

Records

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Botanical Survey of India

VOLUME VI.—No. 3

(1) REPORT ON THE MOSSES OF THE ABOR
EXPEDITION, 1911-12

BY

H. N. DIXON, M.A., F.L.S.

(2) REPORT ON THE MOSSES COLLECTED

BY

MR. C. E. C. FISCHER

AND OTHERS FROM SOUTH INDIA AND CEYLON

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H. N. DIXON, M.A., F.L.S.



the High Commissioner

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CALCUTTA

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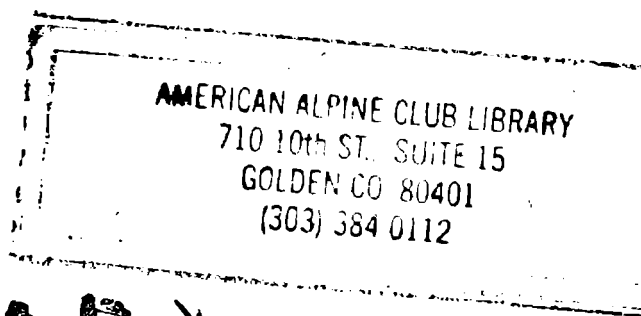
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REPORT ON THE MOSSES OF THE ABOR EXPEDITION, 1911-12

By

H. N. DIXON, M.A., F.L.S.

[Editorial Note :—The Abor Hills constitute “a section of the Himalayan range lying on the northern frontier of Assam, between the Siom river on the west and the Dibang on the east, occupied by tribes of Tibeto-Burman origin.” (Imperial Gazetteer of India 1908, V, 9.)

A punitive expedition was despatched against the Abors towards the end of 1911. Several officers of the Scientific departments of the Government of India were permitted to accompany the expedition and amongst them was Mr. I. H. Burkill, M.A., F.L.S., lately Economic Botanist to the Botanical Survey of India, and now Director of the Botanical Gardens in the Straits Settlements. The mosses collected by Mr. Burkill were sent to Mr. H. N. Dixon, M.A., F.L.S., for determination, and the following report has been kindly contributed by the latter.]

The mosses collected by Mr. Burkill were not numerous, amounting to a little over 60 numbers; but for the size of the collection they presented a considerable degree of interest, including some half-a-dozen undescribed species besides a few which indicated an interesting extension of geographical range. The most notable perhaps of these is *Claspodium crispulum* Broth. (*Pseudoleskea crispula* Bry. jav.), which has hitherto been recorded only from Java and Formosa. Cardot in the *Mousses de l'île Formose* (Beihefte zum Bot. Centralbl., Bd. XIX, Abt. II, 1905), in giving some account of the general distribution of the mosses of that island, has drawn up a list of 15 species which are common to Formosa, the Himalayan range, and the Malayan Archipelago, with six others found in the two former regions but not known at present from Malaysia. This relationship supports, so far as it goes, the evidence afforded by Phanerogams and Vascular Cryptogams as to the geographical affinities of the flora of the Assam region. Drude (Handb. der Pflanzengeographie, p. 479), divides the Indo-Malayan tract into ten floral regions; the 5th and 6th being—

5. Birma (Pegu, Cachar, etc., nordwärts sich mit der Tropenregion des südöstl. Himalaya mischend).

6. Siam—Annam mit Formosa und dem nordöstlichen Ausläufern des indischen Reiches.

These two regions merge together in Assam, from the south and east, while from the west the flora of the great Himalayan range intrudes; and these three floral zones are represented among the bryophytes equally with the higher plants; indeed even the comparatively small

collection dealt with here includes representatives of all three. Thus, Drude's regions 5 and 6 respectively, and the Himalayan region, are represented by the species, among others, in the following three groups:—

- (1) *Vesicularia Montagnei*, *Mnium succulentum*.
- (2) *Barbella enervis*, *Leucobryum javense*, *Floribundaria floribunda*, *Campylium glaucocarpum*, *Physcomitrium repandum*.
- (3) *Neckeropsis acutata*, *Vesicularia succosa*, *Hypopterygium flavo-limbatum*, *Trematodon conformis*.

All the species in (1) and (2) were collected, as would be expected, in the plains around Kobo or at quite low altitudes in the hills. As soon as we ascend to the higher levels, the Lower Hill and Upper Hill Forests described by Mr. Burkill (The Botany of the Abor Expedition—Report of the British Association, Section K, Dundee, 1912), these floral relations cease and the affinity of the mosses with those of the Himalayan range becomes at once evident as in (3).

It is obvious that the geographical and climatal conditions that permit a given area to be the meeting place of several phyto-geographical regions, may also, provided the conditions persist over a sufficient period, permit also of that area being a centre of distribution back into the several regions concerned; indeed identical facts of distribution might in certain cases be explicable on either ground. This should perhaps be taken into account in considering the plant distribution in this district. I have not attempted to ascertain what body of evidence there is for looking upon the Assam or Khasian region as a centre of dispersal, either from the bryophytes or other groups of plants, but the distribution of one genus of mosses, at least, is certainly highly suggestive in this direction. I refer to the genus *Symphiodon*. This is a clearly characterized and striking genus, of which at present, so far as I am aware, eighteen species are known. Of these the Philippines, New Caledonia and S. China furnish one endemic species each, the remaining 15 being entirely confined to the Indian and Malayan peninsulas, except that one species, *S. Perrottetii* with a wide distribution in India extends also to Java and the Moluccas. Fourteen species, therefore, out of eighteen find their limits within the East Indian peninsular region, and of these eleven are confined to the area centring round Khasia, from Nepal and Bhotan on the west (including four undescribed species of *Brotherus* in Sikkim), and an unpublished species of Mitten's from Burma on the south-east; five or six of them, including the two species described in this paper, occurring in, and four being confined to this part of Assam. It seems impossible in such a case to look upon the Khasian district in any

other way than as the centre of dispersal of this genus, and without attempting to base any generalizations upon a single case, I suggest that it may be worth investigation how far it is supported by further evidence from this and other groups of plants.

I desire to express my obligation to M. Cardot for assistance in the preparation of both this and the following report.

I may also mention that the types of the new species here described are in my herbarium, which I hope will ultimately find a home in the British Museum collection; co-type specimens of each, moreover, are in the Herbarium of the Royal Botanic Garden, Calcutta.

1. *Trematodon* Rich.

1. *Trematodon conformis* Mitt. Musc. Ind. or. p. 12.

On a stone, Pasighat (n. 36537). Kobo, February, 1912 (n. 38107).

Mr. Burkill remarks on this that "it was very common about the clearing of the camp, growing on the bare earth. It was not present in December, or at least not noticed." As the capsules are in many cases ripe and deoperculate, it is scarcely possible that the entire development could have taken place, from the spore, between the two visits. It is probable that the gametophyte was present, but being small would be inconspicuous, or indeed partly hidden; the clearing would give an opportunity for the better development of the plants, no doubt, than would normally be the case. Both specimens were in good fruit, the capsules exhibiting, as is usual in this genus, a great diversity of maturity in the same gathering.

2. *Dicranoloma* Ren.

2. *Dicranoloma subreflexifolium* Par.

Syn. *Dicranum reflexifolium* Mitt. Musc. Ind. or. p. 15 (haud C. Müll.)

Dicranum subreflexifolium C. M. in Bot. Zeit., 1864, p. 349. Summit between Serpo and Lalik, alt. 5,100 ft., xerophytic moss from rocks (n. 36344) c. fr.

I have compared this with the Khasian specimens in Hooker's herbarium, referred (erroneously) by Mitten to the Malaysian *D. reflexifolium* C. M., but distinguished by C. Müller and forming the type of his *D. subreflexifolium*. It agrees in nearly every detail, the toothing of the leaves varies in Hooker and Thomson's plant, being often weaker

than, but at times equal to, that of the Abor specimen; and the leaves are a shade closer, and not markedly fragile, as they are to some extent in the latter; the seta also is a shade shorter; but the differences are minute in comparison with the general agreement, and I do not think it is possible to separate them.

3. *Leucobryum* Hpe.

3. *Leucobryum javense* (Brid.) Mitt. Musc. Ind. or. p. 25, Rocks at top of summit between Serpo and Lalik, alt. 5,100 ft., c. fr. n. 36345).

Fleischer (Musci...von Buitenzorg I, 149) cites Hampe's description of the fruit of this species, which is in some respects rather misleading, notably in the terms "Kapsel klein trocken wenig gestreift." I have examined the fruiting specimens in Hampe's herbarium (Borneo, leg. Beccari), which shows the capsules exactly as in the Abor plant, by no means small for the genus, and quite markedly striate when dry.

4. *Octoblepharum* Hedw.

4. *Octoblepharum albidum* (Linn.) Hedw.

South side of a tree trunk in dense shade, Kobo, c. fr. (n. 37027).

5. *Fissidens* Hedw.

5. *Fissidens diversifolius* Mitt. Musc. Ind. or. p. 140.

Fruiting abundantly on pieces of wood embedded in the river bed; it had been submerged all the rains. Kobo, c. fr. (n. 37086). On lower rocks on the river bank, Janakmukh, c. fr. (n. 37160).

From the description of the locality for the type plant, and from specimens which I have received from southern India, it is evident that the normal habitat for this species is within the reach of, and frequently overflowed by, water. It varies very greatly, not only in the form of leaf but also in the degree of limbation, for though usually quite immarginate the vaginant lamina may sometimes show a quite distinct though narrow border.

Mr. Burkill informs me that the Abor plant bears ripe fruit early in December only a month, or even less, from the date when it becomes exposed—a very interesting instance of adaptation to the special circumstances of its development.

6. Fissidens pulchellus Mitt. *Musc. Ind. or.* p. 140.

Trees, summit of Bapu, alt. 6,240 ft. c. fr. (n. 36563).

I only know this plant from descriptions, but I think there can be little doubt of the correctness of the determination. The single specimen of this name in the Brit. Mus. in herb. Hampe does not look to me at all likely to be correctly determined.

7. Fissidens nobilis Griff.

Near Upper Rengging camp at 2,600 ft.; on a rock in considerable shade, on north exposure, growing downwards and outwards; ♀ (n. 36258).

6. Barbula Hedw.**8. Barbula comosa** Dz. and Mb.

On small stones on the undercliff below Janakmukh where water trickles down c. fr. (n. 37214).

7. Macromitrium Brid.**9. Macromitrium nepalense** (Hook. and Grev.) Schwaegr.

On upper side of branches of *Flacourtia cataphracta* Roxb., Janakmukh, c. fr. (n. 37185).

On trunks of *Terminalia myriocarpa*, Janakmukh, c. fr. (n. 37255).
On rocks, Yambung stream, alt. 900 ft. c. fr. (n. 37723).

A slender, lax, elongate form with more pellucid, thinner-walled cells (n. 36485 without locality) seems to be a shade form of the same plant. *M. nepalense* is a wide-spread and apparently a variable species, and judging from Wilson's specimen of *M. assamicum* in the British Museum collection (W. 28 without locality), I should think that Mitten is quite correct in tentatively referring that species to *M. nepalense*.

8. Physcomitrium Brid.**10. Physcomitrium pulchellum** Mitt. *Musc. Ind. or.* p. 54.

Syn. *Gymnostomum pulchellum* Griff.

On bare soil, near Rotung, c. fr. (n. 37625).

11. Physcomitrium repandum Mitt. *op. et. loc. cit.*

Syn. *Gymnostomum repandum* Griff.

On vertical face of earth, alt. 900 ft., junction of Yambung and Dehong, c. fr. (n. 37722).

9. *Rhizogonium* Brid.

12. *Rhizogonium spiniforme* (Linn.) Bruch.

Spur above upper Rengging camp, on fallen rotten branch, alt. 4,200 ft., c. fr. (n. 36285). Tree trunk, Lalik Valley, alt. 2,700 ft., c. fr. (n. 37335a.)

10. *Mnium* Dill.

13. *Mnium rostratum* Schrad.

Evidently a common moss here as throughout the Himalaya range (nos. 36115, 36174, 36541).

14. *Mnium succulentum* Mitt. Musc. Ind. or. p. 143.

Janakmukh; with Hepatic on rocks, st. (n. 37177). (Plates I, II, fig. 5.)

Fleischer (Musci.....von Buitenzorg, II, 581) describes *M. succulentum*, referring to it *M. integrum* Bry. jav.; and has issued Javanese specimens as *M. succulentum* and *M. succulentum*. n. var. *densum* Fleisch. in the M. Frond. Arch. Ind., nos. 367 and 467. He has however unfortunately been misled, no doubt by an examination of the specimens purporting to be Mitten's types. The type specimen should be No. 680, Hb. Ind. or. of Hooker, Nepal orient. reg. temp. Unhappily both at Kew and at the British Museum the specimen under this number contains only *M. rostratum*, with which no doubt the true plant was associated. Mitten however describes his plant as "*M. rostrato habitu omnino simile, sed foliis paululum majoribus, cellulis sexies majoribus succulentis*," and Assam specimens, leg. Griffith, at Kew, determined by Mitten, agree precisely in these respects with his description, having a quite different texture, a narrow, not cartilaginous border to the leaves, and the cells between two and three times the diameter of those of *M. rostratum* (Mitten's "sexies" would apply quite well to the superficial measurement).

It will be seen from a comparison of Fleischer's description that it applies to a moss in no way markedly distinct from *M. rostratum* except in the dioicous inflorescence (the cell measurements would apply very well to that, but by no means to the true *M. succulentum*). I have not seen No. 367 M. Fr. Arch. Ind.; but No. 467—which has the leaves by no means entire—I should refer unhesitatingly to *M. rostratum*, judging from the vegetative characters; I have not been able to examine the inflorescence.

The margin in *M. succulentum* varies greatly even as between the leaves of a single stem. Mitten describes the cells as "marginalibus con-

formis intensius coloratis," which however scarcely applies to the prevailing type so far as I have studied his specimens. In most cases I find a narrow border of a single or at times double row of elongate cells, which are by no means cartilaginous or incrassate, often scarcely narrower than the interior cells, sometimes chlorophyllose, at others nearly empty and pellucid. The number of rows of marginal cells varies from one to three or four, and the border may be subentire or sharply and closely toothed, with all intervening forms. In no case could it, I think, be taken for *M. rostratum*, and in certain forms where it is entire or practically so, it more nearly resembles that of *M. subglobosum*. The cells in the upper part of the leaf, about half-way between the nerve and the margin, measure about 45–60 μ in the shortest diameter (as compared with 18–25 μ in *M. rostratum*), and are not at all incrassate or collenchymatous.

As it seems desirable to establish the species more firmly, and it has not yet been figured, I have given figures of the Abor plant (Plate I, fig. 5a) showing the cells as compared with those of *M. rostratum* (fig. 4a), and also of the Assam plant at Kew, referred to above, showing the marginal cells on different leaves.

11. *Philonotis* Brid.

15. *Philonotis speciosa* (Griff.) Mitt.

Janakmukh, c. fr. (n. 36474, 37171); on loose stones and mud on the undercliff below Janakmukh, c. fr. (n. 37213).

12. *Pogonatum* P. Beauv.

16. *Pogonatum* sp. On dry stony surface of undercliff below Janakmukh (n. 37215).

Possibly *P. leucopogon* Ren. and Card. but in the absence of mature fruit doubtful. The capsule is only slightly papillose, the seta slightly longer, and the leaf base only slightly and not abruptly widened. The marginal cell of lamella in section is not enlarged and scarcely flattened.

13. *Floribundaria* C. Müll.

17. *Floribundaria floribunda* (Dz. & Mb.) Fleisch.

On the upper side of a hanging tree trunk in deep shade, Kobo, st. (n. 37070). A rather robust, bright green form, but consisting entirely of quite young stems. The cells are nearly all unipapillate; the margin here and there narrowly recurved.

14. *Barbella* Fleisch.

18. *Barbella enervis* (Thw. & Mitt.) Fleisch. (Plate II, fig. 8).

Syn. *Meteorium enerve* Thw. & Mitt.

Meteorium trichophoroides (Hampe) Mitt.

Puak, alt. 800 ft. st. (n. 36039); det. Cardot.

M. Cardot points out that this differs from *B. enervis* only in the alar cells being slightly larger and more distinct; the habit, very marked in the distinction between the widely spreading large leaves of the secondary stems and the closely appressed filiform pointed leaves of the flagellate branches is identical in both, and the leaf characters apart from the difference referred to above, are also the same. The distribution of this plant as at present known is remarkable, being recorded hitherto only from Ceylon, the Australian Continent and Lord Howe Island. The Abor specimen, which I have figured on Plate II, is a small, probably only partially grown plant.

15. *Aerobryopsis* Fleisch.

19. *Aerobryopsis membranacea* Broth.

Syn. *Meteorium membranaceum* Mitt. Musc. Ind. or. p. 88.

Tree trunk, Rotung, 1,300 ft. alt., st. (n. 37515).

This agrees exactly with Griffith's Assam plant at Kew, on which Mitten's species was founded. I do not know that it has since been recorded.

16. *Meteoriopsis* Fleisch.

20. *Meteoriopsis squarrosa* (Hook.) Fleisch.

Trunk of *Stereospermum*, Rotung, 1,300 ft., st. (n. 36068).

17. *Trachypodopsis* Fleisch.

21. *Trachypodopsis crispatula* (Hook.) Fleisch.

Trees, summit of Bapu, alt. 6,240 ft., c. fr. (n. 36564). A green form.

18. *Neckeropsis* Rehd.

22. *Neckeropsis acutata* Fleisch.

Syn. *Neckera acutata* Mitt. Musc. Ind. or. p. 121.

On tree trunks, above the head of the Egar, alt. 4,500 ft., st. (n. 36196).

23. *Neckeropsis crinita* (Griff.) Fleisch.

Syn. *Neckera crinita* Griff., Mitt. Musc. Ind. or. p. 120.

Boulders in stream-bed, between Yabung and Sissin, alt. 1,000 ft., st. (n. 36015).

19. Homalia (Brid.) Schpr.**24. Homalia exigua** Bry. jav.

Boulders in stream-bed, with the previous species, st. (n. 36015b).

20. Homaliodendron Fleisch.**25. Homaliodendron flabellatum** (Dicks.) Fleisch.

Tree trunks, alt. 4,500 ft. above the head of the Egar, st. (n. 36196a).

Tree trunk, Lalik Valley, alt. 2,700 ft., st. (n. 37385b).

21. Symphyodon Mont.**26. Symphyodon complanatus** Dixon sp. nov. (Plate I, fig. 2.)

Procerus, *late-virens*, nitidus. Caulis frons diformis, *percomplanatus*, bis-, terpinatus, repens, ad 10 cm. longus., ramis ramulisque brevibus, *obtusis, rigidiusculis*. Folia laxiuscule disposita, *percomplanata*, lateralialia a caule *valde distantia, patula, immo subrecurva*, dorsalia ventraliaque erecta, appressa. Folia caulina e basi ovali oblonga subcultriformia, 2mm. longa, ad 75mm. lata, breviter bicostata, uno margine incurvo, superne *rotundata, obtusa*, apicem versus vel e medio folio *grossiuscule irregulariter, dentibus inæqualibus, sæpe recurvatis, dentata*. Cellulæ angustissime lineares, 50-80 μ longæ, 3-5 μ latæ, prope apicem paullo breviores, *omnino laeves*, ad infimam basin tantum latiores, irregulariter hexagono-rectangulares, alares perpaucae, parvæ, rectangulares pellucidæ, parietibus subincrassatis, Folia ramea ramulinaque minora, ceterum similia. Dioicus Fl. ♂ haud visi. Flores feminei medium versus caulem insiti, bracteæ perichætiales patulæ externæ longiuscule, internæ breviter late acuminatæ, acutæ, omnes *grosse dense dentatæ*. Seta elongata, gracilis, 3.5—4.5 cm. longa, parte inferiore *omnino laevis, prope apicem tantum scabriusculum*; theca elliptica, 3mm. longa, in parte dimidia inferiore *parce irregulariter humiliter grosse verrucosa*. Peristomium generis, processibus 3-4 dentium longitudinem vel supra æquantibus. Spori circa 15 μ . Calyptra æque ac operculum ignota.

Hab. On a fallen branch of tree, watershed of Egar and Serpo, alt. 5,500 ft., Abor District, 23rd January 1912, leg. Burkill (n. 36208).

A fine species, which with the next is very different in habit from nearly all the species known to me, in the absolutely complanate branching, together with the form of the leaves and their dentation. *S. erraticus* (Mitt.) and *Stercodon pennatululus* Mitt. appear to be its only near allies hitherto described. The former differs in the reddish brown colour, more slender branching, the leaves less complanate, acute, with papillose upper cells, and finer marginal dentation. Brotherus places *S. erraticus* in a section with "Kapsel mit hohen Stacheln dicht besetzt;" but the

specimens in Hooker's herbarium show numerous capsules, lowly tuberculate only, as in the present plant.

Stereodon (*Symphiodon*) *pennatulus* Mitt. (ined.?), "Moulmein. Parish," in Herb. Kew., is similar in the complanate habit, but a very small plant, with very regularly subdistichous foliation, and leaves distinctly spathulate, finely crenulate only or erose at summit.

27. *Symphiodon scabrisetus* Dixon sp. nov. (Plate I, fig. 3.)

Speciei præcedenti habitu similis, sed multo minor, gracilius, minus exacte complanatus, ramis longioribus, ramulis paullo attenuatis; foliis oblongis, minus curvatis, supra vix angustatis, obtusis vel subacutis, tenerius denticulatis nervis binis brevissimis. Flores ♂ numerosi in axillis foliorum præcipue superiorum. Folia perichætialia anguste acuminata, parum denticulata. Seta vix 3 cm. alta, pars infima quarta tantum lævis, supra magis magisque scabra, parte dimidia superiore papillis præaltis cylindricis densissime echinata. Theca elliptica, minor, ore angustiore, per totam fere superficiem verucis valde inæqualibus plerumque humilibus densiuscule irregulariter obtecta. Peristomium ei præcedentis simile, tenerius, dentibus intus altius trabeculatis. Dioicus. Cetera ignota.

Hab. On tree trunk, Lalik Valley, alt. 2,700 ft., Abor District, 22nd December 1911; leg. Burkill (n. 37335).

Closely allied to the last species, and in the vegetative characters only distinguished by slight differences which in a sterile state might have been judged to be varietal merely; they are however in all probability constant, especially the finer denticulation of the leaves in the present species, which is shown to be of no trivial importance by the absolute difference shown by the perichætial bracts in the two species. The fruiting characters also are widely different.

The seta in this genus is usually scabrous in the upper part, especially near the capsule, but rarely if ever approaching the degree of asperity of the present plant.

I find when too late for alteration that a *S. scabrisetus* exists as a MS. name in Hampe's herbarium. It is however certainly identical with *S. erraticus* (Mitt.), so that no confusion is likely to occur.

22. *Distichophyllum* Dz. & mb.

(28). *Distichophyllum Griffithii* Par.

Syn. *Mniadelphus Griffithii* Mitt. Musc. Ind. or. p. 145.

Epiphyllous, growing obliquely forward and downwards on leaves overhanging a stream—a tributary of the Egar—alt. 3,000 ft., c. fr. (n. 36106).

Griffith's specimens at Kew are a little more robust, but essentially agree. In one specimen (H. 3872) the cells are a little smaller, both upper and basal, while in another specimen of the same number they are appreciably larger, and almost exactly identical with those of the Abor plant.

23. *Cyathophorum* P. B.

29. *Cyathophorum* *Burkillii* Dixon sp. nov. (Plate I, fig. 1, II, fig. 9.)

Dioicum; habitu *C. Hookeriani* Mitt. Caulis primarius repens, tomentosus, secundarii sat conferti, ad 5 cm. alti, madefacti ad 8mm. lati, subrigidi, simplices vel sæpius *hic illic ramos laterales paucos* gerentes; plerumque in apicem caudiformem, siccitate decurvatum, filis articulatis dense sitis obrutum sensim attenuati; cæspites saturate virides, siccitate haud nitentes. Folia sat conferta, valde asymmetrica, late ovata, apice breviter acutissime acuminata, illis *C. parvifoliae* figura similia, *distincte sat late limbata, parte superiore dimidia argute minute denticulata*; costa debilis, *partem tertiam vel quartam folii tantum attingens*, sæpe brevior furcata. Areolatio regulariter rhomboideo hexagona, e cellulis apud basin laxis, apicem versus et latera pariter decrescentibus in medio folio circa 30 μ . latis, valde chlorophyllosis, parietibus tenuissimis instructa; marginalibus 2-4 seriebus, angustissimis, linearibus vel peranguste rhomboideo-linearibus, incrassatis, limbum bene notatum, latiusculum formantibus. Amphigastria exacte orbicularia, ad 1.5mm. lata, apice breviuscule rigide cuspidata, ecostata vel costam pertenuem dimidiam partem folii vel infra attingentem exhibentia, margine serie unica cellularum angustissime obscure limbata, *in parte superiore dimidia argute denticulata*.

Flores ♂ in plantæ propriae caulibus copiosi, sæpe in cujusque folii axillis frondis superioris siti. Planta fœminea flores pauciores, medium versus frondem plerumque insertos gerens. Seta valde arcuata vel geniculata, pallida, 4-5 cm. longa lævis, vel cellulis mammosae prominentibus subrugulosa. Theca angustissime elliptica vel elliptico-cylindrica, pallida, 2 mm. longa, collo distincto prædita. Calyptra conico-mitriformis, glabra, basi subintegro. Operculum conicum, *longe rostratum*. Annulus latus, facile friabilis. Peristomium *bene evolutum* fusco-rubrum; dentes externi e basi paullo latiore lineares, fragiles, siccitate arcuato-incurvi, 6 mm. longi, extus densissime minute papilloso, linea media perincrassata recta vel sinuosula exarati, intus conferte altiuscule lamellati; endostomium membrana humilis, processibus linearibus subfiliformibus *dentibus subæquilongis* nodosis papilloso, siccitate erectis, linea media recta tenui pellucida notatis, haud perforatis; cilia nulla. Spori *parvi*, 15-18 μ . lati, virides, *omnino læves*.

Hab. Growing horizontally on a tree trunk near the ground, hill south of the Rebang, alt. 2,800ft., Abor District, 8th January 1912; leg. urkill (n. 37737).

A well marked species of this interesting and very beautiful genus, having for its nearest ally *C. parvifolium* Bry. jav., but distinct from that and all the Indo-Malayan species in the amphigastria, which are perfectly orbicular, with a shorter, cuspidate point. The comparatively broadly margined leaves, and the fine and almost even denticulation over the whole of the upper half both of leaves and amphigastria are also good characters. The fruit is known in but few of these species, so far as I am aware in only *C. Adiantum* and *C. Hookerianum*, and these have the peristome much less developed, indeed comparatively rudimentary. I have figured part of a peristome on Plate II, fig. 9.

24. *Hypopterygium* Brid.

30. *Hypopterygium flavo-limbatum* C. M.

On stump, above the Serpo river, alt. 1,800 ft., c. fr. (n. 37319). Hills south of Rotung, alt. 4,400 ft., c. fr. (n. 36236a).

25. *Leskea* Hedw.

31. *Leskea perstricta* Dixon sp. nov. (Plate II, fig. 6.)

Atroviridis; caules intertexti, repentes, parvè radiculosi, paraphylliis nullis, dense pinnatim vel fasciculatim ramosi; rami suberecti *perbreves*, vix 5 mm. longi, simplices vel hic illic ramulosi, *tenelli*. Rami ramulique *stricti*, nec curvati, sicci *cybindrifici, teretes*. Folia *dense imbricata*, madefacta erecto patentia, sicca *arcte imbricata, adpressa*; caulina 75 mm. longa, e basi late ovato-cordata *tenui-acuminata, acuta*; ramea minora, angustiora, breviter latiuscule *acuminata, minus acuta seu subobtusa*, omnes marginibus planis vel superne leniter anguste reflexis, integerrimis. Costa validiuscula, dorso prominens, lævis, supra vix angustata, *prope apicem soluta vel subpercurrens*. Cellulæ superiores rhomboideo-hexagonæ, 5—8 μ latæ (circa 2 x 1), *juxta costam elongatæ, marginem versus contra breviores*; basillares medianæ subsimiles, paullo laxiores, marginem versus seriebus pluribus breviores, subquadratæ, numerosæ; omnes *parietibus tenuiusculis, laeves*.

Autoica. Flores δ numerosi, parvi, prope flores fœmineos. Perichætia *longa* (ad 4.5 mm.), *stricta*, foliis internis omnino erectis subappressis, subvaginantibus, *pluries plicatis*, integris, longe subulato-acuminatis, tenuiter areolatis, e cellulis pellucidis anguste linearibus instructis, *costa valida, longe excurrente*.

Seta 1.5—2 cm. longa, tenuis; calyptra angusta, pallide straminea, nitida; theca (immatura) cylindrica, leniter curvata vel suberecta, operculo conico obtuso pallido. Cetera ignota.

Hab. On tree trunk, Rotung, alt. 1,000 ft., Abor District, 26th December 1911; leg. Burkill (n. 37514).

A distinct species, and in some respects of somewhat anomalous position. In the branching and foliation it more closely resembles some species of *Pseudoleskea*; the capsule, however, though immature, claims it undoubtedly I think for *Leskea*; the calyptra and lid, etc., being almost exactly those of *L. polycarpa*; the curved, and occasionally even arcuate form of the capsule is no doubt due to its unripe condition, and almost identical forms may be seen in unripe *L. polycarpa*. The straight, terete, rigid branches give it an unusual appearance, and will separate it from other species of the genus, and also from *Lindbergia*. In habit it is much like certain forms of *Leskeella nervosa*, but the inflorescence at once separates it from that. *Leskea pusilla* Mitt., from Japan, must be quite different from our plant, judging from the somewhat brief description.

26. *Claopodium* Ren. & Card.

32. *Claopodium crispulum* Broth. forma.

Syn. *Pseudoleskea crispula* Bry. jav.

On tree trunks, Kobo, c. fr. immatur. (n. 35939, 37070).

A very interesting extension of the range of this plant, hitherto only known from Java and Formosa. It differs from the figures given in the Bry. jav. in having the branch-leaves gradually shorter-pointed as they pass upwards on the branch, the uppermost ones being quite obtuse. I find however that Javanese specimens (leg. Teysmann, in Hb. Hampe, in Hb. Mus. Brit.) show the upper branch-leaves decidedly subobtuse, thus forming an intermediate link with the Abor plant, which must be considered a form only.

27. *Thuidium* Schpr.

33. *Thuidium trachypodium* Bry. jav.

Syn. *Leskea trachypoda* Mitt. Musc. Ind. or p. 133.

On living trunk of tree, Kobo, c. fr. (n. 35954). On rock, alt. 800 ft., mouth of the stream north of Puak, c. fr. (n. 36038). Above the mouth of the Serpo river, alt. 1,800 ft., c. fr. (with n. 37319).

34. *Thuidium cymbifolium* Dz. & Mb.

On fallen log, hills south of Rotung, alt. 4,400 ft., st. (n. 36236).

28. *Macrothamnium* Fleisch.

35. *Macrothamnium macrocarpum* (Reinw. & Hornsch.) Fleisch.

On fallen trunk, south face of Bapu, alt. 3,800 ft., c. fr. (n. 36533).
On decaying trunks on the ground, near the top of Bapu, alt. 5,400 ft.,
c. fr. (n. 36544).

Both these are slender forms, probably referable to *M. pseudo-striatum* (C. M.) Fleisch.; but I am quite unable to detect any characters sufficient to warrant its separation from *M. macrocarpum*, and M. Cardot shares this opinion with me. Fleischer retains it as separate, but has not indicated any distinguishing characters (Hedw. XLIV, 307). It is represented in Mitten's herbarium, but in letters which I have received from him he appears to have thought of it as only a more slender form of *M. macrocarpum*, as his note on the species (Musc. Ind. or. p. 114) also indicates. The distribution of *M. pseudo-striatum*, it may be noted, is identical practically with that of *M. macrocarpum*.

29. *Campylium* Bryhn.

36. *Campylium glaucocarpon* (Reinw.) Broth.

Syn. *Stereodon glaucocarpus* Mitt. Musc. Ind. or. p. 115.

On tree trunks, particularly on loose flakes of bark standing out from the trunk, Janak stream, c. fr. (n. 37303).

The specimen is in young and good fruit, and shows well the remarkable cæsious waxy excretion on the capsule and summit of the seta.

30. *Ectropothecium* Mitt.

37. *Ectropothecium cyperoides* (Hook.) Jaeg.

Syn. *Stereodon cyperoides* Mitt. Musc. Ind. or. p. 99.

On upper rocks of river bank, Janakmukh, c. fr. (n. 37161). On tree trunks, Janak stream, c. fr. (n. 37302).

E. cyperoides is a highly variable plant, as Mitten has pointed out (l. c.); but I am quite in agreement with M. Cardot, who has expressed the opinion to me in letters, that it will not include the Javan moss figured in Bry. jav. II, t. 294. I have examined carefully the original plants of Harvey's and others in Hooker's herbarium, and while finding there all the variation in leaf-form mentioned by Mitten, I find no forms with the leaves so shortly and widely pointed as figured in the Bry. jav., while the areolation there depicted is of quite a different character from that of *E. cyperoides*, in all forms of which it is extremely narrow, linear-vermicular, with a single marginal row usually very

slightly wider; and the cells remain almost unaltered to the base. The leaves vary from shortly acuminate and almost plane to a form with finely, almost filiform-acuminate leaves, strongly decurved and falcate, almost exactly as in *Stereodon cupressiformis*. The species appears to have a wide geographical range, and I can find no correlation between the form of leaf and the distribution. The length of seta and size of capsule also show considerable variability. I think there is no doubt that the Javan moss issued by Fleischer as *E. pseudo-cyperoides* Fleisch. n. sp. (M. Fr. Arch. Ind., No. 343) belongs to the true *E. cyperoides* (Hook). It is identical with "*E. cyperoides*, Ceylon, Gardner, No. 971," cited by Mitten, which in its turn is quite the same as several North Indian plants. The Javan plant described under this name in the Bry. jav. must, I feel assured, receive another designation; I have seen no specimens agreeing with the figures.

Var. *papillosum* Card. and Dixon var. nov.

Cellulæ superiores sæpe, præcipue foliorum rameorum, *dense, argute, altiuscule papillosæ*.

On logs, above upper Rotung, alt. 2,500 ft., 23, Jan. 1912. c. fr. leg. Burkill (n. 36173) also n. 37301A without further localization.

E. cyperoides is described as having the cells occasionally papillose with the projecting ends of the upper cell walls, but in this case it is so much more highly developed as to seem worthy of varietal distinction. The cells are somewhat shorter than in the type in some leaves, but I do not find this a sufficiently constant character to be included in the diagnosis. The papillæ are somewhat less pronounced in 37301A.

31. *Vesicularia* C. Müll.

38. *Vesicularia succosa* (Mitt.) Broth.

Syn. *Stereodon succosus* Mitt. Musc. Ind. or. p. 101.

On a stone, under Rotung in the Dehong gorge, alt. 900 ft., c. fr. (n. 36154). On a fallen log, Kobo, c. fr. (n. 37091).

(The former specimen appears to be actually growing on wood as would be expected.) I have compared this with Mitten's co-type (no. 1038, Hooker) in the British Museum.

39. *Vesicularia Montagnei* (Bél.) Broth.

Running along the upper surface of a fallen and rapidly decaying log, Kobo, c. fr., det. Cardot (n. 37079). On rotten wood, Kobo, c. fr. (n. 37104).

32. *Isopterygium* Mitt.

40. *Isopterygium taxirameum* (Mitt.) Jaeg.

Syn. *Stereodon taxirameus* Mitt. Musc. Ind. or. p. 105

On sand, Janakmukh, c. fr. (n. 37263).

A large form, with rather long setæ and large capsules. M. Cardot writes of it "ne me paraît être qu'une des nombreuses formes de l'*I. taxirameum* (Mitt.), à peu près identique à celle que Müller a appelé *I. taxirameoides*."

33. *Rhynchostegiella* Limps.

41. *Rhynchostegiella assamica* Card. and Dixon sp. nov. (Plate II, fig. 7.)

Caulis reptans, ad terram arcte adhærens, vage ramosus; folia juniora læteviridia, senilia nigricantia. Folia caulina sat conferta, erecto-patentia nec compressa, siccitate vix mutata, circa 1.5 mm. longa, e basi angustata, parum decurrente, *ovato-lanceolata acuta nec acuminata*, paullo concava, marginibus planis, *ubique conferte regulariter denticulatis*; costa sat valida, $\frac{3}{4}$ folii longitudinem attingens, dorso in spiculum apicalem sæpe excedens. Cellulæ rhomboideo-lineares, subvermiculares, 30-40 μ longæ, 5-6 μ latæ, parietibus firmis; apicem versus breviores, elongate ellipticæ, inferiores sensim laxiores, infimæ anguste rectangulares, alares numerosæ, *sat magnæ late breviter rectangulares, pellucidæ bene notatæ*. Folia ramea minora, *minus acuta vel obtusiuscula, siccitate marginibus involutis sub-tubulosis* (interdum ramuli tenerimi angustifolii subflagelliformes inveniuntur).

Autoica. Perichætium parvum, bracteis erecto-patentibus vel recurvis, argute acuminatis, fortiter denticulatis vaginula elongata. Seta tenuis, rubra, *lævis* (interdum prope apicem obscure humiliter sub-scaberula seu rugulosa), 1-1.25 cm. longa. Theca parva pallida, breviter turgide ovata, curvata, cernua, operculum *acute decurvato-rostratum*.

Hab. Kekar Monnying, Abor District, alt. 800 ft., on silted earth on tree trunks, 15th Jan. 1912, leg. Burkill (n. 36044). On stem of *Ficus pyriformis* var. and stones near the stem, alt. 1,200 ft., gorge of the Yambung, 9th Jan. 1912 (n. 37766).

This rather uninteresting little plant is placed by M. Cardot in the Section Lepto-rhynchostegium of Brotherus, but does not seem quite at home there, any more than in Eu-rhynchostegiella. The cells are somewhat long for the former section, and the leaves scarcely concave. The limits between *Rhynchostegiella* (especially the Section Lepto-rhynchostegium) and Eurhynchium seem very ill-defined, and it is doubtful whether the separation can be maintained.

The other Indian species of the genus have the leaves widely spreading or squarrose with long acute points and a scabrous seta. The

blackish colour of the older leaves, and the pale green of the younger branch leaves which are strongly enrolled and subtubular when dry, give the plant a distinct appearance.

34. *Rhynchostegium* Schpr.

42. *Rhynchostegium herbaceum* (Mitt.) Jaeg.

Syn. *Hypnum herbaceum* Mitt. Musc. Ind. or. p. 81.

On fallen tree trunks and branches, Kobo, c. fr. (n. 35989, 37070 bis, 37099). On decayed stump, above the Egar stream, alt. 3,400 ft., c. fr. (n. 36103). On rotten branch on the ground, alt. 1,000 ft., Yabung to Sissin, st. (n. 36018).

Explanation of Plates.

Plate I.—Fig. 1. *Cyathophorum Burkillii*. *a*, stem of ♂ plant, nat. size. *b*, portion of stem, under side $\times 3$. *c, c*, leaves $\times 4$. *d, d*, amphigastria $\times 4$. *e*, upper median cells $\times 250$. *f*, calyptra $\times 8$. *g*, lid $\times 8$. *h*, marginal cells $\times 200$.

Fig. 2. *Symphyodon complanatus*. *a*, stem nat. size. *b*, stem leaf $\times 20$. *c*, branch leaf $\times 20$. *d*, upper cells $\times 200$. *e*, capsule $\times 10$. *f*, apex of perichætal bract $\times 40$.

Fig. 3. *Symphyodon scabrisetus*. *a*, stem leaf $\times 20$. *b*, branch leaf $\times 20$. *c*, apex of perichætal bract $\times 40$. *d*, capsule $\times 10$. *e*, portion of upper part of seta $\times 40$.

Fig. 4. *Mnium rostratum*. *a*, upper marginal cells $\times 200$.

Fig. 5. *Mnium succulentum* (Burkill, no. 37177). *a*, upper marginal cells $\times 200$.

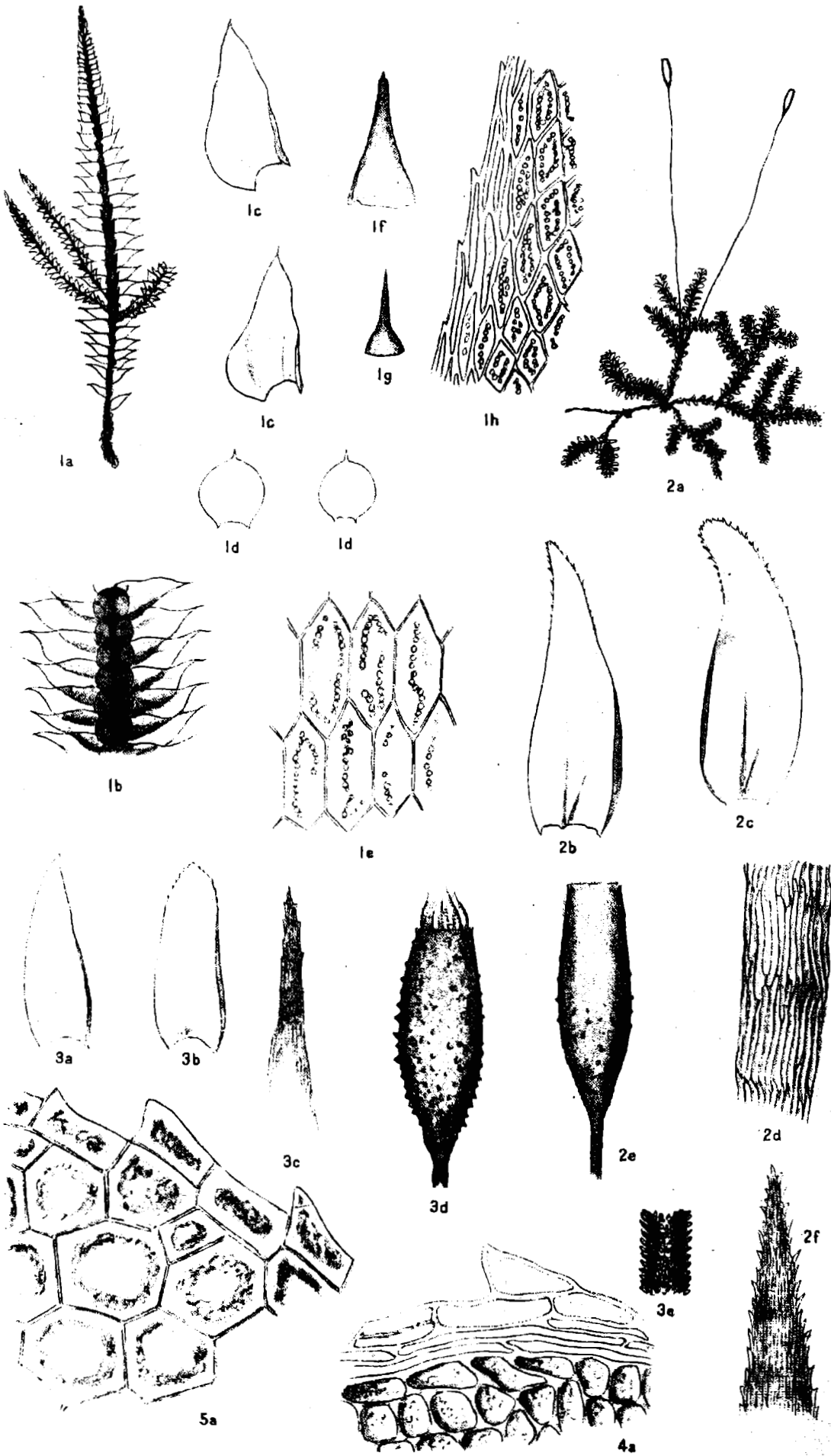
Plate II.—Fig. 5. *Mnium succulentum* (Assam, leg. Griffith). *b, c, d*, marginal cells near apex $\times 50$. *e*, do. at mid-leaf.

Fig. 6. *Leskea perstricta*. *a*, plant, nat. size. *b*, stem leaf $\times 20$. *c, c*, branch leaves $\times 20$. *d*, perichæcium $\times 10$. *e*, capsule $\times 5$. *f*, outer, *g*, inner perichætal bracts, $\times 10$. *h*, upper leaf cells $\times 200$. *i*, alar do. $\times 200$.

Fig. 7. *Rhynchostegiella assamica*. *a*, stem, nat. size. *b, b*, stem leaves $\times 20$. *c, c*, branch leaves $\times 20$. *d*, apex of stem leaf $\times 150$. *e*, upper cells $\times 200$. *f*, capsules $\times 4$.

Fig. 8. *Barbella enervis* (Burkill, no. 36039). *a*, stem, nat. size. *b*, leaf of secondary stem $\times 10$. *c, c*, do. (somewhat flattened out) $\times 20$. *c*, upper cells $\times 200$.

Fig. 9. *Cyathophorum Burkillii*, peristome $\times 80$ (*left*, outer tooth, ventral surface; *middle*, do., dorsal surface; *right*, process of endostome).



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