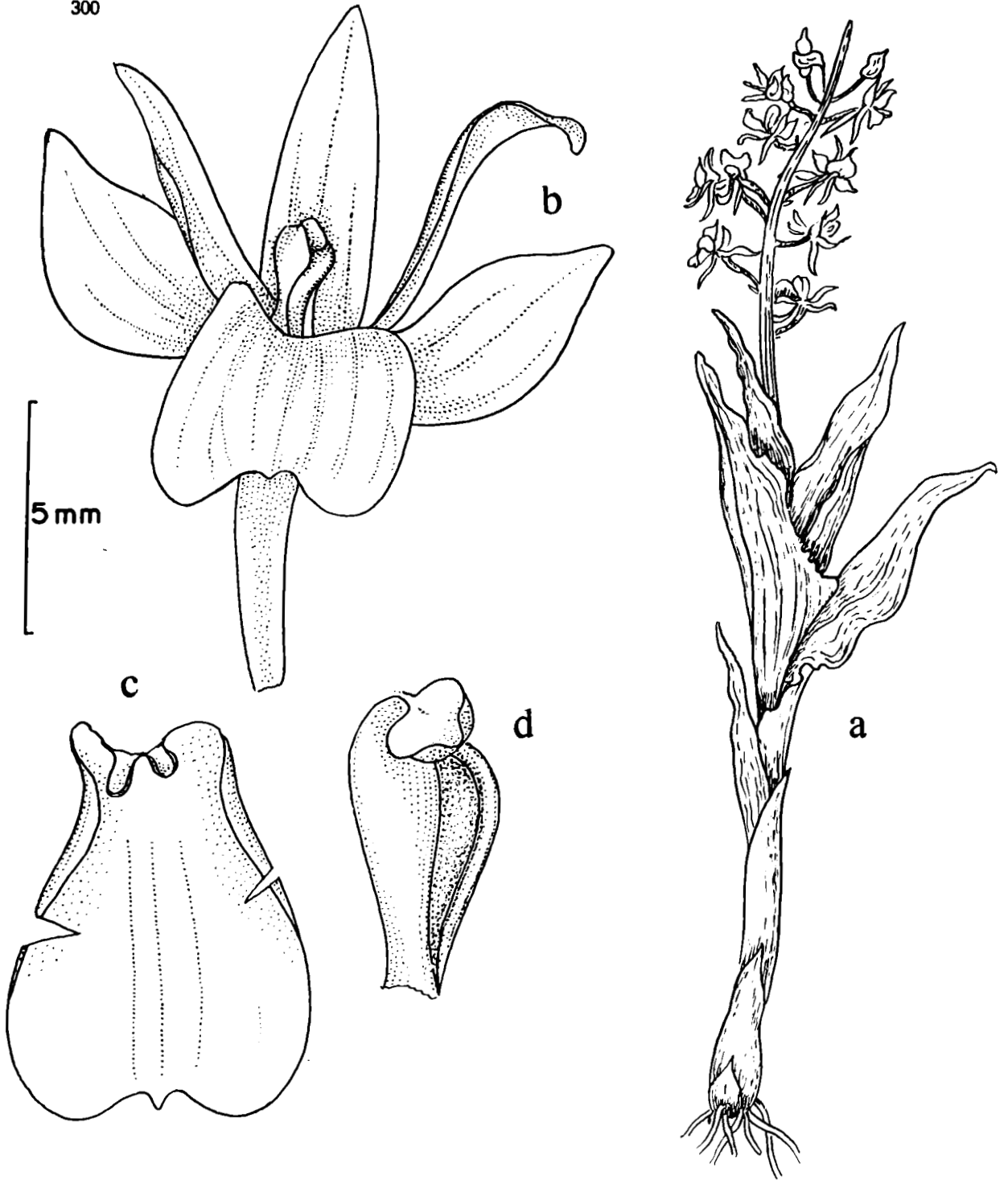


Fig. 170 *Liparis nervosa* (Thunb.) Lindl. -- a. plant; b. flower; c. lip; d. column.

*Cymbidium bituberculatum* Hook. Exot. Fl. 2: t. 116. 1824

(Fig. 170)

*Pseudobulbs* 20-25 cm, robust, fleshy. *Leaves* 4-5, elliptic-lanceolate, 10-20 × 4-7 cm, membranous, plicate, margins wavy, 7-nerved; petioles with sheathing base. *Inflorescence* stout, rigid, longer than leaves, 15-20 cm; raceme 10-20 cm long, 12-14 flowered. *Flowers* 15 mm long, dull purple. *Bracts* minute with a broad base, ovate and deflexed. *Sepals* the dorsal linear-oblong, obtuse, reflexed, lateral broader and spreading. *Petals* with one unbranched vein, linear spreading, like dorsal sepal. *Lip* oblong, concave with entire margin, base having two teeth like calli. *Column* curved, slightly winged near the apex.

*Flowering*: July.

*Distribution*: Himalaya 1500-2300 m (Kumaun to Arunachal Pradesh), Meghalaya, Bengal, Orissa, N. Kanara, Nilgiris. Burma, China, Indo-China, Japan, Thailand, Sri Lanka.

KUMAUN: *Blinkworth* (Duthie, *l.c.*).

It has only been collected once long ago around 1823 from Kumaun by Blinkworth, who was Wallich's collector, and one of the first explorer of the flora of this region. We here follow the mature decision of Seidenfaden (1976) in keeping *L. bituberculata* (Hook.) Lindl., as a synonym of *L. nervosa*. Unfortunately there is no material of *L. bituberculata* for us to examine from N.W. Himalaya however we have examined *L. paradoxa* which shows very clearly the spatulate petals with 3-veins from base which are further branched upwards, and have kept it separately confirming Seidenfaden's conclusions. The confusion still persists as *L. nervosa* in Sant. & Kapadia (1966) is mentioned and illustrated clearly with 3-veined petals and longer lanceolate bracts. It will require much more work on Indian Orchids to settle this question satisfactorily.

*Liparis elata* Lindl., is also considered to be identical with *L. nervosa* (Seidenfaden *l.c.* p. 34). Dr. J. Renz in his herbarium has many specimens of *L. elata* from Columbia, Venezuela, Puerto Rico and Jamaica. All have petals with 3-veins. Sometimes if the margins of the petals are rolled inwards length wise, the 3-veins are more difficult to be seen.

***Liparis paradoxa*** (Lindl.) Rehb. f. Walp. Ann. Bot. Syst. 6: 218. 1861; Hook. f., 5: 697. 1890; King & Pantl. 27, t. 34. 1898; Duthie, 92, 1906; Seidenf., 38. fig. 22. 1978.

*Empusa paradoxa* Lindl. in Edw. Bot. Reg. 10: sub. t. 825. 1824.

*L. nervosa* auct. non (Thunb.) Lindl. Gen. & Sp. Orch. 26. 1830.

*L. odorata* (Willd.) Lindl. Gen. & Sp. Orch. 26. 1830.

*Malaxis odorata* Willd. Sp. Pl. 4: 91. 1805.

(Fig. 171)

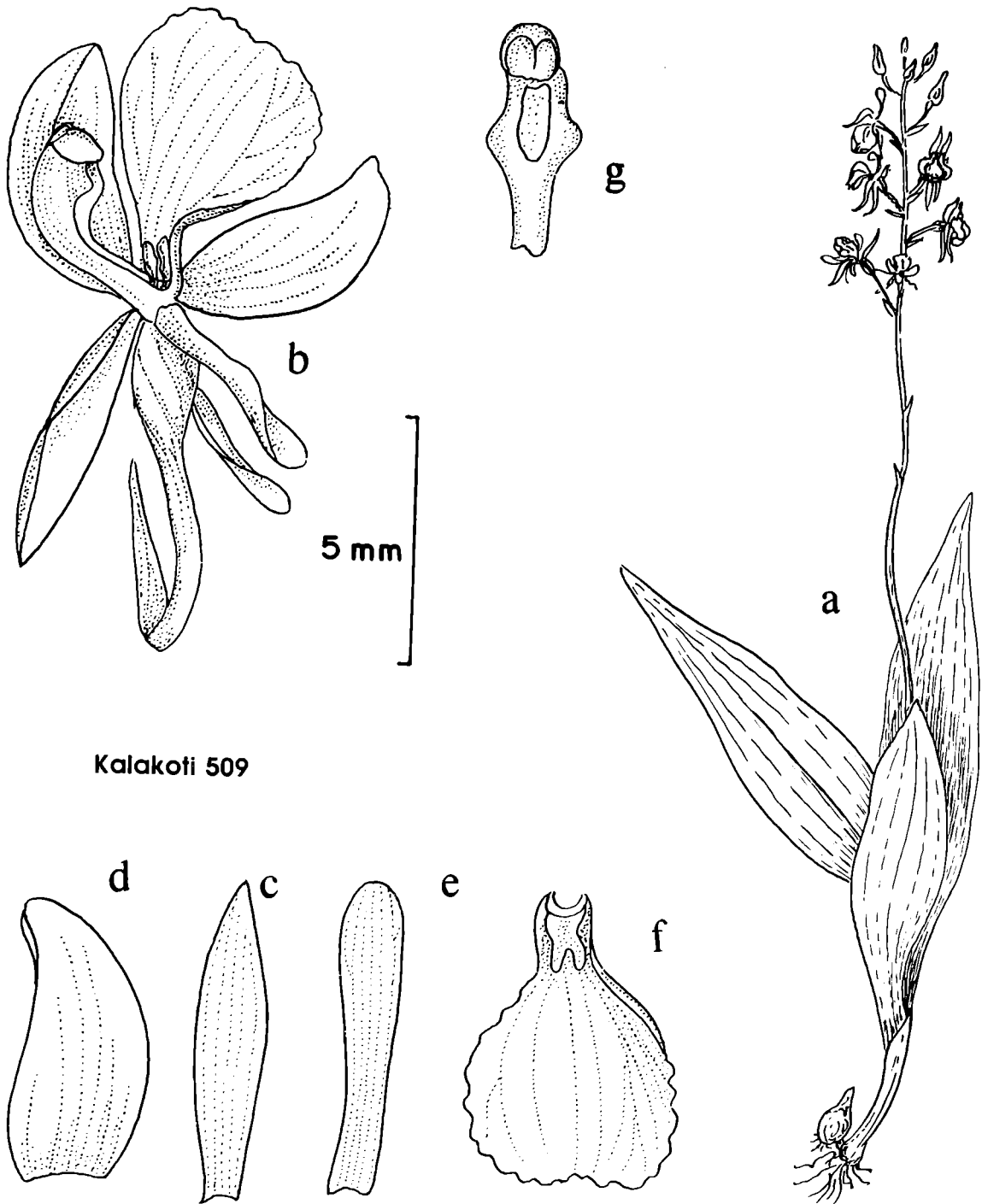
Terrestrial. *Pseudobulbs* narrowly ovoid. *Stem* 10-14 cm long, bulbous at the base, sheathed. *Leaves* two or three, 12-15 × 2.5 cm, alternate, elliptic, lanceolate. *Inflorescence* raceme, 10-15 cm long, 10-12 flowered. *Flowers* 13 mm long, green, with dull purple lip. *Bracts* long, ovate-lanceolate. *Sepals* the dorsal linear, blunt, spreading, laterals broadly ovate, 5-nerved, recurved. *Petals* spatulate, with three veins from the base, lateral further branched. *Lip* obovate, concave, with two teeth like calli near the base, apex broad, emarginate, crenulate, erose to almost entire. *Column* not curved, upper half hook like from the large rounded crenulate wings.

*Flowering*: July - August.

*Distribution*: Himalaya 1800-2400 m (Himachal Pradesh to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram, Bengal, Bihar, Burma, China, Cambodia, Vietnam, Taiwan & Japan.

Specimens examined:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 22995; Near Mussoorie, *Mackinnon* 21775. **Tehri-Nagtibba**, *Mackinnon* 21775(a).



Kalakoti 509

Fig. 171 *Liparis paradoxa* Rchb. f. - a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. column.

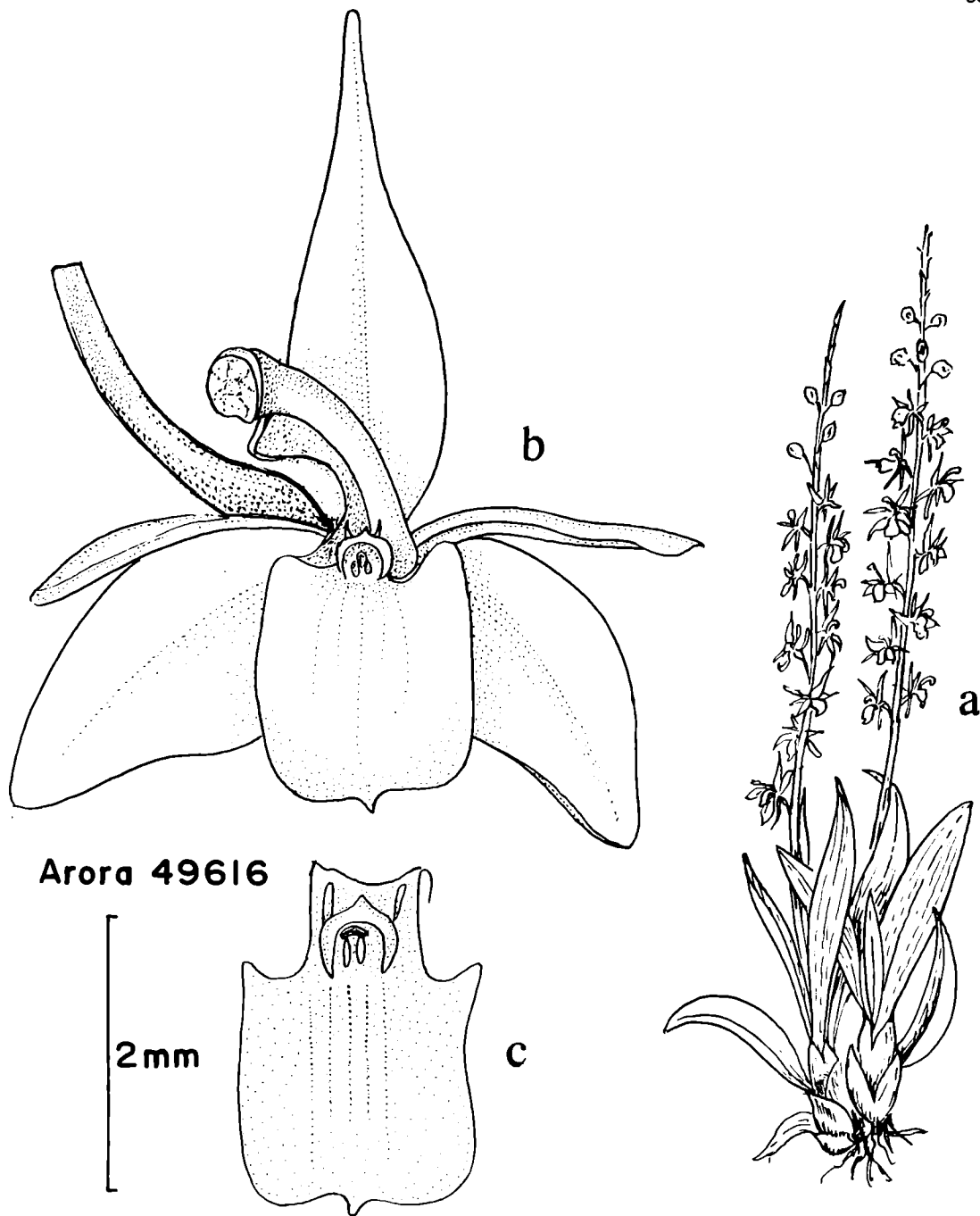


Fig. 172 *Liparis platyrchis* Hook. f. — a. plant; b. flower; c. lip.

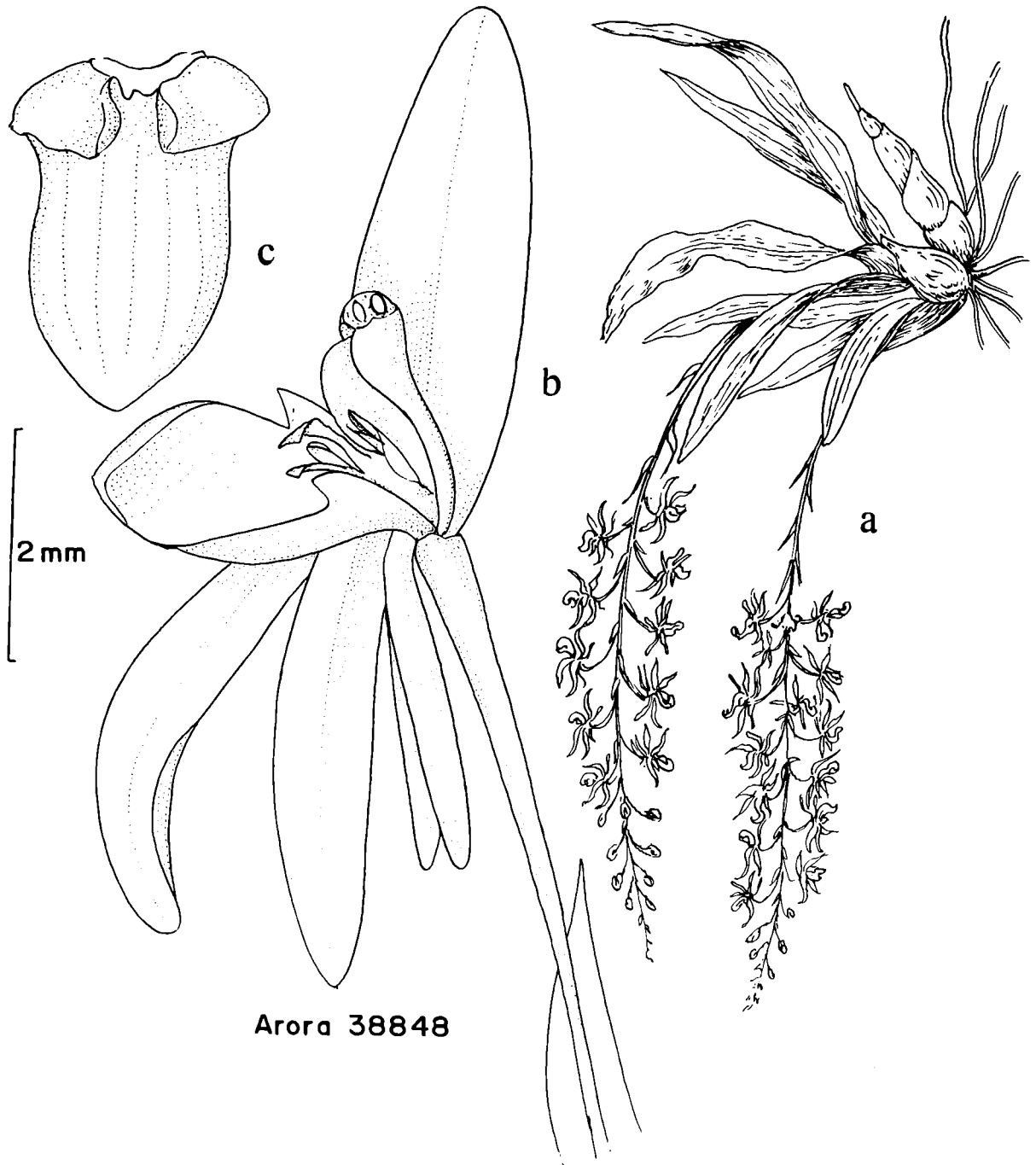


Fig. 173 *Liparis resupinata* Ridl.—a. plant; b. flower; c. lip.



KUMAUN: **Pithoragarh**-Binsar, *Inayat* 24110(a); Boripatu Gori Valley, *Inayat* 24110(b); Dafiadhura, *Arora* 70830 & 70831. **Nainital**-Nainital, *Kalakoti* 509, Shimola near Nainital, *Inayat* 24110; Ramgarh, *Falconer*. **Almora**-Almora, *Jameson*.

HIMACHAL PRADESH: Shimla, Below Saog Mahasu, *Gamble* 6437.

Spathulate 3-veined petals, with the lateral veins further branched and the longer lanceolate floral bracts easily distinguish it from *L. nervosa* from which it is often confused (see note under *L. nervosa*).

**Liparis platyrachis** Hook. f., Ic. Pl. 19. t. 1890, 1889 et 5: 706. 1890; King & Pantl. 34, t. 45. 1898; Seidenf., 92, fig. 62. 1976; Arora, 298. 1978 (Fig. 172)

Epiphytic. *Pseudobulbs* tufted, oblong, compressed, 12 mm long. *Leaves* 3-5, linear-lanceolate, acute, 1.5-3 × 0.3-0.5 cm. *Inflorescence* 4-10 cm long, pendulous; raceme semi-dense, with winged rachis, many flowered. *Flowers* 6-7 mm long, pale ochraceous-yellow. *Bracts* subulate, much shorter than the ovary. *Sepals* elliptic (when flattened out), edges recurved, the dorsal narrower than laterals. *Petals* linear, blunt, decurved, edges revolute. *Lip* quadrate, oblong, lobes at base pointing upwards, apex broad truncate to rounded with a short apiculus at its centre. *Column* front triangular, wings without any filiform process.

*Flowering*: August.

*Distribution*: Himalaya 1500 m (Kumaun to Arunachal Pradesh). Yunnan in China.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Dafiatop, *Arora* 44616, 52436 & 66186.

**Liparis resupinata** Ridley in J. Linn. Soc. Bot. 22: 290. 1886; Hook. f., 5: 705. 1890; King & Pantl. 36, t. 48. 1898; Seidenf., 88, fig. 60. 1976.

*L. ridleyi* Hook. f. Ic. Pl. t. 1887. 1889; Hook. f., 5: 705. 1890; Arora, 438. fig. 1-5. 1969. (Fig. 173)

Epiphytic. *Pseudobulbs* tufted, sheathed, 1.5-4 cm long. *Leaves* 2-4, membranous, alternate, linear-lanceolate, semi-pendulous, raceme numerous-flowered. *Flowers* 8 mm across, brownish-yellow and having odour of raw blood. *Bracts* linear, shorter or longer than the ovary. *Sepals* straight, oblong, obtuse, 1-nerved. *Petals* linear, obtuse, spreading. *Lip* broadly oblong or ovate, sagittate with lobes pointing outwards, apex broad, slightly triangular. *Column* front triangular, wings with a filiform downward turned process from each wing.

*Flowering*: December - January.

*Distribution*: Himalaya 1600-2200 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram, Tamil Nadu. Thailand, China.

*Specimen examined*:

KUMAUN: **Pithoragarh**-Thalkedar, *Arora* 38848.

We have not observed that the incurved apex of the lip forms a small pouch as illustrated by Seidenfaden (fig. 60, 1976). However the plant can be easily identified by the very distinct filiform tail-like process produced by the teeth of the wings of the column.

**Liparis rostrata** Rchb. f., in Linnaea 41: 44, 1876; Hook. f., 5: 694. 1890; Duthie, 91. t. 96. 1906; Stewart, 71. 1972; Seidenf., 20. fig. 10. 1976; Renz, 50. 1984.

*L. diodon* Rchb. f. in Linnaea 41: 43. 1876; Hook. f., 5: 693. 1890; Duthie, 91. 1906. (Fig. 174)

Terrestrial. *Pseudobulbs* 1.5-2 cm, tufted, on short rootstock. *Stem* 2.5-7.5 cm with two obtuse sheaths. *Leaves* two, opposite, 10 × 3-5 cm, base petiolate. *Inflorescence* 15-20 cm; raceme 5-15 cm, laxly flowered.

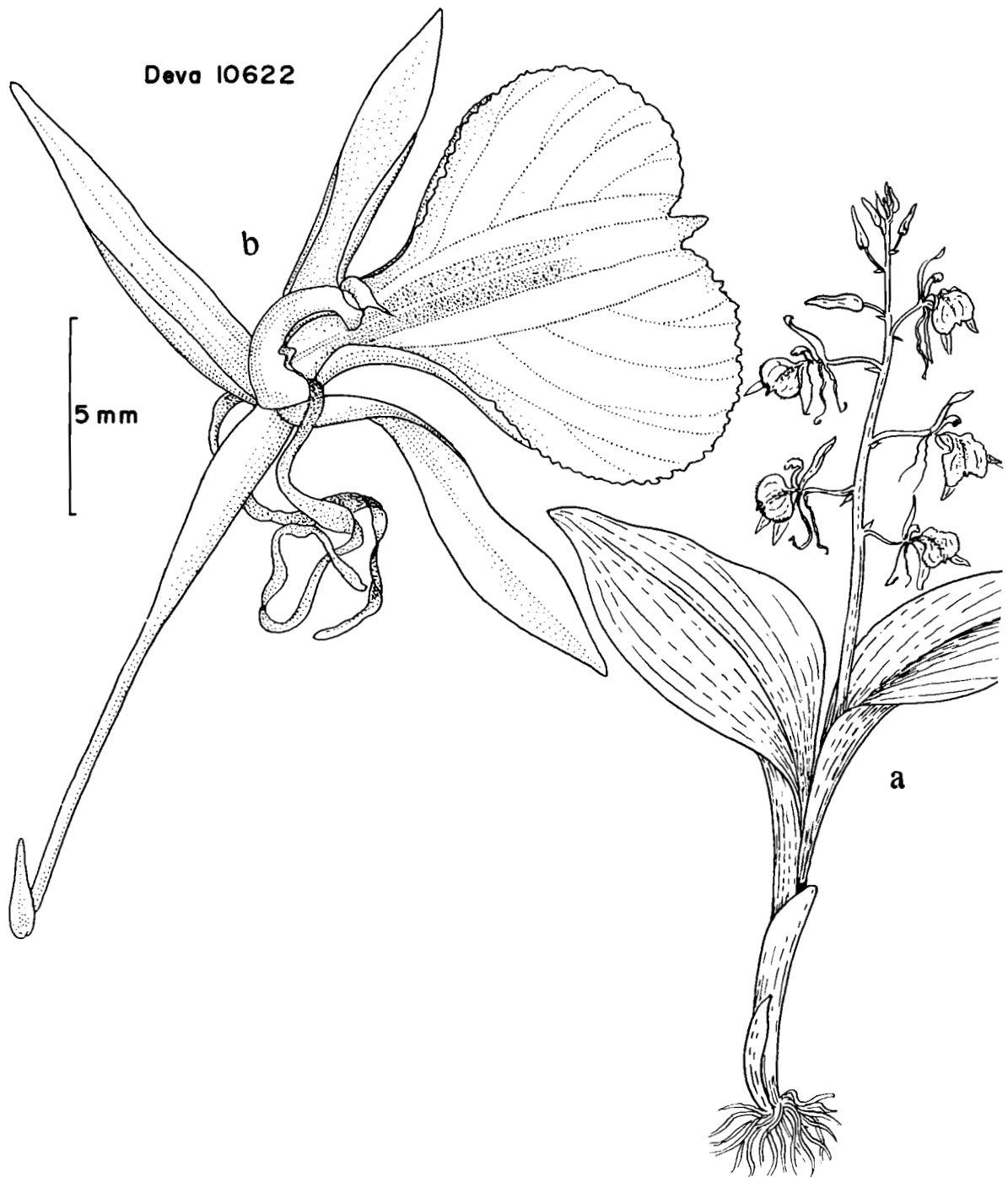


Fig. 174 *Liparis rostrata* Rchb. f. — a. plant; b. flower.

Flowers large, ca 2 cm across. *Sepals* 3-nerved, narrowly lanceolate or spatulate, margins reflexed, the dorsal with cordate base. *Petals* reflexed, linear, one veined, as long as sepals, yellow-green. *Lip* flat, without callus, broadly obcordate, apiculate, margin crenulate, green flushed with purple, base channelled. *Column* with two knob like protuberances near the base. *Anthers* with broad triangular beak.

*Flowering*: July -August.

*Distribution*: Himalaya 1500-2500 m (Pakistan, Kashmir to Sikkim).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 21773(b) & (c), 22971, *Duthie* 23108, *Saxena* 937 & 2043, *Arora* 2850 & 36467; Camel Back Road, *Deva* 10662, *Renz* 13577, *Naithani* 987; Chakrata-Jaunsar, Matakangra, *B.B. Osmaston* 21774; Kanasar-konain Road, *Raizada* 7726; Chakrata, *Raizada* 18309, *Mishra* 38094. Tehri-Nagtibba, *Ramsukh* 22971(a), *Bhattacharyya* 33720; Melkhuli, *Bhattacharyya* 31149. Pauri-Botanical Garden, *A.S. Rao* 56390; Above Khirsu, *Renz* 13631; Khirsu, *Naithani* 1052. **Chamoli**-Way to Dunagiri, *Naithani* 54077.

KUMAUN: **Pithoragarh**-Thalkedar, *Arora* 38422. **Nainital**-Tonnochy Road, *Champion*. **Almora**-Binsar, *Vohra* 58070; Ranikhet to Chaubatia, *Renz* 13599.

HIMACHAL PRADESH: Shimla, Deha-Chopal Road, *Raizada* 13044; Bashahr, Between Panchut & Ramni, Jaranda Range, *S.P. Sethi* 20316.

PAKISTAN: Murree Hills, Rawalpindi, Hazara (*Renz, loc. cit.*)

*L. diodon* considered conspecific, was collected only once from Dehra Dun and was cultivated by W. Sanders in his nursery at Edinburgh in 1872. The specimen was sent to Reichenbach for identification, but as Sanders wanted to keep his plant alive under cultivation he sent only a single leaf and the inflorescence. This caused a great confusion as Reichenbach described it a new species distinct from *L. rostrata*, characterised by a solitary leaf. This fact was repeated by Hook. f. and Duthie both, and *L. diodon* was considered as a distinct species, till Seidenfaden in 1976 proved it convincingly that both the species are identical. On the type sheet in Herb. Reichb., there is a sketch which has two leaves exactly like *L. rostrata*.

**Liparis viridiflora** (Bl.) Lindl. Gen. & Sp. Orch. 31. Apr. 1830 p.p.; Hook. f., 5: 704. 1890 p.p.; Seidenf., 82. fig. 55, 1976.

*Malaxis viridiflora* Bl. Bijdr. 392. 1825.

*L. longipes* Lindl. in Wall. Pl. Asiat. Rar. 1:31, t. 35. (Apr. 1830); Lindl. Gen. & Sp. Orch. 30 (Apr.-Jun. 1830); Hook. f., 5: 703, 1890; King & Pantl. 29, t. 37. 1898; Duthie, 93. 1906. (Fig. 175)

Epiphytic. *Pseudobulbs* tufted, orbicular, compressed laterally, 7-15 cm long. *Leaves* two, 7.5-15 × 2-2.5 cm, from the apex of pseudobulb, oblong, lanceolate, base tapering. *Inflorescence* erect, 8-12 cm long; raceme densely flowered. *Flowers* 7 mm long, pale yellowish-green. *Bracts* linear-lanceolate, shorter than the ovary. *Sepals* linear-oblong, sub-acute. *Petals* shorter than sepals, linear, reflexed. *Lip* without callus, recurved, broadly oblong, apex rounded, entire, shortly apiculate or not. *Column* not winged or thickened at the base.

*Flowering*: September - October.

*Distribution*: Himalaya 1500-2000 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram, Manipur, Tripura, Tamil Nadu. Burma, China, Taiwan, Laos, Vietnam, Malaya, Sumatra, Phillipines, Sri Lanka, Malaya.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 24184 & 25433, *Falconer*. **Pauri**-Outer Garhwal Hills, *Inayat* 25838.

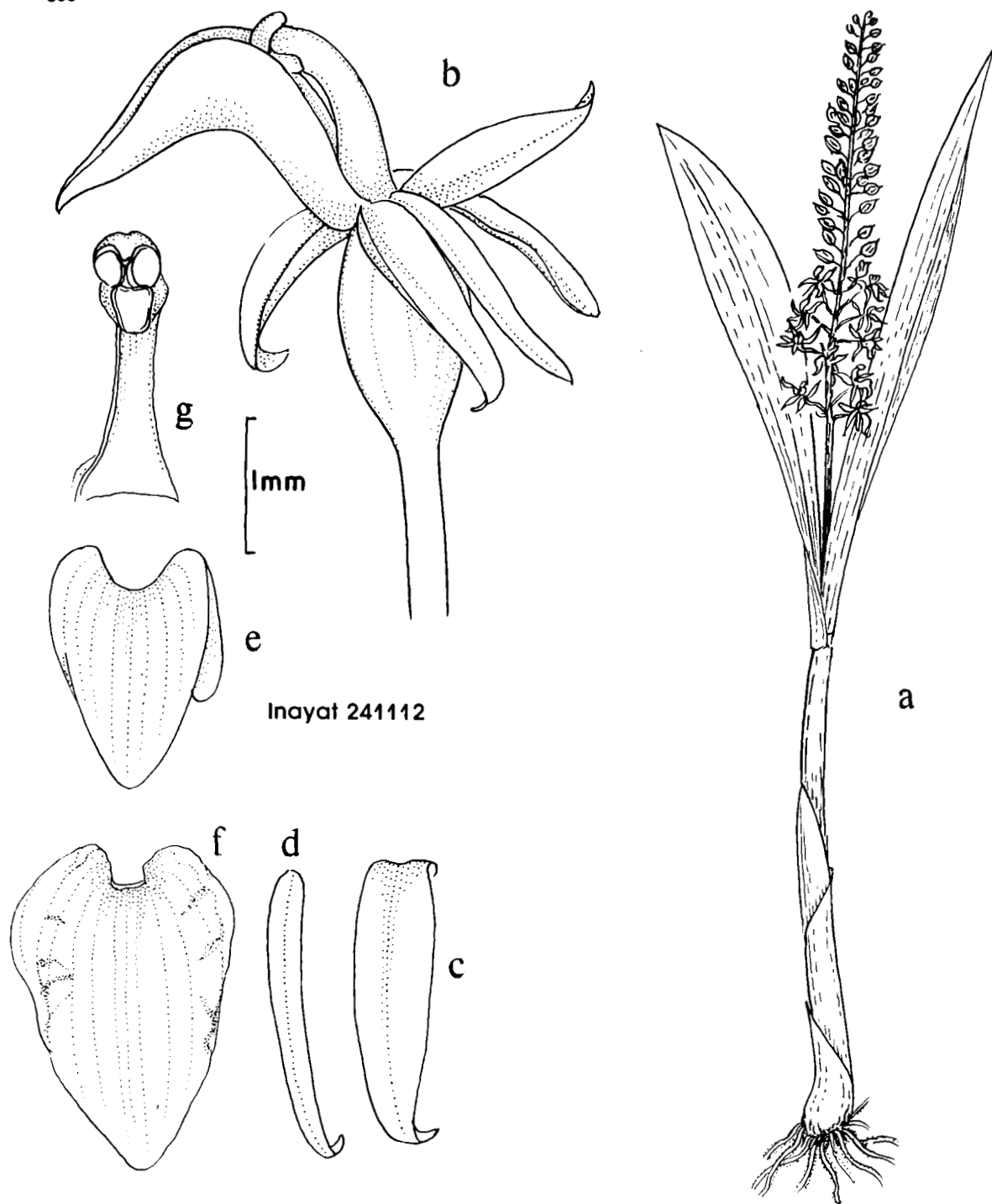


Fig. 175 *Liparis viridiflora* (Bl.) Lindl. —a. plant; b. flower; c. sepal; d. petal; e. & f. lip; g. column.

KUMAUN: Pithoragarh-Khela, Kali Valley, *Inayat* 24112; Between Bering and Munkata, *D.D. Awasthi* 1534; Gargia-Baram, *Bhattacharyya* 21265; Askot, *Arora* 37809 & 35825, *Bhattacharyya* 21153; Thal, *M.A. Rau* 35345, *Arora* 36403; Dafiadhura, *Arora* 45565.

*Liparis viridiflora* as considered by Hook. f. (1890) and King & Pantl. (1898) is a very different species and is probably conspecific with *L. elliptica* Wight.

#### Malaxis Sol. ex Sw.

Terrestrial, sometimes epiphytic, often with pseudobulbs. *Leaves* one or more, membranous, plicate, usually with sheathing leaf base. *Flowers* small, green, purple or yellow, arranged in terminal racemes. *Sepals* spreading or recurved, sub-equal. *Petals* narrower. *Lip* adnate to the base of the column, flat or concave, with or without basal auricles, apex entire, emarginate, 2-lobed or with several teeth. *Column* short with short spreading arms. *Anther* sub-terminal, bilocular; *pollinia* 4, ovoid or obovoid.

#### Key to species

1. Sides of the lip produced into auricles, stretching backwards on both sides of the column; lip usually flat .....2
- + Sides of the lip not produced into auricles, not stretching backwards on both sides of the column; lip concave, fleshy.....5
2. Apex of the lip emarginate or bilobulate, not entire, column without prominent protruding appendages .....3
- + Apex of the lip entire; column with conspicuous protruding, rounded appendages; lip with two triangular calli..... *M. biauriata*
3. Plants with only two radical leaves, rarely three, sessile, with cordate amplexicaule base, and almost rounded apex ..... *M. mackinnonii*
- + Plants with three to several leaves, base sheathing, apex acute to acuminate.....4
4. Sides of the apical part of the lip with straight edges from the base to the apex, without any indentation and separation of the apical part from the basal part, apex slightly notched to bilobulate.....  
.....*M. acuminata*
- + Sides of the apical part of the lip with indentation, separating the apical part as a distinct lobe from the basal part, the apex deeply bilobed.....*M. purpurea*
5. Leaves three or more, lanceolate; lip with a transverse callus in front of the column, margins not thickened, apical part distinctly 3-lobed, apex broadly rounded; flowers yellow.....*M. latifolia*
- + Leaves one or two only; lip without a transverse callus in front of the column, margin thickened almost forming a rim, usually denticulate, rarely entire, apical part obscurely lobed or unlobed; flowers yellowish-green.....6
6. Leaf one; lip not lobed, margin thickened, entire to denticulate, apex produced in a short fleshy beak with almost rounded tip ..... *M. cylindrostachya*
- + Leaves two; lip 3-lobed by a notch near the centre, side lobes obscure, apex produced into a long narrow beak with acute to acuminate tip .....*M. muscifera*

**Malaxis acuminata** D. Don, Prodr. Fl. Nepal 29. 1825; Seidenf., 55, fig. 43, 44, 1978.

*Microstylis wallichii* Lindl. Wall. Cat. No. 1938, 1828 *nom. nud.*, Gen. & Sp. Orch. 20, 1830; Hook. f., 5: 686, 1890; King & Pantl. 15. t. 18, 1898; Duthie, 87. 1906.

*Microstylis biloba* Lindl. Wall. Cat. no. 1940/1. 1828 *nom. nud.*, Gen. & Sp. Orch. 20. 1830.

*Microstylis wallichii* var. *biloba* (Lindl.) Hook. f., Fl. Brit. Ind. 5: 686. 1890.

*Malaxis biloba* (Lindl.) Ames. Orch. 2: 112. 1908.

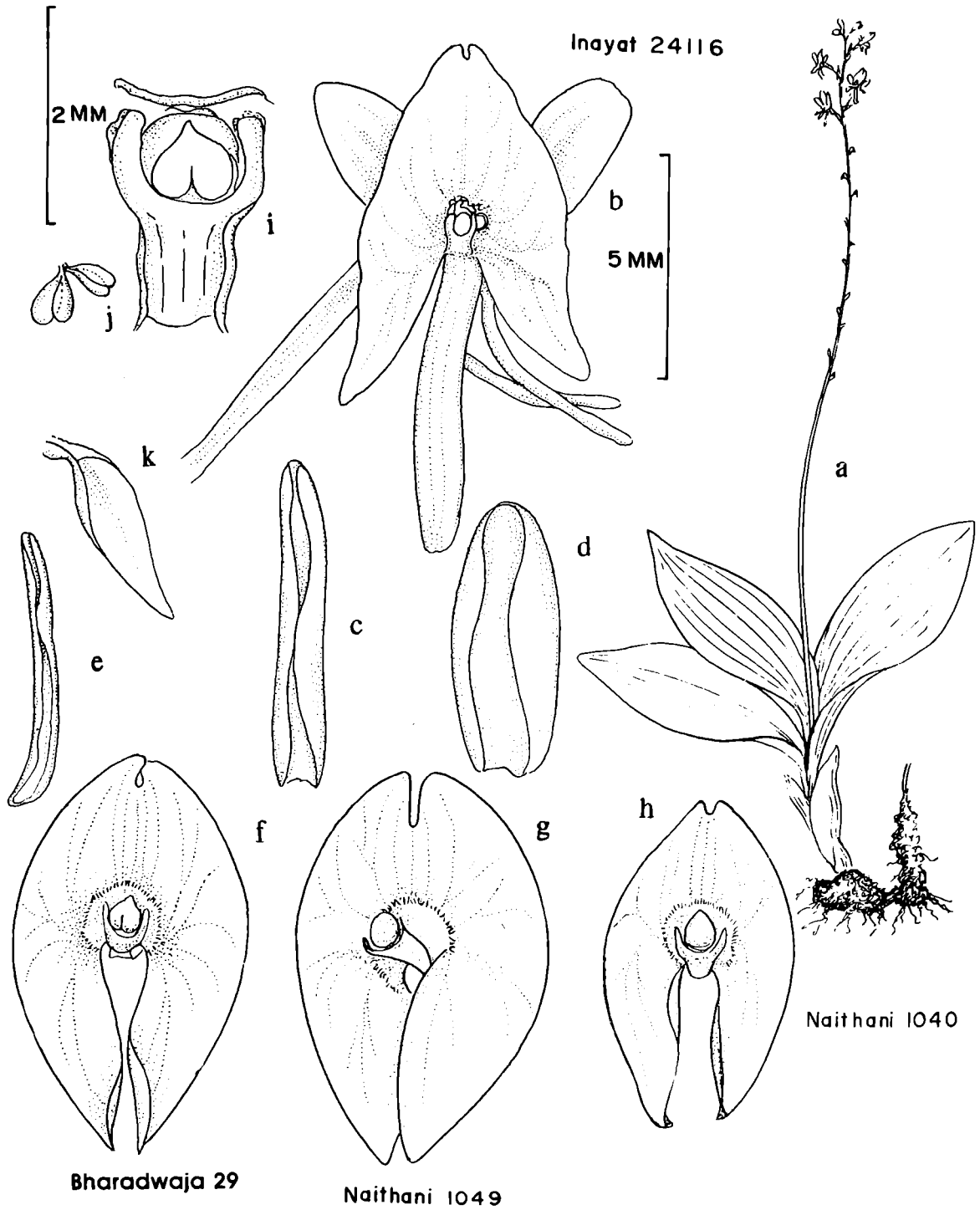


Fig. 176 *Malaxis acuminata* D. Don—*a.* plant; *b.* flower; *c.* dorsal sepal; *d.* lateral sepal; *e.* petal; *f.*, *g.* & *h.* tip; *i.* column; *j.* pollinia; *k.* bract.

*Malaxis acuminata* var. *biloba* (Lindl.) Ames Bur. Sci. Publ. 18: 302. 1925; Hunt, 78. 1970.

*Malaxis wallichii* (Lindl.) Deb. in Bull. bot. Surv. Ind. 3: 128. 1962.

*Malaxis acuminata* forma *biloba* (Lindl.) Tuyama in Hara Fl. E. Himal. 1: 443. 1966.

*Malaxis rheedii* sensu Seidenf. & Arora in Nord. J. Bot. 2: 21. 1982. *non* Sw. (Fig. 176)

Terrestrial. *Stem* 10-25 cm high, pseudobulbous. *Leaves* usually 3 or more, 11 × 5-6.5 cm, membranous, ovate, acute or acuminate, margin undulate, upper sessile, lower one with sheathing base. *Flowers* yellowish-green with purple tinge near the centre, ca 10 mm in diameter. *Bracts* lanceolate. *Sepals* oblong, the laterals broad and oblong, 3-5-nerved; dorsal shorter than laterals, 1-3-nerved, sub-acute. *Petals* linear, 3-nerved, longer than sepals. *Lip* shield-like, narrowly ovate, slightly convex, tip notched or bilobulate, auricles straight and slightly overlapping. *Column* with fleshy rounded arms.

*Flowering*: July - August.

*Distribution*: Himalaya 1800-2300 m (Himachal Pradesh to Arunachal Pradesh), Meghalaya, Assam, Nagaland, Manipur, Mizoram, Tripura, Madhya Pradesh. Thailand, China, Burma, Indo-China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, Camels Back Road, *Saxena* 1992; Kampti fall, *Gollen*, *Mackinnon* 22792(a) & (b); Below Mussoorie, *Harmusji* 21778; Jharipani, *Arora* 38880, *Deva* 5074; Tolgate, *Pant* 58512; above Barlowganj, *Renz* 13578; Chakrata, Jaunsar, *Bhattacharyya* 14878; *Mishra* 33021. **Tehri-Magra**, *Bhattacharyya* 31187; Suakholi, *Naithani* 1006; Phakot, *Bharadwaja* 29. **Pauri**-Pauri-*Naithani* 481; Padekhal between Pauri & Khirsu, *Naithani* 1049, *Renz* 13628. **Chamoli**-Nagnath, *Surendra Singh* 31576; Kanol, *M.A. Rau* 10337; Ukhimath, *M.A. Rau* 38875; Gopeshwar, *M.A. Rau* 28590; Phata, *Nair* 35921 & 35924; Mandal near Gopeshwar, *Naithani* 1040, *Renz* 13628.

KUMAUN: **Pithoragarh**-Sarju Valley, *Inayat* 241166; Berenag, *Parker* 2032; Didihat, *Arora* 35104, 36487, 36488, 37875 & 41361; Dafiadhura, *Arora* 36499, 49509 & 50028, 53279; Thal Kedar, *Arora* 38837; Pithoragarh, *Arora* 28590. **Nainital**-Nainital, *Inayat*, 24116(a); Ramgarh, *Inayat* 24116. **Almora**-Ranikhet, *T.A. Rao* 4780, *Wadhwa* 57305; Between Ranikhet and Chaubattia, *Renz* 13626.

HIMACHAL PRADESH: Khajiar to Chamba, *Lace* 1604; Way to Rani forest, *S.K. Malhotra* 29018.

*Arora* 53279, which was identified as *M. rheedii* Sw. is in a late fruiting stage, with only the upper two leaves intact and the lower leaves having been decayed. However even under this poor condition it can be matched with similar specimens of *M. acuminata*. About the separation of *M. biloba* as a species or a variety cf. Seidenf., fig. 43, 1978 who has every convincingly shown that it is not distinct; moreover specimens quoted by Duthie (1906) from Western Himalaya as variety *biloba* are not available and we have not been able to examine them.

**Malaxis biaurita** (Lindl.) O. Ktze., Rev. Gen. 2: 673. 1891; Seidenf., 67, fig. 46. 1978; *Deva* 242. fig. A-C. 1982; *Kataki et al.* 5: 23. 1984.

*Microstylis biaurita* Lindl., Wall. Cat. no. 1941. 1828 *nom. nud.*, Gen & Sp. Orch 20. 1830; Hook. f., 5: 687. 1890. (Fig. 177)

Plant 20 cm high. *Stem* conical, 3 cm long, pseudobulbs covered with leaf sheaths. *Leaves* ovate-lanceolate, upto 12 × 4 cm, sessile with sheathing leaf-base, 5-7 nerved, apex acuminate. *Flowers* 8-10 mm, reddish-purple. *Bracts* lanceolate. *Sepals* the dorsal longer, acute, the laterals ovate, shorter, obtuse. *Petals* linear with recurved margins. *Lip* ovate, basal auricles triangular, tip acute, divergent or overlapping, apical portion with acute entire apex, and two triangular calli one on each side of the centre. *Column* short with two protruding prominent round appendages.

*Flowering*: July - August.

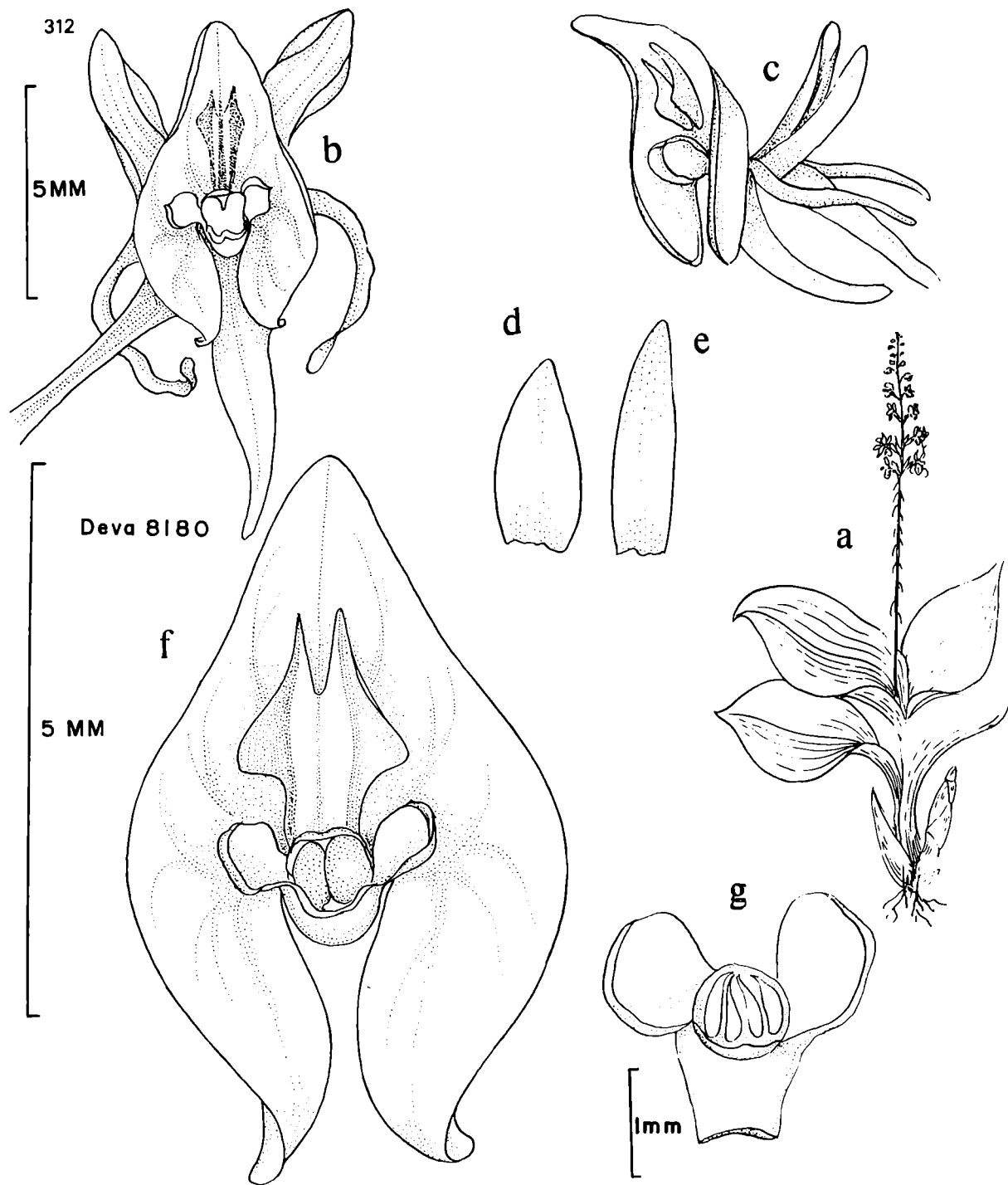


Fig. 177 *Malaxis biaurita* (Lindl.) O. Ktze. —a. plant; b. & c. flower; d. lateral sepal; e. dorsal sepal; f. lip; g. column.



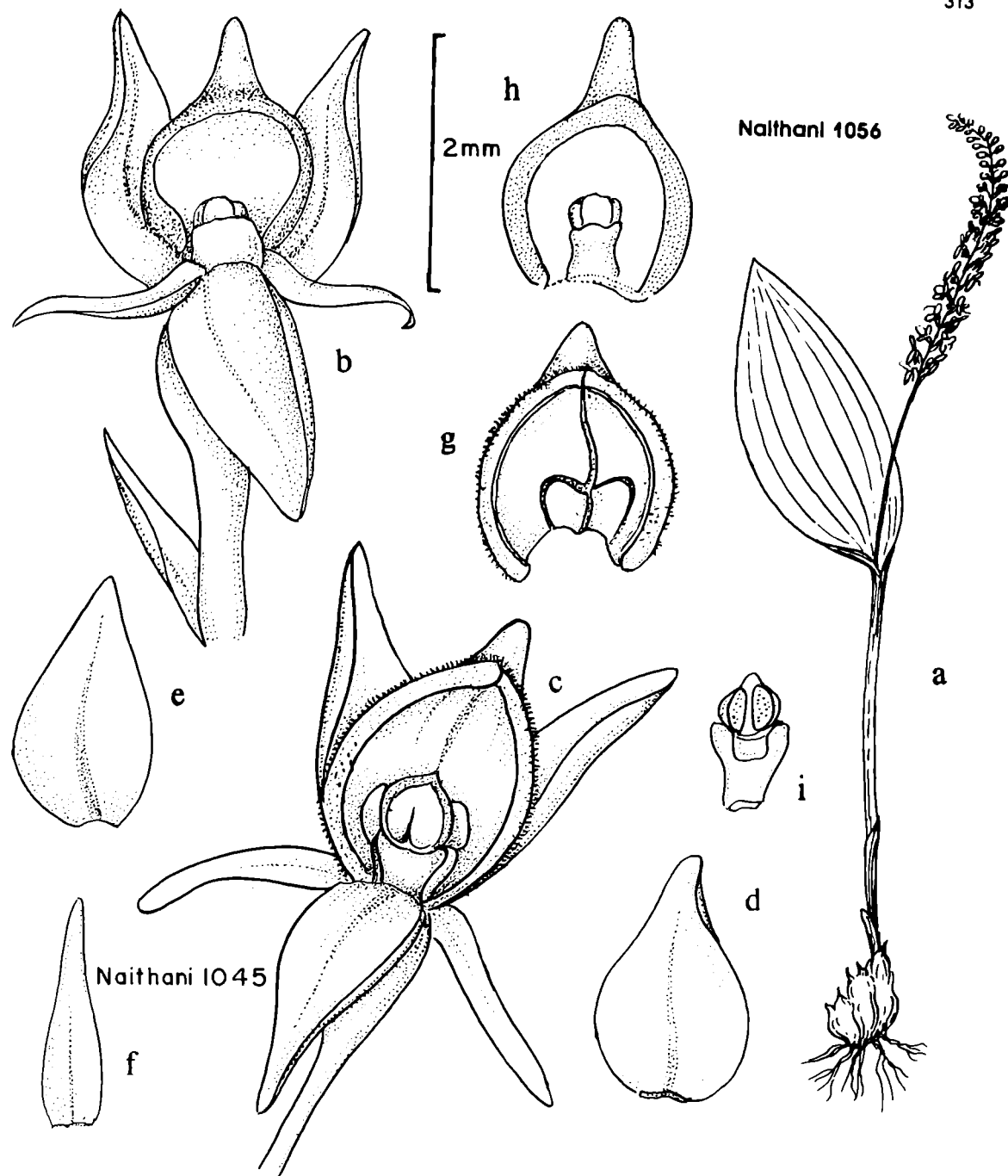
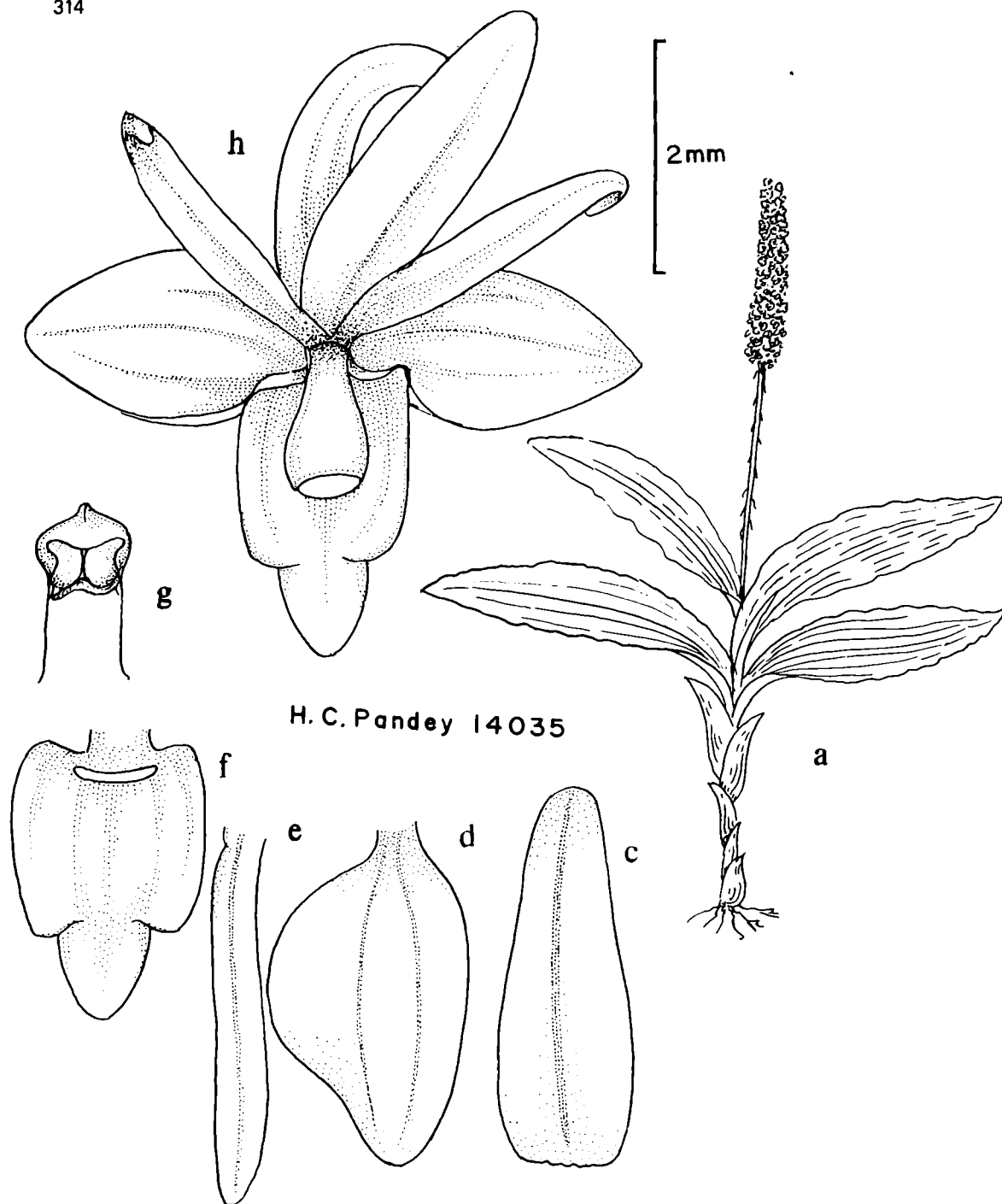


Fig. 178 *Malaxis cylindrostachya* (Lindl.) O. Ktze. —a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. lip; h. column & lip; i. column.



**Fig. 179** *Malaxis latifolia* J.J. Sm. — a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. column.

*Flowering:* July - August.

*Distribution:* Himalaya up to 800 m (Dehra Dun & Arunachal Pradesh), Meghalaya. Indo-China, Thailand, Burma.

*Specimens examined:*

GARHWAL: **Dehra Dun Valley**-Laxmansidh, *Deva* 8180 & 8529.

It is presumed that it will also be found east of Dehra Dun in similar situation along the base of Himalaya. Externally the plant resembles with *M. acuminata* D. Don, and can easily be confused with it. However on closer examination, the triangular calli along with the protruding round appendages from the column easily distinguishes it. It also very closely resembles to *M. andamanica* (Lindl.) Balak. & Rao (1979) as far as the tip of the lip is concerned, but the absence of protruding appendages and calli easily distinguish it from that species also (Deva, 242. 1982).

**Malaxis cylindrostachya** (Lindl.) O. Ktze., Rev. Gen. 673. 1891; Stewart, 72. 1972; Renz, 51. 1984.

*Microstylis cylindrostachya* (Lindl.) Rchb. f. Walp. Ann. 6: 207. 1861; Hook. f., 5: 689. 1890; King & Pantl. 20, t. 24, 1898; Duthie, 88. 1906.

*Dienia cylindrostachya* Lindl. Wall. Cat. no. 1934. 1824 *nom. nud.*, Gen. & Sp. Orch. 23. 1830.

(Fig. 178)

Terrestrial with small conical tubers. *Stem* 4-30 cm high, sheathed with 2-3 tubular sheaths. *Leaf* solitary, 3-10 × 2-5 cm, elliptic, sub-acute, margin undulate. *Flower* 3.5 mm across, greenish-yellow. *Bracts* lanceolate. *Sepals* sub-equal, ovate, acuminate. *Petals* acute, linear-lanceolate. *Lip* fleshy, broadly ovate, excavated, margins thickened, angled and denticulate, at apex produced into a fleshy beak, upper surface with a raised central line from base to apex, and two concavities immediately under the column; *pollinia* divergent, sub-ovoid.

*Flowering:* July - August.

*Distribution:* Himalaya 2400-3500 m (Kashmir to Arunachal Pradesh). China and Burma.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, *Duthie* 21777(a), *Saxena* 1256; Chakrata, Jaunsar, *Raizada* 7166, 18224, *Mishra* 38071, *Bhattacharyya* 16035. **Tehri-Nagtibba**, *Naithani* 1058 & 1077, *Bhattacharyya* 33724 & 33725, *Mackinnon* 21777(c); Palligad, Nagtibba, *Deva* 9590; Suakholi, *Renz* 13637; Buranskhanda, *Naithani* 1056. **Uttarkashi**-Ganga Valley, Birch Wood above Jhalla, *Duthie* 2065. **Chamoli**-Mandakni, *M.A. Rau* 38653; Above Mandal, *Naithani* 1045; Chopta Pass, *Renz* 13636.

KUMAUN: **Pithoragarh**-Dafiadhura, *Arora* 49618; Nagling Darnav, *Inayat* 241174; Kali Valley, *Duthie* 3417; Bakriudiyar, *Arora* 49627. **Nainital**-Nainital, *Duthie* 4430, *Champion* 6126; Naina Peak, *Renz* 13600. **Almora**-Binsar, *Vohra* 58091.

HIMACHAL PRADESH: Shimla-Fagu Road, *Raizada* 10019; Kothi, *V.K. Sharma* 19061; Dharmsala, *S.K. Malhotra* 29043.

JAMMU & KASHMIR: Bhadarwar (Stewart, *loc. cit.*; Renz, *loc. cit.*).

**Malaxis latifolia** J.E. Sm., in Rees. Cyclop. 22. 1822; Seidenf., 33; 45. fig. 35. 1976; Jayaweera, 2: 42. 1981.

*Microstylis congesta* (Lindl.) Rchb. f., Walp. Ann. 6: 206. 1861; Hook. f., 5: 689. 1890; King & Pantl. 19. t. 23. 1898.

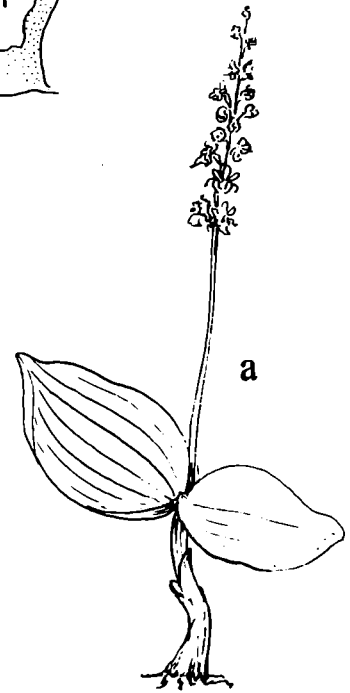
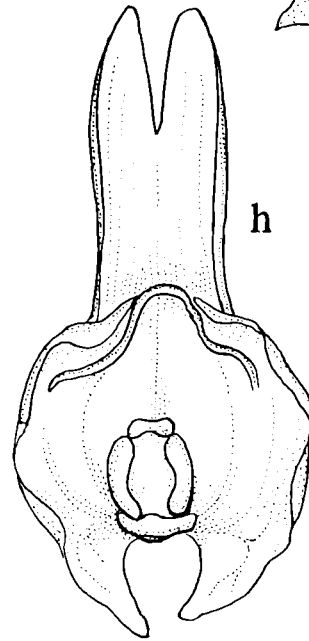
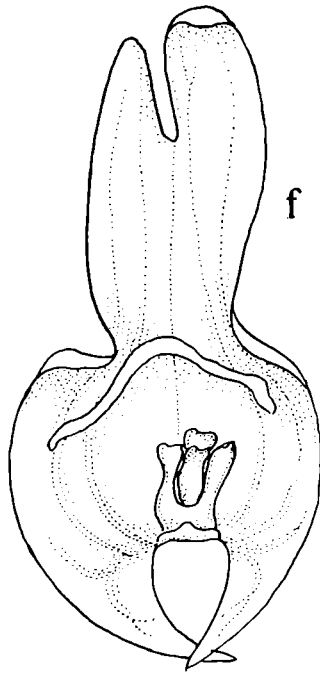
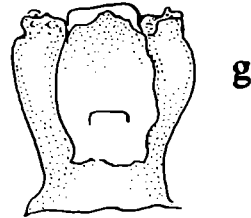
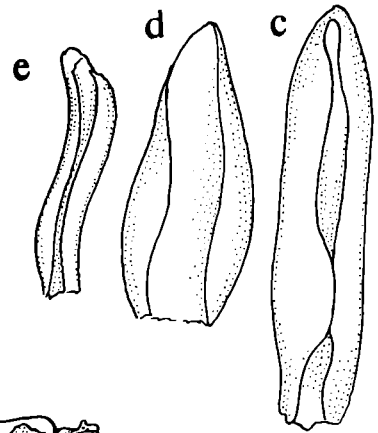
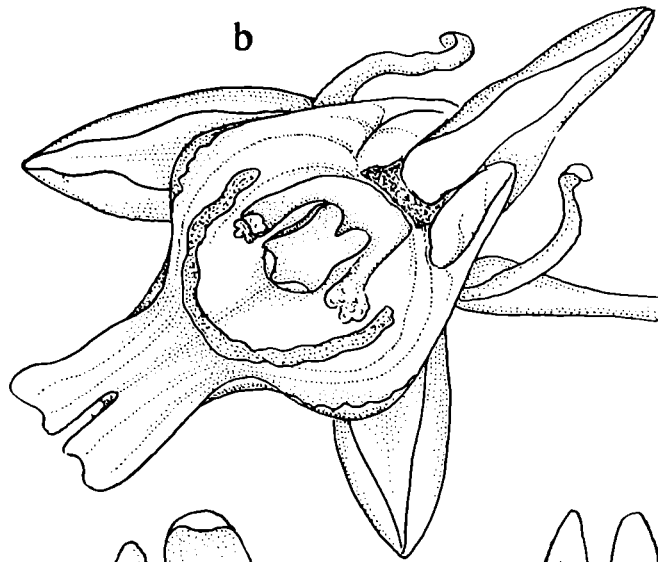
*Dienia congesta* Lindl. in Edew. Bot. Reg. 10: sub. t. 825. 1824.

*Microstylis latifolia* (J.E. Sm.) J.J. Sm., Fl. Buitenz. 6: 248. fig. 135. 1905.

*Malaxis congesta* (Lindl.) Deb in Bull. bot. Surv. Ind. 3: 128. 1961

(Fig. 179)

Mackinnon 25429



Deva 5855

Deva 2685

Fig. 180 *Malaxis mackinnonii* (Duthie) Ames—*a.* plant; *b.* flower; *c.* dorsal sepal; *d.* lateral sepal; *e.* petal; *g.* & *h.* lip & column.

Terrestrial. *Stem* 5-15 cm tall, pseudobulbous. *Leaves* three or more, sessile or petioled, lanceolate, 10-20 cm long, margin wavy. *Flowers* yellow, small, dense. *Bracts* subulate, lanceolate, as long as the ovary. *Sepals* the dorsal oblong, margins recurved; the laterals large, oblong-obtuse, deflexed. *Petals* linear, obtuse. *Lip* ovate-oblong, concave, with a transverse callus in front of the column, margins not thickened, apical part distinctly 3-lobed, the apex broadly rounded.

*Flowering*: July - August.

*Distribution*: Himalaya (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram, Tripura, Manipur, Andaman Island, Deccan. Sri Lanka, Burma, China, Philippines, Laos, Cambodia, Vietnam, Sumatra, Java, New Guinea, Thailand and Australia.

*Specimen examined*:

KUMAUN: **Almora**-Near Ranikhet, H.C. Pandey 14035.

**Malaxis mackinnonii** (Duthie) Ames Orch. 6: 289. 1920; Seidenf., 50. fig. 38. 1978; Saxena, 88. 1971.

*Microstylis mackinnonii* Duthie in J. As. Soc. Beng. 71(2): 37, 1902 et 88. t. 95. 1906.

*Microstylis cordonii* Prain, Beng. Pl. 1004, 1903; Haines, 1165. 1924.

(Fig. 180)

Plant 8-20 (- 40) cm high. *Stem* underground with round pseudobulbs. *Leaves* usually 2, rarely 3, radical, flat on the surface of ground, ovate, usually obtuse, upto 6 × 4 cm, sessile, base cordate, amplexicaule, 3-7-nerved. *Scapes* quadrangular. *Flowers* small, sessile, 4-5 mm, reddish-purple to yellow. *Bracts* persistent, 5 mm long, deflexed. *Sepals* ovate-lanceolate, unequal, margins infolded. *Petals* linear, shorter than the sepals, reflexed. *Lip* ovate-oblong, constricted near the middle with a raised ridge dividing the apical and basal portions; the basal auricles with inner margin contiguous and overlapping at tip, apical portion with deeply divided 2-lobes. *Column* short, with fleshy round arms.

*Flowering*: July - September.

*Distribution*: Himalaya up to 1500 m (Garhwal). Bihar, Orissa, Madhya Pradesh, Gujarat. North Thailand and Yunnan in China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Kalanga Hill, Mackinnon 25429; Mussoorie, Mackinnon 21779; Rajpur, Deva 5855; Nalapani, Deva 2685.

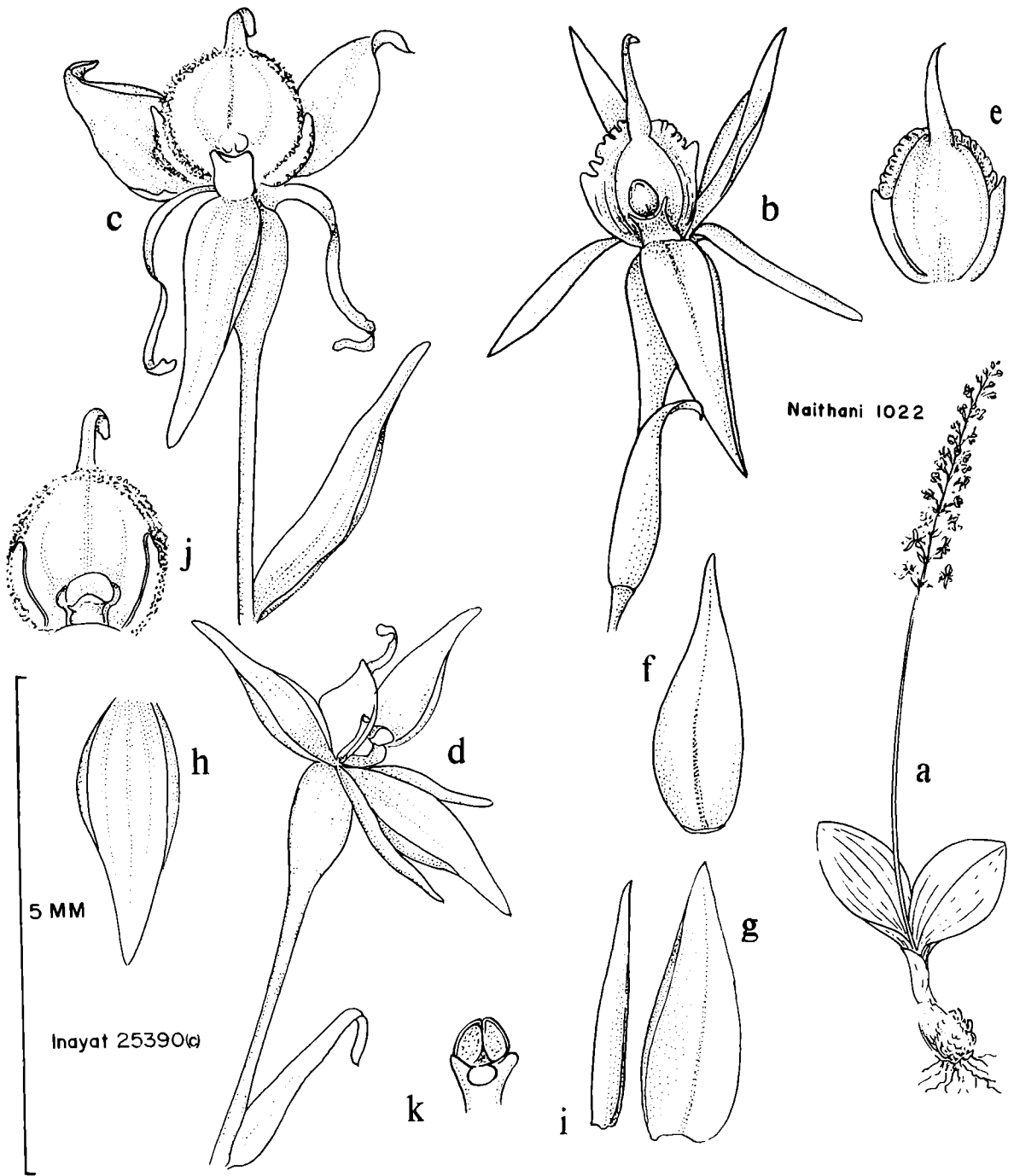
This plant was first discovered by P.W. Mackinnon from Kalanga hills Dehra Dun (Type: Mackinnon 25429, DD) and Duthie considered it to be endemic. Since then it has been found not only from other parts of India, but also from Yunnan in China and North Thailand. Except the much smaller size, the lip resembles very much with *M. acuminata*, however the radical ovate leaves flat on the surface of the ground, easily distinguish this species from others.

**Malaxis muscifera** (Lindl.) O. Ktze. Rev. Gen. Pl. 2: 673. 1891; Stewart, 72. 1972; Renz, 51. 1984.

*Microstylis muscifera* (Lindl.) Ridley in Journ. Linn. Soc. Bot. 24: 333. 1888; Hook. f., 5: 689. 1890; King & Pantl. 20. t. 25. 1898; Duthie, 89. 1906; Renz, 140. 1978; Naithani et al. 8: 333. 1985.

*Dienia muscifera* Lindl. Wall. Cat. no 1935. 1828 *nom. nud.*, Gen & Sp. Orch. 23. 1830. (Fig. 181)

Terrestrial with ovoid pseudobulb. *Stem* 3-20 cm high. *Leaves* two, unequal, 3-10 × 2-4 cm, sessile, orbicular-ovate to ovate-lanceolate, obtuse or sub-acute, more or less narrowed at base to the sheathing petiole. *Inflorescence* 10-25 cm long. *Flowers* 3 mm in diameter, yellowish-green. *Bracts* lanceolate, shorter than the ovary. *Sepals* sub-equal, oblong-lanceolate, sub-acute. *Petals* linear, shorter than sepals. *Lip* fleshy, broadly ovate, acute, with a beak, without auricles, side lobes obscure, convex, thickened. *Column* fleshy, sessile.



**Fig. 181** *Malaxis muscifera* (Lindl.) O.Ktze. — a. plant; b. c. & d. flower; e. lip; f. & h. lateral sepal; g. dorsal sepal; i. petal; j. lip & column; k. column.

*Flowering:* July - September.

*Distribution:* Himalaya between 1850-3500 m (Pakistan, Kashmir to Arunachal Pradesh).

*Specimens examined:*

GARHWAL: **Dehra Dun**-Chakraia, Deoban, *Raizada* 18224. **Tehri**-Masartal, *Vishwanath* 55138; Bok Hills, *Harsukh* 24183; Near Dhanolti, *Renz* 13639; Way to Nagtibba, *Naithani* 1063 & 1065. **Chamoli**-Bajmore, *M.A. Rau* 70287; Vasukital, *M.A. Rau* 35674; Gangharea, *M.A. Rau* 31746; Jumma area, *Naithani* 54076; Dunagiri, *Naithani* 54076; Valley of flowers, *Naithani* 1022, *Renz* 13616, *Bhattacharyya* 24450; Rambara, *Nair* 35870; Hemkund, *Bhattacharyya* 29471. **Uttarkashi**-Jamuna Valley above village Kharsli, *Deva* 5788.

KUMAUN: **Pithoragarh**-Tejum Haya, *Arora* 49809; Bakariudiyar, *Arora* 49629; Ralam Valley, *Inayat* 24117; Palangadh, *Duthie* 6007; Ralam, *G.S. Rawat* 559. **Almora**-Dwali, *T.A. Rau* 4378.

HIMACHAL PRADESH: Shimla-Fagu Road, *Raizada* 10114; Pangi, *Harsukh* 24183; Rahla, *Bhattacharyya* 40424; Dhanchoo, *C.L. Malhotra* 28482; Bashar Sangla, *Nair* 34106 & 34125; Chamba Satrundi, *Nair* 32792.

JAMMU & KASHMIR: Gulmarg, *Inayat* 25390(c); Datni, *T.A. Rao* 7433; Leh, *Bhattacharyya* 48758.

PAKISTAN: Hazara, Rawalpindi dist. (Stewart, *loc. cit.*; *Renz. loc. cit.*).

**Malaxis purpurea** (Lindl.) O. Ktze. *Rev. Gen.* 2: 673. 1891; Seidenf., 63. fig. 45. 1978; Jayaweera 2: 39. fig. 16. 1981.

*Microstylis purpurea* Lindl. *Gen. & Sp. Orch.* 20. 1830.

*Microstylis wallichii* var. *biloba* King & Pantl. in *Ann. Roy. Bot. Gard. Cal.* 8: 16. t. 19. 1898 (non *Microstylis biloba* Lindl.). (Fig. 182).

Terrestrial. *Stem* 7.5-10 cm tall, stout, slightly pseudobulbous. *Leaves* 3, petioled, 7.5-12.5 × 3.5-5.5 cm, oval to suborbicular, acute or acuminate, base sheathing, margins wavy. *Flowers* many, yellow, 6-10 mm long; peduncle 9-25 cm long, quadrangular. *Bracts* lanceolate, acuminate, reflexed. *Sepals* the dorsal oblong-ovate, margins reflexed, the laterals oblong, obtuse or rounded. *Petals* equal to the lateral sepals, linear, truncate, margin reflexed. *Lip* superior, fleshy, longer than sepals and petals, concave, sides of the apical part with indentation, the apical part spreading as a distinct lobe from the basal part, the apex deeply bilobed.

*Flowering:* July - August.

*Distribution:* Himalaya 900 m (Garhwal, Kumaun & Sikkim). Sri Lanka, Laos, Vietnam, China, Philippines and Thailand.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, Jharipani, *Deva* 2699. **Chamoli**-Mandal, *Naithani* 1042.

KUMAUN: **Nainital**-Do Gaon, *Kalakoti* 5216, *Pangtey*.

We have followed Seidenf., 62-63. 1978. in referring the above plants to *M. purpurea*. King & Pantl., however identified exactly similar specimen t. 19, 1898 as *M. wallichii* var. *biloba*. In recent years similar specimens, such as Abraham & Vatsala, f. 106. D. 1981 and Banerji & Pradhan Pl. 135. 1982 have been also referred to *M. acuminata* or *M. acuminata* forma *biloba*. The type has to be found out to solve this problem.

#### **Oberonia** Lindl.

Epiphytic or rarely lithophytic. *Stem* close together. *Leaves* distichous, equitant, much laterally compressed, fleshy, ensiform, oblong or linear. *Inflorescence* terminal, short or long, usually curved, densely

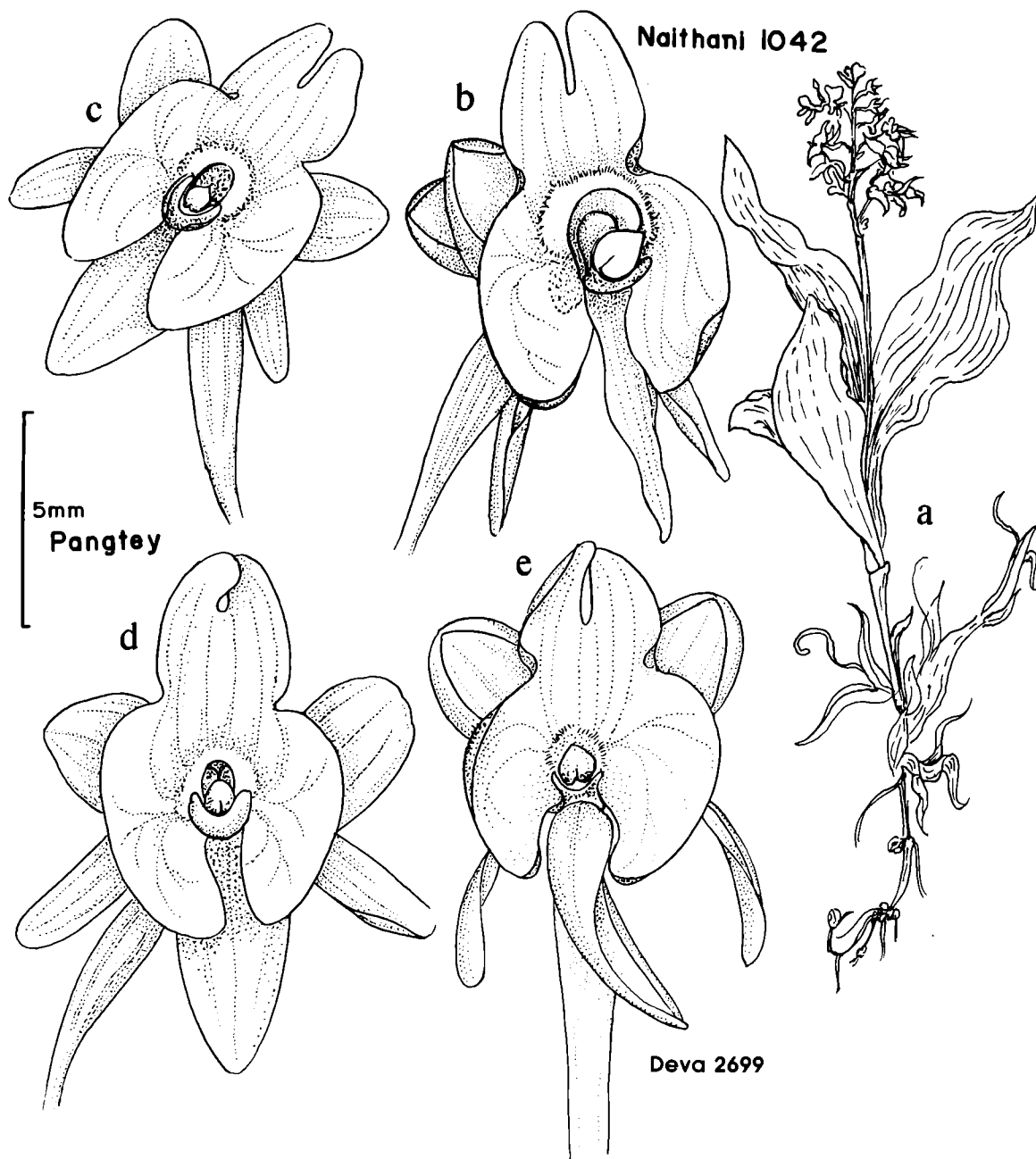


Fig. 182 *Malaxis purpurea* (Lindl.) O. Ktze.—a. plant; b., c., d. & e. flower.



covered with very small flowers, sometimes in regular whorls. *Sepals* nearly equal, often reflexed. *Petals* usually narrower than sepals, sometimes toothed. *Lip* superior, sessile on the base of the column, usually 3-lobed, spreading, concave at the base, often with the basal lobes embracing the column. *Column* very short, *Anther* terminal, incumbent; *pollinia* 4, in two pairs, without caudicles.

#### Key to species

1. Lip without any lateral lobe.....2
- + Lip with lateral lobes, lobes small to well developed or only as basal auricles.....3
2. Lip oblong, longer than broad, margin erose from base to the apex; petals linear with erose margin; inflorescence slender.....*O. prainiana*
- + Lip orbicular, broader than long, margin entire; petals linear with entire margin; inflorescence fleshy; flower sunk in distant pits on the axis.....*O. pachyrachis*
3. Leaves terete or sub-terete; midlobe of the lip dissected into 4-7 filiform appendages of unequal length .....*O. myosurus*
- + Leaves laterally compressed; mid lobe bilobulate.....4
4. Lateral lobes of the lip fringed to lacinate.....5
- + Lateral lobes of the lip with entire to erose margin, not lacinate.....6
5. Lateral lobes of the lip, long lacinate, split in to 3 appendages of about 1 mm length, mid lobe with 2-lobes, linear, acute, apex with a deep sinus, very small; leaves 2.5 – 5 × 0.3 – 0.6 cm .....*O. griffithiana*
- + Lateral lobes of lip shortly to deeply fringed, split into 6 short appendages, mid-lobe with 2-lobes, oblong to rounded, apex with a shallow sinus often only emarginate, margin entire to erose; leaves big upto 25 × 1-2.5 cm.....*O. iridifolia*
6. Leaves large, 12-35 (– 50) cm long, ensiform, all curved in same direction; raceme shorter than the leaves; lip pubescent with stiff hairs, margin ciliolate or erose, the disc with 2 calli projecting outside at the joint of mid and lateral lobes.....*O. ensiformis*
- + Leaves smaller (– 2) 3-6 (– 10) cm; racemes longer than the leaves; lip of the lobes smooth or blistered but not hairy, 2 projecting calli absent.....7
7. Lateral lobes of the lip small, often represented in the form of basal auricles only, lobes of the mid lobe elongated, not rounded.....8
- + Lateral lobes of the lip well developed, oblong, tip pointed forward, almost reaching half the length of the lip, mid lobe with nearly 2 circular divergent lobules, separated from one another by a shallow triangular sinus.....*O. acaulis*
8. Mid lobe with two short incurved lobules with obtuse tip, separated from one another by a broad sinus, and less than quarter the length of the whole lip, surface with scattered glands like glistening blisters, lateral lobes small.....*O. falconeri*
- + Mid lobe with two long divergent lobules with acute to sub-acute tip, separated from each another by a deep triangular sinus and about half the length of the whole lip, surface smooth, lateral lobes small like auricles.....*O. pyrulifera*

**Oberonia acaulis** Griff. Itin. Not. 1848: 76. Pl. 1. Not. 3: 275. 1851; Seidenf., 20. fig. 11. 1978.

*O. myriantha* Lindl. Fol. Orchid, Oberonia, no. 23. 1859; Hook. f. 5: 679. 1890: King & Pantl. 10. t. 12. 1898; Arora, 204. fig. 1-6. 1969.

*O. sikkimensi* Lindl. Fol. Orchid, Oberonia, no. 22. 1859.

(Fig. 183)

Stem erect, short, slightly tufted. *Leaves* ensiform, acuminate, falcate, unequal, 2-15 × 5-10 cm. *Inflorescence* slender, pendant, much longer than leaves. *Flowers* 2 mm across, crowded, pale-yellow or brown. *Bracts* lanceolate, coarsely erose-fimbriate. *Sepals* ovate, entire. *Petals* oblong, entire, truncate. *Lip* longer

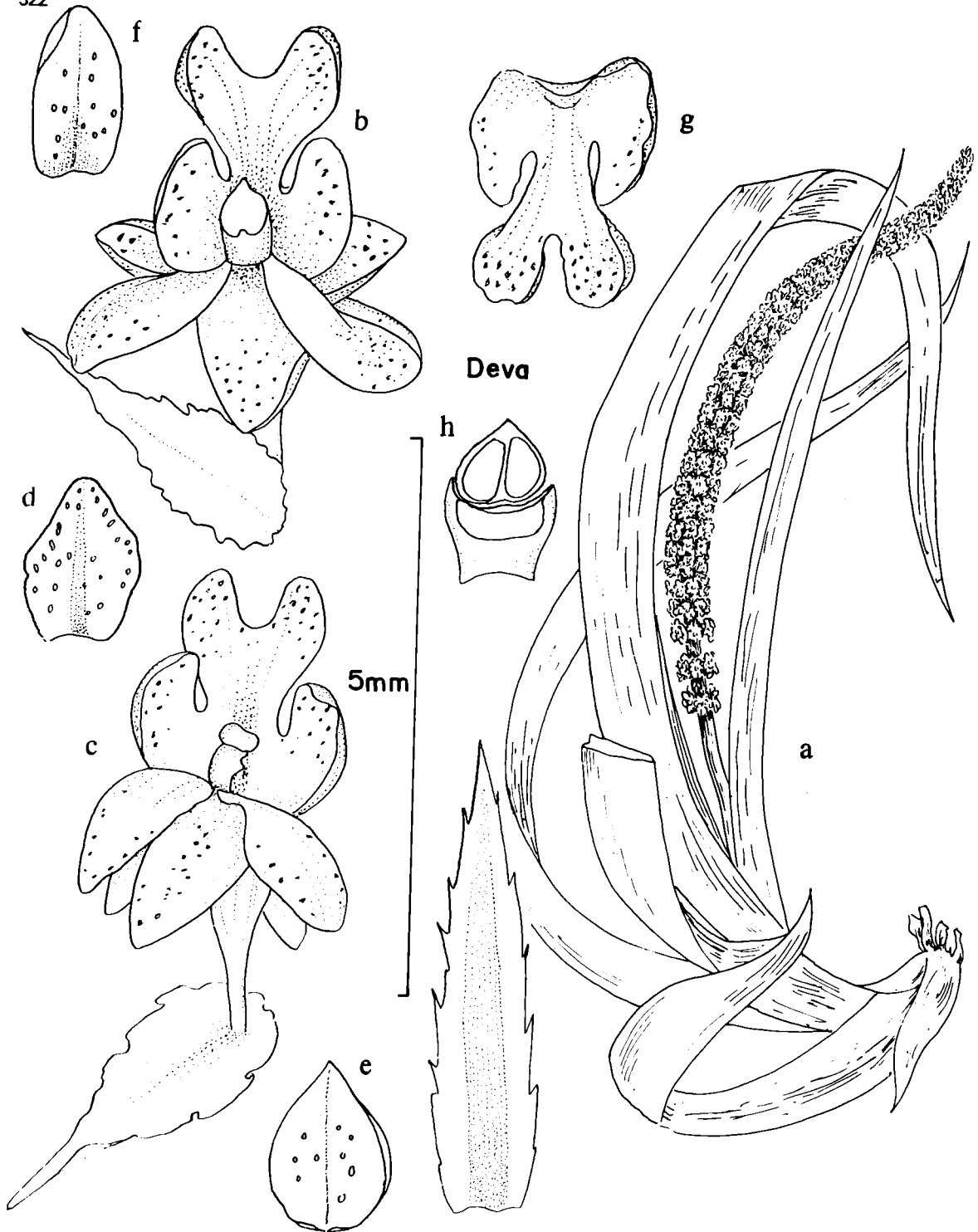


Fig. 183 *Oberonia acaulis* Griff. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. lip; h. column.

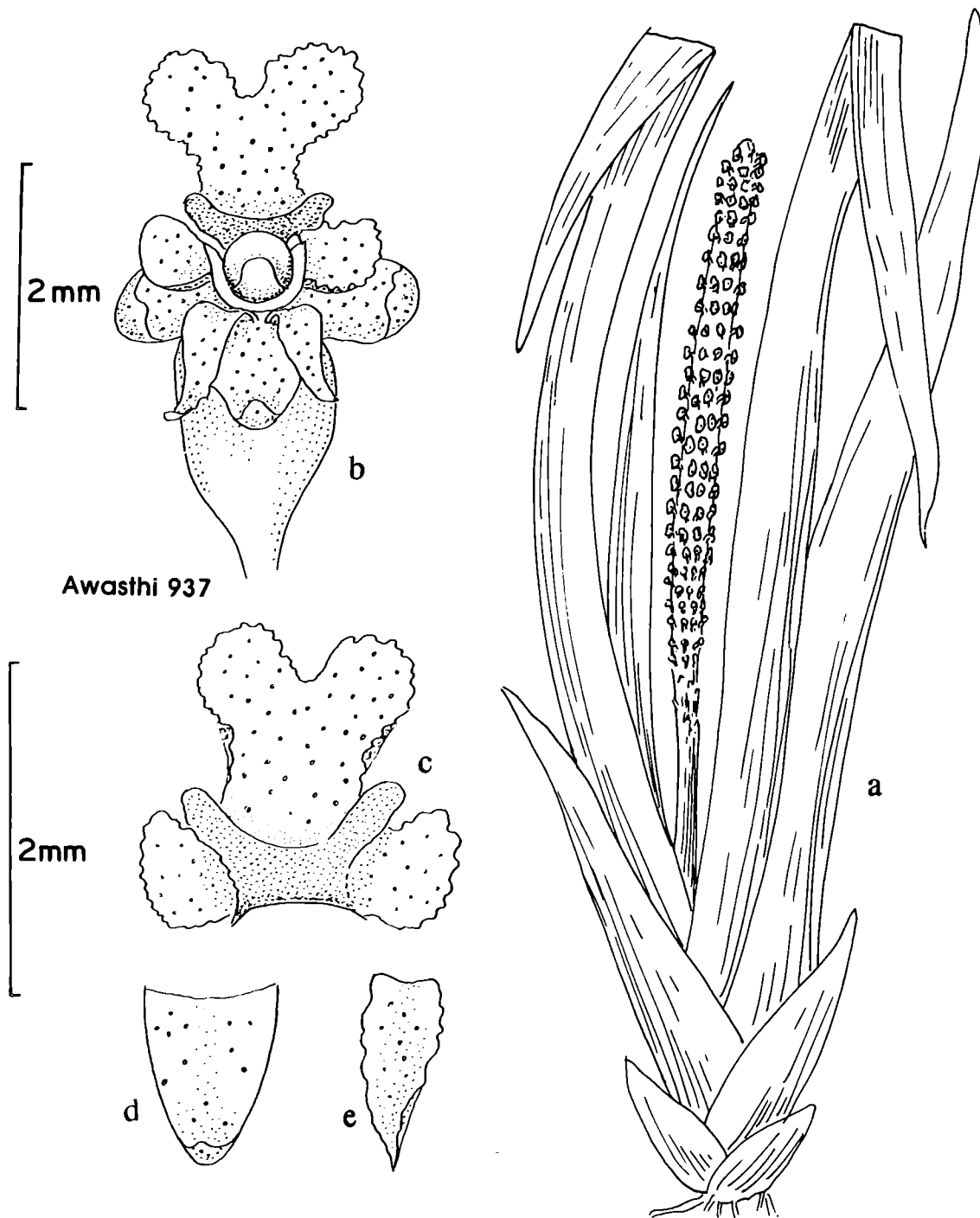


Fig. 184 *Oberonia ensiformis* (Sm.) Lindl.—a. plant; b. flower; c. lip; d. dorsal sepal; e. petal.

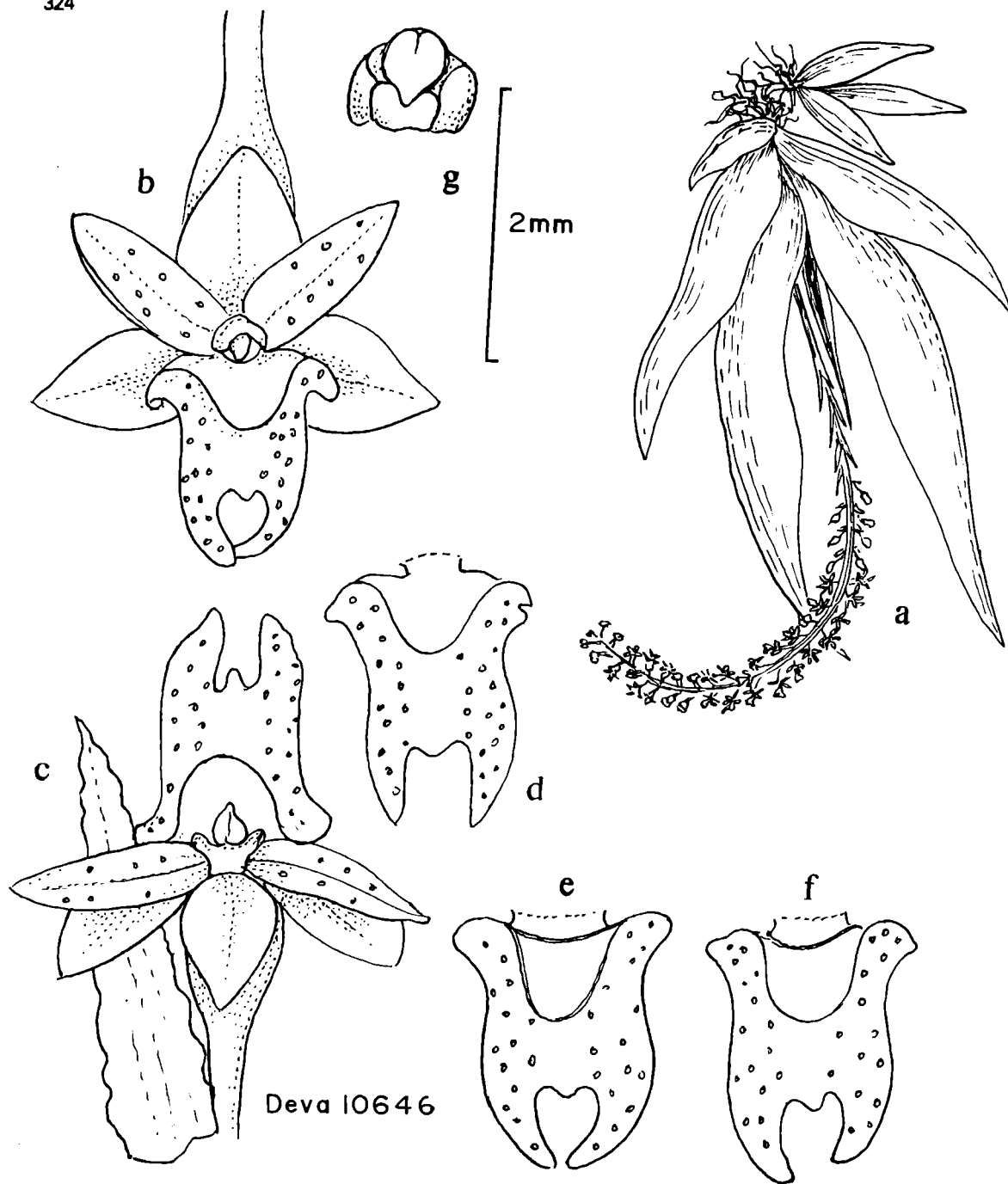


Fig. 185 *Oberonia falconeri* Hook. f.—a. plant; b. & c. flower; d., e. & f. lip; g. column.

than sepals, irregularly blistered, lateral lobes well developed, oblong, tip pointed forwards almost reaching half the length of the lip; mid lobe with nearly 2-circular divergent lobules, separated from one another by a shallow triangular sinus.

*Flowering:* August - November.

*Distribution:* Himalay 1400-1800 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. Burma. Thailand, Vietnam and China.

*Specimens examined:*

KUMAUN: **Pithoragarh**-SandeV, *Arora* 36426, 55803, *Deva*; Samadhura, *M.A. Rau* 6559.

**Oberonia ensiformis** (Smith) Lindl. *Fol. Orch.* Oberonia, no. 21. 1859. (excl. syn. *acaulis*); Hook. f., 5: 679. 1890; King & Pantl. 8, t. 9. 1898; Duthie, 86. 1906; Seidenf., 13. fig. 6. 1978.

*Malaxis ensiformis* Smith in Res. Cyclop. 22. 1, No. 14. 1812

*O. acaulis* auct. non Griff.: Hooker, Bot. Mag. 3. s. 14: T. 5056. 1858.

*O. trilobata* Griff. Not. 3: 273. 1851.

(Fig. 184)

Stem 8 cm high. *Leaves* ensiform 12-35(-50) × 1-1.5 cm, curved in same direction, erect, 5-7 in number, thick, coriaceous, glaucous. *Inflorescence* shorter than leaves, 9-10 cm long, erect or slightly arched. *Flowers* 2 mm across, orange-yellow, becoming brown in age. *Bracts* convolute, ovate, rotund, sub-acute, erose. *Sepals* broadly ovate, sub-acute, not ciliolate. *Petals* ovate, stiffy pubescent, edge entire and ciliolate. *Lip* twice the size of sepals and petals, 2-lobed, stiffy pubescent, margin ciliolate or erose, the disc with two globular calli projecting outside at joint of mid lobe and lateral lobes; lateral lobe broad, rounded; mid lobe further 2-lobed, kidney-shaped.

*Flowering:* May - July.

*Distribution:* Himalaya 1000-1500 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Western Ghats. Burma, Thailand, Indo-China and China.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun Valley, *Mackinnon* 24186, *Duthie*. **Pauri**-Outer hills, *Inayat*, 25833 & 25834.

KUMAUN: **Almora**-Kapkot, *D.D. Awasthi* 937.

**Oberonia falconeri** Hook. f., Ic. Pl. t. 1780. 1888 et 5: 678. 1890; Duthie, 86. t. 94. 1906; Seidenf., 22. fig. 12. 1978.

*O. iridifolia* sensu Strach. & Winter. Cat. Kum. Pl. in Atk. Gaz. N. W. Front. Prov. 594, 1882; King, 318. 1882; Watson, 385. 1882 (*non* Lindl.).

(Fig. 185)

Erect short epiphyte. *Leaves* broadly ensiform, 2-9 × 1.5 cm thick, slightly curved, acuter or sub-acuminate. *Inflorescence* equal to or longer than the leaves, 2-14 cm long, laxly many flowered, its peduncle strongly grooved. *Flowers* small, 1.5 mm across, spiral, greenish-yellow, shortly pedicelled. *Bracts* serrate, ovate-lanceolate, 1-nerved. *Sepals* yellow, obtuse, faintly 1-nerved. *Petals* ovate, yellow. *Lip* twice as long as the sepals, broadly oblong; side lobes small; mid lobe with two short incurved lobules with obtuse tip separated from one another by a broad sinus, and are less than quarter the length of the whole lip, surface with scattered gland like glistening blisters.

*Flowering:* September - October.

*Distribution:* Himalaya 800-1500 m (Garhwal to Arunachal Pradesh), Madhya Pradesh, Meghalaya, Andhra Pradesh, Karnataka, Gujarat, Maharashtra. Thailand, Laos, Vietnam, Malaya.

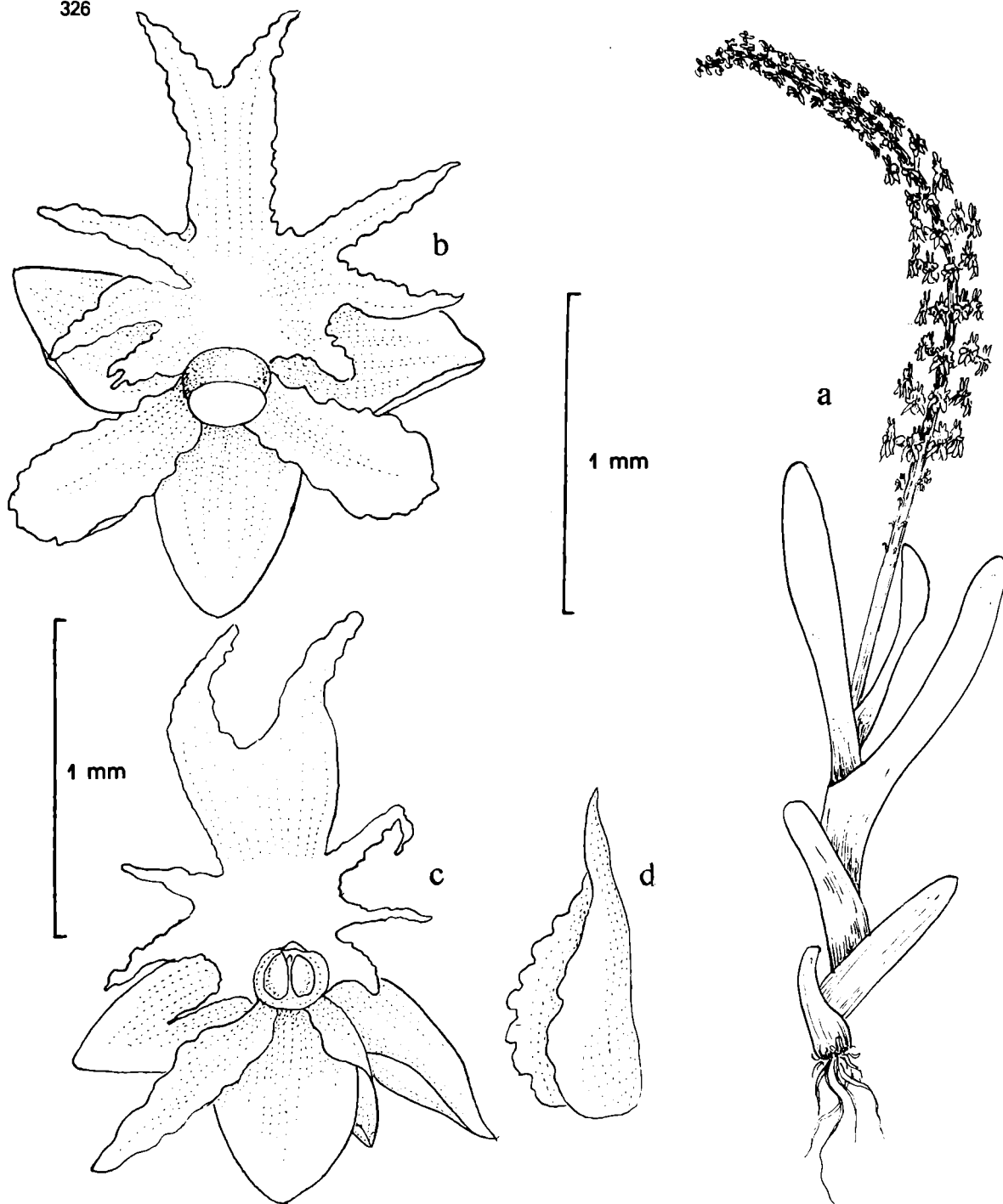


Fig. 186 *Oberonia griffithiana* Lindl. — a. plant; b. & c. flower; d. floral bract (after Seidenf.).

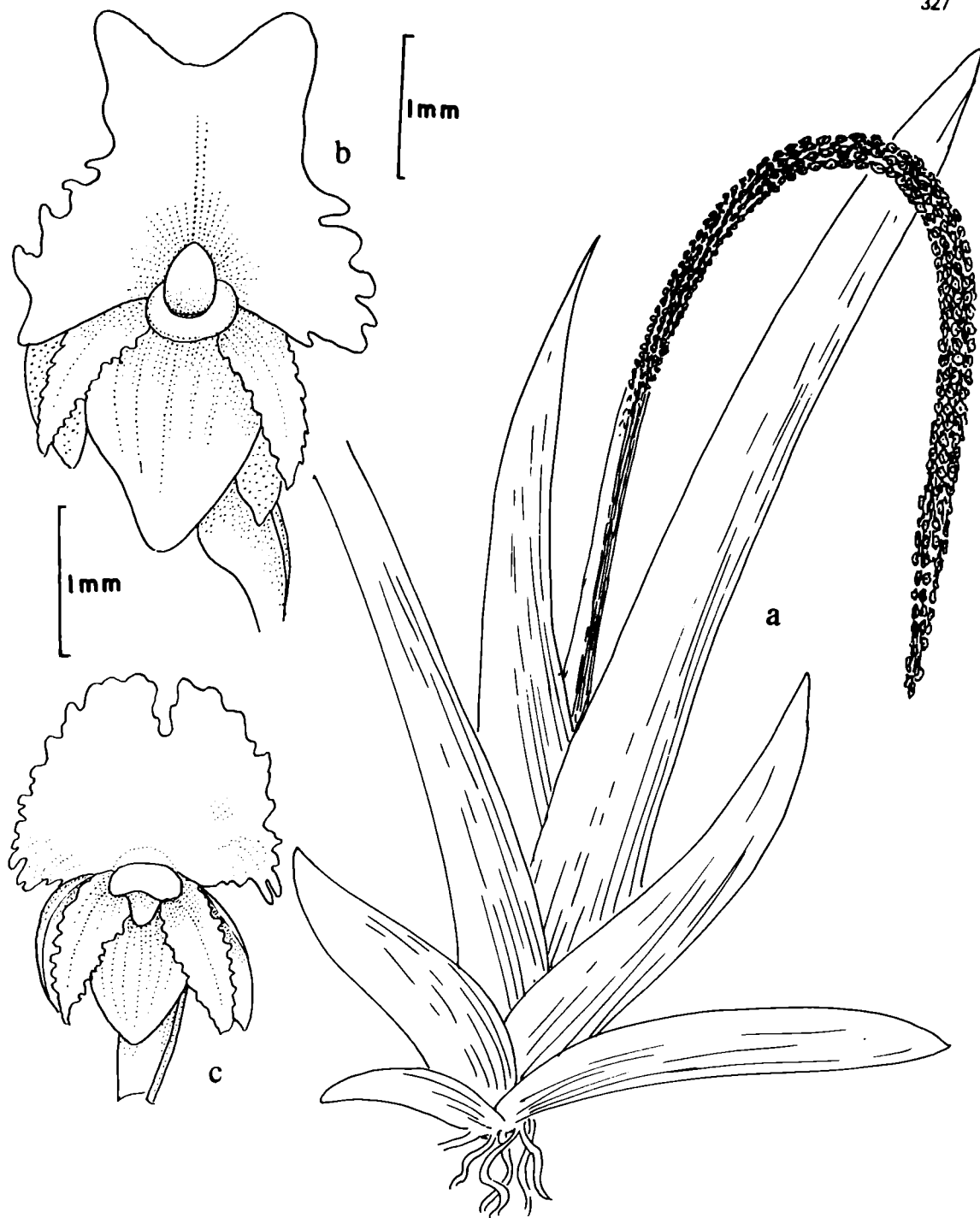


Fig. 187 *Oberonia iridifolia* (Roxb.) Lindl. —a. plant; b. & c. flower (after Seidenf.).

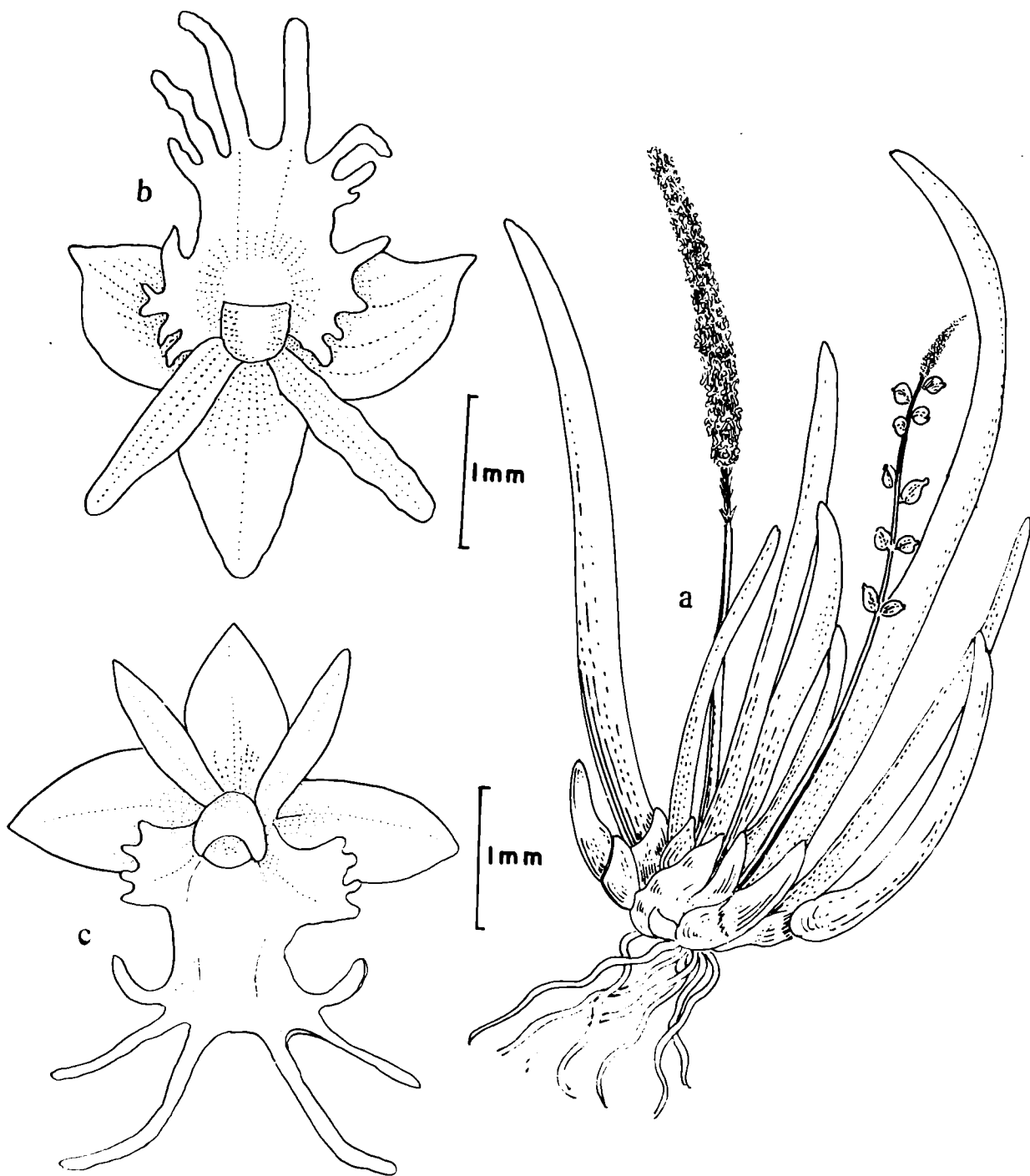


Fig. 188 *Oberonia myosurus* Lindl.—a. plant; b. & c. flower (b. after Seidenf.), (c. after Pradhan).



*Specimens examined:*

GARHWAL: **Dehra Dun**- Dehra Dun Valley, Laxmansidh, *Deva* 2564 & 10646; Kalanga Hills, *Duthie, Mackinnon*; Thano, *Raizada*; Nakund, *Ramsukh*; Chakrata (Jaunsar), *Gammie*. Pauri-Outer Garhwal Hills, *Inayat* 25832 & 24835.

KUMAUN: **Pithoragarh**-Dafiadhura, *Arora* 41331; Kali Valley, *Inayat*. Nainital-Haldwani, *Champion*.

**Oberonia griffithiana** Lindl. Sert. Orch. t. 813, 1838; Hook. f., 5: 676. 1890; Grant, 30. 1895; Seidenf., 29. fig. 18. 1978; Seidenf. & Arora 22. 1982.

*O. cimicina* Griff. Not. 3: 275. 1851.

(Fig. 186)

Stem elongate, 3-9 cm. *Leaves* linear, 2.5-5 × 0.3-0.5 cm, acute or obtuse, straight or falcate. *Inflorescence* up to 9 cm long, decurved. *Flowers* pedicelled, more or less whorled, purple-brown. *Bracts* lanceolate, sub-entire. *Petals* narrower, linear. *Lip* the lateral lobes laciniate, split into 3 appendages, about 1 mm long, mid lobe with linear acute 2-lobules, apex with a deep sinus.

*Flowering*: March - June.

*Distribution*: Himalaya 1500 m (Kumaun). Burma and Thailand.

*Specimens examined:*

KUMAUN: **Pithoragarh**-Sandev, *Deva* 9751; Dafiadhoora, *Arora* 55803.

**Oberonia iridifolia** (Roxb.) Lindl. Wall. Cat. no. 1948. 1828 p.p. *nom. nud.*, Gen. & Sp. Orch. 15. 1830; Hook. f., 5: 675. 1890; King & Pantl. 8, t. 8. 1898; Seidenf., 16. fig. 7. 1978; Seidenf. & Arora, 22. 1982.

*Cymbidium iridifolium* Roxb. Hort. Beng. 63. 1814. *nom. nud.* et Fl. Ind. ed. 2, 3: 458. 1832.

*O. denticulata* Wight, Ic. Pl. 1625. 1852.

(Fig. 187)

Stem very short. *Leaves* 4-6, basal smallest, larger 5-25 × 1-2.5 cm, ensiform, acute. *Inflorescence* dense flowered, decurved upto 18 cm long. *Flower* 1 mm across, pale-greenish or brownish, stalked. *Bracts* minute, broad, toothed at tip. *Sepals* sub-equal, reflexed. *Petals* broadly ovate, reflexed. *Lip* orbicular in outline; lateral lobes shortly to deeply fimbriate, split in 6 to many short appendages; mid lobe with broad rounded 2-lobules, with entire to erose margins, apex with a shallow sinus, often only emarginate.

*Flowering*: October - November.

*Distribution*: Himalaya 800-1500 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Karnataka, Maharashtra, Andaman Island. Burma, Thailand, Malaya.

GARHWAL: **Dehra Dun**-Dehra Dun *Wallich* (BM); *King's collectors* (G).

We are including the plants on the authority of Seidenf., 43. 1968, who has examined Dehra Dun specimens of *Wallich* (BM) and *King's collectors* (G). There is no specimen from North West Himalaya at CAL, DD and BSD. The earlier confusion caused by its inclusion in the lists of *Strachey & Winterbottom*, 594. 1882; *Watson*, 385, 1882, and *King*, 318. 1882, was cleared by *Duthie* (*Duthie*, 256. 1906) who reidentified them as *Oberonia falconeri* Hook. f.

**Oberonia myosurus** Lindl. Wall. Cat. no. 1947. 1829 *nom. nud.* Gen. & Sp. Orch. 16. 1830; Hook. f., 5: 685. 1890; Arora 14: 175. fig. D. 1972; Seidenf., 10, fig. 1. 1978.

(Fig. 188)

Epiphytic. *Leaves* linear, terete or subterete, 6-12 cm, all radical, 6-12 × 1-2 cm, fleshy, elongate, slightly curved. *Scape* short, dense-flowered, spike like. *Flowers* small, pale. *Bracts* lanceolate, denticulate, longer than flowers. *Petals* narrow, linear. *Lip* with two curved spurs on each side of its tip; mid lobe of the lip dissected into 4-7 filiform appendages of unequal length.

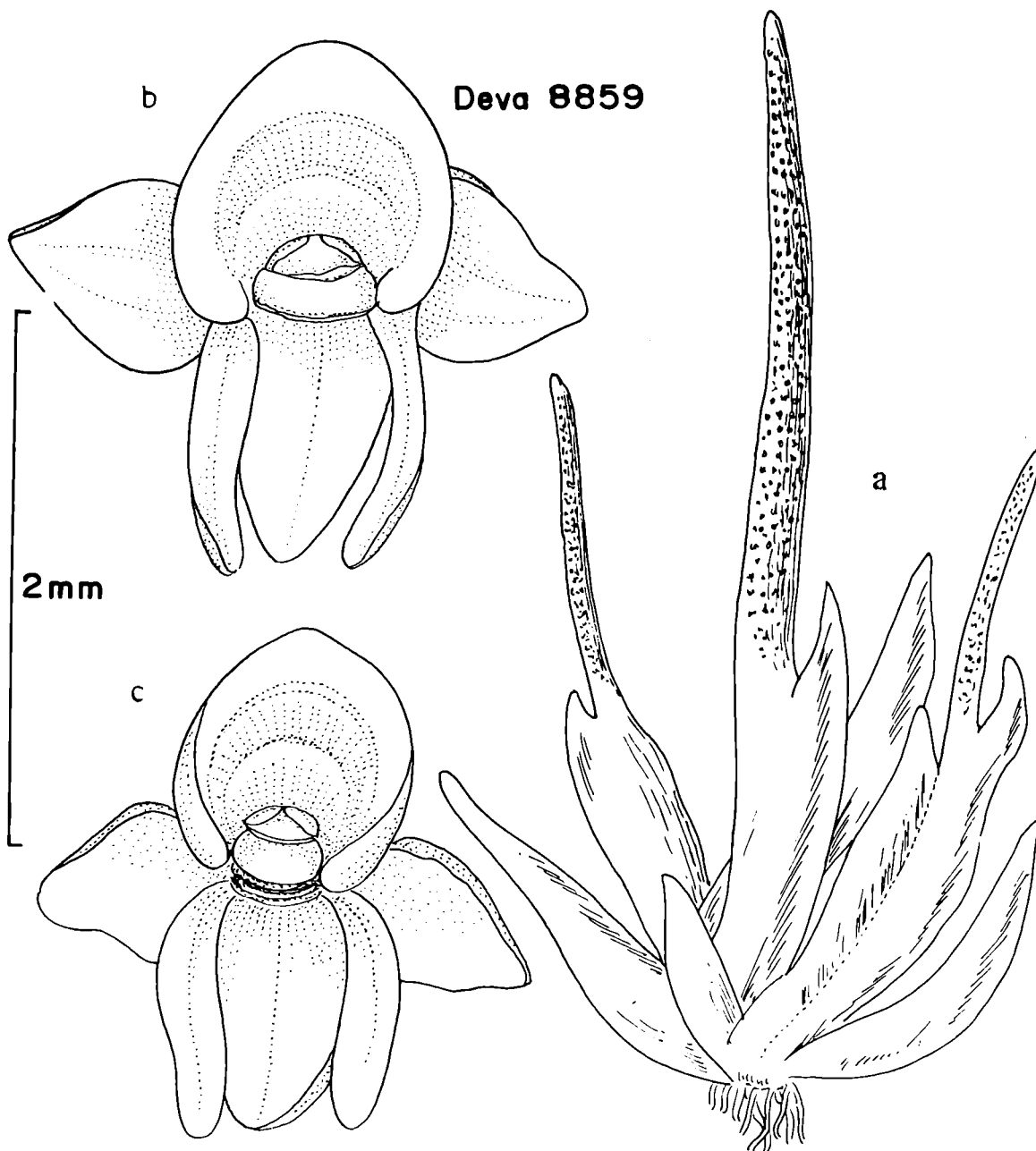


Fig. 189 *Oberonia pachyrachis* Rchb. f. ex Hook. f.—a. plant; b. & c. flower.

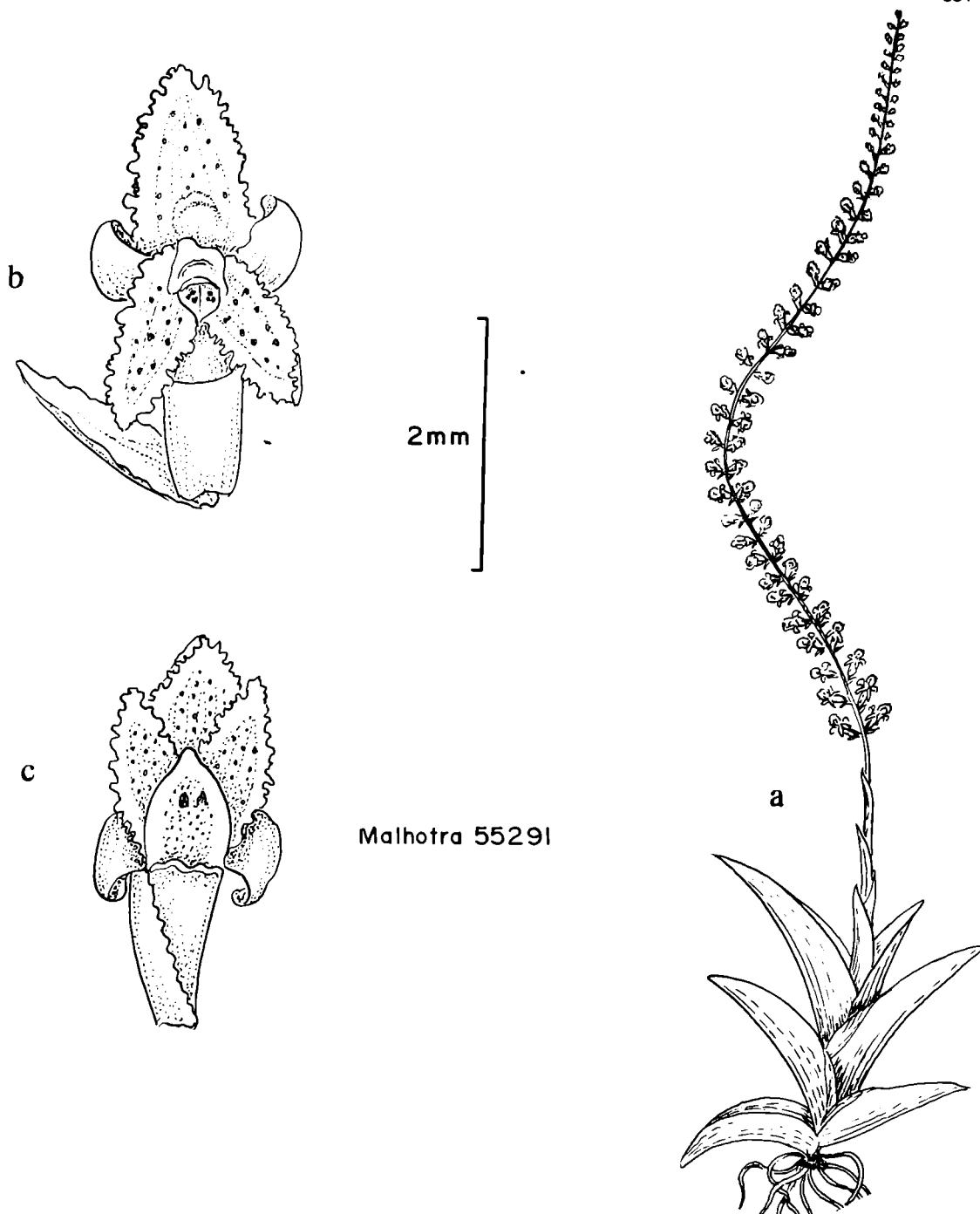
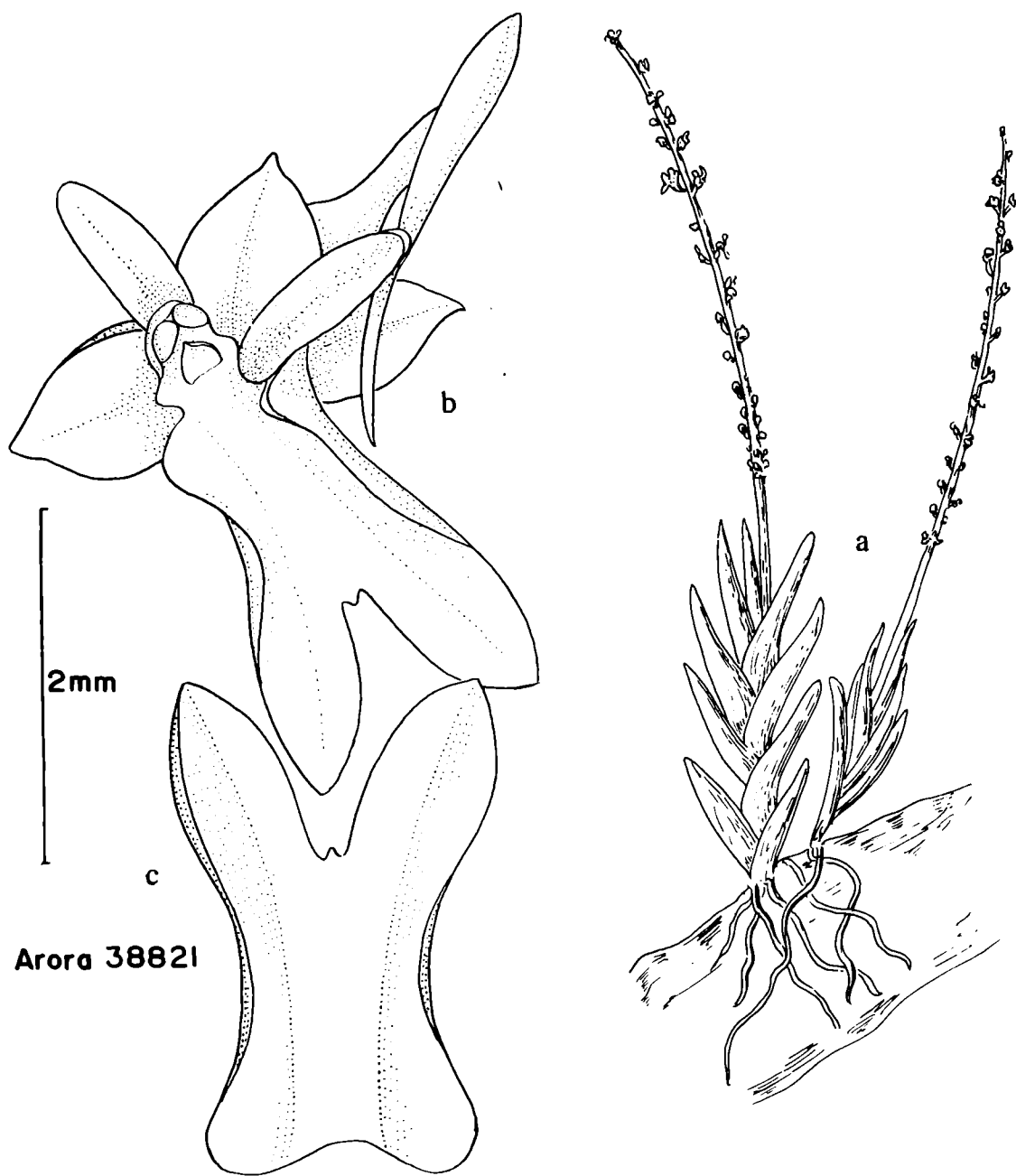


Fig. 190 *Oberonia prainiana* King & Pantl. —a. plant; b. & c. flower.



**Fig. 191** *Oberonia pyrullifera* Lindl. —a. plant; b. flower; c. lip.

*Flowering*: July - September.

*Distribution*: Himalaya 1000-1500 m (Kumaun, Nepal). Burma, China, Thailand.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Between Berinag and Munkata, *D.D. Awasthi* 1535; *Sandev, Arora* 41332.

**Oberonia pachyrachis** Rchb. f. ex Hook. f., *Fl. Brit. Ind.* 5: 681. 1980; *King & Pantl.* 4, t. 3. 1898; *Duthie*, 85. 1906; *Seidenf.*, 11. fig. 4. 1978. (Fig. 189)

Stem tufted, short. *Leaves* narrowly ensiform, 8-15 × 1.5 cm, acuminate, slightly falcate. *Inflorescence* 6-12 cm long. *Flowers* pale-brown, more or less 1 mm or less, sunk in a pit of the floral axis. *Bracts* deep and irregularly serrate. *Petals* smaller, sub-entire, linear-oblong, obtuse. *Lip* not bifid, concave, orbicular-elliptic, broader than long, entire or slightly erose at the apex.

*Flowering*: August - September.

*Distribution*: Himalaya 1000-1500 m (Garhwal to Arunachal Pradesh), Assam, Bihar, Orissa, Manipur, Nagaland, Mizoram, Meghalaya, Tripura, Gujarat, Karnataka, Andhra Pradesh, Maharashtra. Burma, Thailand and Yunnan in China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 24185; Kalanga Hills, *Duthie*; Nakund, *Ramsukh* 23005; Sahashtradhara, *S.K. Malhotra* 29296; Mussoorie, Jharipani, *Deva* 8859. Tehri-Agrakhal above Narendranagar, *Deva* 9638. **Chamoli**-Batwalchari, *M.A. Rau* 6425; Ukhimath, *M.A. Rau* 38772; Phata, *Nair* 35916.

KUMAUN: **Pithoragarh**-Askot, *Pant* 38141, *Arora* 45508, *Bhattacharyya* 21376; Gorpatta-Thal, *M.A. Rau* 35339; Thal, *Arora* 36404; Barum, *Arora* 55805; Dafiadhura, *Arora* 45556; Vasuvud, *Bhattacharyya* 21279.

Pradhan (1979) strongly feels that *Oberonia orbicularis* Hook. f., is synonym of *O. pachyrachis* Rchb. f., the former is known from Sikkim Himalaya.

**Oberonia prainiana** King & Pantl. in *J. As. Soc. Beng.* 64(2): 331. 1895; et 3, t. 1. 1898; *Seidenf.*, 35. fig. 25. 1978; *Malhotra & Singh*, 337, fig. 1. 1983.

*O. brunnescens* Ridl. in *J. Linn. Soc. Bot.* 32: 220. 1896. (Fig. 190)

Stem very short. *Leaves* fleshy, oblong, subacute, slightly falcate, 12-20 × 3-6 mm. *Inflorescence* slender, erect, 8-10 cm long and jointed to the uppermost leaf, rachis densely flowered in the lower portion, laxly flowered in the upper. *Flowers* whorled, 2 mm long, yellow-brown. *Bracts* oblong, sub-entire, sheathing and equal in length to the ovary. *Sepals* oblong, blunt, entire, revolute. *Petals* linear, subacute with erose margin. *Lip* somewhat equalling sepals, oblong, longer than broad, not distinctly lobed, margin erose from base to the apex, base truncate and with a circular nectar bearing pit just under the column.

*Flowering*: April - June.

*Distribution*: Himalaya 300-600 m (Kumaun, Sikkim). Malaya, Thailand.

KUMAUN: **Pithoragarh**-Vasavagarh, *Melhotra* 55291.

**Oberonia pyrulifera** Lindl. *Fol. Orch. Oberonia* no. 15. 1859; *Hook. f.*, 5: 678. 1890; *King & Pantl.* 14. t. 16 B. 1898; *Seidenf.*, 23. fig. 13. 1978.

*O. auriculata* sensu *Arora* in *Bull. bot. Surv. Ind.* 14: 174. fig. c. 1972 (*non* King & Pantl.).

*O. caulescens* sensu *Seidenf. & Arora*, in *Nord. J. Bot.* 22. 1982. (*non* Lindl.) (Fig. 191)

Stem very short. *Leaves* ensiform, semi-falcate, acute, 2.5-6 × 0.3-0.8 cm. *Inflorescence* slender, 3.6 cm long, peduncle terete. *Flowers* minute, green, scattered, not verticillate. *Bracts* lanceolate, acuminate,

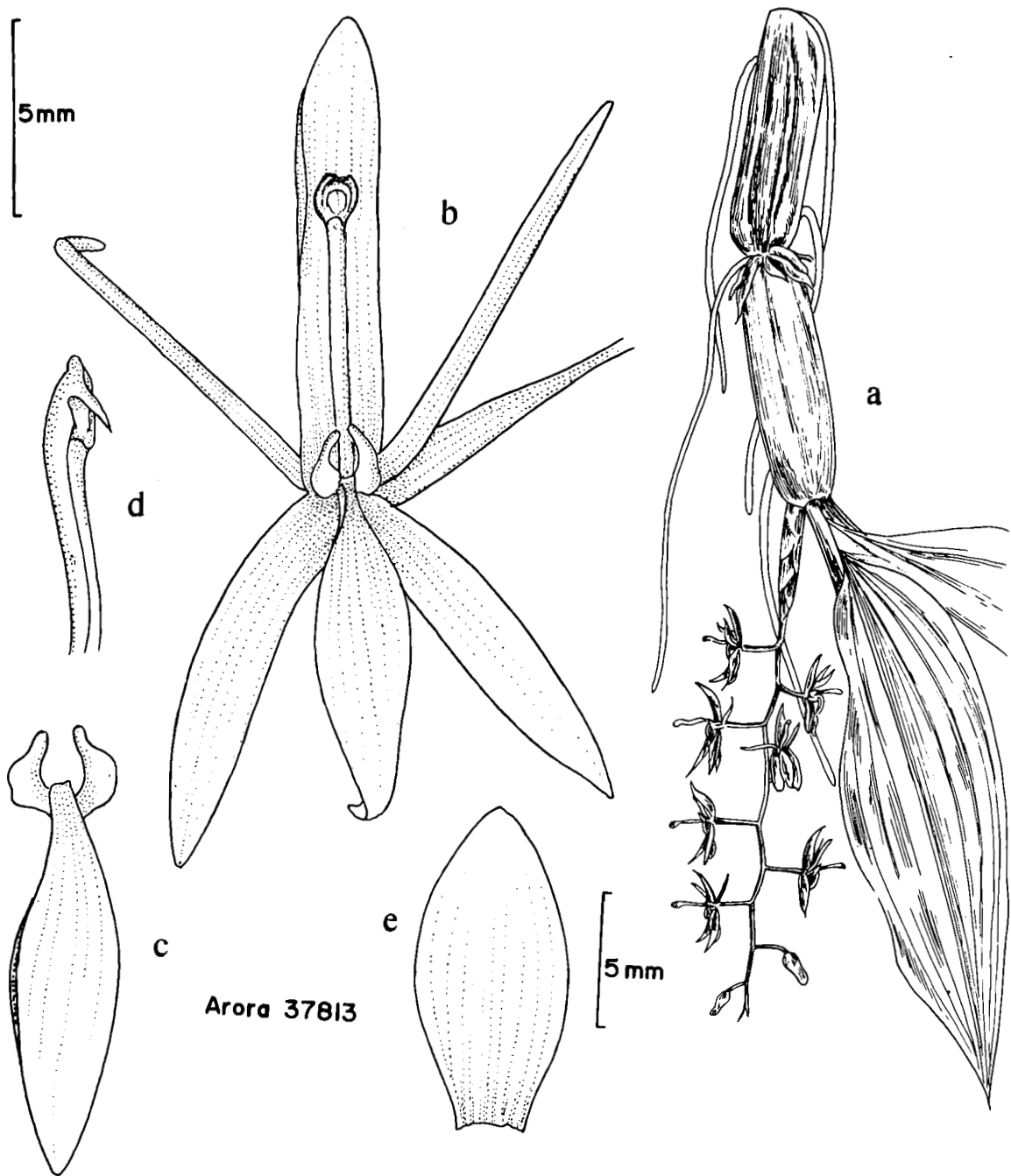


Fig. 192 *Otochilus lancilabius* Seidenf. — a. plant; b. flower; c. lip; d. column; e. floral bract.

erose shorter than the ovary. *Sepals* ovate, acute, entire. *Petals* oblong, blunt, reflexed like the sepals and resting on the ovary. *Lip* twice as long as the sepals, oblong; mid lobe with two long divergent lobules with acute to sub-acute tip, separated from each other by a deep triangular sinus and are about half the length of the lip, surface smooth; lateral lobes small, like auricles.

*Flowering*: September - October.

*Distribution*: Himalaya 300-2000 m (Kumaun, Sikkim to Arunachal Pradesh), Assam, Meghalaya, Manipur Nagaland, Mizoram. Yunnan in China, Thailand.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Sandev, *Arora* 38821, 37801 & 38418; Baram, *Pant & Naithani* 39573; Balmara, *Arora* 66143

We have checked carefully the specimens from the region and are convinced that these can not be placed any where else. *O. auriculata* King & Pantl., and *O. longilabris* King & Pantl., may prove conspecific. The possibility that all these species are part of *O. caulescens* Lindl. complex, cannot be ruled out.

#### **Otochilus** Lindl.

Epiphytic, *Stem* pendulous, jointed, branched, formed of superposed elongate pseudobulb-like internode, bearing roots at the nodes. *Leaves* in pairs from the apex of the terminal node, linear, elliptic or lanceolate, membranous, plicate. *Racemes* pedulous, from the pseudobulb just below the leaves, many-flowered; the flowers distichous, the peduncle sheathed. *Flowers* small, white, cream-coloured. *Bracts* scarious. *Sepals* and *petals* sub-equal, spreading, free, narrow. *Lip* with a short two-horned sac at the base and a long narrow, acute, entire, concave, deflexed terminal lobe. *Column* long, slender, clavate, erect, without foot. *Anther cells* distinct; *pollinia* 4, ovoid or cuneate, flattened, attached to a single bilobed membrane.

**Otochilus lancilabius** Seidenf., in Bot. Tidsskr, 71: 13. fig. 11. 1976; Seidenf. & Arora, 2: 23. 1982. *O. porrecta* auct. p.p. non Lindl; Hook. f., 5: 844. 1890; King & Pantl. 142, t. 198. 1898; Arora, 430. fig. 1-6. 1969.

*Pholidota recurva* sensu Arora in Ind. J. For. 3(1): 79. 1980; Seidenf. & Arora, 2: 24. 1982, (*non* Lindl.).

*O. albus* Lindl. var. *lancilabius* (Seidenf.) Pradhan, Ind. Orch. 2: 706. 1979.

(Fig. 192)

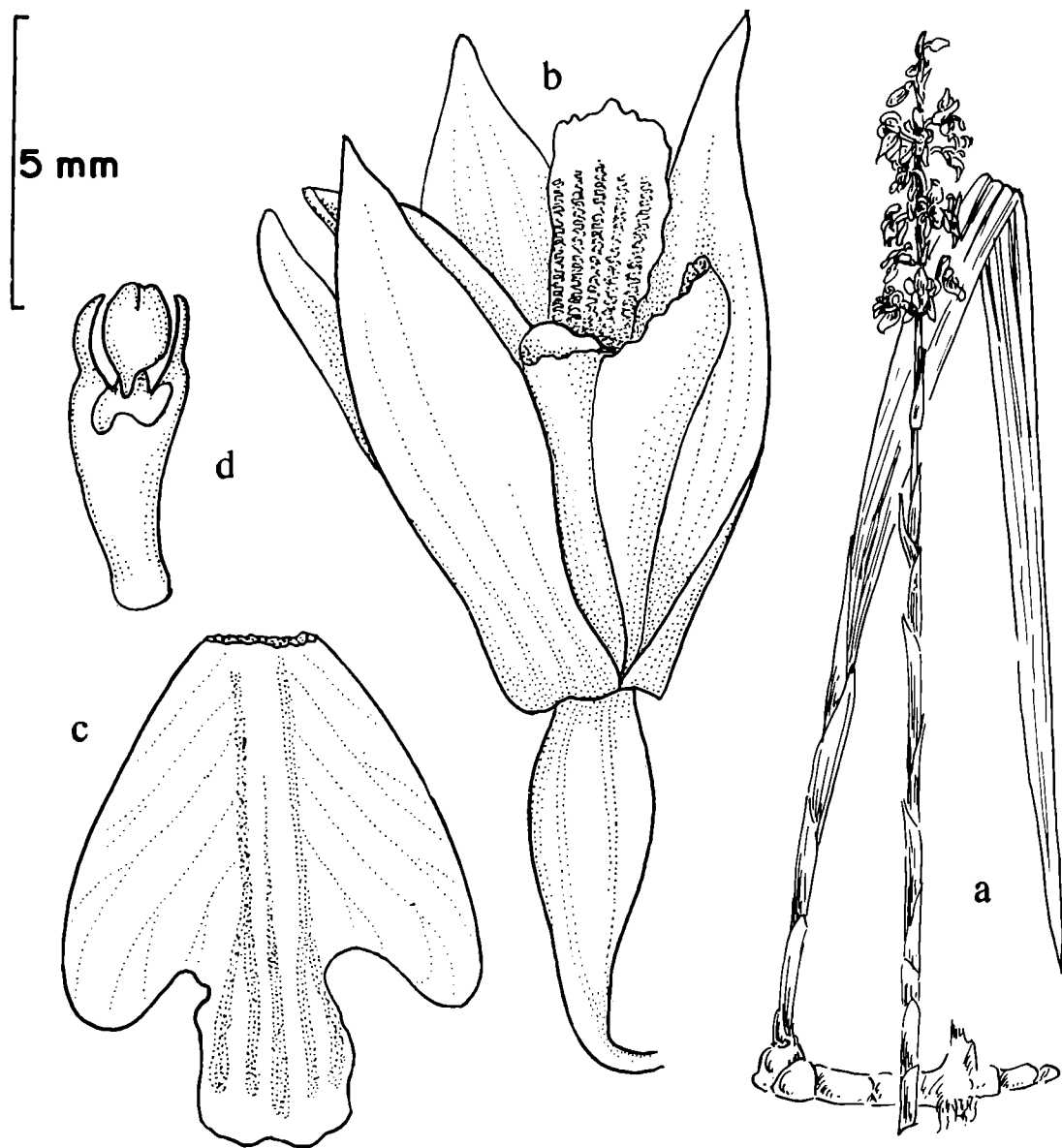
Pseudobulbs slender, 2-11 cm long, winged, keeled when old, roots at the internodes. *Leaves* two at each internode, only uppermost pair persistent, ovate-lanceolate, acute, 10-20 × 3.5 cm. *Inflorescences* pendulous from internodes, about 16 cm long, the scape short, enveloped in sheath. *Flowers* white-cream or pink tint, about 3 cm long. *Bracts* elliptic, triangular, caducous. *Sepal* 12-14 mm long, lanceolate, 5-veined. *Petals* linear, as long as the sepals, 3-veined. *Lip* about 12 mm long, epichile lanceolate, 8-10 mm long, less than 3 mm broad without laminate keels, hypochile short, sac-shaped, with short vertical side lobes with broad obtuse apex, their proximal edges enveloping and overlapping behind the column, in sac three strong veins as rounded keels near base, but disappearing before reaching the base of epichile.

*Flowering*: October - January.

*Distribution*: Himalaya 1000-1800 m (Kumaun to Sikkim), Meghalaya. Laos.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Didihat-Sandev, *Arora* 37813; Kafiani, *Arora* 68256.



Osmaston 1354

**Fig. 193** *Pachystoma senile* (Lindl.) Rchb. f.—a. plant; b. flower; c. lip; d. column.



### Pachystoma Blume

Terrestrial, with a nodose rhizome or pseudobulb. *Leaves* 1-2, narrow, plaited, appearing after flowering. *Inflorescence* a raceme with many rather small flowers. *Flowers* small with large scarious bracts. *Sepals* sub-equal, not widely spreading, the laterals distinctly swollen at the base, like a small mentum. *Petals* similar to *sepals*. *Lip* sessile, 3-lobed, slightly saccate at the base, with 5-longitudinal keels. *Column* slender, without or with a short foot. *Anther* 4-chambered, deciduous; *pollinia* 8, pyriform, connected by viscus at their base.

**Pachystoma senile** (Lindl.) Rchb. f. Bonpl. 3: 250. 1858; Hook. f., 5: 812. 1890; King & Pantl. 101, t. 140. 1898; Duthie, 108. 1906; Raizada et al. 18. 1981.

*Apaturia senilis* Lindl. Gen. & Sp. Orch. 130. 1831.

(Fig. 193)

Tuberous terrestrial. *Rhizome* horizontal, sub-cylindric, leafless while flowering, with only a single raceme, 30-35 cm high. *Leaves* one or two, appearing after flowering, grass like, 40 × 6.6 cm, 4-5-nerved. *Flowers* sub-secund, dull purplish or pinkish, glandular-puberulous. *Bracts* very long, 1-2.5 cm long, lanceolate, acuminate. Ovary and pedicel 1.5 cm long, glandular-pubescent. *Sepals* spreading; the dorsal 1-1.3 cm long, oblong, abruptly toothed at tip, 5-nerved; laterals equal to the dorsal, sub-saccate at the base, lanceolate, oblique and mucronate at tip. *Petals* spreading, 1-1.4 cm long, much narrower than the sepals, spatulate, more or less beaked at tip. *Lip* 10-12 mm long, trilobed, saccate at the base; sac with a median thickening, proximal rim clad with hairs; side lobes erect, oblong, obtuse; mid lobe oblong-orbicular, 5-lamellate; lamella thick, crested.

*Flowering*: March - April.

*Distribution*: Himalaya 1000-1200 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram, Manipur, Tripura, Plains of Uttar Pradesh, W. Ghats, Nicobar Island. Burma, Malaya, Java, Sumatra, Vietnam, Thailand, China.

*Specimens examined*:

GARHWAL: Dehra Dun-Dehra Dun, Mackinnon 24191; Lachiwala, Raizada; Mussoorie, Falconer. PAURI-SOUDLA, Ganges Valley, Osmaston 289; Dhikala, Kalagarh, Osmaston 1354, Pant 43136.

KUMAUN: Pithoragarh-Vasavgad Gori Valley, Bhattacharyya 21276. Nainital-Nainital, Champion 7804.

### Phaius Lour.

Tall and stout terrestrial herbs with leafy stems; more or less pseudobulbous. *Leaves* broad, plaited. *Scape* with raceme arising from the side of pseudobulb or axillary. *Flowers* large. *Sepals* and *petals* free, spreading. *Lip* slightly joined to the base of the column and embracing it, 3-lobed, more or less saccate or spurred at the base with longitudinal ridges on the upper surface. *Column* long, slender; foot absent or very short. *Anther* incompletely 4-chambered; *pollinia* 8, waxy, in two groups of 4, with a caudicle.

**Phaius tancarvilleae** (L. Herit.) Blume, Bot. Lugd. Bat. 2: 177. 1856; Seidenf. & Arora, 24. 1982.

*Limodorum tancarvilleae* Banks ex L. Herit., Sert. Angl.: 28. 1789.

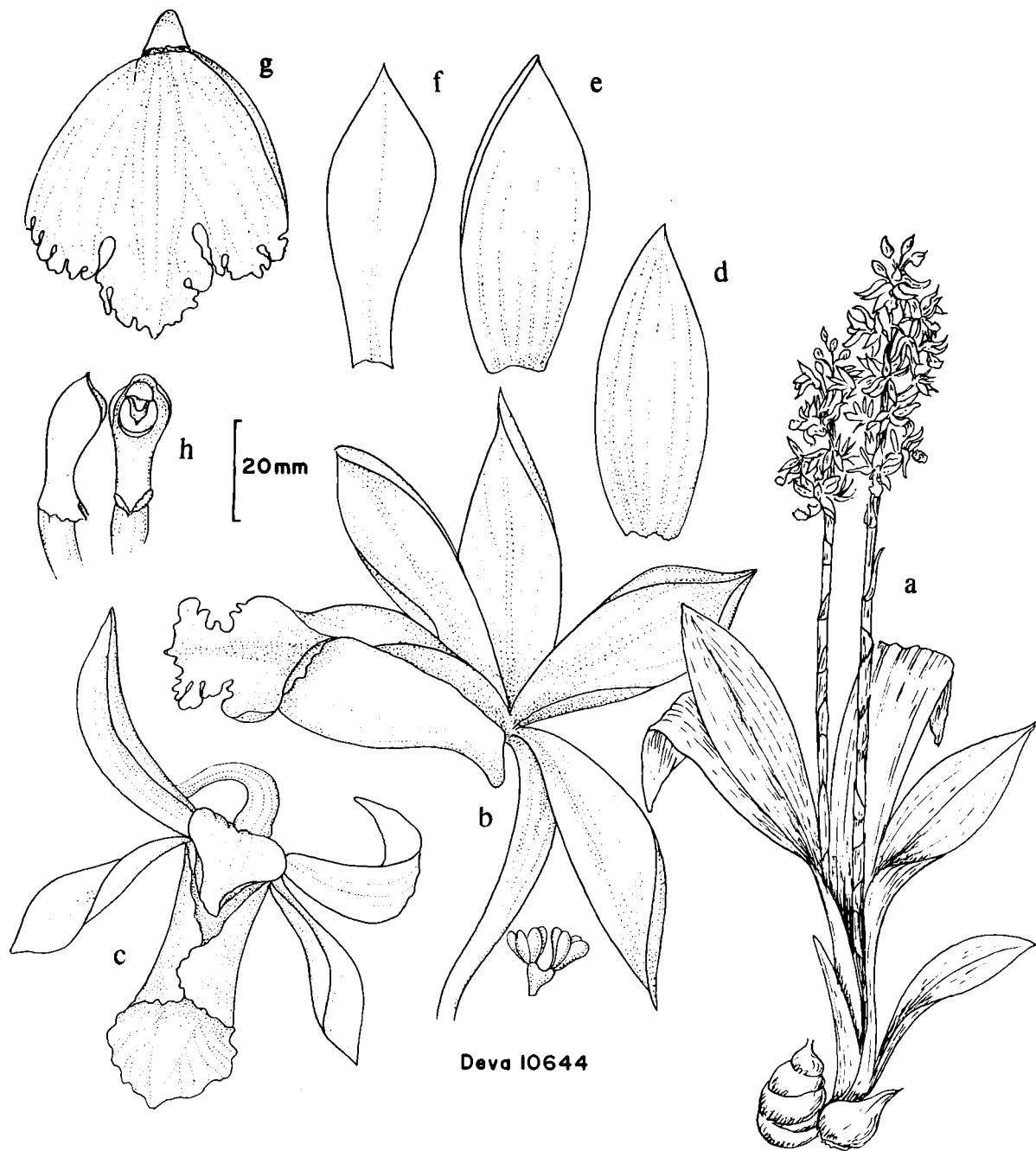
*P. wallichii* Lindl. in Wall. Pl. Asiat. Rarior. 2: 46, t. 158. 1831; Hook. f., 5: 816. 1890; King & Pantl. 108, t. 150. 1898.

*P. grandifolius* Lour. Fl. Cochinch. 2: 529. 1790.

*P. blumei* Lindl. Gen. & Sp. Orch. 127. 1830.

(Fig. 194)

Large terrestrial herb with pseudobulbs, leafy stem and vermiform roots. *Pseudobulbs* about 8 cm long, 2.5-3 cm in diameter, annulate, internodes greenish-white. *Leaves* 2-4 on each pseudobulb, 30-120 cm long from the base of petiole to apex, 4.5-13.5 cm broad, lanceolate or oblong-lanceolate, acuminate, strongly



**Fig. 194** *Phaius tancarvilleae* (L. Herit.) Bl.—a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. lip with spur; h. column.

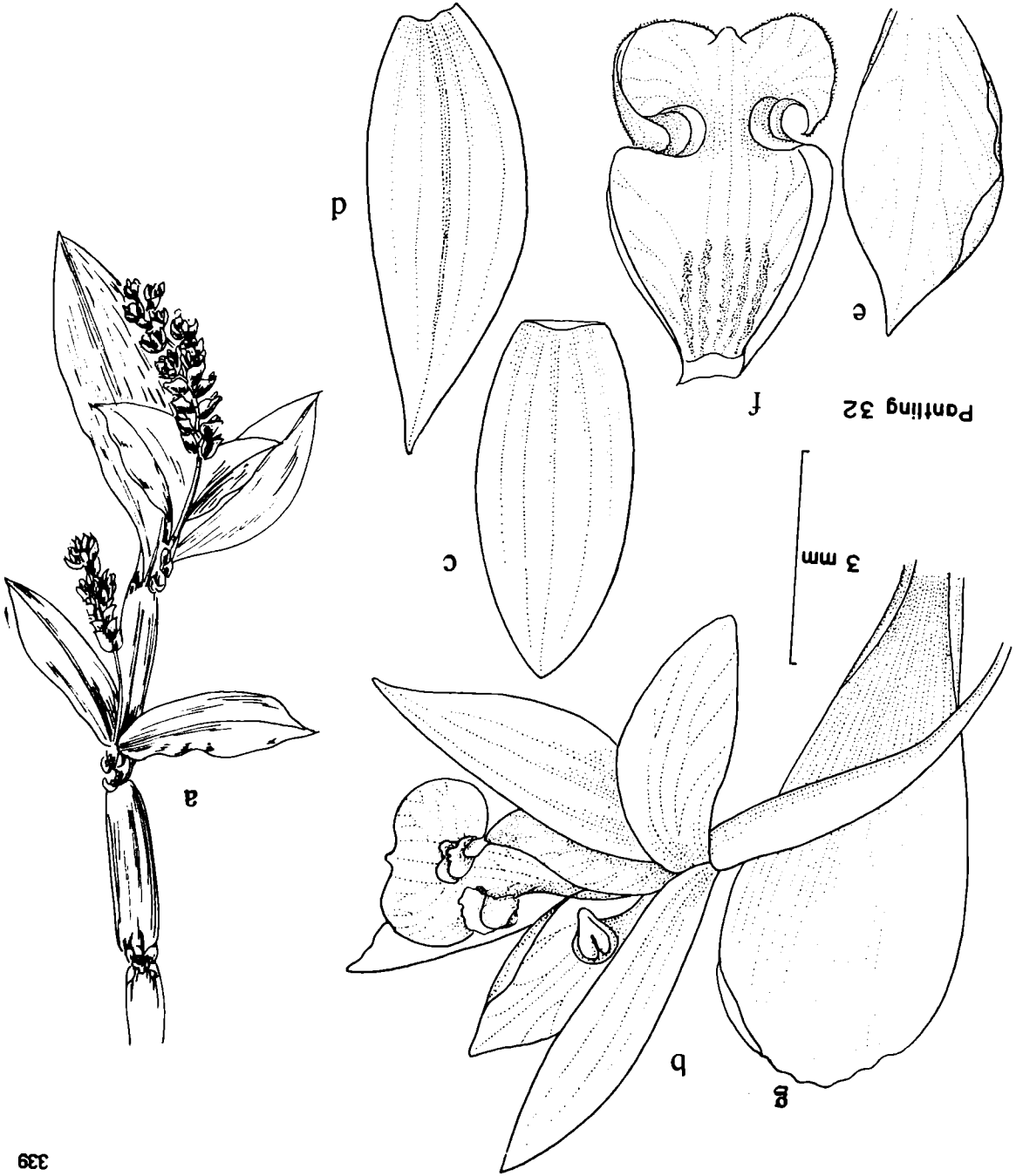
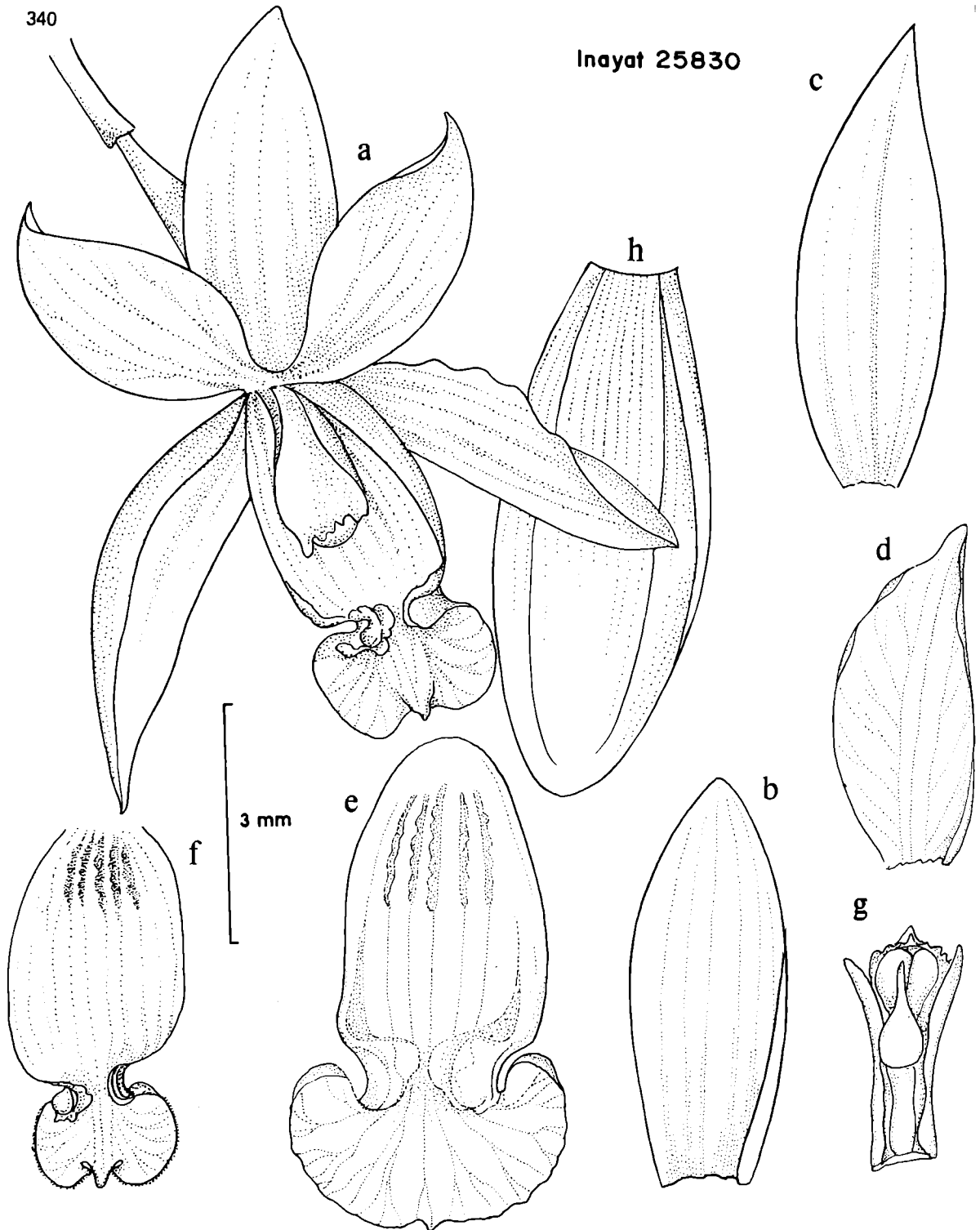


Fig. 195 *Pholidota articulata* Lindl.—a. plant; b. flower; c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. floral bract.



**Fig. 196** *Pholidota articulata* Lindl. —a. flower; b. dorsal sepal; c. lateral sepal; d. petal; e. & f. lip; g. column; h. floral bract.

ribbed. *Inflorescence* many flowered raceme. *Flowers* 6-11 cm across, varying in colour from purplish-orange to pale orange-yellow with an orange-yellow to purplish-white lip. *Bracts* 4.5 cm long, orbicular-ovate, acuminate or cuspidately acute, 11-veined. *Sepals* the dorsal 4-5 cm long, lanceolate, acute, 7-veined. *Petals* 3.7-5.2 cm long, lanceolate or oblong-lanceolate, acute or sub-acute, 7-veined. *Lip* 3.5-5 cm long, erect, 3-lobed, adnate to the base of the column and embracing it by the convolute and recurved crenate lateral lobes; mid lobe orbicular, crenate, posteriorly produced into a horn-like spur, sometimes bifid.

*Flowering*: April - June.

*Distribution*: Himalaya (Nepal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Mizoram, Manipur, Tripura. Bangladesh, Sri Lanka, Burma, Java, Sumatra, Borneo, Thailand, Indo-China, China, New Guinea, Formosa, Samoan and Fiji Islands.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Rajpur Road, Arora 36482; 13 Balbir Avenue, Deva 10644 (cultivated).

Widely cultivated in the region, there is no record of a wild plant occurring in N.W. Himalaya.

#### **Pholidota** Lindl. ex Hook.

Epiphytes with tufted 1 or 2 leaf pseudobulbs. *Leaves* broad, paited. *Inflorescence* terminal on pseudobulb, slender, decurved, pendulous, rachis often conspicuously zigzag. *Flowers* small, borne alternately in two ranks. *Bracts* large, cymbiform, distichous. *Sepals* concave, the laterals often keeled at the back. *Petals* narrow, flat. *Lip* sessile on the base of the column, base saccate and distinct from the blade, blade small, deflexed. *Column* very short, with a wide wing round the anther, foot absent. *Anther* 2 chambered; *pollinia* 4, waxy, sub-globose, free or cohering in pairs by a viscus.

#### **Key to species**

1. New pseudobulbs arising from the base of the old; leaf solitary; epichile of the lip divided at the apex by a broad to narrow sinus..... *P. imbricata*
- + New pseudobulb arising near the apex of the old, giving a jointed stem-like appearance; leaves two; hypochile with 5-lamellate nerves; epichile bilobulate or not, apex usually apiculate.... *P. articulata*

***Pholidota articulata*** Lindl. Gen. & Sp. Orch. 38, 1830; Hook. f., 5: 844. 1890; King & Pantl. 146, t. 205. 1898; Duthie, 116. 1906; Seidenf. & Smitinand 139. 1959.

*P. griffithii* Hook. f., Fl. Brit. Ind. 5: 845. 1890 et Ic. Pl. t. 1881. 1890; Arora 438, fig. 1-4. 1969; Raizada et al. 25. 1981.

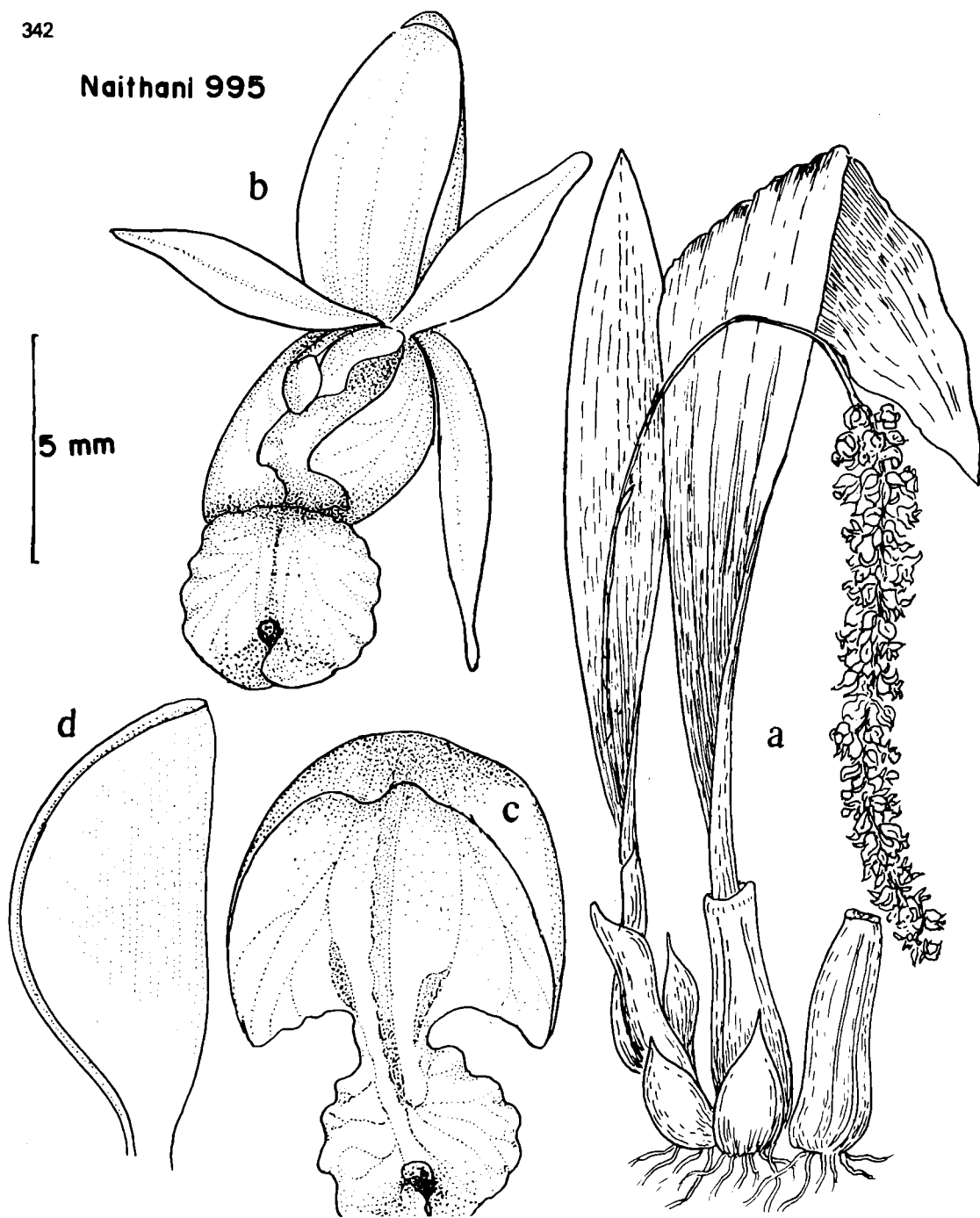
*P. articulata* var. *griffithii* (Hook. f.) King & Pantl. in Ann. Roy. Bot. Gard. Cal. 8: 147, t. 204, 1898; Duthie, 116. 1906. (Fig. 195, 196)

*Pseudobulbs* 5-10 × 1.2-2 cm, new one arising near the apex of the old, jointed, branching, furrowed. *Leaves* two, 7.5-12 × 2.5-4.5 cm, narrowly oblong, sessile or shortly petiolate, tapering to each end, many-nerved, membranous. *Inflorescence* raceme, 20-55 cm long, pendulous, densely may flowered. *Flowers* 8 mm across, white, suffused with brownish-pink. *Bracts* large, distichous, broadly-ovate, convolute, deciduous when flowers open, acute or obtuse, longer than ovary. *Sepals* the dorsal sub-orbicular, laterals ovate, keeled. *Petals* ovate-robicular, blunt. *Lip* about as long as the sepals, 3-lobed, hypochile with rounded lobes, cymbiform, with 5-lamellate nerves; epichile broad bilobulate or not, apex usually apiculate.

*Flowering*: July - August.

*Distribution*: Himalaya 1200-1600 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, Tripura. Burma, China, Indo-China, Malaya.

Naithani 995



197 *Pholidota imbricata* (Roxb.) Lindl.—a. plant; b. flower; c. lip; d. floral bract.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Near Mussoorie, *Mackinnon* 21780. **Pauri**-Outer Garhwal hills, *Inayat* 25830. **Chamoli**-Guptkashi, *Kirat Ram* 8976.

KUMAUN: **Pithoragarh**-Near Askot, *Duthie*; Shama, Sarju Valley, *Inayat* 24125; Bram, *Bhattacharyya* 21217; Didihat, *Arora* 37872, *M.A. Rau* 35319; Askot, *Arora* 66104. **Nainital**-Below Nainital, *Strachey & Winterbotton* 17; Kaladoongee, *Davidson*.

We find that it is not possible to distinguish *Pholidota griffithii* Hook. f. form *Pholidota articulata* Lindl. The lip in both the species is identical. King & Pantl. (1898) kept it as a variety of *P. articulata* and distinguished it on the basis of its being smaller in all its parts, the floral bracts being oblong or sub-orbicular, obtuse and smaller. We examined a specimen Pantling No. 32 (specimen of *P. griffithii*, see fig. 195) and do not find it different in any way from *P. articulata*. Seidenfaden & Smitinand (1959) have also been unable, to distinguish between these two species and consider the smaller size due to ecological conditions of the locality.

**Pholidota imbricata** Lindl. in Hook. Ex. Fl. t. 138. 1825; Hook. f., 5: 845. 1890 p.p.; King & Pantl. 144, t. 201. 1898; Duthie, 115. 1906.

*Cymbidium imbricatum* Roxb. Fl. Ind. ed. 2, 3: 460. 1832.

*Ptilocnema bracteatum* D. Don Prodr. Fl. Nepal 33. 1825.

*Coelogyne imbricata* (Roxb.) Rchb. f. in Walp. Ann. Bot. Syst., 6: 238. 1861.

(Fig. 197)

*Pseudobulbs* in clusters, new one arising from the base of the old, swollen, green, 2.5-5 × 1-2 cm, oblong-conical. *Leaf* solitary, 12.5-35 × 3-6 cm, elliptic-oblongate, acute. *Inflorescence* a raceme, 25-55 cm long, pendulous, with bifarious imbricate bracts from the tip of the fresh offshoots; inflorescence axis straight or zigzag; scape 12 cm long. *Flowers* 7 mm across, white, arranged in two rows. *Bracts* large, about 8 × 7 mm, broadly ovate, concave, obtuse, pinkish-brown, persistent, longer than the ovary. *Sepals* sub-equal, concave, 3-nerved; the dorsal 5 × 4.5 mm, broadly ovate, obtuse; the laterals 6.5 × 3 mm, cymbiform, obtuse, with a dorsal median wing. *Petals* the lateral 5 × 1.2-2 mm, falcate-linear, acute, 1-nerved. *Lip* 6.5 mm long, deeply saccate, sac with 3 longitudinal ridges; hypochile broadly triangular, obtuse, erect; epichile 2-lobulate, with a shallow median sinus, lobules auricular.

*Flowering*: July - August.

*Distribution*: Himalaya 1400-1800 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, Tripura, Bihar, Orissa, Deccan Peninsula. Burma, Sri Lanka, W. China, Malaysia, Thailand, Australia.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Near Mussoorie, *Duthie* 24192; New Forest, *Naithani* 995 (Cultivated).

KUMAUN: **Pithoragarh**-Khela, Kali Valley, *Inayat* 24123; Gori Valley, *Inayat* 24124; Askot, *Arora* 36938. The pseudobulbs of *P. imbricata* finely macerated in mustard oil and applied to joints helped to alleviate rheumatic pain (Sarker & Agarwal, 1978).

There is a lot of confusion about this species whether it is distinct from *Pholidota pallida* Lindl. Hook. f., (1890); King & Pantl. (1898) and Duthie (1906) have kept *P. imbricata* and *P. pallida* together, while Pfitz & Kranzl. (1907) kept them distinct. Santapau & Kapadia (1966) consider all this very confusing and think them to be identical. Seidenf. & Arora (1982) advice further study and think that some or all the plants from this region may be *P. pallida*. We have not persued this matter further and whatever material we have examined from the N.W. Himalaya is distinctly *P. imbricata*. Holttum (1964) also mentioned that *P. imbricata* is a distinct Himalayan species of limited distribution.

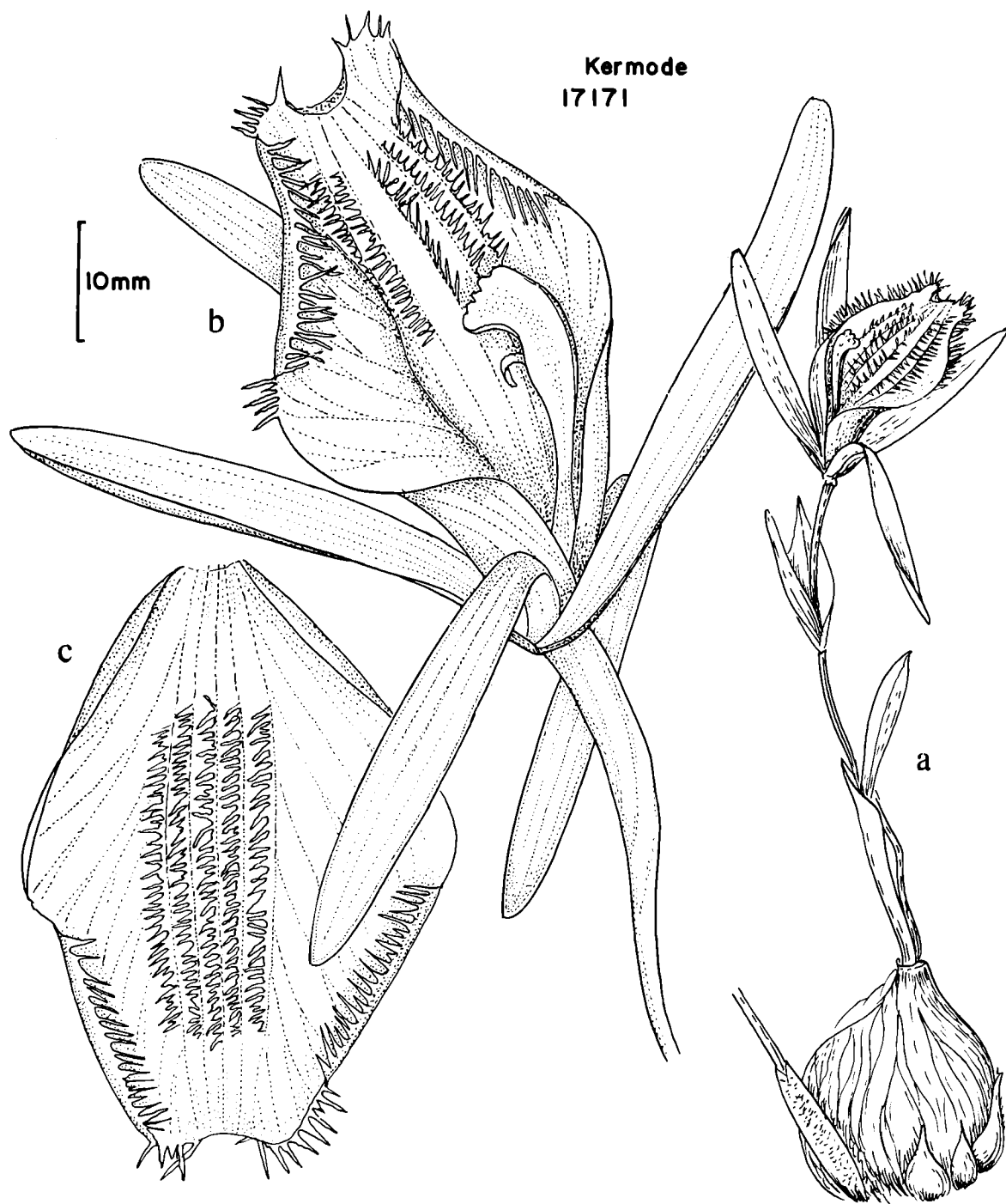
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Fig. 198 *Pleione grandiflora* (Rolfe) Rolfe—*a.* plant; *b.* flower; *c.* lip.



### Pleione D. Don

Terrestrial herb. *Rhizome* absent. *Pseudobulbs* caespitose. *Leaves* 1-2 usually falling off before flowering, coriaceous or membranous. *Peduncle* from the base of adult pseudobulb. *Flower* large, 1 or rarely 2 per pseudobulb, pink or white. *Sepals* sub-equal, spreading, lanceolate or oblong. *Petals* like sepals but narrower. *Lip* more or less orbicular, prominent, almost unlobed to sometimes 2-lobed, margins fringed. *Disc* with prominently fringed folds. *Column* long, curved; *pollinia* 4, in pairs.

#### Key to species

(Based on P.F. Hunt and C.G. Vosa in Kew Bull. 25(3): 430-31, 1971)

1. Pseudobulbs flash-shaped, gradually narrowed into a beak, occasionally somewhat flattened horizontally ..... 2
- + Pseudobulbs barrel-shaped, abruptly contracted into a beak; basal sheaths of flowering stem warty; flowers with lip 3-4.5 × 3.5-5.5 cm; keels extending only two third of length of lip..... *P. praecox*
2. Keels of lip irregularly incised-crested, 4-5 in number, lip broadly elliptical, about 5.5-6 × 3.5-4.5 cm; leaf solitary; pseudobulbs large about 4 cm high and 1.5 cm broad..... *P. grandiflora*
- + Keels of lip barbate, 6-7 in number..... 3
3. Flowers appearing at the same time as young leaves; lip reniform about 3.5-4 × 3.5-4 cm..... *P. hookeriana*
- + Flowers appearing when no leaves present; lip elliptical about 4 × 3 cm ..... *P. humilis*

**Pleione grandiflora** (Rolfe) Rolfe, in Orch. Rev. 11: 291. 1903; Nair, 461. 1966; Hunt & Vosa, 428. 1971

*Coelogyne grandiflora* Rolfe in J. Linn. Soc. Bot. 36: 22. 1903.

(Fig. 198)

*Pseudobulbs* ovate to flask-shaped, 3-4 × 1.5 cm. *Leaf* solitary, lanceolate, acute, 4-5 cm long when the flower opens. *Scape* appearing with the leaf, erect, 10-12 cm long, basal sheaths tubular, obliquely truncate, thin and membranous, transparent, shining, equal to pseudobulbs. *Flower* white, solitary. *Bracts* narrowly elliptic, tip rounded. *Sepals* and *petals* similar, lanceolate-oblong, obtuse, 4-5 × 0.75. *Lip* broadly elliptic, about 5.5-6 × 3.5-4.5 cm, streaked and spotted brown inside, emarginate, margin fimbriate, trilobed; lateral lobes rounded; apical lobe trapeziform. *Disc* with 4-5 incised-crested keels.

*Flowering*: April - May.

*Distribution*: Himalaya 2600-2700 m (Kumaun). Burma, China (Yunnan).

We have seen no specimen and is being included on the authority of Nair (*loc. cit.*). Its presence in Kumaun appears to be doubtful and needs confirmation. Fig. 198 is drawn from a specimen collected by Kermodé from Burma.

KUMAUN: Pithoragarh-Kalamuni Pass, Nair 35536 (Nair, *loc. cit.*).

**Pleione hookeriana** (Lindl.) Moore in Williams, Orch. Grow. Man. ed. 6: 548. 1885; Hunt & Vosa, 428. 1971.

*Coelogyne hookeriana* Lindl. Fol. Orch. 14. 1854; Hook. f., 5: 842. 1890; King & Pantl. 139, t. 193. 1898; Duthie, 114. 1906

(Fig. 199)

*Pseudobulbs* caespitose, oval 2-2.5 cm long, smooth, not mottled, sheaths few, lax. *Leaf* solitary, from the base of adult pseudobulbs, 5-7.5 × 2-2.5 cm, elliptic-lanceolate, acuminate; petiole 2-3 cm long. *Peduncle* enveloped in the sheaths which surround the base of the undeveloped leaf. *Flower* solitary, 5 cm across, bright rose colour except the pale lip which is blotched at the apex with pale brown-purple. *Bracts* persist-

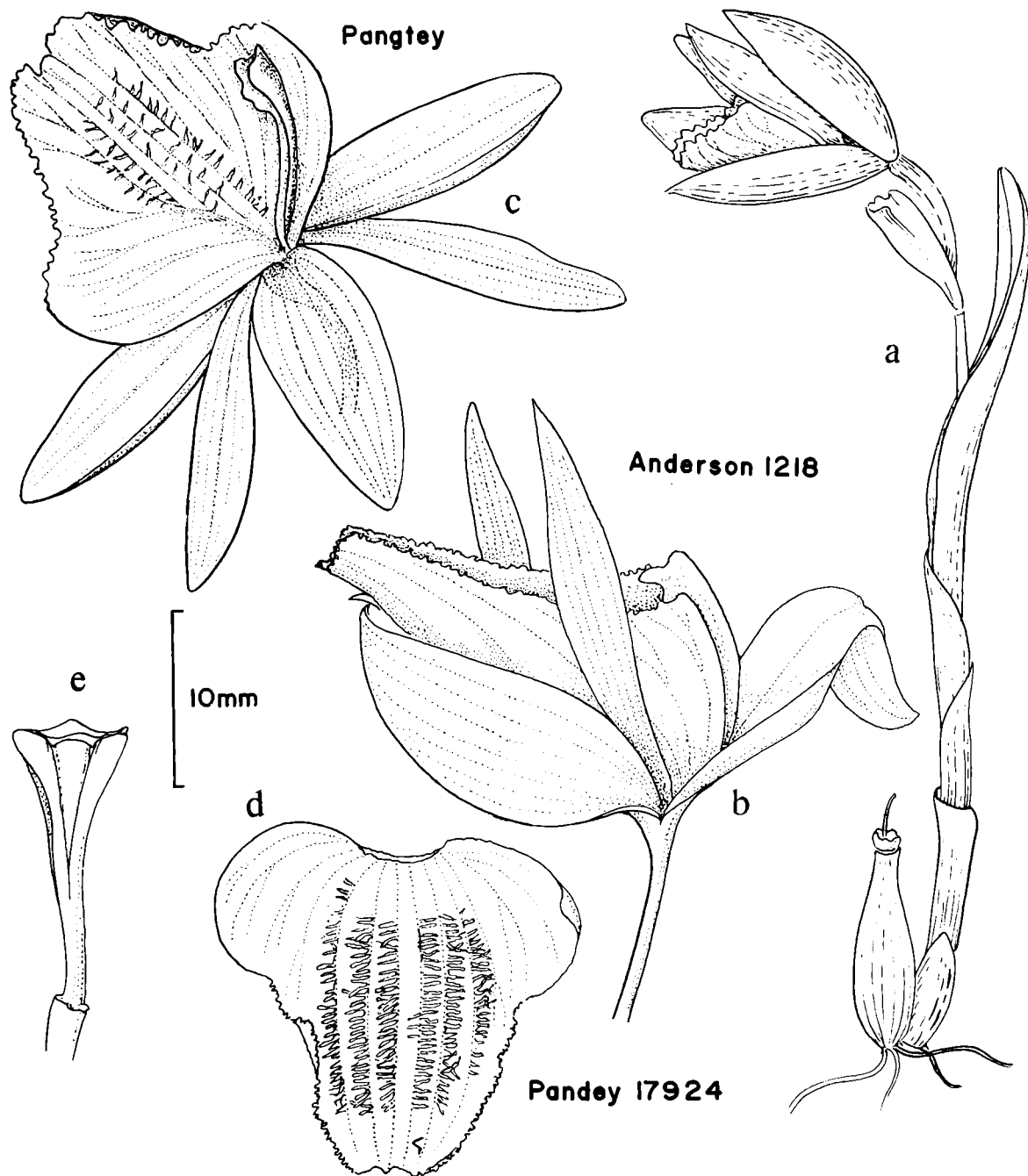


Fig. 199 *Pleione hookeriana* (Lindl.) J. Moor—a. plant; b. & c. flower; d. lip; e. column.

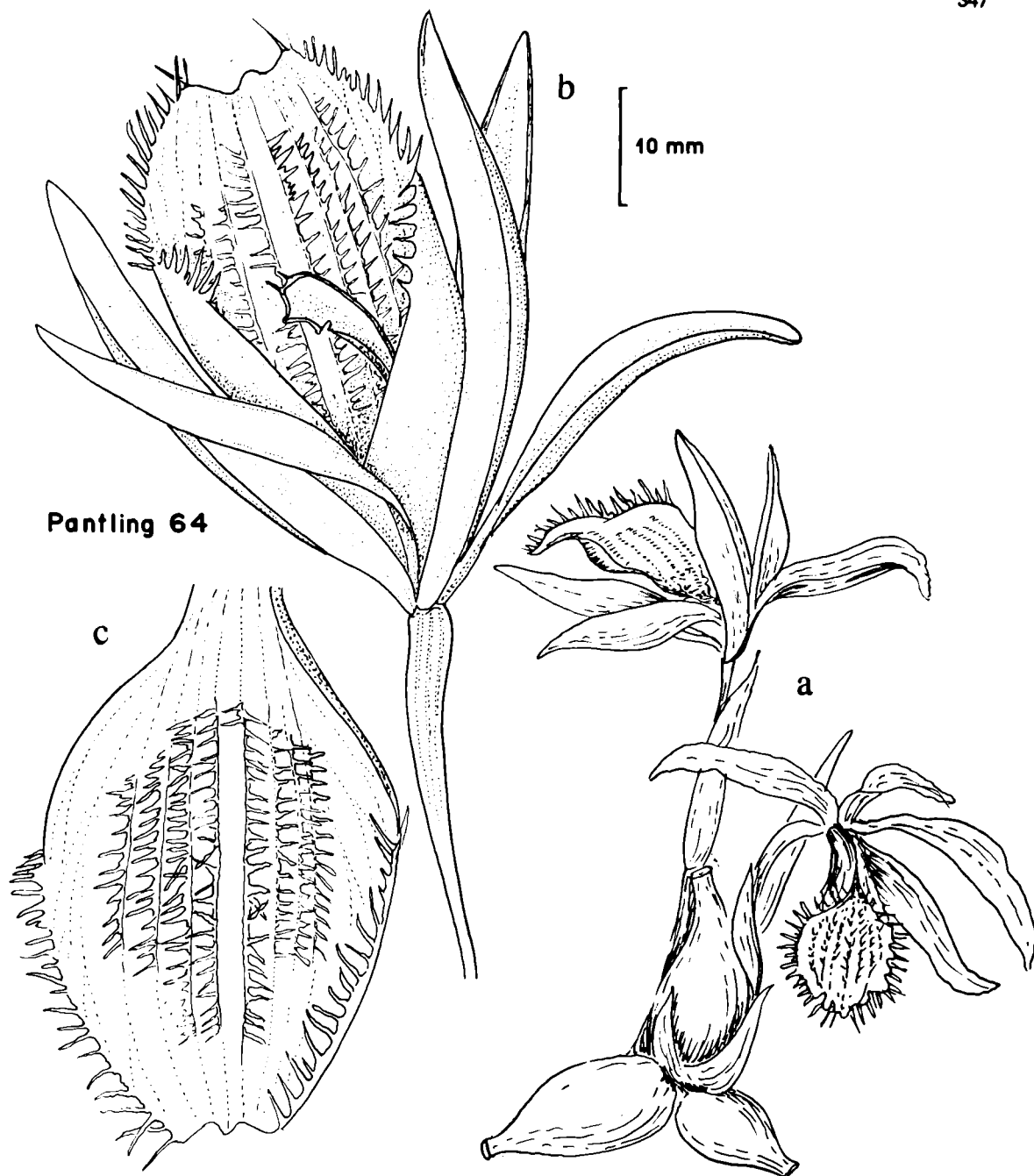


Fig. 200 *Pleione humilis* (Sm.) D. Don.—a. plant; b. flower; c. lip.

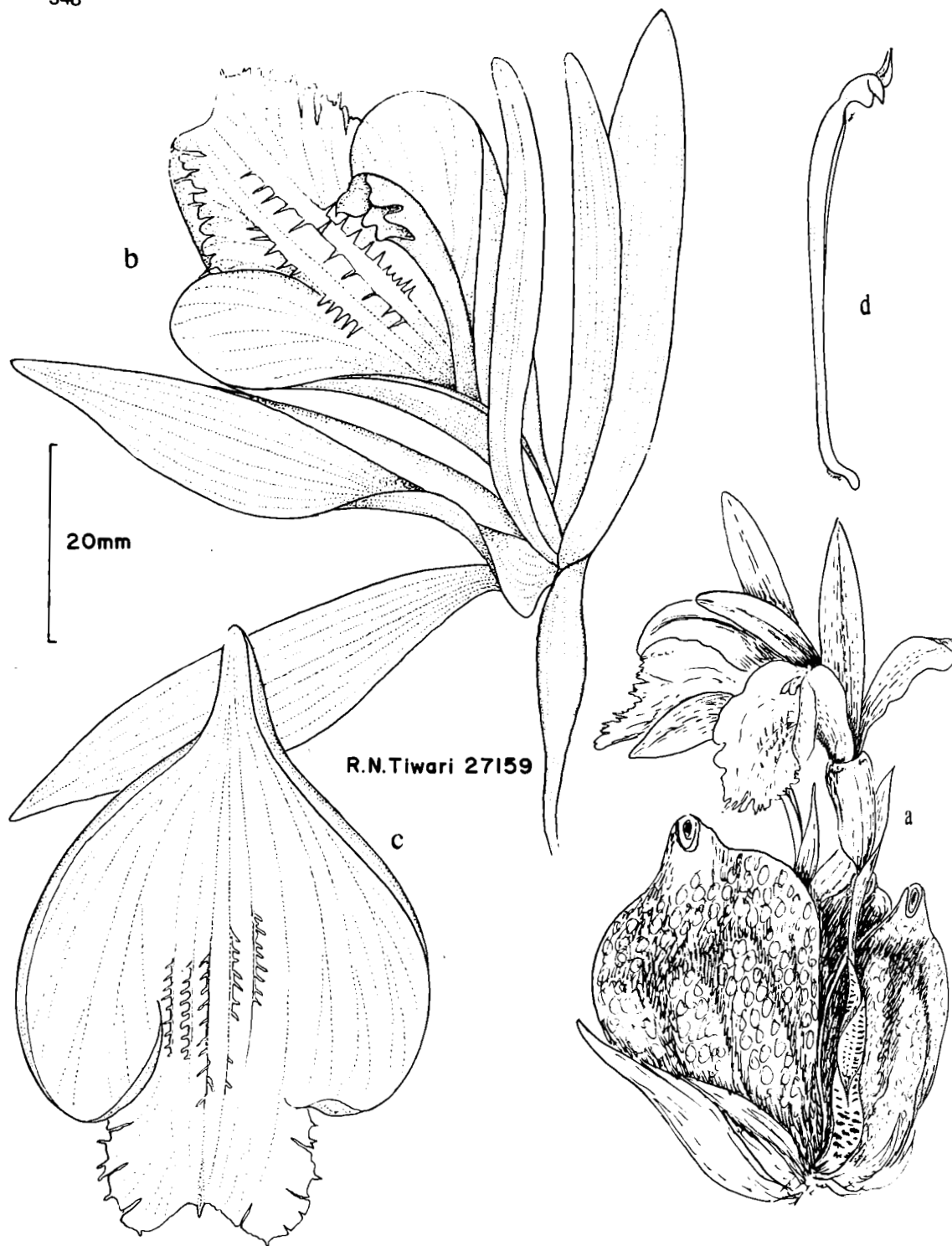


Fig. 201 *Pleione praecox* (Sm.) D. Don—**a**. plant; **b**. flower; **c**. lip; **d**. column.

tent, obovate-elliptic, obtuse, convolute, about as long as the ovary. *Sepals* spreading, sub-equal, 2-2.2 cm long, elliptic-oblong, blunt; the dorsal narrower than the lateral pair. *Petals* as long as the sepals, oblanceolate, sub-falcate. *Lip* reniform, 2.5-4 × 3.5-4 cm, 3-lobed, lateral lobes rounded; apical lobe trapeziform, emarginate. Disc with 7 ciliate keels running from base to apex.

*Flowering*: May - June.

*Distribution*: Himalaya 2400 - 3500 m (Kumaun to Arunachal Pradesh). Burma.

*Specimens examined*:

KUMAUN: **Almora-Malerhari**, *Pandey 17924, Pangtey*.

***Pleione humilis*** (Sm.) D. Don Prodr. Fl. Nepal 37. 1825; Hunt & Vosa, 428. 1971; Katakai et al. 5: 30. 1984.

*Epidendrum humile* Sm. Exot. Bot. 2: 75 t. 98. 1806.

*Coelogyne humilis* (Sm.) Lindl. Coll. Bot. sub. t. 37. 1825; Hook. f., 5: 840. 1890; King & Pantl. 139, t. 194. 1898.

*C. humilis* var. *albata* Rchb. f. in Gard. Chron. ser. 3, 3: 392. 1888.

*P. humilis* var. *albata* Rchb. f. in Gard. Chron. 1: 392. 1888; Nair, 461. 1966. (Fig. 200)

*Pseudobulbs* caespitose, conico-ovate, 4-4.5 cm long, partly enclosed by fibrous sheaths. *Leaf* solitary, sessile, 7.5-12 × 3-4 cm, elliptic, acute, tapering to the base. *Peduncle* from the base of the pseudobulb and about the same length, enveloped to the apex in tubular pale sheaths. *Flower* usually one, rarely two, white, appearing when no leaf is present, 5-6 cm across. *Bracts* obovoid-elliptic, obtuse, convolute, pale-purple, longer than the ovary. *Sepals* sub-equal, spreading, oblong-acute, 3.5-5 cm long, white, faintly tinged with rose. *Petals* narrower, obtuse. *Lip* elliptical, 4 × 3 cm, without lobes, fringed in its upper portion, emarginate, of the same colour as the sepals, except where it is traversed by six parallel veins (that are also fringed), and between each of which rich crimson streaks are interposed.

*Flowering*: February - March.

*Distribution*: Himalaya 2300-2800 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram. Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun-Mussoorie**, *Mackinnon 454694 & 454695*.

KUMAUN: **Pithoragarh-Kalamuni Pass**, *Nair 35519*

Fig. no. 200 drawn from a specimen collected by Pantling from Eastern India.

***Pleione praecox*** (Sm.) D. Don Prodr. Fl. Nepal 37. 1825; Hunt & Vosa, 429. 1971; Katakai et al. 5: 30. 1984.

*Epidendrum praecox* (Sm.) Exot. Bot. 2: 73, t. 97. 1806.

*Coelogyne praecox* (Sm.) Lindl. Coll. Bot. sub. t. 37. 1825; Hook. f., 5: 840. 1890; King & Pantl. 141, t. 196. 1898; Duthie, 114. 1906.

*C. wallichiana* Lindl. Gen. & Sp. Orch. Pl. 43. 1830. (Fig. 201)

*Pseudobulbs* 15 × 2 cm, barrel-shaped, abruptly contracted into a beak; basal sheaths of flowering stem warty. *Leaves* two, 10-20 × 4.5-6.5 cm, oblanceolate to elliptic, sub-acute, many-nerved; petiole 2.5-5 cm long. *Peduncle* from the base of and about as long as the mature pseudobulb. *Flowers* one to two, 7-10 cm across, rose-purple. *Bracts* obovoid, obtuse, convolute, as long as or longer than ovary. *Sepals* sub-equal, spreading, oblanceolate, 5-7 cm long. *Petals* spreading, as long as the sepals but narrower. *Lip* ovate-orbicular, pink with purple spots, 3-lobed; lateral lobes rounded; apical lobes having irregular lobulate-dentate edges, the apex bifid. Disc 5-keeled; keels extending only two-third of the length of lip.

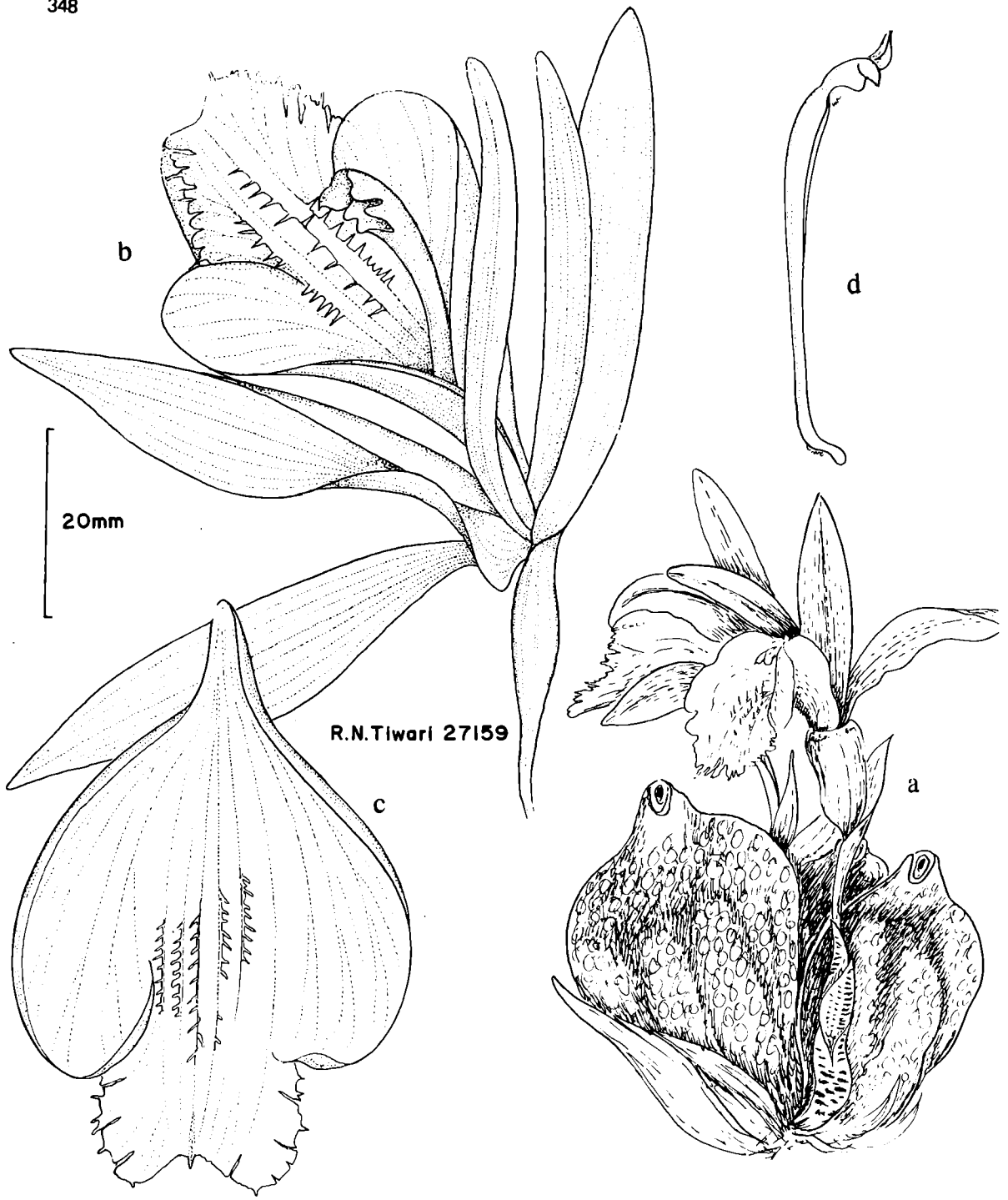


Fig. 201 *Pleione praecox* (Sm.) D. Don— a. plant; b. flower; c. lip; d. column.

tent, obovate-elliptic, obtuse, convolute, about as long as the ovary. *Sepals* spreading, sub-equal, 2-2.2 cm long, elliptic-oblong, blunt; the dorsal narrower than the lateral pair. *Petals* as long as the sepals, oblanceolate, sub-falcate. *Lip* reniform, 2.5-4 × 3.5-4 cm, 3-lobed, lateral lobes rounded; apical lobe trapeziform, emarginate. Disc with 7 ciliate keels running from base to apex.

*Flowering*: May - June.

*Distribution*: Himalaya 2400 - 3500 m (Kumaun to Arunachal Pradesh). Burma.

*Specimens examined*:

KUMAUN: **Almora**-Malerhari, *Pandey* 17924, *Pangtey*.

***Pleione humilis*** (Sm.) D. Don Prodr. Fl. Nepal 37. 1825; Hunt & Vosa, 428. 1971; Katakai et al. 5: 30. 1984.

*Epidendrum humile* Sm. Exot. Bot. 2: 75 t. 98. 1806.

*Coelogyne humilis* (Sm.) Lindl. Coll. Bot. sub. t. 37. 1825; Hook. f., 5: 840. 1890; King & Pantl. 139, t. 194. 1898.

*C. humilis* var. *albata* Rchb. f. in Gard. Chron. ser. 3, 3: 392. 1888.

*P. humilis* var. *albata* Rchb. f. in Gard. Chron. 1: 392. 1888; Nair, 461. 1966. (Fig. 200)

*Pseudobulbs* caespitose, conico-ovate, 4-4.5 cm long, partly enclosed by fibrous sheaths. *Leaf* solitary, sessile, 7.5-12 × 3-4 cm, elliptic, acute, tapering to the base. *Peduncle* from the base of the pseudobulb and about the same length, enveloped to the apex in tubular pale sheaths. *Flower* usually one, rarely two, white, appearing when no leaf is present, 5-6 cm across. *Bracts* obovoid-elliptic, obtuse, convolute, pale-purple, longer than the ovary. *Sepals* sub-equal, spreading, oblong-acute, 3.5-5 cm long, white, faintly tinged with rose. *Petals* narrower, obtuse. *Lip* elliptical, 4 × 3 cm, without lobes, fringed in its upper portion, emarginate, of the same colour as the sepals, except where it is traversed by six parallel veins (that are also fringed), and between each of which rich crimson streaks are interposed.

*Flowering*: February - March.

*Distribution*: Himalaya 2300-2800 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram. Burma.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 454694 & 454695.

KUMAUN: **Pithoragarh**-Kalamuni Pass, *Nair* 35519

Fig. no. 200 drawn from a specimen collected by Pantling from Eastern India.

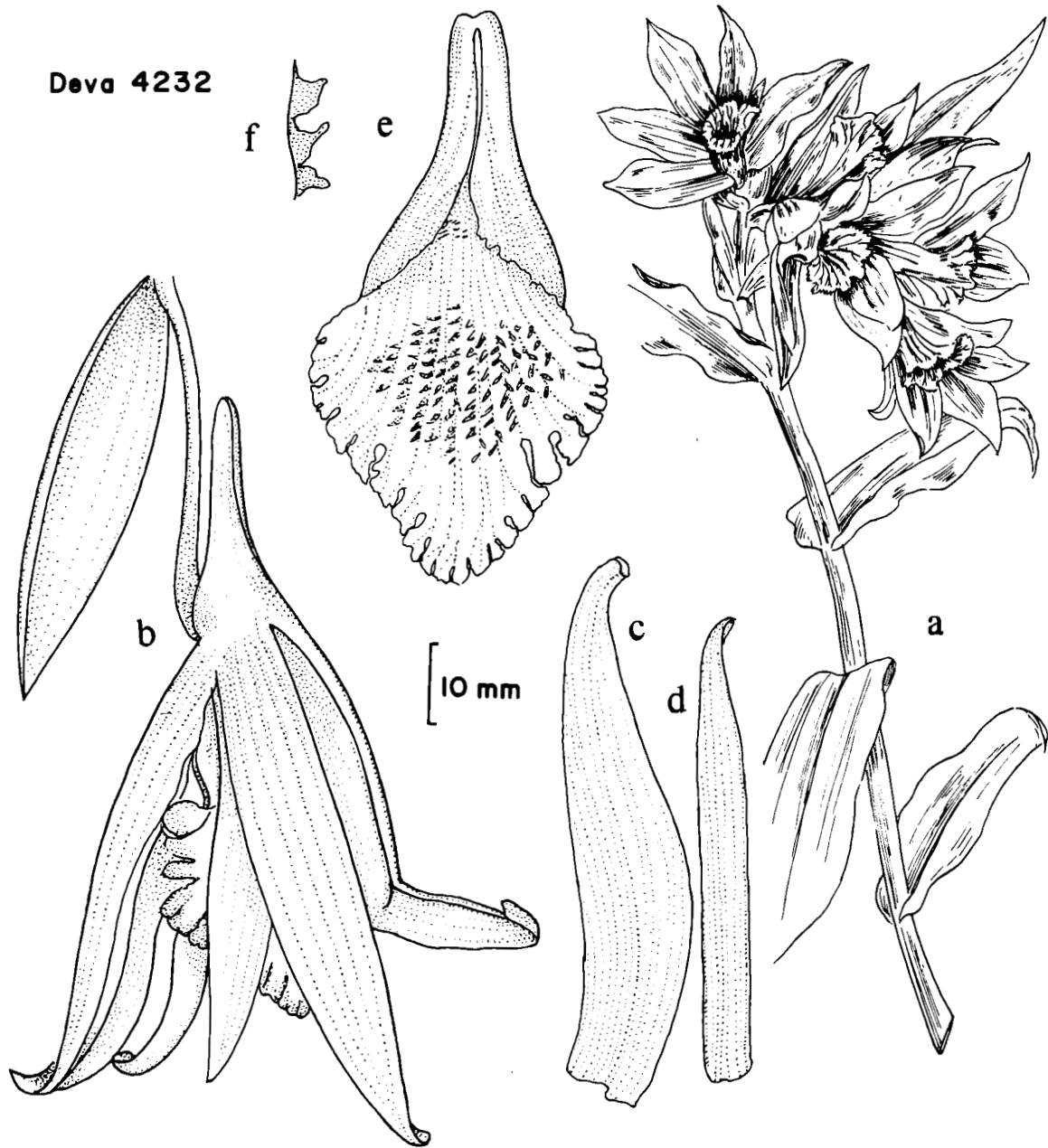
***Pleione praecox*** (Sm.) D. Don Prodr. Fl. Nepal 37. 1825; Hunt & Vosa, 429. 1971; Katakai et al. 5: 30. 1984.

*Epidendrum praecox* (Sm.) Exot. Bot. 2: 73, t. 97. 1806.

*Coelogyne praecox* (Sm.) Lindl. Coll. Bot. sub. t. 37. 1825; Hook. f., 5: 840. 1890; King & Pantl. 141, t. 196. 1898; Duthie, 114. 1906.

*C. wallichiana* Lindl. Gen. & Sp. Orch. Pl. 43. 1830. (Fig. 201)

*Pseudobulbs* 15 × 2 cm, barrel-shaped, abruptly contracted into a beak; basal sheaths of flowering stem warty. *Leaves* two, 10-20 × 4.5-6.5 cm, oblanceolate to elliptic, sub-acute, many-nerved; petiole 2.5-5 cm long. *Peduncle* from the base of and about as long as the mature pseudobulb. *Flowers* one to two, 7-10 cm across, rose-purple. *Bracts* obovoid, obtuse, convolute, as long as or longer than ovary. *Sepals* sub-equal, spreading, oblanceolate, 5-7 cm long. *Petals* spreading, as long as the sepals but narrower. *Lip* ovate-orbicular, pink with purple spots, 3-lobed; lateral lobes rounded; apical lobes having irregular lobulate-dentate edges, the apex bifid. Disc 5-keeled; keels extending only two-third of the length of lip.



**Fig. 202** *Thunia alba* (Lindl.) Rchb. t. — a. plant; b. flower; c. lateral sepal; d. petal; e. lip with spur; f. hair of lip.



*Flowering:* October - November.

*Distribution:* Himalaya 1700-3000 m (Garhwal to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Mizoram. Burma, W. China, Thailand.

*Specimen examined:*

KUMAUN: **Almora**-Mahruri, *R.N. Tiwari* 27159.

#### **Thunia** Rchb. f.

Terrestrial or epiphytic, without pseudobulbs. *Stem* close together, rather fleshy, recurved at the tip, bearing many leaves. *Leaves* distichous, lanceolate, blade covered with a slight waxy bloom. *Inflorescence* a terminal raceme. *Flowers* few, in a rather close pendulous group, with large pale-green or white persistent bracts. *Sepals* erecto-patent, sub-equal, lanceolate. *Petals* similar to sepals. *Lip* large, adnate to the base of column, shortly spurred, side lobes short, embracing the column, centre of mid lobe bearing several keels or crests with long teeth or soft spines. *Anther* incompletely 4-chambered; *pollinia* 8, waxy, in two groups of 4, to a granular membrane.

**Thunia alba** (Lindl.) Rchb. f. in Bot. Zeit 10: 764. 1852.

*Limnodorum bracteatum* Roxb. Fl. Ind. ed. 2, 3: 466. 1832.

*Phaius albus* Lindl. in Wall. Pl. Asist. Rarior 2: 85, t. 198. 1831; Hook. f., 5: 818. 1890; King & Pantl. 110, t. 153. 1898; Duthie, 109. 1906.

*Thunia venosa* Rolfe, in Orch. Rev. 206. 1905; Duthie, 193. 1920.

*Thunia bracteata* (Roxb.) Schlechter in Feede, Repert. Beih. 4: 205. 1919.

(Fig. 202)

Terrestrial, rarely epiphytic; pseudobulbs absent. *Stem* stout, erect, tufted, 30-90 cm high. *Leaves* 10-15 cm long, sessile, elliptic-lanceolate, acuminate, 3-7 nerved. *Inflorescence* drooping, 10-30 cm long, 4-6 flowered. *Flowers* white, 5-6.5 cm long. *Bracts* ovate-oblong, equalling or exceeding the ovary. *Sepals* white, 6-7 cm long, free, sub-equal, narrowly oblong, acute. *Petals* similar to sepals. *Lip* yellow or orange with purple lines, broadly oblong-panduriform when spread out, lower half convolute into a tube, upper portion cucullate, forming a rounded shell like mouth, slightly acuminate, margins undulate or unequally dentate; spur short, horizontal, slightly bifid.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, *Jameson*; Jharipani Mussoorie, *Deva* 2702. **Tehri**-Agrakhal above Narendranagar, *Deva* 4232. **Pauri**-Lansdowne, *Roberts*. **Chamoli**-Badrinath, *Falconer*; Nand-Prayag, *M.A. Rau* 10406.

KUMAUN: **Pithoragarh**-Near Askot, *Duthie* 5983; Thakil hills, *Inayat* 24122; Kanadhar, *Pant* 35108; Vasvgad, *Bhattacharyya* 21262; Dafiadhura, *Arora* 4557, 49526 & 66209; Didihat, *Arora* 36496 & 37873; Maitli, *Arora* 52442; Pithoragarh, *Arora* 37873. **Nainital**-Bhimtal, *Davidson*, *Pangtey*.

### V. Sub-fam. VANDOIDEAE

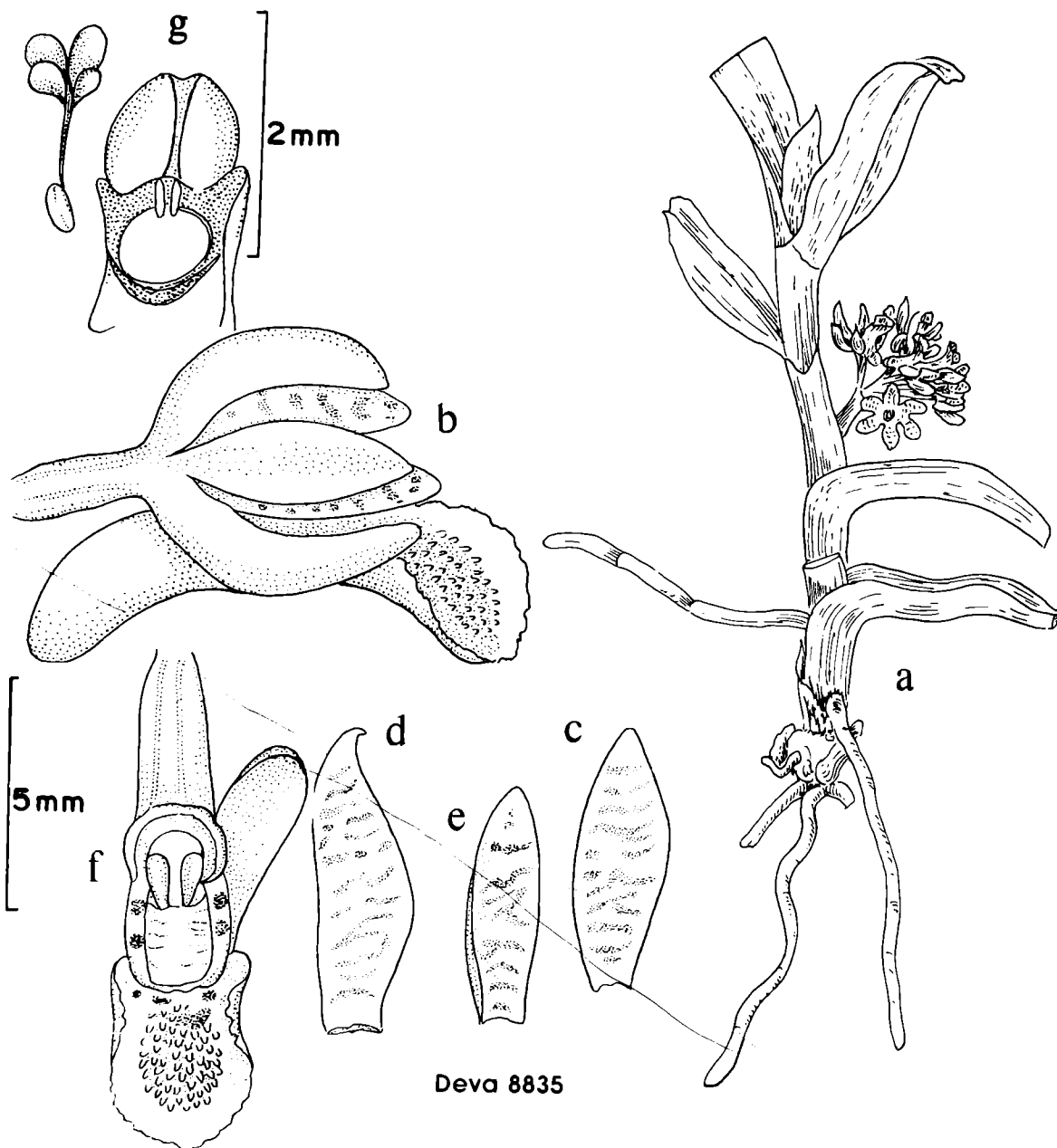
Epiphytic or lithophytes, rarely terrestrial, without pseudobulbs or sometimes with pseudobulbs, roots appearing at intervals or clustered at base. *Leaves* sub-opposite or alternate, flat, variously shaped or terete or sometimes absent. *Inflorescence* from axil of leaf sheaths, short or elongated, simple or branched. *Flowers* varied in shape and size and colour. *Sepals* and *petals* spreading, nearly equal. *Lip* with flat concave saccate or spurred base, with or without internal calli or appendages; *column* footless or with foot. *Anther* incumbent, rostellum porred; *pollina* 2 bilobed or 4, in two pairs, attached singly or in pairs by caudicles to a gland derived from the stigma.

In N.W. Himalaya 21 genera and 50 species.

Tribe	<b>Vandeeae</b>
Sub-tribe	<b>Cymbediinae</b> <i>Cymbidium</i> (8)
Sub-tribe	<b>Cryptopodiinae</b> <i>Eulophia</i> (9) <i>Geodorum</i> (1) <i>Oreorchis</i> (3)
Sub-tribe	<b>Thelasiinae</b> <i>Thelasis</i> (1)
Sub-tribe	<b>Genyorchidinae</b> <i>Sunipia</i> (1)
Sub-tribe	<b>Vandinae</b> <i>Pteroceras</i> (1) <i>Chiloschista</i> (1) <i>Kingidium</i> (2) <i>Ornithochilus</i> (1) <i>Aerides</i> (2) <i>Rhynchostylis</i> (1) <i>Luisia</i> (3) <i>Vanda</i> (5) <i>Vandopsis</i> (1) <i>Ascocentrum</i> (1) <i>Pelatantheria</i> (1) <i>Smitinandia</i> (1) <i>Gastrochilus</i> (4) <i>Cleisostoma</i> (1) <i>Acampe</i> (2)

## Key to Genera

1. Terrestrial.....2
- + Epiphytic.....7
2. Leafless saprophyte.....*Cymbidium*
- + Leafy plants.....3
3. Lip with a distinct spur.....*Eulophia*
- + Lip flat, concave or saccate at the base.....4
4. Pseudobulbs elongate above ground, closely covered with sheathing base of leaves; leaves strap shaped, long, coriaceous, not plicate.....*Cymbidium*
- + Pseudobulbs under ground (except *Eulophia graminea*), not covered with leaf bases; leaves plicate.....5
5. Lip with a short or long claw, deflexed from the middle, pollinia 4.....*Oreorchis*
- + Lip without a claw, base broad embracing the column, pollinia 2, sometime split into 4.....6
6. Inflorescence drooping, leaves at the time of flowering fully developed.....*Geodorum*
- + Inflorescence erect, leaves none or very young at the time of flowering.....*Eulophia*
7. Plants without leaves.....*Chiloschista*
- + Plants with leaves.....8
8. Plants with pseudobulbs.....9
- + Plants with stem.....11
9. Pseudobulbs covered with closely overlapping bases of leaves, leaves long, strap shaped, four or more; lip trilobed.....*Cymbidium*
- + Pseudobulbs not covered with leaf base; leaf single, lip not lobed.....10
10. Lip elliptic, margin entire, minutely bifid at the apex.....*Thelasis*
- + Lip panduriform, margin deeply serrate on anterior part.....*Sunipia*
11. Leaves terete.....12
- + Leaves flat.....13
12. Base of the lip flat or concave, forming shallow sac.....*Luisia*
- + Base of the lip with broad round sac.....*Gastrochilus*
13. Lip with forked appendages at its disc.....*Kingidium*
- + Lip without forked appendages.....14
14. Base of the lip concave, saccate or with a sac like spur almost as long as broad.....15
- + Base of the lip with a distinct spur, cylindrical, completely or partly longer than broad.....22
15. Entrance to the saccate spur occluded by calli on the front and back walls or by a dorsal scale or by a vertical septum .....16
- + Spur with out callus, scale or septum at the entrance.....18
16. Interior of spur with calli and a vertical septum dividing it into two vertical chambers; leaf tip obtusely bilobed .....*Pelatantheria*
- + Interior of spur occluded by calli on front or back wall or by a dorsal scale, but without any vertical septum.....17
17. Tip of the leaf bifid, segments acute-acuminate.....*Cleisostoma*
- + Tip of the leaf bifid, segments obtuse-rounded.....*Smitinandia*
18. Base of the lip concave, prominently auricled, embracing the column; stems and peduncles warted by minute black spots.....*Vandopsis*
- + Base of the lip deeply saccate or with a sac like spur.....19
19. Flowers many, dense, on a long cylindrical raceme, drooping below the leaves, spur sac deep, laterally compressed, pubescent outside.....*Rhynchostylis*
- + Flowers few, more or less in an erect inflorescence, corymbose, crowded, much shorter than the leaves, or in a loose raceme, shorter, equal or slightly longer than the leaves, base of the lip saccate.....20



**Fig. 203** *Acampe carinata* (Griff.) Panigrahi—**a.** plant; **b.** flower; **c.** dorsal sepal; **d.** lateral sepal; **e.** petal; **f.** column, lip with spur; **g.** column and pollina.

20. Flowers large, sepals more than 2 cm long, base of the lip saccate, side lobes large, apical lobe with many crenulate ridges on the upper surface..... *Vanda*  
 + Flowers small, sepals less than 1.5 cm, base of the lip deeply saccate, cup shaped, side lobes none or very small, apical lobe without ridges.....21
21. Flowers in a corymb, peduncle few branched, lip with a short conical sac, parallel to the ovary, side lobes small narrow..... *Acampe*  
 + Flowers in a corymb or raceme, peduncle not branched, lip with a wide cup shaped sac at right angle to the ovary, side lobes none, apical lobe broad and round with entire to fringed margin.....  
 ..... *Gastrochilus*
22. Inflorescence shorter than the leaves, erect or inclined.....23  
 + Inflorescence longer than the leaves, erect or drooping.....24
23. Inflorescence umbellate or sub-corymbose, 4-8 flowered, lip large, longer than the spur, upper surface papillose..... *Acampe*  
 + Inflorescence racemose, many flowered, lip small, shorter than the spur, upper surface not papillose  
 ..... *Ascocentrum*
24. Epichile of the lip with two lateral recurved lobules with long fimbriate margin, and a small triangular lobule in the notch, mouth of the spur closed by two calli projecting from the back and front wall, leaves broad, oblong..... *Ornithochilus*  
 + Epichile of the lip not as above, margins serrate or entire, mouth of the spur open or blocked by calli, leaves narrowly oblong to linear.....25
25. Apical lobe of the lip very small, truncate, spur much longer than the lip, leaves at long internodes, narrowly-oblong..... *Pteroceras*  
 + Apical lobe of the lip long, longer than the spur, leaves in vertical rows with the base of the lower sheathing that of the upper linear or linear-oblong.....26
26. Mouth of the spur or its interior blocked by a callus, raceme deflexed, as long or longer than the leaves densely many flowered..... *Aerides*  
 + Mouth of the spur not closed by callus, raceme erect or declinate, with few flowers, loosely placed, upper surface of the lip with crenulate ridges..... *Vanda*

#### **Acampe Lindl.**

Epiphyte. *Stem* thick, stout, covered with leaf sheaths. *Roots* long, stout, vermiform. *Leaves* distichous, ligulate, coriaceous, bilobed at apex. *Panicle* stoutly peduncled, leaf-opposed or supra-axillary, branches short or long; peduncle with cupular sheaths. *Flowers* comparatively large. *Sepals* and *petals* sub-equal, or petals smaller, thick, barred. *Lip* spurred or saccate, upcurved; lateral lobes small; midlobe ovate, fleshy. *Column* short, stout; foot absent; *pollinia* 2, entire or unequally bipartite, waxy, stipe narrow, gland small.

#### **Key to species**

- Leaves 7.5-10 cm long and 1.5-2 cm broad; inflorescence short, 1-1.5 cm long, umbellate; lip with a definit spur, half as long as the ovary, mature capsule less than 2.5 cm long..... *A. carinata*  
 + Leaves 25-35 cm long 3.5-5 cm broad; inflorescence long about 18 cm long, sub-corymbose lip only saccate without a definit spur, mature capsule more than 5 cm long..... *A. rigida*

***Acampe carinata*** (Griff.) Panigrahi in Taxon 34: 689. 1985.

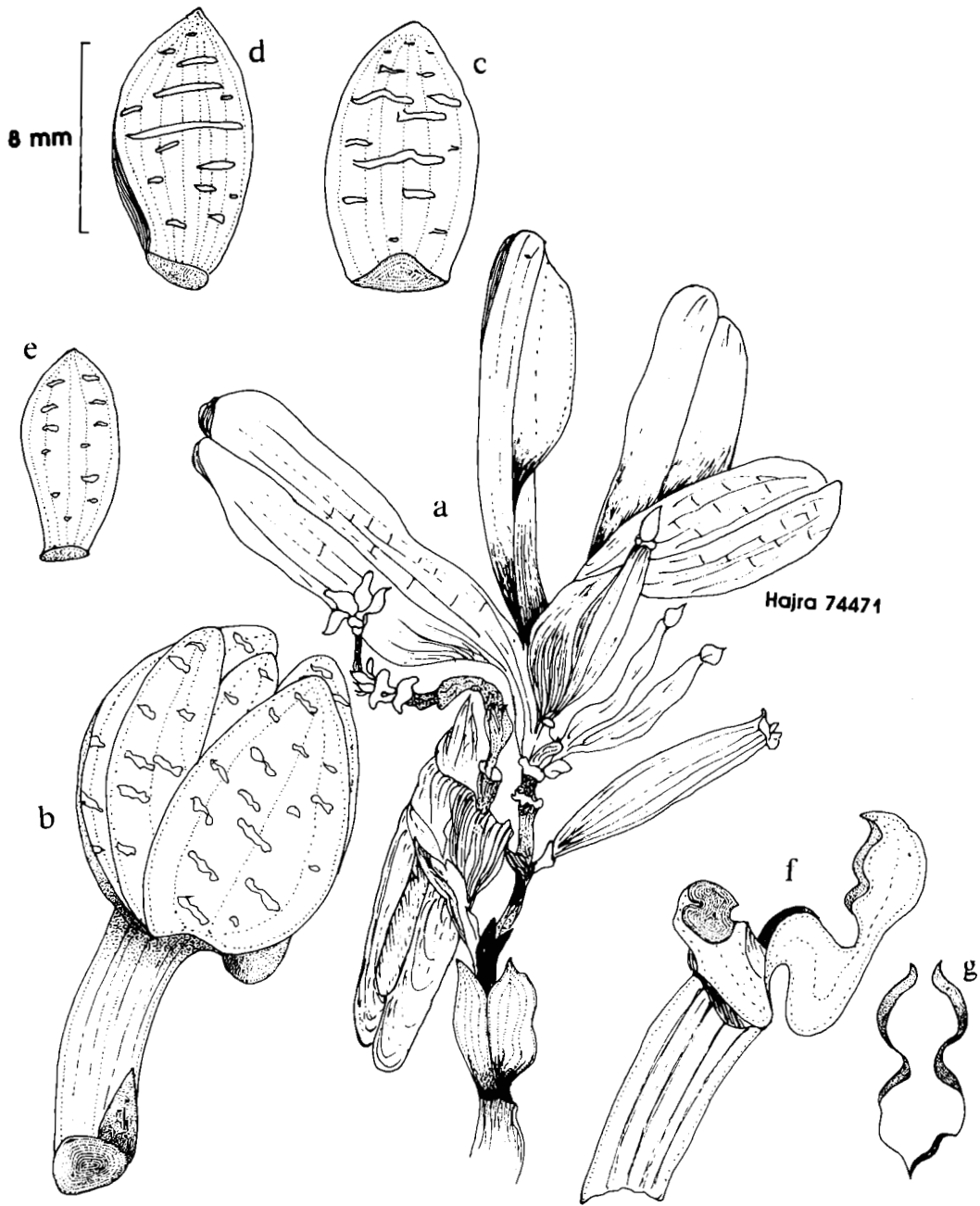
*Saccolabium carinatum* Griff. Noutl. Pl. Asiat. 3: 354. 1851.

*S. papillosum* sensu Lindl. Bot. Reg. 18: t. 1552. Feb (?) 1833 p.p. excludo type et syn., et Gen. & Sp. Orch. 222. Apr. 1833; King & Pantl. 219, t. 290. 1898; Duthie, 147. 1906.

*A. papillosa* sensu Lindl. Fol. Ord. Acampe 2. 1853. non Lindl. (1853)

(Fig. 203)

*Stem* erect, clustered, rigid, stout. *Leaves* coriaceous, 7.5-10 × 1.5-2 cm, fleshy, deeply channelled,



**Fig. 203A** *Acampe rigida* (Buch.-Ham. ex J.E. Smith) P.F. Hunt—**a.** plant; **b.** flower; **c.** dorsal sepal; **d.** lateral sepal; **e.** petal; **f.** column, lip with spur; **g.** lip.

apex truncate or deeply notched. *Inflorescence* leaf-opposed, stout, 1-1.5 cm long, umbellate or subcorymbose, 4-8 flowered. *Flowers* 9 mm across. *Bracts* triangular. *Sepals* sub-equal, 4 mm long, yellow with brown blotches, oblong, sub-spreading. *Petals* narrower, linear-spathulate, yellow with brown blotches. *Lip* longer than the sepals, adnate to the base of the column; lateral lobes none; mid lobe decurved, oblong-ovate, obtuse, crenate, upper surface transversely rugulose, white with transverse pale-purple bars. *Spur* half as long as the ovary, cylindrical, straight, pale-yellow, hairy within. *Capsule* fusiform, rigid, less than 2.5 cm in length.

*Flowering*: October - January.

*Distribution*: Himalaya (Garhwal to Arunachal Pradesh), Assam, Bengal, Meghalaya, Tripura. Bangladesh, Burma, Thailand and Laos.

*Specimens examined*:

GARHWAL: **Dehra Dun**-New Forest, *R. Dayal* 8961; Dehra Dun, *Rogers*; Gularghati, *Deva* 1650; Lachiwala, *Deva* 8835. **Pauri**-Outer Gahrwal Hills, *Inayat* 25823.

KUMAUN: **Pithoragarh**-Askot, *Inayat* 24126; Dafiadhura, *Arora* 52435; Pithoragath, *Bhattacharyya* 20390; Baram, *Bhattacharyya* 21188; Gargia, *Pant* 31839. **Nainital**-Tanakpur, *Rao* 11536.

The root is considered a specific for rheumatism. It is commonly used as a substitute for sarsaparilla and for *Vanda tessellata*. In Konkan the roots are used as cooling remedy (Caius, 1936).

**Acampe rigida** (Buch.-Ham. ex J.E. Smith) P.F. Hunt in Kew Bull. 24(1): 98. 1970; Hara et al. 1: 31. 1978; Jayaweera 2: 229. 1981; Hajra & Kothari 160, Pl. 2. 1983; Singh & Dawre, 1021. 1983.

*Aerides rigida* Buch.-Ham. ex J.E. Smith in Rees Cyclop. 39: *Aerides* n. 12. 1819.

*Vanda longifolia* Lindl. Gen. & Sp. Orch. 215. 1833.

*Acampe longifolia* (Lindl.) Lindl. Fol. Orch. *Acampe* 1. 1853.

*Saccolabium longifolium* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 62. 1890; King & Pantl. 220. t. 292. 1898.

*Vanda multiflora* Lindl. Collect. Bot. t. 38. 1825.

*Acampe multiflora* (Lindl.) Lindl. Fol. Orch. *Acampe* 1. 1853.

(Fig. 203A)

*Stem* stout, 60-90 cm long. *Leaves* thick, many, 25-35 × 3.5-5 cm, coriaceous, elongated, oblong, unequal at the apex. *Inflorescence* upto 18 cm long, erect, leaf-opposed, stout, with one or two short lateral branches. *Flowers* crowded, fleshy, 12-18 mm across. *Bracts* small, rounded. *Sepals* sub-equal, broadly oblong, obtuse, 13-14 × 7-8 mm, yellow with transverse stripes of crimson. *Petals* ovate-oblong, falcate, 12 × 4 mm, yellow with transverse stripes of crimson. *Lip* saccate, white purple spots, 3-lobed; lateral lobes erect, narrow, hairy within; mid lobe ovate, obtuse, slightly recurved, concave. *Capsule* greenish-yellow, obconical, 4-6 cm long.

*Flowering*: September - October.

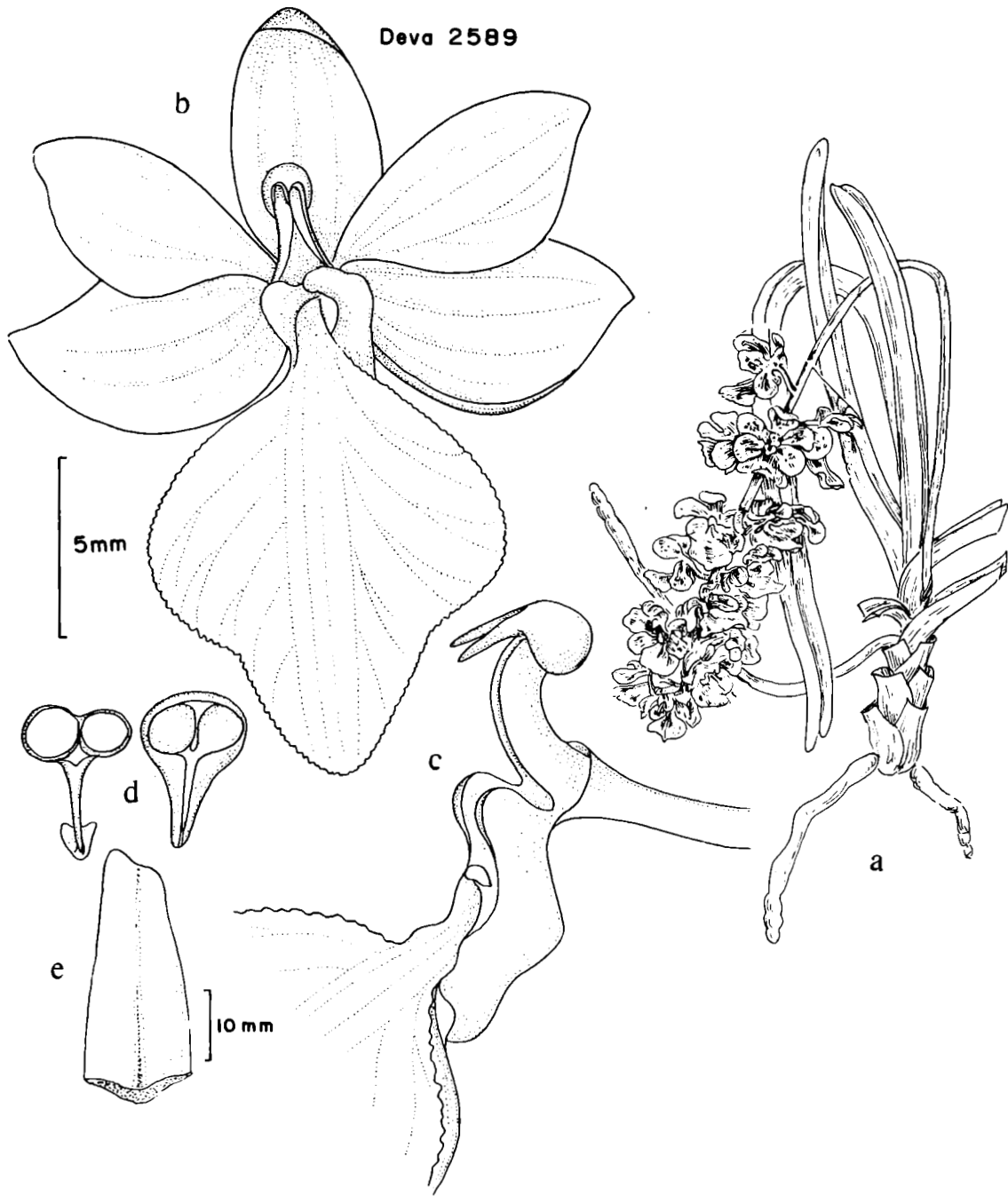
*Distribution*: Himalaya (Kumaun to Arunachal Pradesh). Assam, Meghalaya, Nagaland, Maharashtra, Karnataka, Kerala, Goa. Burma, China, Phillipine, Thailand, Indo-China, Malaya, Sri Lanka.

*Specimen examined*:

KUMAUN: **Pithoragarh**-Jauljibi-Baram Road, *Hajra* 74471.

#### **Aerides** Lour.

Epiphytic. *Stem* long with many thick roots. *Leaves* flat or terete, coriaceous. *Flowers* few or many, bright coloured, in decurved raceme, sometime solitary. *Bracts* minute, *Sepals* and *petals* similar, spreading; the lateral adnate to the base of foot of the column. *Lip* adnate to column, spurred; side lobes large or small, sometimes absent; the mid lobe larger than side lobes, or smaller and incurved, spur with swelling or callus within. *Column* short with short or long foot; *rostellum* short or long, bifid. *Anthers* 2-celled, with or without a beak; *pollinia* 2, globose, waxy, stipe long or short.



**Fig. 204** *Aerides multiflora* Roxb. — a. plant; b. flower; c. column, spur with base of lip; d. pollina; e. leaf tip.



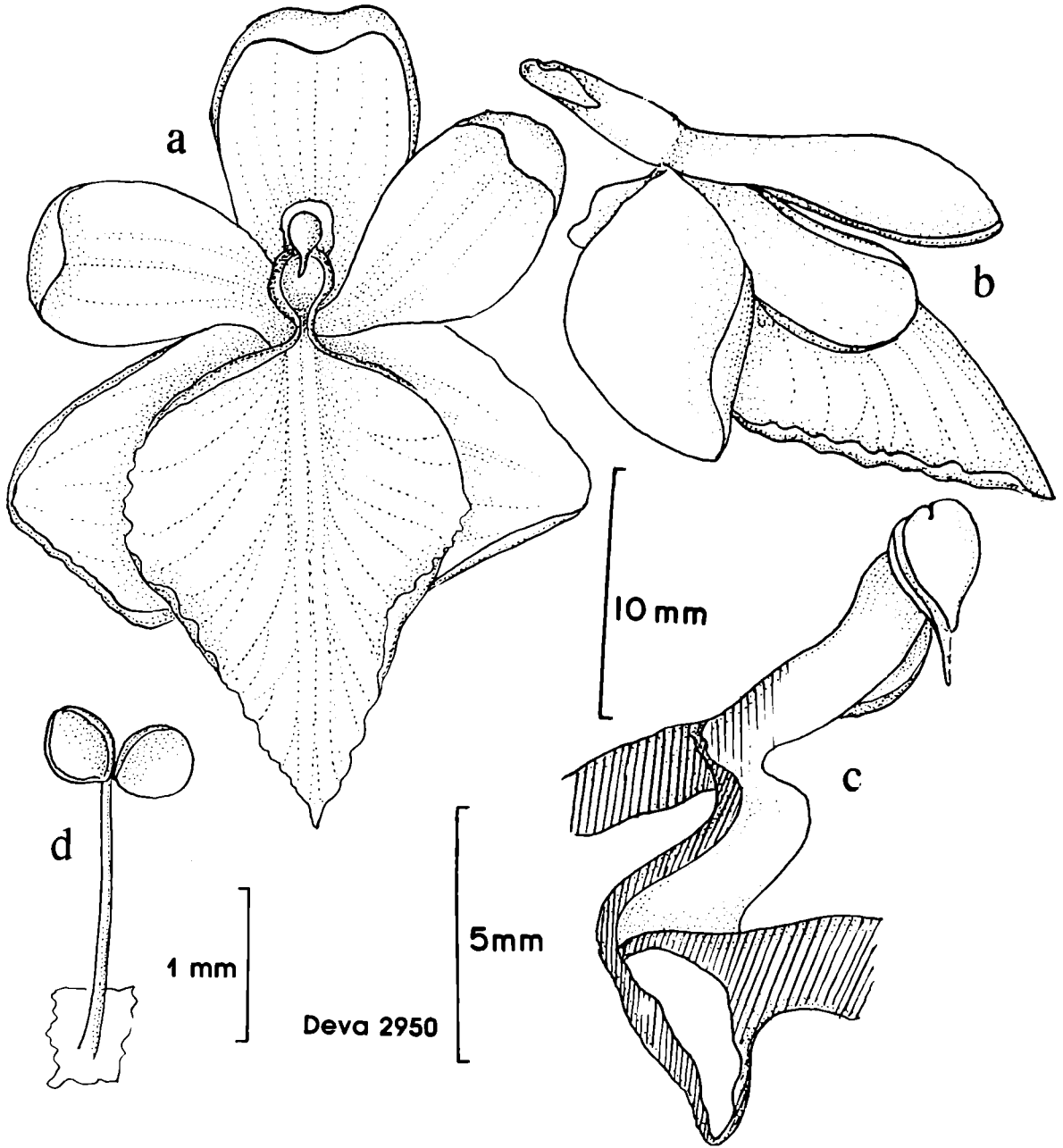
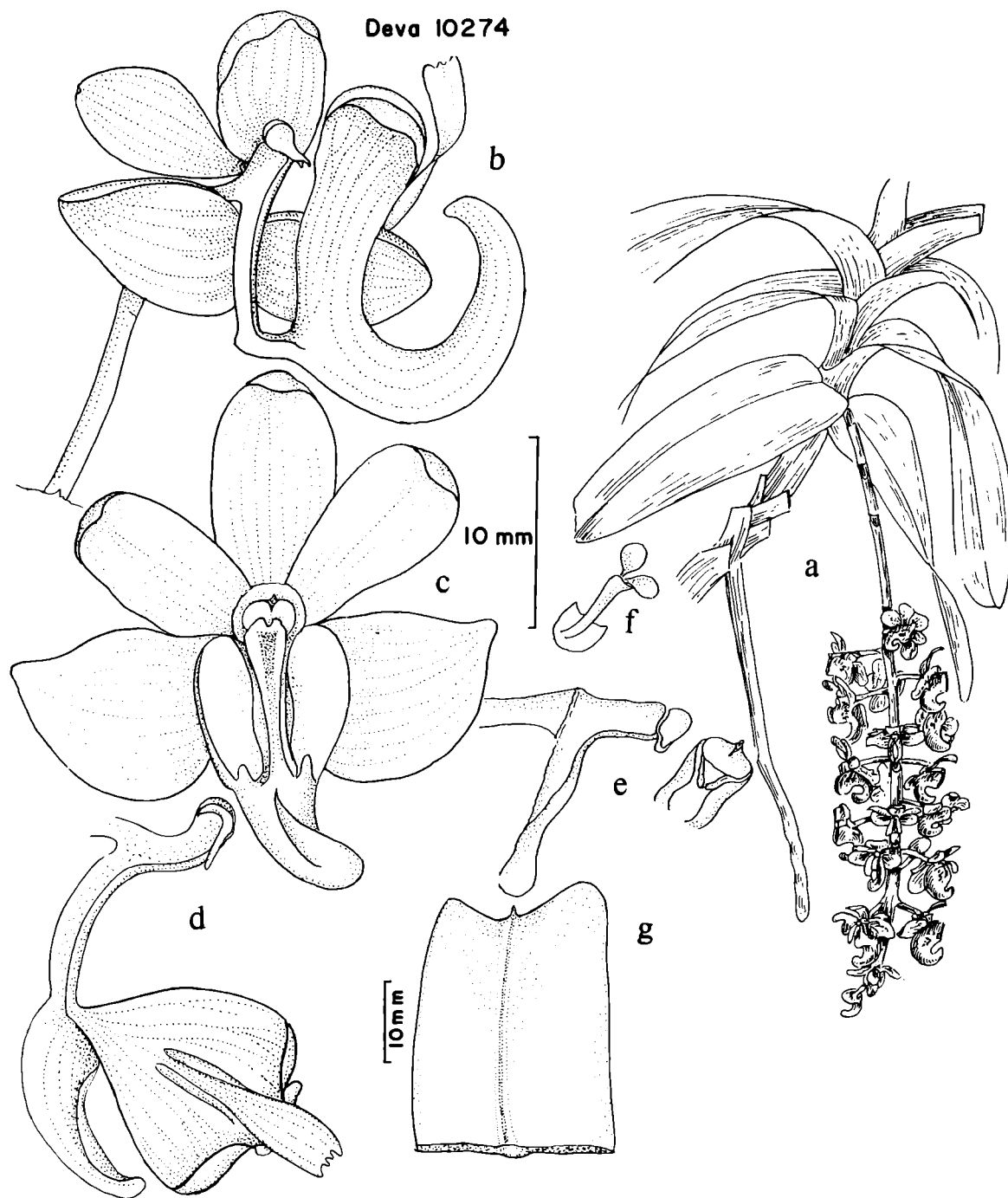


Fig. 205 *Aerides multiflora* Roxb. — a. & b. flower; c. column, spur and base of lip cut vertically; d. pollinia.

Deva 10274



**Fig. 206** *Aerides odorata* Lour. — a. plant; b. & c. flower; d. column, lip with spur; e. column; f. pollinia; g. leaf tip.

### Key to species

- Lip deeply 3-lobed, turned upwards, margin entire to erose; mid lobe narrower and longer than the side lobes, apex emarginate; spur longer, curved upwards; column foot long ..... *A. odorata*
- + Lip indistinctly 3-lobed, pointing forward, margin denticulate; mid lobe broad, hastate, ovate, apex rounded to acute; spur small almost straight, mouth covered by a callus from the base of the lip; column foot indistinctly short..... *A. multiflora*

***Aerides multiflora*** Roxb. Pl. Coromand. 3: 68. t. 271. 1820; Hook. f., 6: 44. 1890; King & Pantl. 212, t. 283. 1898; Duthie, 142. 1906.

*A. affine* Lindl. Gen. & Sp. Orch. 239. 1833.

(Fig. 204, 206)

*Stem* 10-25 cm long. *Leaves* 15-25 × 1.5-3 cm, linear-oblong, conduplicate, apex obliquely bifid, often tinged with reddish-purple. *Racemes* longer than the leaves, simple, axillary, densely many flowered. *Flowers* 2 cm across, white, flushed with pink or purple. *Sepals* and *petals* sub-equal, oblong, blunt, 8-9 mm long. *Lip* twice as long the sepals, adnate to the base of the column, indistinctly 3-lobed, pointing forwards, margin denticulate; mid lobe broad, hastate, ovate, apex rounded to acute, mouth covered by a callus from the base of the lip. *Spur* small, almost straight. *Column foot* indistinctly short.

*Flowering*: June - July.

*Distribution*: Himalaya up to 1400 m (Himachal Pradesh to Arunachal Pradesh), Assam, Nagaland, Meghalaya, Manipur, Mizoram, Tripura, Orissa, Madhya Pradesh, Andaman Island. Bangladesh, Burma, Java, Indo-China, Malaya, Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun Valley, New Forest, *Naithani* 3618; Rajpur Road, *Arora* 36453, *Bhattacharyya* 28595; Laxmanshidh, *T.A. Rao* 3216; Ajabpur, *Deva* 2589; Rajpur, *Deva* 2950. **Pauri**-Outer Garhwal Hills, *Inayat* 25811; Rathwadhab, *Janardhanan* 51400. **Chamoli**-Batwalchari, *M.A. Rau* 4112.

KUMAUN: **Pithoragarh**-Munshyari, *Inayat* 241029; Maitli, *Arora* 52447; Dharchula, *Rao* 11944; Tejum, *Nair* 34598. **Nainital**-Below Nainital. *Ramsukh* 4429; Kaladoongee, *Davidson*. **Almora**-Between Bageshwar and Kapkot, *Awasthi* 673; Almora, *Jameson*.

HIMACHAL PRADESH: Nurpur-Chuan Road, Kangra, *Harsukh* 23344; Nahan, Renukalake, *M.A. Rau* 11383.

J.D. Hooker (1890) separated *A. multiflora*, which is said to have the tip of the lip rounded, from *A. fieldingii* Lodd. ex Morr., which has an acute apex of the lip. Seidenfaden (1973, p. 76) has made it further clear that in *A. multiflora* the mid lobe is heart shaped and the tip is emarginate truncate, while in *A. fieldingii* the mid lobes is triangular with acute tip. King & Pantling (1898) described on the other hand the tip of midlobe *A. multiflora* as acute or blunt, and they further mentioned that this species is closely allied to *A. fieldingii*, but that it is a more robust plant and has wider flat leaves. They also have mentioned that the plant has not been recorded from Sikkim. Many specimens that we have studied from the region of N.W Himalaya have got the lip which matches with *A. fieldingii*, but we have not segregated it from *A. multiflora* because in our opinion it is necessary that cyto-taxonomic studies should be conducted to distinguish these two very closely allied species.

***Aerides odorata*** Lour. Fl. Cochin. 2: 525. 1790; Hook. f., 6: 47. 1890; King & Pantl. 212, t. 282. 1898; Duthie, 142. 1906. (Fig. 206)

*Stem* stout, 30-45 cm long. *Leaves* 15-30 × 4-5 cm, oblong, flat, keeled, apex unequally bilobed. *Racemes* supra-axillary, deflexed, as long as or longer than the leaves, many flowered. *Flowers* fragrant, smelling like lemon, 1.8-2.5 cm across, white with purple blotches and spots. *Bracts* broad, blunt, much shorter than the ovary. *Sepals* unequal, obtuse, spreading; the dorsal 10 mm long, elliptic ovate; the laterals 10-11

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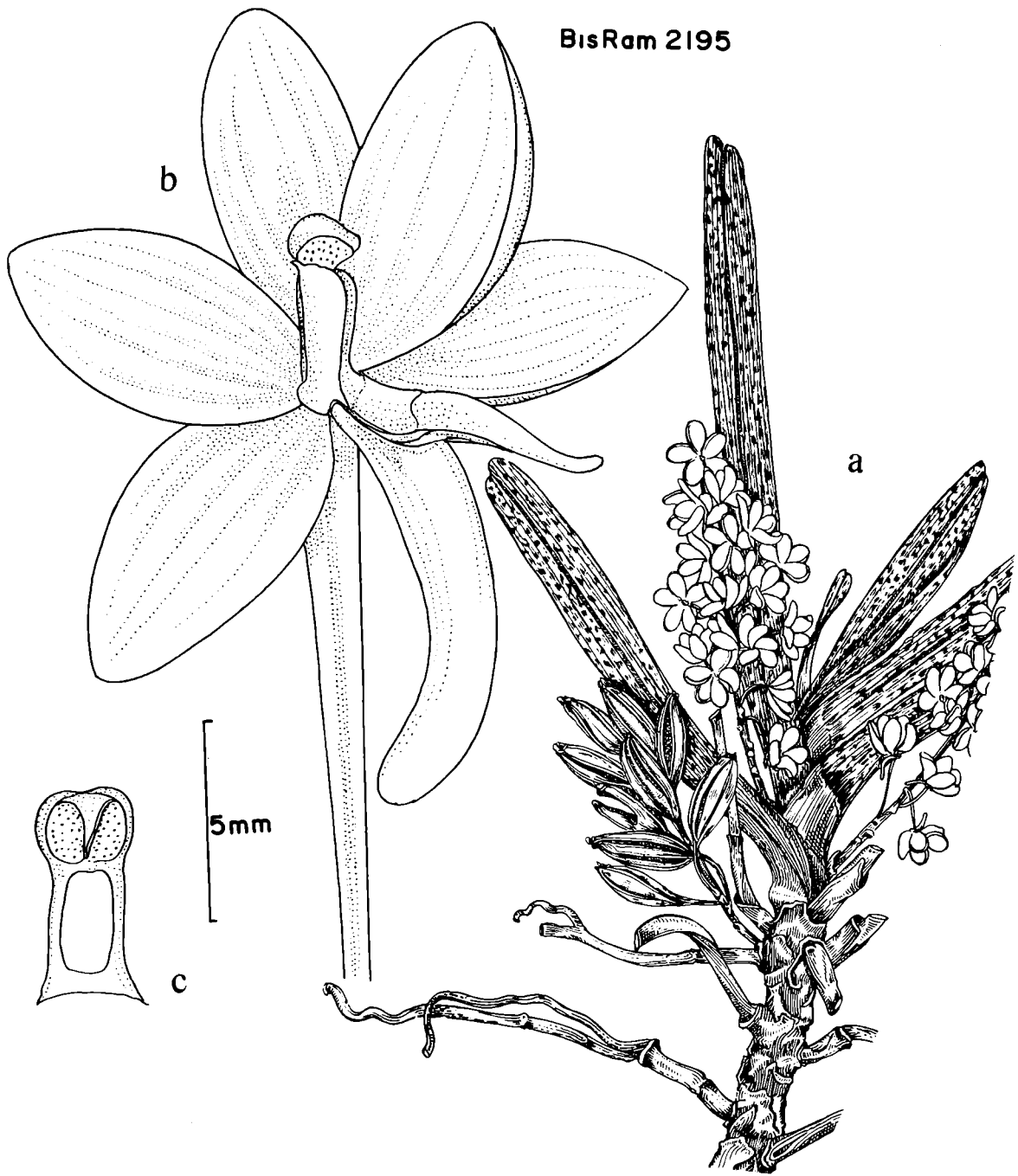


Fig. 207 *Ascocentrum ampullaceum* (Roxb.) Schltr.—a. plant; b. flower; c. column.

mm long, orbicular-ovate. *Petals* oblong, 10 mm long, spreading. *Lip* adnate to the short foot of the column, turned upwards, margin entire to erose, deeply 3-lobed; mid lobe narrow and longer than the side lobes; side lobes very shallow, truncate, erose. *Spur* large, funnel-shaped, curved upwards, tip greenish or yellowish with small keels guarding the nectar containing tip. *Column foot* long.

*Flowering*: June - July.

*Distribution*: Himalaya upto 1400 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Orissa, Madhya Pradesh. Bangladesh, Burma, Indo-China, China, Malaya, Thailand.

*Specimens examined*:

GARHWAL; Dehra Dun-Dehra Dun Valley, Rajpur Road, Vaid; Saharanpur Road, Arora 36455; Laxmansidh, T.A. Rao 328; Rajpur, Deva 2562; Dalanwala, Deva 10274. Pauri-Outer Garhwal Hills, Inayat 25816 & 25818.

KUMAUN: Pithoragarh-Askot, Arora 41381; Maitli, Arora 52448 & 55818; Dafiadhura, Arora 49522; Baram, Bhattacharyya 21169; Vasavgad, Bhattacharyya 21358. Nainital-Below Nainital, Ramsukh 4428; Kaladoongee, Davidson.

#### **Ascocentrum** Schltr.

Small epiphytic, monopodial plants with snort stems and distichous leaves. *Inflorescence* lateral, simple, many flowered. *Bracts* minute. *Flowers* pink. *Sepals* and *petals* equal in length and size. *Lip* shorter than sepals, 3-lobed; mid lobe ligulate, spreading; side lobes small, erect. *Spur* cylindrical, shorter than ovary. *Column* short, without foot; *pollinia* 2 with stipe and viscidium; stigma entire.

**Ascocentrum ampullaceum** (Roxb.) Schltr. in Fedde, Repert, 1: 975. 1913; Bhattacharyya, 166, fig. 2. 1969.

*Aerides ampullacea* Roxb. Fl. Ind. ed. 2, 3: 476. 1832.

*Saccolabium ampullaceum* (Roxb.) Lindl., Sert. Orch. t. 17. 1838; Hook. f., 6: 64. 1890; King & Pantl. 220, t. 292. 1898. (Fig. 207)

*Stem* stout, clustered, erect, 7-13 cm long. *Leaves* 8-10, thickly coriaceous, oblong-linear, keeled, bifid at apex, sometimes toothed between the lobes, mottled with brownish-purple, 7-15 × 1.2-2 cm. *Racemes* from the axis of the leaves, 7-12 cm long, many flowered, erect, shorter than the leaves. *Flowers* 17-20 mm across, deep pink. *Bracts* minute. *Sepals* and *petals* sub-equal, spreading, obovate, 6-8 × 4-5 mm. *Lip* with a spur longer than the sepals, flexuose, cylindrical, blunt, sometimes inflated at the bend; lateral lobes obscure or none; mid lobe linear-oblong, sub-acute, entire with upturned apex.

*Flowering*: March - April.

*Distribution*: Himalaya 300-1000 m (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Manipur, Andaman Island. Bangladesh, Burma, Thailand, China, Indo-China.

*Specimens examined*:

KUMAUN: Pithoragarh-East Almora division, Bis Ram 2195; Gori Valley Baram, Bhattacharyya 21185.

#### **Chiloschista** Lindl.

Epiphytes. *Stem* reduced. *Root* flattened, spreading and compressed. *Leaves* narrowly oblong or absent. *Flowers* usually in pendulous racemes, peduncle erect. *Sepals* and *petals* larger than sepals with the base of the lateral sepal adnate to the long column. *Lip* sessile, without spur, jointed or adnate to the long produced foot of the column, base saccate or conical; lateral lobes large, erect, mid lobe minute. *Column* small, erect, semi-terete or cylindrical. *Anther* terminal; *pollinia* 2, glands minute.

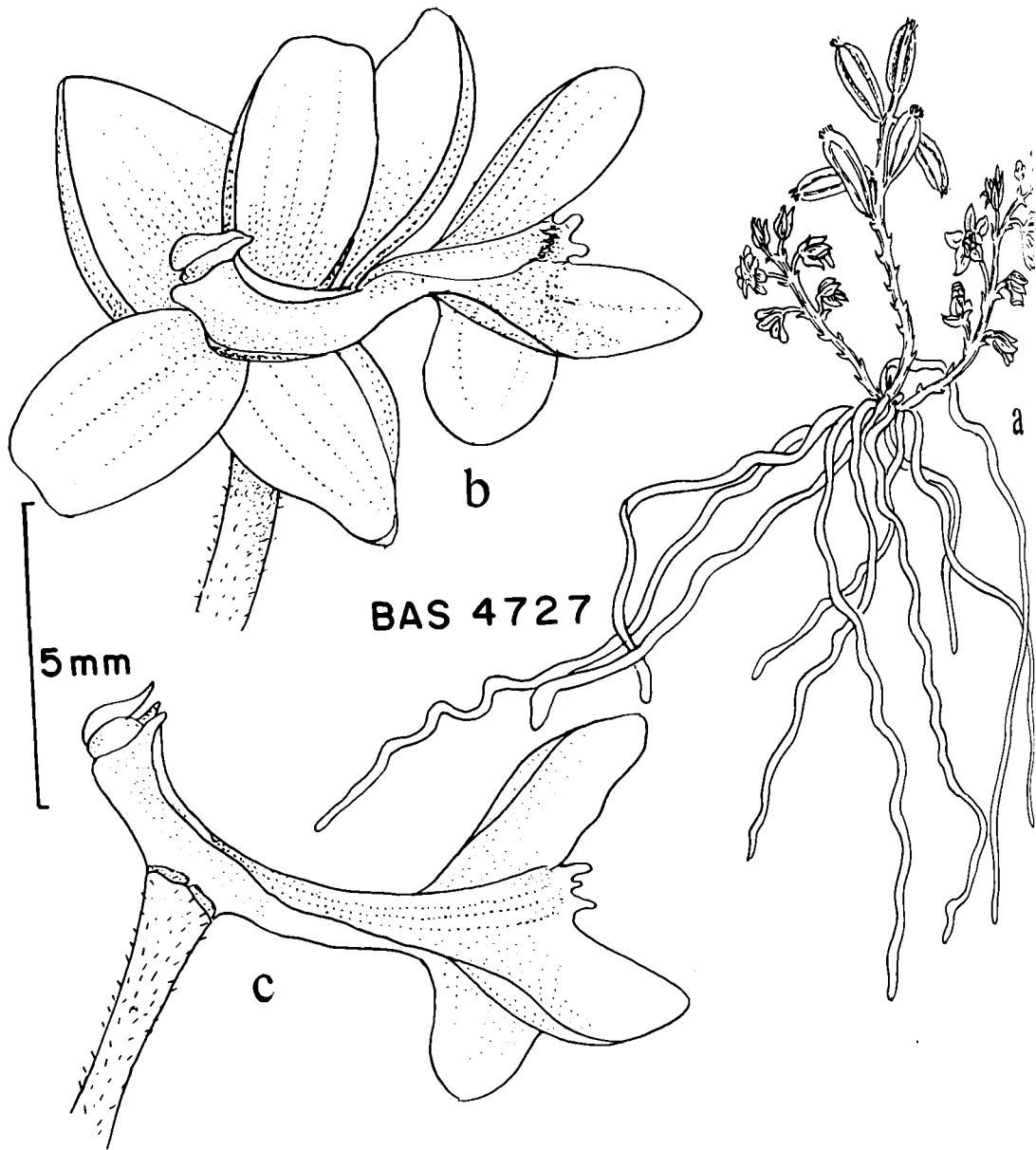


Fig. 208 *Chiloschista usneoides* (D. Don) Lindl.—a. plant; b. flower; c. lip and column.

**Chiloschista usneoides** (D. Don) Lindl. in Edw. Bot. Reg. 18: sub. t. 1522. 1832; Hara et al. 1:35. 1978. *Epidendrum usneoides* D. Don Prodr. Fl. Nepal 37. 1825.

*Sarcophilus usneoides* (D. Don) Rchb.f. Walp. Ann. Bot. Syst. 6: 497. 1861; Hook. f., 6:37. 1890; Duthie, 141. 1906. (Fig. 208)

Root densely tufted. *Stem* absent. *Leaves* absent. *Raceme* 7.5-15 cm long, many flowered, peduncle brownish, bearing few amplexicaule, ovate-acute, membranous, deciduous bracts; rachis flexuous. *Flowers* sub sessile, 13 mm across, white or rosy. *Sepals* spreading, oblong, obtuse. *Petals* spreading broader. Lip gibbous or slightly saccate at the base, with a long claw; lateral lobes linear-oblong, obtuse, disc between the lateral lobes pubescent; mid lobe truncate, emarginate. *Column* very short.

*Flowering*: February - March.

*Distribution*: Himalaya (Garhwal, Nepal, Sikkim, Arunachal Pradesh). Burma.

GARHWAL: Tehri-Chamassoore, Vicary (Duthie, *loc. cit.*).

Fig 208 has been sketched from a specimen collected by Bas from Burma.

### Cleisostoma Blume

Epiphytes. *Pseudobulbs* absent. *Stem* elongated. *Leaves* coriaceous or fleshy, flat or terete, usually bilobulate at apex. *Inflorescence* racemose or paniculate, lax, many flowered. *Sepals* sub-equal, spreading. *Petals* spreading, smaller than the sepals. *Lip* as long as the sepals, fleshy, obscurely 3-lobed, the base with a large saccate or infundibuliform spur, sometimes dilated at the apex, its cavity closed by two calli, the posterior of which is sometimes bifid, and sometimes also by a dorsal scale, with or without septum. *Column* short, thick, *Anther* depressed; *pollinia* 2, unequally split in halves, on stipe.

**Cleisostoma aspersum** (Rchb.f.) Garay. in Bot. Mus. Leafl. Harv. 23,4: 169. 1971; Seidenf., 29(3): 12. 1975.

*Sarcanthus aspersum* Rchb. f. Hamb. Gart. 21: 297. 1865; Hook. f., 6:70. 1890.

*Cleisostoma bicuspidatum* Hook. f., Fl. Brit. Ind. 6: 75. 1890; Hook. f., Ic. Pl. T. 2144. 1893.

*Stereochilus bicuspidatum* (Hook. f.) King & Pantl. in Ann. Roy. Bot. Gard. Cal. 236, t. 314. 1898.

*Sarcanthus bicuspidatus* (Hook. f.) J.J. Sm. in Nat. Tijds. Ned. Ind. 72: 84. 1912.

*Sarcanthus khasiaensis* Tang & Wang in Act. Phytotax. Peking 1, 1: 98. 1951.

*Cleisostoma parishii* Seidenf. & Arora in Nord. J. Bot. 2(1): 11. 1982. *non* (Hook. f.) Garay. (Fig. 209)

Plant 7-10 cm long, with numerous roots at the base. *Leaves* 6-8, coriaceous, narrowly oblong, 9-15 × 1.2-2 cm, bilobulate at the apex, lobules acute. *Inflorescence* axillary, from the lower end of stem, usually longer than leaves. *Flowers* in raceme or shortly branched panicle, numerous, 8 mm across, yellowish and marked with pink. *Bracts* minute. *Sepals* sub-equal, spreading, elliptic to ovate-elliptic. *Petals* oblanceolate, blunt, shorter than the sepals. *Lip* long as the sepals, 3-lobed, lateral lobes broad, rounded, erose; mid lobe flat, obtuse, straight upwards directed, ovate, acute. *Spur* cylindric, obtuse at the upper edge and meeting the larger one from the front wall and occluding the spur entrance.

*Flowering*: July - August.

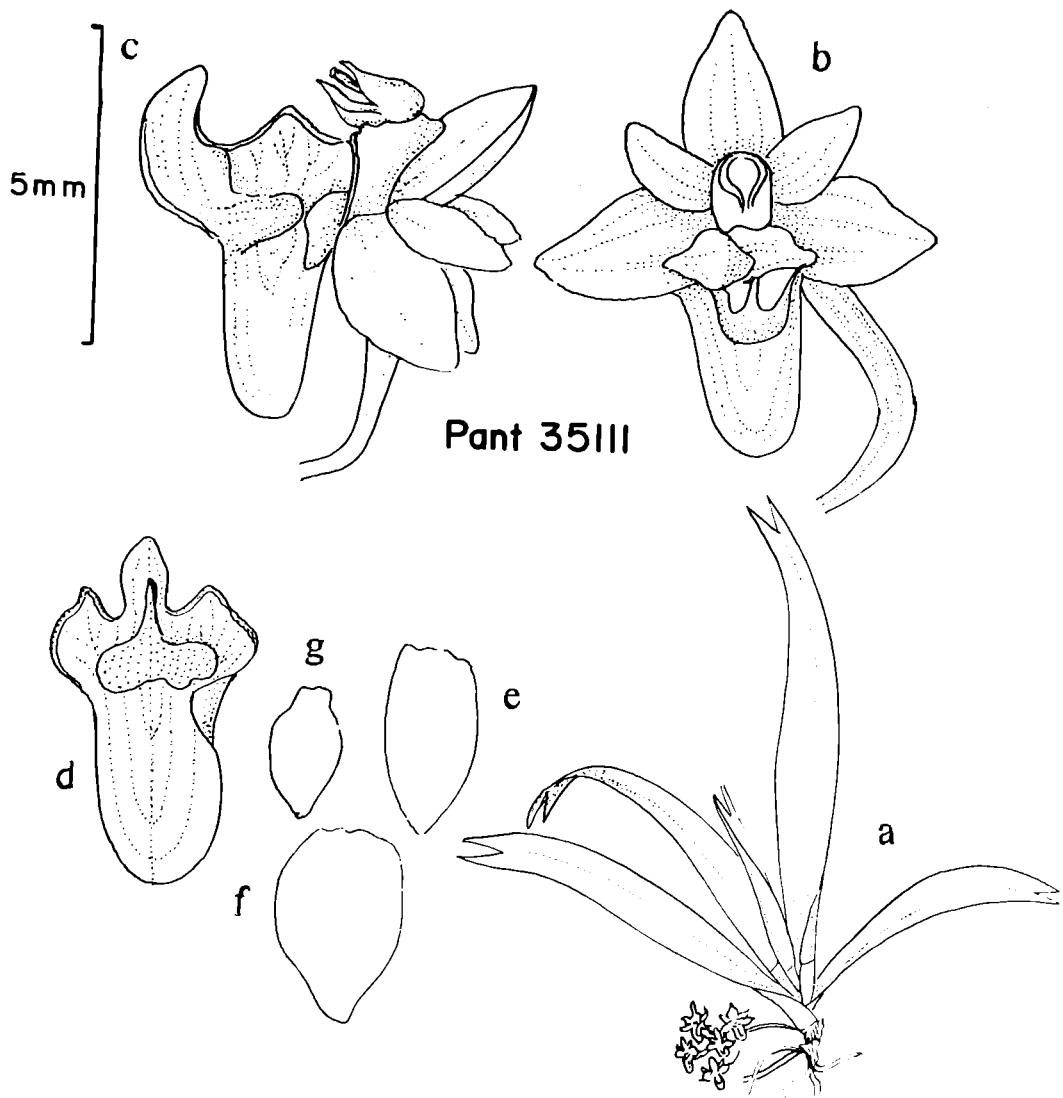
*Distribution*: Himalaya 600-700 m (Kumaun, Sikkim, Arunachal Pradesh), Meghalaya, Mizoram. Burma and Thailand.

*Specimen examined*:

KUMAUN: Pithoragarh-Didihat, Pant 35111.

### Cymbidium Swartz

Epiphytic, rarely terrestrial herbs with short or sometimes elongate pseudobulbs, mostly covered with



**Fig. 209** *Cleisostoma aspersum* (Rchb. f.) Garay.- a. plant; b. & c. flower; d. lip split open; e. dorsal sepal; f. lateral sepal; g. petal.



closely overlapping sheathing bases of leaves. *Leaves* usually very long and narrow, coriaceous, erect or curved, jointed on their sheaths, rarely none or rudimentary at the time of flowering. *Inflorescence* from the base of pseudobulbs, loosely sheathed at the base, erect or pendulous, usually long. *Flowers* one to many, often large. *Sepals* and *petals* free, sub-equal wide spreading or erect, narrow. *Lip* 3-lobed, adnate to the base of the column and embracing it by convolute side lobes, base saccate, mid lobe recurved, often with undulate margins; disc lamellate or ridged. *Column* long, foot absent or very short. *Anther* imperfectly two chambered; *pollinia* 2 cleft, subglobose, waxy, joined by a common caudicle and seated on a broad disc or gland.

#### Key to species

1. Terrestrial; inflorescence erect .....2.
- + Epiphyte; inflorescence decurved.....3
2. Leafless saprophytic plant; sepals and petals tinged with pink; raceme with 2-8-flowers.....  
..... *C. macrorhizon*
- + Leaves present, long linear, rigid, bases overlapping forming a pseudobulb; sepals and petals green; scape with rarely 1-usually 3-7 flowers ..... *C. cyprifolium*
3. Flowers small, sepals up to 2 cm long.....4
- + Flowers large; sepals up to 3.5-6.5 cm long.....5
4. Leaves less than 3 cm broad, mid lobe of lip spotted with purple, side lobes of lip obtuse, shorter than the column..... *C. bicolor*
- + Leaves more than 3 cm broad; mid lobe of lip striped with pink or purple, side lobes of lip acute, longer than the column..... *C. aloifolium*
5. Raceme 1-2, rarely 3-flowered; flowers pure ivory-white, lip with yellow keels..... *C. eburneum*
- + Raceme with many flowers; flowers variously coloured, but not pure ivory-white.....6
6. Dorsal sepal up to 5-6.5 cm long, sepals and petals apple-green on both sides; lip yellow, speckled with purple, margins ciliate, upper surface with 2 prominent hairy keels..... *C. hookerianum*
- + Dorsal sepal up to 3.5-4 cm long; sepals and petals pale-green to ochraceous yellow with brown stripes on inner side.....7
7. Leaves 12-16 mm broad in about the middle, acuminate; lip white and spotted with purple, mid lobe thinly pubescent on the upper surface..... *C. longifolium*
- + Leaves 20-25 mm broad in about the middle; lip ochraceous-yellow with broad transverse band of brown, upper surface puberulous ..... *C. iridioides*

*Cymbidium aloifolium* (Linn.) Sw. in Nov. Act. Sci. Ups. 6: 73. 1799; Hook. f., 6: 8. 1890; King & Pantl. 189, t. 252. 1898; Duthie, 136. 1906; Seth, 399, Pl. 26, fig. A.C. 1982; Seidenf., 72: 77, fig. 43. 1983.

*Epidendrum aloifolium* Linn. Sp. Pl. ed. 1: 953. 1753.

*E. pendulum* Roxb. Pl. Coromandel. 1: 35. 1759.

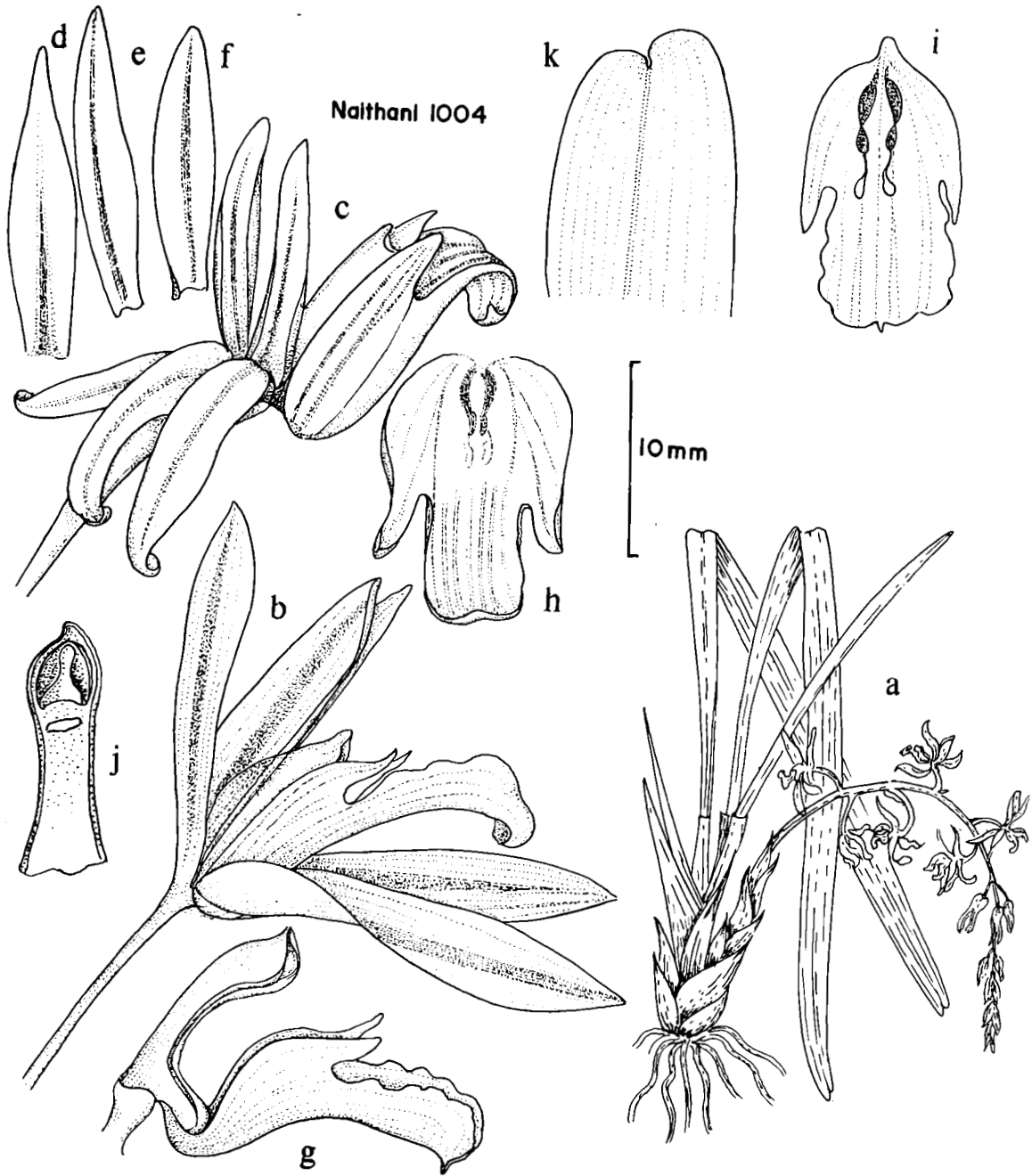
*E. aloides* Curtis, Bot. Mag. 11: t. 387. 1797, sphalm. for *E. aloifolium*.

*C. pendulum* (Roxb.) Sw., in Nov. Act. Soc. Sci. Ups. 6: 73. 1799; Abrahm & Vatsala, 325. fig. 70. 1981.

(Fig. 210)

Pseudobulbs laterally compressed, 6-7 mm long. *Leaves* 30-35 cm long and more than 3 cm broad, linear-oblong, curved, obtuse, fleshy, obliquely notched at the apex. *Inflorescence* from the base of pseudobulbs, some what shorter than the leaves, peduncle 7-10 cm long bearing several tubular acute scarious sheaths near the base, raceme many flowered, decurved, 30-40 cm long. *Flowers* 3.5 cm across. *Bracts* minute, ovate, much shorter than the ovary. *Sepals* subequal, oblong or slightly lanceolate, blunt, 2 cm long or less. *Petals* as long as the sepals, ovate-lanceolate, blunt. *Lip* as long as the sepals, oblong, 3-lobed; lateral lobes acute, longer than the column; mid lobe ovate-oblong, decurved, striped with pink or purple.

*Flowering*: April - May.



**Fig. 210** *Cymbidium aloifolium* (Linn.) Sw. — a. plant; b. & c. flower; d. & e. sepal; f. petal; g. column and lip; h. & i. lip; j. column; k. leaf tip.

Mackinnon 22719

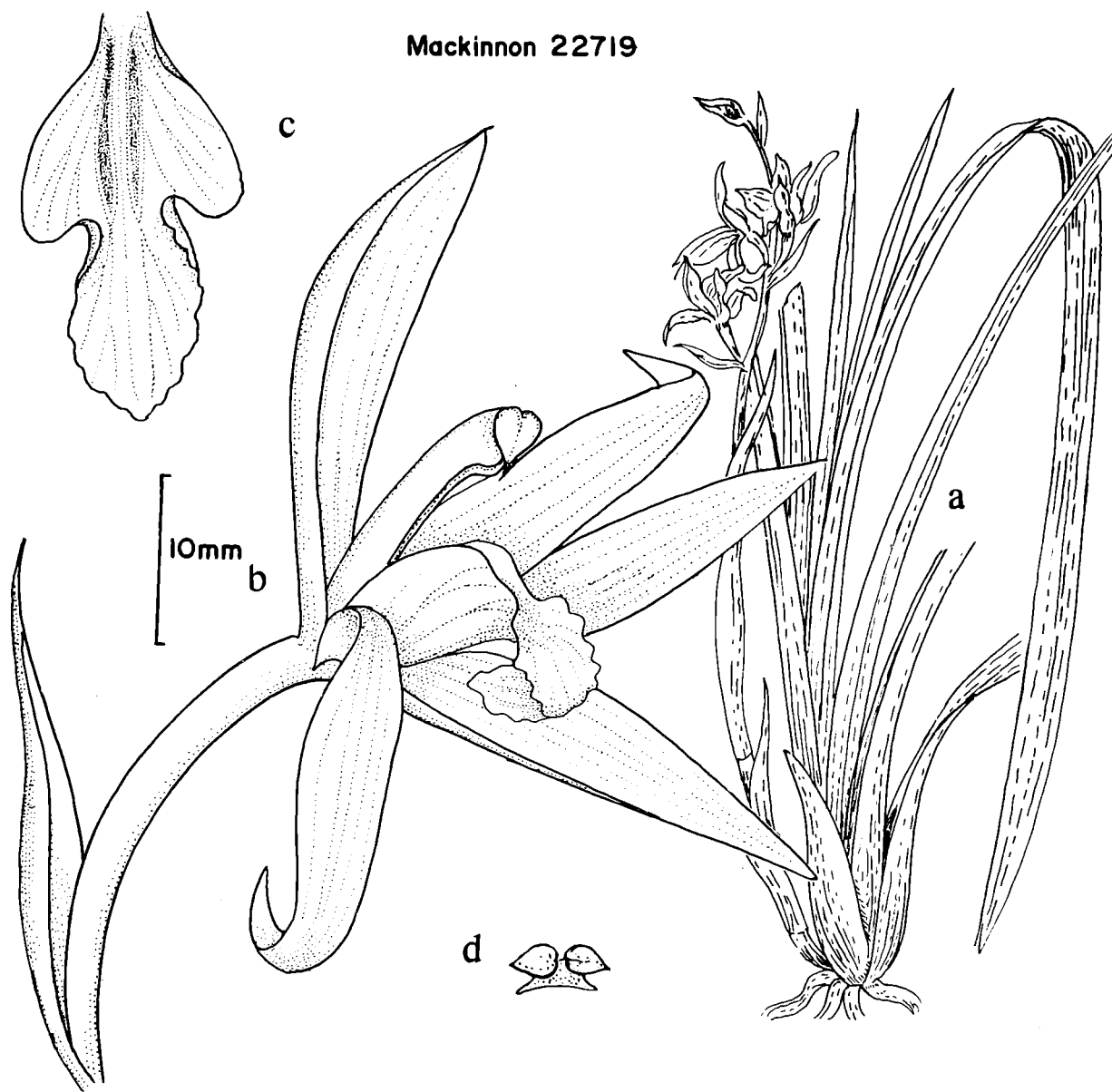


Fig. 211 *Cymbidium cyperifolium* Lindl. —a. plant; b. flower; c. lip. d. pollinia.



Fig. 212 *Cymbidium cyperifolium* Lindl.—a. plant; b. flower; c. lip; d. pollinia.

*Distribution:* Himalaya up to 1400 (Kumaun to Arunachal Pradesh), Assam, Meghalaya, Mizoram, Nagaland, Tripura, Manipur, Madhya Pradesh, South India, Andaman Island. S. China, Hong Kong, Burma, Thailand, Malaya, Sumatra, Java, Borneo, Vietnam, Taiwan and Sri Lanka.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun Valley, Dalanwala, 13 Balbir Road, *Deva* 10263 (Cult.); New Forest, *Naithani* 1004 (Cult.).

KUMAUN: **Pithoragarh**-Jauljibee, *M.A. Rau* 35327; Askot-Kaflani, *Arora* 66261.

The plant is said to be emetic and purgative (Caius, 1936).

**Cymbidium bicolor** Lindl. Gen. & Sp. Orch. 164. 1833; Abrahm & Vatsala, 307. fig. 69. 1981; Seth, 400. Pl. 27. fig. A-C. 1982; Hook. f., 6: 11. 1890 (*excl. syn.*); Seidenf., 72: 81. fig. 44. 1983.

*C. aloifolium* sensu Bl. Bijdr. 378. 1825. *non* (L.) Sw.

*C. pubescens* Lindl. in Bot. Reg. 26: misc. 75. 1840. & 27: t. 38. 1841; Hook. f., 6: 11. 1890; Holttum, 522. 1964.

*C. mannii* Rchb. f. in Flora 55: 274. 1872.

*C. pendulum* Duthie, in Ann. Roy. Bot. Gard. Cal. 9: 136. 1906. *excl. cit.*, *non* (L.) Sw.

*Pseudobulbs* stout, 7.6 cm long. *Leaves* linear-oblong, acute, up to 30-40 cm long and less than 3 cm broad with obliquely obtuse tip. *Inflorescence* from the base of pseudobulbs, sharply pendulous, 25-30 cm long, peduncle about 7.5 cm, clothed with many imbricate sheaths. *Flowers* many, not crowded, purple-brown, about 3 cm across. *Bracts* minute, triangular, shorter than the ovary. *Sepals* and *petals* widely spreading, similar, 2 cm long or less. *Lip* adnate to the short foot of the column, oblong, dilated, sub-saccate at the base, 3-lobed; lateral lobes obtuse, shorter than the column; mid lobe about 5 mm broad, reflexed spotted with purple.

*Flowering:* May.

*Distribution:* Himalaya (Kumaun ? & Sikkim), Andaman Island, South India. Thailand, Malaya, Sumatra, Java, Borneo, Phillipines, Laos, Cambodia, Vietnam, China, Celebes.

Duthie (1906) cited a single specimen No. 24097, from Kali Valley Kumaun, which we have not been able to examine as it is not present at DD. Recently Seth (*loc. cit.*) has excluded the specimen no. 24097 from *C. bicolor*, thus the occurrence of this species in the N.W. Himalaya is doubtful.

**Cymbidium cyperifolium** Lindl. Gen. & Sp. Orch. 163. 1833; Hook. f., 6: 13. 1890; Duthie, 135. 1906.

*C. mackinnonii* Duthie in J. As. Soc. Beng. 71(2): 41. 1902; et 134. t. 115. 1906; Pandey 5: 154. fig. 1. 1982. *syn. nov.* (Fig. 211, 212)

Terrestrial. *Leaves* up to 75 cm × 10 mm, linear, rigid, bases overlapping and thickened, margin serrulate or entire. *Inflorescence* from the base of the pseudobulb, erect, up to 30 cm long; raceme with rarely one usually 3-7 flowers. *Flowers* fragrant, green, with dull purple markings on the lip and column, 25 mm long and about 35 mm across. *Bracts* 15-30 mm long, lanceolate, acuminate, longer than the ovary. *Sepals* sub-equal, linear-lanceolate, acute, spreading. *Petals* shorter and broader than sepals. *Lip* as long as the petals, oblong (when spread out), 3-lobed; lateral lobes narrow, erect; mid lobe deflexed, ovate or oblong-ovate, entire; disc with two smooth keels; *pollinia* 2 cleft.

*Flowering:* November to April.

*Distribution:* Himalaya 1500-1800 m (Garhwal, Kumaun, Sikkim to Arunachal Pradesh), Meghalaya, Nagaland, Manipur, Madhya Pradesh. Upper Burma.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon* 21743, 22709, 22719 & 24152.

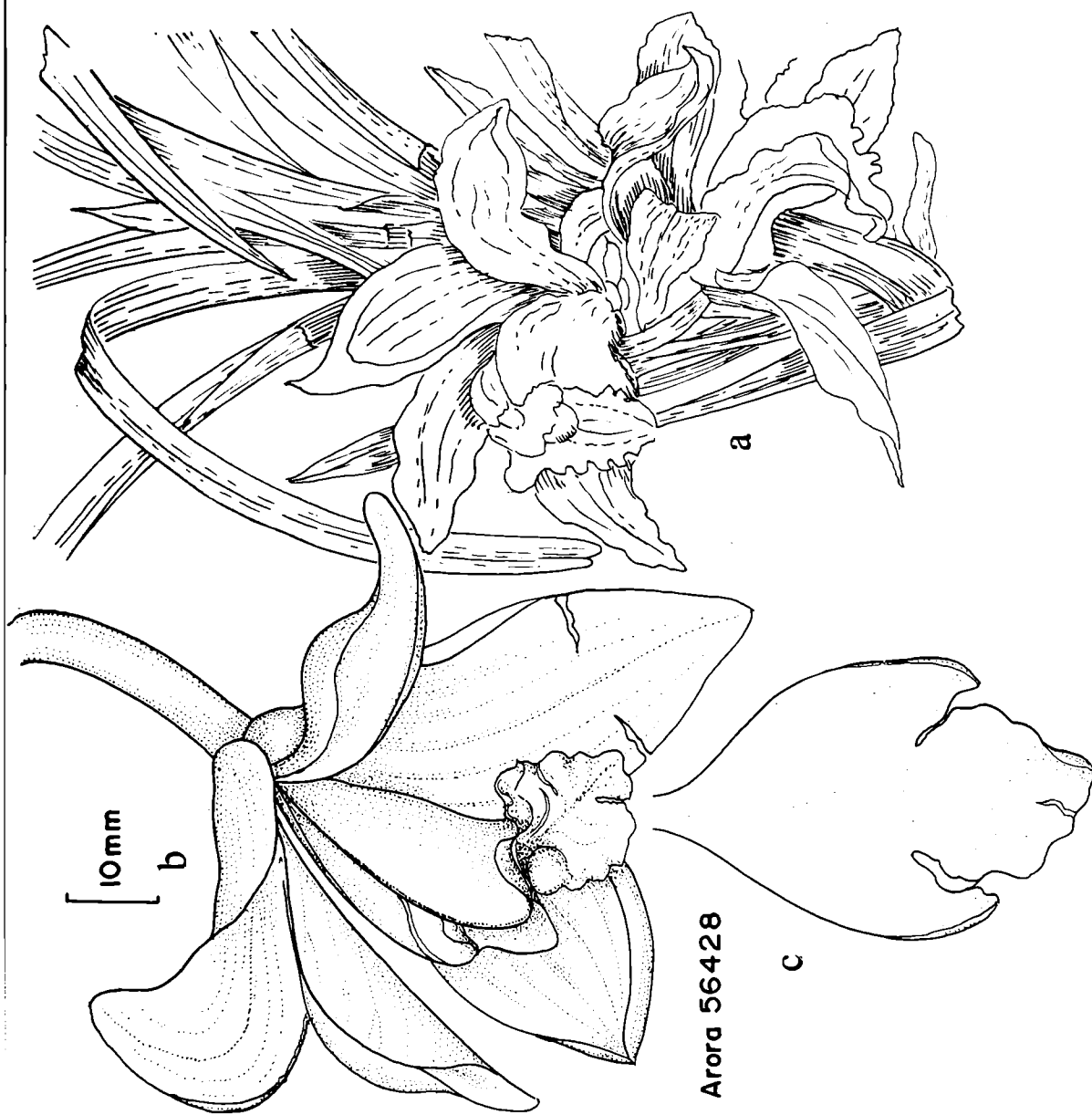


Fig. 213 *Cymbidium eburneum* Lindl. — a. plant; b. flower; c. lip.

KUMAUN: Pithoragarh-Thal, M.A. Rau 35331.

We are convinced that *Cymbidium mackinnonii* is not distinct from *C. cyperifolium*. Duthie distinguished it on the basis of four characters; scape one-flowered, floral bracts pale-yellow with purple veins, margin of the leaves entire and obliquely obovoid, plano-convex pollinia. On a critical examination we found that first two characters are due to the effect of very cold conditions when the plant was collected. While the other two are well within the range of variation of *C. cyperifolium*. Mackinnon's specimen 22709 (type of *C. mackinnonii*) was collected from Mussoorie at an altitude of 1800 m on 15.2.1899. It is the coldest month of the year and usually Mussoorie is snow bound at this time, a fact also admitted by Duthie l.c. 83. 1906. It is quite possible that under the effect of low temperature the growth has been arrested and only a single flower developed on the scape and the colour of the bracts changed. The presence of entire or a serrulate margin of the leaf is not a constant character. The serrulate margin of the leaf in *C. cyperifolium* is visible under magnification in the specimens collected from Mussoorie, but it is completely entire in all other specimens collected from Eastern Himalaya. King & Pantling, 186. 1898 and Hook. f., 13. 1890, have not mentioned this character about *C. cyperifolium*. The last character, the presence of 4 pollinia in *C. mackinnonii* and only 2 which are cleft in *C. cyperifolium* is a question of interpretation. King & Pantling sketch a case t. 248. f. 6 where there are only two pollinia, (on page 186: "Cleft to nearly the base") while Hook. f., 13. 1890 describes in the same species "pollinia 4, broadly oblong plano-convex, each pair of a large and small placed face to face". This is exactly same what has been described and sketched by Duthie 135, t. 115, f. 3. 1906 about *C. mackinnonii*.

**Cymbidium eburneum** Lindl. in Edw. Bot. Reg. 33: t. 67. 1847; Hook. f., 6: 11. 1890; King & Pantl. 196, t. 262. 1898; Arora, 298. 1978.

*Cyperorchis eburnea* (Lindl.) Schl. in Fedde, Repert. 20: 107. 1924

(Fig. 213)

*Pseudobulbs* short, stout, 8-12 cm long. *Leaves* numerous, linear, 30-60 cm × 6-12 mm, sheathing and equitant below. *Inflorescence* 20-30 cm long, erect or sub-erect, clothed to the base of the raceme by loose lanceolate sheaths, raceme 1-2, rarely 3-flowered. *Flowers* large, 7.5-10 cm across, pure ivory-white, sweetly scented. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* spreading, oblong, sub-acute, variable in breadth, the dorsal concave. *Petals* similar to sepals, sub-falcate. *Lip* oblong-obovate, 3-lobed; lateral lobes narrow, obtuse; mid lobe slightly deflexed, short, broadly obtriangular, margins undulate-crenulate; disc between the lateral lobes with 3-pubescent yellow keels.

*Flowering*: March - April.

*Distribution*: Himalaya 1000-1500 m (Kumaun ? to Arunchal Pradesh), Meghalaya, Nagaland, Manipur.

*Specimen examined*:

KUMAUN: Pithoragarh-Didihat, Arora 56428.

This species is commonly cultivated in gardens of this region. Its occurrence in the wild state in this region needs confirmation.

**Cymbidium hookerianum** Rchb. f. in Gard. Chron. 1866: 7. 1866; Arora, 78. 1980; Seidenf., 72: 89. fig. 49. 1983.

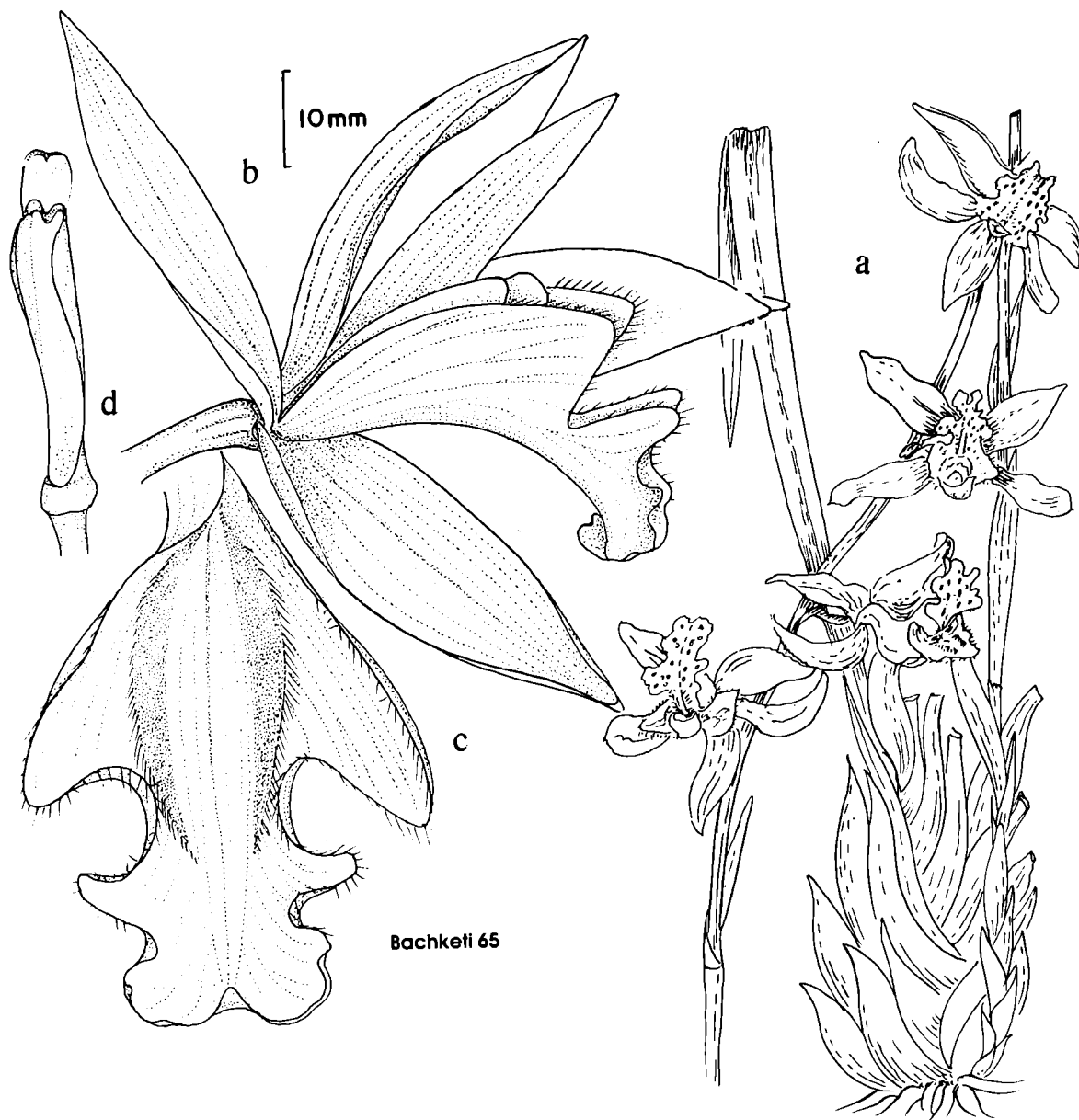
*C. grandiflorum* Griff. Ic. Pl. Asiat. 3: t. 321. 1851; Hook. f., 6: 12, 1890; King & Pantl. 192. t. 256. 1898.

*Cyperorchis grandiflora* (Griff.) Schl. in Fedde, Repert. 20: 107. 1924.

*Cymbidium lowianum* sensu Seidenf & Arora in Nord. J. Bot. 2(1): 12 1982. (*non* Rchb. f.).

(Fig. 214)

*Pseudobulbs* short, 6-8 cm long. *Leaves* linear-oblong, 40-60 cm × 20-25 mm, acute, narrowed towards the base and the expanded and equitant. *Inflorescence* from the base of the pseudobulb, 60-120 cm long,



**Fig. 214** *Cymbidium hookerianum* Rchb. f.—a. plant; b. flower; c. lip; d. column.



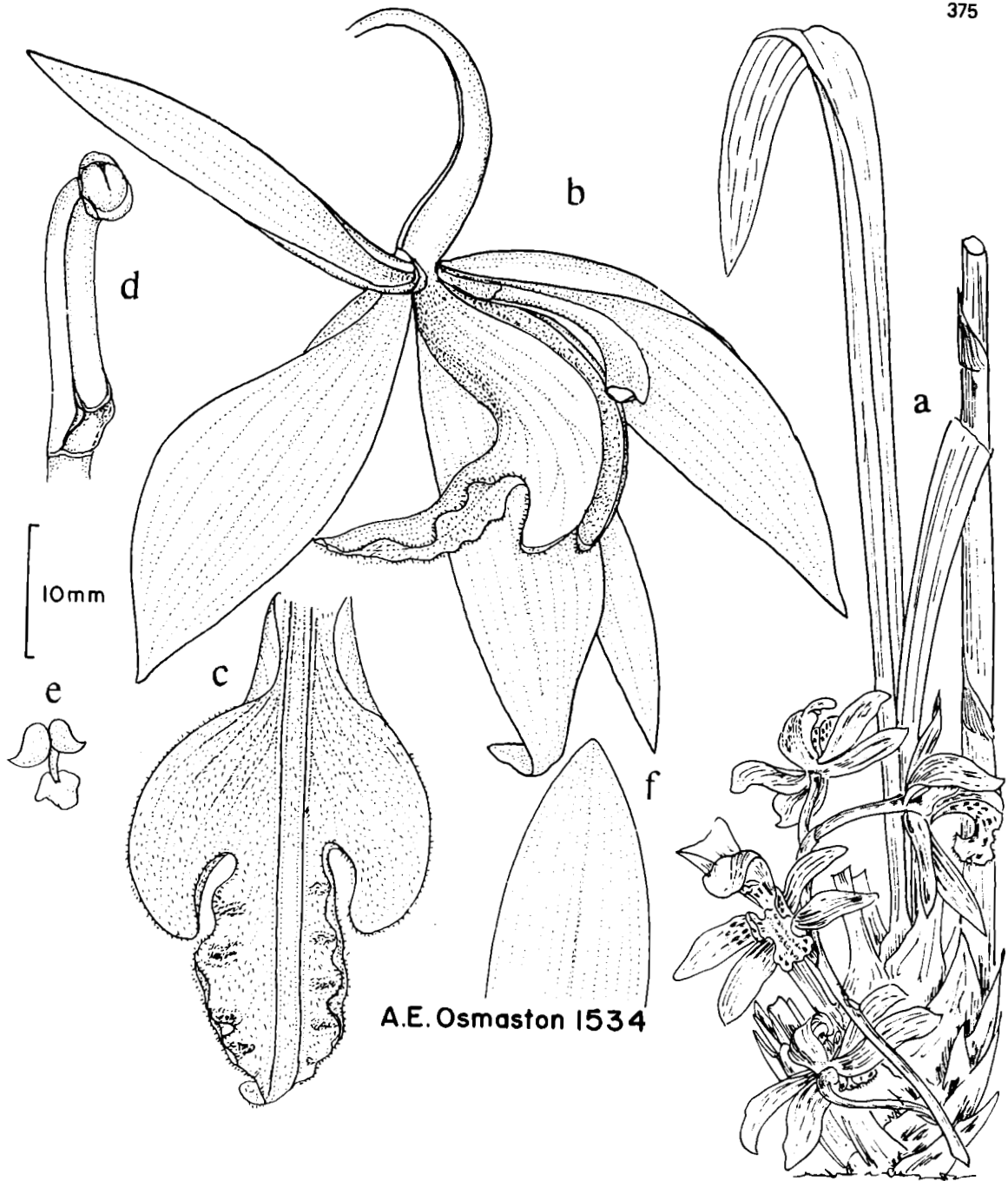


Fig. 215 *Cymbidium iridioides* D. Don.—a. plant; b. flower; c. lip; d. column; e. pollinia; f. leaf tip.

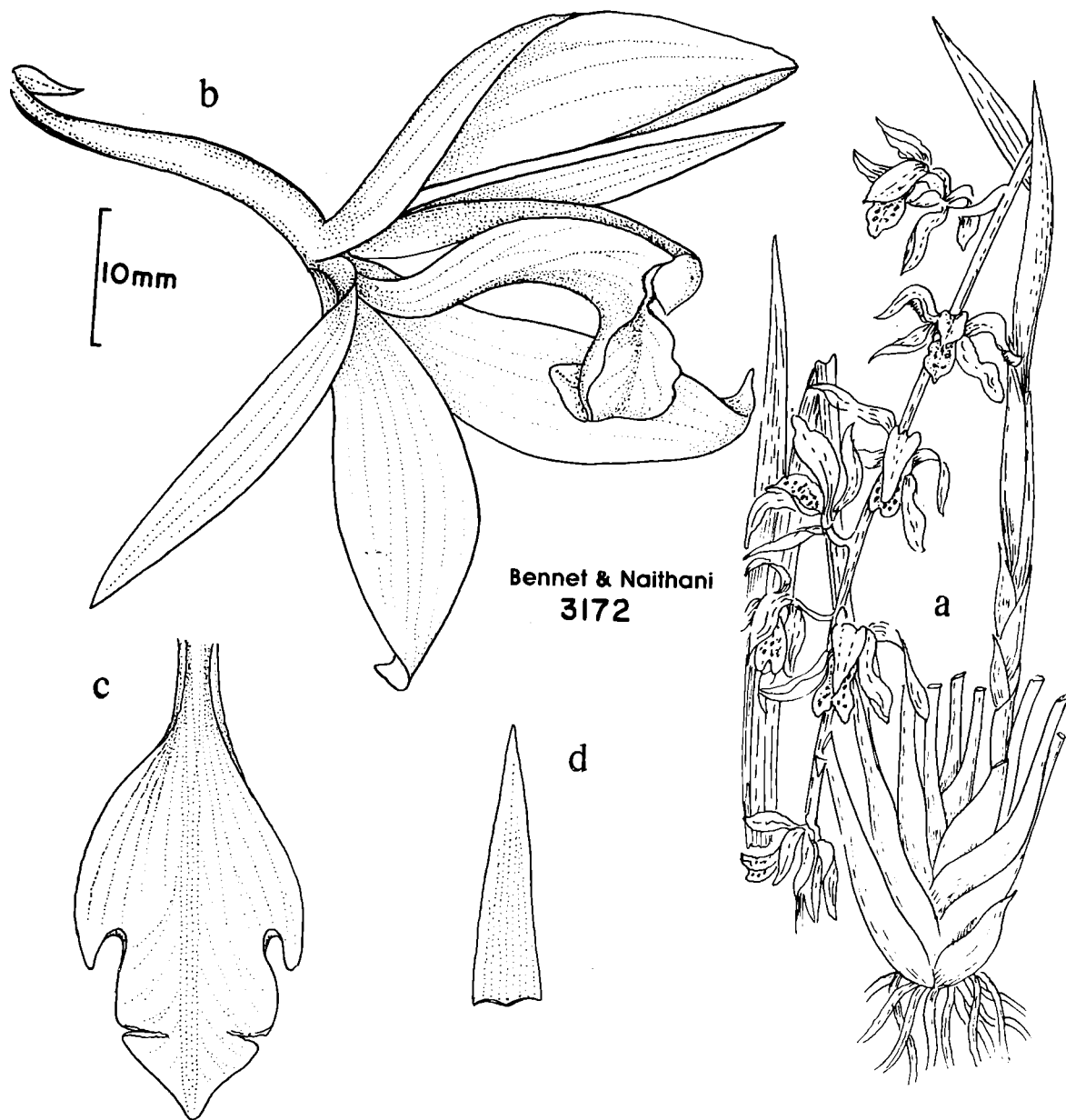


Fig. 216 *Cymbidium longifolium* D. Don.—a. plant; b. flower; c. lip; d. leaf tip.

decurved; peduncle stout, enveloped in numerous imbricate acute sheaths; raceme laxly 10-20 flowered. *Flowers* large, 7.5-10 cm across, fragrant, yellowish-purple. *Bracts* minute. *Sepals* apple-green; the dorsal oblong, acute, 6 cm long, incurved; the laterals slightly narrower, acute; sub-falcate, spreading, margins paler. *Petals* apple-green, smaller than sepals, oblong, somewhat falcate, spreading, margins paler. *Lip* as long as the sepals, yellow, speckled with purple, margins ciliate, 3-lobed, lateral lobes narrow, erect, obtuse; mid lobe large, deflexed, broadly oblong, margins undulate, its apex deeply emarginate; disc between lateral lobes with 2 prominent hairy keels.

*Flowering*: February.

*Distribution*: Himalaya 1500-2500 m (Kumaun ? to Arunachal Pradesh). S.E. Thailand, Upper Burma, China.

*Specimen examined*:

KUMAUN: Pithoragarh-Didihat, Arora 38433.

This species is commonly cultivated in gardens. We doubt about its presence in a wild state in this region.

Fig. No. 214 is drawn from a specimen collected by N.D. Bachketi from Nepal.

**Cymbidium iridoides** D. Don Prodr. Fl. Nepal 36. 1825; Hook. f., 6: 14. 1890.

*C. giganteum* Wall. ex Lindl. Gen. & Sp. Orch. 163. 1833. (*non* Sw.); Hook. f., 6: 12. 1890; King & Pantl. 191. t. 255. 1898; Duthie, 137. 1906.

*Cyperorchis gigantea* (Wall. ex Lindl.) Schl. in Fedde, Repert. 20: 107. 1924. (Fig. 215)

*Pseudobulbs* 6-8 cm long. *Leaves* linear-oblong, acute, entire, narrowed towards the base and then dilated and equitant, 35-60 cm × 20-25 mm. *Inflorescence* from the base of the pseudobulb, upto 60 cm long, peduncle curved nearly to the top with imbricate sheaths; raceme laxly 10-20 flowers. *Flowers* dingy yellow with vertical lines of brown, 6-7 cm across. *Bracts* minute, broad. *Sepals* sub-equal, elliptic-oblong, sub-acute; the dorsal incurved; the laterals spreading. *Petals* as long as the sepals but narrower, oblong, sub-acute. *Lip* shorter than sepals, ochraceous-yellow with broad transverse band of brown, upper surface puberulous, 3-lobed; lateral lobes large, their apices elliptic and directed forwards; midlobe ovate-oblong, sub-acute, deflexed, margins undulate-crenate; keel 2, running from base to near apex, hairy and separated by smooth groove.

*Flowering*: October - November.

*Distribution*: Himalaya 1500-2000 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland. N. Burma.

*Specimens examined*:

GARHWAL: Pauri-Maikhanda Patti, A.E. Osmaston. Chamoli-Phata, Mehrotra 8626, Palvi 11895.

KUMAUN: Pithoragarh-Didihat, Arora 36428. Almora-Parkot Reserve, A.E. Osmaston 1534.

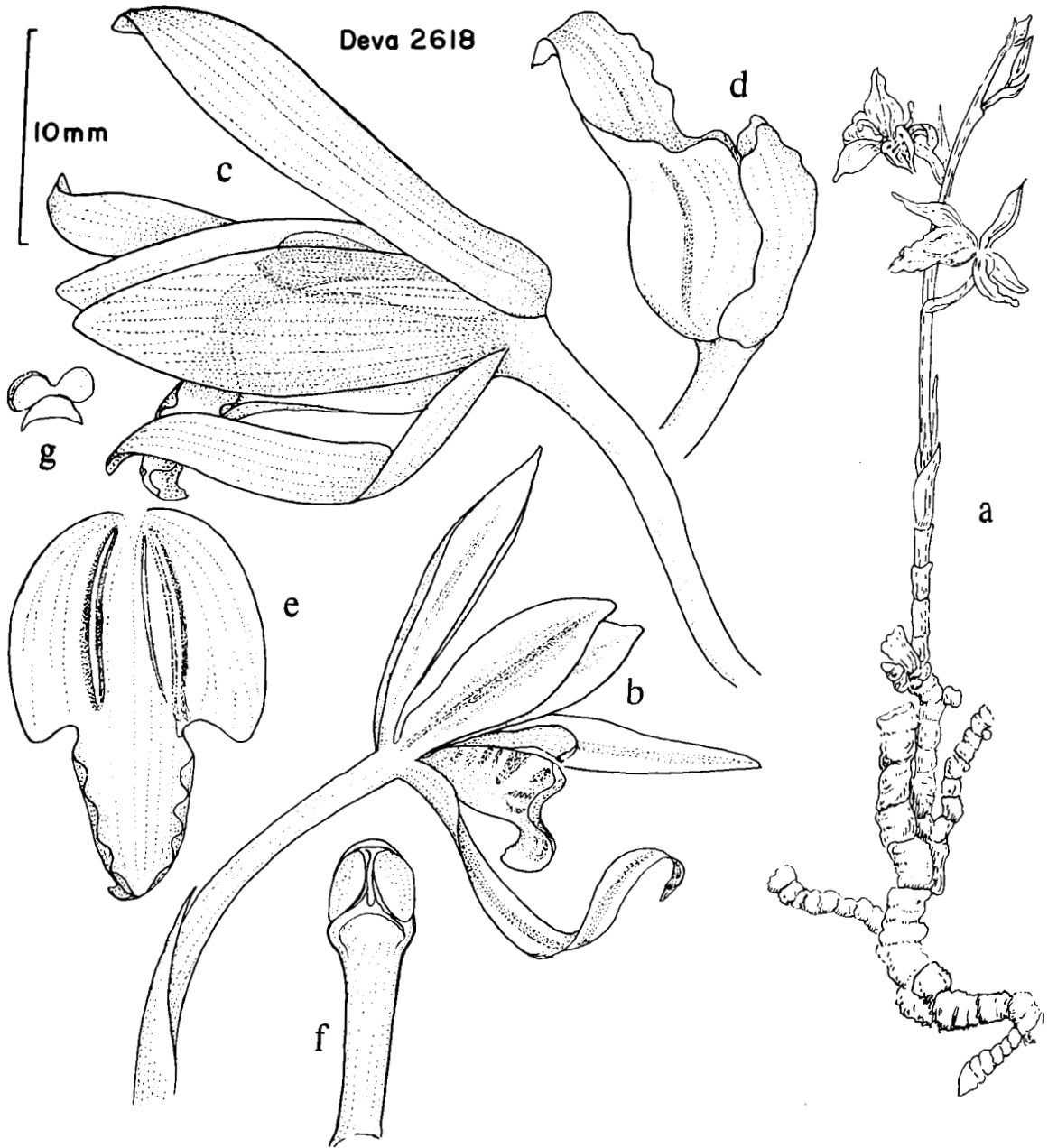
**Cymbidium longifolium** D. Don, Prodr. Fl. Nepal 36. 1825; Hook. f., 6: 13. 1890; King & Pantl. 191. t. 255. 1898; Duthie, 137. 1906; Hara, 34: 691. 1985.

*Cyperorchis longifolia* (D. Don) Schl. in Fedde, Repert. 20. 108. 1924.

*Cymbidium elegans* Lindl. Gen. & Sp. Orch. 161. 1833; Cribb & Dupuy in Kew Bull. 38: 66. 1983

*Cyperorchis elegans* (Lindl.) Blume, Rumphia 4: 47. 1848. (Fig. 216)

*Pseudobulb* short, up to 8 cm long. *Leaves* linear-acuminate, channelled below, dilated or equitant at the base, 60-90 cm × 12-16 mm. *Inflorescence* stout, sub-erect, the upper half decurved, up to 40 cm long; raceme 10-15 flowered. *Flowers* 6-7.5 cm across, green and brownish-purple. *Bracts* minute, triangular,



**Fig. 217** *Cymbidium macrorhizon* Lindl. — a. plant; b. & c. flower; d. column and lip; e. lip; f. column; g. pollinia.

shorter than the ovary. *Sepals* sub-equal, oblong; the dorsal broader or incurved; the laterals spreading. *Petals* as long as the sepals, but narrower, spreading. *Lip* oblong, shortly clawed, white, spotted with purple, 3-lobed, lateral lobes long, narrow, acute, directed forwards; mid lobe thinly pubescent on the upper surface, decurved, orbicular, acute, margins slightly undulate.

*Flowering*: September - October.

*Distribution*: Himalaya 1200-2000 m (Kumaun to Arunachal Pradesh), Meghalaya, Nagaland, Manipur.

KUMAUN: Kumaun, *Blinkworth* (Duthie, *loc. cit.*).

Fig. No. 216 is drawn from a specimen collected by Bennet & Naithani from Arunachal Pradesh.

**Cymbidium macrorhizon** Lindl. Gen. & Sp. Orch. 162. 1833; Hook. f., 6: 9. 1890; Duthie, 134. t. 114. 1906; Seidenf., 116. 1972; Pradhan 2: 470. 1970; Sen Gupta, 327. 1983; Seidenf., 72: 67. fig. 35. 1983; Renz. 58. 1984. (Fig. 217)

Terrestrial, leafless saprophytic. *Stem* underground with distinct nodes and internodes, nodes scaly. *Scape* erect, 10 (-20) cm long, faintly greenish-white, basal sheaths 3-4, elongated, ovate, 16 × 8 mm, purplish-white, turning brown with age; raceme bearing 2-8 flowers. *Flowers* creamy flushed with purplish-pink. *Sepals* 12-20 × 4-5 mm, lanceolate, acute, tinged with pink. *Petals* 18 × 6 mm, lanceolate, acute, tinged with pink, partly expanded. *Lip* 16 × 10 mm, ovate, obtuse, white with crimson or purple blotches along the margins, 3-lobed; lateral lobes narrow, erect, rounded with inflexed margins; mid lobe oblong or sub-panduriform, apex curving or rolling downwards, margins wavy; disc with two thick elongated ridges between the lateral lobes.

*Flowering*: July - August.

*Distribution*: Himalaya 500-2500 m (Pakistan, Himachal Pradesh, Garhwal, Kumaun and Sikkim to Arunachal Pradesh), Meghalaya, Nagaland, Mizoram, Madhya Pradesh. Thailand, Burma, Laos, Cambodia, China, Japan.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Kalinga Hills (Nalapani), *Deva* 2618; Rajpur Sal Forest, *Deva* 8974; Laxman-sidh, *Deva* 8179 & 10267; On Baneg near Mussoorie, *Mackinnon* 22717. **Tehri**-Hill east of Tehri, *Mackinnon's collector* 25403. **Uttarkashi**-Jamuna Valley Barkota, *Deva* 6830; Jamuna Valley Gangnani, *M.A. Rau* 15631; Ganga Valley, Indravati near Uttarkashi, *Deva* 9229.

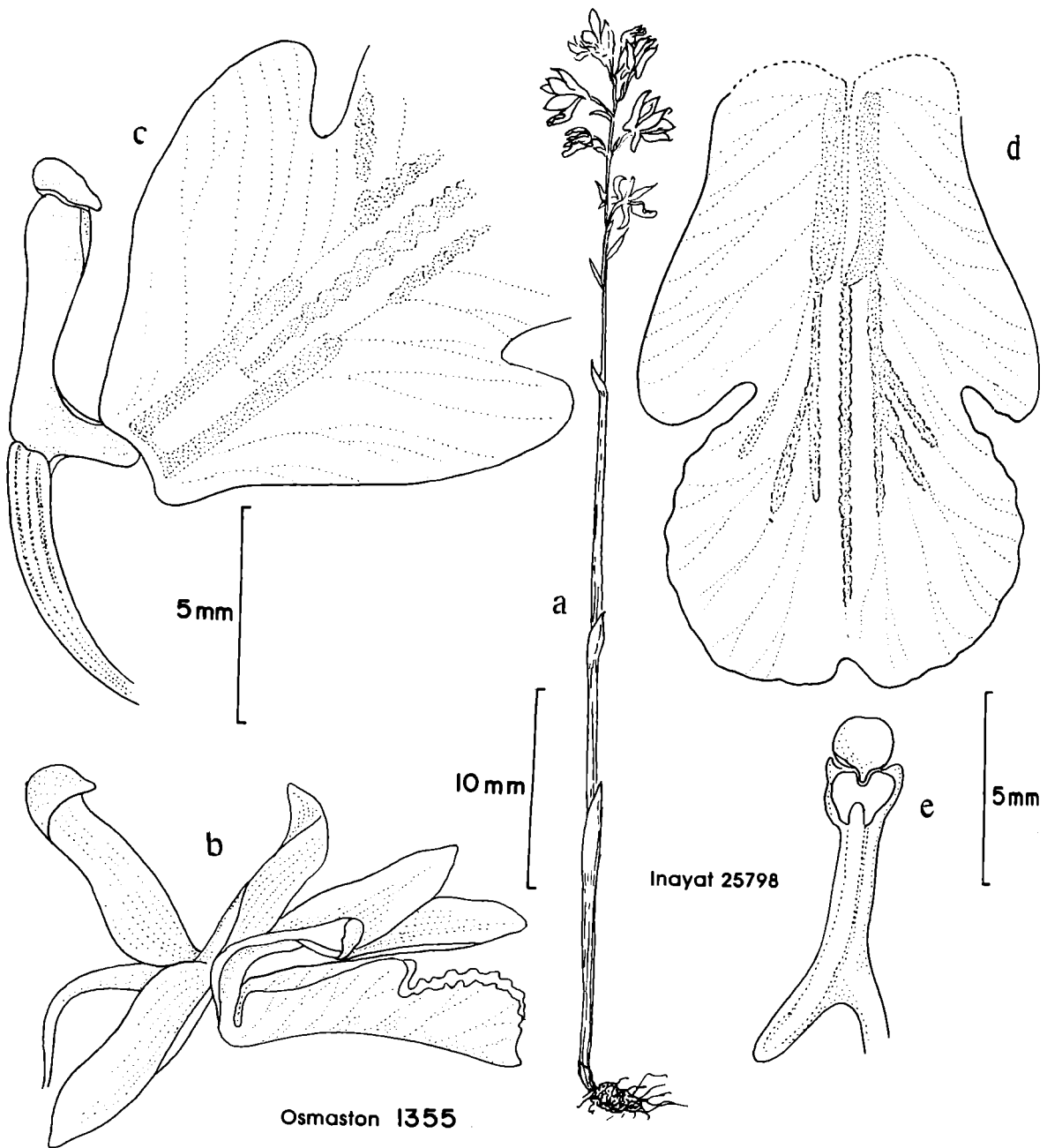
KUMAUN: **Pithoragarh**-Shama, Sarju Valley, *Inayat* 24098; Satta-Ghorpatta, *Pant* 31896. **Nainital**-Nainital between Sat-tal & Bhimtal, *Renz* 13583.

HIMACHAL PRADESH: Daulhousie, *Raizada*; Chail Shimla Hills, *Kirat Ram*.

PAKISTAN: Murree, *Saunders*.

#### **Eulophia** R. Br ex Lindl.

Terrestrial herbs with pseudobulbous or tuberous root stocks. *Leaves* appearing with or after the flowers, thin and grass like, usually plicate. *Scape* or peduncle lateral or terminal on pseudobulb or root stock, erect, racemose or loosely paniculate above. *Sepals* and *petals* free, spreading, usually sub-equal. *Lip* adnate to the foot of the column, erect, base saccate or spurred; lateral lobes embracing the column; midlobe spreading or recurved, disc cristate or lamellate. *Column* short or long, sometimes with wings or lobed margins; foot present or absent. *Anther* terminal, 2-chambered; *pollinia* 2, more or less cleft, globose, waxy, sessile or attached by a short strap to a discoid gland.



**Fig. 218** *Eulophia bicallosa* (D. Don) P.F. Hunt & Sumerh.—a. plant; b. flower; c. column & lip; d. lip; e. column.

## Key to species

1. Lip without a spur, the base forming a blunt shallow or deep sac.....2
- + Lip with a distinct spur.....4
2. Column not produced into a foot; lip about 10 mm long, sub-panduriform, lateral lobes when spread out pointing outwards, hypochile with 2-crenulate lamellae, mesochile and epichile with 3-crenulate lamellae..... *E. explanata*
- + Column produced into a distinct foot; lip longer, 14-25 mm, lateral lobes when spread out pointing forwards, lamellae 3-5 crenulate.....3
3. Lip about 14-15 mm long, lateral lobes narrower than the broad midlobe, hypochile with 2-thick smooth callus-like lamellae, mesochile and the base of epichile with 5-crenulate lamellae; flowers greenish-yellow, lip tinged with purple.....*E. bicallosa*
- + Lip about 20-25 mm long, lateral lobes broader than the narrow mid lobe with 3-crenulate lamellae from the base of hypochile to the base of epichile; flowers lemon-yellow, base of the lip with purple spots.....*E. flava*
4. Column produced into a distinct foot.....5
- + Column not produced into a foot.....6
5. Lateral basal lobes of the lip absent or obscure, lip when spread out at base 9-11 mm broad, spur short flat, tip usually pointing backwards.....*E. nuda*
- + Lateral basal lobes of the lip prominent, lip when spread out at base more than 14 mm broad, spur small usually pointing forward.....*E. obtusa*
6. Pseudobulbs epigeal, green; scape often branched; sepals and petals with prominent reddish-purple veins; lip 8-13 mm long with 3-5 crested veins, crests becoming fimbriate on the mid lobe, flowers and leaves more or less coetaneous .....*E. graminea*
- + Pseudobulbs hypogeal; scape always unbranched; sepals and petals without reddish-purple veins; lip usually more to much more than 12 mm.....7
7. Leaves and flowers coetaneous; leaves lanceolate well developed at the time of flowering; colour of flower white or yellowish-brown.....8
- + Flowers appear much before the leaves; leaves linear, colour of the flowers pale-pink with purple tinge; lip with lamellate veins, finely fimbriate to closely or sparsely tuberculed.....*E. dabia*
8. Sepal linear-lanceolate, acute, greenish; petals and lip pure white; lip with finely fimbriate hair like lamellae on the veins of the midlobe.....*E. herbacea*
- + Sepals ovate, obtuse, yellow tinged with brown; petals of the same colour as the sepals, oblong-obovate, veins on the mid lobe of the lip with tuberculed lamellae.....*E. mackinnonii*

***Eulophia bicallosa*** (D. Don) P.F. Hunt & Summerh. in Kew Bull. 20: 60. 1966; Seidenf., 72: 38 fig. 22. 1983.

*Bletia bicallosa* D. Don Prodr. Fl. Nepal 30. 1825; Hook. f., 6: 196. 1890.

*Limodorum bicallosum* Buch.-Ham. ex D. Don Prodr. Fl. Nepal 30. 1825.

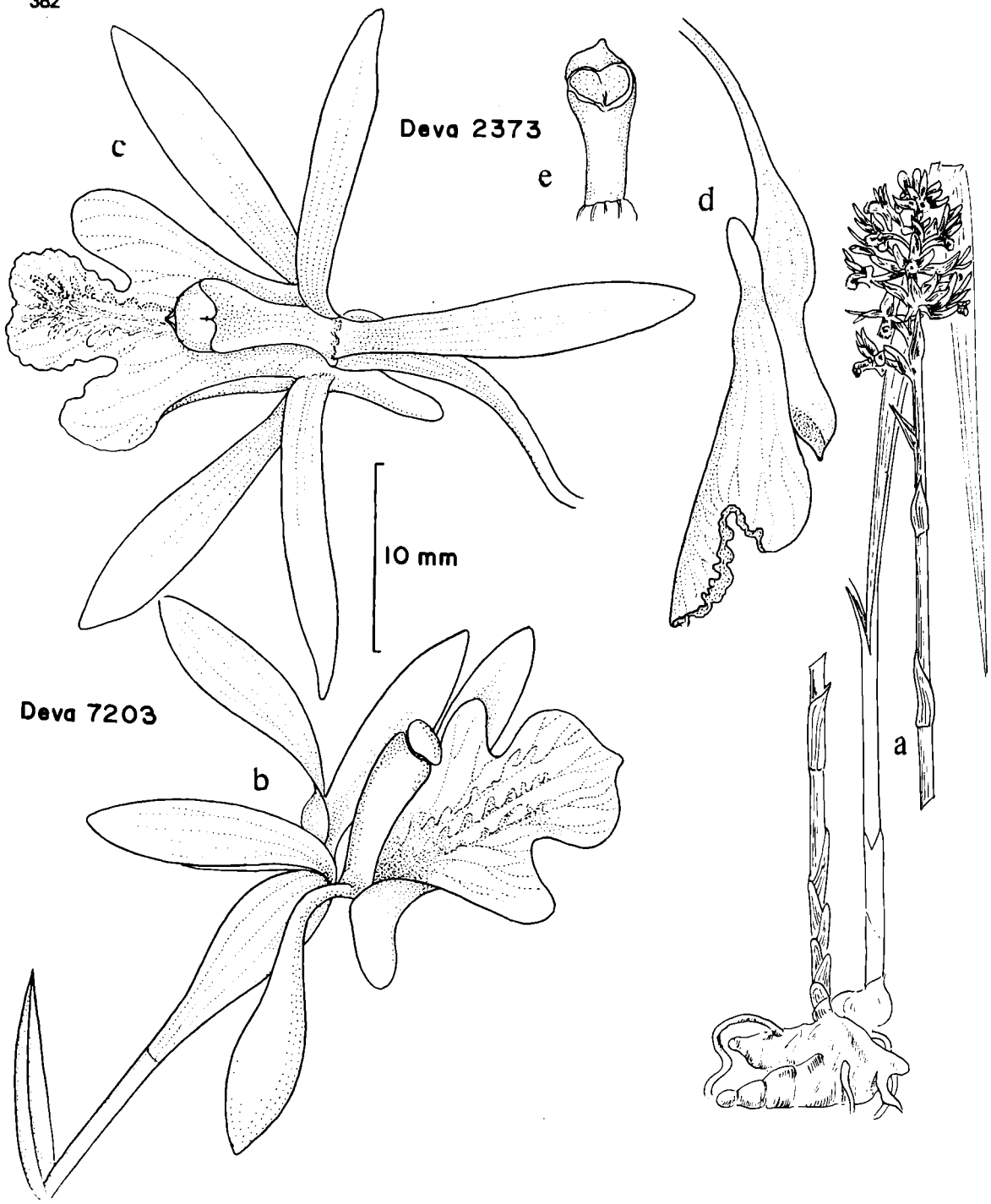
*Cyrtopera bicarinata* Lindl. Gen. & Sp. Orch. 190. 1833.

*Eulophia bicarinata* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 6. 1890; King & Pantl. 180, t. 244. 1898; Duthie, 127. 1906.

*Liparis bicallosa* (D. Don) Schlechter in Feede, Repert. Beih. 4: 196. 1919.

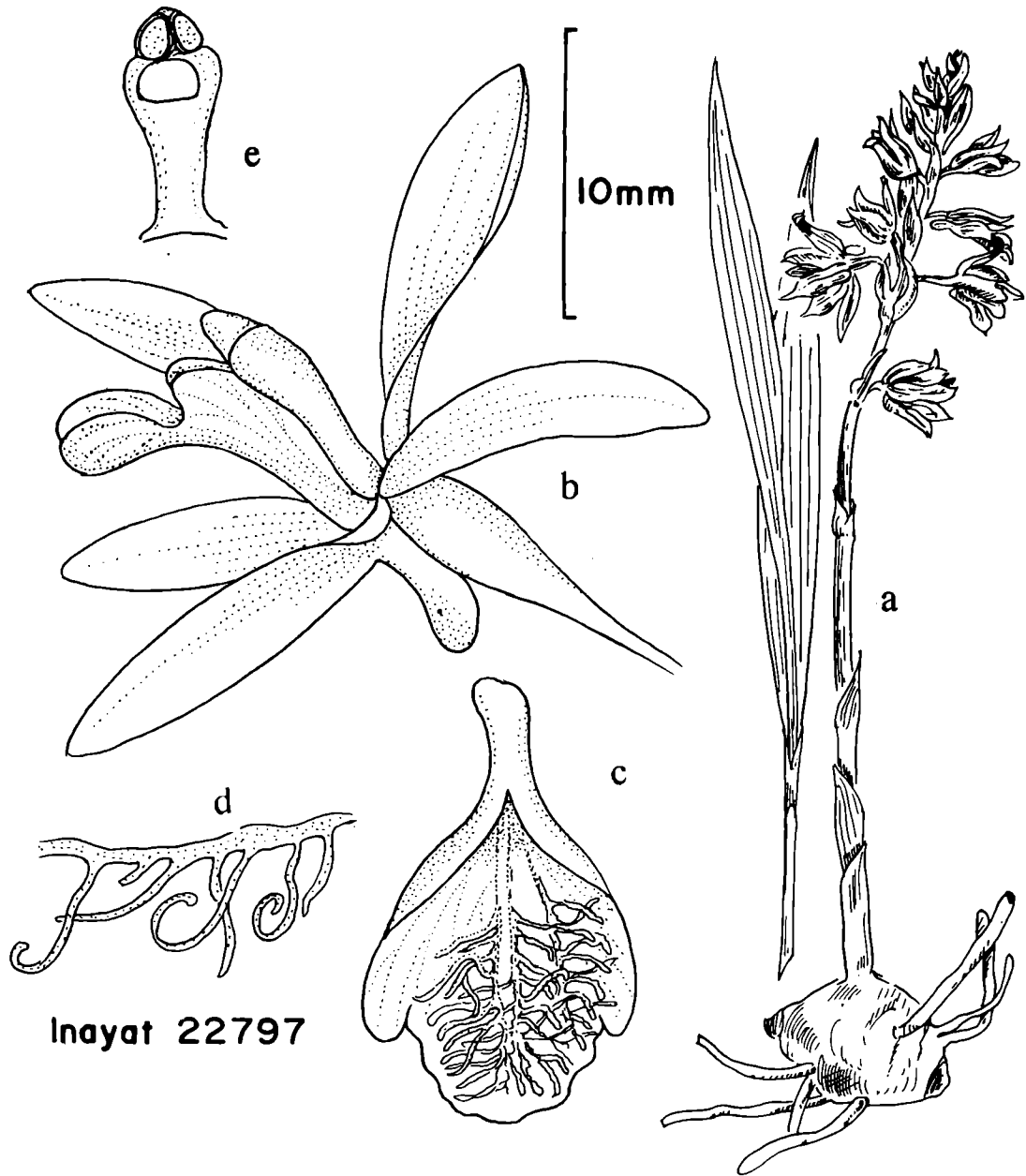
(Fig. 218)

Tuber 5 cm long, oblong, irregularly lobed. *Leaves* appearing after flowers, 18-30 × 2 cm, linear, acuminate, narrowed to a long petiole. *Inflorescence* 25-50 cm long; raceme densely flowered, 7.5-12 cm long. *Flowers* pale yellowish-green, 2.5 cm across. *Bracts* membranous, lanceolate, shorter than the ovary. *Sepals* oblong, acute, keeled, edges reflexed. *Petals* narrowly-elliptic, sub-acute, shorter and wider than sepals. *Lip* 14-15 mm long, adnate to the column, yellow tinged with purple, 3-lobed; lateral lobes narrower than the broad midlobe, hypochile with 2-thick smooth callus-like lamellae, mesochile and the base of epichile with 5-crenulate lamellae. *Column* produced into a foot.



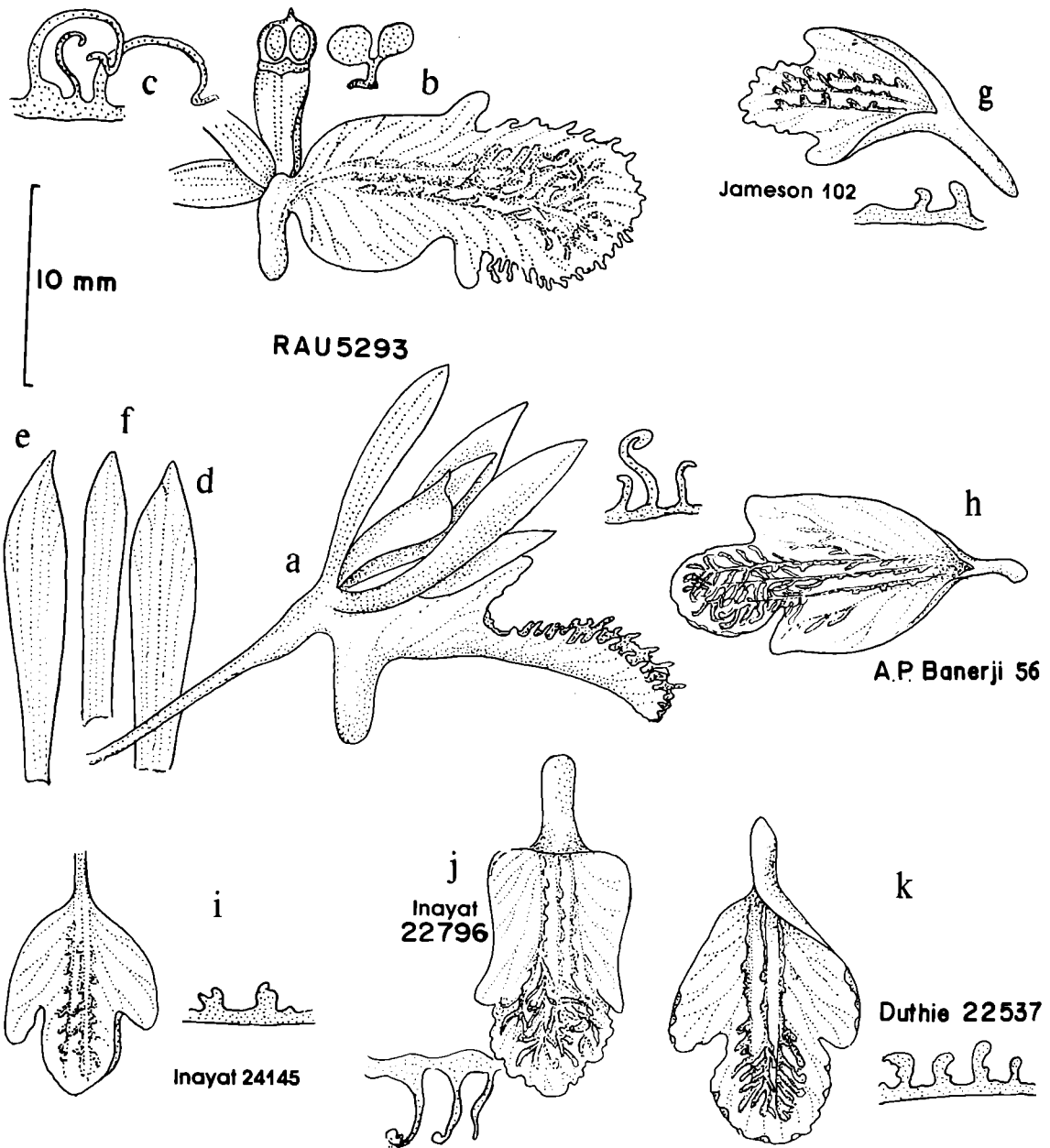
219 *Eulophia dabia* (D. Don) Hochr. — a. plant; b. & c. flower; d. column & lip; e. column.





Inayat 22797

**Fig. 220** *Eulophia dabia* (D. Don) Hochr. — a. plant; b. flower; c. lip. & spur; d. hairs on lip enlarged; e. column.



**Fig. 221** *Eulophia dabia* (D. Don) Hochr.-a. flower; b. lip, column & pollinia; c. hairs on lip enlarged; d. dorsal sepal; e. lateral sepal; f. petal; g., h., i., j. & k. lip and spur, hairs on the lip enlarged.

*Flowering:* March - April.

*Distribution:* Himalaya up to 1000 m (Garhwal, Nepal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram.

*Specimens examined:*

GARHWAL: **Pauri-Patli Dun**, *Inayat* 25803; Dhikala Kalagarh, *Osmaston* 1355, *Pant* 43735.

Fig. 218 in drawn from a specimen collected by *Inayat* 25798 from Kheri district Uttar Pradesh.

***Eulophia dabia*** (D. Don) Hochr. in Bull. N.Y. Bot. Gard. 6: 270. 1910; Renz, 55. 1984.

*Bletia dabia* D. Don Prodr. Fl. Nepal 30. 1825.

*E. campestris* Lindl. Gen. & Sp. Orch. 185. 1833; Hook. f., 6: 4. 1890; King & Pantl. 178, t. 241. 1898; Duthie, 126. 1906; Stewart, 69. 1972.

*E. ramentacea* Lindl. Gen. & Sp. Orch. 185. 1833.

*E. hormusjii* Duthie in Ann. Roy. Bot. Gard. Cal. 9(2): 125, t. 109. 1906; Renz., 143. 1978; & 59, 1984; Sharma & Kachroo 198. 1982; Hegde & Rao, 386. 1983, *syn. nov.*, (Fig. 219, 220, 221)

*Pseudobulbs* tuberous, irregular in shape, generally oblong-orbicular. *Leaves* two, appear much after the flowers, 24-40 cm long, about 10 mm broad, linear, acuminate, plicate. *Inflorescence* 25-30 cm long; raceme laxly many-flowered. *Flowers* pale-pink with purple tinge, 25mm across, drooping. *Bracts* membranous, linear-lanceolate, acuminate, usually longer than the ovary. *Sepals* wide spreading, oblong-lanceolate, acute or acuminate, 5-nerved. *Petals* narrower, oblanceolate, spreading. *Lip* as long as the sepals, cuneate-obovate or oblong, with lamellate veins, finally fimbriate to closely or sparsely tubercled, 3-lobed; lateral lobes rounded or sub-acute; apical lobe orbicular quadrate or oblong, crenulate. *Spur* short, conical, sub-clavate or sub-acute. *Column* long, without foot.

*Flowering:* March - May

*Distribution:* Himalaya up to 2000 m (Pakistan, Kashmir to Arunachal Pradesh), Bengal, Manipur, Deccan, Konkan, Plains of Uttar Pradesh, Andaman Island. Afghanistan, Baluchistan, Burma.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 22724 & 22708(a); Siwaliks, Mohand, *Dev* 2373 & 7203; Mussoorie, *Mackinnon* 22708 & 25407; Chakrata-Jaunsar, below Konain, *Duthie* 1977; Jaunsar below Katheyain, *Duthie* 12896; Jaunsar Tons Valley, *Duthie* 22537, *Brandis*. Tehri-Nagtibba, *Gollen* 2061; Above Dhakara, *Gollen* 2060. **Chamoli**-Way to Valley of Flowers, *Naithani* 1012.

KUMAUN: **Nainital**-Ram Nagar, *M.A. Rau* 5293.

HIMACHAL PRADESH: Mundali, *Parkinson* 7103.

JAMMU & KASHMIR: Batah, Geynasu, Jammu (Sharma & Kachroo *loc. cit.*).

PAKISTAN: Chitral (Stewart, *loc. cit.*; Renz, *loc. cit.*).

Fig. No. 220 & 221 were drawn from *Inayat's* coll. no. 22796, 22799, 24145 collected from Kheri and Oudh, Jameson 102, without any locality.

*E. dabia* is a very widely spread species (type. Buch.-Ham. in Central Nepal) over the Indian sub-continent from Pakistan to Burma and extending to the Himalaya up to 2000 m. It is very variable, as regards the size of the plants, colour and number of flowers in the inflorescence. Duthie (1906) segregated from the material another species *E. hormusjii* which has condensed inflorescence with large flowers and yellowish lip. Duthie further pointed out that *E. hormusjii* is a species of higher altitude, while *E. dabia* is from plains. We have examined a large number of specimens and have failed to distinguish *E. hormusjii* from *E. dabia*.

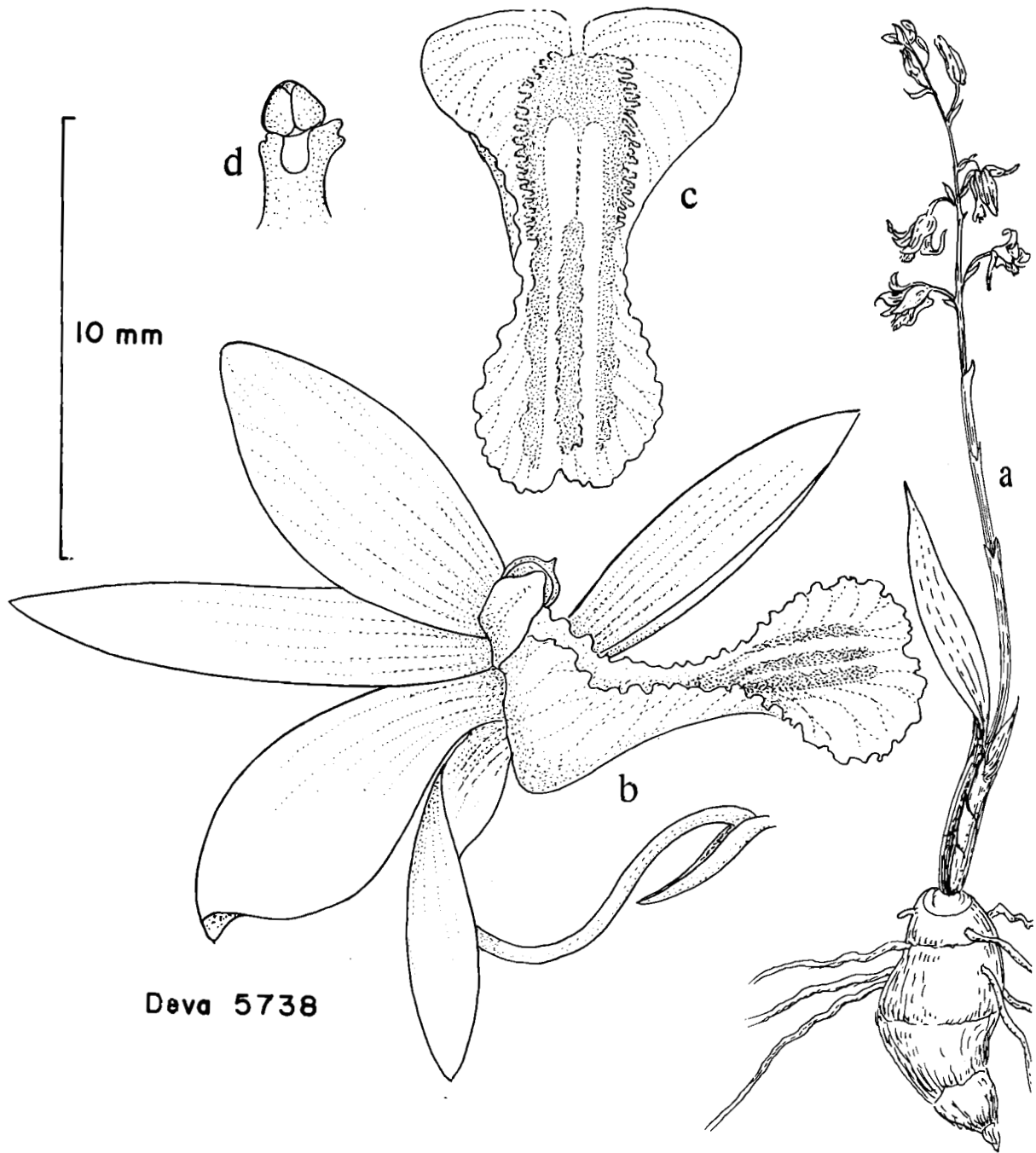


Fig. 222 *Eulophia explanata* Lindl.—a. plant; b. flower; c. lip; d. column.

Even Duthie's own t. 100, 1906 drawn by Hormusjee has a lax inflorescence, while the King & Pantling t. 241, 1898 (*E. campestris*) has more condensed inflorescence with few flowers. The colour of mid lobe is also variable. Haines (1924) has mentioned that the colour of the lip of *E. dabia* as yellow. The size of the flowers is almost same in both as is clear from the various illustrations which we have drawn including of those which were segregated by Duthie as *E. hormusjii*. About the distinction due to distribution at higher and lower altitudes, Duthie himself quotes many examples of *E. hormusjii* occurring at low altitude in Dehra Dun Valley, Siwaliks and Kheri District North Oudh.

Another species *E. turkistanica* Schlecht., with has 40 cm high stem and larger flowers than *E. campestris* (*E. dabia*) is probably also the same, Stewart (1972) had a doubt and we also examined a specimen A.P. Banerjee No. 56 from Waziristan in Pakistan see fig. 221 with the above characters it is no way different form *E. dabia*. This specimen even has a remark by Rolfe "I should say quite agrees with the type"

**Eulophia explanata** Lindl. Gen. & Sp. Orch. 180. 1833; Hook. f., 6: 3 & 195. 1890; Duthie, 125. t. 108. 1906 et 3: 198. 1920; Haines, 1171. 1921; Raizada et al. 31. 1981.

*Dipodium scariosum* Buch.-Ham. ex Hook. f., Fl. Brit. Ind. 6: 3. 1890. (Fig. 222)

Plant 20-25 cm high. *Pseudobulbs* ovoid, 5 cm long, annulate. *Stem* 4-5 cm long. *Leaves* young at the time of flowering, lanceolate, acuminate, plicate, 30 × 10 cm, tapering to a short petiole, 7-nerved. *Inflorescence* raceme, 20 cm long, laxly many flowered. *Flowers* about 25 mm across, yellow and purple. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* spatulate-lanceolate, acute, 5-nerved, yellow with purple lines or blotches. *Petals* broader, oblong or rounded at the apex. *Lip* about 10 mm long, sub-panduriform, 3-lobed; lateral lobes when spread out pointing outwards, hypochile with 2-crenulate lamella, mesochile and epichile with 3-crenulate lamelle. *Column* produced in to a foot.

*Flowering*: May - June.

*Distribution*: Himalaya 1000 m (Garhwal, Nepal ?), Gangetic Plain, Madhya Pradesh, Bihar, Meghalaya.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 22710; Mohand above Tunnel, *Deva* 4243, 5009, 5738 & 5810, *Renz* 13571; *Bibiwala*, *Deva* 7548. **Pauri**-Haldu Parao, *Inayat* 25792; Dholipani, *Inayat* 25791.

**Eulophia flava** (Lindl.) Hook. f., Fl. Brit. Ind. 6: 7. 1890; Duthie, 128. t. 110. 1906; Seidenf., 72: 33. f. 16. 1983.

*Cyrtopera flava* Lindl. Gen. & Sp. Orch. 189. 1833.

*Eulophia cullenii* (Wt.) Fischer in Gamble Fl. Pres. Madras 3: 1435. 1928; Abrahm & Vatsala 298. f. 66. 1981.

*Cyrtopera cullenii* Wt. Ic. t. 1754. 1851.

*Lissochilus flavus* (Lindl.) Schltr. in Fedde Repert. Beih. 4: 260. 1919 (Fig. 223)

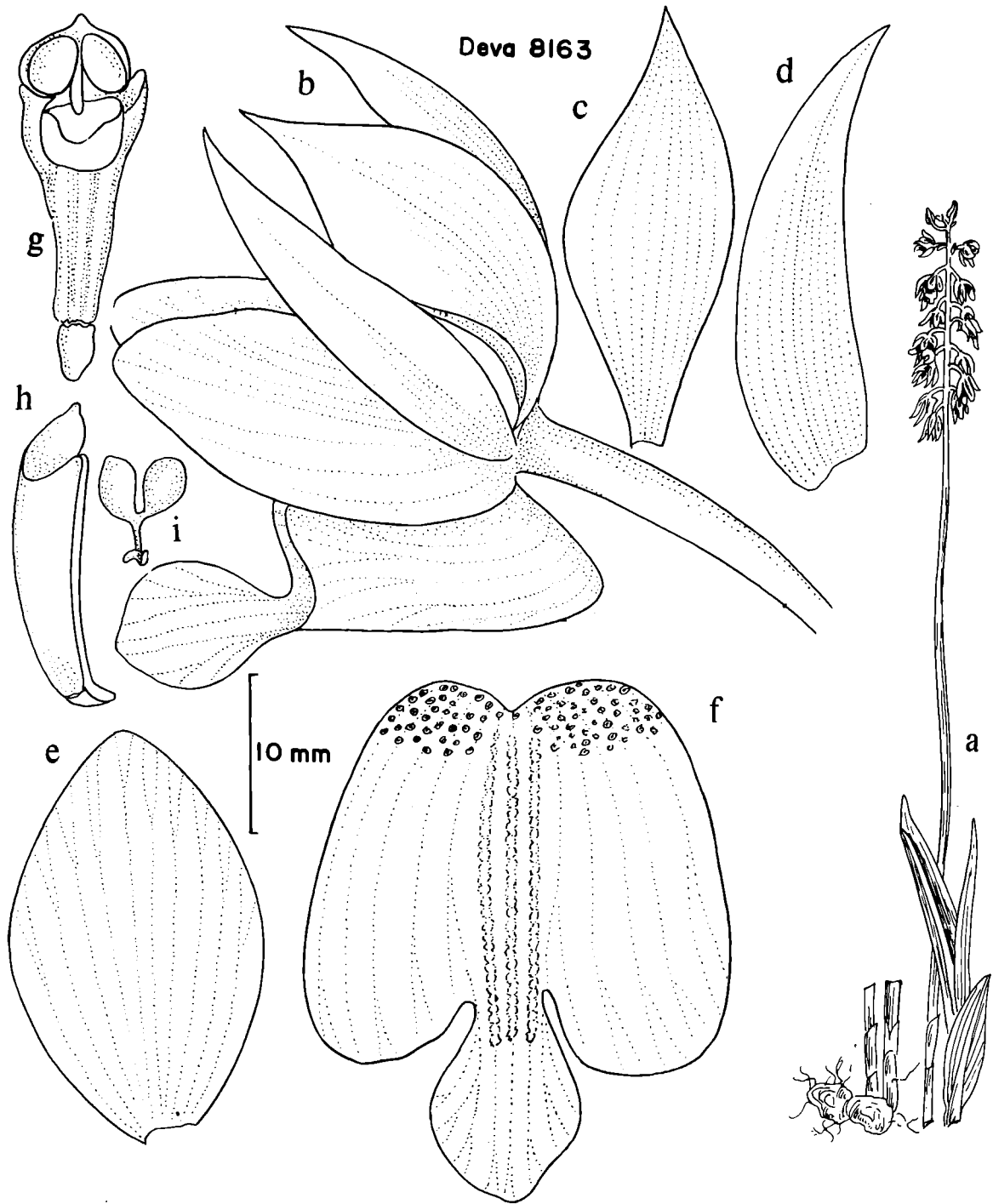
Tuber rough, 5-6 cm long, ovoid, hypogaeal. *Leaves* 2-3, appearing after flowers, 20-30 × 5-6 cm, plicate. *Inflorescence* stout, 60-150 cm arising from side of leaf-bearing stem; racemes 30-60 cm long with 12-15 flowers. *Flowers* 4 cm across, lemon-yellow, slightly drooping. *Bracts* ovate, acuminate, much shorter than ovary. *Sepals* 3 cm long, oblong-lanceolate, acuminate. *Petals* shorter, much broader, obtuse or rounded with several veins. *Lip* 2-2.5 cm long, saccate at base, 3-lobed; lateral lobes broader than the narrow mid lobe, 3-crenulate lamellae from the base of hypochile to the base of epichile. *Column* long, foot short.

*Flowering*: June - July.

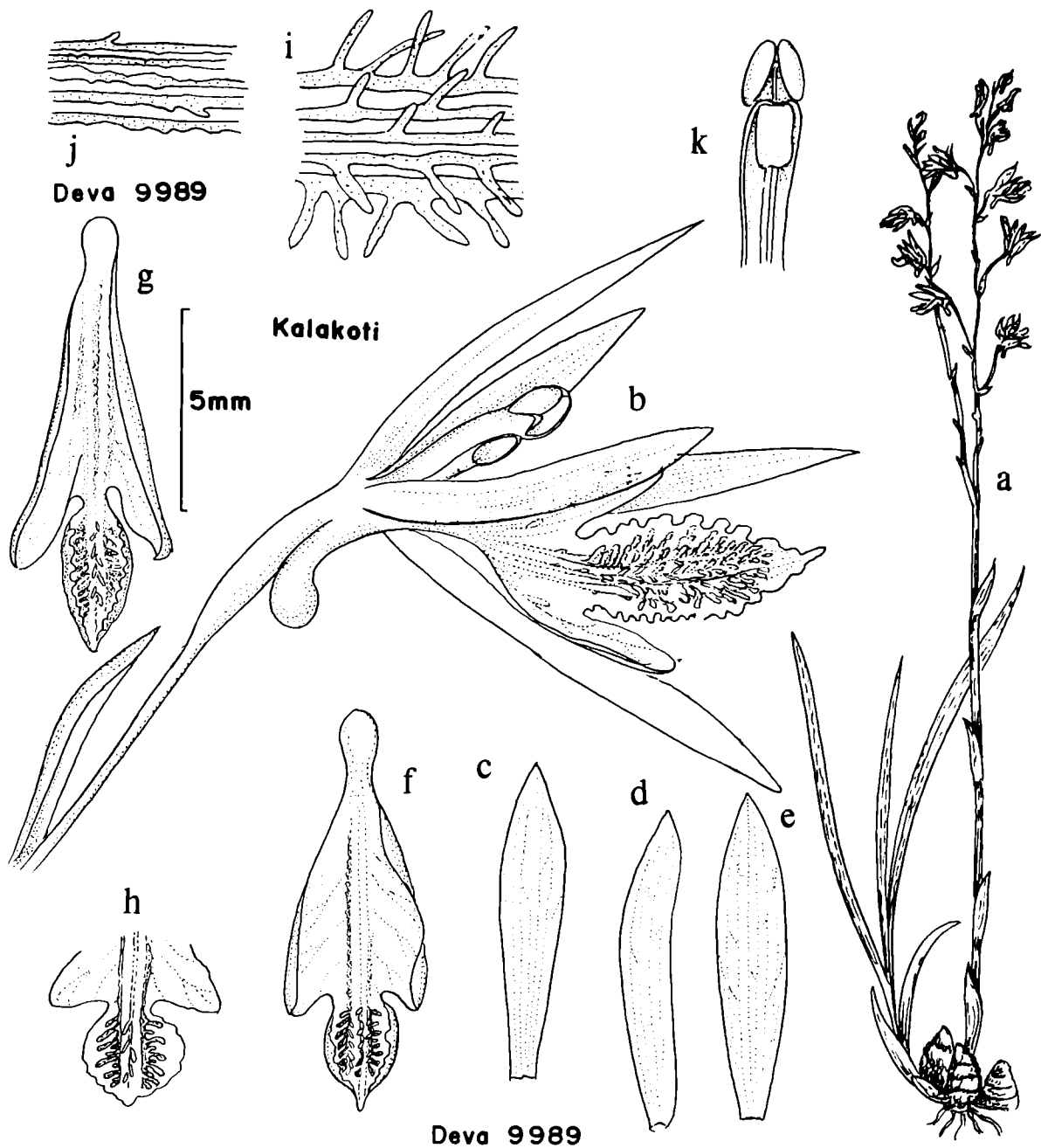
*Distribution*: Himalaya 1000 m (Garhwal & Nepal), Madhya Pradesh, Western Ghats. China, Hong Kong.

*Specimens examined*:

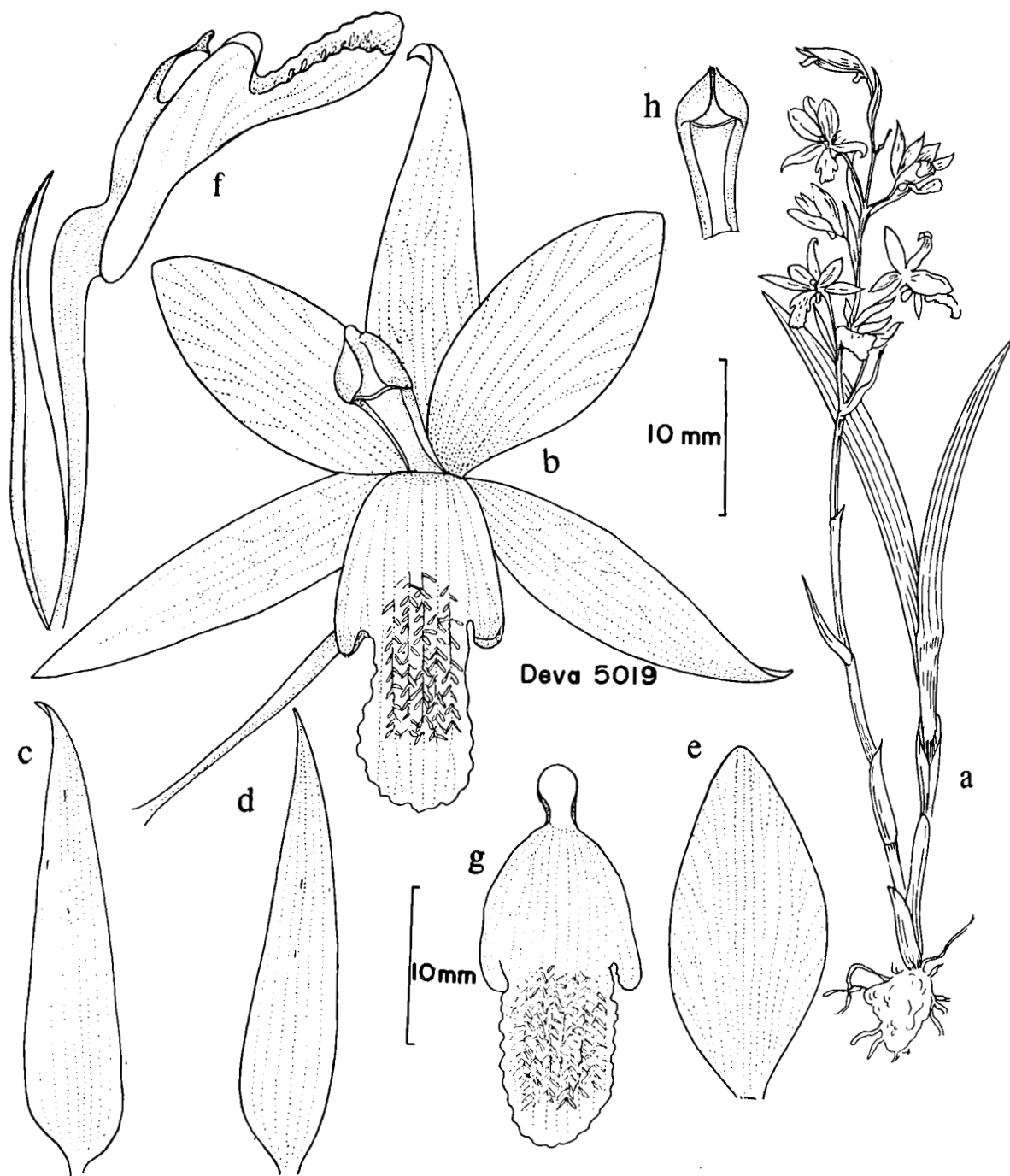
GARHWAL: **Derha Dun**-Dehra Dun, *Mackinnon* 22725; Morthronwala, *Dakshini* 5535 & 8050; Siwaliks Mohand, *Deva* 4242; Mansa Devi Hardwar, *Deva* 9354. **Pauri**-Suttan Chora, *Inayat* 25790



**Fig. 223** *Eulophia flava* (Lindl.) Hook. f. — a plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. lip; g. & h. column; i. pollinia.



**Fig. 224** *Eulophia graminea* Lindl.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. & g. lip with spur; h. lip apical portion; i. & j. hairs on lip enlarged; k. column.



**Fig. 225** *Eulophia herbacea* Lindl.—a. plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column, lip & spur; g. lip & spur; h. column.



**Eulophia graminea** Lindl. Gen. & Sp. Orch. 182. 1833; Hook. f., 6: 2. 1890; King & Pantl. 176, t. 238. 1898; Malhotra, 77. 1966; Renz, 142. 1978; Seidenf. & Arora, 16. 1982; Sharma & Kachroo, 298, 1982; Seidenf., 72: 29. fig. 14. 1983; Renz. 53. 1984.

*E. decipiens* Kurz in J. As. Soc. Beng. 75: 155. t. 13. 1876.

*E. ucbii* Malhotra & Balodi in Bull. bot. Surv. Ind. 26(1-2): 92, 1984. *syn nov.* (Fig. 224)

*Pseudobulbs* 2.5-10 cm long, obpyriform, epigeal. *Leaves* 3-8, persistent, 10-30 × 1-1.5 cm, linear, acute, plicate. *Inflorescence* from the side of pseudobulbs, 30-80 cm long, branched, many flowered. *Flowers* distant, greenish and whitish, with reddish nerves, about 2 cm across. *Bracts* lanceolate, shorter than ovary. *Sepals* and *petals* greenish with reddish veins, sub-equal, oblanceolate, spreading, sepals 15-17 mm long, petals shorter and broader than sepals. *Lip* 8-12 mm long, white with reddish veins, 3-lobed, with 3-5 crested veins, crests becoming fimbriate on the mid lobe; lateral lobes short, blunt. *Spur* short, wider at the apex, incurved. *Column* long not produced in foot, arched.

*Flowering*: March - April.

*Distribution*: Himalaya up to 1000 m (Pakistan, Jammu, Garhwal, Kumaun to Arunachal Pradesh), Pilibhit in Uttar Pradesh plains, Madhya Pradesh, Bihar, Assam, Bengal, Nagaland, Meghalaya, Kerala, Tamil Nadu, Nicobar Islands. Burma, Sri Lanka, Malaya Peninsula, Indo-China, China, Philippine, Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Siwalik near Mansa Devi, *Deva* 9989.

KUMAUN: **Almora**-Chatikhhet near Bageshwar, *Kalakoti*.

JAMMU & KASHMIR: Jammu (Sharma & Kachroo, *loc. cit.*).

PAKISTAN: Panjar, *Y. Nasir* 8181 (Renz, *loc. cit.*).

*E. graminea* is very similar to *E. epidendreae* (Koen.) Fischer, but differs in small size of all its parts. Abrahm & Vatsala (1981) call it simply a pocket size edition of *E. epidendreae*. Jayaweera (1981) add further that *E. graminea* has cylindrical spur with clavate tip, but this character has also been given by Santapau & Kapadia (1966) for *E. epidendreae*. Sometimes leaves are absent at the time of flowering in those plants which grow in very dry situations.

**Eulophia herbacea** Lindl. Gen. & Sp. Orch. 182: 1833; Hook. f., 6: 2. 1890; Duthie, 123, t. 106. 1906; Seidenf., 72: 36. fig. 19. 1983. (Fig. 225)

*Pseudobulbs* 4 cm long, broadly ovate to conical. *Stem* 10 cm long. *Leaves* 2-5, linear to elliptic-lanceolate, 10-30 × 3-10 cm, acute-acuminate, plicate. *Inflorescence* 30-60 cm tall, erect, with few sheathing bracts at the base. *Flowers* in lax raceme, pale-green, 4-5.5 cm across, fragrant. *Bracts* lanceolate, acuminate, longer than the ovary. *Sepals* greenish, 18-20 mm long, linear-lanceolate, acuminate, spreading the laterals adnate to the base of column. *Petals* 15-17 mm long, white, oblong-elliptic or lanceolate. *Lip* 15-20 mm long, white, oblong-elliptic, 3-lobed; lateral lobes short, obtuse or rounded; mid lobe oblong, rounded with finely fimbriate hair like lamellae on the veins. *Spur* short, somewhat geniculate, rounded. *Column* stout, curved.

*Flowering*: June - July.

*Distribution*: Himalaya up to 1000 m (Garhwal to Nepal), Bengal, Madhya Pradesh, Gujarat, Bombay, Konkan, Karnataka. Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon*; Mohand Siwaliks, *Deva* 4244, 5019 & 5020, *Renz* 13570; Mussoorie, Badraj, *Mackinnon* 21749.

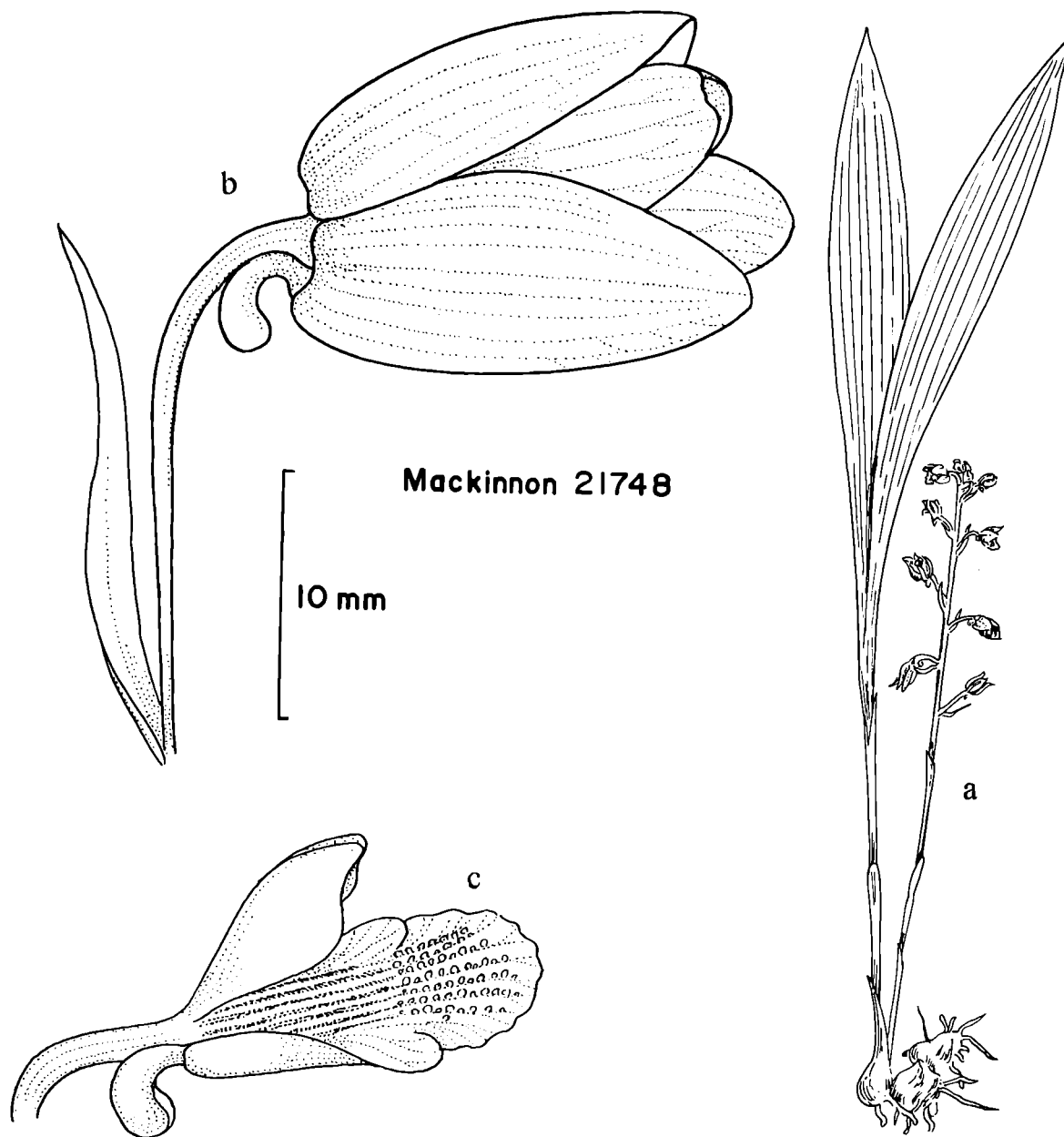


Fig. 226 *Eulophia mackinnonii* Duthie—a. plant; b. flower; c. column, lip & spur.

KUMAUN: Nainital-Ranibagh, Davidson. Almora-Almora, Jameson.

HIMACHAL PRADESH: Mahasu, Jeori, N.C. Nair 30018.

**Eulophia mackinnonii** Duthie in J. As. Soc. Beng. 71(2): 40. 1902 et 124. t. 107. 1906; Raizada et al. 34. 1981. (Fig. 226)

*Rhizome* with flattened triangular shaped tubers. *Stem* up to 20 cm long. *Leaves* usually two, 70-80 × 5-8 cm, plicate, lanceolate, acuminate tapering to a long sheath. *Inflorescence* about 65 cm long; raceme laxly 8-10 flowered. *Flowers* 10-20 mm long, yellow tinged with brown. *Bracts* lanceolate, acuminate, equalling or longer than the ovary. *Sepals* 20 mm long, ovate, obtuse, yellow tinged with brown. *Petals* same colour of the sepals, oblong-obovate, equal to the sepals. *Lip* longer than sepals, 3-lobed; lateral lobes long and shallow; mid lobe broad, rounded, with tubercled lamellae. *Spur* short, geniculate. *Column* short, broadly winged, with a short foot.

*Distribution*: July - August.

*Distribution*: Himalaya up to 800 m (Dehra Dun, Mussoorie, Ram Nagar in Garhwal), Swatiks, Upper Gangetic plain and Madhya Pradesh.

*Specimens examined*:

GARHWAL: Dehra Dun-Dehra Dun, Mackinnon 21748 & 22723; Mussoorie, Falconer. Pauri-Ram Nagar, Inayat 25798.

It is necessary to examine the status of this species critically. Duthie (*loc. cit.*) pointed out that it is related most nearly to *E. geniculata* King & Pantl., an extremely rare species of Sikkim. A comparison with King & Pantl. t. 240 and Seidenf. Fig 25. 1983, shows that the two may not be distinct.

**Eulophia nuda** Lindl. Gen. & Sp. Orch. 180. 1833; Hook. f., 6: 5. 1890 et 5: 32. t. 47. 1895; King & Pantl. 180, t. 243. 1898; Duthie, 127. 1906; Seidenf., 72: 40 fig. 26. 1983; Kataki et al. 5: 17. 1984 (Fig. 227)

*Tuber* spherical, smooth, about 8 cm long, with transverse ridges. *Leaves* three, appearing after flowers from the side of tuber, 35-60 × 9 cm, distichous, broad, elliptic, acute-acuminate. *Inflorescence* arise from the side of tuber, 30-70 cm long, raceme laxly 6-10 flowered. *Flowers* 2.5-4 cm across, greenish-white. *Bracts* lanceolate, acuminate. *Sepals* green 24-28 mm long, inserted on sac of the labellum, falcate, acute. *Petals* 17-18 mm, oblong, oblique at base, obtuse, many nerved, green. *Lip* 19 mm long, 9-11 mm broad when spread out, 3-lobed; lateral basal lobes absent or obscure, upper surface with several thickened veins of with three lamellate veins prominently winged on epichile. *Spur* short, flat, usually pointing back-wards. *Column* short with long foot.

*Flowering*: April - June.

*Distribution*: Himalaya (Nepal to Arunachal Pradesh), Assam, Meghalaya, Nagaland, Manipur, Mizoram, Upper Gangetic plain, Madhya Pradesh, Western Ghats, Andaman Island. Burma, Indo-China, Malaya, Thailand, Sri Lanka.

The plant has not been discovered so far from any where in Western Himalaya. Specimens examined by us are all from Indo-Gangetic plains from the districts Kheri and Gonda adjacent to Kumaun Himalaya.

*Specimens examined*:

UTTAR PRADESH: Kheri-Lalapur, Inayat 24143. Gonda-Gonda, Harsukh 22793.

*E. nuda* is probably a species complex. Hook. f. (1895) has tried to solve the problem and created several varieties. Harsukh's plant No. 22793, with 3-prominent crenulate lamellae further elevated into 3-erect plates on the epichile seems yet one more variety or a new species. However Santapau & Kapadia (1966) consider all these varieties as forms. We also refrain from pursuing it any further till more material is available and leave it as Duthie has done.

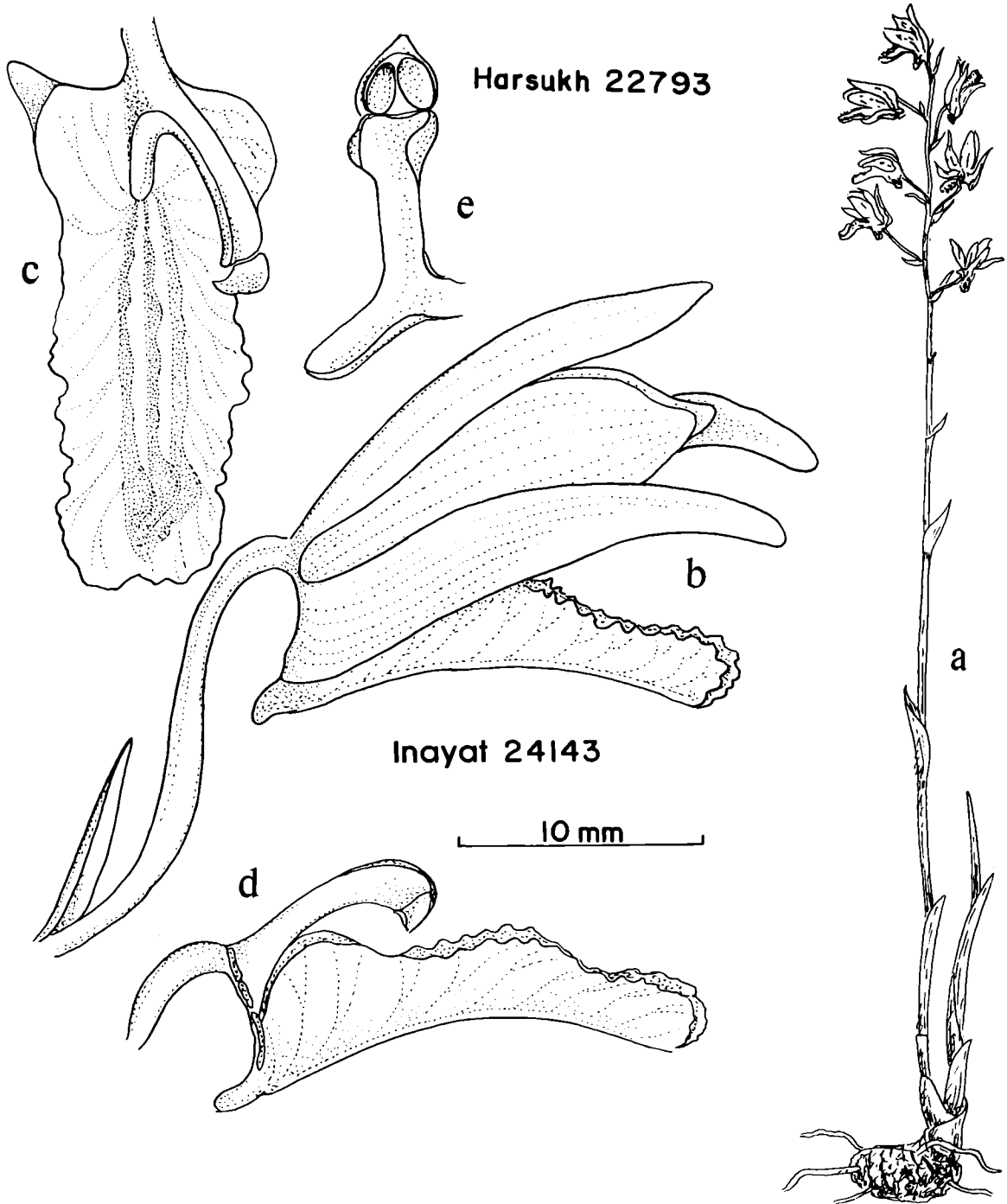


Fig. 227 *Eulophia nuda* Lindl.—a. plant; b. flower; c. & d. column, lip & spur; e. column.

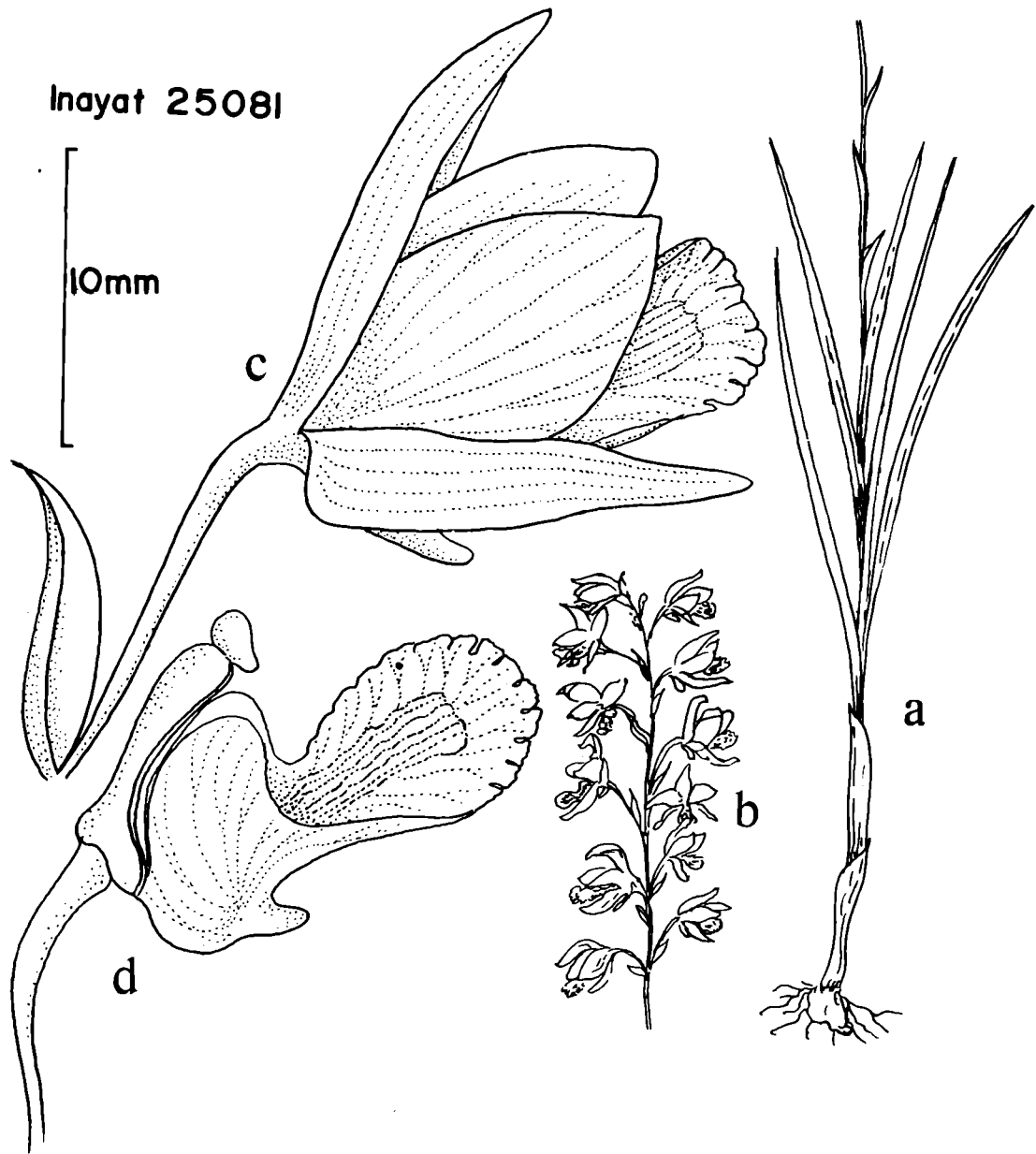


Fig. 228 *Eulophia obtusa* (Lindl.) Lindl. — a. plant; b. inflorescence; c. flower; d. column, lip & spur.

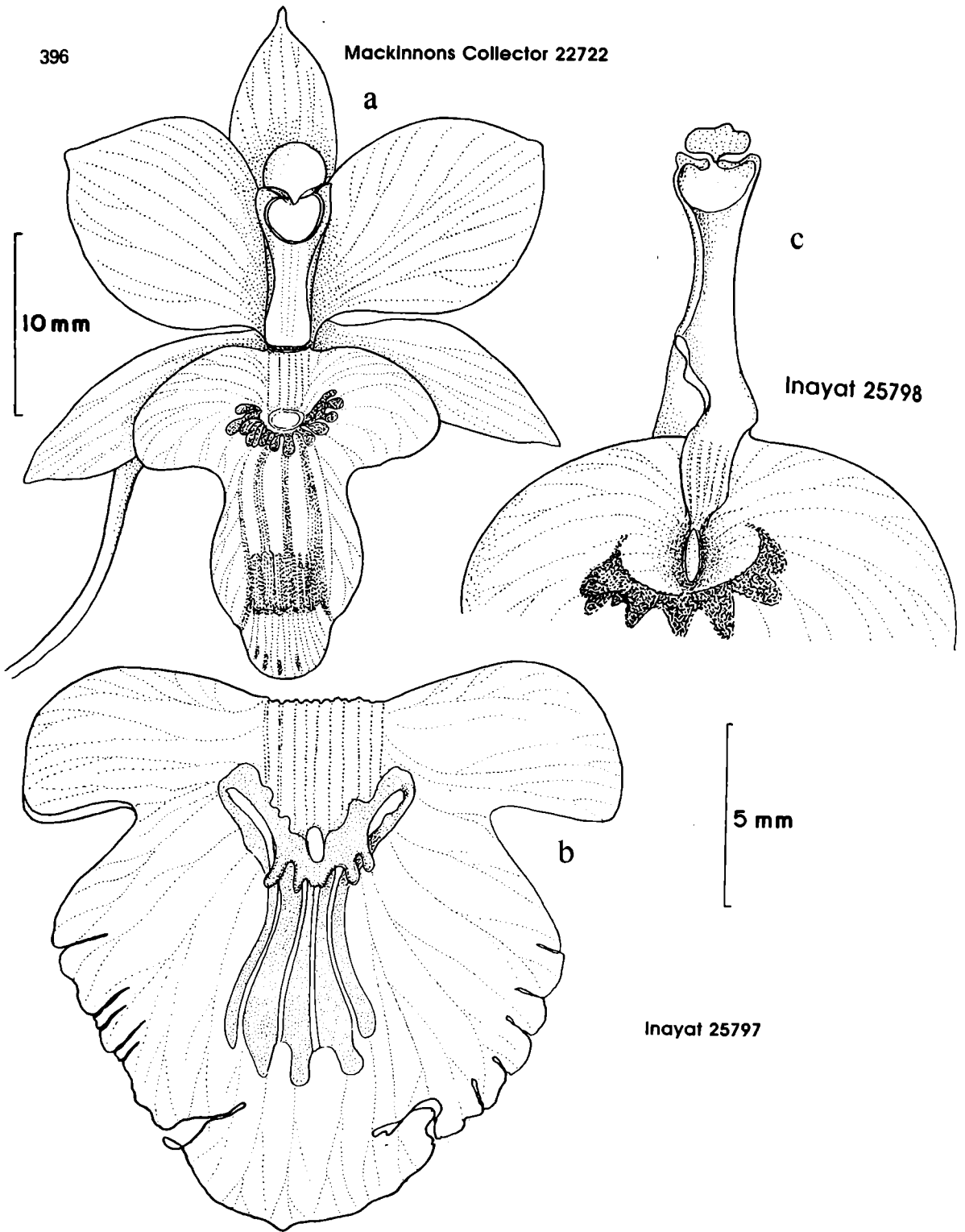


Fig. 229 *Eulophia obtusa* (Lindl.) Lindl.—a. flower; b. lip; c. column and lip.

**Eulophia obtusa** (Lindl.) Hook. f., Fl. Brit. Ind. 6: 3, 1890; Duthie, 129. t. 111. 1906 et 200. 1920.

*Cyrtopera obtusa* Lindl. Gen. & Sp. Orch. 190. 1833.

*E. campanulata* Duthie in J. As. Soc. Beng. 71(2): 39. 1902.

(Fig. 228, 229)

Plants 90-130 cm. *Scape* exceeding the leaves; tuber oblong. *Leaves* 2-3, appearing with the flowers, 30-45 cm long, linear, acuminate, plicate, nerves prominent. *Inflorescence* lax raceme with 6-10 flowers. *Flowers* 2.5 cm across, yellow, drooping. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* the dorsal ovate, acute, 2 cm long, the laterals shorter. *Petals* equalling the lateral sepals, ovate, obtuse. *Lip* longer than sepals, 14 mm when spread out more than 14 mm broad, 3-lobed; lateral basal lobes prominent, upper surface with several thickened veins, ending in epichile in an oblong grooved callus and produced at the base in hypochile at the mouth of spur in to finger-like projection. *Spur* short, curved forwards. *Column* long with short foot.

*Flowering*: July - August.

*Distribution*: Himalaya (Dehra Dun, Mussoorie in Garhwal), Plains of Uttar Pradesh.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, Rajawala, *Harsukh*; Karwapani, *Mackinnons collector 22722*.

This endemic species has not been collected since 1902, but looking at the number of herbarium sheets it does not appear to be so rare. A search in fresh water swamps at the base of Himalaya will definitely yield results. Hook. f. (1890) mentioned that in this species there is no foot to the column and Lindley was mistaken to keep it in section *Cyrtopera* where there is a distinct foot present. To accommodate those specimens which had distinct foot to the column (see fig. 228) Duthie created a new species *E. campanulata*, but examination of the Royle's specimen, the type of *E. obtusa* Duthie *loc. cit.*, found that it has also distinct foot. This confusion is usually caused because the foot of the column is completely fused with the base of lip, however the presence of finger like projection at the mouth of the spur on the lip are so distinctive, that it can never be mistaken.

Inayat 25081, 25797 & 25798 have been collected from Indo-Gangetic plain.

### Gastrochilus D. Don

Epiphytic with rootstock creeping or absent, with or without leafy stem. *Leaves* few close together. *Flowers* fleshy, solitary or in a few flowered spathe or spicate. *Lip* basin-shaped to semi-globose with its sides firmly adnate to the column, apical lobe pointing forwards, broad and round, nearly flat, sometimes hairy and fringed. *Column* very short, stout, without a foot; *pollinia* 2, porate or slightly notched, never split on a linear stipe; rostellum short, bifid.

### Key to species

1. Leaves terete; apical lobe of the lip uniform, with 6-10 vertical lines, apex notched.....  
..... *G. inconspicuum*
- + Leaves flattend; apical lobe of the lip with thickened ridges or a fleshy patch; without vertical lines  
..... 2
2. Leaves small, less than 3 cm long, tip with 1-3 setae; stem small, wirey usually less than 10 cm long;  
inflorescence a raceme equal to or smaller than the leaves; apical lobe of lip with entire to undulate  
margin, with 2 rather small to long ridges in the centre, upper surface glabrous.....  
..... *G. distichus*
- + Leaves large, more than 10 cm long, tip bifid; stem none to short or long, thick; inflorescence corym-  
bose to umbellate; apical lobe of lip semi-circular to slightly tri-lobulate, margin erose to fimbriate,  
with a fleshy patch in the centre, upper surface papillose hairy..... 3

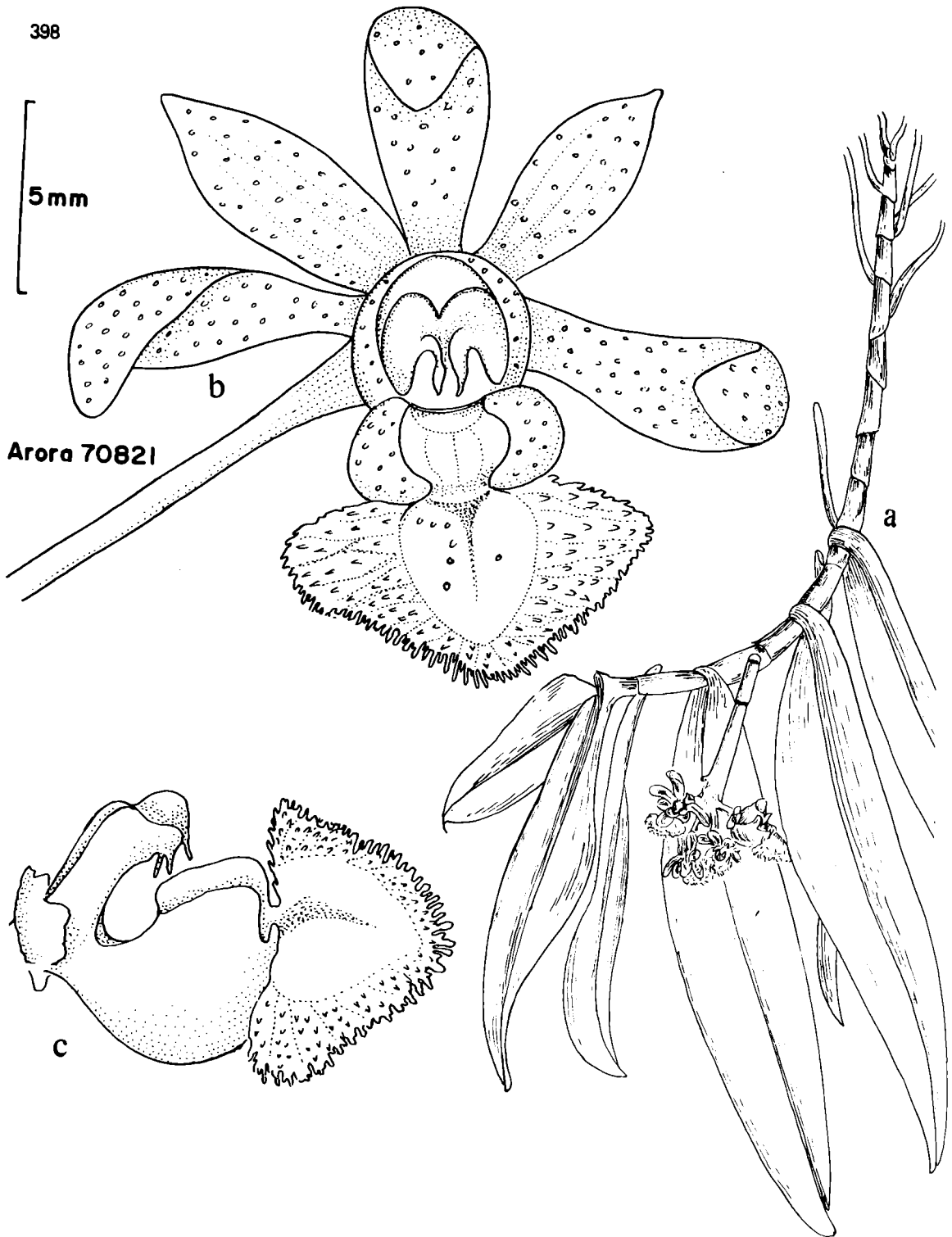


Fig. 230 *Gastrochilus acutifolius* (Lindl.) Kze.—a. plant; b. flower; c. column & lip.



3. Stem none or very short; inflorescence corymbose; apical lobe of the lip semi-circular and not tri-lobulate, margin round, the fleshy patch in the centre at equal breadth all around..... *G. calceolaris*  
 + Stem elongated, 20-35 cm long; inflorescence umbellate; apical lobe of the lip slightly tri-lobulate, margin around the fleshy patch in the centre broader near the base and narrower near the apex.....  
 ..... *G. acutifolius*

***Gastrochilus acutifolius*** (Lindl.) O. Ktze, Rev. Gen 2: 661. 1891; Seidenf. & Arora, 17. 1982.

*Saccolabium acutifolium* Lindl. Gen. & Sp. Orch. 233. 1833; Hook. f., 6: 61. 1890; King & Pantl. 226, t. 302. 1898. (Fig. 230)

Stem elongated, 20-35 cm long. *Leaves* 6-10, fleshy, 10-15 × 2-3 cm, oblong-lanceolate, acute, obliquely bifid at apex. *Inflorescence* leaf opposed, umbellate, 5-6 cm long, with 6-8 flowers. *Flowers* 2 cm across, dull pale-green, flushed and spotted with dull brown or of uniform yellow colour. *Bracts* broadly oblong, blunt. *Sepals* and *petals* fleshy, sub-equal, slightly reflexed, oblong-obovate, blunt. *Lip* adnate to the column almost to the apex, 3-lobed, side lobes very narrow, entire or almost obsolete; apical lobe reniform, slightly tri-lobulate, the edges fimbriate-erose, margin around the fleshy patch in the centre broader near the base and narrower near the apex.

*Flowering*: November - December.

*Distribution*: Himalaya 1500 m (Kumaun, Sikkim to Arunachal Pradesh), Meghalaya.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Didihat, *Arora* 41336; *Dafidhura*, *Arora* 70821.

***Gastrochilus calceolaris*** (Buch.-Ham. ex Sm.) D. Don Prodr. Fl. Nepal 32, 1825; Raizada et al. 91, fig. 90. 1981; Joseph, 123. 1982; Katakai et al. 5: 18. 1984.

*Aerides calceolare* Buch.-Ham. ex Sm. in Rees Cycl. 39: 11. 1818.

*Saccolabium calceolare* (Buch.-Ham. ex Sm.) Lindl. Gen. & Sp. Orch. 223. 1833; Hook. f., 6: 60. 1890; King & Pantl. 225, t. 300. 1898; Duthie, 147. 1906.

*S. nilagiricum* Hook. f., Fl. Brit. Ind. 6: 60. 1890.

*S. pulchellum* (Wight) Fischer in Fl. Pres. Madras 3: 1446. 1928.

*Vanda pulchella* Wight, Ic. 5(1): 9.t. 1671. 1852. (Fig. 231)

Stem none or very short. *Leaves* 6-8, linear-oblong, narrow, unequally bifid at the apex, 10-30 × 2-3 cm. *Inflorescence* corymbose to umbellate, many flowered, much shorter than the leaves. *Flowers* 15-17 mm across, crowded, pale-green speckled with red-brown, waxy, faintly fragrant. *Bracts* small, broadly ovate, obtuse. *Sepals* unequal, 6 mm long, spreading, the dorsal ovate-oblong; the laterals oblong, falcate, narrower than the dorsal. *Petals* slightly shorter or equal to the sepals, oblong-obovate, cuneate. *Lip* adnate to the lower half of the column, the base forming a short wide yellow sac, side lobes absent; apical lobe semicircular but not tri-lobulate, margin around the fleshy patch in the centre of equal breadth all around. *Spur* short, yellow.

*Flowering*: April - May.

*Distribution*: Himalaya 1200-1600 m (Garhwal to Arunachal Pradesh), Assam, Nagaland, Meghalaya, Tripura, Tamil Nadu. Indo-China, Thailand, China, Malaya.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Gamble*; Mussoorie, Jharipani, *Arora* 38844, *Rao & Sarin* 2372, *Deva* 3095, *Rajwar* 54. **Pauri**-Outer Garhwal hills, *Inayat*. **Chamoli**-Phata, *N. C. Nair* 35920.

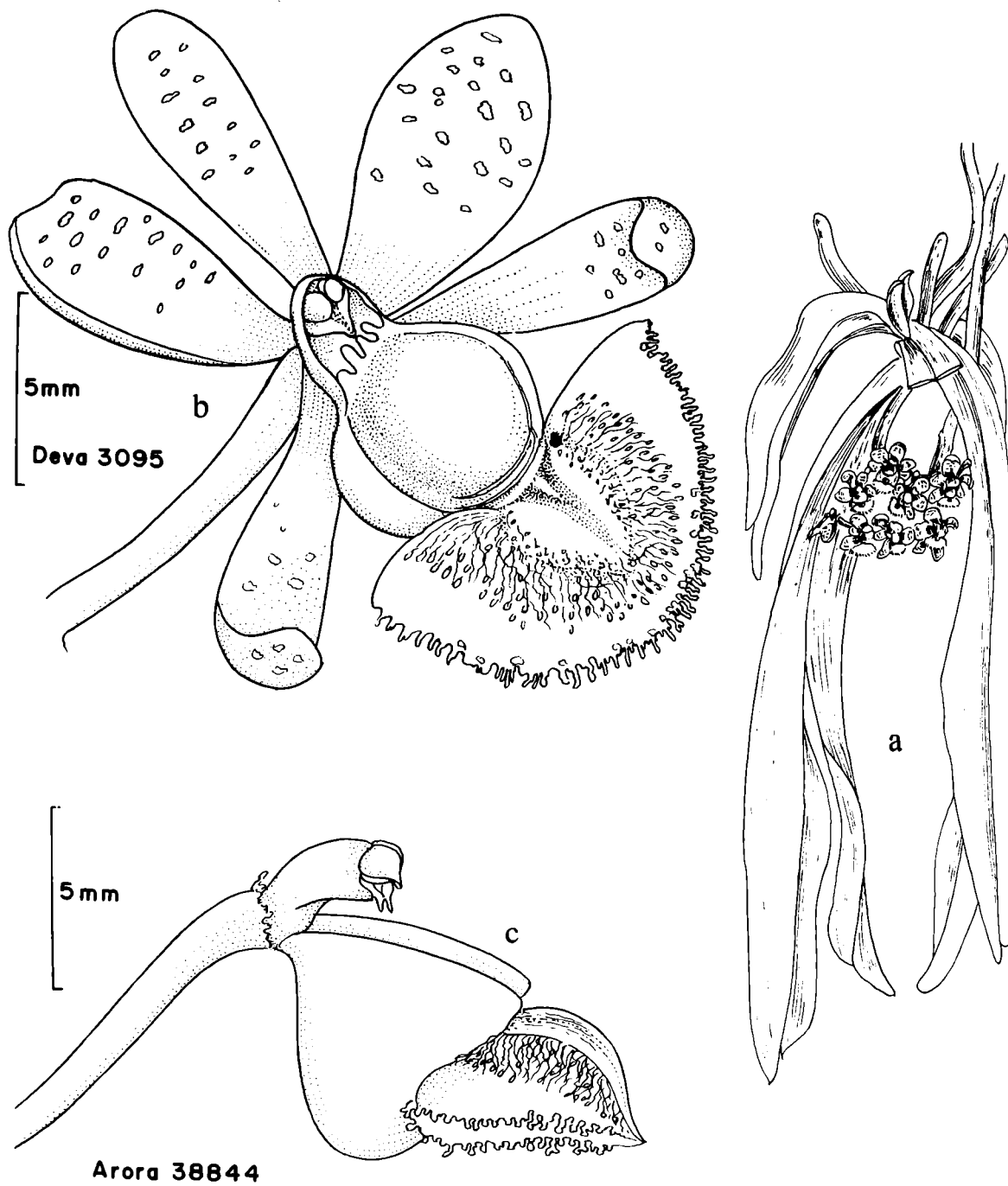
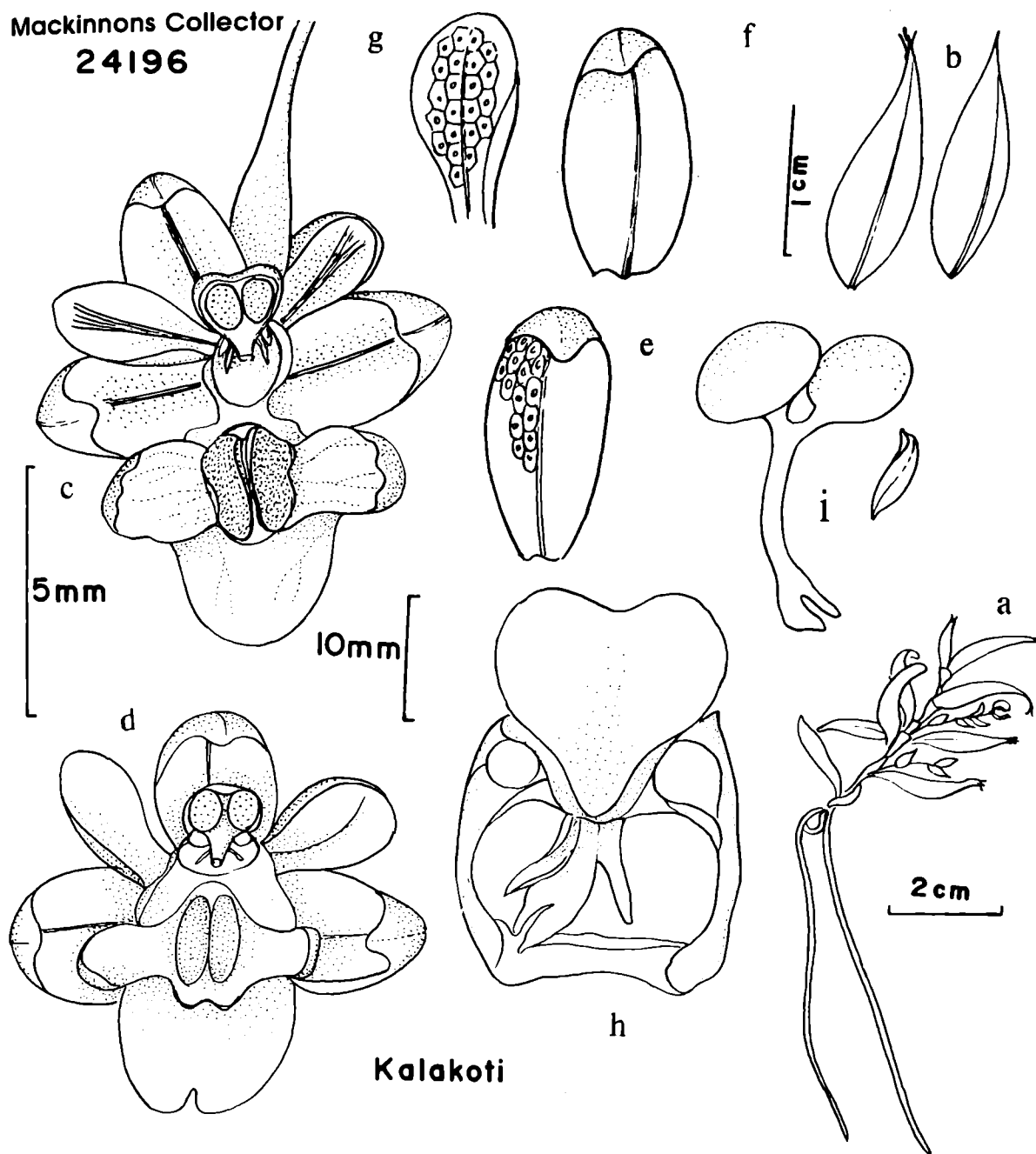


Fig. 231 *Gastrochilus calceolaris* (J.E. Sm.) D. Don—*a.* plant; *b.* flower; *c.* column & lip.

Mackinnons Collector  
24196



Kalakoti

Fig. 232 *Gastrochilus distichus* (Lindl.) Kze. —a. plant; b. leaves; c. & d. flower; e. dorsal sepal; f. lateral sepal; g. petal; h. column; i. pollinia.

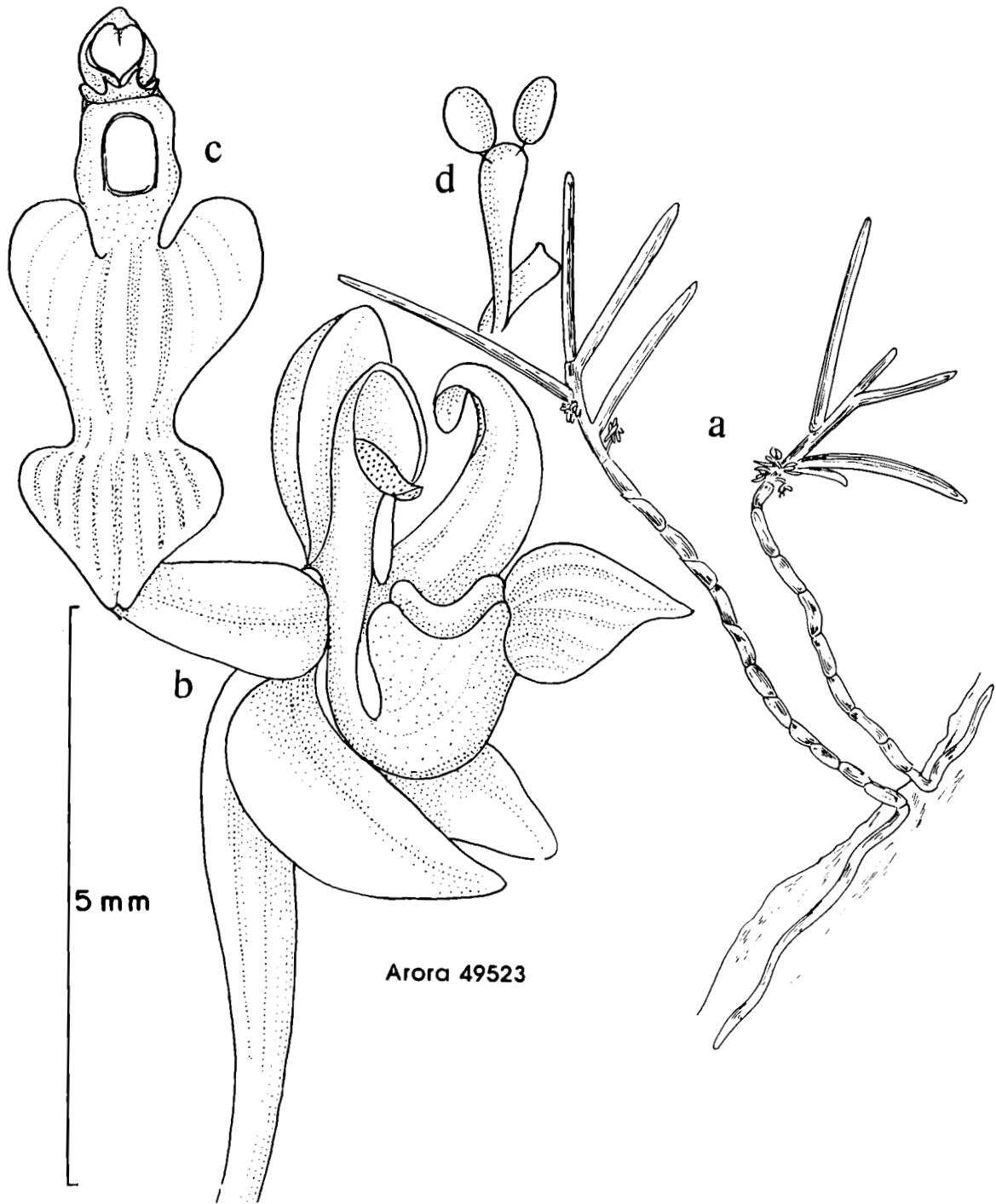


Fig. 233 *Gastrochilus inconspicuus* (Hook. f.) Kze. — a. plant; b. flower; c. column & lip; d. pollinia.

KUMAUN: **Pithoragarh**-Tejam, *Inayat* 24114; Shama, Sarju Valley, *Inayat* 24114(a); Dafiadhura, *Arora* 55806 & 55812.

**Gastrochilus distichus** (Lindl.) O. Ktze. Rev. Gen. 2: 661. 1891; Hara et al. 1: 44. 1978.

*Saccolabium distichum* Lindl. in J. Proc. Linn. Soc. Bot. 3: 36. 1859; Hook. f., 6: 64. 1890; King & Pantl. 227, t. 303. 1898; Duthie, 148. 1906; Goel & Bhattacharyya 19. 1982. (Fig. 232)

Stem leafy, wirey, usually less than 10 cm long, pendulous. *Leaves* many, 15-27 × 5-6 mm, fleshy, distichous, lanceolate, acuminate with 1-3 fine setae, base oblique. *Inflorescence* raceme, leaf opposed equalling or smaller the leaves in length, 2-4 flowered. *Flowers* 10-12 mm across, greenish with brown spots. *Bracts* oblong, sub-acute. *Sepals* and *petals* subequal, oblong-elliptic, obtuse, 4-6.5 mm long. *Lip* as the sepals, adnate to the lower half of the column, the base with a wide blunt 5-7 mm long sac at right angle to the ovary, side lobes none; apical lobe yellow, semicircular with entire to undulate margins, with 2 rather small to long ridges in the centre, upper surface glabrous.

*Flowering*: April - May.

*Distribution*: Himalaya 1500-2000 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram.

*Specimens examined*:

GARHWAL: **Tehri**-Tehri, *Mackinnon's collector* 24196; Govana, *Goel* 67819 & 67822.

KUMAUN: **Almora**-Loharkhet, *Kalakoti*.

*G. distichus* is very variable species and probably also embraces the two allied species *G. pseudodistichus* (King & Pantl.) Seidenf. and *G. affinis* (King & Pantl.) O. Ktze. The stem in the N.W. Himalayan specimens is always short less than 10 cm in length. Lip is also different including that of the Mackinnon's 24196, which was identified by Duthie. It is horizontally elongated, the sides are rounded with entire margin and in the centre are two thick ridges almost from the apex to the base. The sac in the specimen of Kalakoti is bifid at the base. A comparison of the sketches of the specimens of N.W. Himalaya with those drawn by King & Pantling and Hook. f. clearly exhibits overlapping characters.

**Gastrochilus inconspicuus** (Hook. f.) O. Ktze. Rev. Gen. 2: 661. 1891; Seidenf., 94. 1971.

*Saccolabium inconspicuus* Hook. f., Fl. Brit. Ind. 6: 56. 1890.

*Luisia inconspicua* (Hook. f.) Hook. f. ex King & Pantl. in Ann. Roy. Bot. Gard. Cal. 8: 203, t. 272. 1898; Duthie, 141. 1906. (Fig. 233)

Stem 10-15 cm long, slender, unbranched. *Leaves* 3-5, terete, 35-65 × 2.5 mm. *Inflorescence* a slender spike, 1-3 flowered. *Flowers* pale yellowish-green, 4 mm across. *Bracts* membranous, triangular, acuminate. *Sepals* sub-equal, ovate-lanceolate, sub-acute, spreading. *Petals* oblong, tapering slightly to the blunt apex. *Lip* as long as the sepals, hypochile hemispherically saccate, green spotted with purple, epichile uniform, with 6-10 vertical lines, decurved, flat, sub-reniform, apex notched, upper surface minutely hispid.

*Flowering*: June - July.

*Distribution*: Himalaya 1500 m (Garhwal to Sikkim and Arunachal Pradesh), Assam, Madhya Pradesh.

*Specimens examined*:

GARHWAL: **Tehri**-East of Tehri, *Mackinnon* 25427. **Chamoli**-Batwalchari, *M.A. Rau* 6427.

KUMAUN: **Pithoragarh**-Tejam, *Inayat* 24114; Shama, Sarju Valley, *Inayat* 24114(a); Dafiadhura, *Arora* 49523; Maitli, *Arora* 70840; Barum, *Bhattacharyya* 21210.

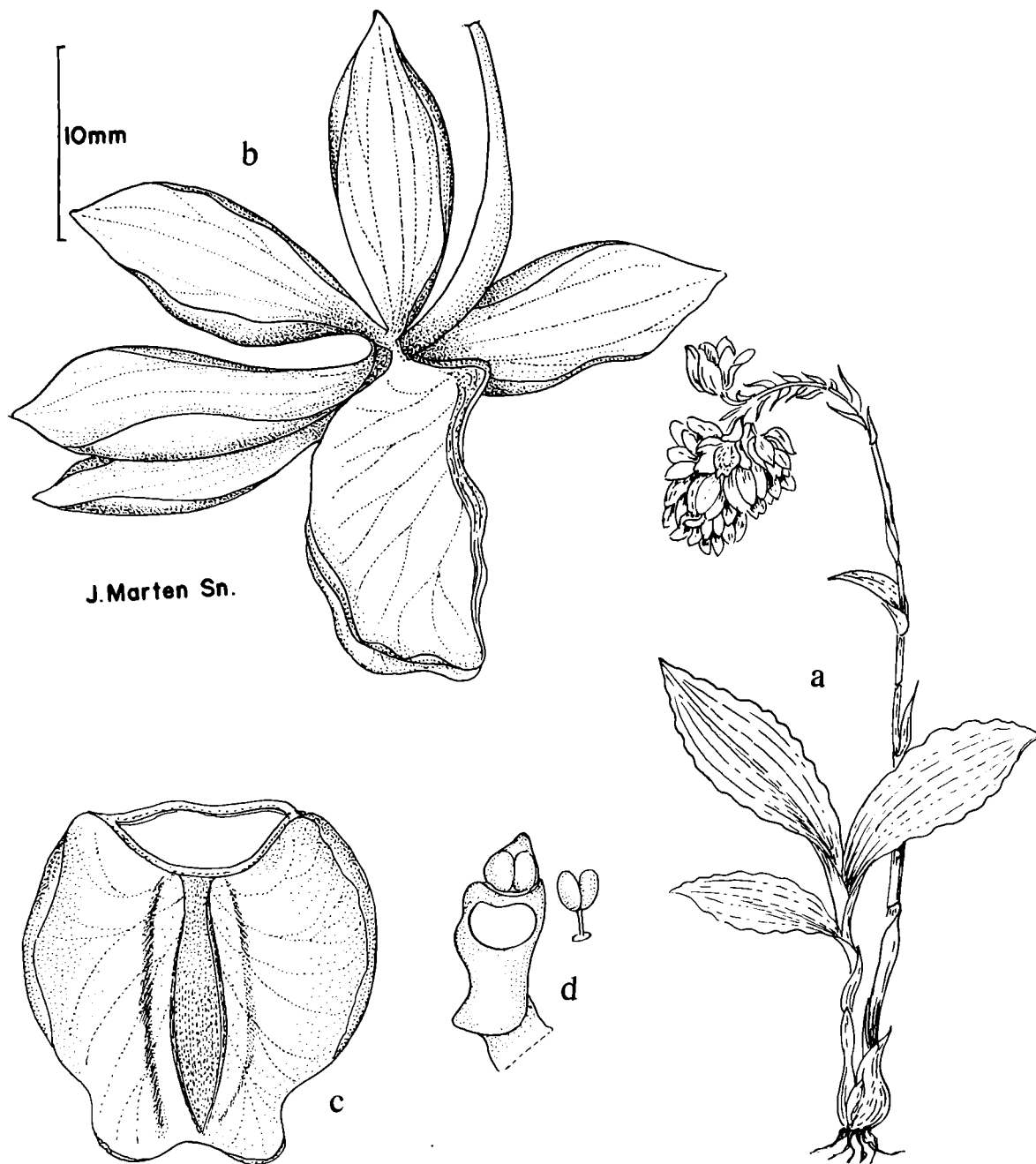


Fig. 234 *Geodorum densiflorum* (Lem.) Schltr. — a. plant; b. flower; c. lip; d. column & pollinia.

### Geodorum Jackson

Terrestrial herb with underground sub-globose rhizome. *Leaves* more or less stalked, elliptic, base sheathing and forming a joint stem, lamina plaited. *Scape* from the base of the joint stem, stout, erect, bearing a decurved corymbose raceme. *Flowers* about 15 mm long, rather crowded. *Sepals* equal, oblong sub-acute, erect. *Petals* as long as the sepals, but broader and blunt. *Lip* sessile forming with the column-foot a short saccate base, without side lobes, apex broad, rounded, bifid or emarginate. *Column* short with distinct foot. *Anther* broad, 2-chambered; *pollinia* 2, globose, waxy, sub-sessile on a broad gland.

**Geodorum densiflorum** (Lamk.) Schltr. in Fedde, Repert. Beih. 4: 259. 1919; Sant. & Kapadia 203. t. 50. 1966; Seidenf., 72: 61. fig. 33: 1983.

*Limodorum densiflorum* Lamk. Encl. 3: 516. 1792.

*Limodorum purpureum* R. Br. in Aiton, Hort. Kew ed 2, 5: 207. 1813; Hook. f., 6: 16. 1890; King & Pantl. 181, t. 245. 1898; Duthie, 130. 1906.

*Geodorum dilatatum* R. Br. in Aiton, Hort. Kew. ed 2, 5: 207. 1813; Duthie, 203. 1920. (Fig. 234)

Terrestrial herb with underground tuberous pseudobulbs and thick vermiform roots; *tubers* about 1.3 cm in diameter. *Stem* 10-12.5 cm high, sheathed. *Leaves* two to three, 10-13 × 4-10 cm, sessile, elliptic-lanceolate, plicate, acuminate. *Inflorescence* a crowded raceme, ca 33 cm long, scape thick, arise from the side of the fresh off-shoot. *Flowers* 10-12, white or pale-purple, about 7.5-15 mm long. *Bracts* lanceolate, acuminate, longer than the ovary. *Sepals* linear-oblong, the dorsal more or less beaked at the tip, the laterals oblong-lanceolate, acute. *Petals* as long as the sepals, slightly broader, oblong, acute at tip. *Lip* longer than sepals, sub-pandurate, purple streaked within, cymbiform, tip recurved, ventricose at base, edges involute, more or less truncate in front with a median sinus.

*Flowering*: June - July.

*Distribution*: Himalaya below 1000 m (Garhwal, Nepal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Mizoram, Tripura, Bihar, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Konkan, Andaman Islands. Burma, China, Indo-China, Malaya, Thailand, Sri Lanka.

*Specimens examined*:

GARHWAL: Dehra Dun-Dehra Dun, Mackinnon's collector.

We have preferred to treat this species with a very broad circumscription because there was very little material at our disposal for critical evaluation. Fig No. 234 is drawn from a specimen collected by J. Marten from Madhya Pradesh.

### Kingidium P.F. Hunt

Epiphytic. *Stem* short, stout, leafy without pseudobulbs. *Leaves* sessile, flat, distichous, coriaceous. *Inflorescence* from the side of the stem or axillary, erect or pendulous, simple or paniculately branched. *Flowers* small. *Sepals* and narrower petals spreading, obovate or oblong; lateral sepals adnate to the lip forming a short conical spur-like mentum from which the lobes are borne directly without an unguis, furnished with linear appendages, oblong, subfalcate. *Petals* as long, linear-oblong. *Lip* shortly clawed, 3-lobed, the apex broad and deeply cleft into two spreading teeth. *Column* short, broad, margin winged, foot absent. *Anther* low acuminate, 2-locular; *pollinia* 2, waxy, strap long, slender gland small.

### Key to species

1. Lip with a short wide spur; lateral lobes broader than long, apex rounded to truncate, mid lobe obcordate with a broad emarginate apex; leaves larger, oblong-oblong-lanceolate, 15-20 cm long and 3.5-5 cm broad.....*K. deliciosum*

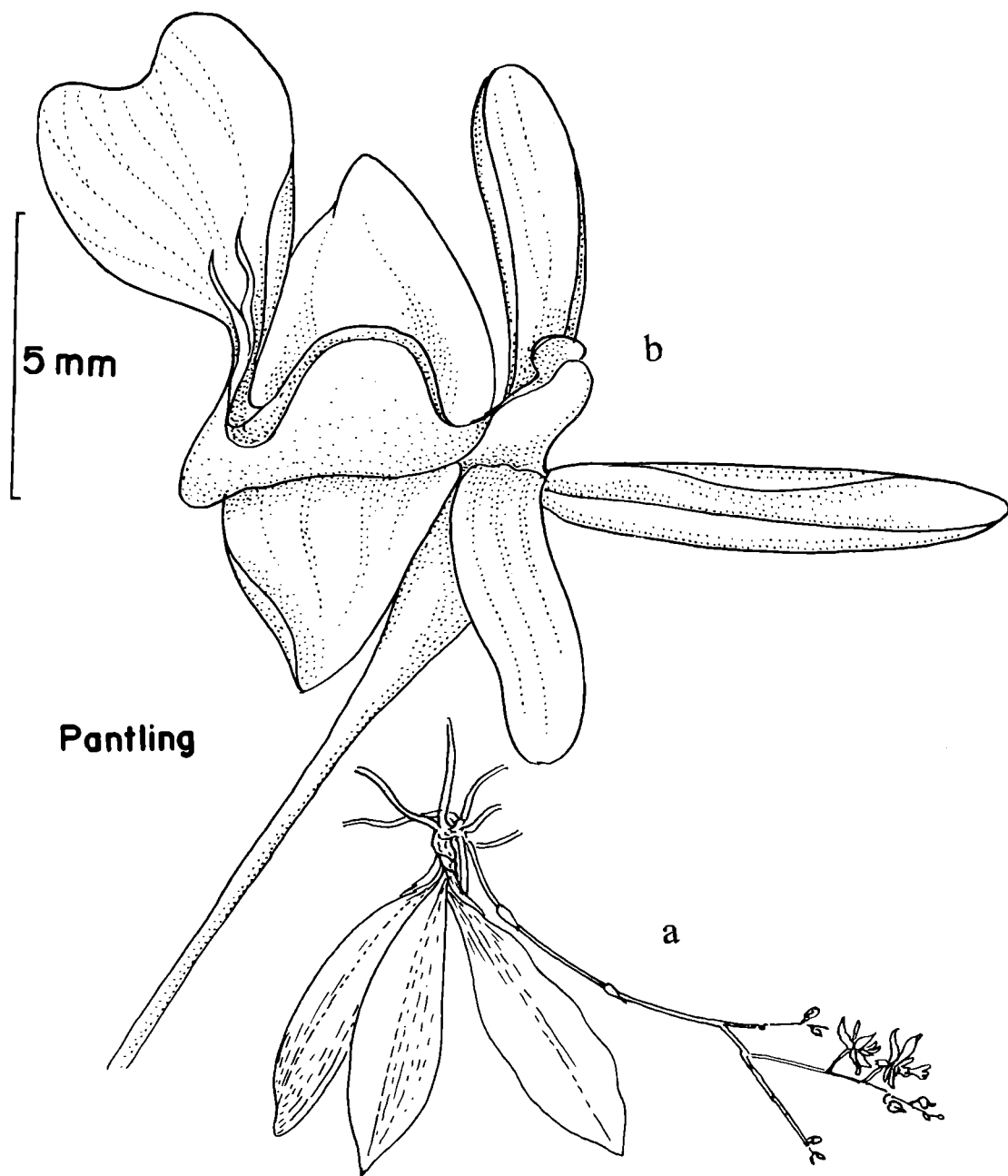


Fig. 235 *Kingidium deliciosum* (Rchb. f.) Sweet.—a. plant; b. flower.



- + Lip with a longer sub-cylindric spur, lateral lobes longer than broad, falcate, backward pointing, mid lobe oblong, spatulate with entire apex; leaves smaller, narrowly elliptic-oblong, 7.5-12.5 × 1.5-2 cm.....*K. taenialis*

**Kingidium deliciosum** (Rchb. f.) Sweet. in Am. Orch. Soc. Bull. 39: 1095. 1970; Seidenf. & Arora, 20. 1982.

*Phalaenopsis deliciosa* Rchb. f. in Bonpandia ii, 93, 1854.

*Doritis wightii* (Rchb. f.) Benth. & Hook. f. Gen. Pl. 3: 574. 1883; Hook. f., 6: 32. 1890; King & Pantl. 198, t. 264. 1898.

*Phalaenopsis wightii* Rchb. f. in Bot. Zeitung 20: 214. 1832.

(Fig. 235)

*Stem* 2-3 cm long. *Leaves* 2-3, coriaceous, pendulous, sessile, 15-20 × 3.5-5 cm, oblong-lanceolate, margin sub-undulate, apex blunt, minutely or obliquely notched. *Inflorescence* pendulous, from the stem beneath the leaves, 6-8 cm long, slender below, slightly thickened towards the tip, sometimes with a short branch. *Flowers* 2 cm across cream-yellow marked with violet and purple. *Bracts* ovate, acute, minute. *Sepals* unequal, 10 mm long, the dorsal oblong, obtuse, blunt; lateral pair shorter but broader, falcate, apex obliquely truncate. *Petals* equal to the lateral sepals, oblong, blunt. *Lip* with a short wide spur, yellow with purple markings, 3-lobed; lateral lobes broader than long, apex rounded to truncate, mid lobe obcordate with a broad emarginate apex.

*Flowering*: July - August.

*Distribution*: Himalaya 1500 m (Kumaun, Bhutan to Arunachal Pradesh), Assam, Western Ghats. Sri Lanka, Burma, Malaysia, China, Phillipines, Java and Thailand.

*Specimens examined*:

KUMAUN: Pithoragarh-Dafiadhura, Arora 70820.

Fig. No. 235 is drawn from a specimen collected by Pantling from Eastern India.

**Kingidium taenialis** (Lindl.) P.F. Hunt in Kew Bull. 24: 98. 1970.

*Aerides taeniale* Lindl. Gen. & Sp. Orch. 239. 1833.

*Doritis taenialis* (Lindl.) Hook. f., Fl. Brit. Ind. 6: 31. 1890; King & Pantl. 199, t. 266. 1898; Duthie, 138. 1906.

*Kingiella taenialis* (Lindl.) Rolfe in Orchid Rev. 25: 197. 1917.

*Biermannia taenialis* (Lindl.) Tang & Wang in Acta. Phytotax Sin. 1: 96. 1951.

(Fig. 236)

*Leaves* 1-2, sometimes absent, pendulous, sessile, 7-12.5 × 1.5-2 cm, narrowly elliptic-oblong, acute. *Inflorescence* longer than leaves, pendulous, 6-8-flowered, rarely more. *Flowers* 20 mm across, pale-purple. *Bracts* broadly triangular minute. *Sepals* unequal, blunt, the dorsal oblong-oblong-oblanceolate; laterals broader, elliptic, blunt. *Petals* obovate, blunt, shorter than sepals. *Lip* with a long sub-cylindric spur, shorter than petals, 3-lobed; lateral lobes longer than broad, falcate, backward pointing; mid lobe spatulate with entire apex.

*Flowering*: April - May.

*Distribution*: Himalaya 1300-1600 m (Garhwal to Arunachal Pradesh), Meghalaya, Manipur, Nagaland, Mizoram. Burma.

*Specimens examined*:

GARHWAL: Tehri-Kulni Parao, Tehri, Duthie 22559. Pauri-Khirsu, Aswal 11999, A. S. Rao 55331; Narara, A. S. Rao 56445. Chamoli-Mandal, Naithani 43958.

KUMAUN: Pithoragarh-Kanali-chinna, Sahni 20403; Takil hills, Inayat 24091; Satta, Pant 31863; Cham-Pawat, Arora 38890; Askot, Bhattacharyya 21374. Almora-Ranikhet, Duthie 5987; Dharamgarh, Pangtey.

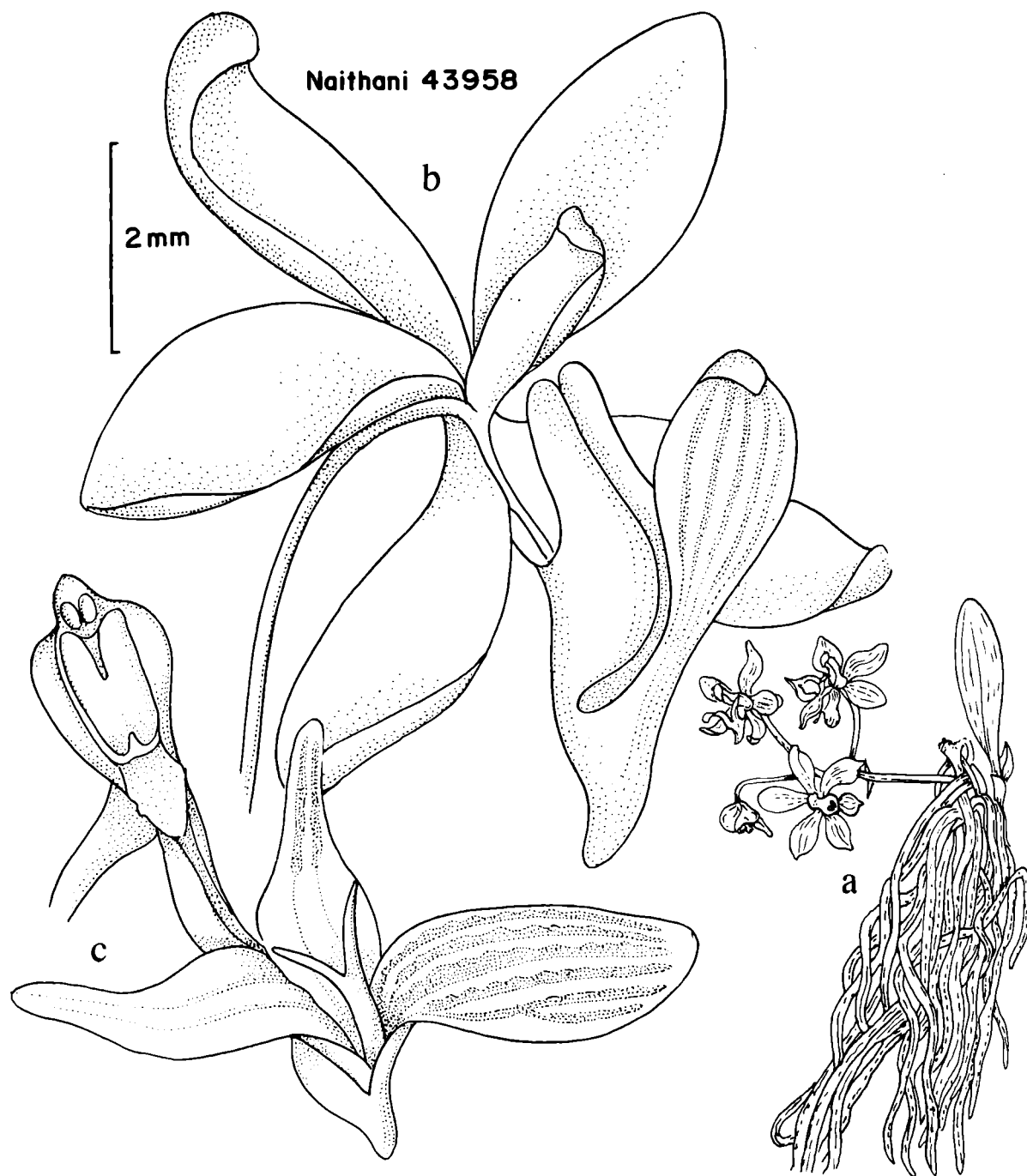


Fig. 236 *Kingidium taenialis* (Lindl.) Hunt.—a. plant; b. flower; c. column & lip.

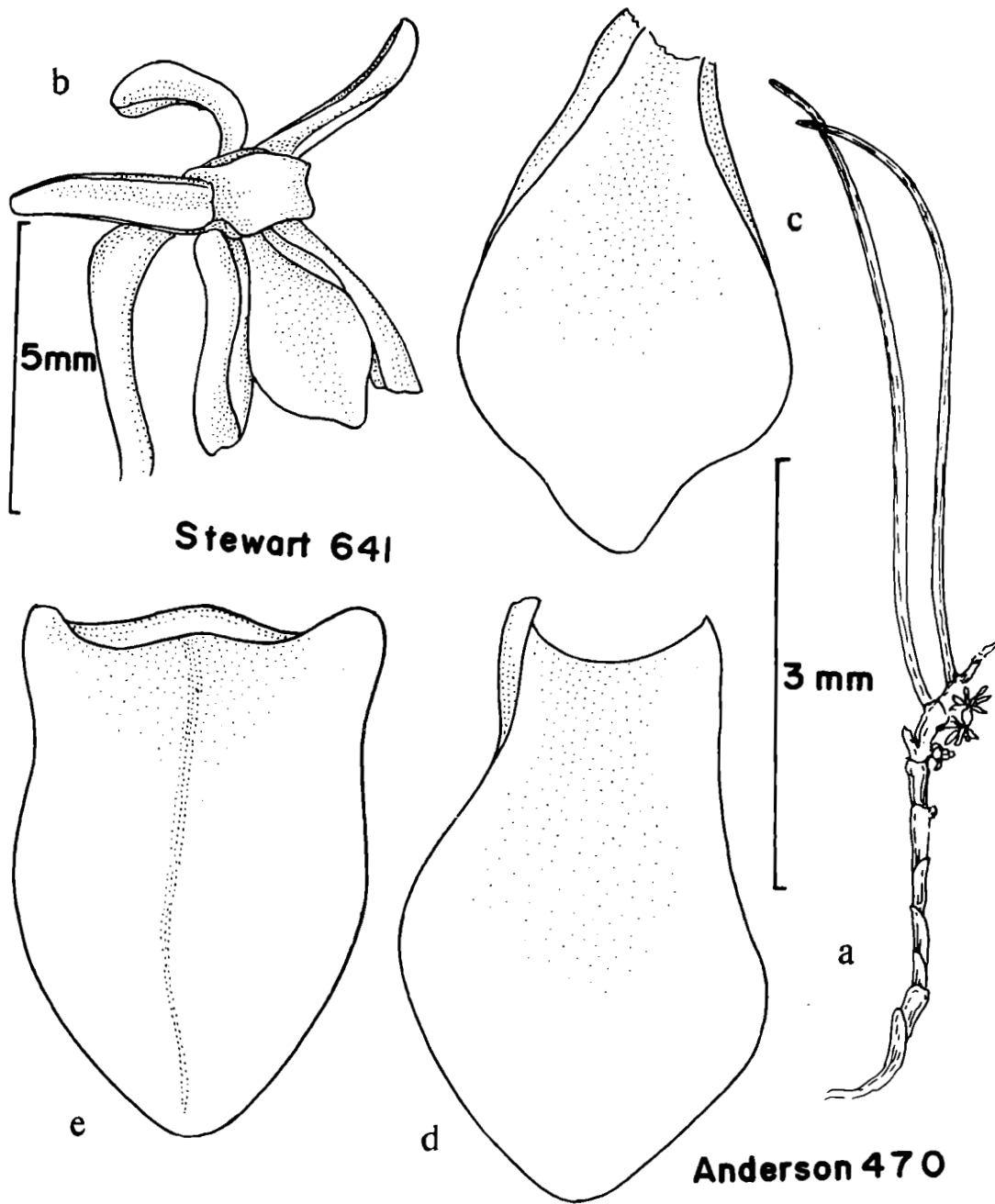
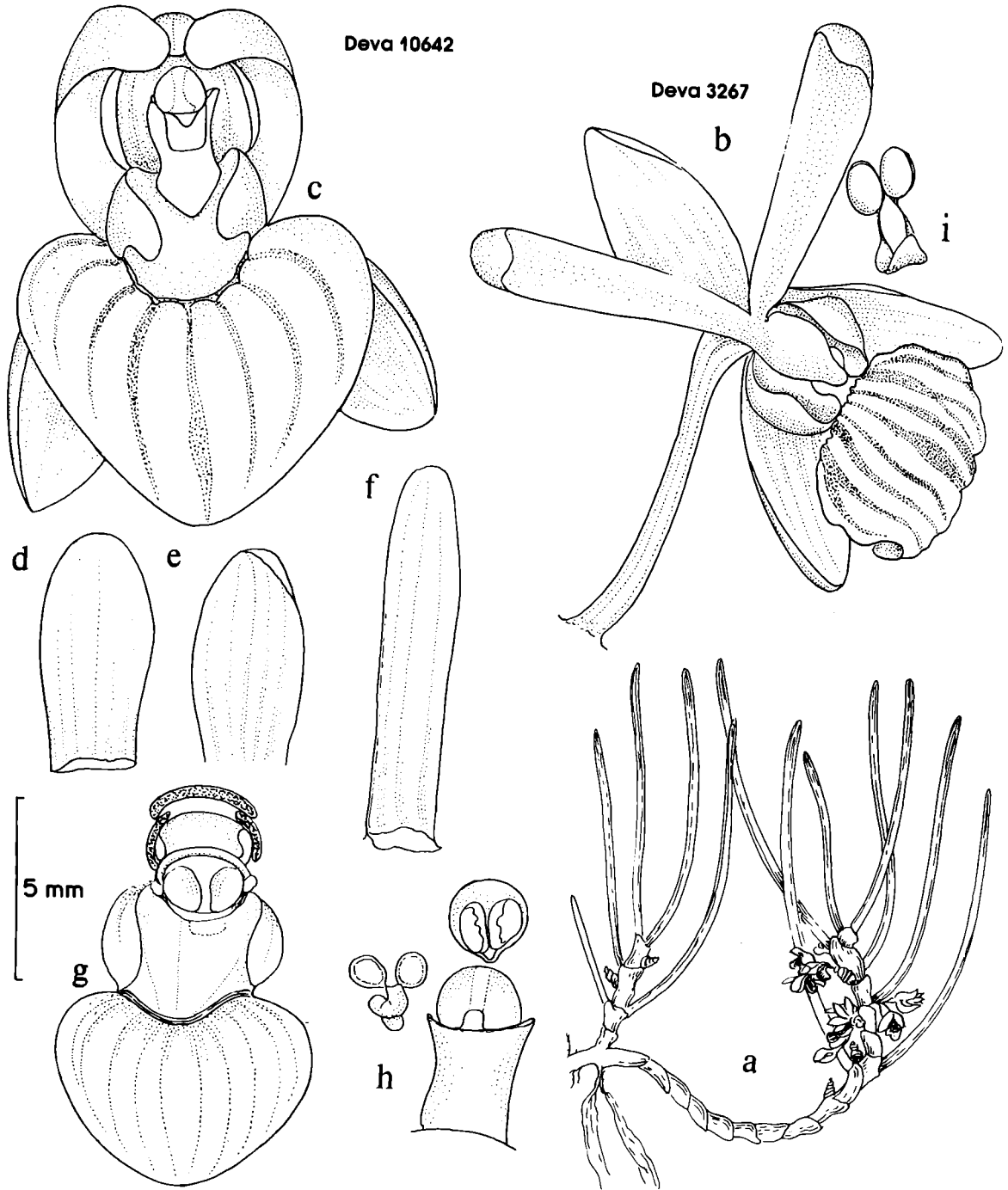


Fig. 237 *Luisia prachystachys* (Lindl.) Bl. — a. plant; b. flower; c., d. & e. lip (after Seidenf.).



**Fig. 238** *Luisia trichorhiza* (Hook.) Bl. —a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. column & lip; h. column & pollinia; i. pollinia.

**Luisia Gaud.**

Epiphytes. *Stem* rigid, terete, woody below, usually erect, without pseudobulbs. *Leaves* slender, terete, distant, spreading. *Flowers* small, dull coloured, in short extra axillary spikes, with stout axis. *Bracts* short, scarious, persistent. *Sepals* sub-equal, or the depressed, dorsal smaller. *Petals* equal to the sepals or much longer, spreading. *Lip* sessile, fleshy, fixed immovably on the base of the column, divided in to two parts; the hypochile saccate, concave or flat, and the epichile decurved, broad and ridged, entire or crenate, undulate, more or less blunt. *Column* much shorter than lip, stout, foot absent. *Stigma* large. *Anther* broad, 2-celled; *pollinia* 2, ovoid or sub-globose.

**Key to species**

1. Lip with a distinct semicircular dividing line between the hypochile and the epichile, the base of epichile cordate, apex truncate to rounded, upper surface convex, the hypochile deeply concave with erect rounded edges, when spread out broader than the epichile .....2
- + Lip without a dividing line between hypochile and epichile, the base of epichile united by its whole edge to the hypochile and without a cordate base, apex broad triangular sub-acute, upper surface concave, the hypochile without lateral lobes, when spread out almost as broad or little narrower than the epichile.....*L. brachystachys*
2. Flowers 5-7 mm across; epichile less than 5 mm broad; dorsal sepal and petals of almost equal length; inflorescence 2-3 (-4) flowered.....*L. zeylanica*
- + Flowers 10 mm across, epichile more than 5 mm broad; dorsal sepal much smaller than the petals in length, inflorescence 4-5 flowered.....*L. trichorhiza*

**Luisia brachystachys** (Lindl.) Bl. Rumph. 4: 50. 1848; Hook. f., 6: 23. 1890; Duthie, 140. 1906; Seidenf., 75. fig. 41. 1971.

*Mesoclastes brachystachys* Lindl. Gen. & Sp. Orch. 43. 1830.

*L. indivisia* King & Pantl. in Ann. Roy. Bot. Gard. Cal. 8: 201, t. 269. 1898. (Fig. 237)

*Stem* 12-18 cm, erect. *Leaves* 5-7, slender, 7-18 cm long, blunt at apex. *Inflorescence* short, 4-5 flowered. *Flowers* 7-10 mm across, pale-green. *Bracts* minute, triangular. *Sepals* 5-6 mm long, sub-equal, oblong, blunt; the dorsal concave, the laterals sub-cymbiform. *Petals* up to 7 mm long, narrower, oblong. *Lip* without a dividing line between hypochile and epichile, the base of epichile united by its whole edge to the hypochile and without a cordate base, apex broad triangular, sub-acute, upper surface concave, the hypochile without lateral lobes, when spread out almost as broad or little narrower the epichile.

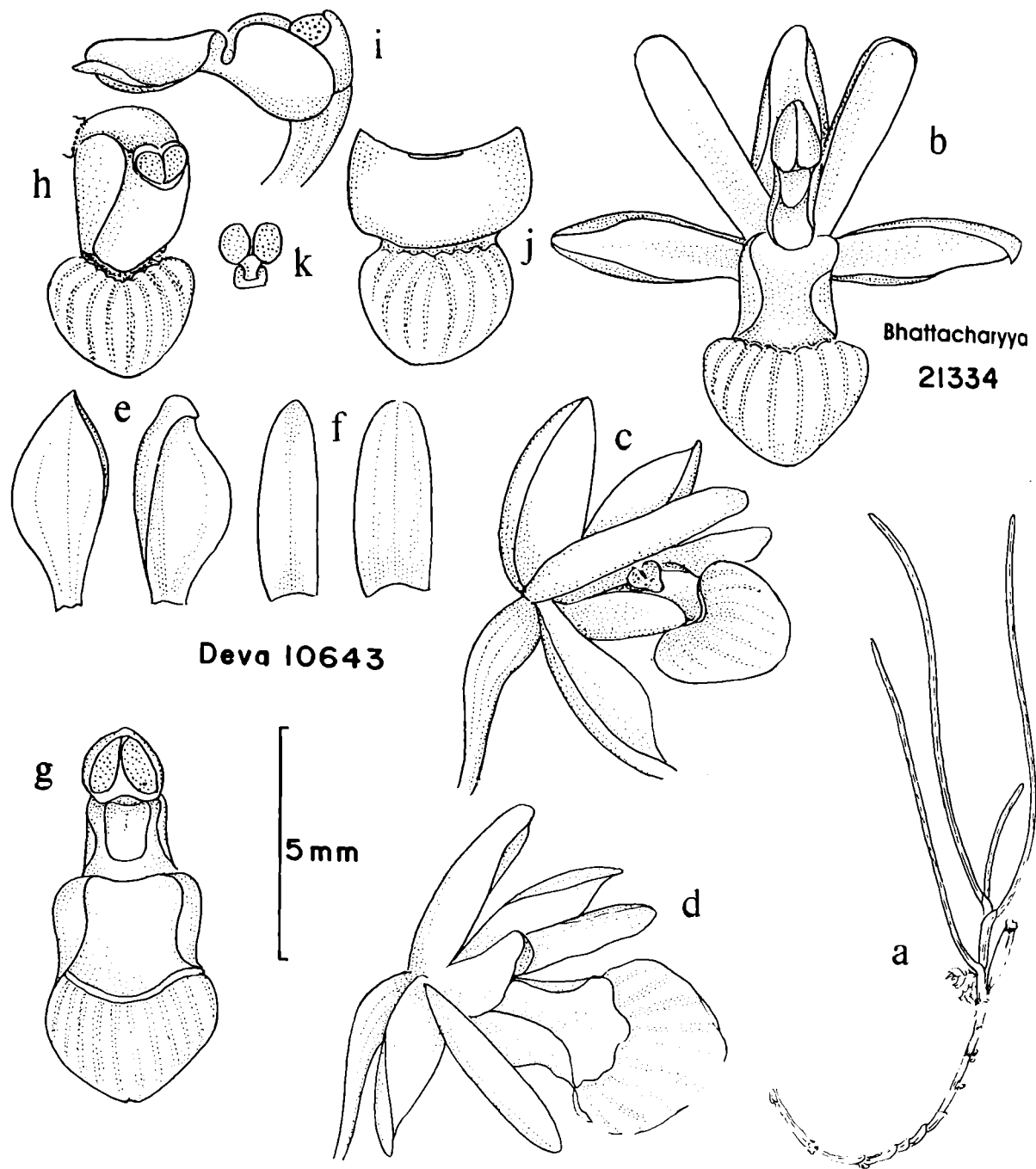
*Flowering*: March - April.

*Distribution*: Himalaya 1500 m (Garhwal, Kumaun, Sikkim, Arunachal Pradesh), Meghalaya, Nagaland, Bengal, Madhya Pradesh. Bangladesh, Burma, Laos, Indo-China, Thailand.

It is very rare in our region and has not been collected for the last 125 years. Duthie (1906) quoted two specimens one by *Falconer* from Garhwal and other by *J. L. S. Stewart* No. 641 from Kumaun between 780-830 m, probably from outer Himalayan ranges. Seidenfaden (1971) has examined these specimens and has confirmed their identification. Stewart has never collected outside the region and its location can not be doubted. However this species has not been recorded so far from the adjoining Nepal Himalaya. It is quite often confused with *L. zeylanica* from which it superficially resembles.

**Luisia trichorhiza** (W.J. Hooker) Bl. Mus. Bot. Lugd. Bot. 1: 63. 1849; Hook. f., 6: 23. 1890; King & Pantl. 202, t. 270. 1898; Duthie, 140. 1906; Seidenf., 66. fig. 35. 1971.

*Vanda ? trichorhiza* W.J. Hooker, Exot. Fl. 1: t. 72. 1823. (Fig. 238)



**Fig. 239** *Luisia zeylanica* Lindl.—a. plant; b., c. & d. flower; e. sepal; f. petal; g., h. & i. column and lip; j. lip; k. pollinia.

*Stem* 10-25 cm, stout, branched. *Leaves* fleshy, 10-20 × 0.5-0.6 cm, slightly tapering to the apex. *Inflorescence* short, extra-axillary, 4-5 flowered. *Flowers* 10 mm across, greenish-pink to purple. *Bracts* broad with an acuminate point. *Sepals* un-equal, green with faint purple lines; the dorsal oblong, blunt 5 mm long; laterals obliquely ovate, keeled, 6 mm long. *Petals* longer than sepals, 10 mm long, oblong, blunt, spreading, green with faint purple lines. *Lip* longer than sepals, 3-lobed, epichile broadly cordate, more than 5 mm broad, tapering to the subtruncate emarginate apex; hypochile concave with erect rounded lobes, purple, out lined with pale-green.

*Flowering*: March - April.

*Distribution*: Himalaya 1500 m (Garhwal to Arunachal Pradesh), Meghalaya, Tripura, Bihar. Burma, China, Thailand.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Dehra Dun, *Mackinnon* 24182; Lachiwala, *Deva* 10642; Asarori, *Deva* 2573; Laxmansidh, *Deva* 2539. **Tehri**-Tehri Garhwal East of Tehri, *Mackinnon's collector* 25428; Tehri, *Mackinnon* 23004. **Pauri**-Garhwal outer Hills, *Inayat* 25836 & 25837; Duggada, *Sumer Chandra*. **Chamoli**-Ghat, Nandprayag, *M.A. Rau* 10399; Nigali Valley, *Naithani* 63752.

KUMAUN: **Pithoragarh**-Kali Valley, *Duthie*, Tejam Girgaon, *T.A. Rao* 6593; Baram, *Bhattacharyya* 21192; Askot-Gargia Bridle Road, *Pant* 31820; Maitli, *Arora* 55813, Tanakpur, *T.A. Rao* 11535. **Almora**-Bageshwar/Kapkot, *T.A. Rao* 4118.

**Luisia zeylanica** Lindl. *Fol. Orch.* *Luisia* 3. 1853; *Seidentf.* 27(4): 62. 1971.

*L. teretifolia* auct non Gaud. *Freye. Voy. aout. du Monde*: 427, t. 37. 1826; *Hook. f.*, 6: 22. 1890 p.p.; *King & Pantl.* 202, t. 271. 1898; *Duthie*, 140. 1906.

*Cymbidium tenuifolium* Wight *lc.* 5(1): t. 1689. 1852.

(Fig. 239)

Epiphytic. *Stem* tufted, 3-10 cm long, terete. *Leaves* 6-15 × 0.2-0.5 cm, alternate, terete. *Inflorescence* condensed raceme, 2-3 (-4) flowered. *Flowers* 5-7 mm across, greenish-pink to purple. *Bracts* small, oblong, obtuse, shorter than ovary. *Sepals* sub-equal, the dorsal green, 3-4 mm long, ovate, obtuse; laterals equal to dorsal, keeled towards the apex, ovate, acute. *Petals* as long as or slightly longer than sepals, oblong, obtuse, sparsely gland dotted or not. *Lip* 3.5-5 mm long, with dark maroon horizontal bands, concave towards the base, 3-lobed; epichile less than 5 mm broad, rhomboid, entire; hypochile thin, erect, auricular, shorter than epichile.

*Flowering*: April.

*Distribution*: Himalaya 1400 m (Garhwal to Arunachal Pradesh), Bengal, Meghalaya, Madhya Pradesh, Western Ghats, Andaman Islands. Sri Lanka.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Jharipani, *Naithani* 1000. **Uttarkashi**-Near Uttarkashi, *Deva* 10643.

KUMAUN: **Pithoragarh**-Madhote, Gori Valley, *Bhattacharyya* 21334; Gargia Gori Valley, *Bhattacharyya* 21192; Askot, *Arora* 37820; Tawa Ghat, *Arora* 56681; Baram, *Bhattacharyya* 21195; Kapkot, *T.A. Rao* 6511; Rahti Bogdwar, *T.A. Rao* 6707.

#### **Oreorchis** Lindl.

Terrestrial. *Pseudobulbs* corm like, broadly ovoid, 1-3 leaved. *Leaves* long, narrow. *Scape* tall, slender, produced from the side of the pseudobulb. *Flowers* small in racemes. *Sepals* ovate-lanceolate. *Petals* sub-similar, slightly spreading or sub-connivent. *Lip* attached to the base of the column by a short narrow claw,

Deva 3706

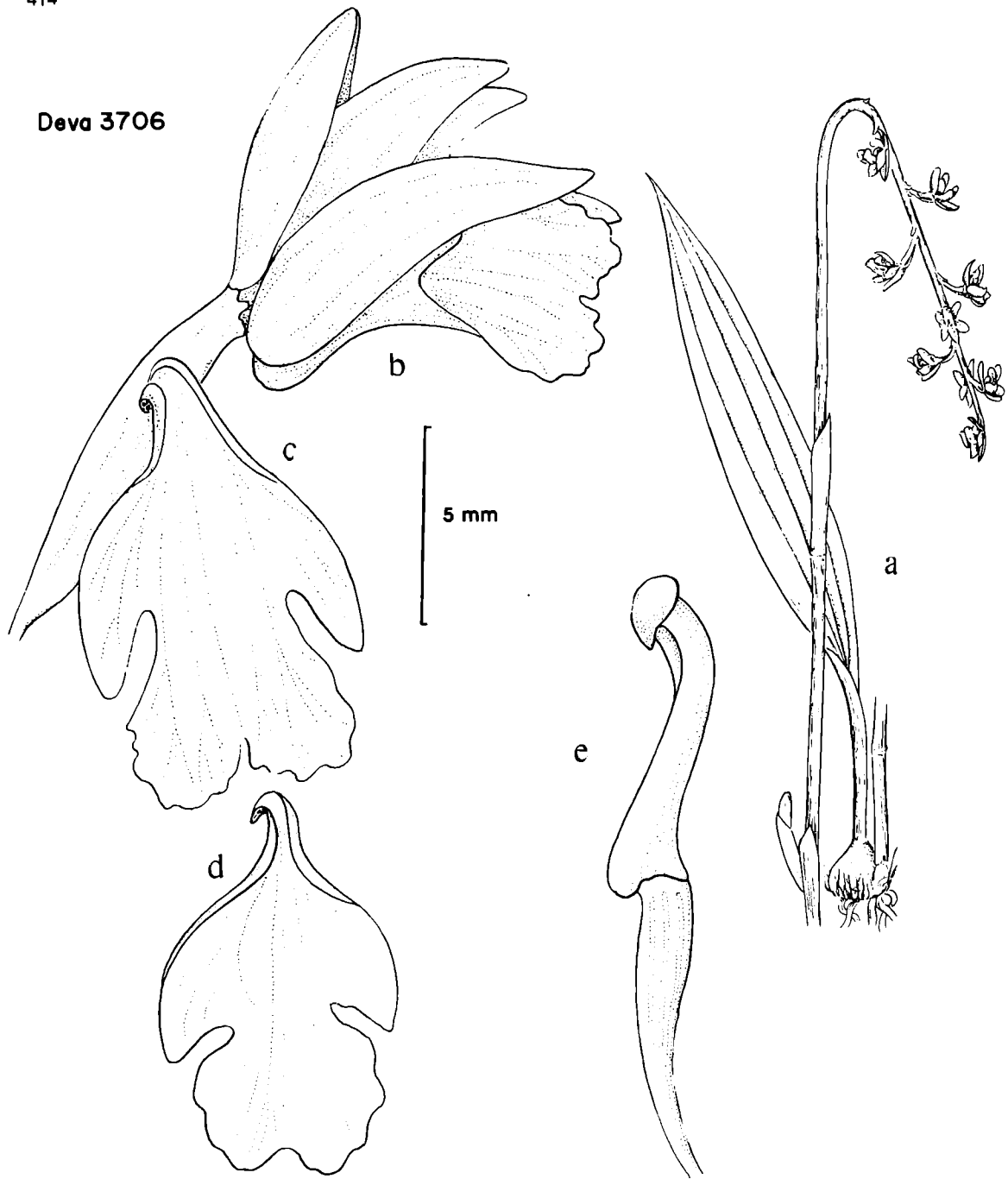


Fig. 240 *Oreorchis foliosa* (Lindl.) Lindl. — a. plant; b. flower; c. & d. lip; e. column.



more or less oblong, gibbous at the base or not, 3-lobed, side lobes short, entire, mid lobe broad, more or less bifid. *Column* elongated, stout, more or less curved, apex subtruncate. *Anther* 1-celled; *pollinia* 4, globose, united to a short common stipe ending in a gland derived from the stigma.

#### Key to species

1. Lateral lobes of the lip slender, lanceolate, falcate, thin, free and attached by a narrow base to a position just above the claw near the base of the lip, hypochile with ovate to linear elevated channelled fleshy callus, epichile bi-lobed with crumpled margin; flowers white to pale-yellow; leaves 2 rarely 3, narrowly linear-lanceolate, 6-12 mm broad..... *O. micrantha*
- + Lateral lobes of the lip broad, not slender, oblong to ovate, attached by a broad base to the centre of the lip, hypochile with or without any callus, epichile usually bi-lobed with entire to undulate margin; flowers reddish-yellow; leaf one, narrowly lanceolate to oblong-lanceolate, 15-25 mm broad..... 2
2. Lip saccate at the base, with the base of the column slightly to prominently projected in foot, upper surface without any keel, only strongly nerved, side lobes broadly oblong..... *O. foliosa*
- + Lip not saccate at the base, column not produced into a foot (very rarely saccate and column produced), upper surface with a long linear keel from the base to the middle, side lobes ear shaped, with incurved tips ..... *O. indica*

*Oreorchis foliosa* (Lindl.) Lindl. in J. Linn. Soc. Bot. 3: 27. 1859; Hook. f., 5: 709. 1890; King & Pantl. 183, t. 137. 1898; Collett, 493. 1902; Duthie, 131. 1906.

*Corallorhiza foliosa* Lindl. in Royle, Ill. Bot. Himal. 1: 363. 1839 *nom. nud.* et Gen. & Sp. Orch. 535. 1840. (Fig. 240)

*Pseudobulbs* 1.5 cm long, with few lax root fibres. *Leaf* solitary, terminal, 10-23 × 1.2-2 cm, oblong-lanceolate, acuminate, narrowed to a short petiole, nerves 2-3, prominent. *Scape* 30-40 cm long with 2-3 tubular sheaths; raceme 7-20 cm long, laxly few-flowered. *Flowers* 1.3 cm long, sub-secund, yellowish tinged with red. *Bracts* small, equal or shorter than the ovary. *Sepals* ovate, lanceolate, sub-acute. *Petals* shorter but broader than sepals. *Lip* longer than sepals, saccate at the base, 3-lobed, side lobes broadly oblong, obtuse, apical lobe sub-reniform, shortly bifid, the margin thickened and erose, upper surface without any keel, only strongly nerved. *Column* produced slightly to prominently in a foot.

*Flowering*: June - July.

*Distribution*: Himalaya 2500-3500 m (Himachal Pradesh, Garhwal and Nepal to Arunachal Pradesh). Burma, S.E. Tibet, W. China.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Jaunsar *Gleadow*; Deoban Jaunsar, *B.B. Osmaston* 24188. **Uttarkashi**-Syanachatti, *M.A. Rau* 15795; Bheena, *M.A. Rau* 10305.

HIMACHAL PRADESH: Mandali, *Rogers, Gamble*; Narkanda, *Lace* 2160; Jakha, *Deva* 3706.

Lindley described *Corallorhiza indica* [*Oreorchis indica* (Lindl.) Hook. f.] and based his description on a solitary specimen collected by T. Thomas from the N.W. Himalaya (upper part of Hatee?). The type sheet consists of a sketch which shows clearly a saccate base and no callus on the centre of the lip. On the other hand Duthie (1906) and Hook. f. (1890) mentioned "disk with a raised median lamellae midway between the side lobes" and further "mentum O or lip not saccate". It is clear that Lindley's plant is different from what has been described later. The other specimen described by Lindley *loc. cit.* is *Oreorchis foliosa*. It has "carinulis parallis membranaceis" and further explained as that the lip has two distinct parallel lamellae terminating opposite the re-entering angles of the lip. The type sheet quoted here is one from Mussoorie by Royle where the sketch on the sheet shows distinctly parallel lamellae. In another specimen

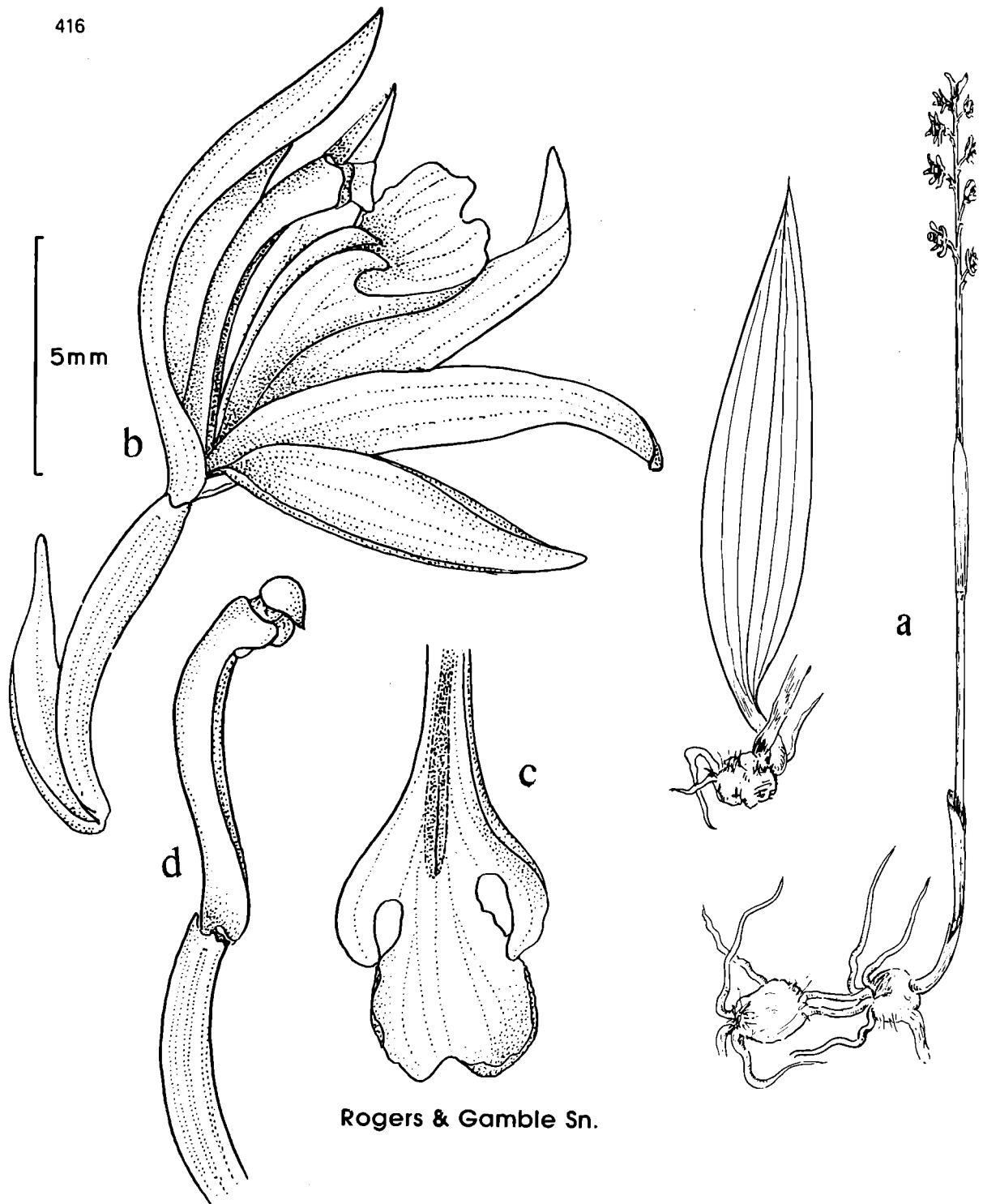


Fig. 241 *Oreorchis indica* (Lindl.) Hook. f.—a. plant; b. flower; c. lip; d. column.

## Thomas 20717

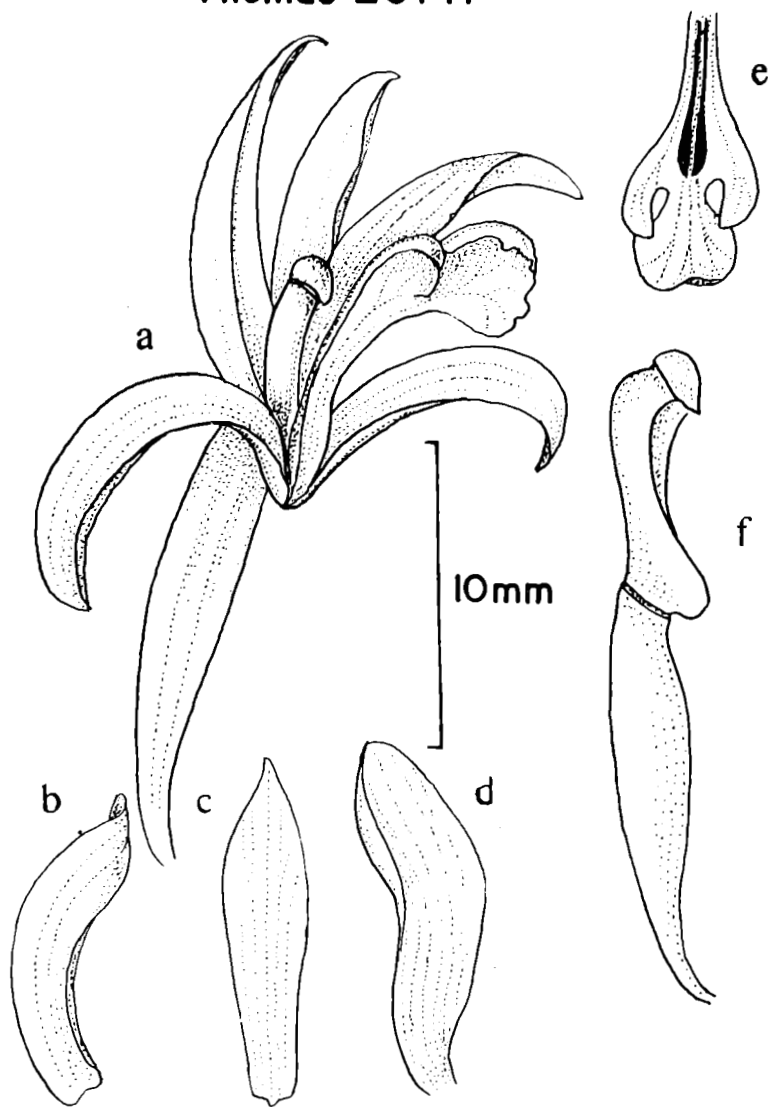


Fig. 242 *Oreorchis indica* (Lindl.) Hook. f.—a. flower; b. & c. sepal; d. petal; e. lip; f. column.

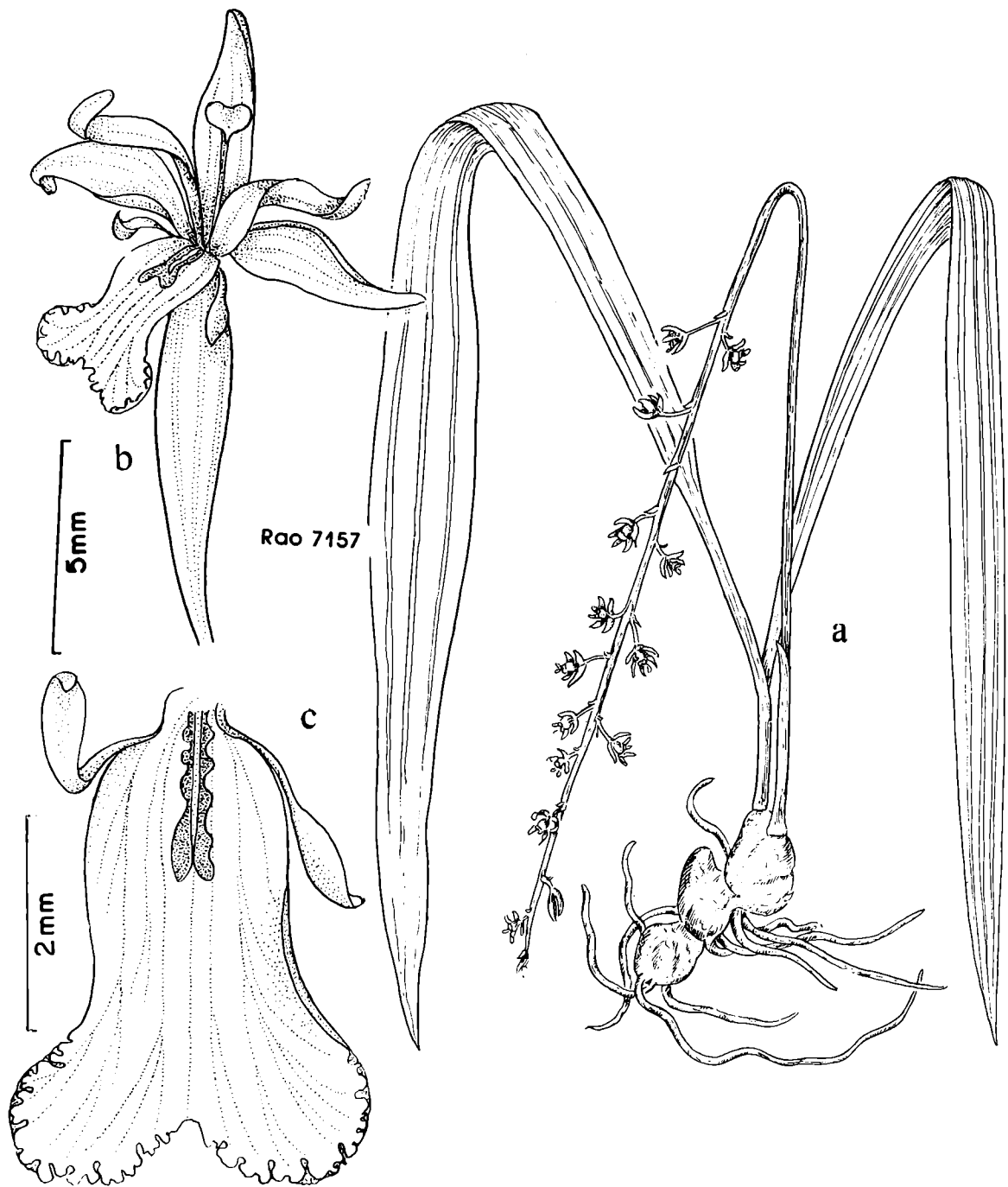
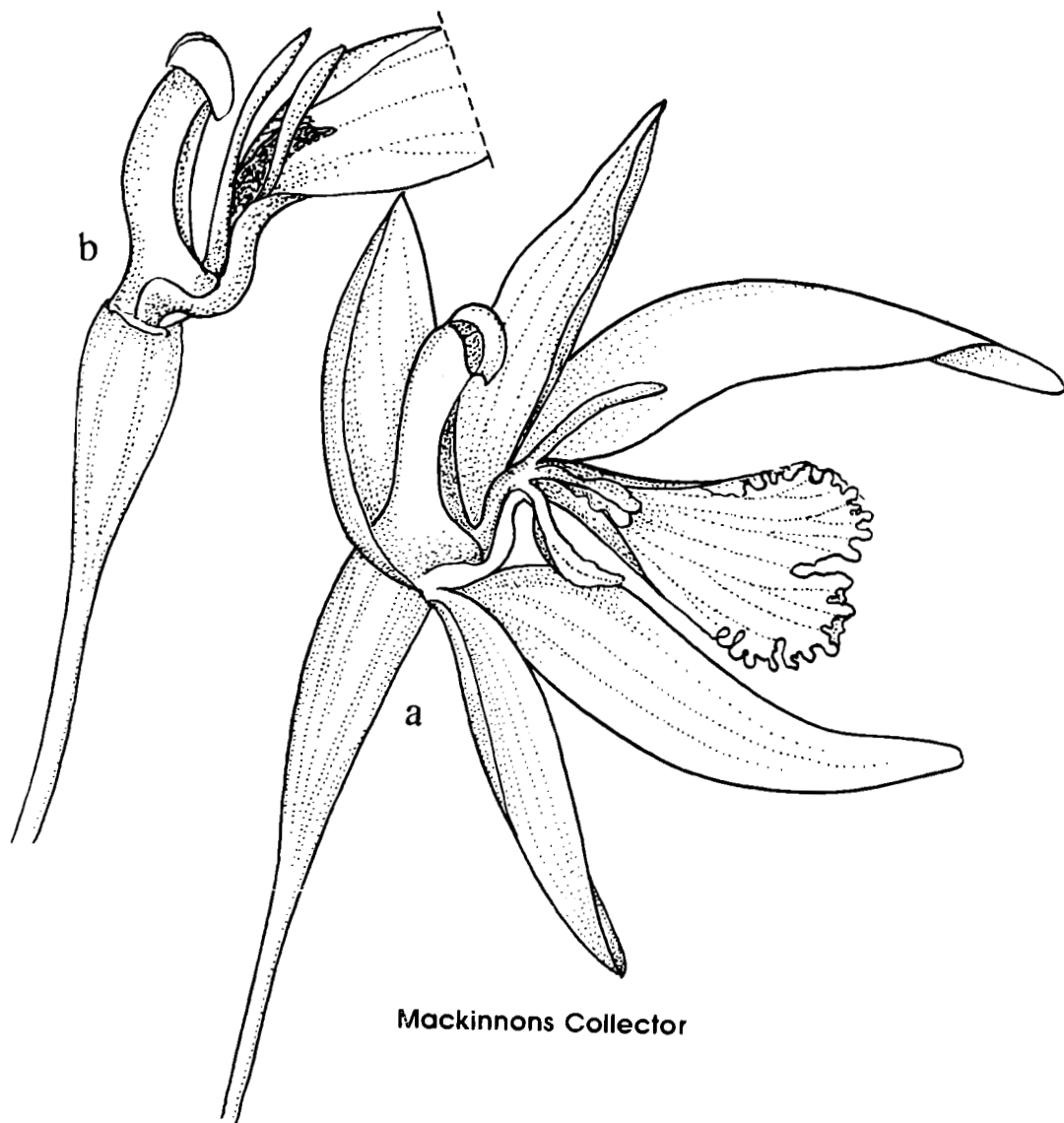


Fig. 243 *Oreorchis micrantha* Lindl.—a. plant; b. flower; c. lip.



Mackinnons Collector

Fig. 244 *Oreorchis micrantha* Lindl. —a flower; b. column and lip.

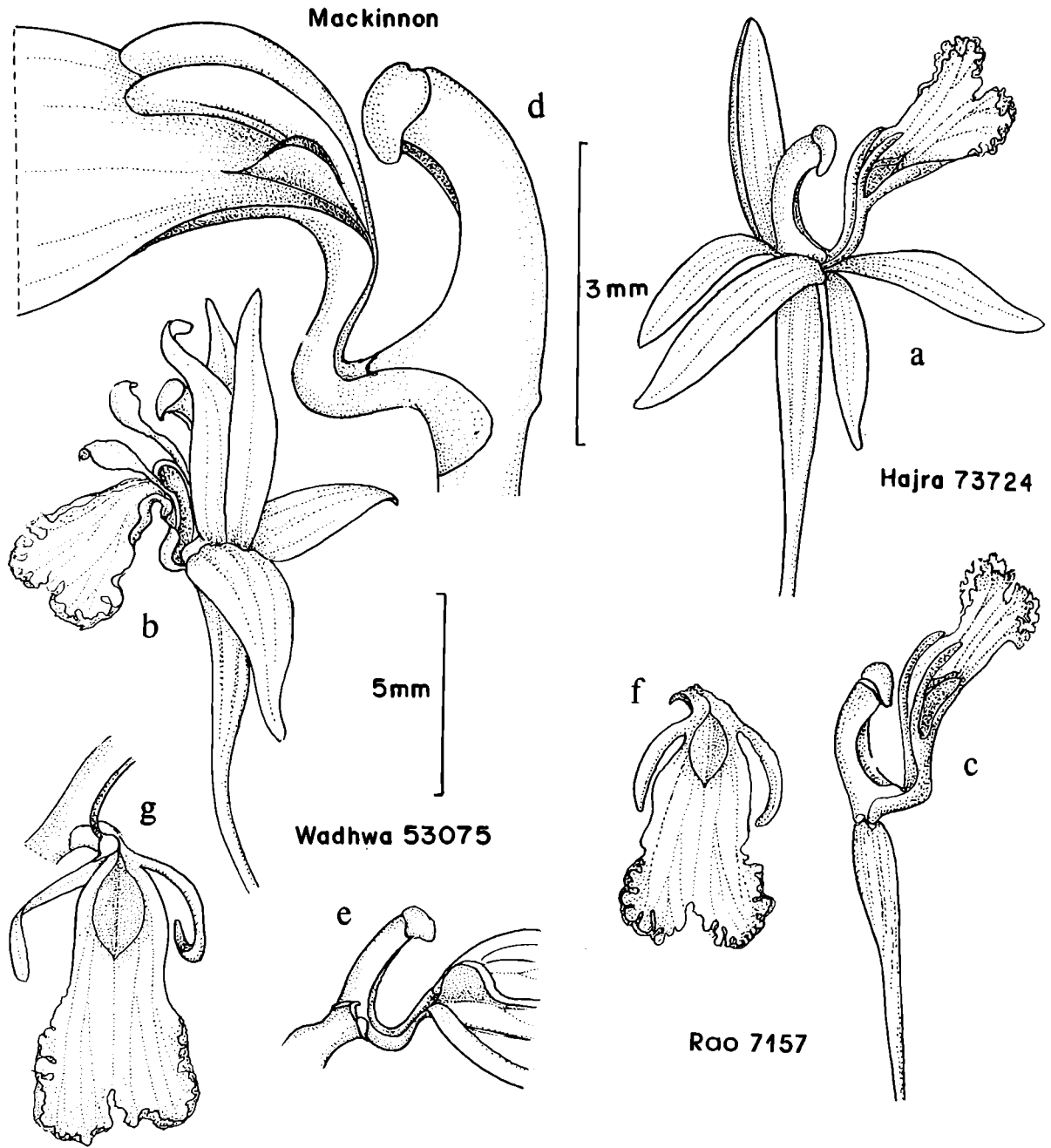


Fig. 245 *Oreorchis micrantha* Lindl.—a. & b. flower; c., d. & e. column & lip; f. & g. lip.

examined by Lindley from Lachen Sikkim collected by J.D. Hooker No. 213 the lamellae are short, broad and acute. This description also does not comply with the description and figure given by King & Pantling, 183. t. 137 (1898), Hook. f. (1890); Duthie (1906). There the lip has been shown without any lamellae, it is only strongly nerved. There is another specimen collected by Hooker no. 213 from Lachen valley in Sikkim probably a duplicate of the specimen examined by Lindley. This was examined probably by Hooker himself and here the lip has no lamellae and is only strongly nerved. This specimen is identical with those described by J.D. Hooker and other authors as *O. foliosa* Lindl. It is now evident that there is a discrepancy between Lindley's description and that of the J.D. Hooker and later authors. In our opinion the species commonly known as *O. foliosa* of Hook. f. and other is *O. indica* of Lindl., and the species *O. indica* Hook. f. others, is *O. foliosa* Lindl. This problem does not end here, we have examined a specimen Thomas 20717 (Fig. 242), which has a distinct saccate base, and the lip exactly like *O. indica*. This further complicates the problem. The material at our disposal is not enough to reach a satisfactory conclusion, nor we have been able to examine the actual types, but have only been able to see the photographs of the types. At present this nomenclature problem we leave for the future revisionist of this genera, and followed Hook. f. and other authors to distinguish our material from the N.W. Himalaya.

**Oreorchis indica** (Lindl.) Hook. f., Fl. Brit. Ind. 5: 709. 1890; Collett, 493. 1902; Duthie, 131, t. 112. 1906.  
*Corallorhiza indica* Lindl. in J. Linn. Soc. Bot. 3: 26. 1859. (*non*. Dcne.) (Fig. 241, 242)

Rhizome bearing 1-2 ovoid annulated pseudobulbs from the base of which several stout fibrous roots are given out. *Leaf* solitary, narrowly lanceolate, 6-28 × 1-2.5 cm, developing after flowering. *Scape* about 20 cm long, stout, with few loose sheaths. *Flowers* many, sessile, 1.7 cm long, yellow blotched with reddish-purple. *Bracts* lanceolate, acuminate, shorter than the ovary. *Sepals* the dorsal linear-lanceolate, 11 mm long; laterals subfalcately lanceolate, slightly shorter than the dorsal. *Petals* subfalcately oblong, obtuse, little shorter than the sepals. *Lip* deflexed from the middle, clawed, not saccate at the base; side lobes ear-shaped with incurved tips, obtuse to acute, mid lobe rounded, entire or 2-lobed, upper surface with a long linear keel from the base to the middle. *Column* not produced in to a foot.

*Flowering*: June - August.

*Distribution*: Himalaya 2000 - 2500 m (Himachal Pradesh to Kumaun).

*Specimens examined*:

GARHWAL: **Dehra Dun**-Mussoorie, *Falconer*; Jaunsar W. Kathyan, *Duthie* 14592. **Tehri-Nagtibba**, *Naithani* 1079, *Ramsukh* 22998 & 24189. **Chamoli**-Tung Nath, *Kirat Ram* 8979.

KUMAUN: **Pithoragarh**-Hot Spring Camp, *Thomas* 207171; Panch-Chuli basin, *G.S. Rawat* 22.

HIMACHAL PRADESH: Chachpur valley Shimla Hills, *Duthie* 21074; Mandali, *Rogers*.

**Oreorchis micrantha** Lindl. in J. Proc. Linn. Soc. Bot. 3: 27. 1859; Hook. f., 5: 709. 1890; King & Pantl. 183. t. 138. 1898; Collett, 493. 1902; Duthie, 132. 1906; Renz, 52. 1984.

*O. rolfei* Duthie in J. As. Soc. Beng. 71 (2): 38. 1902; Duthie, 132. 1906. (Fig. 243, 244, 245)

*O. foliosa* sensu Stewart Fl. W. Pak. 73. 1972. non (Lindl.) Lindl.

*Pseudobulbs* about 2 cm long, ovoid conic, base with few fibres. *Leaves* two rarely three, linear-lanceolate, 15-30 × 0.6-1 cm, prominently 2-5 nerved. *Scape* from the side of pseudobulb; raceme 5-10 cm long, few flowered. *Flowers* almost sessile, 1 cm long, pale-yellow, the lip white spotted purple. *Bracts* minute, hairy, subulate, much shorter than the ovary. *Sepals* linear-lanceolate, acute, slightly spreading, lateral pair subfalcate, little shorter and broader than the dorsal. *Petals* shorter than the lateral sepals, sometimes spotted purple. *Lip* white, spotted with purple, 3-lobed, lateral lobes slender, lanceolate, falcate, thin, free and attached by a narrow base to a position above the claw near the base, hypochile with ovate to linear elevated channelled fleshy callus, epichile bilobed with crumpled margin.

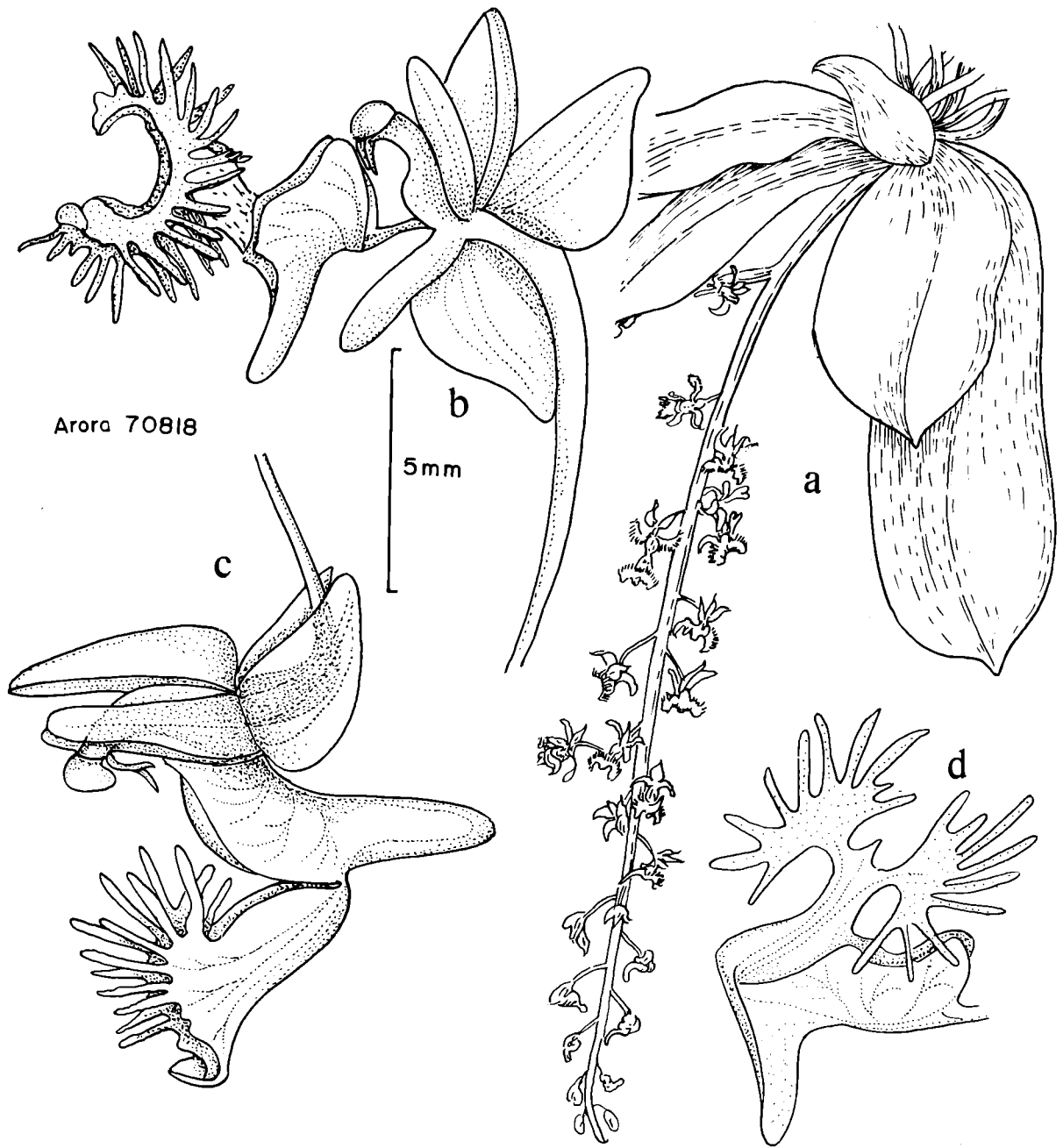


Fig. 246 *Ornithochilus difformis* (Wall. ex Lindl.) Schltr. — a. plant; b. & c. flower; d. lip.



*Flowering:* June - July.

*Distribution:* Himalaya 3300 m (Kashmir to Bhutan). Tibet, W. China.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Mussoorie, *Mackinnon*; Chakrata, *B.B. Osmaston*. Tehri-Nagtibba, *Mackinnon's collector*. **Chamoli**-Kanol, *M.A. Rao* 10358; Ramni Forest, *M.A. Rao* 10120; Bajmora, *M.A. Rao* 10259; On way to Sonnwara from Dibrugheta, Nanda Devi National Park, *Hajra* 72724.

KUMAUN: **Almora**-Bagdwar, *T.A. Rao* 7157; Way to Pindari, *R.N. Tiwari*.

HIMACHAL PRADESH: Talli forest, *Wadhwa* 53075; Narkanda, *Lace* 2159; Mashobra, Shimla, *Gamble* 4427 (c).

JAMMU & KASHMIR: Poonch below Badori, (*Renz, loc. cit.*)

Duthie 1902, described a species *O. rolfei* (type Mackinnon's collector, 10.6.1900 from Nagtibba Garhwal altitude 2400 m (DD)). This species is known only from a single locality and was distinguished from *O. micrantha* to which it is most nearly allied mainly by that the lip has been described saccate at the base, and the basal callus on the upper surface is oval and not linear. We examined the type (Fig. 244) and also many other specimens identified by Duthie, and others as *O. micrantha* but have failed to find any distinction between these two species. All the specimens including that of the type of *O. rolfei* have the lip with a long to short claw forming a somewhat saccate base. The callus on the lip is elongated and linear to oval. In Duthie's type specimens it is definitely not oval but distinctly linear with more elevated apical parts (Fig. 244), while in several specimens of *O. micrantha* including those identified by Duthie the callus is oval or linear elongated. We have not been able to examine the Lindley's type of *O. micrantha* but have seen a photograph (BSI no. 9885) TT 214 from Yakul mountain (Kumaun). The sketch of the lip shows a distinct but small claw, however the saccate base and the foot of the column is not clear. We have also seen similar specimen, *Rao* 7157 and *Wadhwa* 53075.

#### **Ornithochilus** Wall. ex Hook. f.

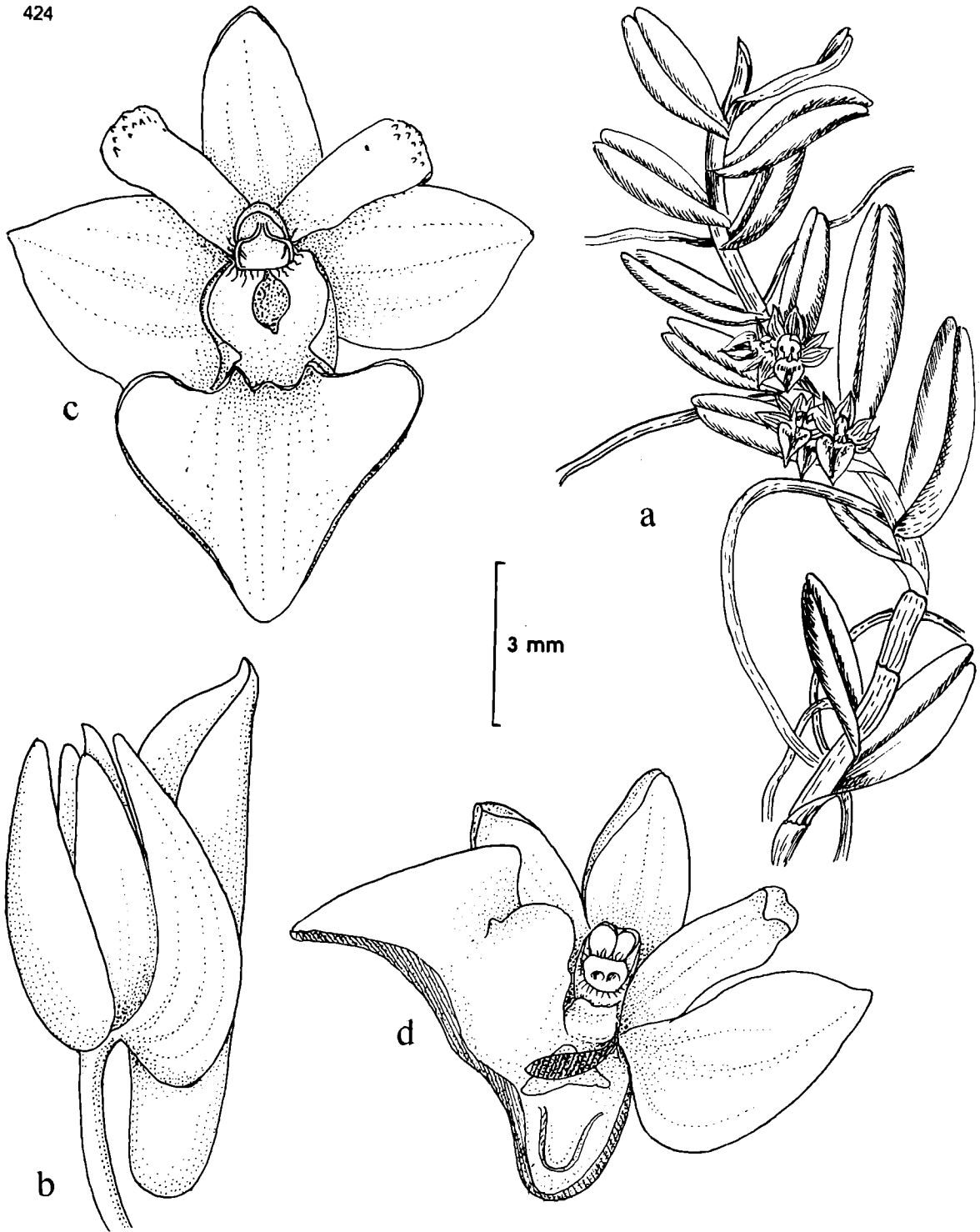
Epiphytic, without pseudobulbs. *Stem* short or absent. *Leaves* few, crowded, broadly oblong, softly coriaceous. *Inflorescence* supra-axillary racemose or panioled. *Sepals* sub-equal, spreading, incurved at the apex, lateral obliquely obovate. *Petals* smaller, cuneate-oblong, blunt. *Lip* much longer than the sepals, adnate to the foot of the column by a long broad claw, the claw with a rectangularly bent sub-cylindric spur at the junction with the epichile; side lobes shallow, sub-quadrate, epichile with three lobules, the two lateral recurved and fimbriate, the central triangular, entire or infolded; the mouth of the spur closed by two calli projecting from its back and front wall, the latter hairy. *Column* short, cylindrical, stout, with a short foot; rostellum forked; stigma circular, surrounded by a hairy rim. *Anther* oblong; *pollinia* 2, subglobose; caudicle very hard, obcuneate, gland large.

**Ornithochilus difformis** (Wall. ex Lindl.) Schltr. in Feede, Repert. Beih. 4: 277, 1919; Seidenf., 86. 1975.

*Aerides difformis* Wall. ex Lindl. Gen. & Sp. Orch. 242. 1833.

*O. fuscus* Wall. ex (Lindl. Gen. & Sp. Orch. 242. 1833, pro syn.) Hook. f., Fl. Brit. Ind. 6: 76. 1890 *nom. illegit.*, in Curits. Bot. Mag. 120: t. 7385. 1894; King & Pantl. 200, t. 268. 1898; Duthie, 139. 1906; Raizada et al. 40. 1981. (Fig. 246)

*Stem* absent. Roots very stout, vermiform. *Leaves* few, sessile, 7-15 cm long, spreading, elliptic-oblong, acute, sub-recurved, flat, coriaceous. *Racemes* simple or branched at the base, arising close to the base of the leaves, about 30 cm long, pendulous, many flowered. *Flowers* 1 cm across, greenish-yellow with bands of brown. *Bracts* very small, lanceolate. *Sepals* spreading or reflexed, oblong-ovate, obtuse, yellow streaked with red. *Petals* like sepals, but smaller. *Lip* much longer than the sepals, divided into a hypochile



**Fig. 247** *Platantheria insectifera* (Rchb. f.) Ridl. — a. plant; b. flower side view; c. flower front view; d. flower cut through column, spur and lip (after Seidenf.).

with rounded side lobes and horn like spur, attached to the short foot of the column by a claw and an epichile with 2 lateral recurved pectinate lobules and a small triangular lobule in the notch; epichile with a rather long spine beneath.

*Flowering:* July.

*Distribution:* Himalaya 1500-2000 m (Garhwal to Arunachal Pradesh), Assam, Meghalaya, Manipur, Mizoram, Tripura. Burma, Indo-China, Thailand.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Below Mussoorie, *Mackinnon's collector* 24190.

KUMAUN: **Pithoragarh**-Baramganw, Gori Valley, *Inayat* 24121; Barum, *Arora* 66162; Maitli, *Arora* 55808; Didihat, *Arora* 36446; Dafia, *Arora* 70818.

#### **Pelatantheria** Ridl.

Epiphytic without pseudo-bulb. *Stem* elongate. *Leaves* coriaceous rather close set, oblong. *Racemes* short. *Flowers* small. *Sepals* and *petals* similar. *Lip* adnate to the base of the column or of its foot; the base with an infundibuliform spur sometimes dilated at the apex, the interior wall with a callus both on the anterior and posterior wall, and always divided in to two lateral compartments by a vertical antero-posterior septum; side lobes small, more or less triangular or acute; mid lobe triangular or hastate. *Column* very short and thick, arms long erect. *Anther* 2 to 4 celled; *pollinia* 2, half divided, caudicle short and broad with a large reniform disc as large.

***Pelatantheria insectifera*** (Rchb. f.) Ridl. in J. Linn. Soc. Bot. 32: 376. 1896; Seidenf. 152, fig. 36. 1969; Katakai et al. 5: 27. 1984.

*Sarcanthus insectifera* Rchb. f., in Bot. Zeit. 15: 159. 1857; Hook. f., 6: 68. 1890 et 53. t. 78. 1895; Duthie, 149. 1906; Haines, 1179. 1924. (Fig. 247)

*Stem* erect, scandent about 15-60 cm in length, flexuous, green. *Leaves* many, almost imbricate, deeply channelled, nerveless, oblong, amplexicaul, lobes unequal, 1.5-4 × 1.2-1.8 cm. *Raceme* sub-sessile, shorter than the leaves, usually 3-5 flowered, 10-12 mm long. *Lip* decurved and appearing from old places on the stem. *Flowers* attractive, well spread out, 13-15 mm across. *Bracts* minute, deciduous. *Sepals* sub-equal, oblong-ovate, obtuse or subacute, 6-3 × 4-5 mm. *Petals* shorter, narrow, oblong; sepals and petals 3-nerved, greenish-yellow striped with red. *Lip* prominent, fleshy, 10-12 mm long, funnel shaped, with a ring of hairs at its mouth, tapering into a conical spur, white to rose or purple, 3-lobed; side lobes short, rounded, incurved; mid lobe large, fleshy, obtriangular-ovate with attenuated fleshy apex; spur with a large bifid callus below the column within; semiseptate by a plate descending from the base of the mid lobe.

*Flowering:* August - September.

*Distribution:* Himalaya (Garhwal, Sikkim & Arunachal Pradesh), Assam, Meghalaya, Nagaland, Tripura, Bihar, Madhya Pradesh. Bangladesh, Burma and Thailand.

*Specimen examined*

GARHWAL: **Pauri**-Outer Garhwal hills near the Ramganga Valley, *Inayat* 25817.

#### **Pteroceras** Hassk.

Epiphytes. *Stem* usually short, horizontal or ascending. *Leaves* coriaceous, narrowly oblong, spreading and drooping, unequally lobed at the apex. *Inflorescence* extra-axillary raceme, many flowered. *Flowers* rather small, short-lived, opening one or a few together. *Sepals* and *petals* almost equal, the lateral sepals more or less jointed to the column foot. *Lip* hinged to the end of column foot, spurred or saccate, 3-lobed,

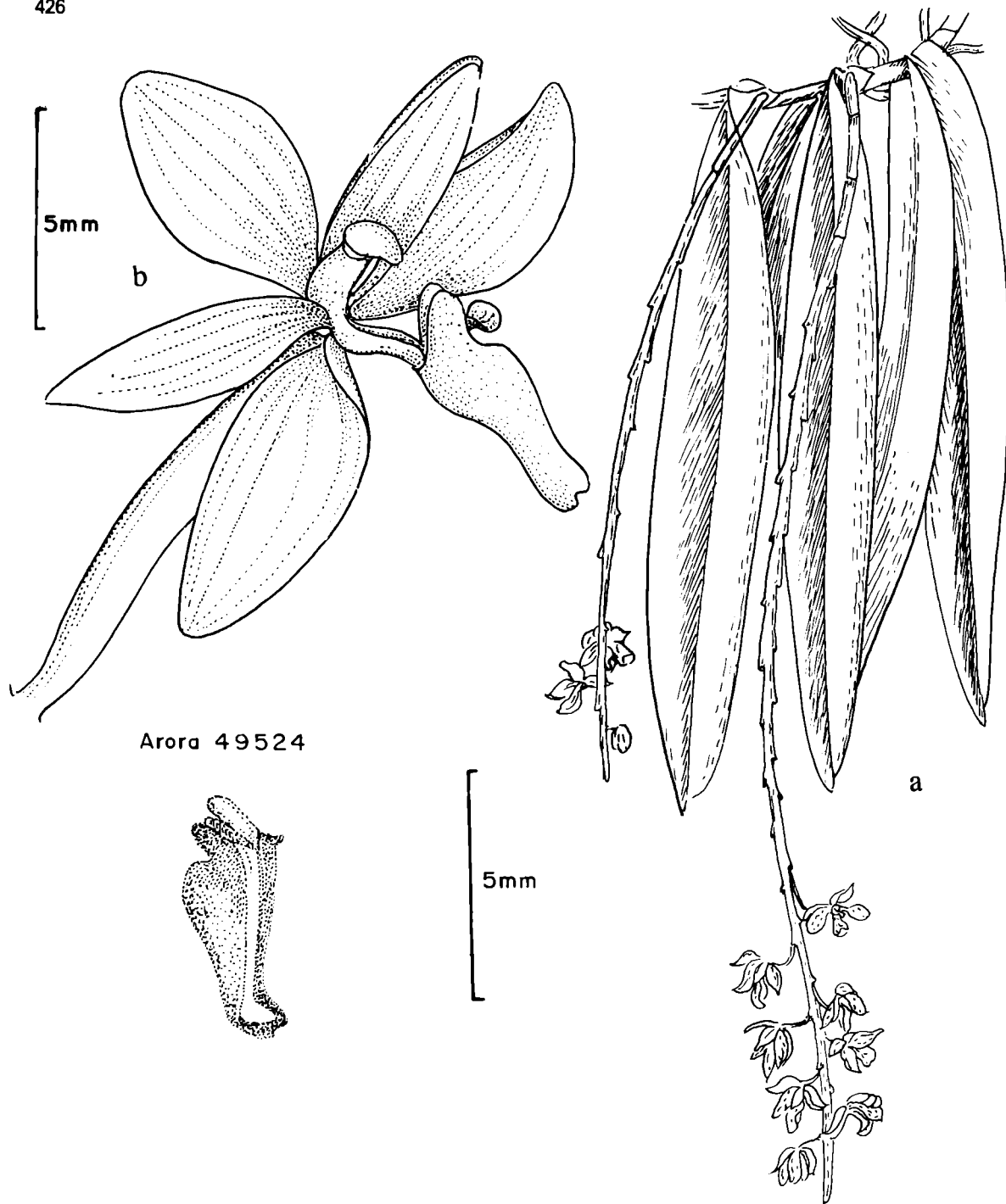


Fig. 248 *Pteroceras suaveolens* (Roxb.) Holtt. — a. plant; b. flower; c. lip cut vertically

side lobes usually narrow, curved, erect; mid lobe thickened as a callus or more or less 3-lobed. *Spur* more or less continuing the line of the column foot. *Column* short or fairly short, with well developed foot. *Anther* depressed, shortly beaked; *pollinia* 2 cleft, on a rather short stiped.

**Pteroceras suaveolens** (Roxb.) Holtt. in Kew Bull. 14: 271. 1960; Arora, 298. 1978.

*Aerides suaveolens* Roxb. Fl. Ind. 3: 473. 1832. non Bl.

*Sarcochilus suaveolens* (Roxb.) Hook. f., Fl. Brit. Ind. 6: 33. 1890.

*Ornitharium striatulum* Lindl. & Paxt. Fl. Gard. 1: 188. fig. 117. 1850-51; King & Pantl. 243, t. 323. 1898.

*Saccolabium pumilo* sensu Bhattacharyya, in Bull. Bot. Soc. Beng. 23: 162. fig. 6. 1969 non Rchb. f.

*Saccolabiopsis pusilla* Seidenf. & Arora in Nord. J. Bot. 2(1): 25. 1982. non (Lindl.) Seidenf. & Garay.

(Fig. 248)

*Stem* pendulous, woody, slender, 7-15 cm long. *Leaves* 6-8, decurved, narrowly oblong, 8-18 × 1.6-2 cm, unequally bifid at the apex. *Inflorescence* a pendulous leaf opposed many flowered raceme. *Flowers* lax, 12-15 mm across, yellow spotted with brown, fragrant. *Bracts* minute, lanceolate. *Sepals* sub-equal, narrowly obovate, blunt, the laterals slightly falcate. *Petals* smaller than the sepals, oblong, sub-acute, slightly falcate. *Lip* jointed to the foot of the column, yellow, 3-lobed; lateral lobes small, oblong, their blunt apices pointing backwards; mid lobe very short, truncate. *Spur* infundibuliform, contracted near the curved bulbous tip and also near mouth, dark purple at the tip.

*Flowering*: Several times during the year.

*Distribution*: Himalaya 1500 m (Kumaun, Sikkim, Arunachal Pradesh). Tripura. Bangladesh, Burma, Thailand and Laos.

*Specimens examined*:

KUMAUN: **Pithoragarh**-Gori Valley, *Inayat* 24121(a); Dafiadhura, *Arora* 49524; Maitli, *Arora* 52445, 55809 & 66159; Vasavgad Gori Valley, *Bhattacharyya* 21248.

#### **Rhynchostylis** Blume

Epiphytic. *Stem* elongate, stout, leafy; pseudobulbs absent. *Leaves* very coriaceous, long, sessile, linear-oblong, unequally bilobed and toothed at the apex. *Flowers* many, densely crowded into long cylindrical racemes, bright coloured. *Bracts* ovate-lanceolate. *Sepals* and *petals* spreading, broad, obtuse, lateral sepals adnate to the column foot, petals narrower and smaller than sepals. *Lip* adnate to the short foot of the column; hypochile forming a deep wide pubescent sac, without lateral lobes; the epichile obovate, acute, concave, the margins erect. *Column* short, stout, dilated at the base, foot short. *Anther* terminal, rounded; *pollinia* 2, elliptic, on a long slender caudicle, gland small.

**Rhynchostylis retusa** (Linn.) Bl. Bijdr. 286. t. 49. 1825; Hook. f., 6: 32. 1890; King & Pantl. 213, t. 284. 1898; Duthie, 148. 1906.

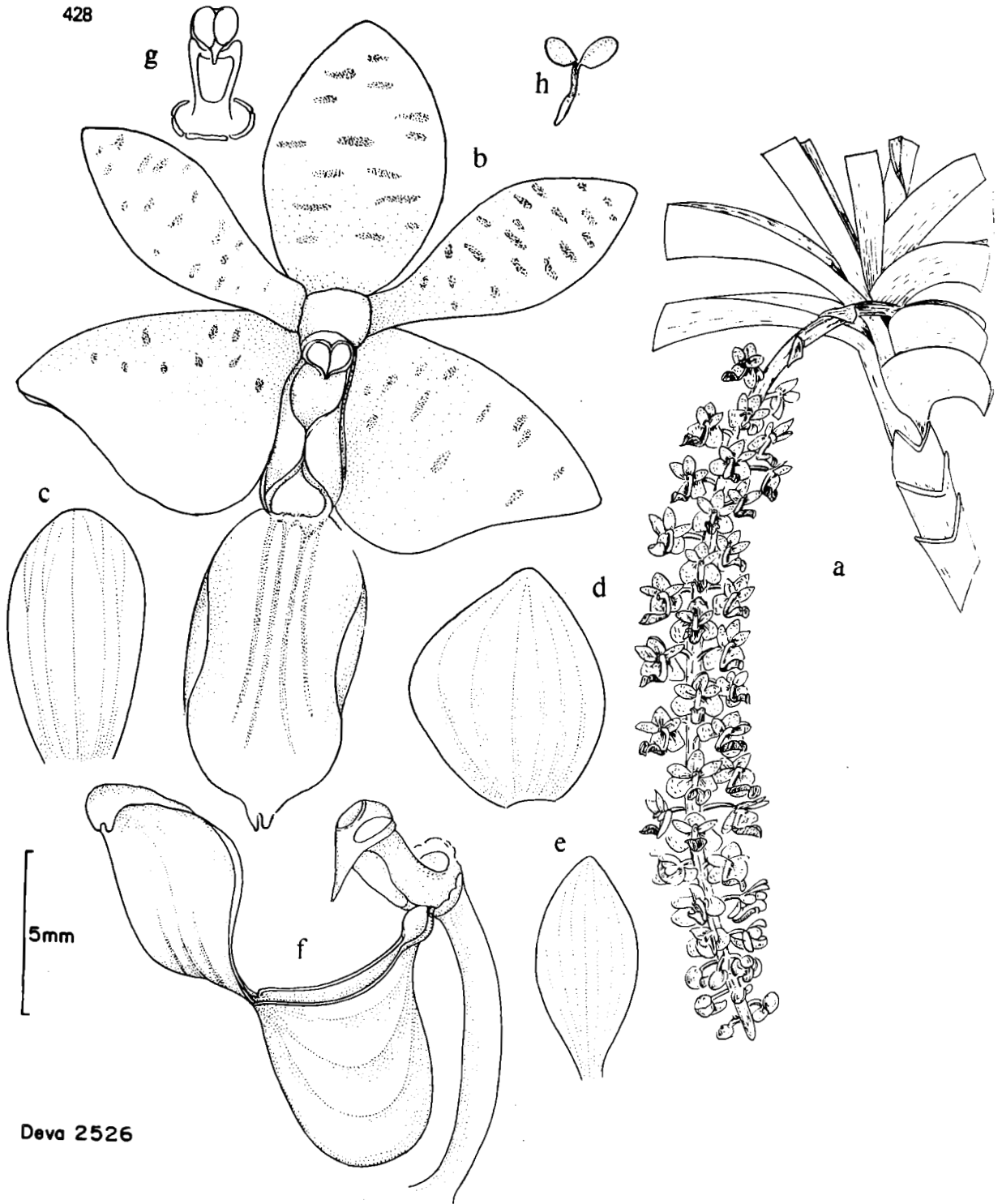
*Epidendrum retusum* Linn. Sp. Pl. 953. 1753.

*Aerides spicatum* D. Don Prodr. Fl. Nepal 31. 1825.

*Saccolabium guttatum* Lindl. Gen. & Sp. Orch. 220. 1833.

(Fig. 249)

*Stem* 10-20 cm long, woody, covered with persistent sheathing base of the fallen leaves. *Leaves* distichous, 15-45 × 2-3.5 cm, dense, linear, praemorse or bluntly bilobed at apex. *Raceme* longer than the leaves, cylindrical, drooping, axillary. *Flowers* 2 cm across, many, dense, white or pink with purple or pink markings. *Bracts* ovate-lanceolate, shorter than ovary. *Sepals* the dorsal 8 mm long, sub-orbicular, obtuse; the laterals 9 mm long, broadly ovate, obtuse. *Petals* ovate-elliptic, obtuse, narrower than sepals. *Lip* 7 mm long, continuous with the foot, spurred, bent inwards; hypochile narrow; epichile obovate, acute, concave with erect margin, deep magenta in colour.



Deva 2526

Fig. 249 *Rhynchosstylis retusa* (Linn.) Bl.-a. plant; b. flowers; c. dorsal sepal d. lateral sepal; e. petal; f. column & lip; g. column; h. pollinia.

*Flowering:* June - July.

*Distribution:* Himalaya up to 1200 m (Himachal Pradesh to Arunachal Pradesh), Assam, Meghalaya, Manipur, Nagaland, Mizoram, Tripura, Bengal, Bihar, Orissa, Madhya Pradesh, Western Ghats, Andaman Island, Burma, Sri Lanka, Malaysia, Java, Thailand and Phillipines.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Dehra Dun Valley, New Forest, *Ram Dayal* 1100, *Naithani* 3617; Ajabpur, *Deva* 2526; Rajpur Road, *Arora* 36454; Sahashtradhara, *S.K. Malhotra* 28103; Mussoorie below Jaripani, *Deva* 8351, *Malhotra* 19153. **Pauri**-Outer Garhwal hills, *Inayat* 25828; Ramganga Valley, *Inayat* 25840. **Chamoli**-Nandprayag, **M.A. Rau** 10396.

KUMAUN: **Pithoragarh**-Bagaura to Berinag, *Awasthi* 1542; Vasavgad, *Bhattacharyya* 21357; Girigaon, *Pant* 28238. **Nainital**-Nainital, *Osmaston* 1311. **Almora**-Khera village, *Wadhawa* 57655.

HIMACHAL PRADESH: Kangra Valley (*Duthie, loc. cit.*).

The fresh plant is used as an emollient (*Caius, 1936*).

### **Smitinandia** Holtt.

Epiphytes. *Stem* elongated without pseudobulb. *Leaves* coriaceous, sessile, linear-oblong, with blunt slightly bilobed apex. *Inflorescence* not exceeding the leaves. *Flowers* small in raceme. *Sepals* sub-equal, broadly ovate. *Petals* smaller and narrow. *Lip* firmly jointed to the column, 3-lobed, spurred, side lobes small, erect, mid lobe larger, tongue-shaped, at base with transverse ridge closing the entrance of the short saccate spur. *Column* short, without distinct foot; *pollinia* 2, divided into unequal halves, on heart-shaped stipe with large gland.

**Smitinandia micrantha** (Lindl.) Holtt. in Gard. Bull. Sing. 25: 106. 1969.

*Saccolabium micranthum* Lindl. Gen. & Sp. Orch. 220. 1833; Hook. f., 6: 59. 1890.

*Gastrochilus parviflora* O. Ktze. Rev. Gen. Pl. 2: 661. 1891.

*Cleisostoma micranthum* (Lindl.) King & Pantl. in Ann. Roy. Bot. Gard. Cal. 8: 234, t. 312. 1898; *Duthie*, 148. 1906. (Fig. 250)

*Stem* stout, 7-20 cm, compressed. *Leaves* 5-8, oblong, keeled, bifid at apex, 6-10 × 1.2-1.5 cm. *Raceme* leaf opposed, longer than leaves in fruits, peduncle and rachis stout. *Flowers* several, 5 mm across, only few opening at a time. *Bracts* broad, blunt less than half as long as the ovary. *Sepals* sub-equal, spreading, broadly ovate. *Petals* smaller than sepals, oblong, spreading, pinkish-white with large pink spots. *Lip* fleshy, pinkish-purple, as long as the sepals, 3-lobed, the base with a wide blunt spur adpressed to and as long as the ovary; lateral lobes small, forward pointing; mid lobe oblong, convex, edges thin and erose. *Spur* inside with a callus near the mouth.

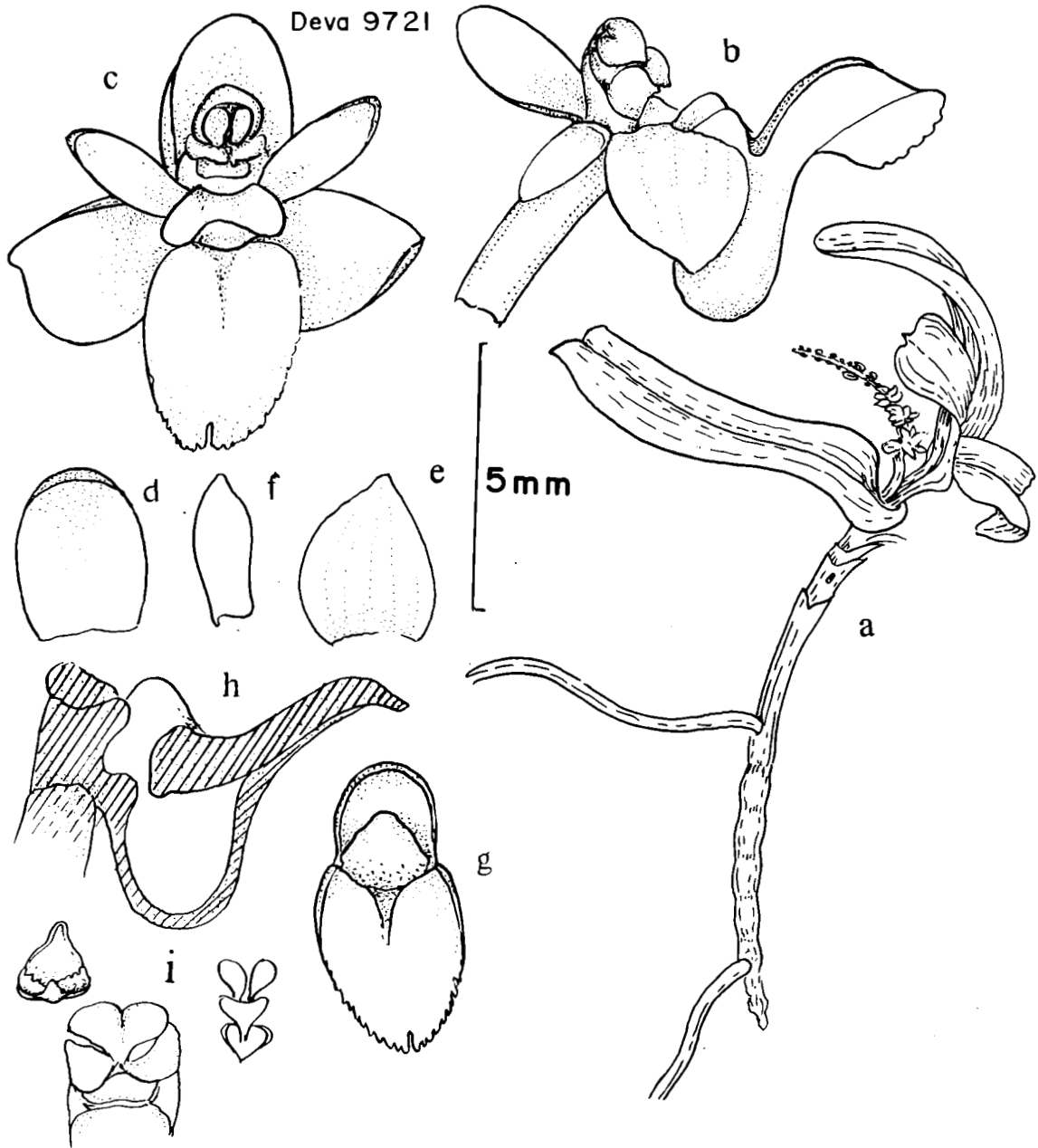
*Flowering:* June - July

*Distribution:* Himalaya up to 1200 m (Garhwal to Arunachal Pradesh), Meghalaya, Nagland, Sarguja in Madhya Pradesh. Burma, Malaya, Thailand, Laos, Vietnam and Cambodia.

*Specimens examined:*

GARHWAL: **Dehra Dun**-Gularghati, *Deva* 2532; Laxmansidh, *Deva* 9721. **Pauri**-Outer Garhwal hills, *Inayat* 25809.

KUMAUN: **Pithoragarh**-East Almora division, *Bis Ram* 2193; Gori Valley, *Duthie* 5986; Burum, *Arora* 66160, *Bhattacharyya* 21209 & 21360; Tjum, *Rao* 6599, *Nair* 35499; Datia Forest, *Arora* 45768; Maitli, *Arora* 52446.



**Fig. 250** *Smitinandia micrantha* (Lindl.) Holtt. — a. plant; b. & c. flower; d. dorsal sepal; e. lateral sepal; f. petal; g. lip; h. column and lip vertically cut; i. column and pollinia.



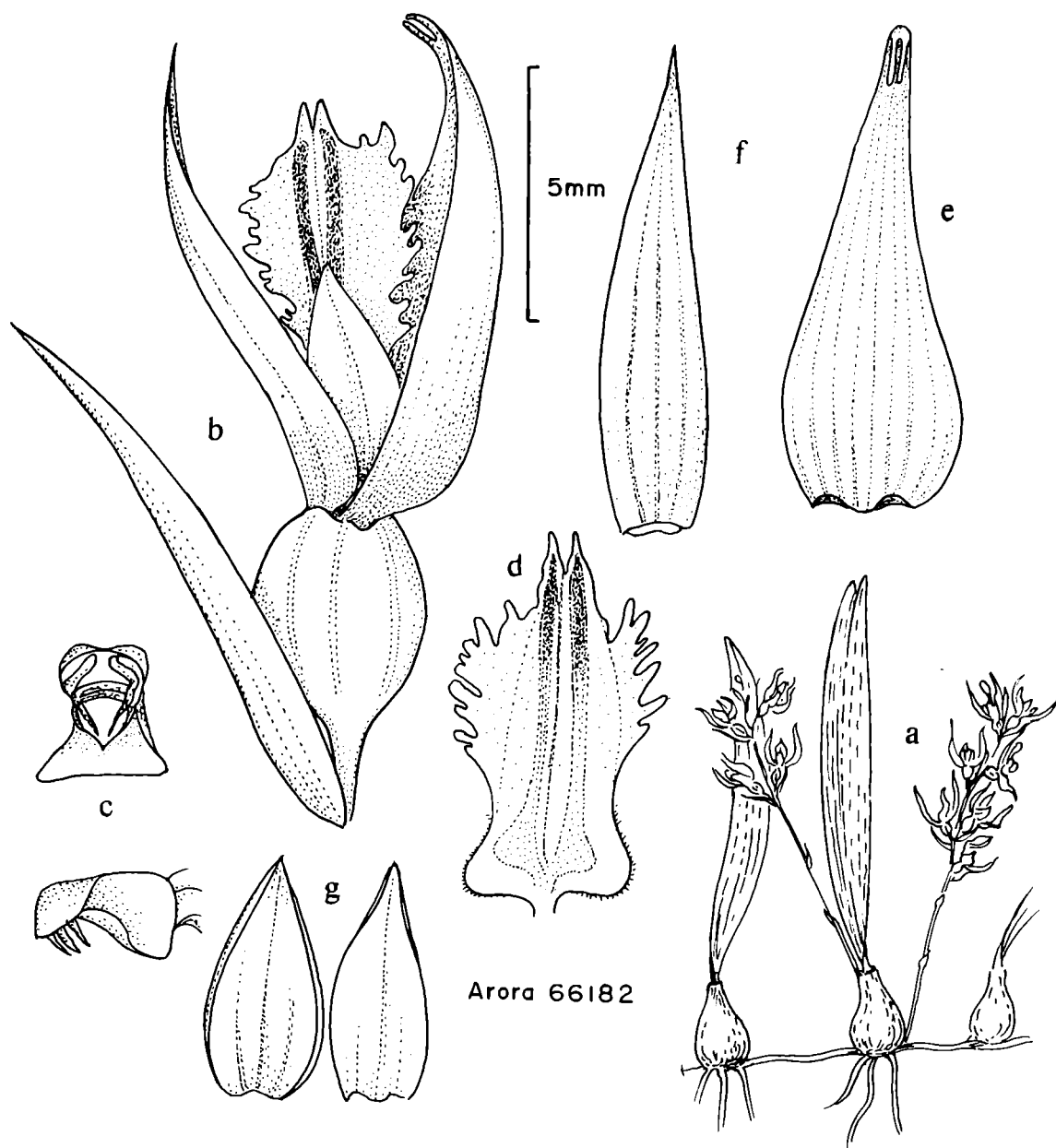


Fig. 251 *Sunipia bicolor* Lindl. — a. plant; b. flower; c. column; d. lip; e. dorsal sepal; f. lateral sepal; g. petal.

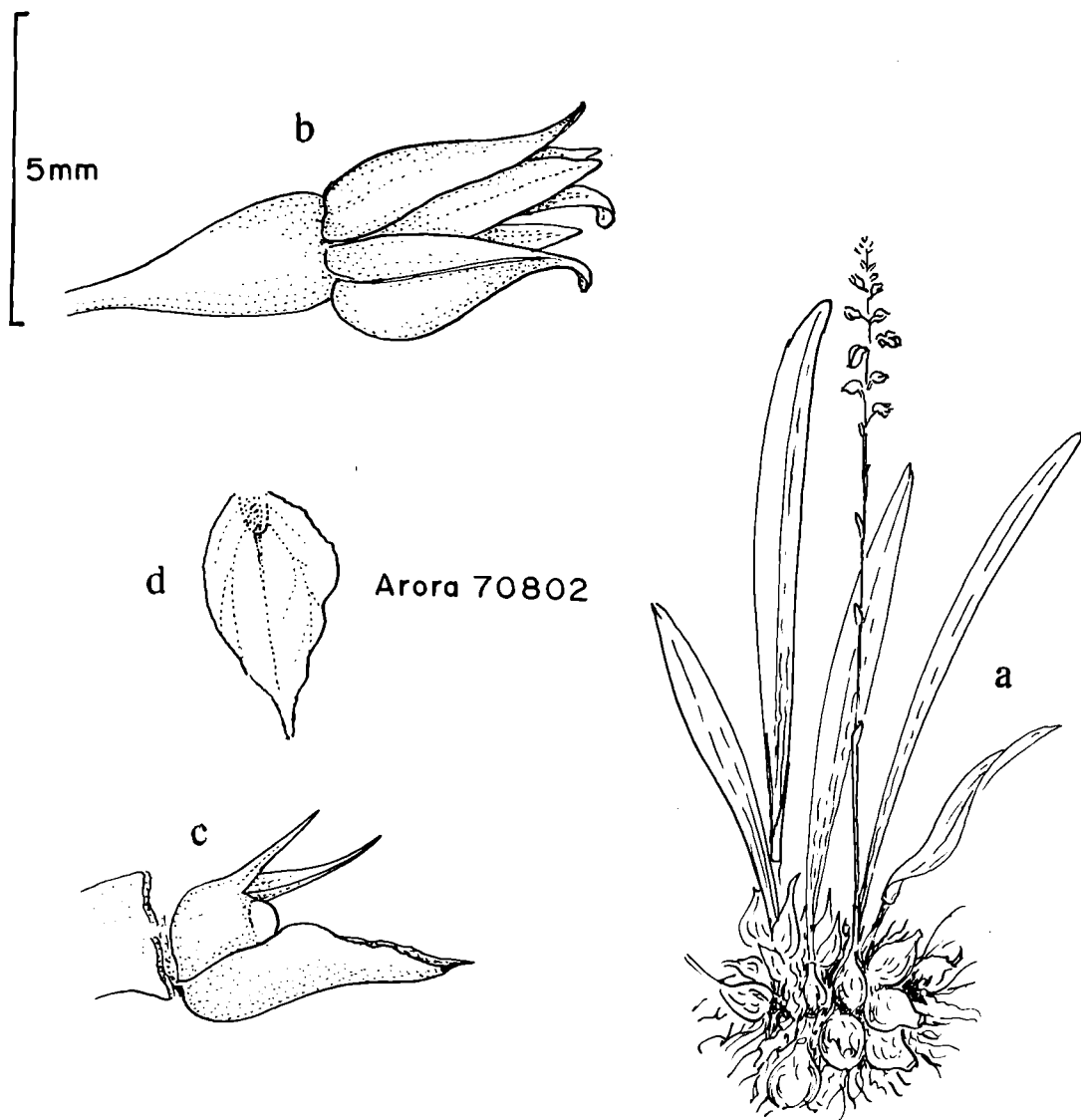


Fig. 252 *Thelasis longifolia* Hook. f.—a. plant; b. flower; c. column and lip; d. lip.

### Sunipia Lindl.

Epiphytes, rhizomes creeping more or less distantly bearing pseudobulbs with solitary leaf. *Inflorescence* from base of pseudobulb. *Flowers* in raceme. *Sepals* sub-equal, laterals more or less connate. *Petals* spreading, small. *Lip* entire, variously formed, not exceeding lateral sepals. *Column* short, foot non or very short; *pollinia* 4, attached by pairs to a caudicle (stipe ?), usually with one gland.

**Sunipia bicolor** Lindl. Gen. & Sp. Orch. 179. 1833; Sert. Orch., fig. 5, 1833; Arora, 298. 1978.

*Ione bicolor* (Lindl.) Lindl. Fol. Orch. Ione: 3. 1853; King & Pantl. 159, t. 216. 1898.

*Bulbophyllum bicolor* (Lindl.) Hook. f., Fl. Brit. Ind. 5: 770. 1890.

(Fig. 251)

*Rhizome* slender. *Pseudobulbs* at a distance of 15-20 mm, obpyriform, 12-16 mm long. *Leaf* solitary, 6-10 cm × 5-10 mm linear, unequally and distinctly bifid at apex. *Scape* solitary or in pairs somewhat shorter than the leaves. *Raceme* distichous, 6-8 flowered. *Flowers* 10 mm long. *Bracts* lanceolate, acute, longer than the ovary. *Sepals* sub-equal; the dorsal longer than connate lateral pair, lanceolate, acute, pale and translucent like the petals and with reddish-violet coloured nerves. *Petals* elliptic, blunt, spreading at right angle to the sepals. *Lip* deep reddish-violet, panduriform, truncate at the base with two rounded auricles; the anterior part expanded and deeply serrate except at the bifid apex; upper surface slightly concave, but with two elliptic thickened processes extending to the apex.

*Flowering*: October - December.

*Distribution*: Himalaya 1500-2000 m (Kumaun to Arunachal Pradesh), Meghalaya. China and Thailand.

*Specimens examined*:

KUMAUN: Pithoragarh-Dafiadhura, Arora 52439, 66169, 66182 & 66184.

The lip is not like as figured by King & Pantling (t. 216), but on the other hand it is closer to Lindley's fig. 5, in *Sert. Orchid*. Seidenfaden remarks about this discrepancy and point out on the sheet that either King & Pantling are wrong in calling their plant as *I. bicolor* or their drawing is not correct.

### Thelasis Blume

Epiphytes. *Stem* pseudobulbous, bearing 1-2 terminating leaves with some sheaths. *Leaves* narrow oblong, flat or loriform. *Inflorescence* from the base of the pseudobulb, sparsely sheathed. *Flowers* minute, in spikes, inverted. *Sepals* connivent, sub-equal, concave, keeled or winged, not widely spreading. *Petals* equal to the sepals, narrow. *Lip* equal to the sepals, sessile, on the base of the column, concave, erect, ovate or oblong, undivided, not spurred. *Column* short without a foot. *Anther* 2-chambered, elongated; *pollinia* 8, minute, globose, attached by granular elastic threads to the slender caudicle; gland long, linear.

**Thelasis longifolia** Hook. f., Fl. Brit. Ind. 6: 87. 1890. et lc. Pl. t. 2155. 1893; King & Pantl. 250, t. 332. 1898; Seidenf. & Arora, 25. 1982.

(Fig. 252)

*Pseudobulbs* conical, 12-15 mm wide. *Leaf* solitary on the apex of pseudobulb, 10-15 × 1.2-1.7 cm, sessile, narrowly oblong to oblanceolate. *Scape* from a developing pseudobulb, 18-20 cm long, sheathed at the base; the raceme 4-5 cm long, many flowered. *Flowers* green, 5 mm long. *Bracts* broadly ovate, acute, shorter than the ovary. *Sepals* without keels; the laterals ovate, blunt, the dorsal longer and narrower than the laterals. *Petals* narrowly ovate, acute. *Lip* elliptic, blunt, minutely bifid at the apex, otherwise entire, somewhat thickened in the middle near the base, the upper surface smooth.

*Flowering*: July - August.

*Distribution*: Himalaya 1400 m (Kumaun, Sikkim and Arunachal Pradesh), Meghalaya.

*Specimen examined*:

KUMAUN: Pithoragarh-Askot, Arora 70802.

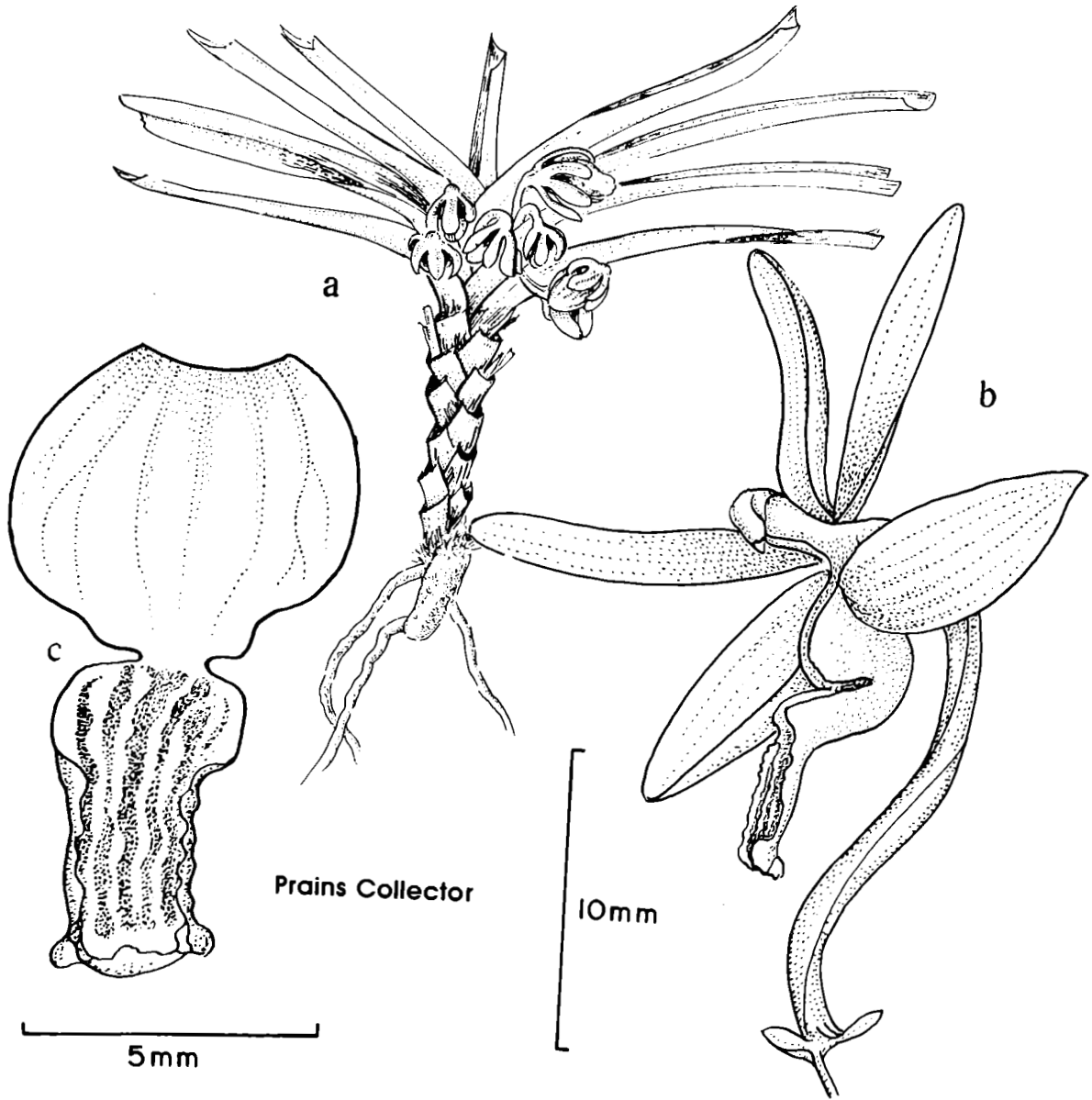


Fig. 253 *Vanda alpina* (Lindl.) Lindl.—a. plant; b. flower; c. lip.

### Vanda R. Br.

Epiphytes. *Stem* long with vermiform roots. *Leaves* thickly coriaceous or fleshy, flat or keeled, bilobed at the apex. *Inflorescence* axillary simple raceme. *Flowers* usually large and handsome. *Sepals* and *petals* nearly equal, narrowed to the base, spreading or connivent, the edges more or less reflexed or crisped. *Lip* smaller than sepals, its base saccate or spurred, attached immovably to short column or foot, 3-lobed; lateral lobes erect, large or small, rarely absent, close to the column; mid lobe fleshy, varying in shape, the disc usually ridged or lamellate, sometimes crenulate. *Column* short, thick, stout, foot short or absent. *Anther* 2-celled; *pollinia* 2 cleft, subglobose or obovoid, waxy; *stipe* broad or short, or long and geniculate, gland usually large.

#### Key to species

1. Sepals and petals widely spreading; peduncle of the inflorescence long; lip with a distinct conical spur projecting much beyond the lateral sepals, apex without horn like fleshy beak, petals obovate, spatulate with a claw .....2
- + Sepals and petals incurved, not spreading; peduncle of the inflorescence short, flowering almost from the base; lip without a distinct spur, with a rounded conical or a shallow sac, not projecting or only projecting little below the lateral sepals, petals oblong without a claw.....3
2. Flowers large; sepals and petals more than 15 mm long, lateral lobes of the lip obliquely elliptic, sub-falcate, acute to acuminate; spur hairy inside..... *V. tessellata*
- + Flowers smaller; sepals and petals 8 mm or less long; lateral lobes of the lip broadly oblong with a broad rounded apex; spur not hairy inside..... *V. testacea*
3. Inflorescence long, equal or slightly shorter than the leaves, 2-5 (-rarely more) flowered; flowers large; dorsal sepal 20-25 mm long; lip with a rounded or rarely conical base not or little projecting beyond the lateral sepal, apex of the lip distinctly 2-3 lobate..... *V. cristata*
- + Inflorescence very short, not reaching much beyond the base of the leaf, 1-2 flowered; flowers small; dorsal sepal 15 mm or less in length; sac of lip shallow or deep, base rounded or conical projecting below the lateral sepals, apex of the lip truncate or retuse.....4
4. Lip with a shallow sac, with rounded base, side lobes small, rounded, apex retuse..... *V. alpina*
- + Lip with a conical sac, projecting below the lateral sepals, lateral lobes small, triangular, oblong, apex truncate or retuse..... *V. pumila*

**Vanda alpina** Lindl. Fol. Orch. Vanda 10. 1853; Hook. f., 6: 53. 1890; King & Pantl. 217, t. 289. 1898; Duthie, 164; 1906; Katakai et al. 5: 33. 1984. (Fig. 253)

*Stem* 15-30 cm long. *Leaves* many, 7-10 × 1.5-2.8 cm, narrowly oblong, conduplicate, unequally bilobed at the apex, dilated towards the base. *Inflorescence* a raceme, very short not reaching much beyond the base of the leaf, 1-2 flowered. *Flowers* nodding, partly open, 2 cm across, greenish. *Sepals* and *petals* sub-equal, connivent, oblong, blunt, dorsal sepal 12 mm or less long, petals narrower than sepals. *Lip* adnate to the column, gibbous at base, 3-lobed, lateral lobes shallow, rounded; mid lobe retuse, not lobulate, beak present or absent.

*Flowering*: June - July.

*Distribution*: Himalaya 1500 m (Garhwal to Arunachal Pradesh) Meghalaya, Manipur, Nagaland, Mizoram.

GARHWAL: Garhwal *T. Thomson*.

KUMAUN: *Strachey & Winterbotton 22* (Authority Duthie, 1906).

Fig. 253 drawn after a specimen collected by Prain's coll. from Eastern India.

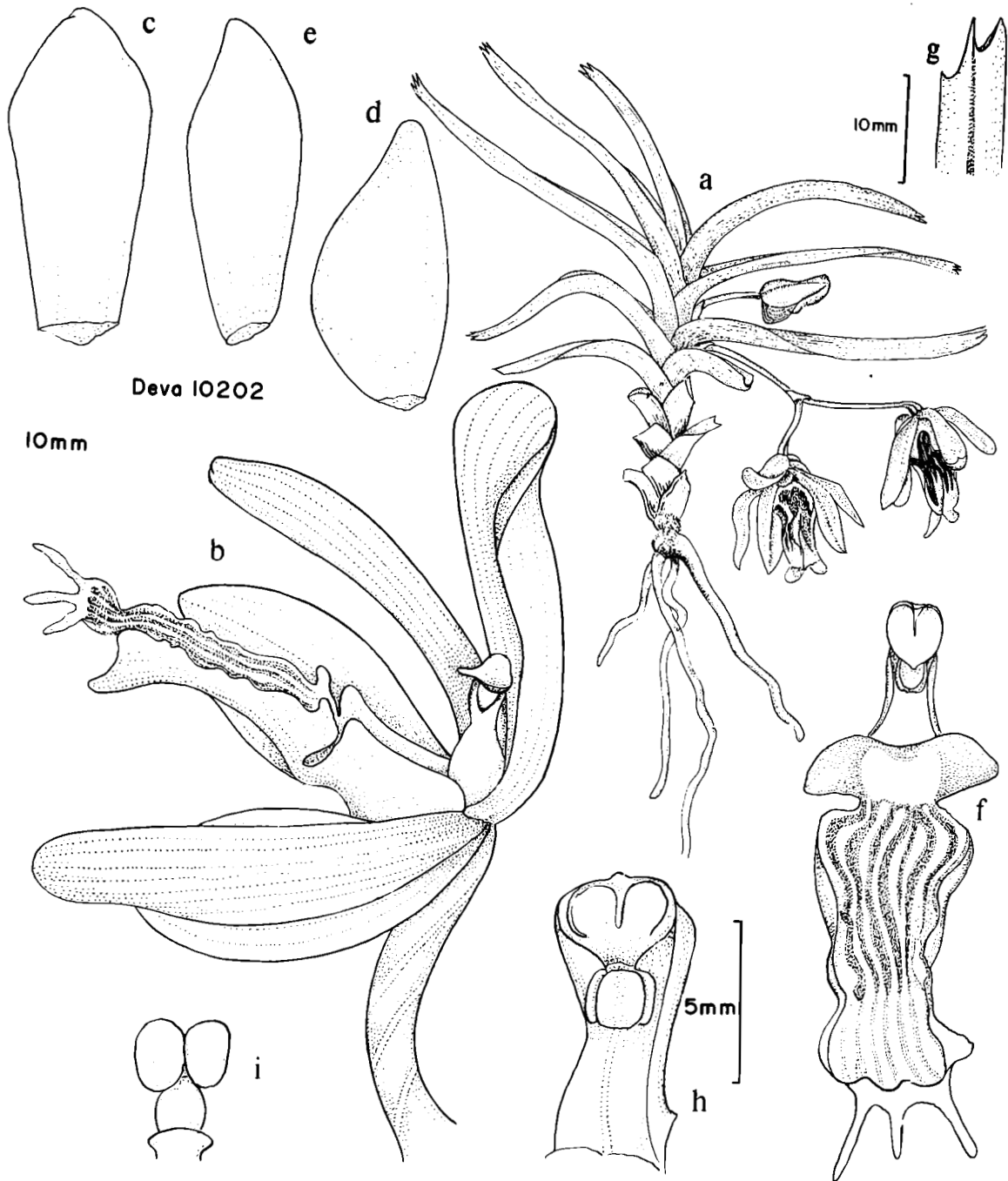


Fig. 254 *Vanda cristata* Lindl.—a plant; b. flower; c. dorsal sepal; d. lateral sepal; e. petal; f. column & lip; g. leaf tip; h. column; i. pollinia.

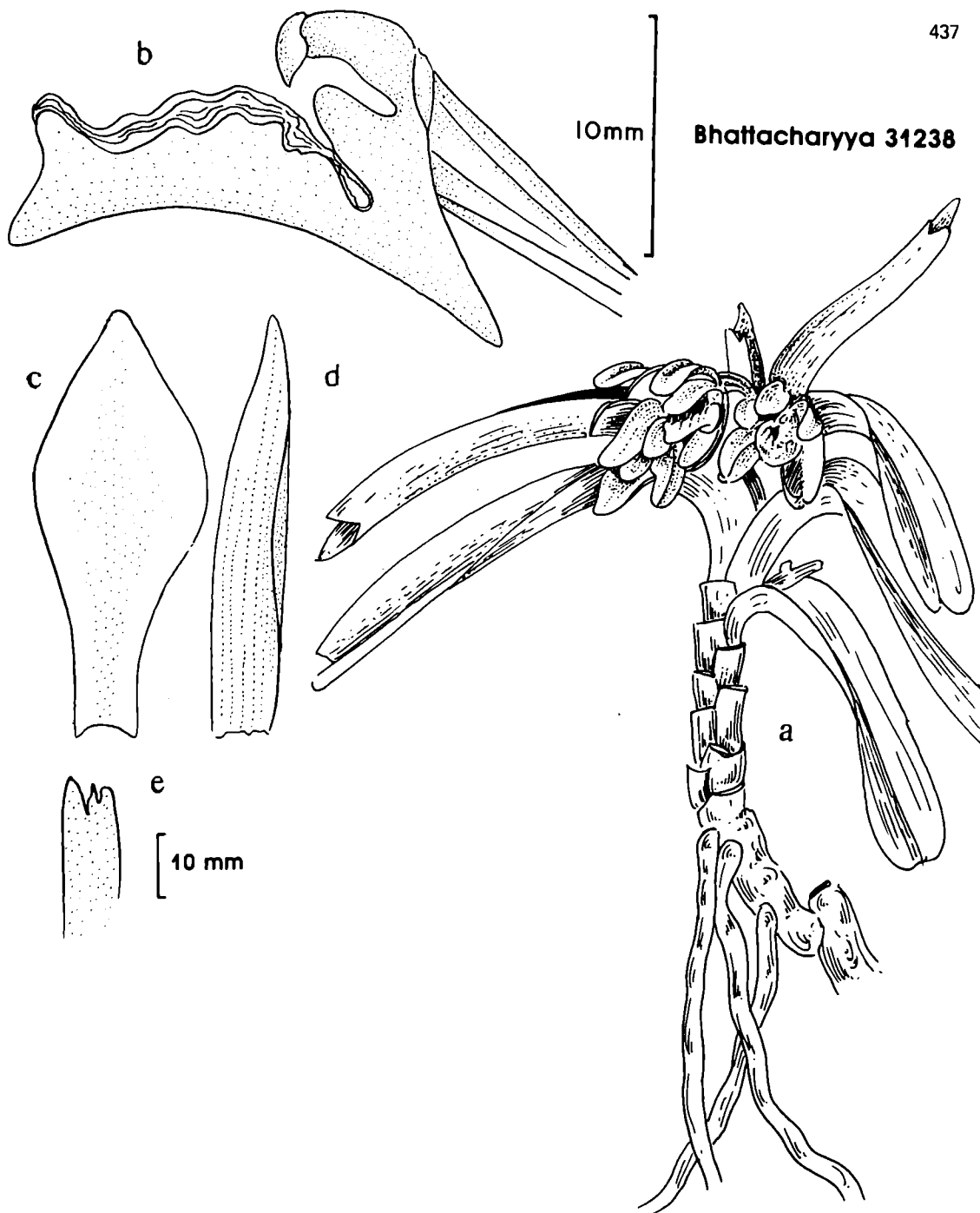


Fig. 255 *Vanda pumila* Hook. f.—a. plant; b. column and lip; c. dorsal sepal; d. petal; e. leaf tip.

Kalakoti

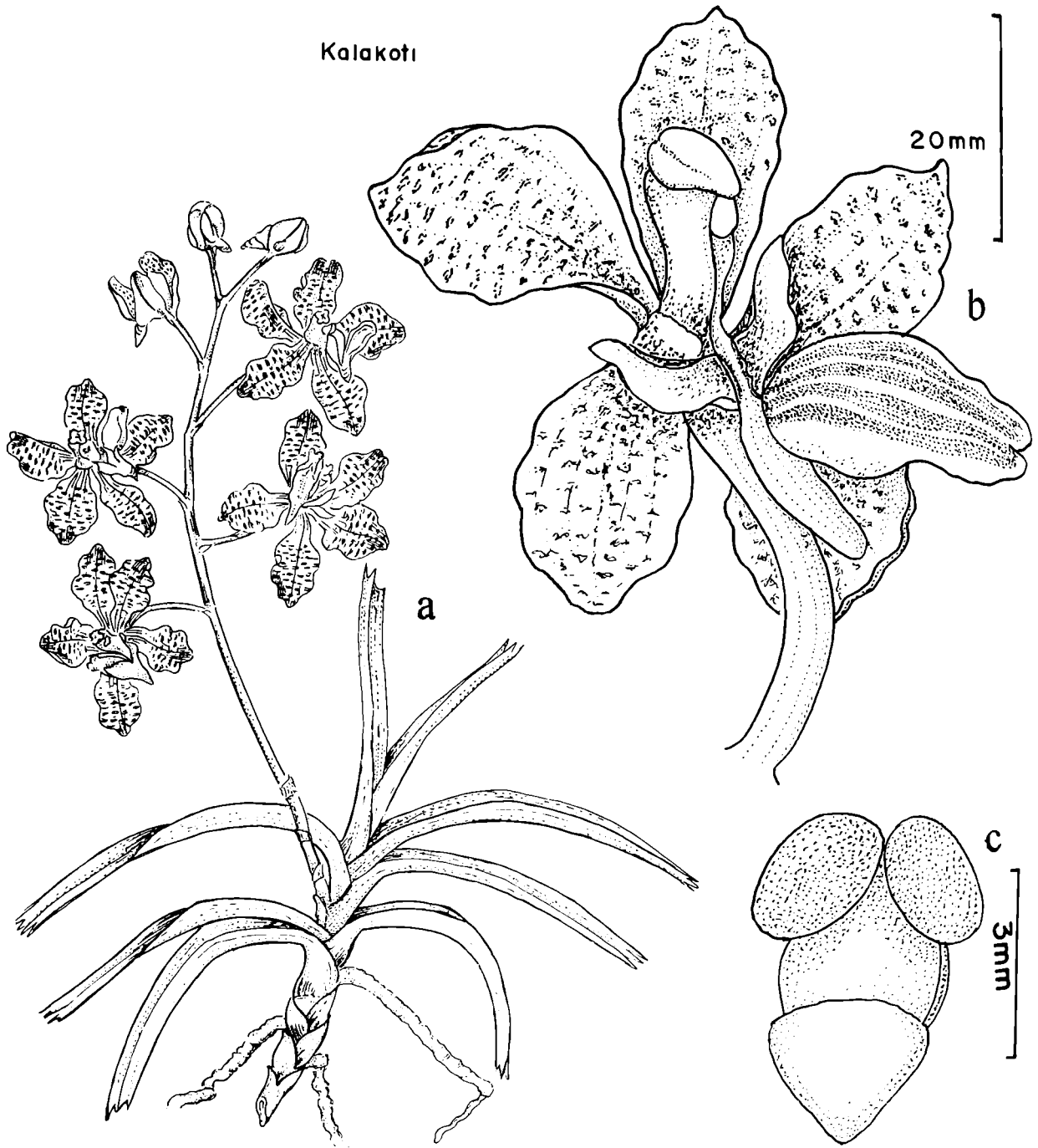


Fig. 256 *Vanda tessellata* (Roxb.) Hook. — a. plant; b. flower; c. pollinia.



**Vanda cristata** Lindl. Gen. & Sp. Orch. 216. 1833: Hook. f., 6: 53. 1890; King & Pantl. 216. t. 287. 1898; Duthie, 146. 1906. (Fig. 254)

*Stem* up to 15 cm tall, erect, stout, covered with remains of old sheaths. *Leaves* bifarious, crowded, 7.5-10 × 1.5-2.8 cm, narrowly oblong, bilobed at the apex. *Inflorescence* raceme, equal or slightly shorter than the leaves, 2-5-flowered. *Flowers* 4-5 cm across, yellowish or olive green with purplish blotches. *Sepals* and *petals* sub-equal, oblong, obtuse, the petals narrower than sepals. *Lip* adnate to the base of the column, longer than the sepals, green blotched with dull purple-brown, 3-lobed; lateral lobes erect, triangular; mid lobe oblong, 2-3 lobulate and with a horn like fleshy beak pointing downwards.

*Flowering*: May.

*Distribution*: Himalaya up to 1800 m (Garhwal to Arunachal Pradesh), Meghalaya, Madhya Pradesh. Bangladesh.

*Specimens examined*:

GARHWAL: **Dehra Dun**-Near Mussoorie, *Mackinnon* 21785; Mussoorie near Jharipani, *Deva* 4161, *Naithani* 1001. **Tehri**-Agrakhal, *Deva* 10202. **Uttarkashi**-Near Dharasu, *Sahni* 24767. **Pauri**-Outer Garhwal hills, *Inayat* 25827; Khirsu, *Rao* 55396. **Chamoli**-Mandal, *M.A. Rau* 2859; Pokhari, *Naithani* 63757.

KUMAUN: **Pithoragarh**-Tawaghat, *Rao* 11692; Didihat, *Arora* 41335; Askot, *Arora* 66107, *Pant* 31843; Baram, *Bhattacharyya* 21178 (Flowers smaller with a conical base of the sac.). **Nainital**-Sat Tal, *Kalakoti* 534. **Almora**-Kanali-Chinna, *Sahni* 20402.

Hook. f., 53. 1890 mentioned a short, obtuse spur and King & Pantling 216, t. 287 described it as being widely infundifulliform half as long as the stalked ovary. The specimens from North Western Himalaya which we have examined (fig. 254) definitely show no spur and only a wide saccate base. The apex of the apical lobe of lip is quite often 2-lobulate, instead of 3-lobate, and the lobes are caducous and fall down as the flower becomes older and quite often when being dried in press. In such starved specimens where the raceme is smaller and number of the flowers only two, it can easily be mistaken with *V. alpina*.

**Vanda pumila** Hook. f., Fl. Brit. Ind. 6: 53. 1890; King & Pantl. 216, t. 288. 1898; Bhattacharyya, 163. fig. 3. 1969. (Fig. 255)

*Stem* 10-15 cm high, stout, covered with old sheaths. *Leaves* numerous, narrowly oblong, unequally bilobed at the apex, 7-10 × 1.5-3 cm, dilated towards the base. *Inflorescence* shorter than leaves, 2-4 flowered. *Flowers* 2.5 cm across, drooping, cream-coloured, lip with red markings, sweetly fragrant. *Bracts* minute. *Sepals* and *petals* sub-equal, up to 20 mm long, the lateral sepals slightly broader, oblong, obtuse, curved, connivent. *Lip* shorter than the sepals, the base with a conical sac projecting below the lateral sepals, 3-lobed; lateral lobes small, triangular, oblong, apex truncate or retuse; midlobe fleshy, broadly ovate, apex truncate, the upper surface with two small knobs near the apex and 4-6 thick ridges in the centre.

*Flowering*: May.

*Distribution*: Himalaya 500-650 m (Kumaun to Arunachal Pradesh), Meghalaya.

*Specimen examined*:

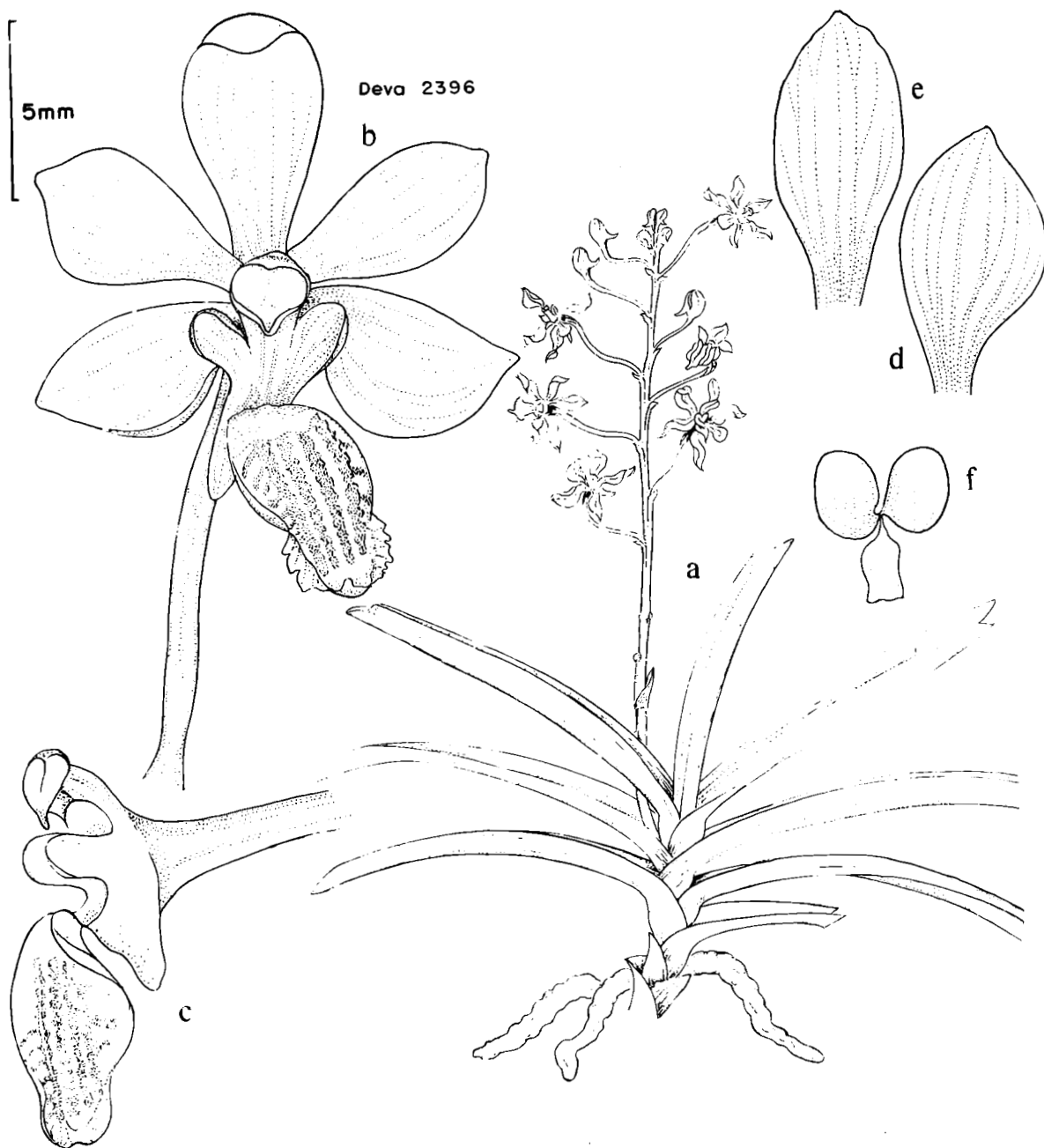
KUMAUN: **Pithoragarh**-Gori Valley, Lumit, *Bhattacharyya* 31238.

**Vanda tessellata** (Roxb.) Hook. ex G. Don in London, Hort. Brit. 372. 1830.

*Epidendrum tessellatum* Roxb. Cor. Pl. 1: 34. t. 42. 1795.

*V. roxburghii* R. Br. in Edgw. Bot. Reg. 6: t. 506. 1820; Hook. f., 6: 52. 1890; Duthie, 145. 1906. (Fig. 256)

*Stem* erect 30 cm long. *Leaves* several, distichous, 10-20 × 1-1.2 cm, linear, keeled, articulate at base, unequally bilobed at the apex. *Inflorescence* a raceme, axillary, 3-10 flowered, longer than leaves, zigzag.



**Fig. 257** *Vanda testacea* (Lindl.) Rchb. f.—a. plant; b. flower; c. column and lip; d. lateral sepal; e. petal; f. pollinia.

*Flowers* 3.5-5 cm across, yellowish-green, with blue tinge, scented. *Bracts* suborbicular, obtuse. *Sepals* and *petals* sub-equal, spreading, clawed, wavy, more than 15 mm long. *Lip* shorter than the sepals, yellow, 3-lobed; lateral lobes obliquely elliptic, subfalcate, acute or acuminate: mid lobe pink or purple dotted, thick, panduriform, apex 2-3 lobed. *Spur* conical, hairy inside.

*Flowering*: June - July.

*Distribution*: Himalaya up to 1000 m (Garhwal to Bhutan), Tripura, Bengal, Bihar, Orissa, Upper Gangetic plain, Madhya Pradesh, Gujarat, Konkan, N. Kanara, Southern Peninsular India, Sri Lanka.

*Specimens examined*:

GARHWAL: **Pauri-Pauri**, *Osmaston*.

KUMAUN: **Nainital**-Haldwani, *M.A. Rau* 5377, *Kalakoti*.

Ayurvedists consider the root antipyretic and an antidote for poisoning; they use it in dyspepsia, bronchitis, inflammation, rheumatic pains, hicough, tremors and diseases of the abdomen. Yunani practitioners hold it to be laxative, and tonic to the liver and the brain; they prescribed it for bronchitis, piles, lumbago, toothache and boils on the scalp; they further say that it lessens inflammation and heals fracture (Caius, 1936).

**Vanda testacea** (Lindl.) Rchb. f. in Gard. Chron. 2: 166. 1877.

*Aerides testaceum* (Lindl) Gen. & Sp. Orch. 238, 1833.

*V. parviflora* Lindl. in Edw. Bot. Reg. 30 (misc.): 45, 1844; Hook. f., 6: 50. 1890; King & Pantl. 215, t. 236, 1898; Duthie, 144, 1906. (Fig. 257)

*Stem* 10-30 cm long, thick, sheathed. *Leaves* distichous, 7-10 × 1-1.3 cm, linear, keeled, unequally and obtusely bilobed at the apex. *Inflorescence* raceme, axillary, erect, as long as the leaves. *Flowers* yellow, 1.5 cm across, long pedicellate. *Bracts* small, ovate, acute. *Sepals* 8 mm or less, spatulate, yellow, obtuse spreading; the lateral pair shorter. *Petals* 8 mm or less, spatulate-oblong, obtuse falcate, spreading, yellow, as long as the lateral sepals. *Lip* adnate to the foot of the column, reflexed, spurred, trilobed; lateral lobes erect, broadly oblong with a broad rounded apex; mid lobe ligulate, fleshy, oblong or cuneate-obovate, apex dilated, truncate or retuse or obscurely lobulate, crenulate. *Spur* slender, conical, half as long as the lip, hairy inside.

*Flowering*: May - June.

*Distribution*: Himalaya up to 1000 m (Himachal Pradesh to Arunachal Pradesh), Assam, Orissa, Bihar, Madhya Pradesh, Gujarat, W. Ghats, N. Kanara, Southern Peninsular India in Hilly tracts. Burma and Sri Lanka.

*Specimens examined*:

GARHWAL:**Dehra Dun**-Dehra Dun, Laxmansidh, *Deva* 2390, *Kirki*21418; Siwalik Mohand, *Deva* 4177, *Arora*38855; Lachiwala, T.A. Rao 3215; New Forest, *Naithani* 1118. **Tehri**-Byasi, *Deva*2563. **Pauri**-Outer Garhwal hills, *Inayat* 25824 & 25825.

KUMAUN: **Pithoragarh**-East Almora Division, *Bis Ram*2194; Vasavgad, *Bhattacharyya*21361; Askot, *Arora* 36483. **Nainital**-Bij Rani, *Pant*43597.

HIMACHAL PRADESH: Nahan, Renukalake, *M.A. Rau* 11384.

#### **Vandopsis** Pfitz.

Epiphytic. *Stem* rigid, internodes short. *Leaves* coriaceous, flat or keeled, spreading. *Inflorescence* stout, extra axillary raceme. *Flowers* large. *Sepals* and *petals* almost equal, spreading. *Lip* attached to the base

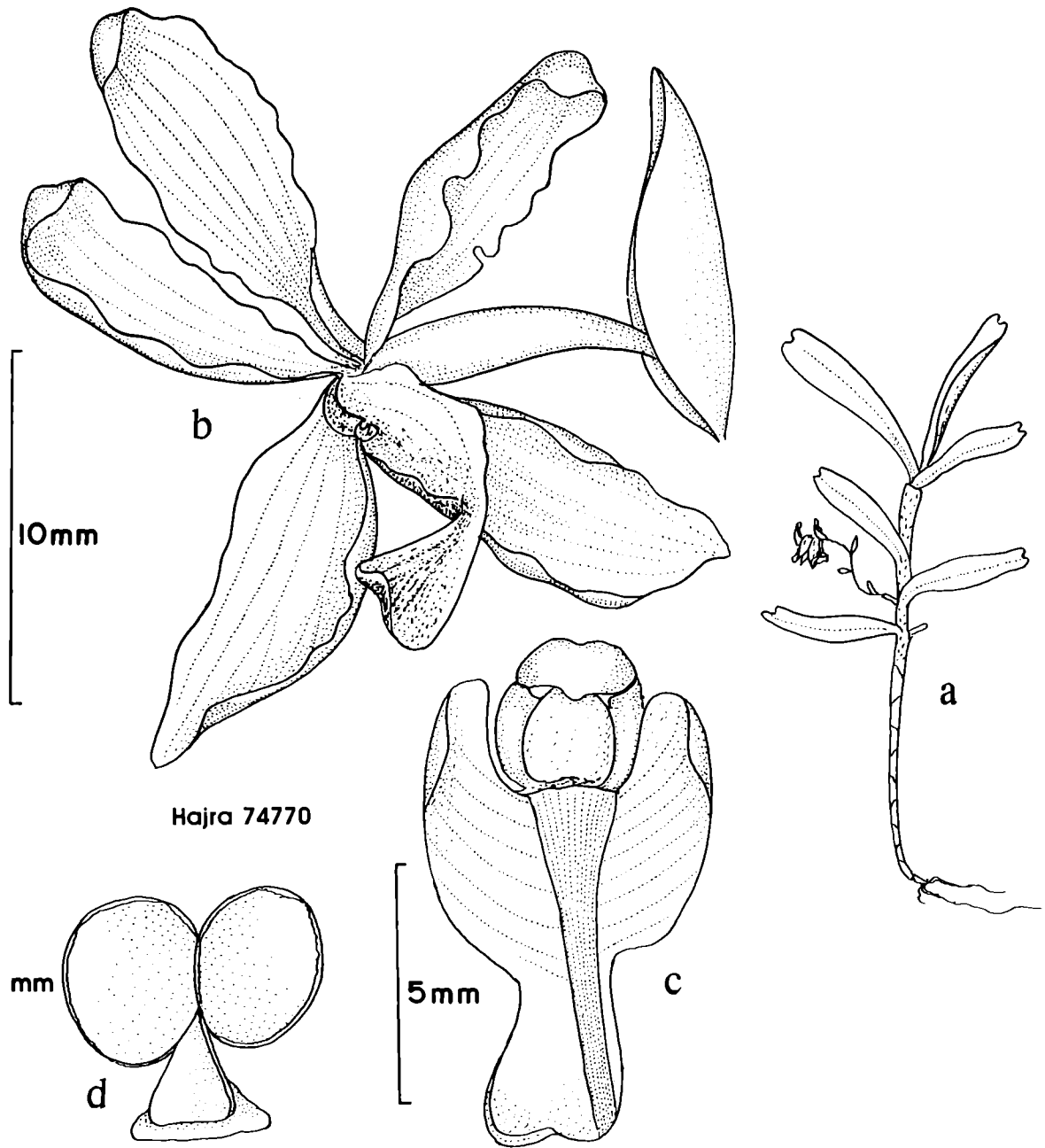


Fig. 258 *Vandopsis undulata* (Lindl.) J.J. Smith—*a.* plant; *b.* flower; *c.* lip & column; *d.* pollinia.

of the column by the lateral lobes; mid lobe long, fleshy laterally flattened, keeled. *Column* short with a projection in front of its base; *pollinia* 4, flat, almost equal, in two pairs, on a short broad thin stipe with recurving edges, gland broad.

**Vandopsis undulata** (Lindl.) J.J. Smith in *Natuurk. Tijdschr. Ned.-Indie* 72: 77. 1912; Hajra & Kothari, 161. Pl. 1. 1983.

*Vanda undulata* Lindl. in *J. Proc. Linn. Soc. Bot.* 3: 42. 1859; Pradhan, 2: 566. 1978.

*Stauroopsis undulatus* (Lindl.) Benth. ex Hook. f., *Fl. Brit. Ind.* 6: 27. 1890; King & Pantl. 205. t. 275. 1898.  
(Fig. 258)

*Stem* 20-40 cm long, climbing or erect, minutely warted. *Leaves* many, narrowly oblong, 7-10 × 1.8-2 cm, flat, unequally lobed at the apex. *Peduncle* leaf opposed, stout, 15-20 cm long, rigid, warty; raceme lax, few flowered near the top. *Flowers* 3-4 cm across, white flushed pink. *Bracts* broad, obtuse. *Sepals* and *petals* with undulate margin, fleshy, reflexed. *Lip* adnate to the base only of the column, as long as the sepals, yellowish-green striped pink, 3-lobed; lateral lobes large, rounded, erect, embracing the column; mid lobe concave. *Disc* with 2 keels running from base nearly to the apex.

*Flowering*: April - May.

*Distribution*: Himalaya (Kumaun to Arunachal Pradesh), Assam, Meghalaya.

*Specimen examined*:

KUMAUN: Pithoragarh-Jauljibi-Baram Road, Hajra 74770.

## REFERENCE

- Abraham, A. & P. Vatsala 1981. Introduction to Orchids - Trivandrum.
- Arora, C.M. 1969. New records of some orchids from western Himalaya - *Bull. bot. Surv. India* 11: 202-204.
- Arora, C.M. 1969. New records of some orchids from western Himalaya 2. - *Bull. bot. Surv. India* 11: 430.
- Arora, C.M. 1969. New records of some orchids from western Himalaya 3. - *Bull. bot. Surv. India* 11: 437-438.
- Arora, C.M. 1969. A new species of *Bulbophyllum* Thou. (Orchidaceae) from eastern Kumaun. - *Bull. bot. Surv. India* 11: 440-441.
- Arora, C.M. 1972. *Habenaria dentata* (Sw.) Schltr., a new record for India from western Himalaya. - *Bull. bot. Surv. India* 14: 155-156.
- Arora, C.M. 1972. New records of some orchids from western Himalaya 4. - *Bull. bot. Surv. India* 14: 173-175.
- Arora, C.M. 1978. New records of some orchids from north-west Himalaya 5. - *Ind. J. Forestry* 1: 297-298.
- Arora, C.M. 1980. New records of some orchids from north west Himalaya 6. - *Ind. J. Forestry* 3: 78-79.
- Arora, C.M. 1985 Flowering of some orchids in Dehra Dun India—*Amer. Orchid Soc. Bull.* 54: 322-324.
- Arora, C.M. & C.L. Malhotra 1979. *Gymnadenia camtschatica* (Cham.) Miyabe & Kudo (Orchidaceae). A new record for India. - *Ind. J. Forestry* 2: 311-312.
- Arora, Y.K. & R.K. Gupta 1983. Native ornamental orchids-conservation and cultivation of Endangered and Extinct species. *J. Econ. Tax. Bot.* 4: 393-411.
- Aswal, B.S. & B.N. Mehrotra 1979. New records of Plants from Himachal Pradesh - *Ind. J. Forestry* 2: 322.
- Balakrishnan, N.P. 1978. Our Orchids - *The Andaman & Nicobar information* 153-165.
- Balakrishnan, N.P. 1983. Flora of Jowai 2: 463-518. - Howrah.
- Balakrishnan, N.P. & M.K.V. Rao 1979. Critical notes on the status of *Microstylis andamanica* King & Pantl. & *Eulophia decipiens* Kurz. - *Bull. bot. Surv. India* 21: 177-179.
- Banerji, M.L. & P. Pradhan 1984. The orchids of Nepal Himalaya. J. Cramer, Vaduz.
- Babu, C.R. 1977. Herbaceous Flora of Dehra Dun 447-498. - New Delhi.
- Blatter, E. 1929. Beautiful Flowers of Kashmir 2: 155-165. - London.
- Bhattacharyya, U.C. 1969. New distributional records of orchids for West Himalaya - *Bull. bot. Soc. Bengal.* 23: 161-165.
- Bhattacharyya, U.C. & A.K. Goel 1982. *Aphyllorchis parviflora* King & Pantl. New distribution record of a rare Orchid from Tehri Garhwal - *J. Econ. Tax. Bot.* 3: 588-590.
- Bhattacharyya, U.C., C.M. Arora & C.L. Malhotra 1982. The Danger of vanishing orchid species in North West Himalaya - *The Vegetational Wealth of Himalaya* 249-255 - Delhi.
- Bose, T.K., & S.K. Bhattacharjee 1980. Orchids of India - Calcutta.
- Bruhl, P. 1926. A guide to the orchids of Sikkim 1-208 - Calcutta.
- Burkill, I.H. 1965. Chapters on the History of Botany in India - Delhi.
- Caius, J.F. 1936. Medicinal and poisonous orchids of India. *J. Bombay nat. Hist. Soc.* 38: 791-799.
- Chen, S.C. & T. Tang 1979. A general review of the orchid flora of China. *Phytogeography* 2: 40-81.
- Chowdhury, H.J. & B.M. Wadhwa 1984. Orchidaceae In: Flora of Himachal Pradesh 3: 680-693 - Howrah.
- Collett, H. 1902. Flora Simlensis 289-508 - London.
- Coventry, B.O. 1923. Wild flowers of Kashmir ser. 1: 89-94 - London.
- Cribb, P.J. & D. Dupuy 1983. *Cymbidium longifolium* and *C. elegans* (Orchidaceae) - *Kew Bull.* 38: 65-67.

- Dakshini, K.M.M. 1974. Flora of Mothronwala swamp forest (District Dehra Dun, U.P. India) - *J. Bombay nat. Hist. Soc.* 71: 239.
- Das, S. & S.K. Jain 1980. Orchidaceae: Genus *Coelogyne* - *Fasc. Fl. Ind.* 5: 1-33.
- Deb, D.B. 1961. Monocotyledenous plants from manipur territory - *Bull. bot. Surv. India* 3: 126-129.
- Deb, D.B. 1983. The flora of Tripura State 2: 446-467. - New Delhi.
- Deva, S. 1969. Two new records of orchids from Dehra Dun. - *Indian Forester* 95: 268-269.
- Deva, S. 1978. New or little known plants from Garhwal Himalaya 2. - *Ind. J. Forestry* 1: 345-348.
- Deva, S. 1980. New or little known plants from Garhwal Himalaya 3. - *Ind. J. Forestry* 3: 148-153.
- Deva, S. 1982. *Malaxis biauurita* (Lindl.) O. ktze. A new record for north Western Himalaya. - *Ind. J. Forestry* 5: 242-244.
- Deva, S. & C.M. Arora. 1971. On the occurrence of *Tropidia curculigoides* Lindl. at Golatappar, Dehra Dun - *Indian Forester* 97: 699-700.
- Dhar, U & P. Kachroo 1983. Alpine flora of Kashmir Himalaya - Jodhpur.
- Duthie, J.F. 1906(a). Catalogue of the Kumeaon plants and the adjacent portion of Garhwal and Tibet 172-183 - London.
- Duthie, J.F. 1906. The orchids of north-west Himalaya - *Ann. Roy. Bot. Gard. Calcutta* 9: 81-211.
- Duthie, J.F. 1920. Flora of the upper Gangetic plain 2. - Calcutta.
- Fischer, C.E.C. 1928. Orchidaceae - In: Gamble, Flora of the Presidency of Madras 3: 1399-1478 - London.
- Fischer, C.E.C. 1938. The Flora of Lushai hills - *Rec. bot. Surv. India* 12(2): 135-143.
- Goel, A.K. & U.C. Bhattacharyya 1982. Rediscovery of three rarely collected plants from North-Western Himalaya - *Ind. J. Forestry* 5: 17-20.
- Good, R. 1964. The geography of the flowering plants - Longmans, Green, London.
- Grant, C.B. 1895. The orchids of Burma - Rangoon.
- Gupta, R. 1966. *Orchis latifolia* Linn. - A little known economic plant of North-Western Himalaya - *Indian Forester* 92: 701-703.
- Gupta, R.K. 1955. Botanical explorations in the Bhillangana Valley of erstwhile Tehri-Garhwal state. - *J. Bombay nat. Hist. Soc.* 53: 581-594.
- Gupta R.K. 1957. Botanical explorations in the erstwhile Tehri Garhwal state 2. - *J. Bombay nat. Hist. Soc.* 54: 878-894.
- Gupta, R.K. 1961. Flora of Lam Dal. - *Indian Forester* 87: 316-324.
- Gupta, R.K. 1962. Botanical explorations in the erstwhile Tehri Garhwal state 3. - *J. Bombay nat. Hist. Soc.* 59: 510.
- Gupta, R.K. 1968. Flora Nainitalensis - New Delhi.
- Haines, H.H. 1924. The Botany of Bihar & Orissa. 1150-1182 - London.
- Hajra, P.K. 1983. A contribution to the Botany of Nanda Devi Natinal Park - Howrah.
- Hajra, P.K. 1983. Threatened Plants of Western Himalayas. In Jain & Sastry's Materials for the Catalogue of threatened Plant of India 49-61.
- Hajra, P.K. 1983. Rare, Threatened and "Endemic plants of the Western Himalayas - Monocotyledons" - *Plant Conservation Bull.* 4: 1-13.
- Hajra, P.K. 1984. Leopard orchid from Pithoragarh district, Uttar Pradesh - *Indian Forester* 110: 686.
- Hajra, P.K. 1983. New species of *Listera* from Nandadevi National Park, Chamoli, District Uttar Pradesh - *Bull. bot. Surv. Ind.* 25: 181-182.
- Hajra, P.K. & M.J. Kothari 1983. On the occurrence of *Acan-pe rigida* (Buch.-Ham. ex Smith) P.F. Hunt and *Vandopsis undulata* (Lindl.) Smith (Orchidaceae) in Pithoragarh District - *Ind. J. Forestry* 6: 160-161.
- Hara, H. 1985. On typification of David Don's names, i.e. *Cymbidium longifolium* (Orchidaceae) - *Taxon* 34: 690-691.
- Hara, H., W.T. Stearn & L.H.J. Williams 1978: An enumeration of the flowering plants of Nepal 1: 30-58 - London.

- Hegde, S.N. 1980. Preliminary observations and list of orchids of Arunachal Pradesh. -*Arunachal Forest News* 3(3): 1-11.
- Hegde, S.N. & A.N. Rao 1982. *Epipogium sessanum* Hegde et Rao-A new species of orchid from Arunachal Pradesh, India - *J. Econ. Tax. Bot.* 3: 597-601.
- Hegde, S.N. & A.N. Rao 1983. Further contribution to the orchid flora of Arunachal Pradesh-I. - *J. Econ. Tax. Bot.* 4: 383-392.
- Hegde, S.N. & A.N. Rao 1984. Further contribution to the orchid flora of Arunachal Pradesh-II. - *Ind. J. Forestry* 7: 76-79.
- Holtum, R.E. 1964. A Revised Flora of Malaya 3rd ed. (Orchids of Malaya) - Singapore.
- Hooker, J.D. 1890. The Flora of British India 5: 667-858; 6: 1-198 - Ashford.
- Hooker, J.D. 1985. A century of Indian orchids - *Ann. Roy. Bot. Gard. Calcutta* 5(1): 1-68.
- Hooker, J.D. 1904. A sketch of the flora of British India - Oxford.
- Hooker, J.D. & T. Thomson 1855. Flora Indica - London.
- Hunt, P.F. 1970. Notes on Asiatic Orchids V - *Kew Bull.* 24: 75-99.
- Hunt, P.F. & C.G. Vosa 1971. The cytology and taxonomy of the genus *Pleione* D. Don (Orchidaceae) - *Kew Bull.* 25: 423-432.
- Hynniewta, T.M. 1978. Some new records of epiphytic orchids from Nagaland - *Bull. bot. Soc. Bengal* 32: 13-17.
- Hynniewta, T.M. 1979. Some additions to our knowledge of terrestrial orchids of Nagaland - *J. University Gauhati* xxvi-xxvii: *Science* 48-50.
- Issar, R.K. & M.R. Uniyal 1967. Orchids of Uttarakhand Himalayas. - *Indian Forester* 67: 713-716.
- Jain, S.K. & A. Mehrotra 1984. A Preliminary Inventory of Orchidaceae in India - Howrah.
- Jayaweera, M.D. 1981. Orchidaceae: In Dassanayake & Flora Fosberg Ceylon 2: 4-386. New Delhi.
- Joseph, J. 1982. Orchids of Nilgiris - *Rec. bot. Surv. Ind.* 22: 1-144.
- Joseph, J. 1984. Flora of Nongpoh and Vicinity East Khasi Hills District, Meghalaya 258-301 - Shillong.
- Joseph, J. & M.K.V. Rao 1981. Himalayan orchids in Peninsular India. *Bull. bot. Surv. India* 23: 165-169.
- Kachroo, P., B.L. Sapru & U. Dhar 1977. Flora of Ladakh. 148-149 - Dehra Dun.
- Kapoor, S.L. 1968. Material for a flora of the Doda district of Jammu & Kashmir state. - *Bull. bot. Surv. India* 10: 28-49.
- Kapoor, S.L., P.C. Sharma, D.P. Badola & L.D. Kapoor, 1977. A botanical trip to Moralkanda (Himachal Pradesh) - *J. Bombay nat. Hist. Soc.* 73: 329-347.
- Kataki, S.K. 1984. Lady's sleeper Orchid in India 1-24. - Howrah.
- Kataki, S.K., S.K. Jain & A.R.K. Sastry 1984. Distribution of Orchids of Sikkim & North - Eastern India. - *Plant Conservation Bull.* 5: 1-38. - Howrah.
- Kaushik, P. 1983. Ecological and anatomical marvels of the Himalayan orchids - New Delhi.
- King, G. 1983. Scientific botany. -In: Atkinson, E.T. (ed.), The Himalayan districts of the NW Provinces of India 1: 299-322. The Gazetteer NW Provinces 10 - Allahabad.
- King, G. & R. Pantling 1898. The orchids of Sikkim Himalaya. - *Ann. Roy. Bot. Gard. Calcutta* 8: 1-212.
- Lal, J. & A. Kumar 1983. Contribution to the botany of Madhya Pradesh VIII (Monocot: Hydrocharitaceae to Eriocaulaceae) - *J. Econ. Tax. Bot.* 4: 421-434.
- Lang, Kar-yung 1980. A study on the geographical distribution and floristic features of the Xizang (Tibet) orchid flora, - *Act. Phytotax. Sinica* 18: 391-407.
- Malhotra, C.L. 1966. New distribution records of plants from the upper Gangetic plain. - *Bull. bot. Surv. India* 8:77.



- Malhotra, C.L. 1969. *Nervilia crispata* (Bl.) Schltr. A new record for the upper Gangetic plain. - *Bull. bot. Surv. India* 11: 208.
- Malhotra, C.L. & B. Balodi 1984. A new species of *Eulophia* R. Br. (Orchidaceae) from Gori Valley. - *Bull. bot. Surv. Ind.* 26: 92-94.
- Malhotra, C.L. & B. Balodi 1984. A new species of *Corallorhiza* Gagnebin from Gori Valley. - *Bull. bot. Surv. Ind.* 26: 108-109.
- Malhotra, C.L. & B. Balodi 1984. A new variety of *Bulbophyllum reptans* (Lindl.) Lindl. from Gori Valley. - *Bull. bot. Surv. Ind.* 26: 110-111.
- Malhotra, C.L. & B. Balodi 1985. *Herminium mackinnon* Duthie - An overlooked species from Kumaun - *J. Econ. Tax. Bot.* 6: 465-466.
- Malhotra, C.L. & S. Singh 1983. *Oberonia prainiana* King & Pantl. (Orchidaceae) a record for North West Himalaya *Ind. J. Forestry* 6: 337-338.
- Mehra, P.N. & Kashyap 1978. In 10 PB Chromosome Number Report 60 - *Taxon* 27: 226.
- Mehrotra, B.N. & B.S. Aswal 1985. The flora of Mandakini Valley (Garhwal Himalaya) - *J. Econ. Tax. Bot.* 6: 619-620.
- Misra, S. 1980. Additions to the orchidaceous flora of Orissa - *Bull. bot. Surv. India* 22: 147-156.
- Misra, S. 1982. Additions to the orchidaceous flora of Orissa-II. *J. Orissa Bot. Soc.* 4: 23-32.
- Mitra, J.N. 1958. Flowering plants of Eastern India 1: 261-357 - Calcutta.
- Mitra, S.N. 1973. Some new combination in Indian plants - *Indian Forester* 99: 100-101.
- Mukerjee, S.K. 1972. Orchids of the plains of North Bengal - *Bull. bot. Surv. Ind.* 14: 92-103.
- Mukerjee, S.K. 1983. Orchids - New Delhi.
- Nair, N.C. 1964. On a botanical tour to Lahul and Spiti (Punjab Himalaya). - *Bull. bot. Surv. India.* 6: 219-236.
- Nair, N.C. 1966. Two interesting orchids from NW Himalaya - *J. Bombay nat. Hist. Soc.* 63: 461-462.
- Nair, N.C. 1977. Flora of Bashahr Himalaya 270-279 - Hissar.
- Nair, N.C. 1978. Flora of the Punjab plains *Rec. bot. Surv. India* 21: 246-247.
- Naithani, B.D. 1969. Plant collections with the Kedarnath Parbat expedition 1967. - *Bull. bot. Surv. India* 11: 224-233.
- Naithani, B.D. 1985. Orchidaceae in Fl. Chamoli 2: 603-636. Howrah.
- Naithani, H.B. & S.C. Tiwari 1983. Flowering plants of Pauri and its vicinity - *Ind. J. Forestry* 6: 109.
- Naithani, H.B., A.N. Rao & K. Haridasan 1985. Some additions to the Orchid flora of Arunachal Pradesh. *Ind. J. Forestry* 8: 333-334.
- Pandey, H.C. 1982. New distributional records of plants from Kumaun (Uttar Pradesh) - *Ind. J. Forestry* 5: 154.
- Pangtey, Y.P.S. & B.S. Kalakoti 1983. A note on the occurrence of *Cheirostylis griffithii* Lindl. (Orchidaceae) from Western Himalaya - *Ind. J. Forestry* 6: 170.
- Panigrahi, G. 1985. Notes on *Acampe papillosa* Lindl. nom illeg. (Orchidaceae) - *Taxon* 34: 688-689.
- Panigrahi, G. & P. Taylor 1975. A new species of *Listera* (Orchidaceae) from Himalaya - *Kew Bull.* 30: 559-561.
- Pradhan, U.C. 1976. Indian orchids: Guide to identification & Culture 1 - Calcutta.
- Pradhan, U.C. 1979. Indian orchids: Guide to identification & Culture 2 - Faridabad.
- Pradhan, U.C. 1982. Himalayan plant red data sheet-3. - *Himal. Plant J.* 2: 49-51.
- Prain, D. 1903. Bengal plants 2: 998-1034 - Calcutta.
- Raizada, M.B. 1941. New or little known plants from Kumaon - *Indian Forester* 67: 15-23.
- Raizada, M.B. & H.B. Naithani, H.O. Saxena, 1981. Orchids of Mussoorie - Dehra Dun.
- Rao, A.N. 1985. *Habenaria seshgiriana* Nageshwar Rao-A new name for *H. polytricha* (Hook. f.) Pradhan (Orchidaceae) *J. Econ. Tax. Bot.* 6: 223-226.

- Rao, A.S. 1963. *Nervelia crispata* (Bl.) Schltr. - *Bull. bot. Surv. India* 5: 63.
- Rao, A.S. 1979. Orchids of India. - New Delhi.
- Rao, A.S. & N.P. Balakrishnan 1973. In Material for the flora of Bhutan - *Rec. bot. Surv. India* 20(2): 204-219.
- Rao, A.S. & C. Deori 1980. A primary census of the orchids of Kameng district Arunachal Pradesh. - *Ind. J. Forestry* 3: 255-260 & 328-335.
- Rao, T.A. 1959. Report on a botanical tour to Milan Glaciers. - *Bull. bot. Surv. India* 1: 117.
- Rao, T.A. 1960. A botanical tour to Pindari Glaciers and Kumaon hill stations. - *Bull. bot. Surv. India* 2: 88-89.
- Rao, T.A. 1961. A botanical tour to Kashmir state. - *Rec. bot. Surv. India* 18: 1-67.
- Rao, T.A. 1964. Observations on the vegetation of eastern Kumaon bordering the Nepal frontier. - *Bull. bot. Surv. India* 6: 56.
- Rathakrishnan 1971. Notes on the distribution, taxonomy and nomenclature of some south Indian orchids. - *Bull. bot. Surv. India* 13: 1-6.
- Rau, M.A. 1961. Flowering plants and ferns of north Garhwal, Uttar Pradesh, India. - *Bull. bot. Surv. India* 2: 215-251.
- Rau, M.A. 1963. The vegetation around Jumnotri in Tehri Garhwal, U.P. - *Bull. bot. Surv. India* 5: 277- 280.
- Rau, M.A. 1964. A visit to the Valley of Flowers and lake Hemkund in north Garhwal. - *Bull. bot. Surv. India* 6: 169-171.
- Rau, M.A. 1968. Flora of the upper Gangetic plain and the adjacent Siwalik and sub-Himalayan tracts. - *Suppl. 2 Bull. bot. Surv. India* 10(2): 76-78.
- Rau, M.A. & C.M. Arora, 1973. On the occurrence of *Diplomeris hirsuta* Lindl. (Orchidaceae) in western Himalaya. *Bull. bot. Surv. India* 15: 138-139.
- Rau, M.A. & U.C. Bhattacharyya 1966. New records of three rare orchids from western Himalaya - *Bull. bot. Surv. India* 8: 93-94.
- Rau, M.A. & T.A. Rao 1960. Some plant records 3. - *Bull. bot. Surv. India* 2: 425-426.
- Rawat, G.S. & Y.P.S. Pangtey 1983. *Herminium josephii* Rchb. f. (Orchidaceae) a new record for western Himalaya - *Ind. J. Forestry* 6: 171.
- Rawat, G.S. & Y.P.S. Pangtey 1985. *Neottianthe calcicola* (W.W. Sm.) Schltr. (Orchidaceae): New to the flora of India - *Curr. Sci.* 54(19): 1005-1006.
- Rawat, G.S. & Y.P.S. Pangtey 1985. Some interesting plants records from Kumaun Himalaya - *J. Econ. Tax. Bot.* 6: 697-698.
- Renz, J. 1978. Orchidaceae. Flora Iranica Lfg. 126. Graz.
- Renz, J. 1984. Orchidaceae. Flora Pakistan No. 164: 1-63.
- Ridley, H.N. 1924. The Flora of the Malaya Peninsula 4: 4-233.
- Royle, J.F. 1839. *Illust. of the botany of Himalayan mountain etc.* 1: 361-371 - London.
- Sahni, K.C. 1955. Observation on the Vegetation of Panch Chulhi - *Indian Forester*. 81: 300-317.
- Sahni, K.C. 1984. Himalayan Flowers - *Namaste* 9-13-A Welcomgroup Publication, New Delhi.
- Sahni, K.C. 1985. Flowers a Fable - *Swagat* 53-56 - Indian Airlines, New Delhi.
- Saldanha 1976. Flora Hassan district Karnataka India, 809-855 - New Delhi.
- Santapau, H. & Z. Kapadia 1966. The orchids of Bombay - Calcutta.
- Sarkar, P.K. & V.S. Agarwal 1978. Note on the *Pholidota imbricata* Lindl. (Orchidaceae) and its use in Ranchi district, Bihar - *Bull. bot. Surv. India* 20: 182-183.
- Sen Gupta, G. 1983. Notes on two species collected from Eastern Madhya Pradesh - *Ind. J. Forestry* 6: 326-327.
- Saxena, H.O. 1971. A contribution to the flora of Pachmarhi (Madhya Pradesh) - *Bull. bot. Surv. India* 13: 79-93.
- Seidenfaden, G. 1969. Contributions to the orchid flora of Thailand. - *Bot. Tidsskr.* 65: 100-162.

- Seidenfaden, G. 1970. Contributions to the orchid flora of Thailand II - *Bot. Tidsskr.* 65: 313-370.
- Seidenfaden, G. 1971. Notes on the genus *Luisia*. - *Dansk Bot. Ark.* 27, 4: 1-101.
- Seidenfaden, G. 1972. Contributions to the orchid flora of Thailand III. - *Bot. Tidsskr.* 66: 303-356.
- Seidenfaden, G. 1972. Contribution to the orchid flora of Thailand IV. - *Bot. Tidsskr.* 67: 76-127.
- Seidenfaden, G. 1973. Contributions to the orchid flora of Thailand V. - *Bot. Tidsskr.* 68: 41-95.
- Seidenfaden, G. 1975. Orchid genera in Thailand 1. *Calanthe* R. Br. - *Dansk Bot. Ark.* 29, 2: 1-50.
- Seidenfaden, G. 1975. Orchid genera in Thailand II. *Clelostoma* Bl. - *Dansk Bot. Ark.* 29, 2: 1-80.
- Seidenfaden, G. 1975. Orchid genera in Thailand III. *Coelogyne* Lindl. - *Dansk Bot. Ark.* 29, 4: 1-94.
- Seidenfaden, G. 1975. Contributions to the orchid flora of Thailand VI. - *Bot. Tidsskr.* 70: 64-97.
- Seidenfaden, G. 1976. Orchid genera in Thailand IV. *Liparis* L.C. Rich. - *Dansk Bot. Ark.* 31, 3: 1-105.
- Seidenfaden, G. 1976. Contributions to the orchid flora of Thailand VII. - *Bot. Tidsskr.* 71: 1-30.
- Seidenfaden, G. 1977. Orchid genera in Thailand V. Orchidoideae - *Dansk Bot. Ark.* 31, 3: 1-149.
- Seidenfaden, G. 1977. Contributions to the orchids flora of Thailand VIII. - *Bot. Tidsskr.* 72: 1-14.
- Seidenfaden, G. 1978. Orchid genera in Thailand VI. Neottoideae Lindl. - *Dansk Bot. Ark.* 32, 2: 1-195.
- Seidenfaden, G. 1978. Orchid genera in Thailand VII. *Oberonia* Lindl. & *Malaxis* Sol. ex Sw. - *Dansk Bot. Ark.* 33, 1: 1-94.
- Seidenfaden, G. 1979. Orchid genera in Thailand VII. *Bulbophyllum* Thou. - *Dansk Bot. Ark.* 33, 3: 1-228.
- Seidenfaden, G. 1980. Orchid genera in Thailand IX: *Flickingeria* Hawkes & *Epigeneium* Gagnep. - *Dansk Bot. Ark.* 34, 1: 1-104.
- Seidenfaden, G. 1981. Contributions to the orchid flora of Thailand IX. - *Nord. J. Bot.* 1: 193-217.
- Seidenfaden, G. 1982. Orchid genera in Thailand X. - *Nord. J. Bot.* 2: 193-218.
- Seidenfaden, G. 1983. Orchidaceae: In Matthew Fl. Tamil Nadu & Carnatic 2: 1550-1611. - Trichirapalli.
- Seidenfaden, G. 1983. Orchid Genera in Thailand XI *Cymbidieae* Pfitz. *Opera Bot.* 72: 5-124.
- Seidenfaden, G. 1985. Orchid Genra in Thailand XII - (*Dendrobium* Sw.) *Opera Bot.* 83: 1-295.
- Seidenfaden, G. & C.M. Arora 1982. An enumeration of the orchids of North Western Himalaya - *Nord. J. Bot.* 2: 7-27.
- Seidenfaden, G. & T. Smitinand 1959-65. The Orchids of Thailand. A preliminary list. - Bangkok.
- Seth, C.J. 1982. *Cymbidium aloifolium* (Orchidaceae) and its allies - *Kew Bull.* 37: 397-402.
- Sharma, B.M. & P. Kachroo 1981. Flora of Jammu 1: 297-301 - Dehra Dun.
- Singh, G. & P. Kachroo 1976. Forest flora of Srinagar 217-218 - Dehra Dun.
- Singh, N.P. & M.S. Dawre 1983. On the occurrence of *Acampe rigida* (Buch.-Ham. ex J.E. Smith) P.F. Hunt (Orchidaceae) in Peninsular India - *J. Econ. Tax. Bot.* 4: 1021.
- Stewart, R.R. 1917. The flora of Ladak - *Bull. Torrey Bot. Club* 43: 625-659.
- Stewart, R.R. 1972. An annotated catalogue of the vascular plants of West Pakistan and Kashmir. - In Nasir, E & Ali, S.J. (eds.) Flora of West Pakistan - Ann. Arbor.
- Stewart, R.R. 1982. Flora Pakistan (History and exploration of plants in Pakistan and adjoining areas)- Islamabad.
- Strachey, R. & J.E. Winterbottom 1882. Scientific botany - In: Atkinson, E.T. (ed.), The Himalayan districts of the NW Provinces of India 1: 403-671. The Gazetter NW Provinces 10-Allahabad.
- Subramanyam, K. & N.C. Nair 1973. Dichotomous venation and anastomosis in the corolla of an orchid - *Habenaria dentata* (Sw.) Schltr. - *Proc. Ind. Acad. Sci. B.* 78: 195-202.
- Takhtajan, A. 1969. Flowering plants, origin and dispersal (translated by C. Jeffery) - Edinburgh.
- Tiwari, S.D.N. & J.K. Maheshwari 1963. The orchids of Madhya Pradesh - *Indian Forester* 89: 426-444.

- Tuyama, T. 1966. Orchidaceae in Hara Fl. East. Himal. 424-452 - Tokyo.
- Tuyama, T. 1971. Orchidaceae in Hara Fl. East Himal. 176-196 - Tokyo.
- Tuyama, T. 1975. Orchidaceae in Ohashi Fl. East Himal. 137-196 - Tokyo.
- Uniyal, B.P. & S.C. Srivastava 1983. Distributional notes on two plants - *J. Econ. Tax. Bot.* 4: 1029.
- Wadhwa, B.M. 1977. Floristic studies in north-western India, Present status and future strategy. - *Bull. bot. Surv. India* 19: 185-194.
- Watson, W. 1882. Plants of Kumaon. - In Atkinson, E.T. (ed), The Himalayan districts of the NW Provinces of India 1: 323-402. The Gazetteer NW Provinces 10. - Allahabad.

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39	4	with	without
57	3	<b>rusca</b>	<b>fusca</b>
85	15	add..	<i>Specimens examined:</i> GARHWAL: <b>Dehra Dun</b> - Near Rajpur, Deva 2619
93	27	<b>Trophidia</b>	<b>Tropidia</b>
185	32	to	of
303	-	<b>platyrchis</b>	<b>platyrachis</b>
311	30	every	very
326	-	brack	bract
337	1	narrow	narrow
409	-	<b>prachystachys</b>	<b>brachystachys</b>
424	-	<b>Platantheria</b>	<b>Pelantheria</b>
438	-	<b>tesselata</b>	<b>tessellata</b>