Mosses from Truk, Caroline Islands

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The Truk Islands are situated within a large lagoon formed by an extensive somewhat circular barrier reef. Gressitt (1954) indicated about 40 islands in the lagoon with six being of some size and height. During the Miami University-*Collegiate Rebel* Expedition in 1960 collections were made on Mount Unibot, Tol Island, which is the highest peak in Truk reaching 452 meters. In addition, Mount Tonaken (Chukumong), 370 meters high, on Moen was explored. The ten remaining, and lower, high islands remain bryologically unknown. Only Falas and Etten of the atoll-like islands have been reported on previously (Miller, Whittier, and Bonner, 1963). This is but the second time mosses from Truk have been reported and the first time for any records from the high islands.

A summary of the collection numbers and localities follows:

676–774 Moen Island, Mt. Tonaken, in summit forest, ca. 370 meters, leg. H. O. Whittier and H. A. Miller, 28–29 July 1960.

775–819 Etten Island, near sea level, leg. H. O. Whittier, 1 August 1960.

820–864 Moen Island, Mt. Tonaken, sea level to 100 meters, leg. H. O. Whittier and H. A. Miller, 2 August 1960.

865–1022 Tol Island, Mt. Unibot, sea level to 452 meters, leg. H. O. Whittier and H. A. Miller, 3 August 1960.

7426–7475 Falas Island, near sea level, leg. H. A. Miller and H. O. Whittier, 30 July 1960.

The following key to species presently known from Truk is provided to encourage further study of bryophytes in this greatly isolated island group. Exploration of still uncollected islands in diverse ecological niches as tree tops, dripping banks, exposed rocky cliff faces, leaves, tree bark, exposed roots, soil, humus, rotting logs, and stones will surely result in numerous additions to the moss flora. To assist in the identification of species already known, we have provided a small scaled sketch of each. Naturalists and others working in Truk or elsewhere in Micronesia who have difficulty with identifications of either mosses or liverworts may forward them to the authors.

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Key to Genera and Species Listed

1. Plants erect and unbranched or dichotomously so, sporophyte terminal (acrocarpous mosses) 2
1. Plants prostrate, usually pinnately branched, sporophyte lateral (pleurocarpous mosses) 28
2(1). Plants flat with leaves in only two rows, the leaves with conduplicate blades toward the base of the upper lamina (*Fissidens*)..... 3
2(1). Plants with leaves in three or more rows, the leaves plane or keeled but never with conduplicate blades 5
3(2). Leaves bordered with a band of elongate cells on both blade and duplicate blades ..... 1. *Fissidens zollingeri*
3(2). Leaves not bordered all around with a band of elongate cells 4
4(3). Leaf cells obscure, very small (3–5 μ), strongly inflated with numerous small papillae on each cell.... 3. *Fissidens scabrisetus*
4(3). Leaf cells well defined, small (6–8 μ), relatively flat, with 1–3 low papillae over the lumen of each cell... 2. *Fissidens hillianus*
5(2). Plants whitish or pale glaucous green with a broad costa (often mistaken for the lamina) composed of large thin-walled hyaline cells (leucocysts) and one or more discontinuous layers of much smaller living green cells (chlorocysts) at the angles of the leucocysts (Leucobryaceae)..... 6
5(2). Plants green to yellow, golden-brown, to dark-brown, with a unistratose blade of chlorophyllose cells extending to the tip or nearly so if the costa is excurrent, hyaline cells absent or, if present, extending upward along the well defined costa 10
6(5). Leaves with a central strand of extremely thick-walled cells embedded in the lower side of the blade-like costa (*Leucophanes*).. 8
6(5). Leaves without a central strand of thick-walled cells..... 7
7(6). Leaves distinctly three-ranked and tightly imbricated at the base, leaf tips usually broken off ..... 8. *Arthrocormus schimperi*
7(6). Leaves several ranked, loose, leaf tips usually intact, costa with stalked pluripointed papillae ..... 9. *Exodictyon giulianettii*
8(6). Leaf margins toothed toward the apex, teeth often paired, tip blunt or acuminate and more or less strongly toothed..... 9
8(6). Leaf margins essentially entire with only 2–3 small teeth at the apex, tip cuspidate and nearly smooth... 5. *Leucophanes glaucum*
9(8). Back of the stereid band (false costa) strongly toothed, leaves mostly 4.0×0.5 mm, white and keeled above ..... 7. *Leucophanes glauculum*
9(8). Back of the stereid band smooth to scarcely toothed, leaves mostly 3.5×0.5 mm, pale glaucous green, nearly plane above when dry..... ..... 6. *Leucophanes smaragdinum*
10(5). Cells of the leaf base adjacent to the costa (cancellineae) much enlarged, thin-walled and hyaline (Calymperaceae)..... 11
10(5). Cells of the leaf base little differentiated, or, if differentiated, then not thin-walled and hyaline 23
11(10). Leaves unbordered or with a narrow band of elongate cells (teniolae) two or three cells removed from the margin of normal laminal cells (*Calymperes*) 17

11(10). Leaves bordered with a marginal band of elongate, thick-walled cells or with a marginal cylindrical band of shortened cells surrounding a filament of elongate thick-walled cells 12

12(11). Leaves broadly ovate, border shiny, wide below and becoming narrower above, plants creeping, frequently branched, and may be mistaken for pleurocarpous mosses when sterile (*Tyhridium*)..... 13

12(11). Leaves lanceolate to oblong linear, border nearly uniform throughout, plants erect and sparsely branched (*Syrrhopodon*)... 14

13(12). Leaves with a broadly flared tip, border about 35 cells wide at widest point ..... 15. *Thyridium constrictum*

13(12). Leaves acute, border about 15 cells wide at widest point..... ..... 14. *Thyridium undulatum*

14(12). Leaf margins and costa with widely spaced cilia several times longer than wide..... 11. *Syrrhopodon ciliatus*

14(12). Leaf margins entire or toothed but not ciliate 15

15(14). Cancellineae extending nearly to the tip of the leaf, leaves narrowly lanceolate, tufts of plants pale reddish below.... 10. *Syrrhopodon rufescens*

15(14). Cancellineae restricted to a somewhat expanded base below the oblong-linear blade, tufts of plants dark green, brownish below 16

16(15). Leaf base concolorous below, leaves in three rather well-defined ranks..... 13. *Syrrhopodon tristichus*

16(15). Leaf base with a flash of orange below, leaves several ranked ..... 12. *Syrrhopodon croceus*

17(11). Leaves with a submarginal band of elongate cells (teniolae) present in the leaf shoulders and extending into the blade..... 18

17(11). Leaves lacking teniolae 19

18(17). Plants with leaves about 6 mm long, cancellinease arched to irregularly truncate above..... 17. *Calymperes tahitense*

18(17). Plants with leaves 3–4 mm long, cancellineae extending upward along the costa (scalariform) ..... 16. *Calypmeres porrectum*

19(17). Stems very short, about 1 mm, with linear leaves nearly 10 mm long, cancellineae limited to the very short, scarcely expanded base .... 22. *Calymperes serratum*

19(17). Stems normally longer than the leaves, more than 1 mm, leaf base expanded..... 20

20(19). Leaves 3.0–4.0 mm long, cancellineae rounded above and 8–14 rows wide on each side..... 18. *Calymperes dozyanum*

20(19). Leaves 1.5–2.5 mm long, cancellineae arched or scalariform, 4–8 rows wide on each side..... 21

21(20). Cancellineae scalariform, margin of leaf base shoulders dentate .... 21. *Calymperes hyophilaceum*

21(20). Cancellineae arched, margin of leaf base shoulders entire or nearly so..... 22

22(21). Cells of the cancellineae in 3–5 rows, median leaf cells rounded and thick-walled, the costa percurrent... 19. *Calymperes motleyi*

22(21). Cells of the cancellineae in 5–8 rows, median leaf cells quad-

rate to hexagonal, thin-walled, costa percurrent to excurrent ..... 20. *Calymperes tenerum*

23(10). Leaf cells smooth, costa long excurrent or, if percurrent, in a very asymmetrical leaf 24

23(10). Leaf cells papillose, costa percurrent to short excurrent, leaves symmetrical 25

24(23). Small plants, leaves narrow, symmetrical, costa long excurrent or percurrent ..... 4. *Dicranella ponapensis*

24(23). Small plants, leaves very asymmetrical, costa short excurrent or percurrent ..... 24. *Mniomalia semilimbata*

25(23). Median leaf cells isodiametric, pluripapillate 26

25(23). Median leaf cells elongate rectangular, papillate by projecting end walls (*Philonotis*) 27

26(25). Soil plants, single, inner leaf base cells rectangular with a broad lumen ..... 23. *Barbula indica*

26(25). Epiphytic plants, leafy branches from a prostrate, essentially leafless stem, inner leaf base cells narrow, somewhat sinuous with the lumen narrower than the double-well thickness ..... 27. *Macromitrium subuligerum*

27(25). Leaves 0.4 mm long × 0.07 mm wide, margins plane ..... 25. *Philonotis asperifolia*

27(25). Leaves 0.7 mm × 0.1 mm, margins narrowly revolute below ..... 26. *Philonotis revoluta*

28(1). Inner basal leaf cells a well defined group, large, thin-walled and hyaline, leaves broadly ovate and strongly bordered below (*Thyridium*) 13

28(1). Inner basal leaf cells not sharply defined if at all, leaves various 29

29(28). Costa single 30

29(28). Costa double or lacking 33

30(29). Leafy branches flattened and appearing to have only four rows of leaves ..... 29. *Neckeropsis semperiana*

30(29). Leafy branches not flattened, numerous rows of leaves present 31

31(30). Leaf cells much longer than broad, feathery plants hanging from limbs or rock faces, leaf tips crisped ..... 28. *Aerobryopsis pernitens*

31(30). Leaf cells mostly isodiametric, stiff wiry plants growing over rocks or logs, leaf tips stiff 32

32(31). Paraphyllia scale-like, plants very regularly bipinnately branched, branch leaves imbricate ..... 33. *Thuidium plumulosum*

32(31). Paraphyllia filamentous, plants irregularly to regularly bipinnately branched, branch leaves widely spreading ..... 32. *Pelekium velatum*

33(29). Costa double, strong, and long, extending beyond midleaf 34

33(29). Costa short and weak or absent 35

34(33). Leaf apex coarsely toothed, cells strongly unipapillose over the lumen ..... 30. *Callicostella papillata*

34(33). Leaf apex crenulate, cells smooth or faintly mammillate..... ..... 31. *Callicostella prabaktiana*

35(33). Leaves with a well-defined group of inflated alar cells sometimes extending across the base as a row of yellowish or brownish enlarged cells, leaf cells often papillose (*Sematophyllaceae*) 36

35(33). Leaves lacking well-defined alar cells or with a single inflated cell at the basal angle, leaf cells usually smooth or faintly papillose on the back by projecting end walls of the cells (Hypnaceae) 40

36(35). Leaf cells seriate papillose over the lumen, leaf tip long acuminate..... 36. *Taxithelium vernieri*

36(35). Leaf cells smooth or papillose by projecting end walls 37

37(36). Leaf cells short, 3–4:1, leaves deeply concave, margins entire (*Meiothecium*) 38

37(36). Leaf cells longer, 6–10 or more:1, leaves plane to concave, margins toothed (*Glossadelphus*) 39

38(37). At the basal angles a group of shorter, rhomboidal cells, the outer 1–2 rows extending up the margins above a row of inflated, yellowish, hyaline cells..... 34. *Meiothecium jagorii*

38(37). Cells of basal angles slightly differentiated, but not extending up the margins..... 35. *Meiothecium papillosum*

39(37). Leaves bluntly pointed, the dorsal ones rounded .... 38. *Glossadelphus hermaphroditis*

39(37). Leaves acuminate to acute..... 37. *Glossadelphus leptosigmatum*

40(33). Leaf cells large and lax, relatively short and wide, 3–5:1 (*Vesicularia*)..... 46

40(33). Leaf cells narrow and long 7–10 or more:1..... 41

41(40). Plants regularly pinnately branched or nearly so, paraphyllia absent, leaves strongly falcate secund, plants golden (*Ectropothecium*)..... 42

41(40). Plants intermittently pinnately branched with small clusters of paraphyllia where a branch might be expected to develop if branching were regular, leaves plane, scarcely falcate-secund, plants pale (*Taxiphyllum*) 45

42(41). Leaves with a marginal row of elongate cells, having noticeably thinner outer walls, laminal cells lax, at the basal angles several wider, rectangular, cells extend up the margin .... 41. *Ectropothecium sparsipilum*

42(41). Leaves with marginal row of more or less hyaline cells with uniformly thickened walls, laminal cells firm, cells of the basal angles not extending up the margins 43

43(42). Leaves complanate, spreading, symmetrical, 0.6–0.9×0.2–0.45 mm, 2–3 times longer than broad, strongly concave, the apex not attenuated but in a broad angle, seldom or not at all falcate, cells of the lamina mostly about 8:1 ..... 39. *Ectropothecium cyperoides*

43(42). Leaves weakly to strongly falcate-secund, not regularly complanate, varying from symmetrical to very asymmetrical, mostly 3–4 times longer than broad, the apex acuminate to long acuminate, cells of the lamina mostly 11:1 or more 44

44(43). Cells of the lamina 6–(11)–14 : 1, leaves 3–5 times longer than broad, the apex acuminate but only slightly falcate..... ..... 40. *Ectropothecium monumentorum*

44(43). Cells of the lamina 9–(12)–20 : 1, leaves 5–6 times longer than broad, the apex long acuminate, strongly falcate-secund..... ..... 42. *Ectropothecium dealbatum*

45(41). Leaves lanceolate, apex long acuminate... 43. *Taxiphyllum minutirameum*

45(41). Leaves broadly ovate-lanceolate, apex acute, not long acuminate .... 44. *Taxiphyllum whittierianum*

46(40). Leaves lanceolate, gradually long-acuminate, narrow, elongate marginal cells with thin outer walls .... 47. *Vesicularia subscaturiginosa*

46(40). Leaves broadly ovate, abruptly attenuated, or apex acute, marginal cells undifferentiated..... 47

47(46). Leaves abruptly attenuated to a long narrow acumen, leaf cells short (3–4 : 1)..... 46. *Vesicularia montagnei*

47(46). Leaves not attenuated, apex a short, wide acumen, leaf cells longer (5–8 : 1)..... 45. *Vesicularia dubyana*

ENUMERATION OF COLLECTIONS

The first series of collections is deposited at Miami University Herbarium (MU) with representative specimens distributed to TNS, G, BISH, DS, US, NSW, NY, LE, and the private herbarium of H. A. Miller.

1. *Fissidens zollingeri* Mont. Ann. Sci. Nat. Bot. ser. 3, 4:114. 1845. (Fig. 1)

Collections: 824, 834, 836, 841, 842, 844, 854, 856, 860, 885, 931.

Distribution: Yap (Brotherus, 1902); Fiji (Dixon & Greenwood, 1930); Samoa (Bartram, 1957); New Guinea, S. China, Andaman, Sumatra, Java, New Zealand, Tahiti (Schultze-Motel, 1963); Ceylon, Burma, Hong Kong, Malaya, Borneo, Celebes, Philippines, New Caledonia (van Zanten, 1964).

Fissidens is quickly recognized from its frond-like appearance and the two rows of spoon-shaped leaves, each clasping the base of the one above. The marginal band of elongate cells around the leaf is distinctive for *F. zollingeri.*

2. *Fissidens hillianus* Mill. & Smith, *sp. nov.* (Fig. 2)

Plantae rupestres, ca. 3.0×1.7 mm, foliis ca. 7 jugis. Folia 1.0–1.2×0.25 mm, acuta vel acuminata; costa sub apice 2–4 cellulae soluta; marginis ubique crenulatis. Laminae duplicatae ca. ½ folii extensus et marginibus partim limbatis. Cellulae laminarum 1–3 papillatae, parietibus ±tenuibus, 6–8 μ. Sterilis.

Collections: Truk. Moen, Mt. Tonaken, in summit forest, ca. 370 m, leg. H. O. Whittier and H. A. Miller, 705 (MU-holotype; BISH, G-isotypes), 704, 739, 744. 28–29 July 1960; Tol, Mt. Unibot, 881, 914a.

The border on the duplicate blades of this and *Fissidens scabrisetus* extends to about the middle of each blade and can be easily overlooked. The flat cells with low papillae and somewhat thickened walls are distinctive for *F. hillianus.* This species is named in honor of Mr. Peter Hill, a professionally trained botanist and long-time resident of Truk as a science teacher for the Trust Territory of the Pacific Islands. A former classmate of the senior author at the University of Michigan, Mr. Hill contributed greatly to the success of the Miami University-

Collegiate Rebel Expedition while it was in the Truk Islands.

3. *Fissidens scabrisetus* Mitt. J. Linn. Soc. Bot. 10:184. 1869. (Fig. 3)

Collections: 825, 935, 936, 945.

Distribution: Samoa (Brotherus, 1924). New to Micronesia.

Thin-walled, rounded cells obscured by dense papillae are characteristic for this species.

4. *Dicranella ponapensis* Sak. Bot. Mag. Tokyo 57:86. 1943. Fig. 4)

Collection: 843.

Distribution: Ponape (Glassman, 1952).

Sterile *Dicranellae* are almost impossible to identify accurately, but as our specimens compare favorably with Sakurai's description and figure we have placed our specimen under that name.

5. *Leucophanes glaucum* (Schwaegr.) Mitt. J. Linn. Soc. Bot. Suppl. 1:25. 1859. (Fig. 5)

Collections: 974, 987.

Distribution: Moluccas, Marianas, Java (Paris, 1905).

This species appears to be somewhat more slender leafed than the others. Under the microscope the absence of teeth and the cuspidate tip are distinctive.

6. *Leucophanes smaragdinum* (Mitt.) Jaeg. Ber. S. Gall. Naturw. Ges. 1877–78: 391. 1880. (Fig. 6)

Collections: 736, 756, 775, 777, 787, 788, 807, 810, 812, 814, 816, 817, 855, 863, 867, 880.

Distribution: Rotuma, Guam (Bartram, 1945); Fiji, Admiralties, (Paris, 1905); Gilberts, Little Makin I., Ellice I., Samoa (Dixon, 1927); Arno (Miller, 1953); Kapingamarangi, Nukuoro (Miller, 1956).

Leaves of *L. smaragdinum* are greenish and tend to be undulate and flattened to weakly keeled when dry. The stereid band is weakly toothed in the upper part of the leaf.

7. *Leucophanes glauculum* C. M. *ex* Fleisch. Musci Fl. Buitenzorg 1:181. 1904. (Fig. 7)

Collections: 746, 793, 795, 798, 808, 809, 851, 883, 930, 934.

Distribution: Palau (Dixon, 1943); Yap (Brotherus, 1902); Pingelap (Glassman, 1953), Arno, Malaysia (Miller & Doty, 1953).

Leaves of *L. glauculum* tend to be very pale and sharply keeled when dry. The stereid band is strongly toothed on the back for at least the upper half of the leaf.

8. *Arthrocormus schimperi* (Doz. & Molk.) Doz. & Molk. Musci Fr. Ined. Archip. Indici 76. 1846. (Fig. 8)

Collections: 992, 999, 1010.

Distribution: Java, Borneo, Amboina, Philippines (Fleischer, 1902); Ceylon, Malaysia to Fiji, Tahiti (Bartram, 1939). New to Micronesia.

The whitish leaves are in three well-defined ranks and the tips are usually broken off, apparently as a propagative device, in this species.

9. *Exodictyon giulianettii* (Broth.) Card. Oefv. Finsk. Vet. Soc. Foerh. 40:72. 1898. (Fig. 9)

Collections: 974, 988, 989a, 996, 999, 1004, 1010.

Distribution: New Guinea. New to Micronesia.

The stalked papillae on the costa are so striking even under low magnification that this species can be easily separated from the other whitish mosses.

10. *Syrrhopodon rufescens* Hook. & Grev. Edinburgh J. Sci. 3:227. 1826. (Fig. 10)

Collections: 721, 869, 1019.

Distribution: Singapore, Sundas, Philippines, Marianas (Brotherus, 1924); Malay Peninsula, Java (Bartram, 1939).

The hyaline cancellineae extend so far out in the leaf that a Leucobryaceous moss is suggested. However under the microscope the unistratose leaves and distal lamina of isodiametric chlorophyllose cells establish its true affinities.

11. *Syrrhopodon ciliatus* (Hook.) Schwaegr. Spec. Musc. Suppl. 2(1):114. 1823. (Fig. 11)

Collections: 883, 930.

Distribution: Ponape (Glassman, 1952); Raiatea (Bartram, 1931; Java, Sumatra, Celebes, Amboina, Borneo, Singapore (Sakurai, 1943); New Guinea, Malaya, Banca, Philippines, Moluccas, Admiralties, Louisiades (Schultze-Motel, 1963); Ternate, Samoa (van Zanten, 1964).

This species often occurs on moist rotting wood as scattered plants among other bryophytes. The wide spreading, plane, leaves bearing cilia form a distinctive rosette.

12. *Syrrhopodon croceus* Mitt. J. Linn. Soc. Bot. Suppl. 1:41. 1859. (Fig. 12)

Collection: 1019.

Distribution: Samoa (Mitten, 1868); Admiralties, Ceylon (Mitten, 1885); Sundas (Brotherus, 1924); Fiji (Bartram, 1936); Palau, Java, Sumatra, Banca, Singapore, New Guinea (Sakurai, 1943); Ponape (Glassman, 1952); Philippines, Entrecasteaux, Louisiades, Solomons (Schultze-Motel, 1963); Malaya, Negros, Panay (van Zanten, 1964).

The wiry irregularly ranked leaves with an orange patch in the lower cancellineae are unmistakable.

13. *Syrrhopodon tristichus* Nees *ex* Schwaegr. Spec. Musc. Suppl. 4:316b. 1842. (Fig. 13)

Collecsions: 987a, 1003.

Distribution: Fiji (Mitten, 1871); Ponape, Ceylon, Sumatra, Java, Amboina (Horikawa, 1935); New Guinea, Philippines, Entrecasteaux, Louisiades, Solomons (Schultze-Motel, 1963).

Although there is a superficial similarity with *S. croceus*, the clearly three-ranked, rigid leaves with elongate marginal basal cells eliminate that possibility.

14. *Thyridium undulatum* (Doz. & Molk.) Fleisch. Musci Fl. Buitenzorg 1:230. 1904. (Fig. 14)

Collections: 978, 979, 980, 985, 990, 997.

Distribution: Celebes, Borneo, Sumatra, New Guinea (Fleischer, 1904). Ponape, Java (Sakurai, 1943): Philippines, Bismarcks, Entrecasteaux, Louisiades (Schultze-Motel, 1963); Malaya, Singapore, Mindoro, Negros, Batan, Sumbawa, Australia (van Zanten, 1964).

The prostrate habit of *Thyridium* may result in it being mistaken for a pleurocarpous moss, but the presence of cancellineae places it in the Calymperaceae. The broadly flared tip of *T. constrictum* separates it immediately from *T. undulatum*.

15. *Thyridium constrictum* (Sull.) Mitt. J. Linn. Soc. 10:188. 1868. (Fig. 15)

Collections: 984, 986, 989, 990, 1001, 1019.

Distribution: Raiatea (Bartram, 1931); Great Natuna, Hawaii (Bartram, 1933); Palau, Java, Borneo, Sumatra, Philippines, Samoa (Sakurai, 1943); Ponape (Glassman, 1952); Tahiti (Hurlimann, 1963); New Hebrides, Louisiades (Brotherus, 1924).

16. *Calymperes porrectum* Mitt. J. Linn. Soc. Bot. 10:172. 1868. (Fig. 16)

Collections: 684, 848, 969.

Distribution: Samoa (Mitten, 1968); Moluccas (Yuncker, 1945); New Guinea, Malaya, Java, Philippines, Fiji (Schultze-Motel, 1963); Singapore, Borneo (van Zanten, 1964); Ant (Miller, et al., 1963).

The well-defined teniolae, especially at the leaf shoulders above the cancellineae, set apart *Calymperes porrectum* and *C. tahitense*.

17. *Calymperes tahitense* (Sull.) Mitt. J. Linn. Soc. Bot. 10:172. 1868. (Fig. 17)

Collections: 676, 884.

Distribution: Gambier (Paris, 1904); Raiatea (Bartram, 1931); Guam, Java, Borneo, Philippines, Fiji (Bartram, 1945); New Guinea, Formosa, New Hebrides, Samoa, Marquesas, Solomons (Schultze-Motel, 1963).

18. *Calymperes dozyanum* Mitt. J. Linn. Soc. Bot. Suppl. 1:42. 1859. (Fig. 18)

Collections: 691, 800, 839, 874, 875, 972, 7442, 7447, 7462, 7468, 7469, 7475.

Distribution; Samoa (Mitten, 1868); Admiralties (Mitten, 1885); New Guinea, Ceylon, Malaya, Sumatra, Java, Borneo, Philippines, Louisiades, Gilberts (Schultze-Motel, 1963).

This is a very common species on coconut trunks at lower elevations. When dry the very large area of cancellineae in the leaf base is exposed to show a whitish patch not seen in other species.

19. *Calymperes motleyi* Mitt. *In* Doz. & Molk. Bryol. Jav. 1:48. 1856. (Fig. 19)

Collections: 7436, 7438.

Distribution: Carolines, Marshall (Miller, et al., 1963); Borneo (Brotherus, 1925).

A rather uncommon species often intermixed with other *Calymperes* on coconut bark.

20. *Calymperes tenerum* C. M. Linnaea 37:174. 1872. (Fig. 20a)

Collections: 832, 852, 858, 865, 7437, 7439, 7440, 7450, 7452, 7474.

Distribution: Bengal, Dumbia (Theriot, 1910); Gilberts, India, Malaya, Java, Borneo, New Caledonia, Queensland, Fiji (Dixon, 1927); Societies (Bartram, 1931); Utirik, Ailuk, Likiep, Wotho, Ujae, Lae, Ujelang, Philippines, Hawaii (Miller, 1955); Kapingamarangi (Miller, 1956); Subuai (Hürliman, 1956); Australs, Hao, Pitcairn (Bartram, 1940); Palmyra, (Bartram, 1945); Tuamotus (Bartram, 1933); Vietnam, Singapore, Sumatra, Krakatau, Lumbucan (van Zanten, 1964); Formosa (Schultze-Motel, 1963).

A very common and probably one of the most widely distributed mosses in the Pacific. Sometimes leaves with a bistratose margin are observed but this feature seems to have no taxonomic significance.

Calymperes tenerum var. *edamense* Fleisch. Musc. Archip. Ind. No. 63. 1899. (Fig. 20b)

Collections: 821, 837, 849, 850, 861, 971, 973, 998.

Distribution: Carolines (Miller, et al., 1963); Java (Fleischer, 1902).

The variety is distinguished from the species by the blunt expanded apex of

the costa of propaguliferous leaves.

21. *Calymperes hyophilaceum* C. M. *ex* Besch. Ann. Sci. Nat. Bot. ser. 8, 1:265. 1896. (Fig. 21)

Collections: 777, 781, 782, 784, 786, 790, 800, 804, 808, 821, 822, 858, 868, 7431, 7447, 7459, 7460, 7461, 7471.

Distribution: New Guinea, Thailand, Sumatra, Java, Borneo, Philippines, Carolines, Louisiades, Marshalls (van Zanten, 1964); Tau, Papatea, Samoa (Yuncker, 1945); Arno (Miller & Doty, 1953); Kapingamarangi (Miller, 1956); Lae (Miller, 1955).

The tapering extension of the cancellineae upward along the costa in a narrow leaf with flared proboscoid tip sets *C. hyophilaceum* apart.

22. *Calymperes serratum* A. Br. *ex* C. M. Syn. Musc. 1:527. 1849. (Fig. 22)

Collections: 699, 714.

Distribution: Ponape, Malaysia, E. China, Philippines, New Caledonia, Fiji, Samoa (Bartram, 1945); Ceylon, New Guinea, Formosa, Sumatra, Java, Borneo, Celebes (Schultze-Motel, 1963).

This species has an extremely short stem and very long crisped leaves which curl inward to form a loose tangle when dry. The area of cancellineae is very small compared to the length of the leaf.

23. *Barbula indica* (Schwaegr.) Brid. Bryol. Univ. 1:544. 1826. (Fig. 23)

Collections: 693, 915.

Distribution: India, Ceylon, Java, Borneo, E. China (Bartam, 1939); Guam (Dixon, 1943).

This dark green to brownish species grows on soil. The leaves are densely papillose with obscured isodiametric cells above and somewhat elongate, rectangular, smooth, thick-walled cells below.

24. *Mniomalia semilimbata* C. M. J. Mus. Godeffroy 3:60. 1874. (Fig. 24)

Collection: 713.

Distribution: Kusaie, Sumatra, Borneo, Philippines, New Guinea, Samoa (Miller, et al., 1963); Ceylon, Louisiades (Schultze-Motel, 1963).

The leaf is so extremely asymmetrical that it appears that part of it is missing, and the absence of a border on the narrow side enhances the illusion. Once seen, the species is easily recognized.

25. *Philonotis asperifolia* Mitt. J. Linn. Soc. Bot. 10:185. 1868. (Fig. 25)

Collection: 864.

Distribution: Samoa (Mitten, 1968); Fiji (Dixon & Greenwood, 1930); Guam (Bartram, 1960).

Both species of *Philonotis* were sterile in our collections but they seem to be properly assigned. They generally grow on dripping banks or directly in very shallow water and should be sought there. They are usually bright yellow-green in nature and under the microscope the papillae formed by protruding ends of cell walls are distinctive.

26. *Philonotis revolta* Bosch & Lac. Bryol. Jav. 1:158. 1861. (Fig. 26)

Collections: 863, 970, 994.

Distribution: Fiji (Dixon & Greenwood, 1930). New to Micronesia.

27. *Macromitrium subuligerum* Bosch & Lac. Bryol. Jav. 1:124. 1860. (Fig. 27)

Collection: 892.

Distribution: Carolines, Java, Celebes, Philippines, Tahiti (Bartram, 1945); Tonga, Tuamotus (Hürliman, 1963).

This large genus is characterized by a prostrate, leafless "rhizome" with elect branches of about uniform length. The leaf cells are isodiametric and papillose above and elongate with very thick walls and narrow, slightly S-shaped lumens below. *Macromitrium* usually grows on relatively high tree branches.

28. *Aerobryopsis pernitens* Sak. Bot. Mag. Tokyo 52.254. 1943. (Fig. 28)

Collections: 964, 974, 978, 980, 985, 986, 987, 991, 1001.

Distribution: Palau (Sakurai, 1943).

This species can be recognized by the long, attenuated, crisped, tips on leaves with a thin costa extending about two thirds. It is usually an epiphyte and forms pendant feathery masses.

29. *Neckeropsis semperiana* (Hampe *ex* C. M.) Touw. Blumea 11:414. 1962. (Fig. 29)

Collections: 687, 705, 710, 712, 713, 723, 727, 741.

Distribution: Annam, Tonkin, Philippines (Touw, 1962). New to Micronesia. The pale green, flat, frond-like, epiphytic mosses with rounded, toothed, leaves all seem to belong to this species in Truk. In many leaves the costa is forked near the tip. The widespread *Neckeropsis lepineana* is expected in Truk but has not yet been found. It has an entire margin.

30. *Callicostella papillata* (Mont.) Mitt. J. Linn. Soc. Bot. Suppl. 1:136. 1859. (Fig. 30)

Collections: 705, 737, 738, 908, 958, 984.

Distribution: India, Sumatra, Java, Borneo (Bartram, 1939). New to Micronesia.

The very strong double costa extending nearly to the leaf tip is found in no other genus of Truk mosses. A conical papilla is formed over the lumen of each of the upper cells in this species whereas *C. prabaktiana* has smooth cells.

31. *Callicostella prabaktiana* (C. M.) Bosch & Lac. Bryol. Jav. 2:40. 1862. (Fig. 31)

Collections: 680, 728, 735, 977a.

Distribution: Solomons, Java, Borneo, Philippines, Annam, New Caledonia (Bartram, 1938); New Guinea (Schultze-Motel, 1963). New to Micronesia.

32. *Pelekium velatum* Mitt. J. Linn. Soc. Bot. 10:176. 1868. (Fig. 32)

Collections: 692, 723, 727, 813, 819, 896.

Distribution: Admiralties (Mitten, 1885); Sumatra, Perak, Singapore, Sarawak (Fleischer, 1922); Fiji (Dixon & Greenwood, 1930); Solomons (Bartram, 1938); Moluccas, Bismarcks (Brotherus, 1925); Palau, Java, New Guinea, Amboina, Samoa, Borneo, Celebes (Sakurai, 1943); Ujelang, Siam, Philippines (Miller, 1955); Formosa (van Zanten, 1964); Nepal, India, Louisiades, New Hebrides (Schultze-Motel, 1963).

Pelekium and *Thuidium* are superficially similar when sterile, but the almost spiny upper seta of *Pelekium* sets fertile plants apart. The paraphyllia on the surface of the main stem also differ; those of *Pelekium* are filamentous and those of *Thuidium* are scale-like. Leaf cells of both are strongly papillose and a strong costa is developed in each.

33 *Thuidium plumulosum* (Mitt.) Doz. & Molk. Bryol. Jav. 2:118. 1865. (Fig. 33)

Collections: 700, 705, 707, 710, 713, 730, 961.

Distribution: Sundas (Brotherus, 1925); Bismarcks (Fleischer, 1922); Java,

Sumatra, Borneo, Banca, Amboina, Admiralties (Paris, 1905); Guam (Bartram, 1945); Kapingamarangi, Ceylon, E. India, New Guinea, Moluccas, Fiji, Philippines, Rotuma (Miller, 1956); Entrecasteaux, Solomons (Schultze-Motel, 1963).

34. *Meiothecium jagorii* (C. M.) Broth. *In* Engler & Prantl. Nat. Pfl. 1(3):1103. 1908. (Fig. 34)

Collections: 849, 850, 858, 859, 972.

Distribution: S. E. Asia, widespread in Malaysia (Bartram, 1939); Yap (Brotherus, 1902).

Meiothecium forms julaceous emerald green strands over bark. The species are distinguished by cellular structure of the leaves as indicated in the key, but they share the blunt apices, short laminal cells and concave leaves.

35. *Meiothecium papillosum* (Broth.) *In* Engler & Prantl. Nat. Pfl. 1(3)1103. 1908. (Fig. 35)

Collection: 892.

Distribution: New Caledonia (Brotherus, 1925); Arno (Miller, 1960).

36. *Taxithelium vernieri* (Duby) Besch. Bull. Soc. Bot. France ser. 3, 5:123. 1898. (Fig. 36)

Collections: 776, 777, 778, 779, 780, 784, 791, 795, 797, 802, 805, 811, 813, 815, 818, 819, 7465, 7470, 7471.

Distribution: Nukuoro, Annam, Java, Borneo, Ceram, Amboina, Fiji, Philippines (Miller, 1956); Moluccas, Saporea, Tahiti, Marquesas (Fleischer, 1922); Solomons (Bartram, 1938).

The papillae are well-defined in this species and regularly arranged over the lumen of each cell.

37. *Glossadelphus leptosigmatum* (C. M. *ex* Geheeb) comb. nov. (Fig. 37)

Trichosteleum leptosigmatum C. M. *ex* Geheeb. Biblioth. Bot. 44:24. 1898.

Taxithelium leptosigmatum (C. M. *ex* Geheeb) Fleisch. Musci Fl. Buitenzorg 4:1351. 1923 [not (C. M.) Par. Ind. Bryol. 1261 (≡4:297). 1897. nom. nud.]

Collections: 838, 923.

Distribution: New Guinea. New to Micronesia.

The inflated, brownish, pigmented alar cells which characterize the Sematophyllaceae are well-developed in *Taxithelium*. Sometimes, as in the Trukese material of this species, the papillae are weak, but can be seen in profile on the leaf surfaces of whole mounted plants.

38. *Glossadelphus hermaphroditis* Fleisch. Musci Fl. Buitenzorg 4:1359. 1923. (Fig. 38)

Collection: 719.

Distribution: Java, Salak, Tjibodas (Fleischer, 1923). New to Micronesia.

A pleurocarpous moss with complanate, ecostate, rounded leaves with irregular teeth distally will be this species. *Glossadelphus* usually grows in very moist and somewhat shaded sites on rocks.

39. *Ectropothecium cyperoider* (Hook.) Jaeg. Ber. S. Gall. Naturw. Ges. 1877–78:259. 1880. (Fig. 39)

Collections: 821, 827, 866, 877, 879, 882, 888, 966.

Distribution: Nepal, Assam, Sumatra, Celebes, Ceylon, Philippines (Brotherus, 1925); Java, Kapingamarangi, Puluwat, Nukuoro, Yap (Miller, 1956).

The bright yellow, sometimes faintly green regularly pinnately branched

stems forming mats over sandy soil or rock (rarely bark) set off *Ectropothecium* from other genera. At the basal angle there is often a single enlarged, hyaline cell which remains on the stem unless the leaves are removed very carefully. In *Ectropothecium*, all leaf characteristic are taken from those of the main axis. Branch leaves are often so variable that they are of little assistance in identification. Some specimens will be difficult to place accurately because there are forms which at first appear to integrade. We have found that the distinctions between species given in the key and high-lighted by the illustrations hold when several plants from the same population are examined and ranges of variability are established.

40. *Ectropothecium monumentorum* (Dub.) Jaeg. Ber. S. Gall. Naturw. Ges. 1877–78:259. 1880. (Fig. 40)

Collections: 705, 781, 794, 794, 811, 813, 819, 876, 1015.

Distribution; Java, Sumatra, Banca, Bondaneira, Philippines, Timor, Yap (Fleischer, 1922); Pingelap (Glassman, 1953); New Guinea, Kwashyoto (Schultze-Motel, 1963); Maraki, Tarawa, Tabituea, Butaritari, Ellice, Singapore (Dixon, 1927); Arno (Miller & Doty, 1953); Formosa, Hong Kong (van Zanten, 1964).

41. *Ectropothecium sparsipilum* (Bosch & Lac.) Jaeg. Ber. S. Gall. Naturw. Ges. 1877–78:258. 1880. (Fig. 41)

Collection: 686.

Distribution: Ponape, Java (Sakurai, 1943); Thailand, Malaya, Java, New Caledonia, New Guinea.

42. *Ectropothecium dealbatum* (Hornsch. & Reinw.) Jaeg. Ber. S. Gall. Naturw. Ges. 1877–78:264. 1880. (Fig. 42)

Collection: 728.

Distribution: Guam (Dixon, 1943); Assam, Malaya, Sumatra, Java, Borneo, Panay, Lumbucan, Mindanao, Luzon, Hong Kong, Japan, New Guinea, (van Zanten, 1964).

43. *Taxiphyllum minutirameum* (C. M.) comb. nov. (Fig. 43)

Hypnum minutirameum C. M. Syn. Musc. 2:689. 1951.

Isopterygium minutirameum (C. M.) Jaeg. Ber. S. Gall. Naturw. Ges. 1876–77: 434. 1878.

Collection: 699.

Distribution: Java, Moluccas, Sumatra, Banca, Queensland, Philippines, (Fleischer, 1922); Borneo, Fiji, Marquesas (Bartram, 1939). New to Micronesia.

Assignment of this collection to *Taxiphyllum* is based on the irregularly pinnate branching with clusters of foliose paraphyllia where branches would be expected if more regularly pinnate.

44. *Taxiphyllum whittierianum* Mill. & Smith, *sp. nov.* (Fig. 44)

Plantae ad lignum cariosum; caules prostrati, ramis pinnatis. Folia approximata, complanata vel leniter secunda, caulina 1.2 mm longa, 0.4 mm lata, ovata, acuta vel acuminata, basi constricto, ramea minora; margines serrulati. Costa duplicata brevissima vel nulla. Cellulae laminae angustatae, parietibus tenuibus; alares paucae, abbreviatae, plus minusve inflatae. Autoica? Perichaetium parvum, bracteis paucis, e basi lata in acumen subulatum serratum angustatis. Seta 18 mm alta, lutescens, laevis. Theca cylindrica, sicca deoperculata angusta, asymmetrica, inclinata, brunneola, deoperculata 1.3 mm longa. Reliquae desunt.

Collection: Truk. Moen, Mt. Tonaken, in summit forest ca. 370 m. leg. H. O. Whittier and H. A. Miller. 722(MU-Holotype; BISH, G-isotypes) 28–29 July 1960.

45. *Vesicularia dubyana* (C. M.) Broth. *In* Engler & Prantl. Nat. Pfl.1(3):1095. 1909. (Fig. 45)

Collection: 977a.

Distribution: Java, Amboina, Banca, Philippines (Sakurai, 1943); Ponape (Glassman, 1952); New Guinea, vietnam, Malaya, Hong Kong, Aru (van Zanten, 1964).

The broader leaf tips and more elongate leaf cells distinguish *Vesicularia dubyana* from *V. montagnei* which has leaves ending in a short, sharp acumen, and distinctly shorter cells. *V. subscaturiginosa* has leaves that are more gradually acuminate, with larger, laxer cells and the marginal row has thin outer walls.

46. *Vesicularia montagnei* (Schimp.) Broth. *In* Engler & Prantl. Nat. Pfl. 1(3): 1094. 1909. (Fig. 46)

Collections: 711, 715, 717, 737, 738, 886, 890, 899, 925, 943.

Distribution: Himalayas, Ceylon, Sumatra, Java, Amboina, Borneo (Bartram, 1939); New Caledonia (Bartram, 1953). New to Micronesia.

47. *Vesicularia subscaturiginosa* Fleisch. Musci Fl. Buitenzorg 4:1454. 1922. (Fig. 47)

Collections: 886, 908, 958.

Distribution: Java, Timor (Fleischer, 1922). New to Miconesia.

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Explanation of Figures

Fig. 1. *Fissidens zollingeri*. A. habit ×8; B. leaf ×30; C. upper leaf cells and margin ×240.

Fig. 2. *Fissidens hillianus*. A. habit ×8; B. leaf ×30; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 3. *Fissidens scabrisetus*. A. habit ×8; B. leaf ×30; C. upper leaf cells and margin ×240 (sic!).

Fig. 4. *Dicranella ponapensis*. A. habit ×6; B. leaves ×10; C. leaf ×50; D. leaf base ×240; E. leaf tip ×240.

Fig. 5. *Leucophanes glaucum*. A. leaves ×10; B. leaf blade and margin ×240; C. leaf tip ×240; D. cross-section near leaf base ×240.

Fig. 6. *Leucophanes smaragdinum*. A. leaves ×10; B. leaf tip ×240; C. cross-section of costa and stereid band at mid-leaf ×240.

Fig. 7. *Leucophanes glaucul*um. A. leaves ×10; B. leaf tip ×240; C. cross-section near leaf tip ×240.

Fig. 8. *Arthrocormus schimperi*. A. habit ×6; B. leaf ×10; C. cross-section of middle leaf base ×240.

Fig. 9. *Exodictyon giulianettii*. A. leaves ×10; B. leaf blade cells and margin ×240; C. cross-section near leaf tip ×120; D. detail of papillae in cross-section ×240.

Fig. 10. *Syrrhopodon rufescens*. A. leaves ×10; B. leaf ×25; C. leaf tip and cancellineae ×50; D. leaf base ×100; E. upper portion of cancellineae and blade ×240.

Fig. 11. *Syrrhopodon ciliatus*. A. leaf ×10; B. leaf ×25; C. upper portion of cancellineae and margin ×100; D. upper leaf cells and margin ×240.

Fig. 12. *Syrrhopodon croceus*. A. leaf (base and tiy) ×10; B. leaf ×6; C. margin at basal shoulders ×240; D. upper leaf cells and margin ×240.

Fig. 13. *Syrrhopodon tristichus*. A. leaf ×10; B. leaf base and cancellineae ×50; C. leaf tip ×50; D. margin at basal shoulders ×240; E. upper leaf cells and margin ×240.

Fig. 14. *Thyridium undulatum*. A. leaves ×10; B. leaf tip ×50; C. margin at basal shoulders ×240; D. upper leaf cells and margin ×240.

Fig. 15. *Thyridium constrictum*. A. leaves ×10; B. leaf tip ×50; C. margin at basal shoulders ×240; D. upper median leaf cells ×240; E. upper leaf margin ×240.

Fig. 16. *Calymperes porrectum*. A. leaves ×10; B. leaf base and cancellineae ×50; C. upper leaf cells and margin ×240.

Fig. 17. *Calymperes tahitense*. A. leaf ×10; B. lower cancellineae ×50; C. upper portion of cancellineae ×50; D. upper leaf cells and margin ×240.

Fig. 18. *Calymperes dozyanum*. A. leaves ×10; B. leaf base and cancellineae ×50; C. margin at basal shoulders ×240; D. upper leaf cells and margin ×240.

Fig. 19. *Calymperes motleyi*. A. leaves ×10; B. leaf base and cancellineae ×50; C. upper portion of cancellineae ×240; D. upper leaf cells and margin ×240.

Fig. 20 a. *Calymperes tenerum*. A. leaves ×10; B. leaf base and cancellineae ×50; C. upper portion of cancellineae ×240; D. leaf base margin ×240; E. upper leaf cells and margin ×240.

Fig. 20 b. *Calymperes tenerum* var. *edamense*. A. leaves ×10; B. leaf base and cancellineae ×50; C. leaf tip ×50; D. upper portion of cancellineae ×240; E. upper leaf cells and margin ×240.

Fig. 21. *Calymperes hyophilaceum*. A. leaves ×10; B. leaf base and cancellineae ×50; C. upper portion of cancellineae ×240; D. margin at basal shoulders ×240; E. upper leaf cells and margin ×240.

Fig. 22. *Calymperes serratum*. A. leaf ×10; B. leaf base and cancellineae ×50; C. upper portion of cancellineae ×240; D. median upper leaf cells ×240; E. upper leaf margin ×240.

Fig. 23. *Barbula indica*. A. habit ×6; B. leaf ×10; C. leaf ×25; D. lower leaf base ×240; E. median basal cells ×240; F. upper leaf cells and margin ×240; G. leaf tip ×240.

Fig. 24. *Mniomalia semilimbata*. A. habit ×6; B. leaf ×10; C. leaf ×50; D. upper leaf cells and margin ×240.

Fig. 25. *Philonotis asperifolia*. A. leaves ×10; B. leaf ×50; C. leaf base ×240; D. upper leaf cells ×240; E. leaf tip ×240.

Fig. 26. *Philonotis revoluta*. A. habit ×6; B. leaves ×10; C. leaf ×50; D. leaf base ×240; E. upper leaf cells ×240; F. leaf tip ×240.

Fig. 27. *Macromitrium subuligerum*. A. habit ×1; B. leaves ×10; C. leaf base ×240; D. upper leaf cells and margin ×240.

Fig. 28. *Aerobryopsis pernitens*. A. habit ×6; B. leaf ×10; C. upper leaf cells and margin ×240.

Fig. 29. *Neckeropsis semperiana*. A. leaves ×10; B. leaf tip ×50; C. lower leaf cells and margin ×24; D. upper leaf cells and costa ×240.

Fig. 30. *Callicostella papillata*. A. leaf ×10; B. leaf ×25; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 31. *Callicostella prabaktiana*. A. habit ×6; B. leaves ×30; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 32. *Pelekium velatum*. A. stem leaves ×10; branch leaves ×10; C. stem leaf ×50; D. branch leaf ×50; E. stem leaf upper cells and margin ×240; F. stem leaf tip ×240; G. branch leaf tip ×240; H. paraphyllia ×240.

Fig. 33. *Thuidium plumulosum*. A. stem leaves ×10; B. branch leaves ×10; C. branchlet leaves ×10; D. stem leaf ×50; E. branceh leaf ×50; F. stem leaf upper cells and margin ×240; G. stem leaf tic ×240; H. branch leaf tip×240; I. paraphyllia ×240.

Fig. 34. *Meiothecium jagorii*. A. leaves ×10; B. leaf ×25; C. leaf base ×240; D. upper leaf cells and margin ×240; E. leaf tip ×240.

Fig. 35. *Meiothecium papillosum*. A. leaves ×10; B. leaf ×25; C. leaf base ×240; D. upper leaf cells and margin ×240; E. leaf tip ×240.

Fig. 36. *Taxithelium vernieri*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 37. *Glossadelphus leptosigmatum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. lateral leaf tip ×240; E. dorsal leaf tip ×240.

Fig. 38. *Glossadelphus hermaphroditis*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. lateral leaf tip ×120; E. dorsal leaf tip ×120.

Fig. 39. *Ectropothecium cyperoides*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 40. *Ectropothecium monumentorum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 41. *Ectropothecium sparsipilum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 42. *Ectropothecium dealbatum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

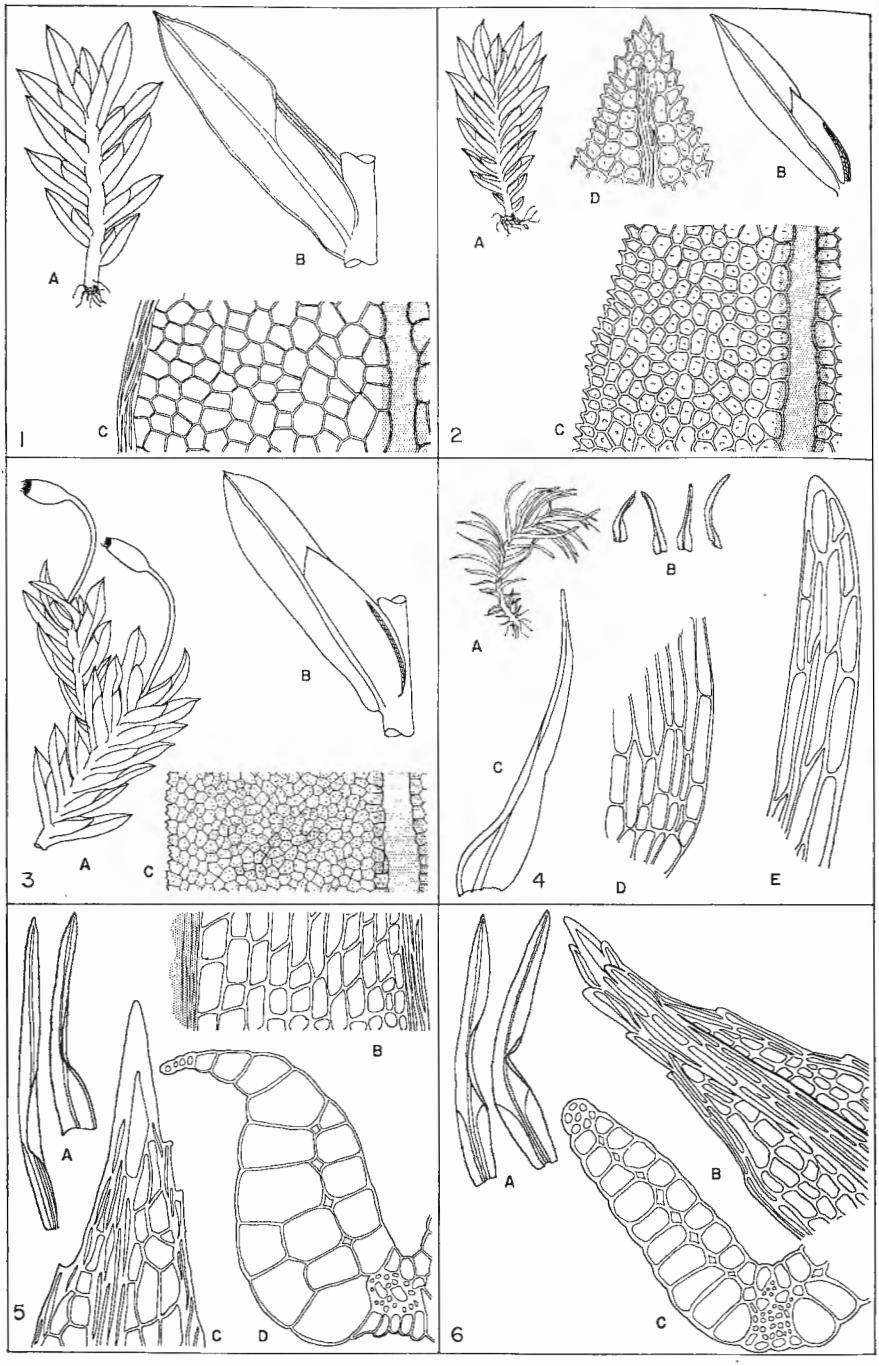
Fig. 43. *Taxiphyllum minutirameum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 44. *Taxiphyllum whittierianum*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. lateral leaf tip ×240; E. dorsal leaf tip ×240.

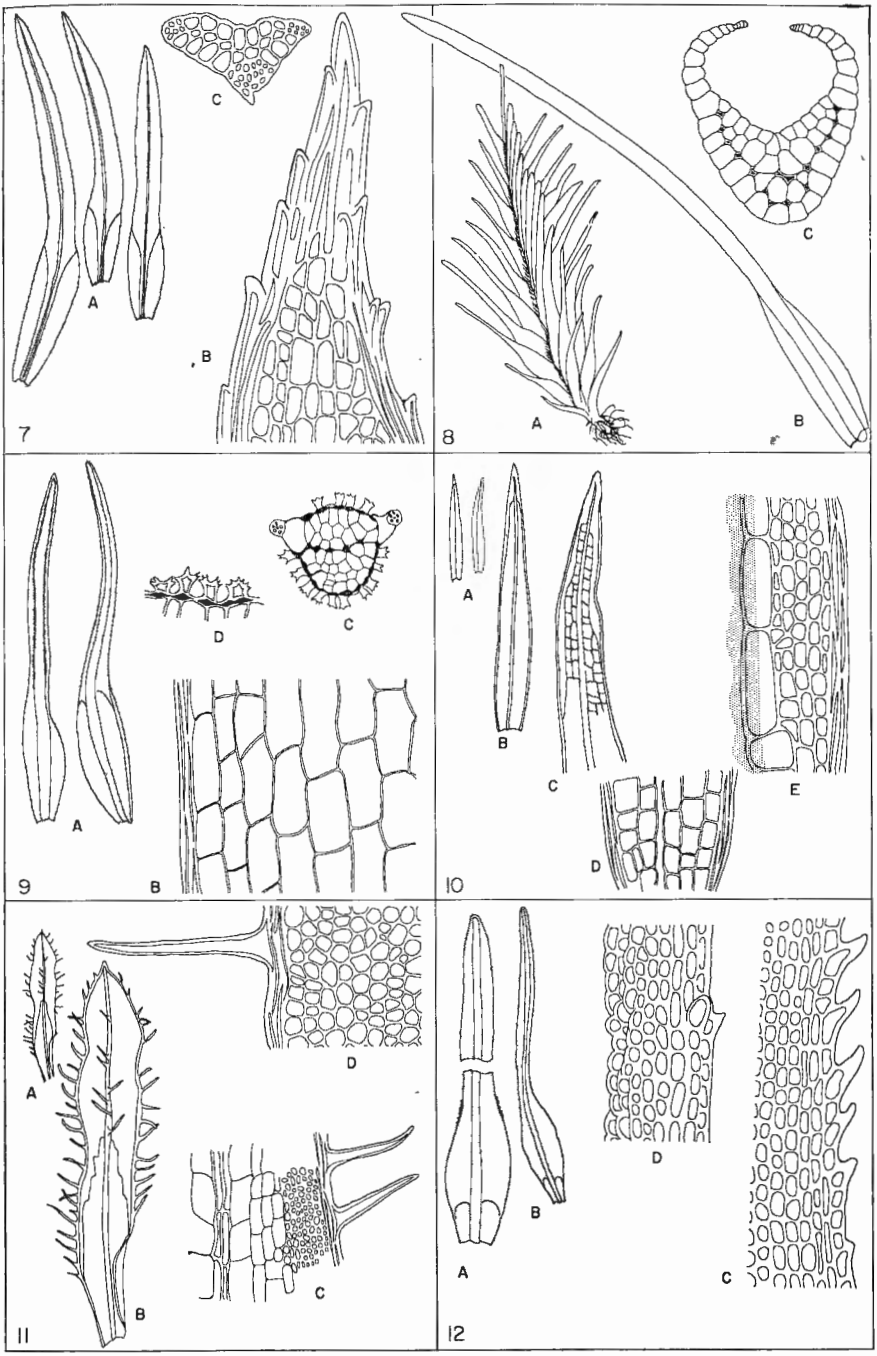
Fig. 45. *Vesicularia dubyana*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

Fig. 46. *Vesicularia montagnei*. A. leaves ×10; B. leaf base ×240; C. upper leaf cells and margin ×240; D. leaf tip ×240.

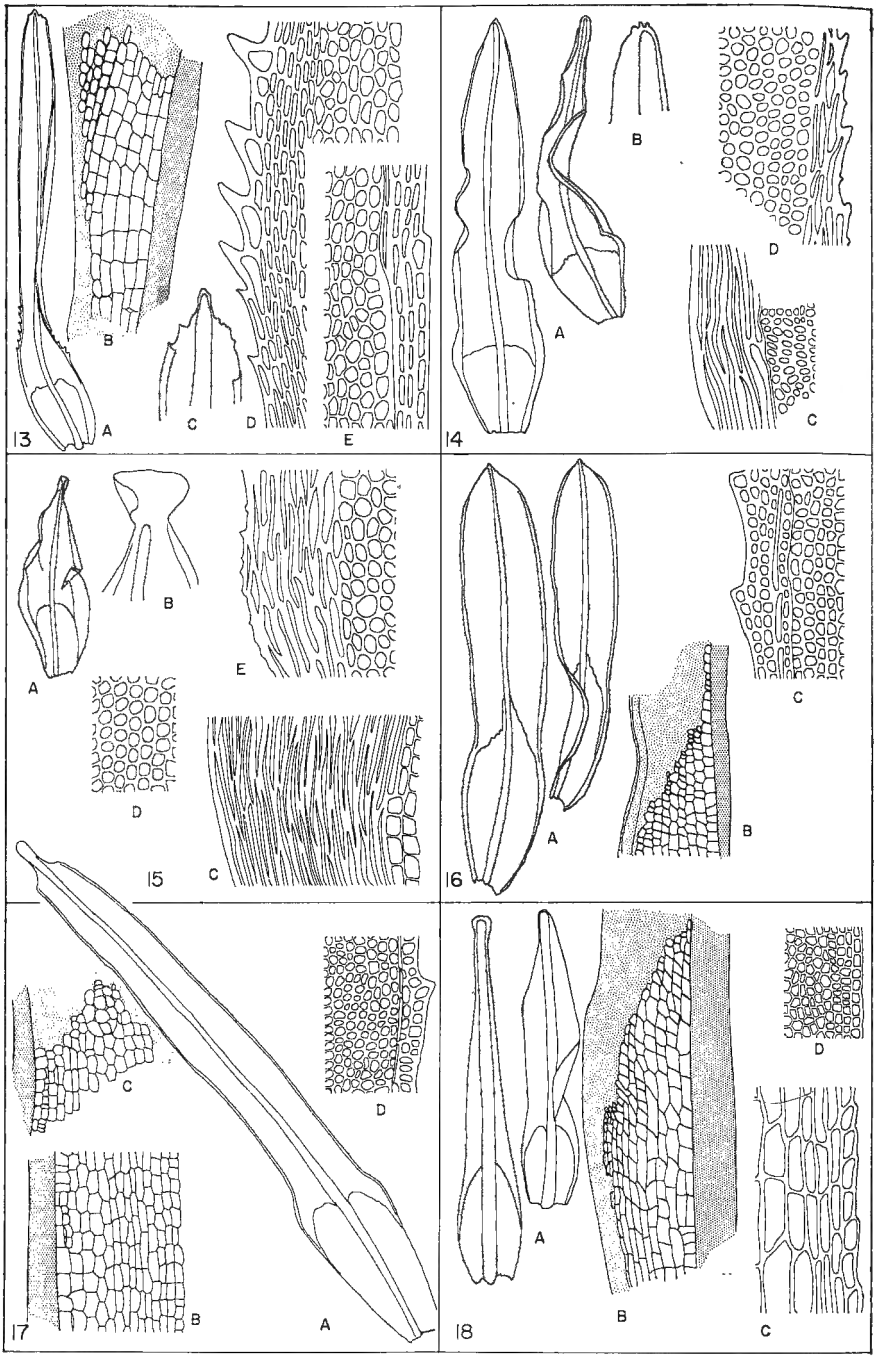
Fig. 47. *Vesicularia subscaturginosa*. A. leaves ×10; B. upper leaf cells and margin ×240; C. leaf tip ×240.



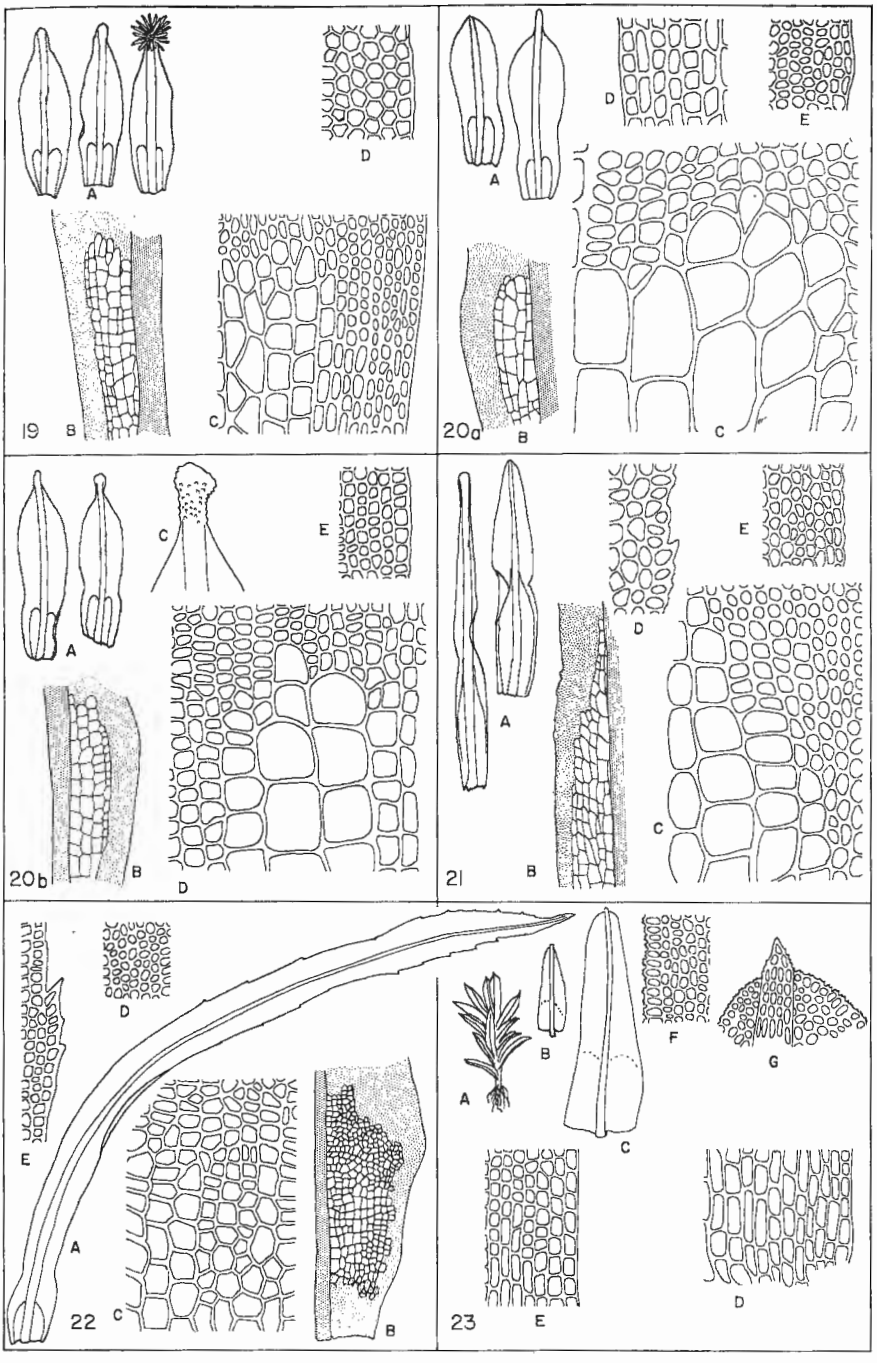
Figs. 1–6.



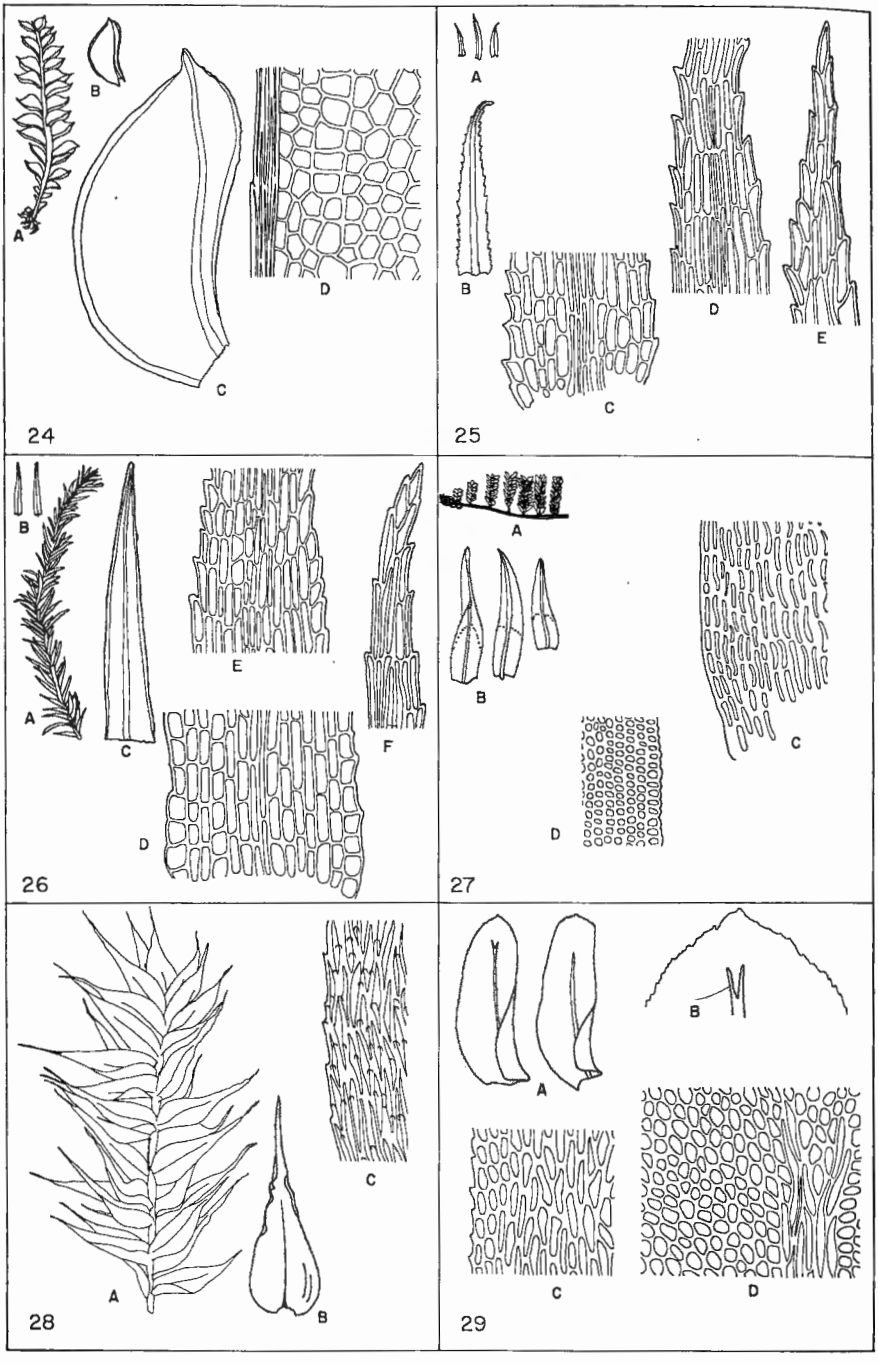
Figs. 7–12.



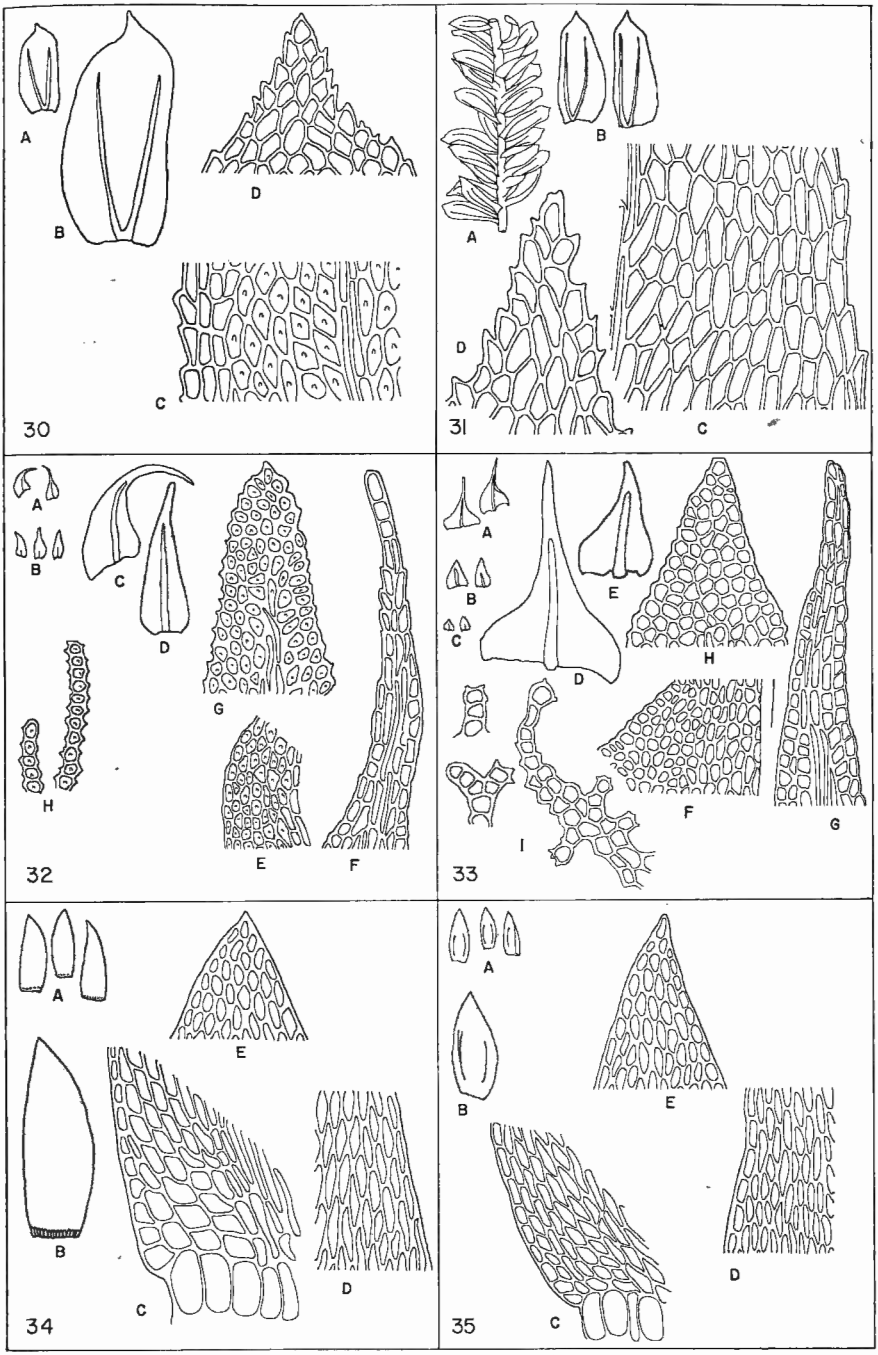
Figs. 13–18.



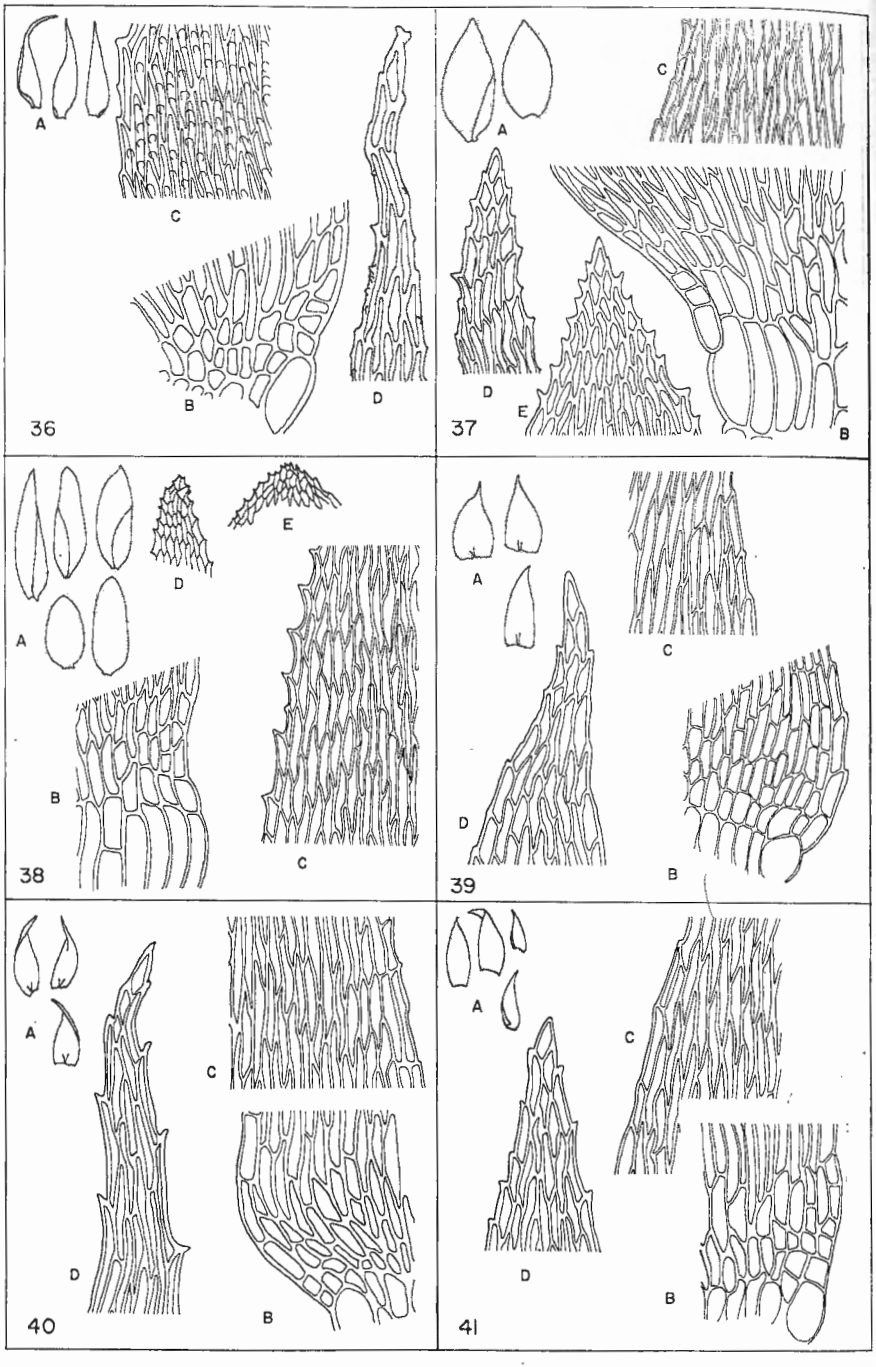
Figs. 19–23.



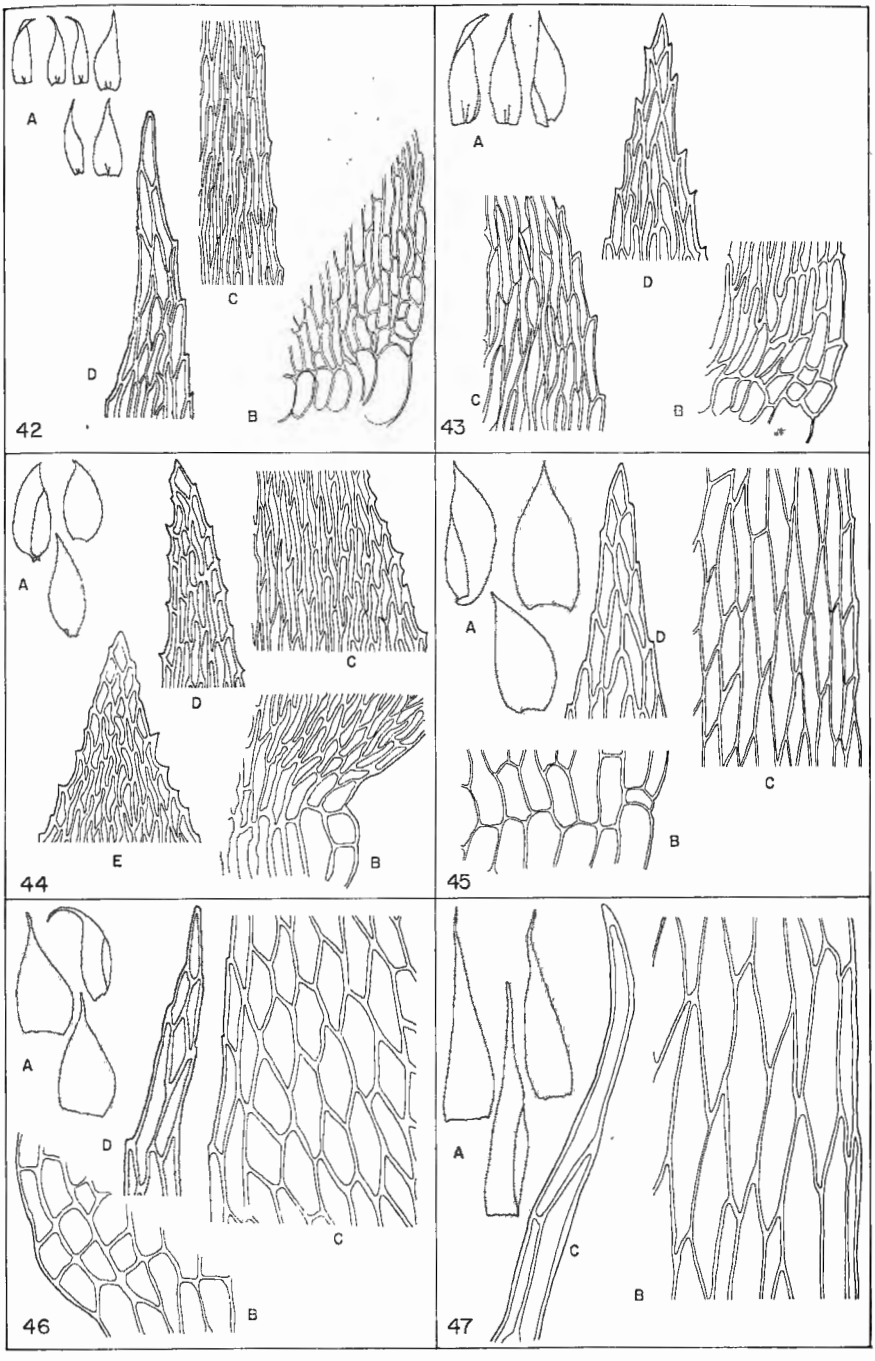
Figs. 24–29.



Figs. 30–35.



Figs. 36–41.



Figs. 42–47.