NOTES ON BRYOPHYTES OF TAIWAN (1-36)

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Abstract: Since 1981 many specimens have been collected and examined by the authors. The problematic and valuable taxa are studied and noted. 36 genera are discussed, of which eleven genera are new additions to the bryoflora of Taiwan. They are *Blindia*, *Cirriphyllum*, *Campyliadelphus*, *Cynodontium*, *Distichium*, *Hygrohypnum*, *Orthothecium*, *Sphaerotheciella*, *Splachnobryum*, *Pterigynandrum* and *Hampeella*. *Distichophyllum pseudo-malayense* sp. nov., *Rhaphidostichum stissophyllum* comb. nov. and *Fissidens crenulatus* var. *pursellii* stat. nov. are new to science. Other 25 species and 3 varieties are reported for the first time in Taiwan. They are *Acroporium alto-pungens*, *Aerobryidium aureo-nitens*, *Didymodon nigrescens*, *Encalypta rhaptocarpa*, *Entodontopsis anceps*, *Fabronia ciliaris*, *F. matsumurae*, *Fissidens crenulatus*, *F. crenulatus* var. *elmeri*, *F. rupicola*, *F. kinabaluensis*, *F. crassinervis*, *F. flabellulus*, *F. ganguleei*, *F. leptopelma*, *F. mangarevensis*, *Forsstroemia cryphacoides*, *Leucodon exalatatus*, *L. sinensis*, *Plagiomnium confertidens*, *Plagiothecium curvifolium*, *Pterobryopsis gedehensis*, *Racomitrium heterostichum* var. *sudeticum*, *Schwetschkeopsis fabronia*, *Tayloria hornschuchii*, *Tortula norvegica*, *Daltonia angustifolia* var. *gemmiphylla* and *Aptychella brevinervis*. Moreover *Boulaya mittenii*, *Horikawaea nitida*, *Macromitrium uraiense* are reconfirmed to be distributed in Taiwan. Discussions are made on 7 noteworthy species, including *Hymenostylium recurvirostre*, *Fissidens japonico-punctatus*, *F. ceylonensis*, *F. mittenii*, *F. laxus*, *F. esquirolii* and *Campylopus gracilentus*.

INTRODUCTION

Taiwan is located in the southeast Asia, 119° 18′–122° 35′ E, 21° 45′–25° 57′ N, besides the main island which has been called "Formosa" since 18th century, comprises the Penghu Archipelago, Orchid Island and other scattered islets. Separated by waters Taiwan is adjacent to Mainland China, Japan and the Philippines, besides the east edge, which borders on the vast Pacific Ocean. The most areas of the longitudinal island are occupied by mountains, especially the so-called "Central Mountain Range", which is composed of more than 150 peaks of 3000 m in elevations or more higher.

The topography in Taiwan is complicated and various owing to the lofty mountains, rugged terrains and the erosions of swift streams. It makes so many vegetative types distribute in this island, and of all kinds bryophytes grow in various habitats and environments. So it is interesting and valuable to study the botany of bryophytes in Taiwan due to the diversities and abundance, especially on the taxonomy, ecology and phytogeography.

The most efforts on the study of bryoflora of Taiwan have been made by the Japanese bryologists since 1914 (cf. Kuo and Chiang 1987). It is estimated more than 80% of the taxa were reported by them. Though a lot of literatures could be consulted, but the scattered depositions of the types and the other cited

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specimens in herbaria of Japan makes it be difficult in studying the bryoflora of Taiwan for the native taxonomists, especially on the taxa which were reported once only or as endemic ones. It is urgent and vital to clarify the bryological taxa of Taiwan now.

As Chuang (1973) mentioned "there still remain vast areas of mountainous Taiwan that are bryologically unexplored", in the fact the most taxa of each vegetative zone have been still short of study by the native taxonomists, even the bryoflora of low elevations. As mentioned above Taiwan is located in subtropical areas, but the vegetative types include the tropical and subtropical broad-leaved forests, warm temperate mountainous broad-leaved forests, temperate coniferous forests and even the alpine tundra. If one makes the researches on the bryological taxa in Taiwan, one must give considerations to the allied taxa of tropical, temperate or even the frigid areas on the viewpoint of phytogeography. For examples the tropical species *Hampeella pallens* (Lac.) Fleisch. and *Acroporium alto-pungens* (C. Muell.) Broth., which occurs separately in Java and the Philippines, were recently found in low elevations of Taiwan. In the same way the temperate species *Cynodontium gracilenscens* (Web. et Mohr) Schimp. and *Distichium capillaceum* (Hedw.) B. S. G. etc., which occur in the high latitudes of North Hemisphere, were found distributed in higher elevations of Taiwan. In the current situation the knowledge on bryoflora of tropical areas seems to be insufficient, it makes more difficult to study the taxa in low elevations of Taiwan, especially on some puzzling genera like *Isopterygium, Taxiphyllum, Leucobryum, Lejeunea,* etc.

In the study of mossflora of Taiwan, some native bryologists have made their efforts and brought out some reports on their work, among them Chuang (1973) was the most prominent one in treating the acrocarpous families. And Wang (1970) was the representative work of initial stage, which was compiled of all literatures recorded available to him and amplified by his own collections (cf. Chuang 1937).

Later on no notable work was brought out, though Lai and Wang-Yang (1976) and Kuo and Chiang (1987) reported the indices of bryophytes, which were only the compiling work of literatures and just a start for making researches, especially on the pleurocarpous families of Taiwan.

Since 1972 H. Inoue and others have continually brought out a lot of valuable reports on Taiwan hepaticae. It is inconceivable that only little work had ever been made by native taxonomists. The authors consider the work of Kuo and Chiang (1988) which was compiled the available literatures related to the flora of Taiwan was just an initial. More efforts must be made by the native bryologists.

The current work of a series of "Notes on bryophytes of Taiwan" will be focused on the problematic and valuable taxa by studying the specimens collected from fields, in order to supply the knowledge on bryoflora of Taiwan.

THE STUDY AREAS AND THE METHODS

Since 1981 the authors have investigated and collected the specimens around the Taiwan Island and Orchid Island, mainly along the three Cross-Island Highways, New Middle-Cross Highway and other truck roads or foot-paths up to the Central Mountain Range. More than twenty mountains of 3000 m alt. or more higher were climbed. The investigations on low elevations mainly made around the Taipei basin, Tzen-wen Dam. and the Hen-chun Peninsula (Fig. 1). In the field

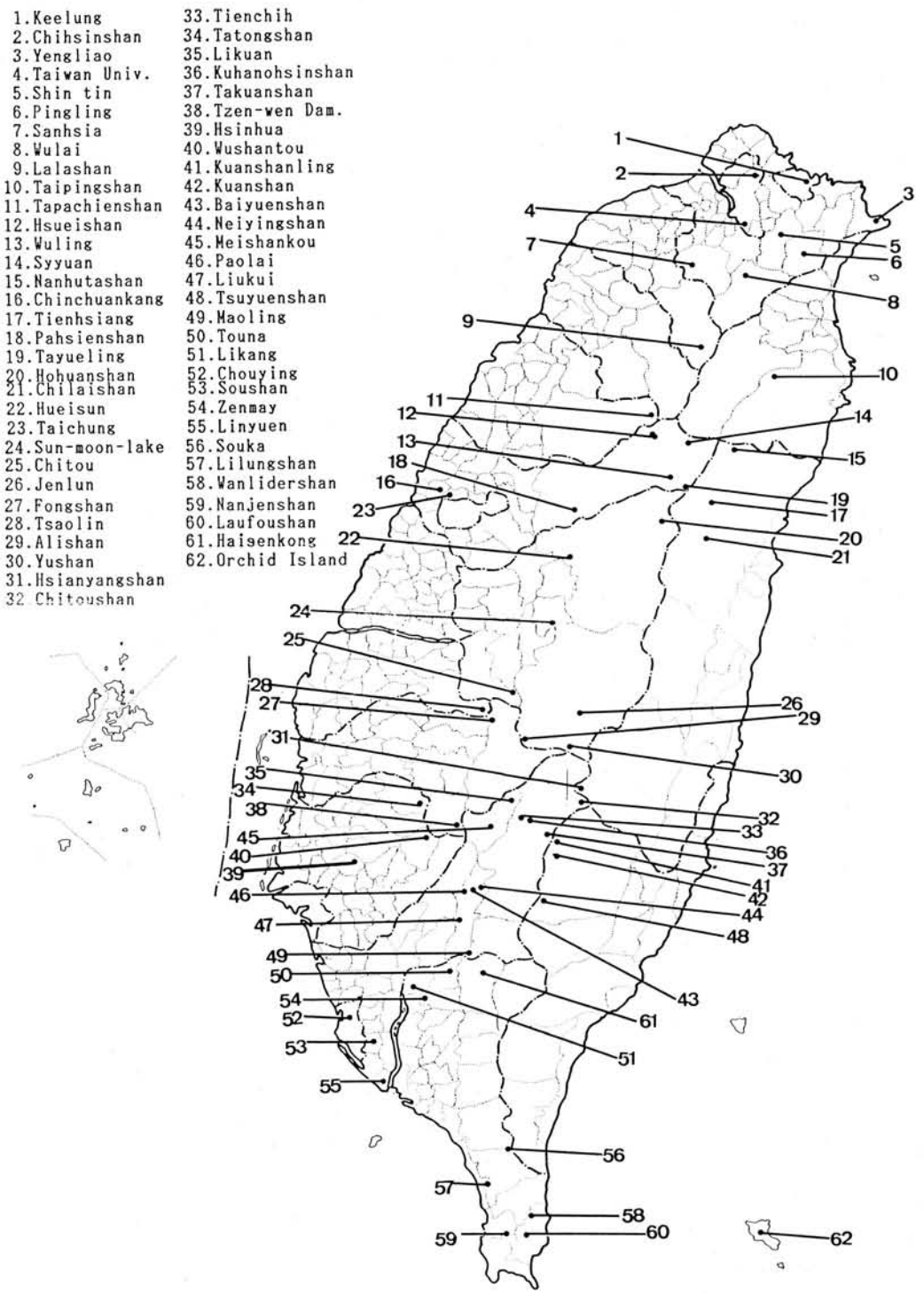

Fig. 1. Map showing localities where the authors made collections.

the specimens were collected and the habitats were recorded. Returning to the laboratory the specimens were wind-dried, enveloped and then examined microscopically and drawn with a drawing tube. The related literatures were consulted before the taxa were determined. The specimens cited in the report are deposited in the Hebarium of Taiwan University (TAI).

TAXONOMIC TREATMENT

1. Note on genus *Acroporium* Mitt. in Taiwan

Acroporium, a genus of the family Sematophyllaceae, is mainly distributed in tropical and subtropical regions, with about 75 species in the world. It is characterized by porous laminal cells and one-rowed inflated alar cells. Three species of the genus were ever reported in Taiwan (cf. Kuo and Chiang 1987). The plants of the genus mainly grow in medium and low elevations of this island. *A. alto-pungens* (C. Muell.) Broth. is a new addition to the mossflora of Taiwan. Besides, the authors consider *A. suzukii* Sak. may be identical with *A. turgidum* Mitt.

Acroporium Mitt., Journ. Linn. Soc. (1868) 182.

Plants lustrous, stems creeping, irregularly branched, densely foliated. Leaves erect-spreading, lanceolate to ovate-lanceolate; laminal cells linear, smooth, mostly porous, alar cells well differentiated, inflated and coloured.

Keys to species of the genus *Acroporium*

1. Leaves with abruptly narrowed caudate apex..... *A. alto-pungens*
1. Leaves with tapering apex.....2
2. Leaves lanceolate, laminal cells thin-walled..... *A. diminutum*
2. Leaves ovate to ovate-lanceolate, laminal cell-walls porous.....3
3. Leaf-apex plane.....*A. oxyporum*
3. Leaf-apex cucullate .....*A. suzukii*

Acroporium alto-pungens (C. Muell.) Broth. in Engler & Prantl, Nat. Pfl. ed. 2, **11**: 437. 1925; Bartram, Philip. Journ. Sci. **68** (1-4): 333. 1939. (PL. I)

Basionym: *Hypnum alto-pungens* C. Muell., Linnaea **37**: 179. 1872.

Plants medium-sized; stem creeping, irregularlly and distally branched, branches ca. 1.5 cm long; stem- and branch-leaves differentiated weakly, widely spreading even when dry, ovate to elliptic, with long acuminate apex, 2.5-2.9 mm long, 0.77-0.97 mm wide, leaf-margins entire, minutely crenulate at apex, ecostate. Laminal cells linear, 68-94 μm long, 2.6-7.9 μm wide, porous; alar cells one-rowed, yellowish-brown, inflated.

Specim. exam. Taipei Hsien: Wulai, Tataushan, 500 m alt., in a ravine, on tree trunk, May 1988, *S. J. Moore 1100*; Huan-ti-tien. 600 m alt., in secondary broad-leaved forest, epiphytic on tree trunk, July 23, 1987, *T. Y. Chiang 21128*.

Distribution: Taiwan, Philippines.

Illustration: Bartram 1939: 333. pl. 25, f. 426.

This species was previously recorded only in the Philippines (cf. Bartram (1939) and Iwatsuki et Tan (1979)). The occurence of the species in Taiwan is the northern limit in the distribution.

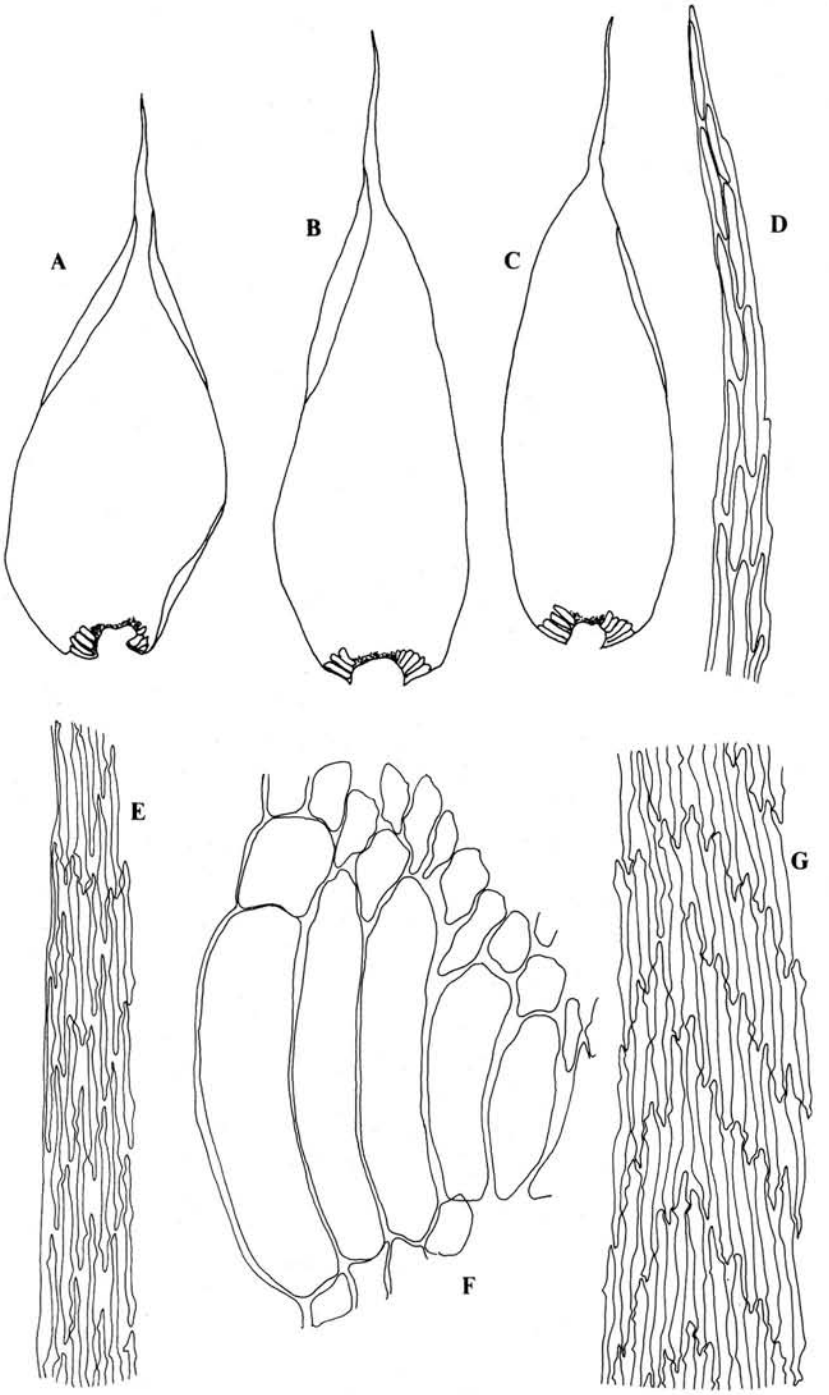

Plate I. Acroporium alto-pungens (C. Muell.) Broth. A-C, leaves (×29). D, apical leaf-cells (×284). E, marginal leaf-cells (×284). F. alar cells (×284). G, median cells (×284). (Drawn from *Moore 1100*)

Acroporium suzukii Sak., Bot. Mag. Tokyo **46**: 504. 1932; Seki, Journ. Sci. Hiroshima Univ., Ser. B, Div. 2, **12**: 28. 1968.

Specim. exam. Taichung Hsien: Chitou, in artificial *Ginkgo* forest, on tree trunk, Aug. 25, 1986, *T. Y. Chiang* 16618; Taipei Hsien: Wulai, 500 m alt., in a ravine, on tree trunk, Feb. 10, 1988, *T. Y. Chiang* 25582.

Distribution: Taiwan, Japan.

Illustrations: Seki 1968: 28. f. 6. 9; Iwatsuki & Suzuki 1972: 244. f. 129.

This species is similar to *A. turgidum* Mitt., which was described by W. Mitten (1868) and distributed in China and Malaya, in the leaf-shape, the porous laminal cells and especially the cucullate leaf-apex. The two species can be distinguished each other only by the more or less acute leaf-apex of *A. turgidum*.

2. *Aerobryidium aureo-nitens* (Schwaegr.) Broth. new to Taiwan

The taxa of the genus *Aerobryidium* in Taiwan have been studied by Wu et Lin (1986), including *A. filamentosum* (Hook.) Fl. and *A. wallichii* (Brid.) Towns. discussed, the latter of which has been placed in the genus *Aerobryopsis* by Fleischer (1907) and quoted by Noguchi (1976) and Norris et Koponen (1985). About 5 species of the genus are distributed in East Asia, 3 of which are listed here, with *A. aureo-nitens* new addition to the mossflora of Taiwan.

Key to species of the genus *Aerobryidium*

1. Leaves without flexuous acumen ..... *A. wallichii*
1. Leaves with flexuous acumen 2
2. Acumen of branch-leaves longer than lamina ..... *A. filamentosum*
2. Acumen of branch-leaves shorter than lamina ..... *A. aureo-nitens*

Aerobryidium aureo-nitens (Schwaegr.) Broth. in Engler & Prantl, Nat. Pfl. 1(3): 820. 1906; Nog., Journ. Hattori Bot. Lab. **41**: 287. 1976. (PL. II, A.-F.)

Stems long creeping, irregularly branched; branches densely and complanately foliated. Branch-leaves similar to stem-leaves, oblong-ovate, tapering to a flexuous acumen, 2.6–3.2 mm long, 1.0–1.8 mm wide, leaf-margins undulate at upper portions of lamina; costa reaching to the base of acumen. Laminal cells rhomboid-linear, 23.7–39.5 μm long, 2.6–5.2 μm wide, with a single papilla, basal cells rectangular, porous; alar cells differentiated, subquadrate to quadrate, 7.9–21.1 μm long, 3.9–7.9 μm wide.

Specim. exam. Nantou Hsien: Yushan area, Salisienchi, 1400 m alt., in semi-original forest, on branches, Apr. 4, 1988, *T. Y. Chiang 26789*; Yushan area, Lele to Leleku, 1500 m alt., in secondary broad-leaved forest, on tree trunk, Aug. 18, 1987, *T. Y. Chiang 22154*.

Distribution: Taiwan, Burma, Thailand, Himalayas, India, Ceylon.

Illustration: Noguchi 1976a: 287. *f. 22. 23.*

This species resembles *A. filamentosum*, but has the shorter and less undulate acumens on branch-leaves. Ecologically *A. filamentosum* is more widely distributed altitudinaly in Taiwan, from 1800 m to 2500 m, whereas *A. aureo-nitens* is limited to lower elevations. In the fields the "appressed smooth mats" growth-form of *A. aureo-nitens* can be separated the "pendent" type of *A. filamentosum*, though the both can be found epiphytic on tree-trunk or branches.

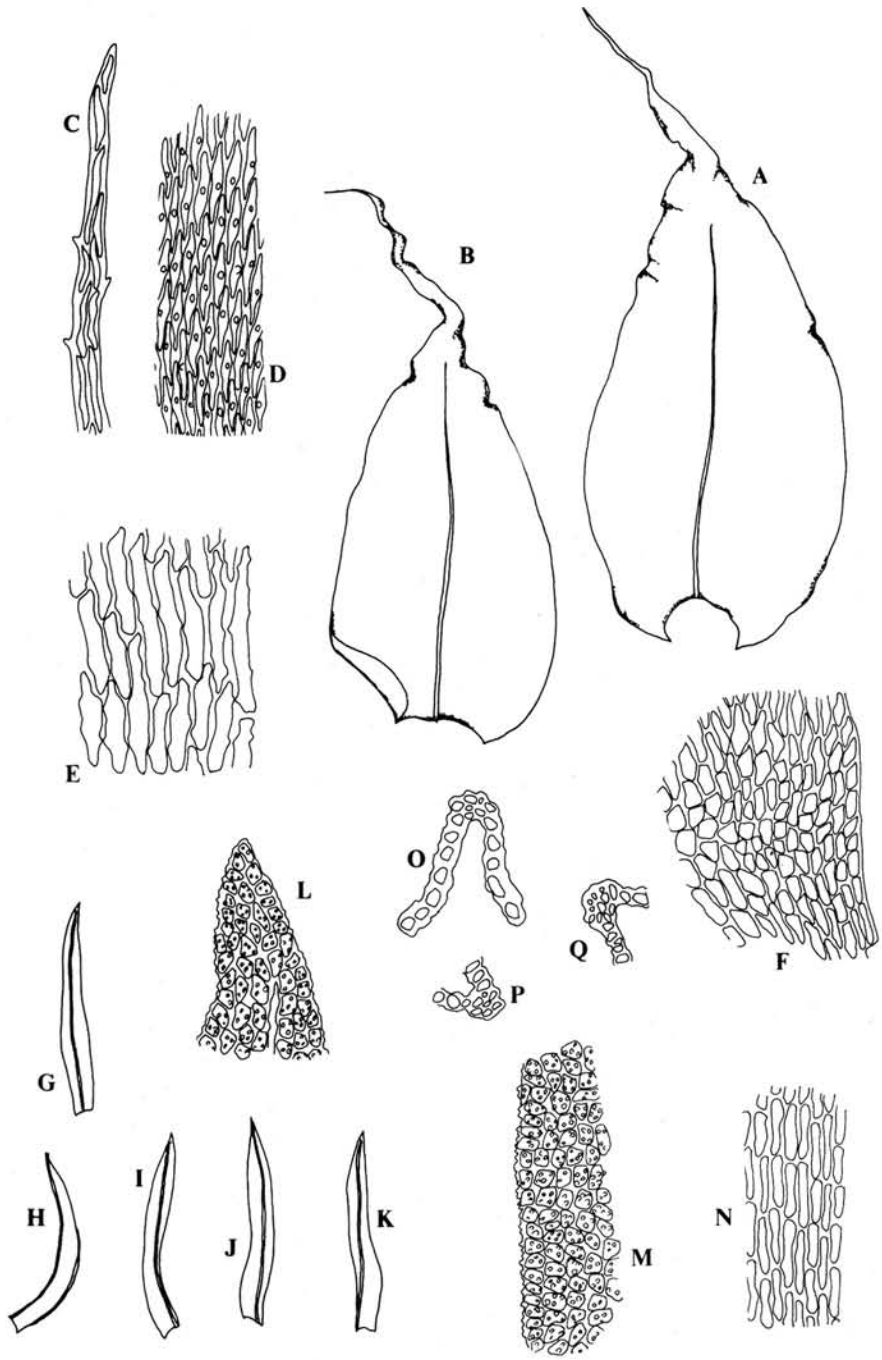

Plate II. A-F, **Aerobryidium aureo-nitens** (Schwaegr.) Broth. & G-Q, **Hymenostylium recurvirostre** (Hedw.) Dix. A-B, leaves (×29). C, apical cells (×284). D, median cells (×284). E, basal cells (×284). G-K, leaves (×29). L, apical cells (×284). M, marginal cells (×284). N, basal cells (×284). O-Q cross section of leaves (×284). (A-F drawn from *Chiang 26789*, G-Q from *Chiang 24202*).

3. Note on the genus *Amphidium* Schimp. in Taiwan

The taxonomic position of the genus *Amphidium* is puzzuling and debatable, it may be a genus of the family Dicranaceae (e. g. Brotherus, 1924-25) or of the family Rhabdoweisiaceae (e. g. Vitt, 1984) and may be a genus of the family Orthotrichaeceae (e. g. Iwatsuki, 1972).

The genus is characterized by: plants grow together and form cushions, clothed with rhizoids at base. Leaves narrowly lanceolate, costa reaching to apex, leaf-cells hexagonal, with multi-papillae.

Two taxa of the genus were ever reported in Taiwan, one of them *A. mougeotii* var. *formosicum* was symnonimized by Chuang (1973) under *Hymenostylium recurvirostre* and the other species *A. papillosum* Bartr. was recorded by Wang (1970). However the members of *Hymenostylium* are easily misidentified as ones of *Amphidium*, especially in lack of capsules. The authors consider the specimens of *A. papillosum* from Taiwan may be conspecific with *A. lapponicum* or *Hymenostylium recurvirostre*.

Hymenostylium recurvirostre (Hedw.) Dix., Rev. Bryol. Lichen. **6**: 96. 1934; Chuang, Journ. Hattori Bot. Lab. **37**: 469. 1973. (PL. II, G.-O.)

Syn. *Amphidium mougeotii* (Bruch & Schimp. in B. S. G.) Schimp. var. *formosicum* Card., Beih. Bot. Centralbl. **19**: 104. 1905.

This species reminds us of a member of the genus *Amphidium*, sharing the common characters of gametophores, not only the habit of plants, but also the leaf-shape, the laminal cells and even the cross-section of costa. It is easily misidentified as *Amphidium* when sterile. The authors agree with Chuang's treatment, regarding *A. mougeotii* var. *formosicum* is identical with *Hymenostylium recurvirostre*.

Specim. exam. Nantou Hsien: Yushan area, Kuankao to Patungkuan, 2700 m alt., in *Pinus* forest, on tree trunk, Nov. 30, 1987, *T. Y. Chiang* 24202.

Distribution: Europe, N. America, Asia, New Zealand, Mexico, Guatemala.

Illustration: Saito 1975: 452. f. 32 (as *Gymnostomum recurvirostre* Hedw.)

The authors have not confirmed the occurance of *A. papillosum* Bortr. in Taiwan. But the generic position of of *A. papillosum* Bartr. seems to be doubtful as Bartram (1939) stated, since no sporophytic characters are known. According to the vegetative characters, the authors consider it may be affined or conspecific with *A. lapponicum* (Hedw.) Schimp. or be a synonym of *Hymenostylium recurvirostre*. Further study must be made with the characters of capsules were available.

4. Seligeriaceae, a family new to Taiwan

The Seligeriaceae comprise 7 genera, which are mainly distributed in temperate and frigid zones of the world. Three of them, *Blindia* B. S. G., *Seligera* B. S. G. and *Brachydontium* Fuernr., were ever recorded in East Asia, including Mainland China and Japan. The family is allied to Dicranaceae. One can distinguish it from the latter by the globular or pyriform capsules and un-clefted peristome.

Blindia B. S. G. is mainly distributed in Southern Hemisphere, with about 40 species in the world. Only 3 taxa were ever reported in high latitudes of Northern Hemisphere. The family Seligeriaceae with genus *Blindia* is for the first time reported in Taiwan.

Blindia Bruch & Schimp. in B. S. G., Bryol. Eur. fasc. 33-36. 1846.

Plants grow together; stems erect, unbranched or sometimes branched; leaves lanceolate, costa percurrent; laminal cells rectangular, smooth; alar cells well differentiated, colored; capsules globular, seta long exserted.

Blindia acuta (Hedw.) Bruch & Schimp. in B. S. G. var. **japonica** (Broth.) Ch. Gao, Fl. Musc. Chinese Bor.-Orient. 52. f. 41. 1977. (PL. III, A.-K·)

Blindia japonica Broth., Oefv. Finsk. Vet. Soc. Foerh. 62: 4. 1921; Iwatsuki in Iwatsuki & Miz., Col. Ill. Bryophytes Japan 62. *pl. 6* 1972.

Plants small, grow together; stems erect, unbranched, 4-22 mm long. Leaves concave, lanceolate, broadest at base, tapering to subulate apex, 1.5-1.8 mm long, 0.21-0.26 mm wide at base, costa excurrent; laminal cells linear, more or less incrassate, 10.5-18.4 μm long, 2.6-5.3 μm wide; alar cells well differentiated, rectangular, thick-walled, coloured, inflated. Capsule globular, erect, 0.56-0.64 mm long, 0.46-0.58 mm wide, lid rostrate, calyptra cucullate; seta elongate, inclined.

Specim. exam. Taichung Hsien: Hsueishan, 3500 m alt., in *Yushania* grassland, terrestrial, June 29, 1983, *T. Y. Chiang* 5198; Chiayi Hsien: Alishan, Menyuei, 2500 m ait., at deforested place, on rock, *T. Y. Chen s. n.*, May 1988.

Distribution: Taiwan, Japan, Mainland China.

Illustrations: Gao 1977: 51. f. 41; Iwatsuki & Mizutani 1972: 62. pl. 6.

5. Rediscovery of *Boulaya mittenii* in Taiwan

Sasaoka (1924) reported the distribution range of *Boulaya mittenii* (Broth.) Card. extending from Hokkaido in Japan southwards to Taiwan, without citation of specimens. Since then, no other report on this species has been made in Taiwan. The existence of *Boulaya mittenii* in Taiwan is however confirmed now, with the recent collection by the authors in Chilaishan, central Taiwan.

Boulaya mittenii (Broth.) Card., Rev. Bryol. **39**: 2. 1912; Watanabe, Journ. Hattori Bot. Lab. **36**: 203. *pl. 24.* 1972. (PL III, L.-X.)

Plants yellowish-green to brown; stem prostrate, regularly pinnately branched; branches ca. 5 mm long; paraphyllia numerous, filiform, branched. Stem leaves and branch leaves well differentiated, the former cordate with abruptly narrowed lanceolate acumen, secund above, 1.0-1.3 mm long, 0.56-0.76 mm wide, costa ceasing below the apex; branch-leaves ovate, tapering to apex, 0.7-0.8 mm long, 0.30-0.35 mm wide, costa ca. 2/3 leaf-length, margins serrulate; median cells hexagonal, with 1-2 papillae, thick-walled, 6.5-13.1 μm long, 3.9-5.2 μm wide, basal cells linear, porous.

Specim. exam. Hualien Hsien: Hohuanshan to Chilaishan, 3000 m alt., in *Tsuga* forest, terrestrial, Sept. 27, 1986, *C. M. Kuo & T. Y. Chiang 16755.*

Distribution: Taiwan, Mainland China, Japan, Korea, USSR

Illustrations: Iwatsuki & Mizutani 1972: 199. pl. 28; Gao 1977: 251. f. 175; Watanabe 1972: 203. pl. 42; Horikawa 1939: 963. pl. 464.

This species is similar to *Abietinella abietina* (Hedw.) Fl. in habits of plants, paraphyllia and branch-leaves, but one can easily distinguish it from the latter by the cordate stem-leaves.

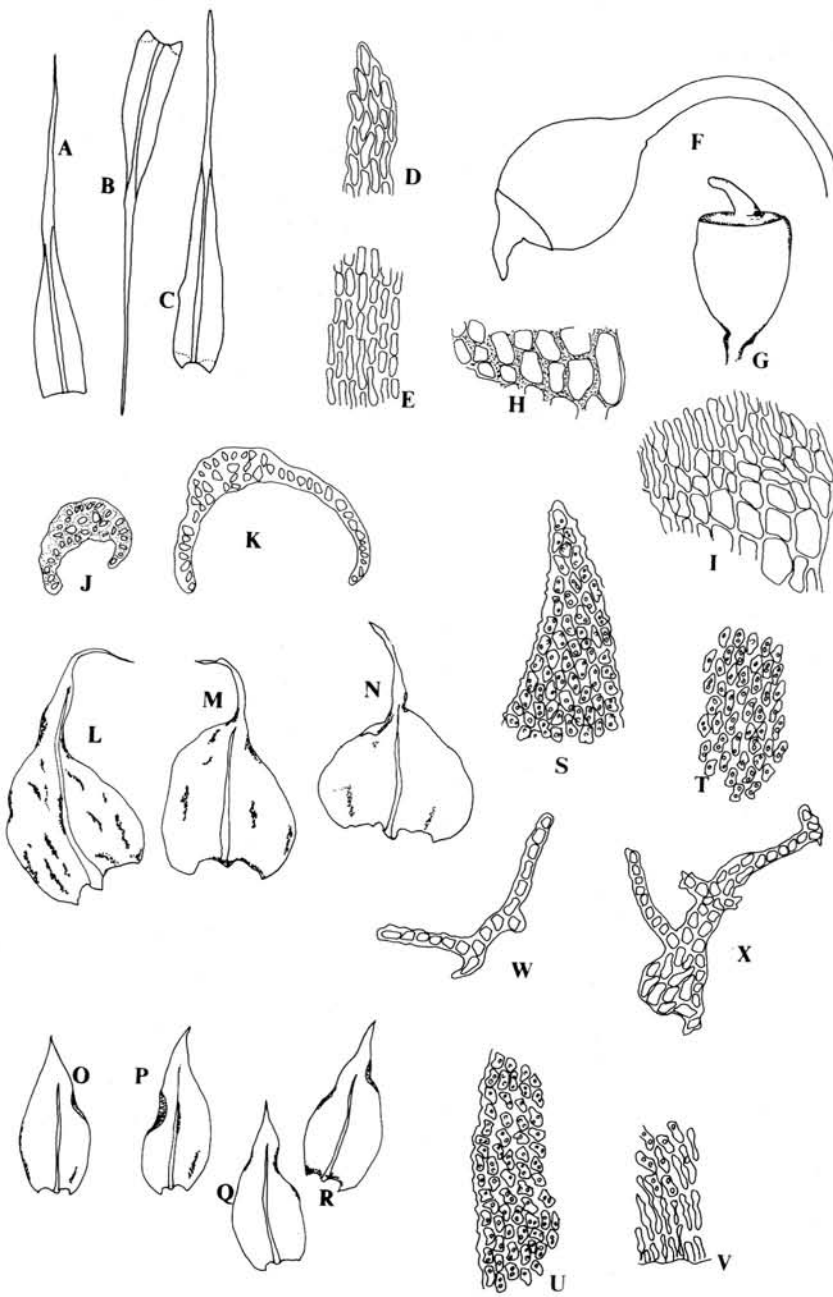

Plate III. A-K, **Blindia acuta** (Hedw.) B.S.G. var. **japonica** (Broth.) Ch. Gao L-X, **Boulaya mittenii** (Broth.) Card. A-C, leaves (×27). D. apical cells (×265). E. laminal cells (×265). F-G, capsules (×27). H-I, alar cells (×265). J-K, cross sections of leaves (×265). L-N, stem-leaves (×27). O-R, branch-leaves (×27). S, apical cells of branch-leaf (×265). T. median cells of branch-leaf (×265). U, marginal cells of branch-leaf (×265). V, basal cells of branch-leaf (×265). W-X, paraphyllia (×265). (A-K drawn from *Chiang 5198*, L-X drawn from *Kuo et Chiang 16755*).

6. *Cirriphyllum*, a genus new to Taiwan

Cirripyllum, a genus of the family Brachytheciaceae, was established by Grout (1895), with about 20 species distributed in the temperate zones of the world. The study of the family Brachytheciaceae in Taiwan was fragmentally made by J. Cardot (1905), S. Okamura (1916), Y. Horikawa (1939) and others. The significant efforts on studying the Asiatic taxa of the family was made by Takaki (1955-56), in which 9 genera and 19 species of Taiwan were discussed.

Four species of the genus *Cirriphyllum* are distributed in temperate Asia, and two of which are found in Taiwan.

Genus **Cirriphyllum** Grout, Bull. Torr. Bot. Cl. **25**: 222. 1898.

Plants medium-sized to robust, grow together, yellowish-green, lustrous; stems long creeping or ascending, irregularly pinnately branched; branches julaceous; leaves imbricate, concave, ovate-oblong, with a long filiform acumen, base decurrent, costa single reaching to the middle or beyond; leaf-cells linear; alar cells well differentiated, quadrate to oblong.

Key to species of genus *Cirriphyllum*

1. Costa of stem-leaves beyond 1/2 to 2/3 lamina ..... *C. piliferum*
1. Costa of stem-leaves shorter than 1/2 lamina ..... *C. cirrosum*

1. **Cirriphyllum piliferum** (Schreb.) Grout, Bull. Torr. Bot. Club **25**: 225. 1898; Takaki, Journ. Hattori Bot. Lab. **16**: 22. f. 37. 1956. (PL. IV)

Plants grow loosely, more soft, yellowish-green, lustrous. Stems creeping, reaching to 10 cm long, irregularly and subpinnately branched; branches julaceous. Leaves ovate to oblong with a long piliform acumen, strongly concave, decurrent at base, margins nearly entire. Stem-leaves broader than branch-leaves, 1.4-1.9 mm long, 0.9-1.1 mm wide, with an acumen reaching 1.0-1.2 mm long and costa extending 1/2-2/3 length of lamina. Laminal median cells linear hexagonal, 31-73 μm long, 3.9-7.9 μm wide, basal cells rectangular, alar cells well differentiated, quadrate, inflated.

Specim. exam. Ilan Co.: Taipingshan, 2000 m alt., *M. T. Kao s.n.*, March 4, 1967; Nantou Hsien: Yushan area, Salisienchi, 2650 m alt., in *Picea* forest, on rotten log, July 19, 1987, *T. Y. Chiang 20691*.

Distribution: Taiwan, Mainland China, Japan, Siberia, Caucasus, Europe, N. America.

Illustrations: Takaki 1956: 22. f. 37; Iwatsuki et Mizutani 1972: 221. f. 453.

In comparing with the specimens of Europe, the authors found those of Taiwan seem to be more soft, flexuous, teret-foliated, irregularly branched, as Takaki (1956) described the Japanese ones.

This species is similar to *Brachythecium helminthocladum* Broth. in habit, and leaf-shape, but the former is more slender and soft, and with areolation of alar region linear-rectangular, whereas that of the latter short-rhomboidal.

2. **Cirriphyllum cirrosum** (Schwaegr.) Grout, *l. c.* **25**: 223. 1898; Takaki, *l. c.* **16**: 20. *f. 37*. 1956. (PL. V)

Plants medium-sized to robust, yellowish- or brownish-green, lustrous. Stems creeping, irregularly and pinnately branched, branches stout, ascending, 0.8-1.5 cm

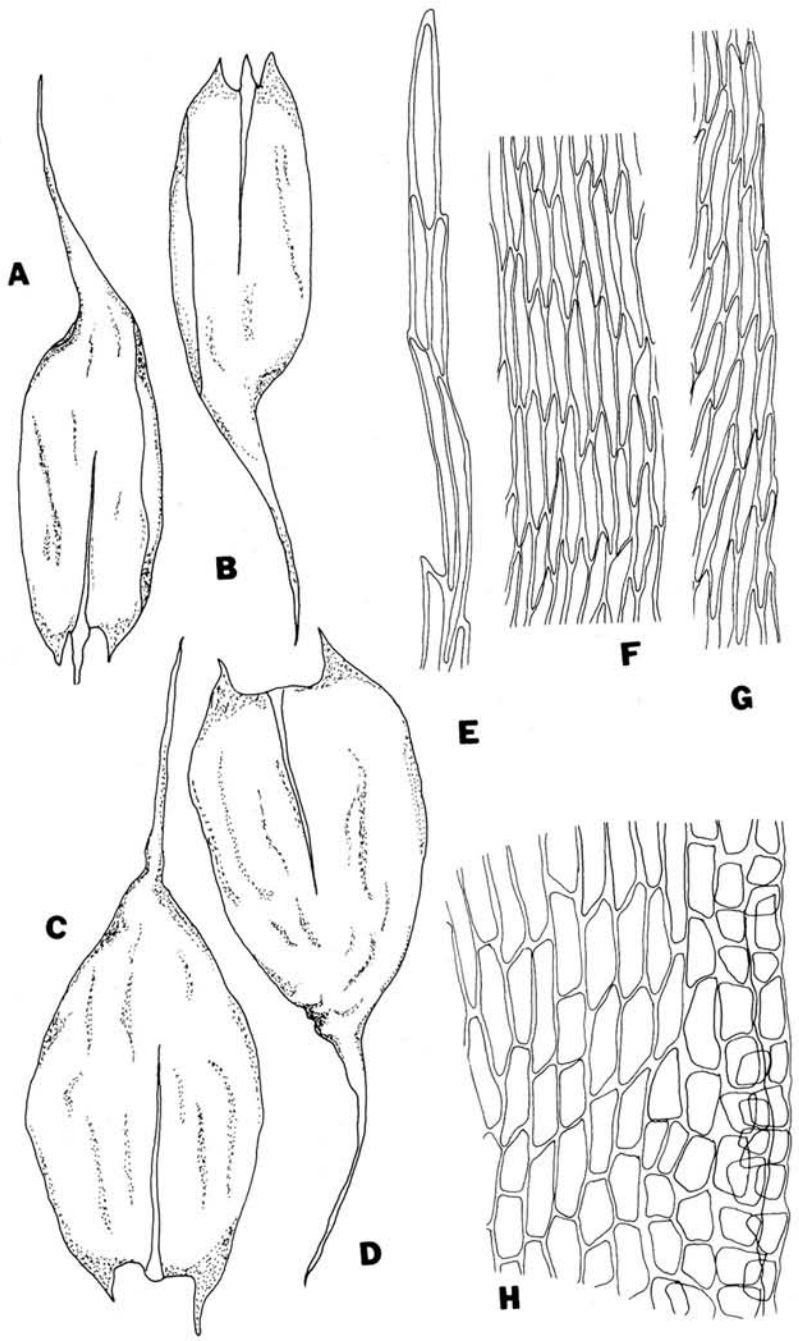

Plate IV. Cirriphyllum piliferum (Schreb.) Grout A-B, branch leaves (×29). C-D, stem-leaves (×29). E, apical cells of branch-leaf (×284). F, median cells of branch-leaf (×284). G, marginal cells of branch-leaf (×284). H, alar cells of branch-leaf (×284). (Drawn from *Chiang 20691*).

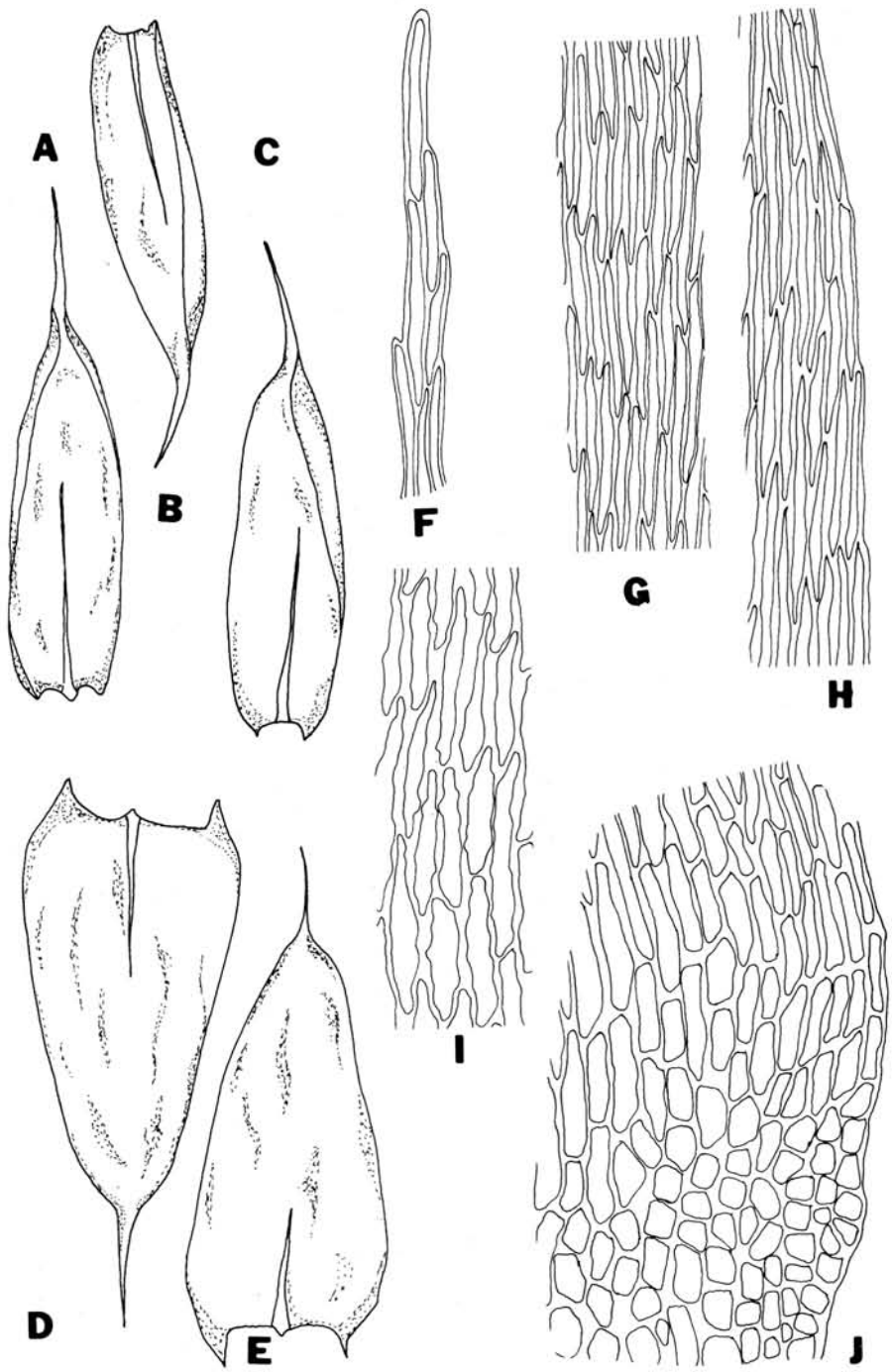

Plate V. Cirriphyllum cirrosum (Schwaegr.) Grout A-C, branch-leaves (×35). D-E, stem-leaves (×39). F, apical cells of branch-leaf (×341). G. median cells of branch-leaf (×341). H, marginal cells of branch-leaf (×341). I, basal cells of branch-leaf (×341). J, alar cells of branch-leaf (×341). (Drawn from *Chiang 4818*).

long. Leaves imbricate, oblong-ovate, strongly concave, abruptly narrowed to a filiform acumen, cucullate at base of acumen, margins obscurely serrulate; stem-leaves ca. 1.7×0.8 mm excluding acumen, costa shorter than 1/2 length of leaf (excl. acumen). Median cells linear-vermicular, ca. 58×4.3 μm; basal cells sinuously incrassate; alar cells well differentiated, quadrate to oblong.

Specim. exam. Hsinchu Hsien: Tapachienshan, 3200 m alt., in *Abies* forest, May 23, 1983, *T. Y. Chiang 4818*.

Distribution: Taiwan, Mainland China, Japan, Siberia, Caucasus, Turkey, N. America.

Illustrations: Takaki 1956: 20. f. 37; Li *et al.* 1985: 370. f. 157.

This species is similar to *C. crassinervium* (Tayl.) Loesk. & Fleisch., which is distributed in Manchuria, Siberia and Europe, in habit of plants and leaf-shapes, but the leaf-acumen of the former is longer than that of the latter, besides the costa of the former is more weaker.

This genus is a new addition to the mossflora of Taiwan. The plants of the genus mainly grow in middle and high elevations of this island.

7. *Campyliadelphus*, a genus new to Taiwan

Campyliadelphus was established by Kindberg (1896) formely as a section of the genus *Hypnum* Hedw. Brotherus (1908) placed it as a section of the genus *Campylium* (Sull.) Mitt., till 1975 Kanda raised it as generic state, with 5 species recognized in Japan. It is difficult to distinguish between the two related genera, especially the species *Campyliadelphus stellatus* (Hedw.) Kanda as Kanda (1975) stated, only by the difference of inner perichaetial leaf. Further study on the taxonomic positions of the genera must be made. This species is for the first time reported in Taiwan.

Campyliadelphus stellatus (Hedw.) Kanda, Journ. Sci. Hiroshima Univ., Ser. B, Div. 2, **15**: 269. *f. 29*. 30. 1975. (PL. VI, A.-L.)

Hypnum stellatum Hedw., Spec. Musc. 280. 1801.
Campylium stellatum (Hedw.) C. Jenus., Medd. Groenland **3**: 328. 1887.

Stems long creeping, irregularly pinnately branched, pseudoparaphyllia foliose. Stem-leaves squarrosa, ovate-lanceolate, tapering to a long acumen, 1.4–2.5 mm long, 0.5–1.2 mm wide, costa double; median cells linear, incrassate, 29–52 μm long, 1.3–3.9 μm wide; alar cells well differentiated, rectangular, inflated. Branch-leaves similar to stem-leaves.

Specim. exam. Hualien Hsien: Chilaishan, Chilaipeifeng, 3200 m alt,, in *Abies* forest, terrestrial, Sept. 27, 1986, *T. Y. Chiang 16903*; Nantou Hsien: Kuankao to Patungkuan, 2600 m alt., in *Pinus* forest, on limestone, in water flow, Nov. 30, 1987, *T. Y. Chiang 24178*; Nantou Hsien: Yushan area, Salisienchi, 2500 m alt., in *Picea* forest, on rock, Dec. 28, 1987, *T. Y. Chiang 25123*.

Distribution: Taiwan, Japan, Korea, North and Central Asia, Greenland, N. America, Europe, North Africa.

Illustrations: Kanda 1975: 269. f. 29. 30; Iwatsuki & Mizutani 1972: 207. *f. 421*. (as *Campylium stellatum*).

This species often occurs on calcareous rocks, as Kanda stated it in Japan. This genus is a new addition to the mossflora of Taiwan.

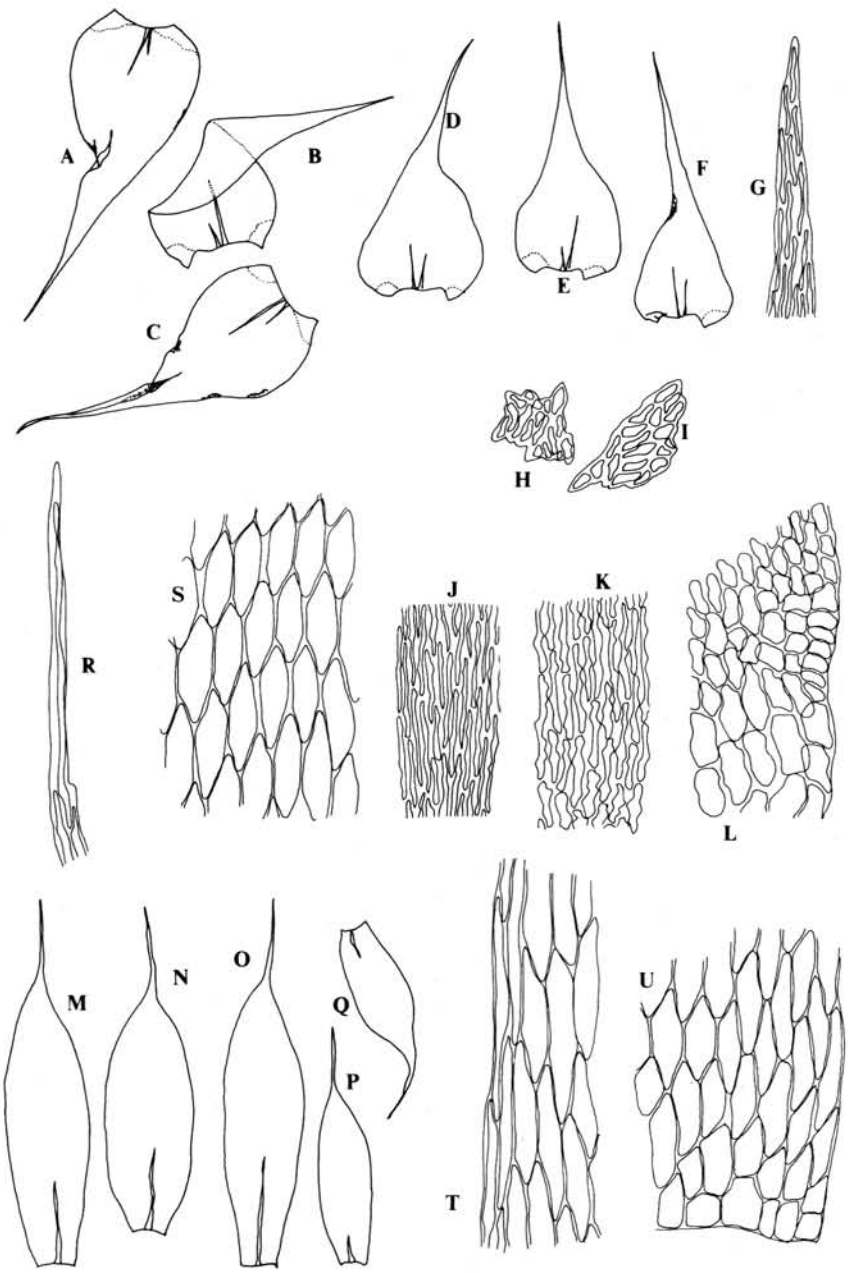

Plate VI. A-L, **Campyliadelphus stellatus** (Hedw.) Kanda M-U, **Distichophyllum pseudo-malayense** Chiang et Kuo A-C, branch-leaves (×25). D-F, stem-leaves (×25). G. apical cells (×246). H-I, paraphyllia (×246). J. median cells of branch-leaf (×246). K, basal cells of branch-leaf (×246). L, alar cells of branch-leaf (×246). M-Q, leaves (×25). R, apical cells (×246). S, median cells (×246). T, marginal cells (×246). U, alar cells (×246). (A-L drawn from *Chiang 24178*, M-U from *Chiang 12817*).

8. *Distichophyllum pseudo-malayense* sp. nov.

Distichophyllum, a genus of the family Hookeriaceae, is mainly distributed in subtropical and tropical regions, with about 12 species in Asia. Yang et Lee (1964a) ever treated the taxa of Taiwan, with 7 species discussed. Here *D. pseudo-malayense* is a species new to science.

Distichophyllum pseudo-malayense T. Y. Chiang & C. M. Kuo, sp. nov.
(PL. VI, M.-U.)

Plantae flavidae-virides, caules erecti, unramosi. Folia elliptica, 0.9-2.0 mm longa, 0.25-0.46 mm lata, apicibus abrupte angustatis, margines fere integri, costae singulae, breves, laminae costa 3 plo longiores, cellulae marginum 2-3 seriatae, lineares; cellulae laminarum rhombeae, 52-74 μ longae, 10.5-15.8 μ latae, laeves; cellulae alares destitutae.

Plants yellowish-green, stems erect, unbranched. Leaves elliptic, with abruptly narrowthe caudate apex, 0.9-2.0 mm long, 0.25-0.46 mm wide, margins nearly entire, costa single, short, not beyond 1/3 leaf-length; marginal cells 2-3 rows, linear; laminal cells rhomboid, 52-74 μm long, 10.5-15.8 μm wide, thin-walled, smooth; alar cells not differentiated.

Specim. exam. Pingtung Hsien: Laufoshan, 600 m alt., in original broad-leaved forest, terrestrial, Jan. 20, 1986, *T. Y. Chiang 12811*..... holotype

This species is similar to *D. malayense* Damanhuri et Mohamed in sharing the leaf with long subulate apex and short costa. But by the larger rhomboidal laminal cells it is easy to distinguish the species from other allied species. The taxonomic position of the species seems to be doubtful, especially in lack of characters of sporophytes. It may be related to *Metadistichophyllum*, a genus distributed in Borneo, in sharing caudate leaf-apex, but no abundant rhizoids and gemmae were found. More study must be made especially when the capsules are available.

9. *Cynodontium*, a genus new to Taiwan

Cynodontium, a genus of the family Dicranaceae, is mainly distributed in the temperate and frigid regions, with about 3 species in east Asia. The genus is characterized by spine-like papillae on laminal cells and costa. *Cynodontium gracilenscens* (Web. et Mohr) Schimp. is a species new to mossflora of Taiwn.

Cynodontium gracilenscens (Web. & Mohr) Schimp., Coroll. 12. 1856; Anonymous, Fl. Musc. Chinae Bor.-Orient. 64. f. 48. 1977; Li *et al.*, Bryoflora of Xizang 39. f. 17. 1985. (PL. VII, A.-F.)

Plants yellowish or brownish green; stems erect, 6-14 mm long, occasionally branched; leaves strongly crisped when dry, oblong-lingulate, apex more or less obtuse, margins dentate by projection of marginal cells, costa single, percurrent. Laminal cells quadrate, 2.6-7.9 μm long, with spine-like papilla; basal cells rectangular, smooth, hyaline, 13.1-29.0 μm long, 7.9-15.8 μm wide; alar cells not differentiated.

Capsules cylindric, ribbed, erect or inclined, 1.2-1.5 mm long, seta 6-8 mm long.

Specim. exam. Hsinchu Hsien: Tapachienshan, 3500 m alt., on eroded windy cliff, May 23, 1983, *T. Y. Chiang 4942.*

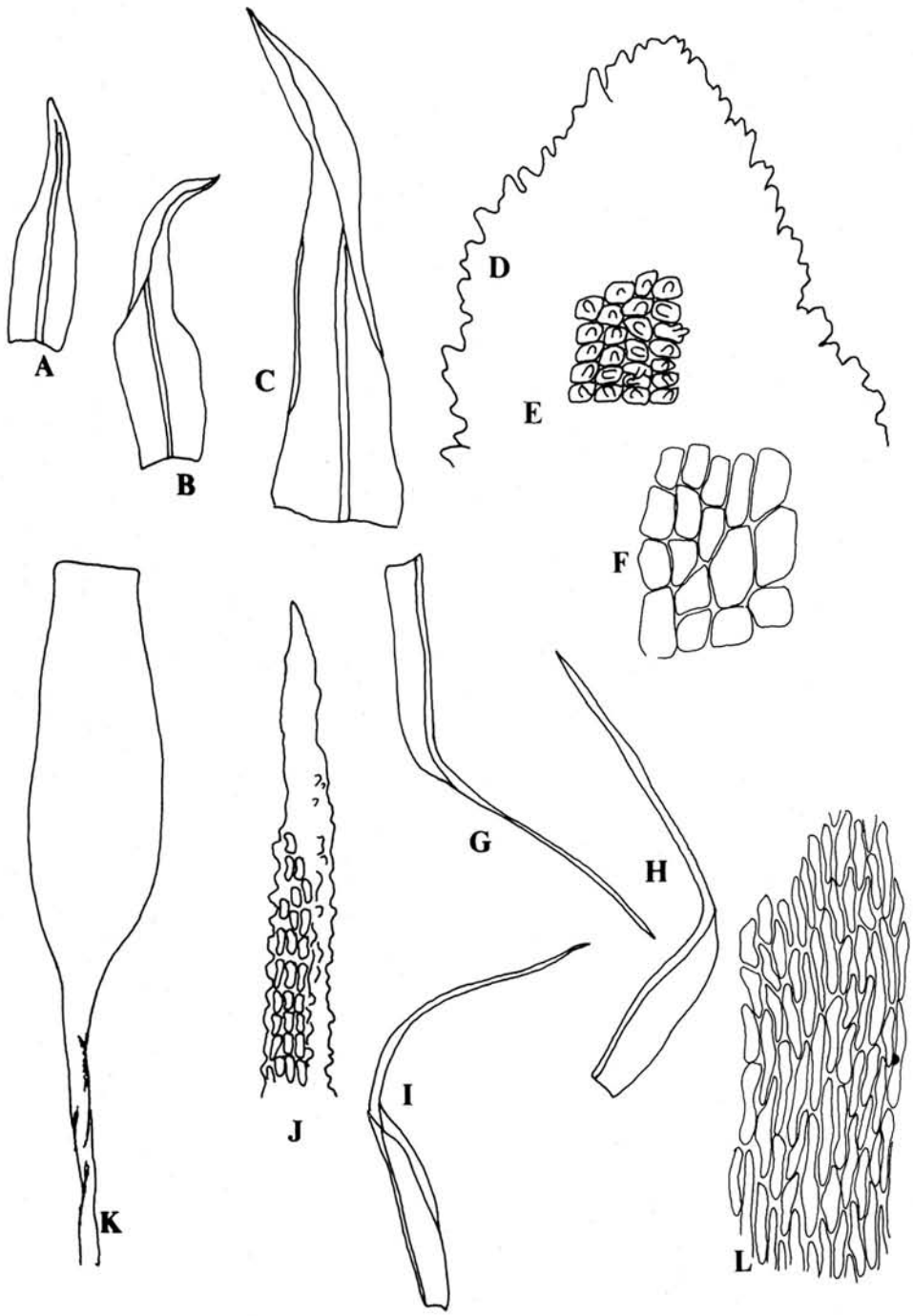

Plate VII. A-F, **Cynodontiun gracilenscens** (Web. & Mohr) Schimp. G-L, **Distichium capillaceum** (Hedw.) B.S.G. A-C, leaves (×37). D, leaf-apex (×90). E, leaf cells (×360). F, basal cells (×360). G-I, leaves (×37). J, leaf-apex (×360). K, capsule (×37). L, laminal cells (×360). (A-F drawn from *Chiang 4942*, G-L from *Chiang 5229*).

Distribution: Taiwan, N. China, Japan, USSR, Europe, N. America.

Illustrations: Anonymous 1977: 64. f. 48; Li *et al.* 1985: 39. f. 17.

The distinct character of the species is the leaf covered by spine-like papilla like a "hedgehog", as Li *et al.* (1985) described it.

10. *Distichium*, a genus new to Taiwan

The genus *Distichium* is mainly distributed in the temperate regions or high elevations of subtropical regions of the world. 6 species of the genus were ever reported in east Asia. The genus is characterized by 2-rowed and complanately foliated plants. *Distichium capillaceum* is a new addition to the mossflora of Taiwan.

Distichium capillaceum (Hedw.) B. S. G., Bryol. Eur. fasc. 29-30. pl. 103. 1846; Iwatsuki in Iwatsuki & Mizutani, Col. Ill. Bryophytes Japan 60. *pl. 5.* 1972; Chen, Gen. Musc. Sin. 1: 109. *f. 67.* 1963; Anonymous, Fl. Musc. Chin. Bor.-Orient. *48. f.* 38. 1977; Li *et al.*, Bryoflora of Xizang, 17. *f. 7.* 1985. (PL. VII, G.-L.)

Plants light-green, stems single, erect, 1.7-4.6 mm long, clothed with brown rhizoids at base, complanately foliated. Leaves 2-rowed, sheath-like at base, apex awned, 1.7-3.3 mm long, 0.2-0.3 mm wide at base, costa occupying most part of leaf-apex, papillose throughout. Cells of leaf-sheath vermicular, 18.4-42.2 μm long, 2.6-5.2 μm wide, smooth.

Capsules cylindric, ca. 1.5 mm long, erect, symmetrical, seta 1.1-1.8 mm long; peristome single.

Specim. exam. Taichung Hsien: Hsueishan, Hsueishantungfeng, 3200 m alt., in *Abies* forest, terrestrial, June 29, 1983, *T. Y. Chiang 5120*; Hsueishan, 3600 m alt., in *Abies* forest, terrestrial, June 30, 1983, *T. Y. Chiang 5229*; Kaohsiung Hsien: Kuanshan, 3500 m alt., in *Abies* forest, on rock, May 24, 1987, *T. Y. Chiang 19015.*

Distribution: Taiwan, S. China (Tibet, Yunnan), Japan, Europe, America.

Illustrations: Iwatsuki et Mizutani 1972: 60. pl. 5; Chen *et al.* 1963: 109. f. 63; Anonymous 1977: 48. f. 38; Li *et al.* 1985: 17. f. 7.

The plants of the species mainly grow in subalpine zones of the island. This species is characterized by erect capsules, by which one can distinguish it from *D. inclinatum* (Hedw.) B. S. G., a species with smaller plants and inclined capsules.

11. *Didymodon nigrescens* new to mossflora of Taiwan

Didymodon nigrescens (Mitt.) Saito, Journ. Hattori Bot. Lab. **39**: 510. 1975. (PL. VIII)

Syn. *Barbula nigrescens* Mitt., Journ. Linn. Soc. Bot. suppl. 1: 36. 1859.
Andreaea takakii Sak., Journ. Jap. Bot. **29**: 111. *f. 1.* 1954.
Andreaea kai-alpina Sak. & Tak., Journ. Jap. Bot. **29**: 112. *f. 2.* 1954.

Plants dark brown to black; stems erect or procumbent, sometimes pinnately branched. Leaves ovate-lanceolate, tapering to apex, more or less obtuse, costa single, ceasing below apex, adaxial stereid band absent, margins recurved, 0.5-1.8 mm long, 0.2-0.6 mm wide; laminal cells quadrate to hexagonal, 5.2-13 μm long, 3.9-10.5 μm wide, smooth, thick-walled; basal cells rectangular, porous.

Specim. exam. Kaohsiung Hsien: Kuanshan, 3500 m alt., at alpine tundra zone, on rock, May 24, 1987, *T. Y. Chiang 19130 & 19710.*

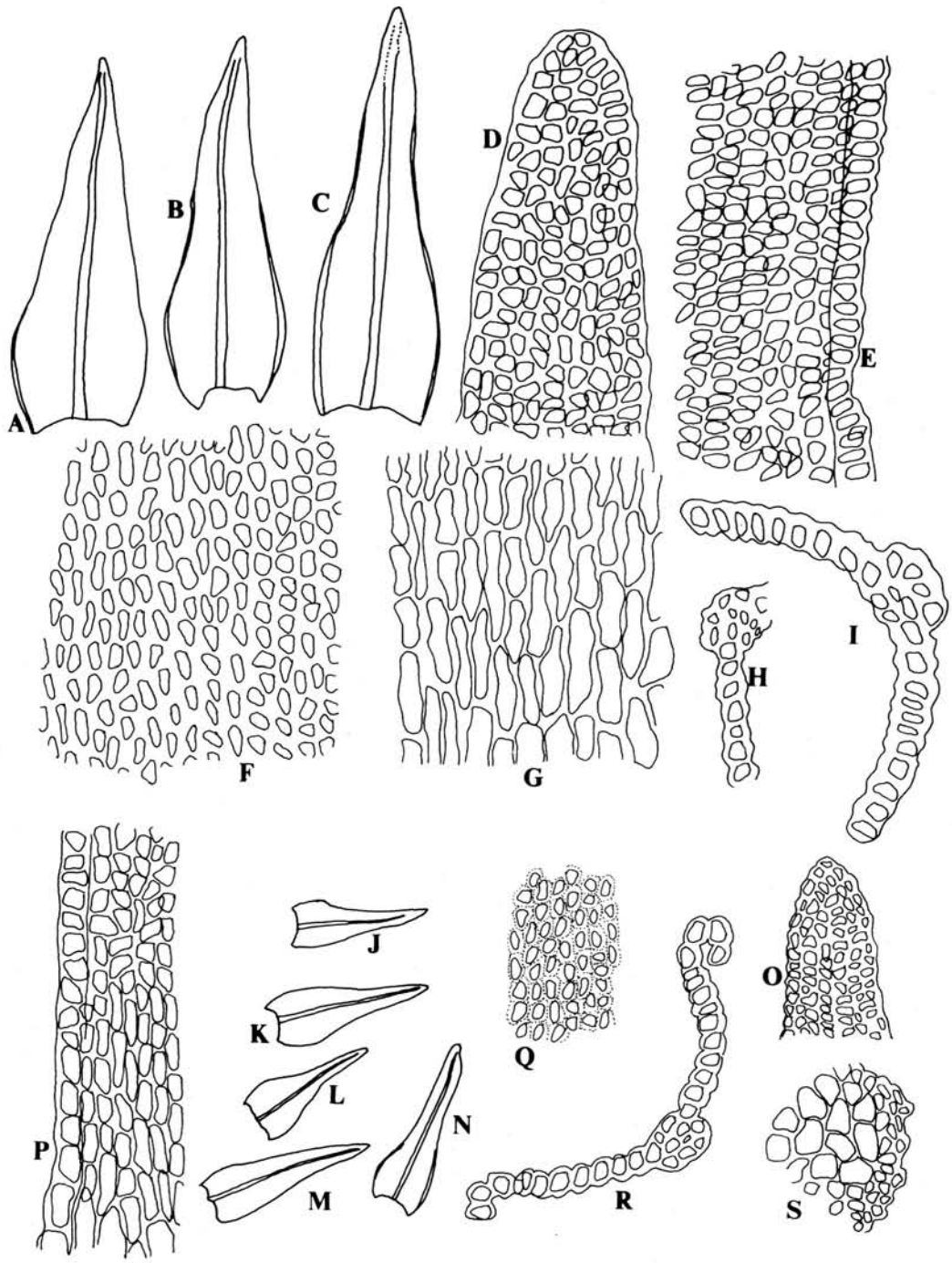

Plate VIII. Didymodon nigrescens (Mitt.) Saito A-C, J-N, leaves (33). D, O, leaf-apex (×330). E, marginal cells (×330). F, laminal cells (×330). G, basal cells (×330). H-I, R, cross section of leaves (×330). S, cross section of stem (×330). (A-I drawn from *Chiang 19130*, J-S from *Chiang 19710*).

Distribution: Taiwan, S. China, Japan and Himalayas.

Illustration: Saito 1975: 510. f. 52.

The species is easy to be confused with members of *Andreaea* when the specimen collected is wanting in capsules. For example, *Andreaea takakii* and *A. kai-alpina* were reported based on sterile specimens. Saito (1975) synonymized the two species to *Didymodon nigrescens*.

The authors consider another species *Andreaea yuennanensis* Broth., which was previously reported in Yunnen of China according to a sterile specimen, may be also identical with this species, as Chen *et al.* (1963) cited, sharing the same leaf-shape, laminal cells and characters of costa and stem. Type specimen and more material must be examined.

12. *Encalypta rhaptocarpa* Schwaegr., new to mossflora of Taiwan

Encalypta Hedw., a genus of Encalyptaceae, is mainly distributed in the temperate and frigid areas, with 50 species in the world. Plants of the genus mainly grow in alpine or subalpine zones of this island. In this report *E. rhaptocarpa* is newly found in Taiwan.

Key to species of genus *Encalypta* in Taiwan

1. Calyptra fringed at base, smooth at rostrum.....*E. ciliata*
1. Calyptra lacerate or entire at base, papillate at rostrum.....*E. rhaptocarpa*

Encalypta rhaptocarpa Schwaegr., Spec. Mus. Suppl. 1(1): 56. 1811; Li *et al.*, Bryoflora of Xizang 63. *pl. 27*: 17-25. 1985. (PL. IX)

Stems erect; leaves spathulate, oblong-lingulate, apex caudate, 2.8-4.1 mm long, 0.6-0.9 mm wide, costa percurrent; laminal cells quadrate, 6.5-18.4 μm long, 7.9-15.8 μm wide, with multi-papillae; basal cells rectangular, smooth; marginal cells of leaf-base linear. Capsules cylindric, ribbed, guard cells differentiated; calyptra cylindric-campanulate, longer than the capsule, entire or lacerate at base, papillose at rostrum.

Specim. exam. Kaohsiung Hsien: Kuanshan, 3500 m alt., in *Juniperus* shrubs, terrestrial, May 24, 1987, *T. Y. Chiang 17333*.

Distribution: Taiwan, Mainland China, Japan, Europe.

Illustrations: Li *et al.* 1985: 62. pl. 72; Kumar 1980: 250. *f. 2*; Horton 1983: 413. f. 171-177.

The distinct character of this species is the papillose rostrum of calyptra. This species is a new addition to the mossflora of Taiwn.

13. Notes on genus *Entodontopsis* in Taiwan

Entodontopsis, a genus of the family Stereophyllaceae, was established by Brotherus (1907), with about 19 taxa distributed mainly in tropical and subtropical areas. The species of the genus have been often confused with those of genus *Stereophyllum*. Buck & Ireland (1985) reclassified the families Plagiotheciaceae and Stereophyllaceae, and they defined *Stereophyllum* with "short, rhomboidal cells often unipapillose over the lumen" and "*Entodontopsis* sometimes papillose on dorsal surface". Two species have been reported in Taiwan under the genus *Stereophyllum*. *Stereophyllum formosanum* Iwats. nom. nud. was reported by Wang (1963), which was synonymized to *Stereophyllum lingulatum* later by Wang (1967). And *Stereo-*

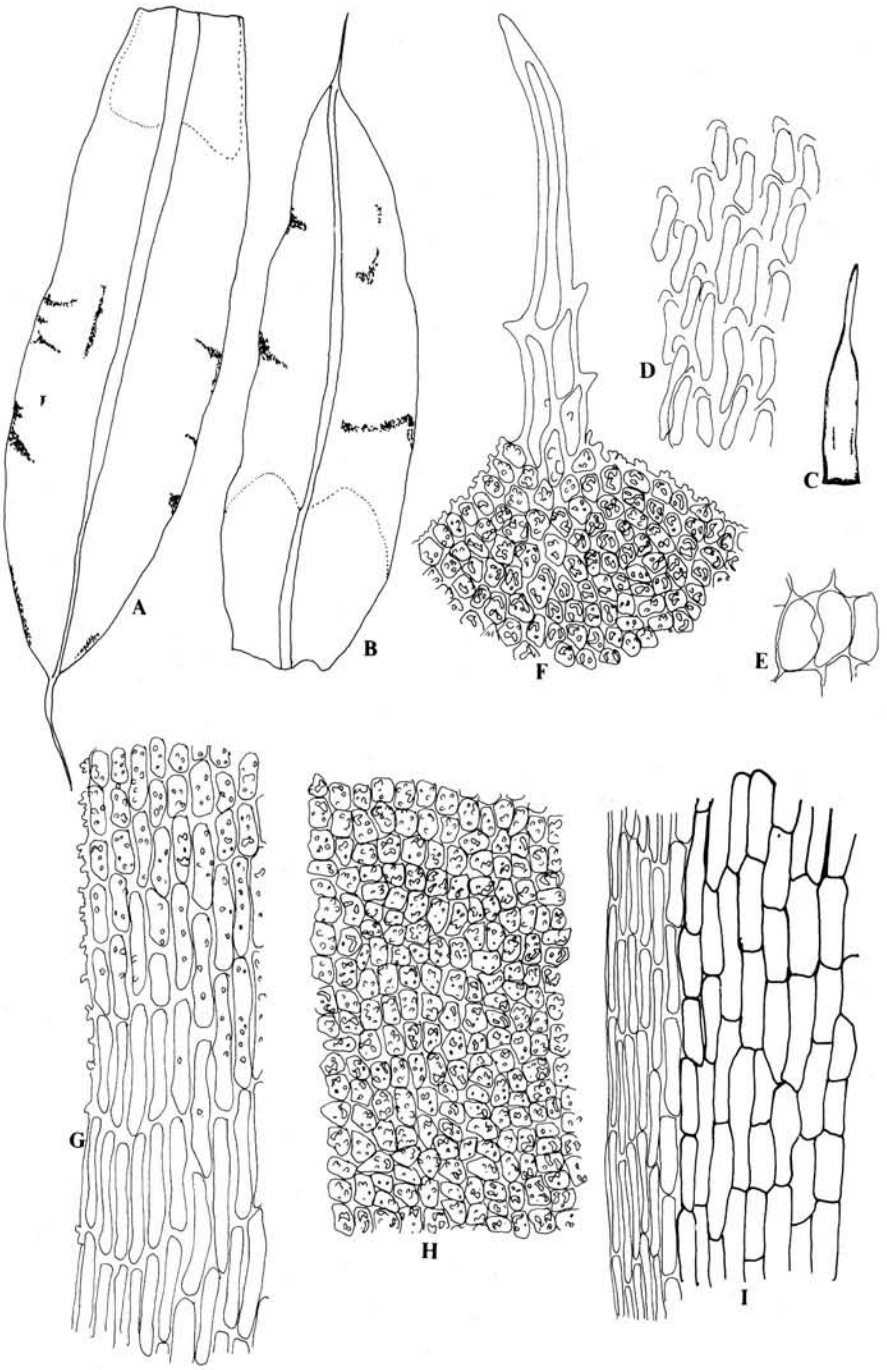

Plate IX. Encalypta rhaptocarpa Schwaegr. A-B, leaves (×27). C, calyptra (×14). D, cells of rostrum (×258). E, guard cells on capsule (×258). G, basal cells (×258). H, laminal cells (×258). I, basal marginal cells (×258). (Drawn from *Chiang 17333*).

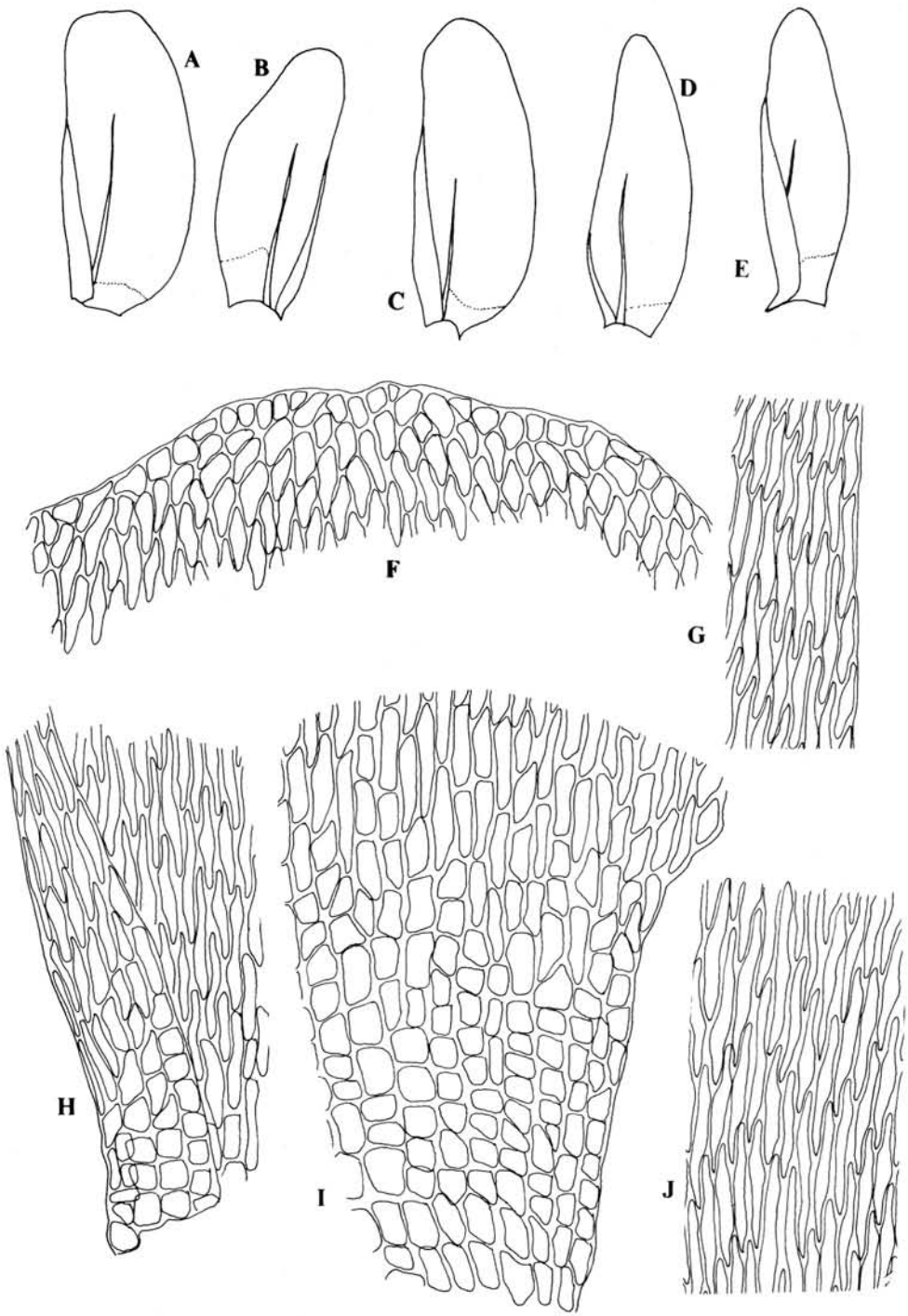

Plate X. **Entodontopsis nitens** (Mitt.) Buck & Ireland A-E, leaves (×31). F, cells of leaf-apex (×303). G, marginal cells (×303). H-I, alar cells (×303). J, laminal cells (×303). (Drawn from *Chiang 8856*).

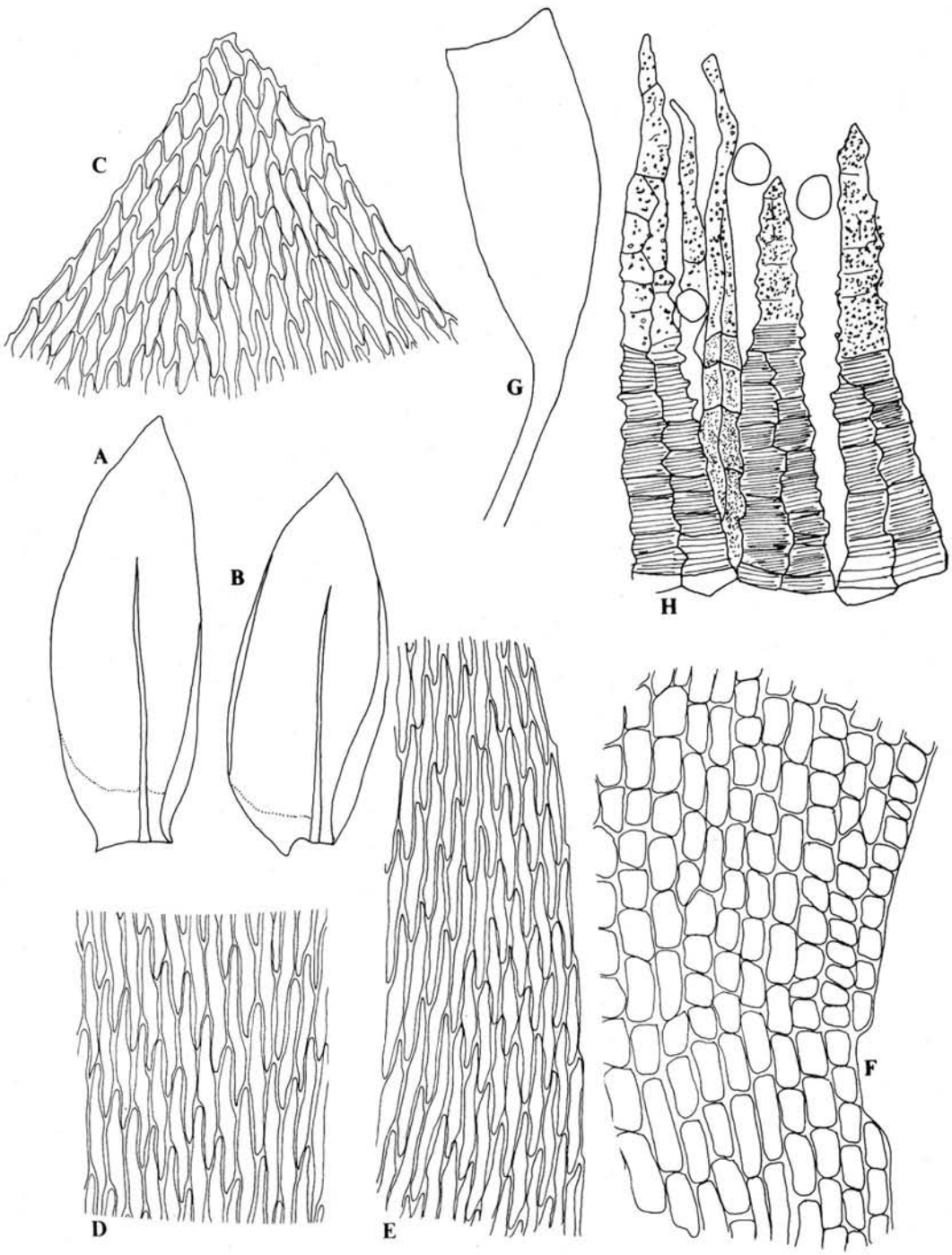

Plate XI. **Entodontopsis anceps** (Bosch & Lac.) Buck & Ireland A-B, leaves (×29). C, cells of leaf-apex (×280). D, laminal cells (×280). E, marginal cells (×280). F, alar cells (×280). G, capsule (×29). H, peristome (×280). (Drawn from *Chiang 17933*).

phyllum lingulatum Jaeg. et Sauerb., according to Buck et Ireland (1985), is placed in the genus *Entodontopsis*.

The plants of the genus grow mainly in low elevations of southern Taiwan and seem to be not rare. Here 2 species are discussed, with *E. anceps* newly found in Taiwan.

Key to species of the genus *Entodontopsis*

1. Leaf-apex obtuse.....*E. nitens*
1. Leaf-apex acute.....*E. anceps*

Entodontopsis nitens (Mitt.) Buck & Ireland, Nova Hedwigia **41**: 104. 1985. (PL. X)

Syn. *Stereophyllum lingulatum* Jaeg. et Sauerb., Ber. St. Gall. Naturw. Ges. 1877-78: 277. 1880; Iwatsuki, Journ. Jap. Bot. **39**(6): 180. f. 1. 1964; Wang, Biol. Bull. Tunghai Univ. **28**: 23. 1967.

Specim. exam. Pingtung Hsien: Nan-huei Highway, Souka, 500 m alt., in secondary broad-leaved forest, terrestrial, May 20, 1985, *T. Y. Chiang 8856*.

Distribution: Taiwan, India, New Guinea, S. Africa, S. America.

Illustration: Iwatsuki 1964: 180. f. 1. (as *Stereophyllum lingulatum*)

The distinct character of the species is the obtuse leaf-apex and the entire leaf-margins.

Entodontopsis anceps (Bosch & Lac.) Buck & Ireland, Nova Hedw. **41**: 103. 1985. (PL. XI)

Syn. *Stereophyllum anceps* (Bosch. & Lac.) Broth., Nat. Pfl. 1(3): 1898. 1903.

Plants yellowish-green; stems creeping, complanately foliated. Leaves oblong, asymmetrical, concave, margins incurved at one side, serrulate above, costa single, 2/3 leaf-length; laminal cells vermiculate, smooth, thin-wall, 34-66 μm long, 5.2-7.9 μm wide; alar cells well differentiated, quadrate, unequally distributed.

Capsules erect, cylindric; exothecial cells thin-walled; peristome double.

Specim. exam. Pingtung Hsien: Haisenkong, 500 m alt., in secondary forest, on rock, Dec. 1986, *T. Y. Chiang 17933*.

Distribution: Taiwan, S. China (Hainan), Philippines, Java, Hawaii.

Illustrations: Bartram 1939: 310. pl. 23. f. 396; Chen *et al.* 1978: 231. f. 343.

This species is a new addition to the mossflora of Taiwan.

14. Nots on the genus *Fabronia* Raddi in Taiwan

Fabronia, a genus of the family Fabroniaceae, is mainly distributed in the temperate zones, with about 92 species in the world. The study on the Asiatic taxa of the genus seems to be insufficient. Only Taoda (1980) and Li *et al.* (1985) can be consulted. Two species of the genus were previously reported by Iwatsuki et Sharp (1970) and Lin (1981) from Taiwan. The authors rècently found two other species *F. ciliaris* (Brid.) Brid. and *F. matsumurae* Besch.

Fabronia Raddi, Atti Acc. Sci. Siena **9**: 230. 1808.

Plants delicate, yellowish-green, lustrous; stems creeping, irregularly branched; leaves fimbriate, ovate-lanceolate; laminal cells rhomboidal to linear; alar cells well differentiated, quadrate.

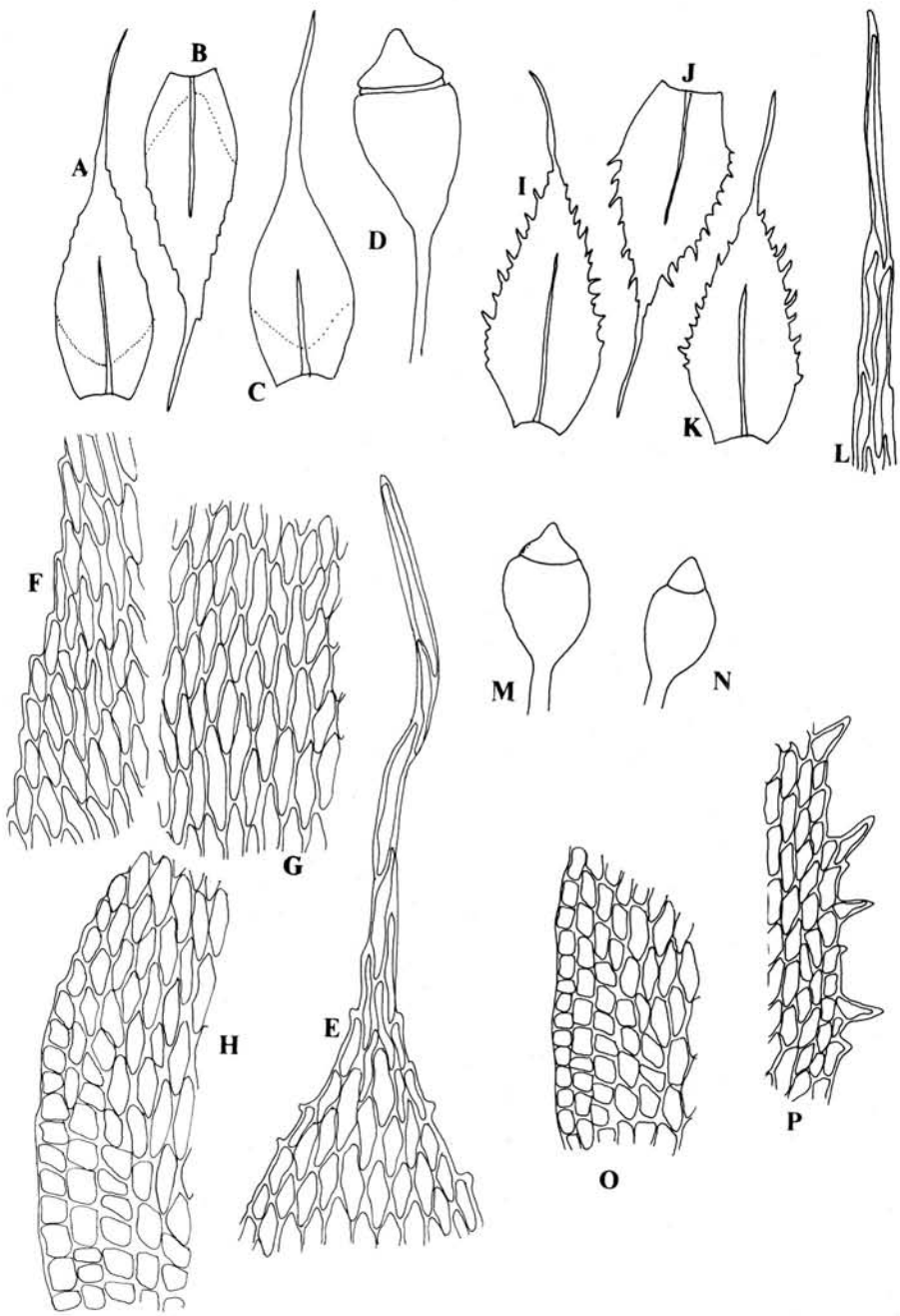

Plate XII. A-H, **Fabronia matsumurae** Besch. I-P, **F. ciliaris** (Brid.) Brid. A-C, leaves (×76). D, capsule (×31). E, cells of leaf-apex (×303). F, marginal cells (×303). G, laminal cells (×303). H, alar cells (×303). I-K, leaves (×76). L, cells of leafapex (×303). M, N, capsules (×31). O, alar cells (×303). P, marginal cells (×303). (A-H drawn from *Chiang 10769*, I-P from *Chiang 21317*).

Key to species of the genus *Fabronia*

1. Laminal cells vermicular ..... *F. secunda*
1. Laminal cells rhomboidal 2
2. Branch-leaves lanceolate ..... *F. curvirostris*
2. Branch-leaves ovate-lanceolate 3
3. Peristome present; leaf-margins dentate above ..... *F. ciliaris*
3. Peristome absent; leaf-margins serrulate above ..... *F. matsumurae*

Fabronia ciliaris (Brid.) Brid., Bryol. Univ. 2: 171. 1827; Taoda, Hikobia 8: 306. *f. 8.* 1980. (PL. XII, I.-P.)

Plants delicate, yellowish-green; stems creeping, irregularly branched; branches densely foliated. Leaves ovate-lanceolate, 1.4–1.5 mm long, 0.38–0.46 mm wide, with abruptly narrowed piliferous apex, margins dentate, costa single, 2/3 leaf-length; laminal cells rhomboidal, 15.8–23.7 μm long, 5.2–7.9 μm wide, smooth; alar cells differentiated, rectangular, 5.2–10.5 μm long, 6.6–10.5 μm wide. Capsules erect, globular; operculum dome-shaped.

Specim. exam. Taichung Hsien: Middle-Cross-Island Highway, Wuling, 2300 m alt., in broad-leaved forest, on tree trunk, Aug. 18, 1985, *T. Y. Chiang 10776, 10769.*

Distribution: Taiwan, N. China, Japan.

Illustrations: Taoda 1980: 307. *f. 8*; Gao *et al.* 1977: 226. *f. 158.*

The distinct character of this species is dentate leaf-margins.

Fabronia matsumurae Besch., Journ. de Bot. 13: 40. 1899; Taoda, Hikobia 8: 308. *f. 9.* 1980. (PL. XII, A.-H.)

Plants delicate, yellowish-green; stems creeping, densely foliated. Leaves ovate- to elliptic-lanceolate, with tapering piliferous apex, margins serrulate above, costa single, 2/3 leaf-length. Laminal cells rhomboidal, 21.1–42.2 μm long, 5.2–7.9 μm wide, smooth; alar cells differentiated, rectangular. Capsules erect, hemispheric, apophysis distinct, operculum shortly rostrated.

Specim. exam. Nantou Hsien: Yushan area, Tunpu to Salihsienchi, 1500 m alt., terrestrial in secondary forest, Aug. 5, 1987, *T. Y. Chiang 21317.*

Distribution: Taiwan, S. & N. China, Japan, Korea.

Illustrations: Taoda 1980: 308. f. 9; Anonymous 1985: 296. f. 126; Iwatsuki et Mizutani 1972: 184. pl. 26; Noguchi 1976: 191. f. 55a.

The specimen cited above seems to be similar to *F. secunda* Mont. in leaf-shape, whereas the rhomboidal laminal cells of the former could be distinguished from vermicular ones of the latter. Lin (1981) listed "*F. curvirostris* Dozy et Molk." without any descriptions and any taxonomic notes on the species. The authors found the characters of the specimen *Chiang 21317* seem to be intermediate between those of *F. matsumurae* and *F. curvirostris.* Only by the leaf-shapes *F. matsumurae* seems to be determined. Further study would be necessary to understand well these two species with the examination of their type specimens as well as other ample specimens.

15. Notes on the genus *Fissidens* in Taiwan

Fissidens, a genus of the family Fissidentaceae, is distributed all over the world, with about 900 species. It is characterized by the divided leaf, which comprises apical lamina, dorsal lamina and vaginant lamina. One can easily

distinguish it from other genera by the distinct character. Owing to wide distribution and well definition, so many bryologists have taken their interests in studying the genus. Among them Iwatsuki et Suzuki (1982) is the most prominent work in treating the Asiatic taxa, especially by the character of inflorescences. The first record on the genus in Taiwan can be date back to Cardot (1905), in which 3 species were reported. Later on Sakurai (1933) and Noguchi (1949, 1952) had ever made their efforts (cf. Kuo et Chiang 1987). According to Li (1985), which is the revised work made by examining the type specimens and other collections from Taiwan and China, 30 taxa of Taiwan were treated and discussed.

The plants of the genus grow almost all over this island, from seashore to subalpine zone, and in diversified environments. Owing to the diversities, the authors take their interests in studing the taxa. In this report 9 taxa are now additions to the mossflora of Taiwan.

1. **Fissidens crenulatus** Mitt., Proc. Linn. Soc. Suppl. Bot. 1: 140. 1859.

Key to varieties of *F. crenulatus*

1. Rhizoautoicous.....1b. var. *pursellii*
1. Cladautoicous 2
2. Limbidia less than 1/2 length of vaginant lamina.....1c. var. *elmeri*
2. Limbidia throughtout vaginant lamina.....1a. var. *crenulatus*

1a. var. **crenulatus** Mitt. Li, Acta Bot. Fenn. **129**: 33. *f. 14.* 1985. (PL XIII, B.-J.)

Plants small, 1.5–1.8 mm long, 1.2–1.4 mm wide. Stems erect, single, with 4–6 pairs leaves, axillary hyaline nodules not differentiated. Leaves lancelate, 0.7–1.0 mm long, 0.12–0.18 mm wide, apex acute; base of dorsal lamina acute; vaginant lamina ca. 1/2–2/3 leaf-length; limbidia differentiated at vaginant lamina; costa percurrent; leaf-margins crenulate; laminal cells quadrate, 9.2–10.2 μm long, with 1–2 papilla.

Autoicous ?, capsules terminal. Perechaetial leaves lanceolate, ca. 1.0 mm long; archegonia ca. 130 μm long.

Specim. exam.: Taipei, campus of National Taiwan University, terrestrial, May 12, 1984, *C. M. Kuo & T. Y Chiang 6510.*

Distribuion: Taiwan, S. China, E. Nepal, S. India, Burma, New Guinea.

Illustration: Li 1985: 33. f. 14.

1b. var. **pursellii** (S. Lin) T. Y. Chiang & C. M. Kuo *stat. nov.* (PL XIV)

Basionym: *Fissidens pursellii* S. Lin, Yushania 1(3): 58. *f. 2.* 1984.

Plants small to medium-sized. Stem erect, single, 1.8–4.3 mm long, 1.0–4.2 mm wide including leaves, axillary hyaline nodules not differentiated. Leaves 6–12 pairs, lanceolate to ovate-lanceolate, 0.9–1.3 mm long, 0.2–0.3 mm wide, apex acute; base of dorsal lamina wedge-shaped; vaginant lamina ca. 2/3 leaf-length; limbididia differentiated at vaginant lamina and extending to the base of apical lamina, consisting of 2–4 rows of elongate cells; costa excurrent; leaf-margins crenulate; laminal cells quadrate to hexagonal, 5.2–10.1 μm long, unipapillose.

Rhizoautoicous, male inflorescences bud-like, axillary; capsules erect, urn cylindric, ca. 0.6 mm long, operculum long rostrate, seta 0.2–0.4 mm long; exothecial cells round-quadrate, collenchymous. Perichaetial leaves lanceolate.

Specim. exam. Taichung, campus of Tunghai University, terrestrial, Apr. 1985,

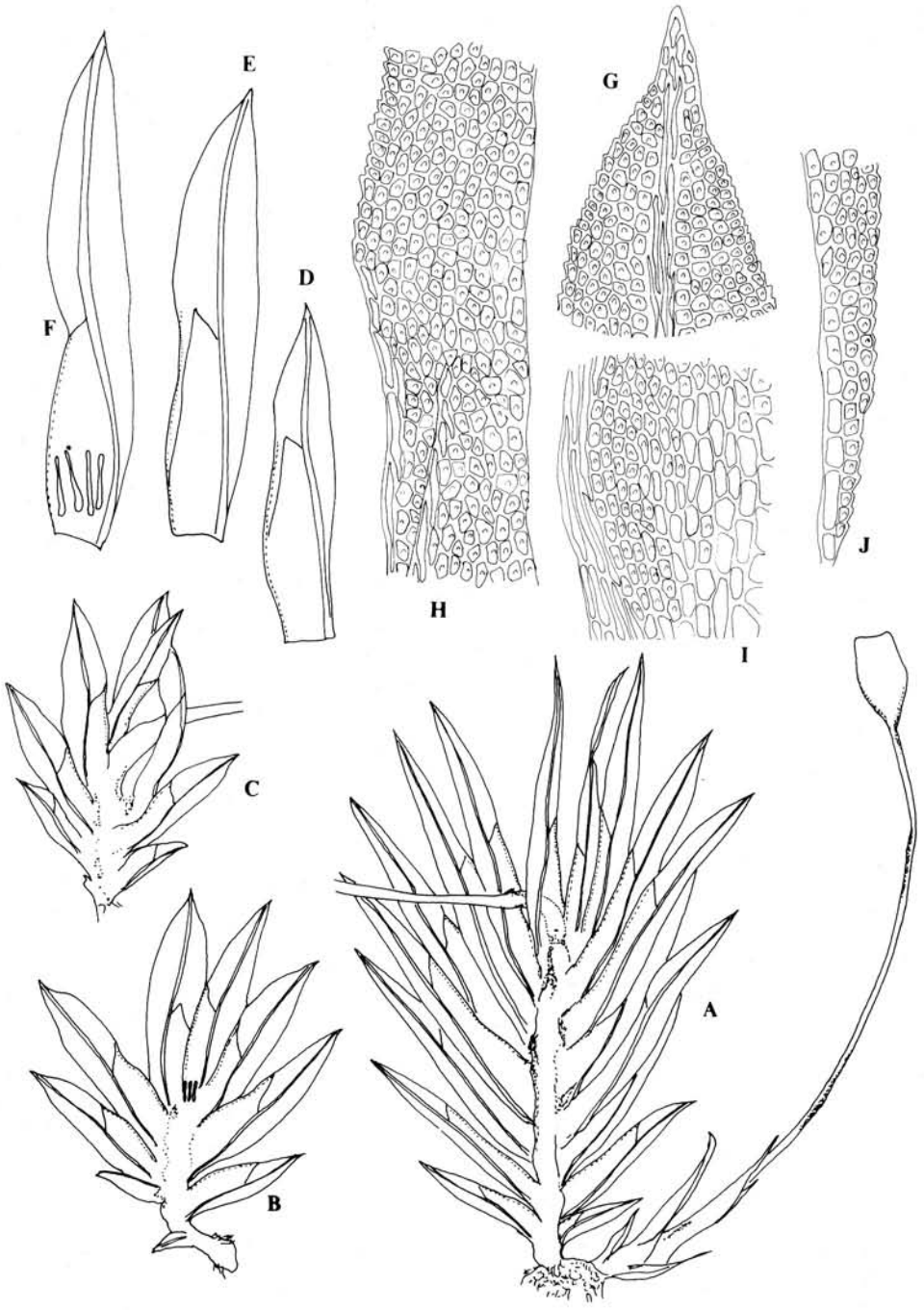

Plate XIII. A. **Fissidens kinabaluensis** Iwatsuki B-J, **Fissidens crenulatus** Mitt. var. **crenulatus** A, plant (×27). B-C, plants (×27). D-E, leaves (×67). F, perichaetial leaf (×67). G, cells of leaf-apex (×265). H, cells of apical and vaginant lamina (×265). I, cells of base of vaginant lamina (×265). J, cells of base of dorsal lamina (×265). (A, drawn from *Chiang 11976*; B-J, drawn from *Kuo & Chiang 6510*).

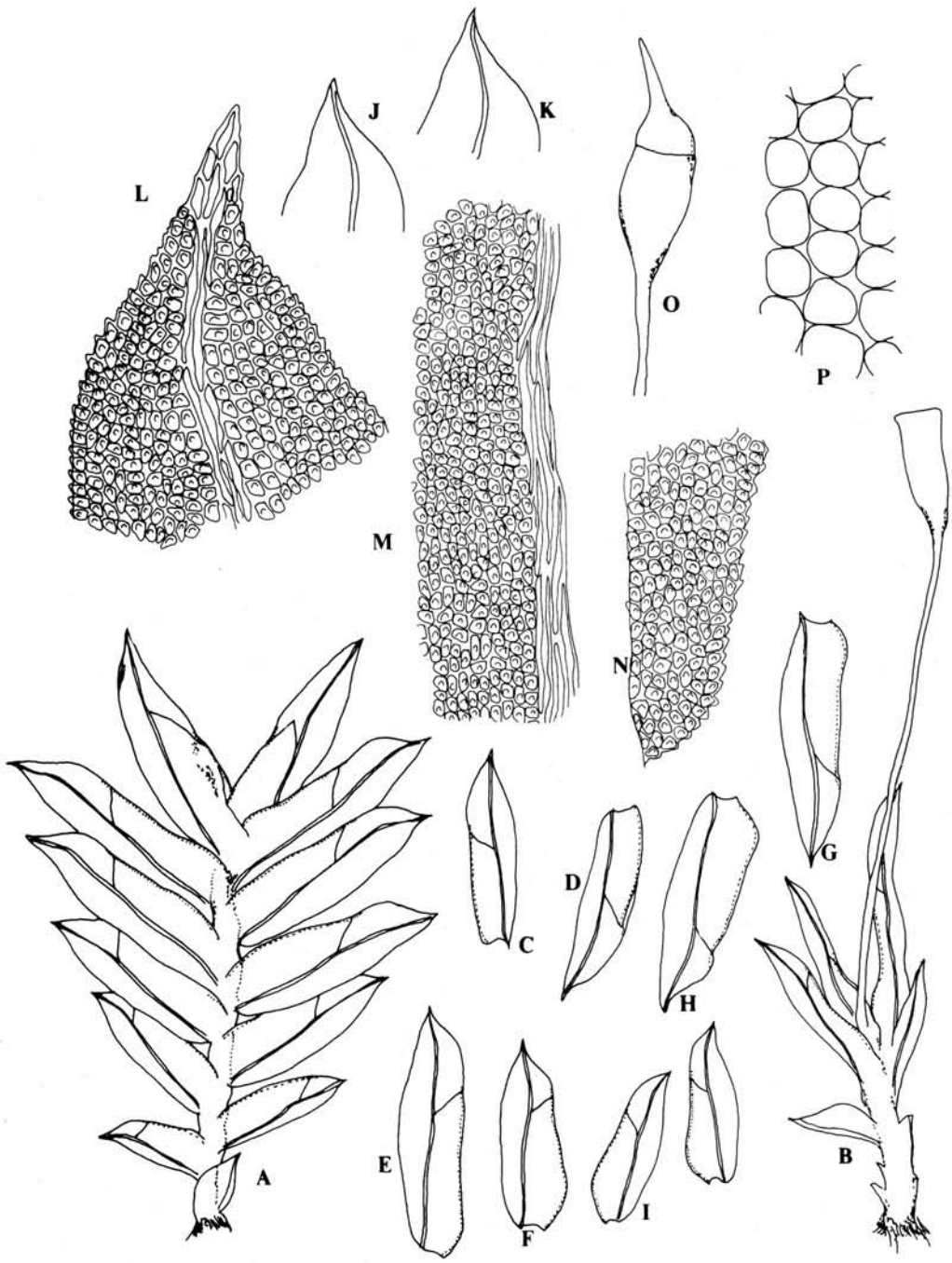

Plate XIV. **Fissidens crenulatus** Mitt. var. **pursellii** (S. Lin) Kuo & Chiang A-B, plants (×29). C-I, leaves (×29). J-K, leaf apex (×71). L, cells of leaf-apex (×284). M, cells of vaginant lamina (×284). N, cells of base of dorsal lamina (×284). O, capsule (×29). P, exothecial cells of capsule (×284). (Drawn from *Chiang 7796*).

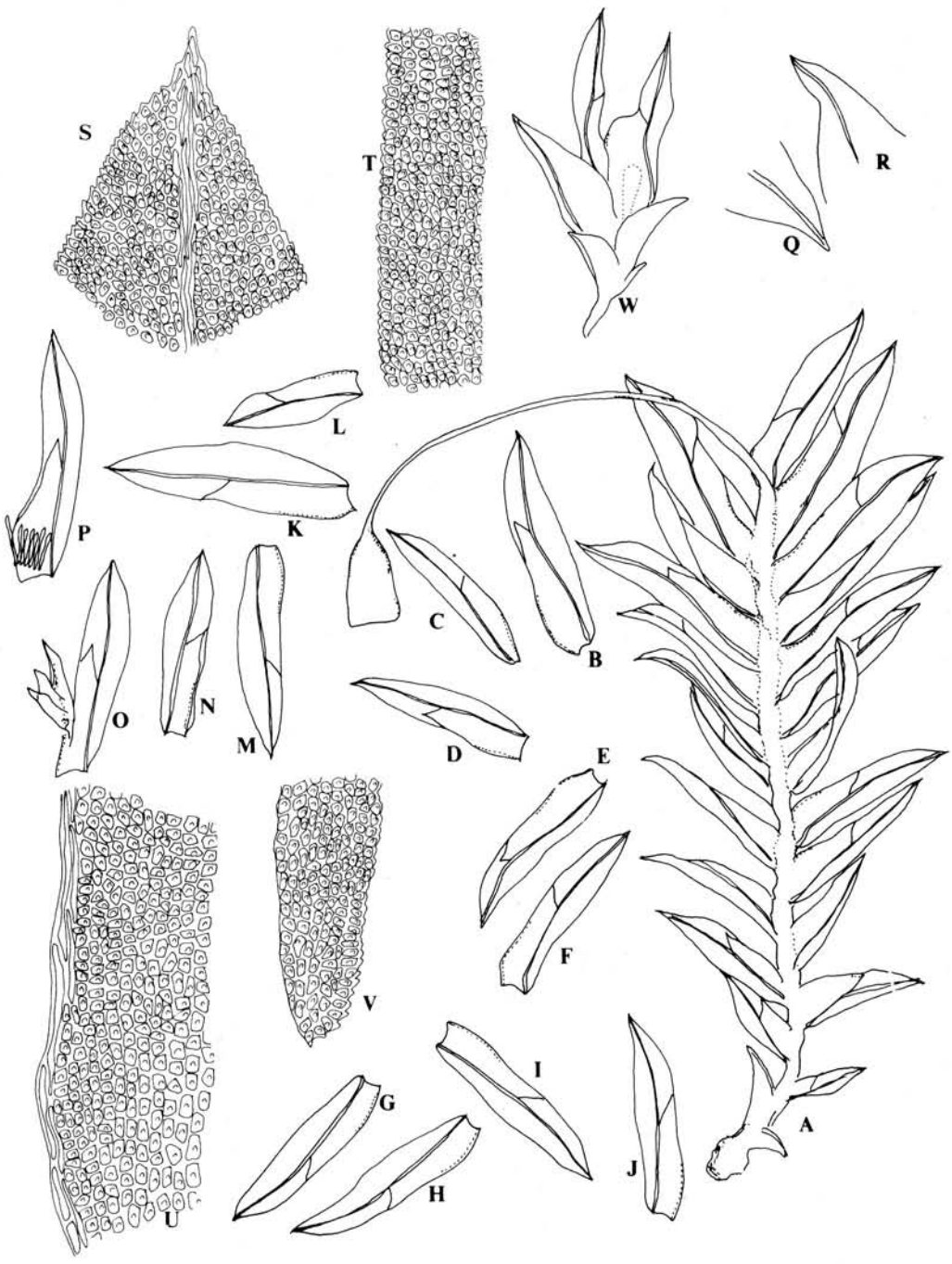

Plate XV. **Fissidens crenulatus** Mitt. var. **elmeri** (Broth.) Iwatsuki & Suz. A, plant (×28). B-N, leaves (×28). O, leaf with male inflorescence (×28). P, perichaetial leaf (×28). Q-R, leaf apex (×69). T, marginal cells of dorsal lamina (×277). U, cells of vaginant lamina (×277). V, cells of base of dorsal lamina (×277). W, male inflorescence (×69). (Drawn from *Chiang 12379*).

T. Y. Chiang 7796; Pintung Hsien: Maoling, 600 m alt., terrestrial, July 13, 1986, *T. Y. Chiang 15470*.

Distribution: Endemic to Taiwan.

F. pursellii was established by Lin (1984) according to a sterile specimen collected at campus of Tunghai University. Specimens with the fertile plants of rhizoautoicous sexuality were collected and examined. Leaf-margins crenulate, laminal cells uni-papillose, differentiated limbidia limited at vaginant lamina etc., show the characters of *F. crenulatus*. By the sexuality, the authors place it as a variety of *F. crenulatus*.

1c. var. **elmeri** (Broth.) Iwatsuki & Suzuki, Journ. Hattori Bot. Lab. **51**: 386. 1982. (PL XV)

Plants medium-sized. Stems erect, single or branched, 2.3–4.6 mm long, 1.0–2.3 mm wide including leaves, axillary hyaline nodules not differentiated. Leaves lanceolate, 0.6–1.2 mm long, 0.18–0.36 mm wide, apex acute, base of dorsal lamina wedge-shaped; vaginant lamina 1/2–2/3 leaflength; limbidia differentiated at vaginant lamina only, ca. 1/2 length; costa percurrent; laminal cells quadrate to hexagonal, 5.2–7.9 μm long, unipapillose.

Autoicous, capsules terminal or lateral; male inflorescences bud-like, axillary; urn cylindric, ca. 0.5 mm long, seta ca. 3.6 mm long, exothecila cells round-quarated, collenchymous; perichaetial leaves differentiated; archegonia ca. 230 μm long.

Specim. exam. Tainan Hsien: Hsinhua, 500 m alt., terrestrial in secondary broad-leaved forest, Dec. 16, 1984, *T. Y. Chiang 6705*; Hsinhua, Tsailiao, terrestrial in bamboo forest, Nov. 1, 1985, *T. Y. Chiang 12379*.

Distribution: Taiwan, S. China, Japan, Vietnam, Malaya, Micronesia, Philippines.

Illustrations: Iwatsuki et Suzuki 1982: 386. pl. XXIII; Li 1985: 34. j.-q.

Fissidens elmeri Broth. was previously reported in Taiwan by Herzog et Noguchi (1955), based on the specimen (*G. H. Schwabe s. n.*) collected at Taipei. Iwatsuki and Suzuki (1977) re-examined the specimen and found it is nothing more than *F. schwabei* Nog. Wang (1960, 1970), Chuang (1973) and Lai et Wang-Yang (1976) also reported the species but without any citations of specimens. The authors were able to confirm the existence of the variety in Taiwan.

The sexuality of the variety seems to be complicated. Iwatsuki & Suzuki (1982) considered it may be dioicous, whereas Li (1985) described it as autoicous, male inflorescences axillary, based on the observation of the holotype of *F. elmeri*. The authors found the same sexuality on Taiwanese specimens (*Chiang 6705, 12379*) as in Li's statements. The capsules may be terminal or lateral even in a same population.

Fissidens pseudohollianus Iwats. & Suzuki, based on the type specimen from Bonin, was described as autoicous, antheridia in axils of median to upper leaves. The authors consider it may be identical with *F. crenulatus* var. *elmeri* according to the vegetative and reproductive characters, although further study must be made.

2. **Fissidens rupicola** Broth., Oefv. Finsk. Vet. Soc. Forek. **48**: 7. 1906; Iwatsuki. Journ. Hattori Bot. Lab. **52**: 122. f. V. 1982. (PL XVI)

Plants small, 1.0–3.1 mm long, 0.5–1.3 mm wide. Stems erect, densely foliated at upper portion, laxly at lower. Leaves 5–8 pairs, lanceolate to narrowly oblong, more or less obtuse at apex; dosal lamina wedge-shaped to rounded at base, not decurrent; vaginant lamina ca. 1/2 leaf-length; costa ceasing below apex, not

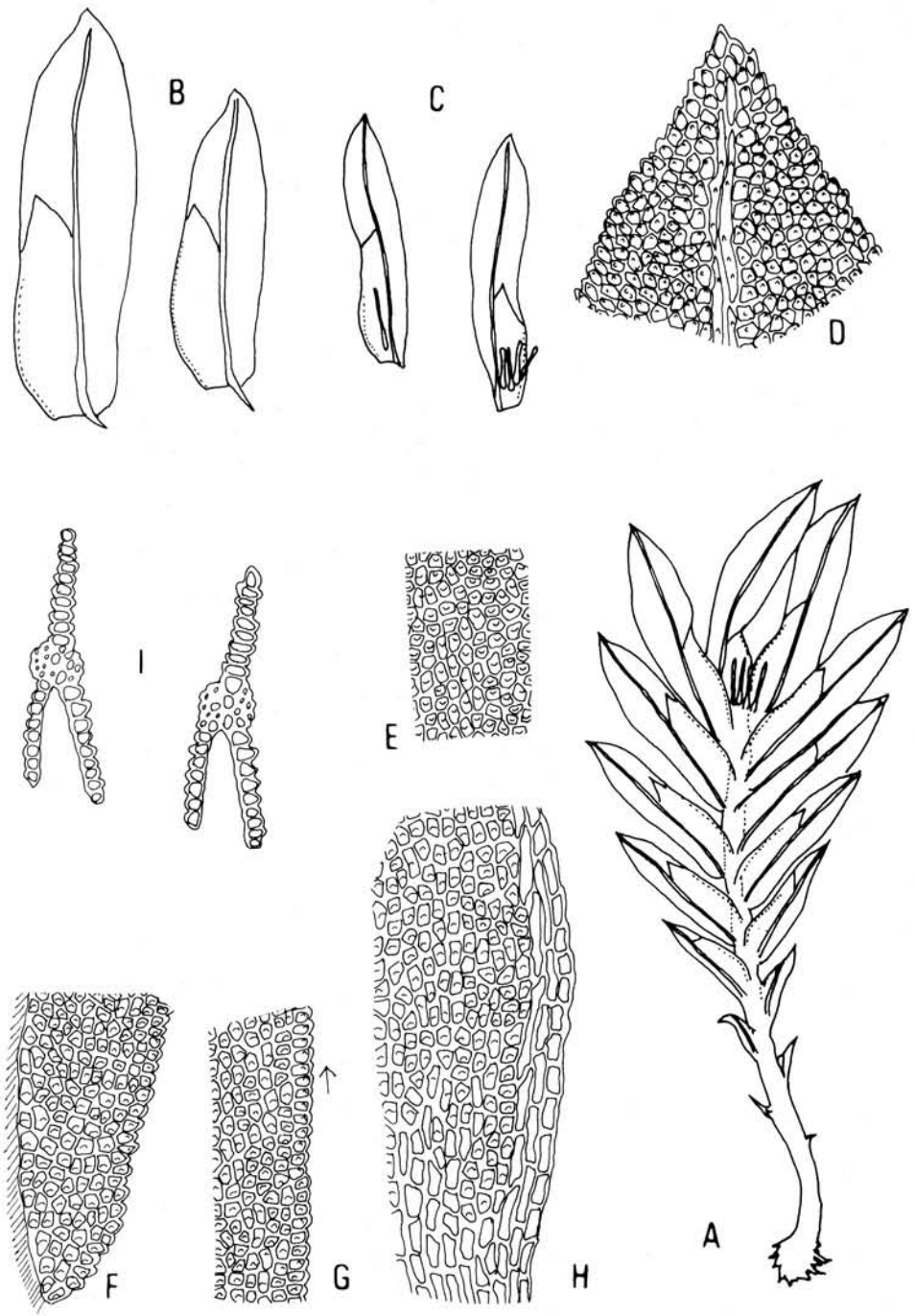

Plate XVI. Fissidens rupicola Broth. A, plant (×35). B, leaves (×35). C, perichaetial leaves with archegonia (×35). D, apical cells of leaf (×341). E, cells of apical lamina (×341). F, basal cells of dorsal lamina (×341). H, basal cells of vaginant lamina (×341). I, cross-sections of leaves (×341). (Drawn from *Chiang 12304*).

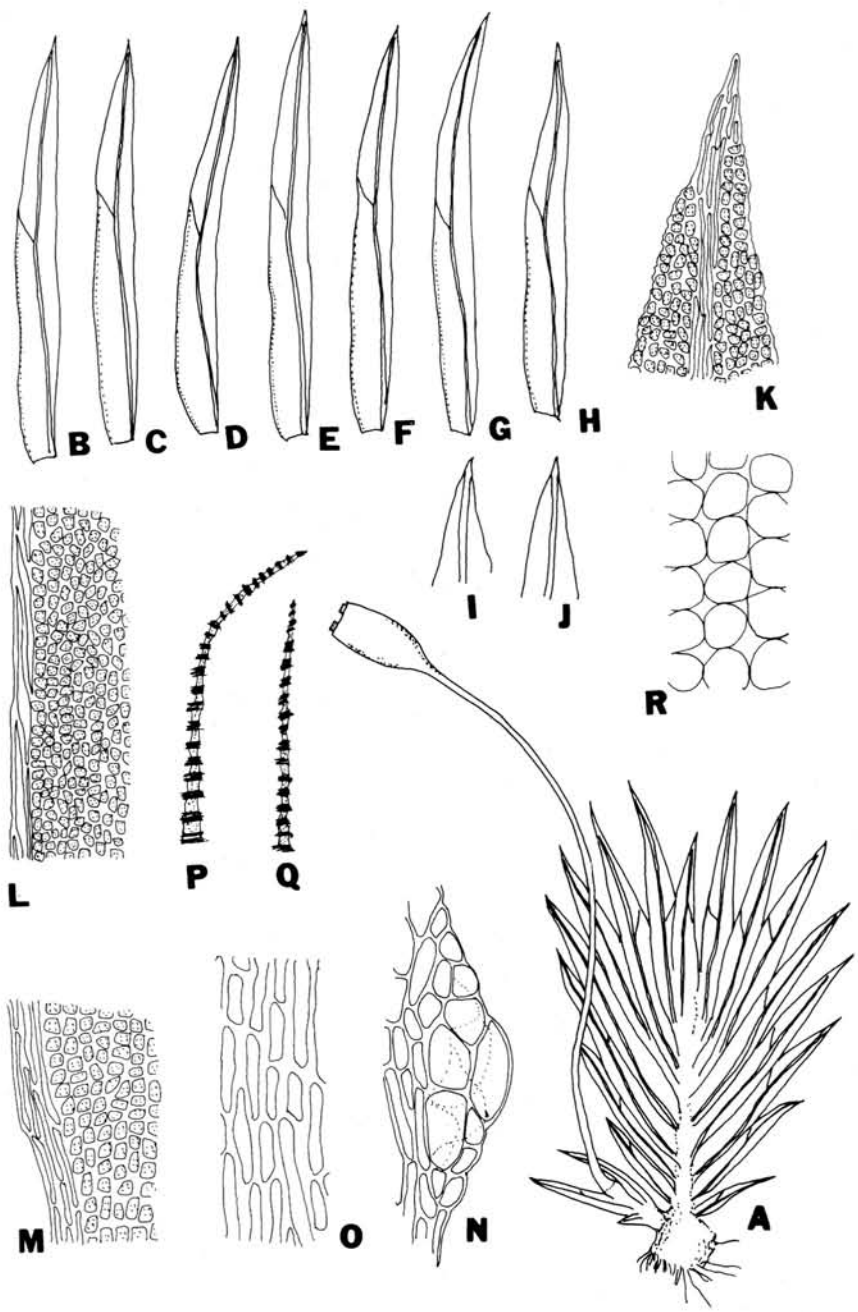

Plate XVII. Fissidens kinabaluensis Iwats. A, plant (×30). B-H, leaves (×30). I-J, leaf apex (×73). K, cells of leaf apex (×292). L, cells of vaginant lamina (×292). M, cells of base of vaginant lamina (×292). N, axillary hyaline nodule (×292). O, cells of lower portion of capsule (×292). P-Q, peristome teeth (×292). R, exothecial cells of capsule (×292). (Drawn from *Chiang 11976*).

percurrent; leaf-margins serrulate; limbidia differentiated at vaginant lamina, consisting of 2-3 rows of elongate cells. Laminal cells quadrate, unipapillose, 3.7-7.9 μm long.

Archegonia terminal, 128-179 μm long. Perichaetial leaves 1.0-1.1 mm long. Capsules not found.

Specim. exam. Taitung Hsien: Souka, 500 m alt., terrestrial in ravine, Dec. 1, 1985, *T. Y. Chiang 12304.*

Distribution: Taiwan, New Calendonia.

Illustration: Iwatsuki 1982: 122. f. V.

According to Iwatsuki (1982), *F. rupicola* is endemic to New Caledonia, an island near Australia in the South Pacific Ocean. The finding of the species in Taiwan is phytogeographically noteworthy. The main factor for extention of the distribution maybe lies in the birds, as Dr. Deguchi suggested (in litt.).

As Iwatsuki (1982) mentioned the species is similar to *F. crenulatus* in the differentiation type of limbidia and unipapillate laminal cells. But it could be easy to distinguish the both species by the obtuse leaf-apex and the costa ceasing below apex.

3. **Fissidens kinabaluensis** Iwatsuki, Journ. Hattori Bot Lab. **32**: 271. *f. 1.* 1969. (PL XVII)

Plants small, 2.3-3.0 mm long, 1.6-1.9 mm wide. Stem single, axillary hyaline nodules well differentiated. Leaves 9-12 pairs, lanceolate, 0.6-1.9 mm long, 0.10-0.19 mm wide, apex acute, margins entire, costa excurrent; vaginant lamina 1/2-2/3 leaf-length; limbidia differentiated at vaginant lamina, consisting of 1-3 rows of elongate cells throughout; laminal cells quadrate to hexagonal, 2.6-9.2 μm long, plurio-papillose.

Autoicous, capsules erect, symmetrical, urn ca. 0.5 mm long; exothecial cells quadrate to round-quadrate, collenchymous; peristome with spiral thickenings.

Specim. exam. Pingtung Hsien: Nanjenshan, terrestrial in a ravine, Oct. 15, 1985, *T. Y. Chiang 11976*; Manchou, terrestrial, Mar. 1, 1986, *T. Y. Chiang 11532.*

Distribution: Taiwan, S. China (Guangzhou), N. Borneo.

Illustration: Iwatsuki 1969: 271. f. 1.

This species is closed to *F. wichurae* in habit of plants, leaf-shape, axillary hyaline nodules, limbidia, pluri-papillose cells and others. *F. wichurae* was reported by Iwatsuki et Sharp (1970) from Taiwan and was noted "the capsules terminal on the stem or branched shoots". The distinct difference between the two species as Iwatsuki (1969) mentioned is the sexuality, rhizo-autoicous inflorescence in *F. kinabaluensis* and cladautoicous in *F. wichurae.* The authors checked the specimens collected in Taiwan and observed both kinds of inflorescences on a same individual. The authors consider *F. kinabaluensis* may be identical with *F. wichurae.*

4. **Fissidens crassinervis** Lac., Naturk. Verh. K. Ak. Wet. Amsterdam **13**: 3. 1872; Iwatsuki & Suzuki, *l. c.* 393. *pl. 26.* 1982. (PL XVIII)

Plants small, 3.3-6.8 mm long, 1.2-1.5 mm wide. Stems erect, single, not curling when dry; the leaves of upper part much longer and denser than those of lower part; axillary hyaline nodules not differentiated. Leaves 7-12 pairs, 1.3-1.8 mm long, 0.12-0.20 mm wide, lanceolate, acute at apex; dorsal lamina wedged to acute at base; vaginant lamina 1/3-1/2 leaf-length, upper part very unequal; costa strong, percurrent; leaf-margins entire to crenulate partly; limbidia not differentiated.

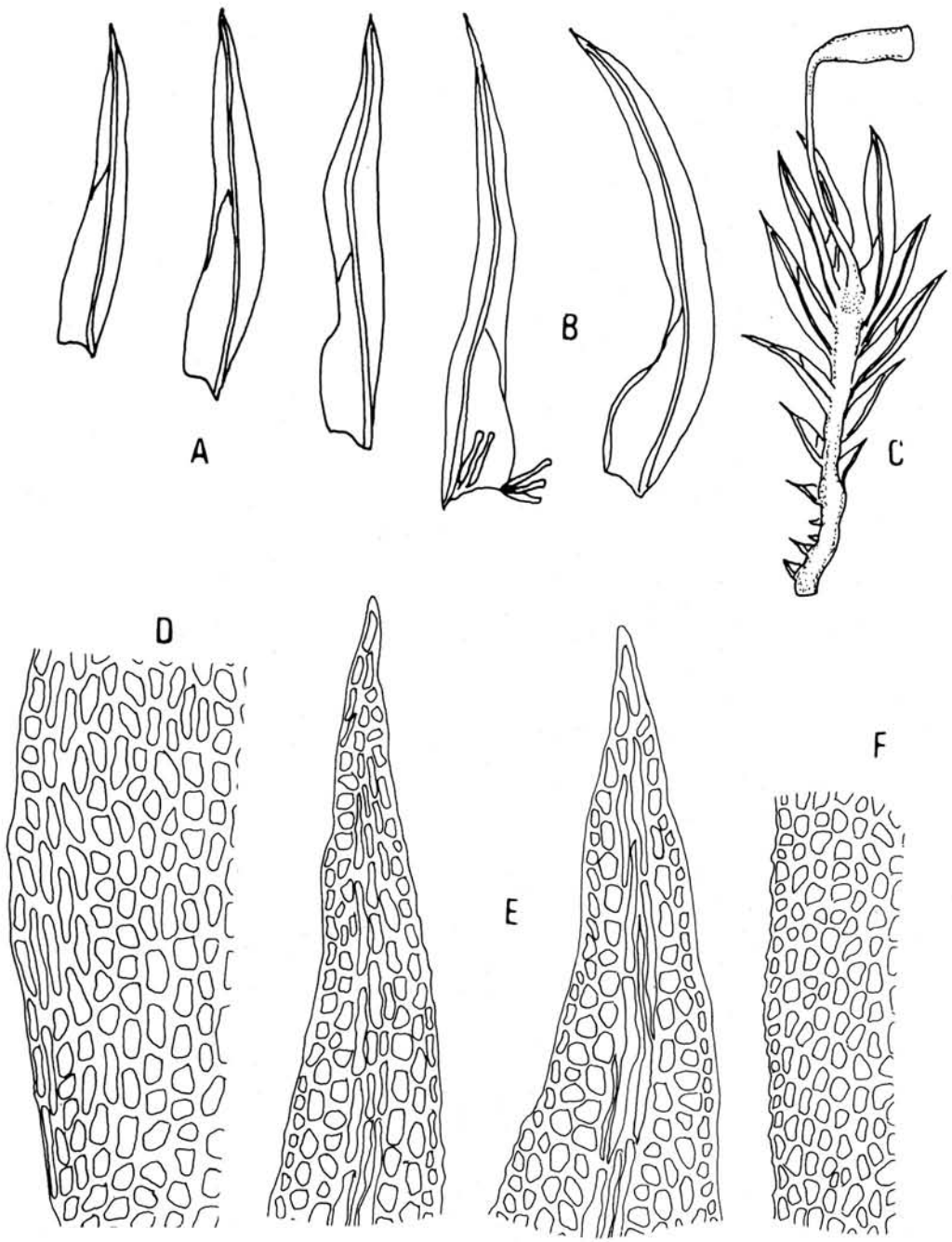

Plate XVIII. Fissidens crassinervis Lac. A, leaves (×37). B, perichaetial leaves with archaegonia (×37). C, plant (×37). D, cells of base of vaginant lamina (×360). E, cells of leaf-apex (×360). F, marginal cells of dorsal lamina (×360). (Drawn from *Kuo & Chiang 11839*).

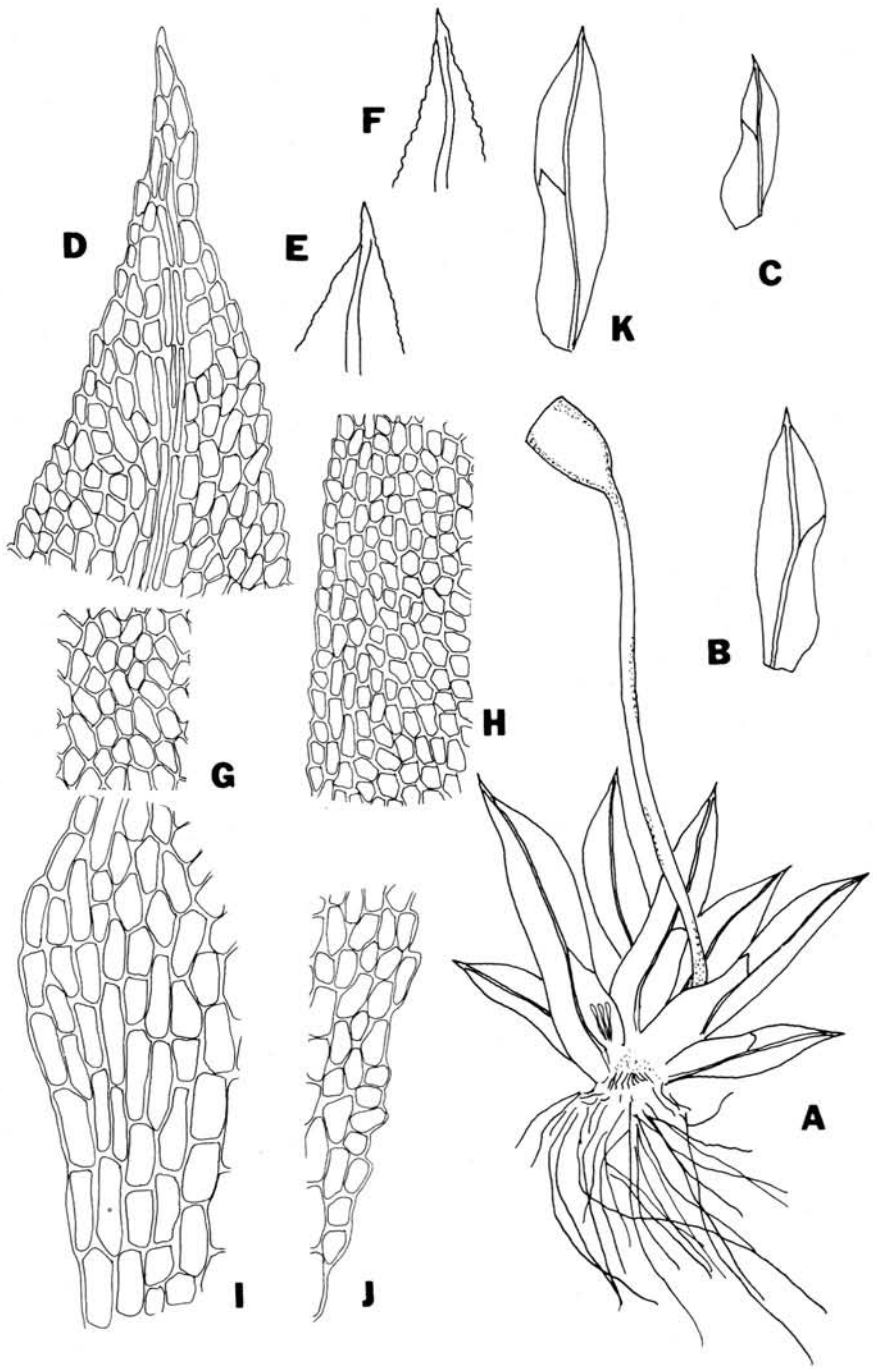

Plate XIX. **Fissidens flabellulus** Thwait. & Mitt. A, plant (×32). B-C, leaves (×32). D, cells of leaf-apex (×315). E-F, leaf apex (×79). G, laminal cells (×315). H, marginal cells of dorsal lamina (×315). I, basal cells of vaginant lamina (×315). J, basal cells of dorsal lamina (×315). K, perichaetial leaf (×32). (Drawn from *Chiang 5243*).

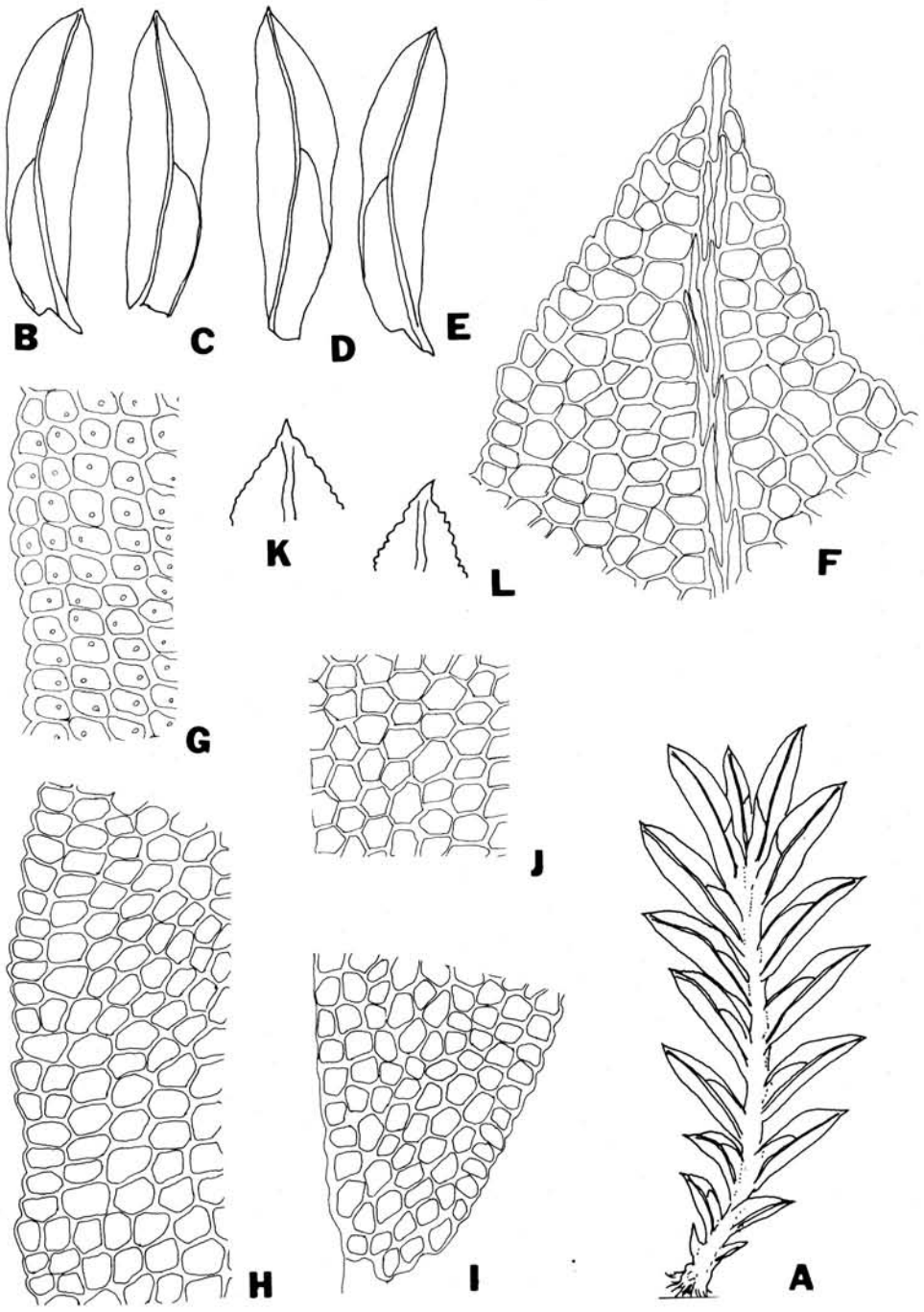

Plate XX. Fissidens ganguleei Norkett ex Gang. A, plant (×15). B-E, leaves (×35). F, cells of leaf-apex (×341). G, cells of dorsal lamina (×341). H, marginal cells of vaginant lamina (×341). I, basal cells of vaginant lamina (×341). I, basal cells of dorsal lamina (×341). J, cells of apical lamina (×341). K-L, leaf apex (×86). (Drawn from *Chiang 10594*).

Laminal cells quadrate to irregularly hexagonal, thick-walled; marginal cells 4.7-7.9 μm long, much smaller than those near costa, 7.8-13.0 μm long, smooth.

Capsules terminal, urn 0.6-0.7 mm long, seta 1.5-1.8 mm long. Perichaetial leaves narrow lanceolate, 1.8-2.0 mm long; archegonia 180-220 μm long.

Specim. exam. Pingtung Hsien: Nanjenshan, terrestrial on the floor of original, broad-leaved forest, Oct. 16, 1985, *C. M. Kuo & T. Y. Chiang 11839*; Wanlidershan, terrestrial, Nov. 13, 1985, *T. Y. Chiang & B. J. Wang 12277*.

Distribution: Taiwan, Japan, Thailand, Malaysia, Singapore, Java, Borneo, New Guinea.

Illustration: Iwatsuki & Suzuki 1982: 393. pl. 26.

5. **Fissidens flabellulus** Thwait. & Mitt., J. Linn. Soc. Bot. **13**: 329. 1897; Iwatsuki & Suzuki, *l. c.* 397. *pl. 30*. 1982. (PL XIX)

Plants small, 0.8-1.8 mm long, 0.5-1.1 mm wide. Stems erect, densely foliated, axillary hyaline nodules not differentiated. Leaves 2-5 pairs, lanceolate to slightly falcate, 0.7-1.1 mm long, 0.1-0.3 mm wide, acute at apex; dorsal lamina wedge-shaped at base; vaginant lamina ca. 1/2 leaf-length; costa strong, percurrent to excurrent, bending at leaf-middle; leaf-margins serrate; limbidia not differentiated.

Laminal cells quadrate to hexagonal, 8-18 μm long, smooth. Cells at lower part of vaginant lamina rectangular, 21-39 μm long.

Capsules terminal, erect and symmetrical, urn. ca. 0.4 mm long, seta ca. 0.2 cm long. Archegonium terminal, ca. 150 μm long. Perichaetial leaves lanceolate, 1.3 mm long, 0.2 mm wide.

Specim. exam. Kaohsiung Hsien: Linyuan, 50 m alt., terrestrial on the floor of bamboo forest, Sept. 27, 1983, *T. Y. Chiang 5243*.

Distribution: Taiwan, Japan, Ceylon.

Illustration: Iwatsuki & Suzuki 1982: 397. pl. 30.

This species resembles *F. serratus* C. Muell. in the leaf-shape and the serrate leaf-margins, but the latter species is distinguished from the former by the unipapillose laminal cells. The species is a new addition to mossflora of Taiwan.

6. **Fissidens ganguleei** Norkett ex Gang., Moss. E. India **2**: 527. 1971; Iwatsuki & Suzuki, *l. c.* 392. *pl. 27*. 1982. (PL XX)

Plants small, 2.3-4.6 mm long, 0.9-2.0 mm wide. Stem erect, not branched, axillary hyaline nodules weakly differentiated. Leaves 5-8 pairs, lanceolate to ovate-lanceolate, 0.5-1.2 mm long, 0.2-0.3 mm wide, acute at apex; dorsal-lamina wedge-shaped at base, not decurrent; vaginant lamina ca. 1/2 leaf-length, upper portion very unequal; costa stout, pecurrent to excurrent, bending at leaf-middle; leaf-margins serrulate.

Laminal cells quadrate to hexagonal, 13-20 μm long, smooth, with a nucleus-like hyaline dot inside.

Capsules not found.

Specim. exam. Chiayi Hsien: Alishan, Chushan, terrestrial, July 13, 1985, *T. Y. Chiang 10594*; Kaohsiung Hsien: Takuanshan, on the Southern-Cross-Island Highway, ca. 2500 m alt., in broad-leaved forest, July 27, 1986, *T. Y. Chiang 14079*.

Distribution: Taiwan, Japan, India, Nepal.

Illustration: Iwatsuki & Suzuki 1982: 392. *pl. 27*.

The most distinct character of this species are the upper portion of vaginant lamina very unequal, laminal cells with nucleus-like hyaline dots. The species is

closed to *F. laxus* but distinguished from the latter by the bending costa and less distinctly range of distribution: *F. ganguleei* is mainly distributed in middle elevations (ca. 2500 m) in Taiwan, whereas *F. laxus* in low elevations only in S. Taiwan.

7. **Fissidens leptopelma** Dix., J. Bombay Nat. Hist. Soc. **39**: 773. 1937; Iwatsuki & Mohamed, Journ. Hattori Bot. Lab. 62: 355. 1987. (PL XXI)

Syn. *Fissidens subangustus* Fleisch., Musci Fl. Buitenzorg **1**: 47. 1904.

Plants small, grow together, irregularly crisping when dry. Stem erect, single, 2.0–5.3 mm long, 1.5–3.5 mm wide, central strand not differentiated, cortical cells small, thick-walled; axillary hyaline nodules well differentiated. Leaves 5–10 pairs, 1.0–1.8 mm long, 0.15–0.20 mm wide, narrow lanceolate, acute at apex; dorsal lamina acute at base, not decurrent; vaginant lamina ca. 1/2 leaf-length; costa stout, percurrent to excurrent; leaf-margins serrulate; limbidia not differentiated.

Laminal cells quadrate to irregularly hexagonal, 7.0–7.9 μm long, 8.1–9.0 μm wide, obscure, with multi-papillae.

Capsules terminal, erect or slightly inclined, symmetrical, seta 0.6–0.7 mm long; perichaetial leaves narrowly lanceolate, ca. 2.2 mm long; archegonia ca. 200 μm long.

Specim. exam. Kaohsiung Hsien: Baiyuenshan, 600 m alt., Dec. 16, 1984, *T. Y. Chiang 6527*; Meishankou, terrestrial in a ravine, 850 m alt., May 1984, *T. Y. Chiang 8067*; Neiyingshan, July 1985, *T. Y. Chiang 10280*. Chiayi Hsien: Tsaoshan, terrestrial, Sept. 15, 1985, *T. Y.* Chiang *11659*; Tzen-wun Dam., terrestrial in a ravine, Jan. 20, 1987, *T. Y. Chiang 18171*.

Distribution: Taiwan, Japan, India, Pen. Malaya, Java, Sumatra.

Illustrations: Iwatsuki 1977: 129. *f. 1*; Iwatsuki & Suzuki 1982: 400. *pl. 32* (as *F. subangustus*); Iwatsuki & Mohamed 1987: 354. *f. 6*.

This species is similar to *F. wichurae* in having the pluri-papillose cells and well-differentiated hyaline nodules. But the latter species has limbidia at vaginant lamina, whereas *F. leptopelma* lacks them.

8. **Fissidens mangarevensis** Mont., Ann. Sci. Nat. Bot. ser. 3, **4**: 113. 1845; Iwatsuki & Suzuki, Journ. Hattori Bot. Lab. **51**: 402. *pl. 34*. 1982. (PL XXIX, A.-H.)

Syn. *Fissidens acutus* Jaeg., Ber. S. Gall. Naturw. Ges. 1874-75: 93. 1876.

Plants small; stems erect, single, 4.2–6.8 mm long, 3.2–4.3 mm wide including leaves, axillary hyaline nodules not differentiated. Leaves lanceolate, 1.3–1.6 mm long, 0.17–0.23 mm wide, acute or more or less obtuse at apex; dorsal lamina wedge-shaped at base, not decurrent; vaginant lamina ca. 1/2 leaf-length; margins serrulate; limbidia not differentiated; costa ceasing below apex. Laminal cells round-hexagonal, 5.2–10.5 μm long, distinctly mammillose.

Specim. exam. Taitung Hsien: Orchid Island, Tienchih, ca. 300 m alt., in broad-leaved forest, terrestrial, Sept. 1, 1987, *T. Y. Chiang 2262*.

Distribution: Taiwan, S. China, Japan, Hong Kong, S. Pacific.

Illustrations: Iwatsuki & Suzuki 1982: 402. *pl. 34*; Li 1985: 43. *f. 18*; Iwatsuki & Suzuki 1977: 398. *f. X.* (as *F. asplenoides*).

The species is characterized by the flexuous costa, the mammillose cells and the absence of axillary hyaline nodules. It is a new addition to the mossflora of Taiwan.

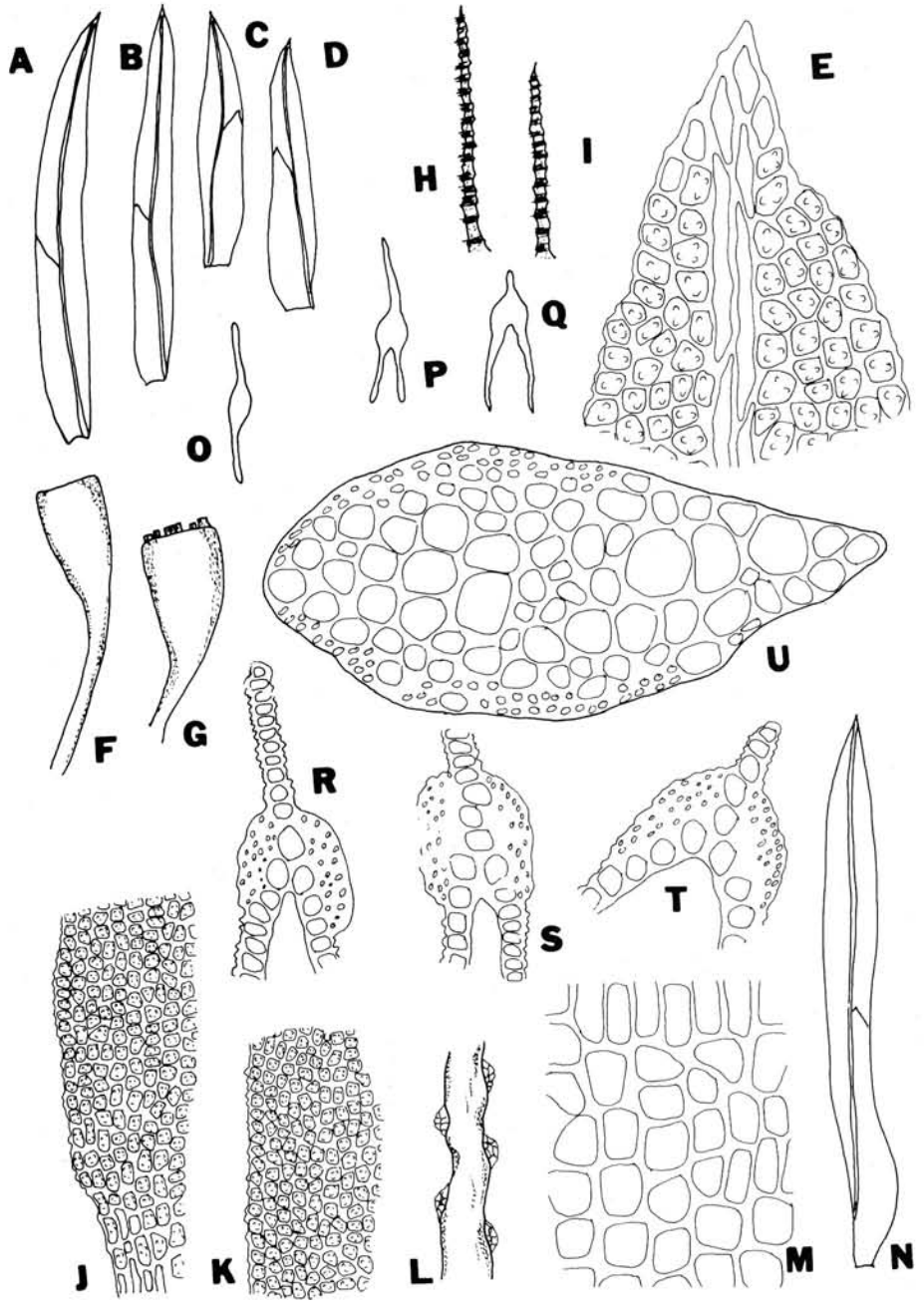

Plate XXI. Fissidens leptopelma Dix. A-D, leaves (×33). E, cells of leaf-apex (×318). F-G, capsules (×33). H-I, peristome teeth (×318). J, basal cells of vaginant lamina (×318). K, marginal cells of dorsal lamina (×318). L, axillary hyaline nodules of stem (×80). M, exothecial cells (×318). N, perichaetial leaf (×33). O-Q, cross-sections of leaves (×80). R-T, cross-sections of leaves (×318). U, crosssection of stem (×318). (Drawn from *Chiang 6527*).

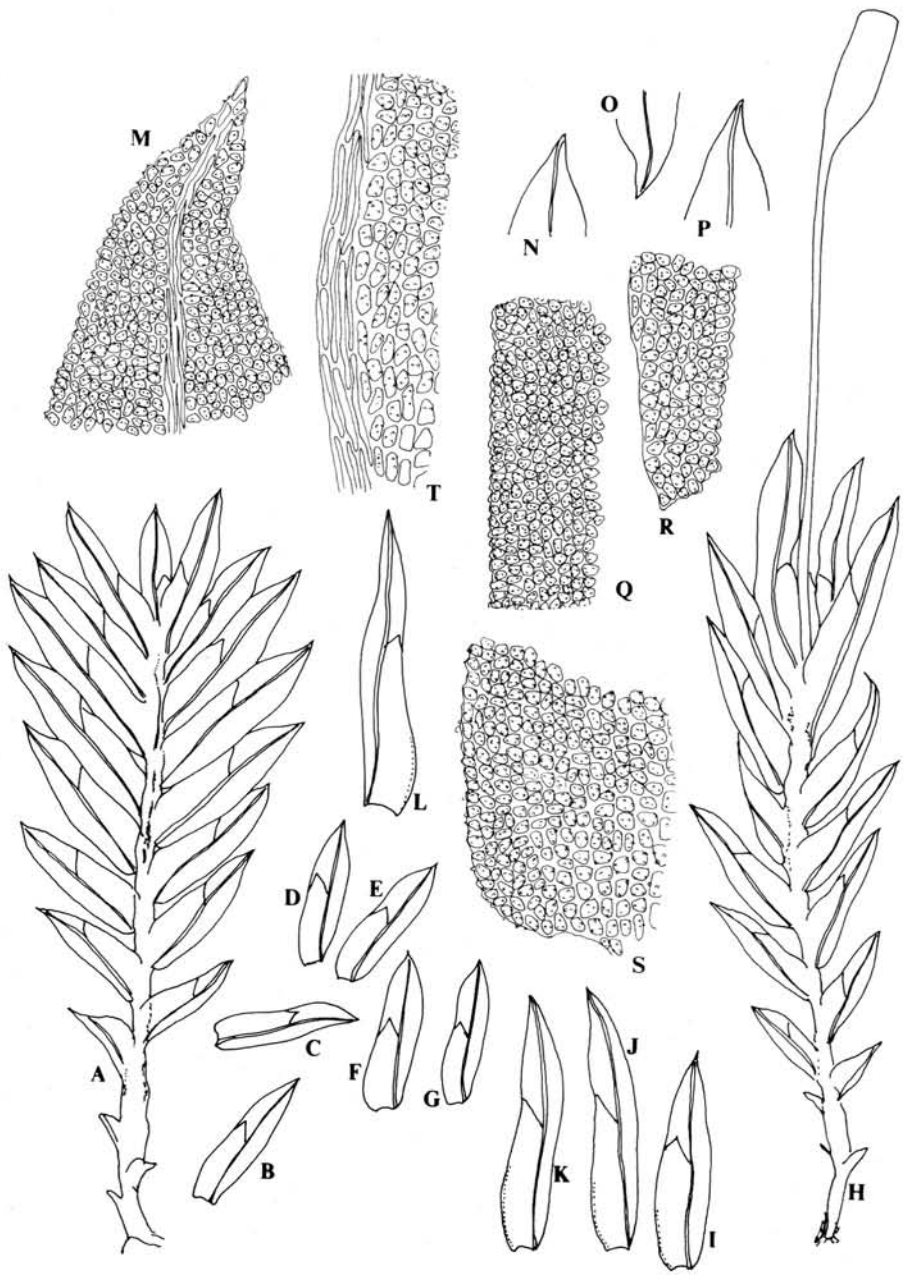

Plate XXII. Fissidens japonico-punctatus Shin A, sterile plant (×27). B-G, leaves of sterile plants (×27). H, fertile plant (×27). I-K, leaves of fertile plant (×37). L, perichaetial leaves (×27). M, cells of leaf-apex (×265). N-P, leaf apex (×67). Q, cells of dorsal lamina (×265). R, cells of base of dorsal lamina (×265). S, cells of vaginant lamina of sterile plant (×265). (Drawn from *Chiang 18198*).

9. ? **F. japonico-punctatus** Shin, Sc. Rep. Kagoshima Univ. **13**: 86. *f. 21.* 1964. (PL XXII)

Plants small, dark green, sterile and fertile plants differentiated. Stems erect, single, 2.4-3.7 mm long, 1.0-1.6 mm wide including leaves, with 6-8 pairs of leaves. Leaves lanceolate, 0.6-1.0 mm long, 0.15-0.26 mm wide, apex acute, oblique; base of dorsal lamina wedge-shaped; vaginant lamina ca. 1/2 leaf-length; limbidia only differentiated at vaginant lamina of fertile plants, ca. 2/3 length of vaginant lamina; costa percurrent. Laminal cells quadrate to irregularly hexagonal, 3.9-7.8 μm long, with 1-4 minute papillae.

Capsules terminal on the stem, erect, urn cylindrical, ca. 0.5 mm long; seta 2.5 mm long; exothecial cells round-quadrate, collenchymous. Perichaetial leaves lanceolate, 1.2-1.4 mm long, 0.1-0.2 mm wide.

Specim. exam. Chiayi Hsien: Tzen-wen Dam., in a ravine, on rock, Jan. 20, 1987, *T. Y. Chiang 18198.*

Distribution: Taiwan, Japan (Ryukyus).

Illustration: Shin 1964: 86. f. 21.

This species was reported by Shin (1964) based on a sterile specimen. Iwatsuki et Suzuki (1977) synonimized it under *F. hollianus* Dozy et Molk. Recently the authors found the fertile plants of the species in the specimen collected at Tzen-wen Dam. No male inflorescences on the axis of stem, limbidia only at vaginant lamina of fertile plants and elongate smooth seta are the characters of the species, which can be used to distinguish it from *F. hollianus* Dozy et Molk.

This species is also closely related to *F. ceylonensis* Dozy et Molk. in the leaf-shape, pluri-papillose cells and differentiation of limbidia at vaginant lamina. Whereas no differentiation of sterile and fertile plants could be observed in *F. ceylonensis*. Further study must be made when more material is available.

10. **Fissidens ceylonensis** Dozy et Molk., Ann. Sc. Nat. Bot. ser. 3, **2**: 304. 1844; Li, Acta Bot. Fennica **129**: 29. *f. 12.* 1985; Iwatsuki & Mohamed, Journ. Hattori Bot. Lab. **62**: 345. *f. II.* 1987. (PL XXIII)

Syn. *Fissidens intromarginatulus* Bartr., Rev. Bryol. Lichen. **23**: 242. 1954; Li, Act. Bot. Fennica **129**: 25. *f. 11.* 1985.

Autoicous, male inflorescences bud-like; capsules terminal on stems or lateral.

Specim. exam. Kaohsiung Hsien: Neiyingshan, 1000 m alt., terrestrial on the the floor of secondary forest, July 1985, *T. Y. Chiang 10203*; Baiyuenshan, 1000 m alt., in broad-leaved forest, on a stone, *T. Y. Chiang s.n.*, Jan. 18 1987.

Distribution: Taiwan, S. China (Yunnen), Philippines, Burma, Vietnam, Java, Borneo, Thailand, India, Malaysia, Singapore, Sri Lanka.

Illustrations: Iwatsuki et Mohamed 1987: 345. f. 2; Li 1985: 29. f. 12.

Fissidens intromarginatulus Bartr. was synonimized by Iwatsuki et Mohamed (1987) under *F. ceylonensis* Dozy et Molk. The positions of capsules as either terminal on stems or on upper short lateral branches have been reported. The authors examined the specimes of the species collected in Taiwan and found the positions of capsules be terminal or lateral even on a same individual.

11. ? **Fissidens mittenii** Par., Ind. Bryol.: 477. 1896; Noguchi, Journ. Hattori Bot. Lab. **5**: 41. *f. 3.* 1951. (PL XXIV, XXV)

This species was synonimized by Iwatsuki et Suzuki (1977) under *F. laxus* Sull.

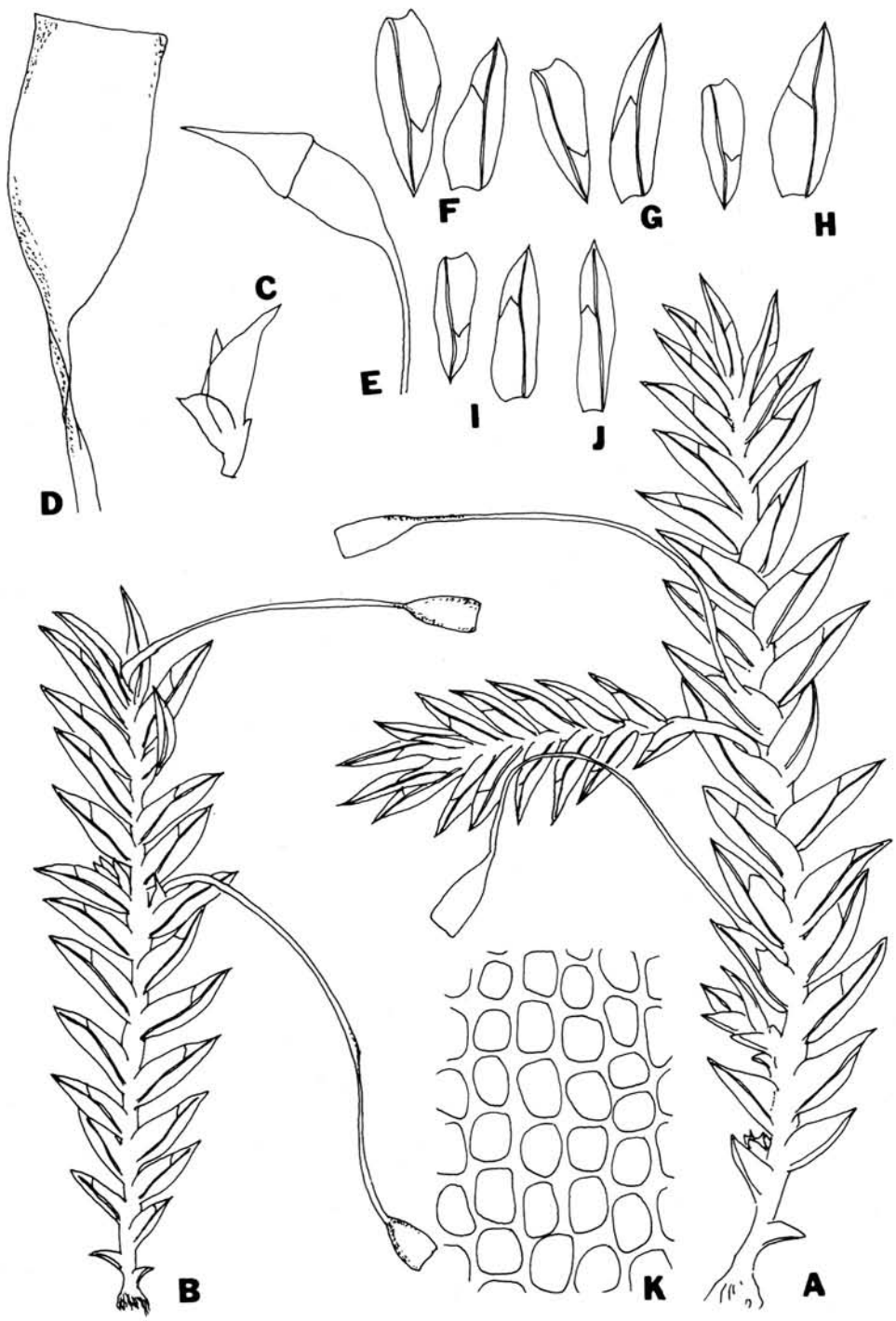

Plate XXIII. Fissidens ceylonensis Dozy & Molk. A-B, plants (×32). C, male inflorescence (×79). D, capsule (×167). E. capsule with operculum (×78). F-J, leaves (×32). K, exothecial cells (×315). (Drawn from *Chiang 10203*).

Table 1. Diagnostic characters of *F. mittenii* and *F. laxus*

	F. mittenii	*F. laxus*
Leaf-shape	Oblong	Lanceolate
Costa	Ceasing below apex	Pecurrent to excurrent
Nucleus-like spot	Obscure or abscent	Clear

et Lesq. The authors examined the specimens collected from many places in Taiwan and agreed that *F. mittenii* is closely related to *F. laxus*, but doubt whether the two species are really identical. Of course in failure of checking the type specimen, the authors can't confirm what the "F. mittenii" really is. In this report the differences between the two "types" of Taiwan are listed in Table 1.

Specim. exam.

F. mittenii: Nantou Hsien: Fonghuangshan, 1500 m alt., on rock, Aug. 25, 1986, *T. Y. Chiang 16550*; Chiayi Hsien: Alishan, Fushan, ca. 1500 m alt., in secondary broad-leaved forest, Oct. 24, 1986, *T. Y. Chiang 17153*; Nantou Hsien: Chitou, 2000 m alt., terrestrial, July 9, 1985, *T. Y. Chiang 10346*; Nantou Hsien: Tsaoling, 1500 m alt., on rock, Jan. 1986, *T. Y. Chiang 13388*; Nantou Hsien: Chitou to Chiti, 1200-1800 m alt., on cliff, May 15, 1968, *C. C. Chuang 400*. (PL. XXIV)

Distribution: Taiwan, Ceylon, Siam, Singapore, Sumatra, Java.

Illustration: Noguchi 1951: 41. f. 3.

F. laux: Pingtung Hsien: Nanjenshan, 400 m alt., in ravine, on rock, Oct. 16, 1985, *T. Y. Chiang 11875*; Wanlideshan, Nov. 13, 1985, *T. Y. Chiang 12280*; Laufoshan, 600 m alt., Nov. 12, 1985, *T. Y. Chiang 12278*; Maolin, terrestrial, July 13, 1986, *T. Y. Chiang 15445*. (PL. XXV)

Distribution: Taiwan, S. China (Guandong, Yunnen), Hongkong, Japan.

Illustrations: Iwatsuki et Suzuki 1982: 390. pl. XXV; Li 1985: 35. pl. 15. 1.-m.

From the specimens cited above, we could find *F. laxus* mainly distributed in low elevations of S. Taiwan whereas *F. mittenii* in middle elevations.

12. **Fissidens hyalinus** Hook. & Wils. in Hook., J. Bot. **3**: 89. *f. 2.* 1840; Iwatsuki et et Sharp, Journ. Hattori Bot. Lab. **33**: 162. 1970; Iwatsuki & Suzuki, Journ. Hattori Bot. Lab. **51**: 350. pl. I. II. 1982; Li, Acta Bot. Fennica **129**: 5. *f. 1.* 1985. (PL XXVI)

Specim. exam. Chiayi Hsien: Alishan, by the railway, at the edge of *Cryptomeria* forest, terrestrial, Dec. 23, 1985, *T. Y. Chiang 12390*; Alishan, Fushan, on the Alishan Highway, in a ravine, 1500 m alt., terrestrial, Oct. 24, 1986, *T. Y. Chiang 17049*.

Distribution: Taiwan, Japan, India, N. America.

Illustrations: Iwatsuki et Suzuki 1982: 350. pl. 1 & 2; Li 1985: 5. f. 1.

The species was previously reported by Iwatsuki et Sharp (1970) based on the specimen collected at Anmashan. Since then no other collections were recorded again. Two new additional localities in Taiwan are reported here. The ecoatate leaf is the remarkable character of this species.

13. **Fissidens esquirolii** Thér., Bull. Ac. Int. Géogr. Bot. **18**: 251. 1908; Li, Acta Bot. Fennica **129**: 20. *f. 9.* 1985. (PL XXVII)

Syn. *Fissidens bryoides* Hedw. var. *esquirolii* (Thér.) Iwatsuki & Suzuki, Journ.

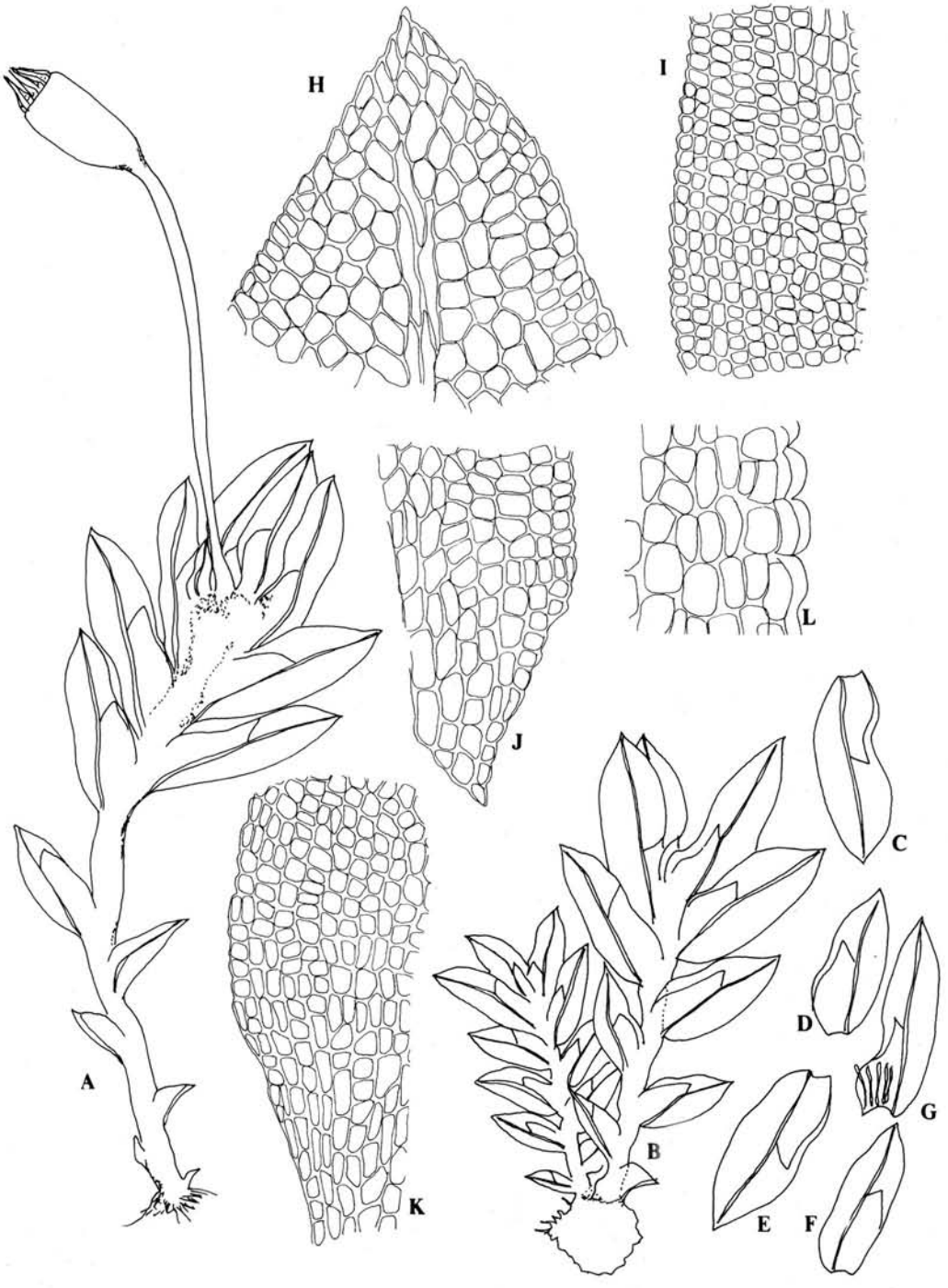

Plate XXIV. Fissidens mittenii Par. A-B, plants (×29). C-F, leaves (×29). G, perichaetial leaf with archegonia (×29). H, cells of leaf-apex (280). I, cells of dorsal lamina (×280). J, cells of base of dorsal lamina (×280). (Drown from *Chiang 16550*).

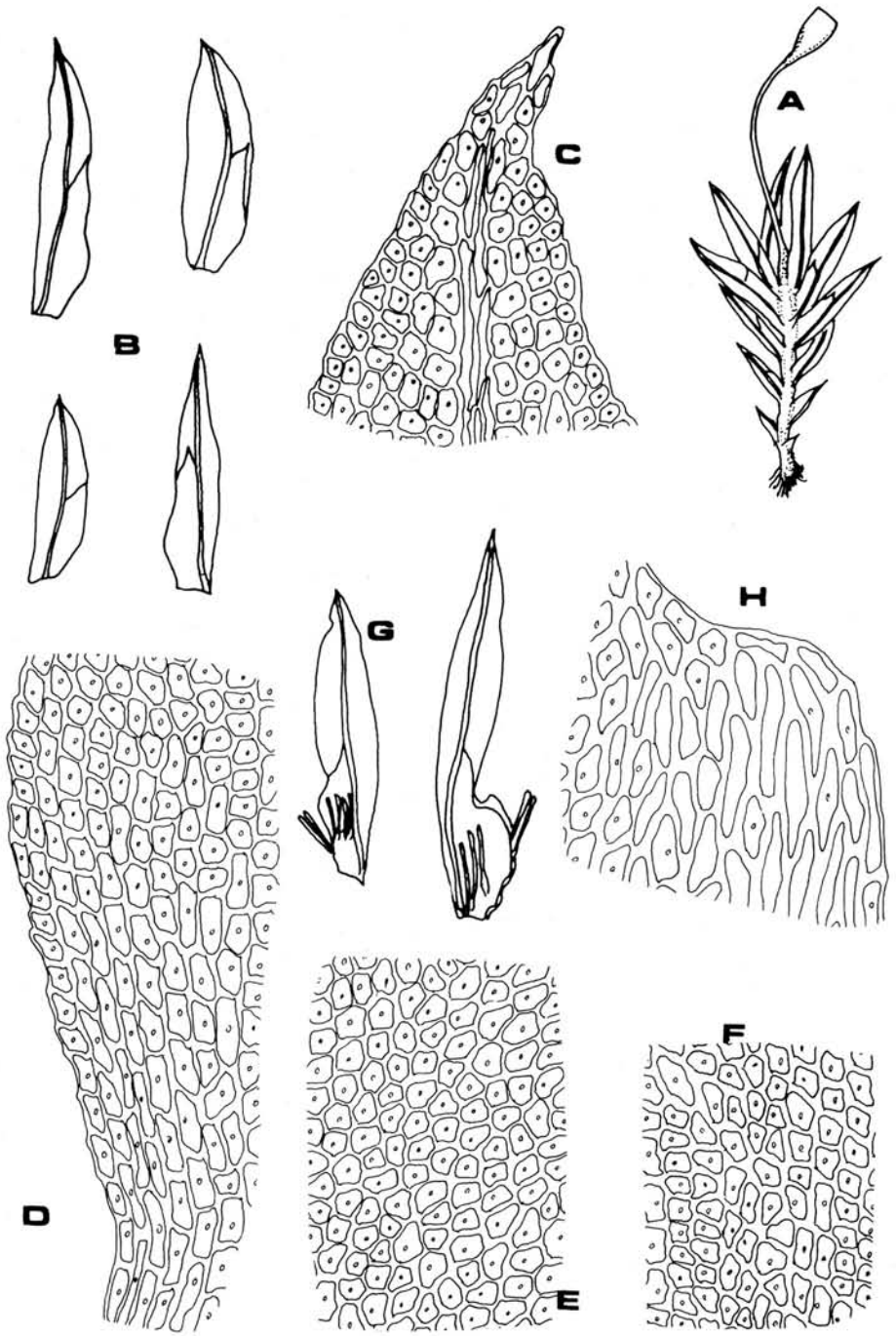

Plate XXV. **Fissidens laxus** Sull. & Lesq. A, plant (×34). B, leaves (×34). C, cells of leaf-apex (×334). D, cells of base of vaginant lamina (×334). E, cells of dorsal lamina (×334). F, cells of apical laminae (×334). G, perichaetial leaf (×34). H, apical part of vaginant lamina of perichaetial leaf (×334). (Drawn from *Chiang 11758*).

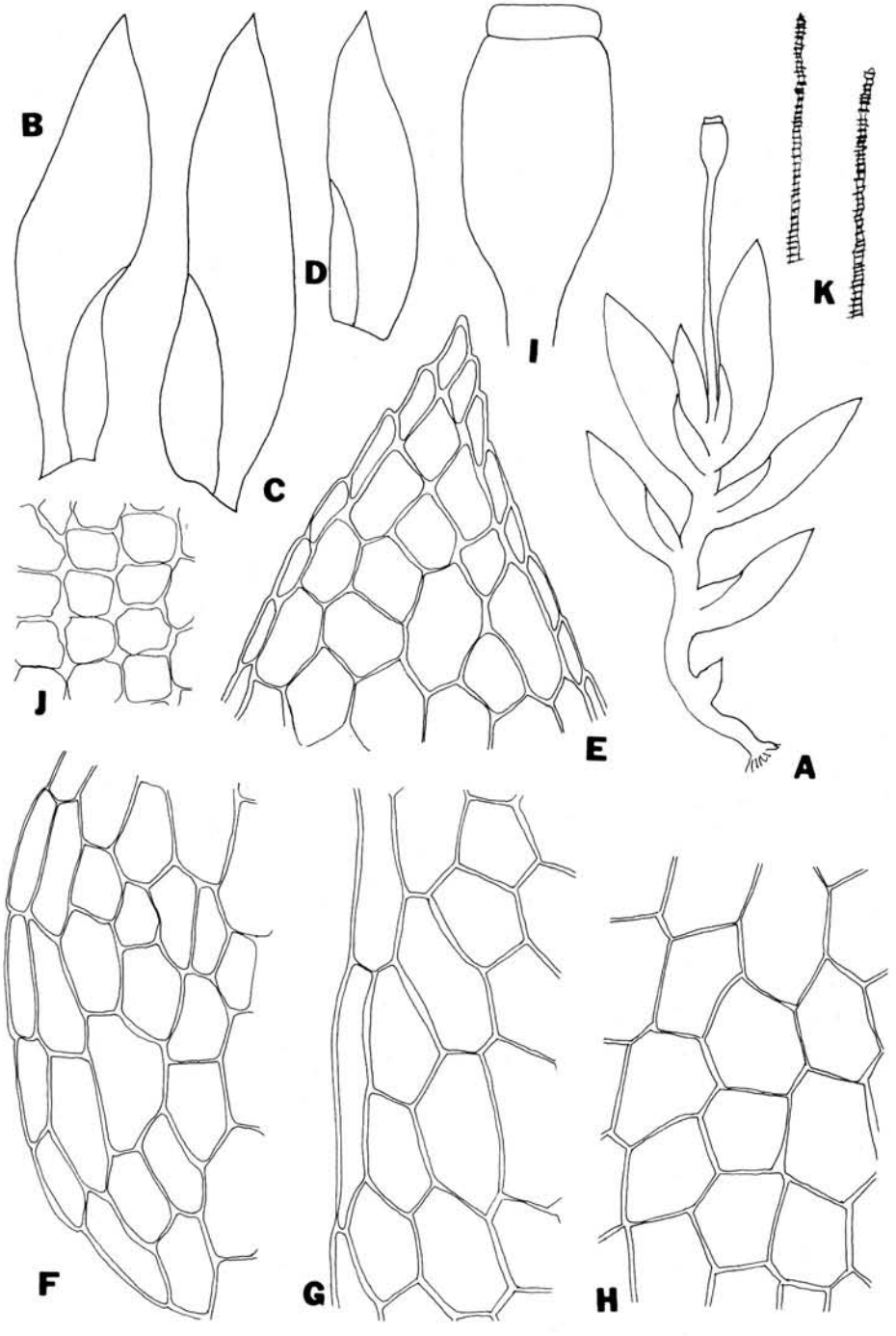

Plate XXVI. Fissidens hyalinus Hook. & Wils. A, plant (×31). B-D, leaves (×31). E, cells of leaf-apex (×303). F, cells of vaginant lamina (×303). G, cells of leaf-margin (×303). H, laminal cells (×303). I, capsule (×31). J, exothecial cells of capsule (×303), K, peristome teeth (×303). (Drawn from *Chiang 12390*).

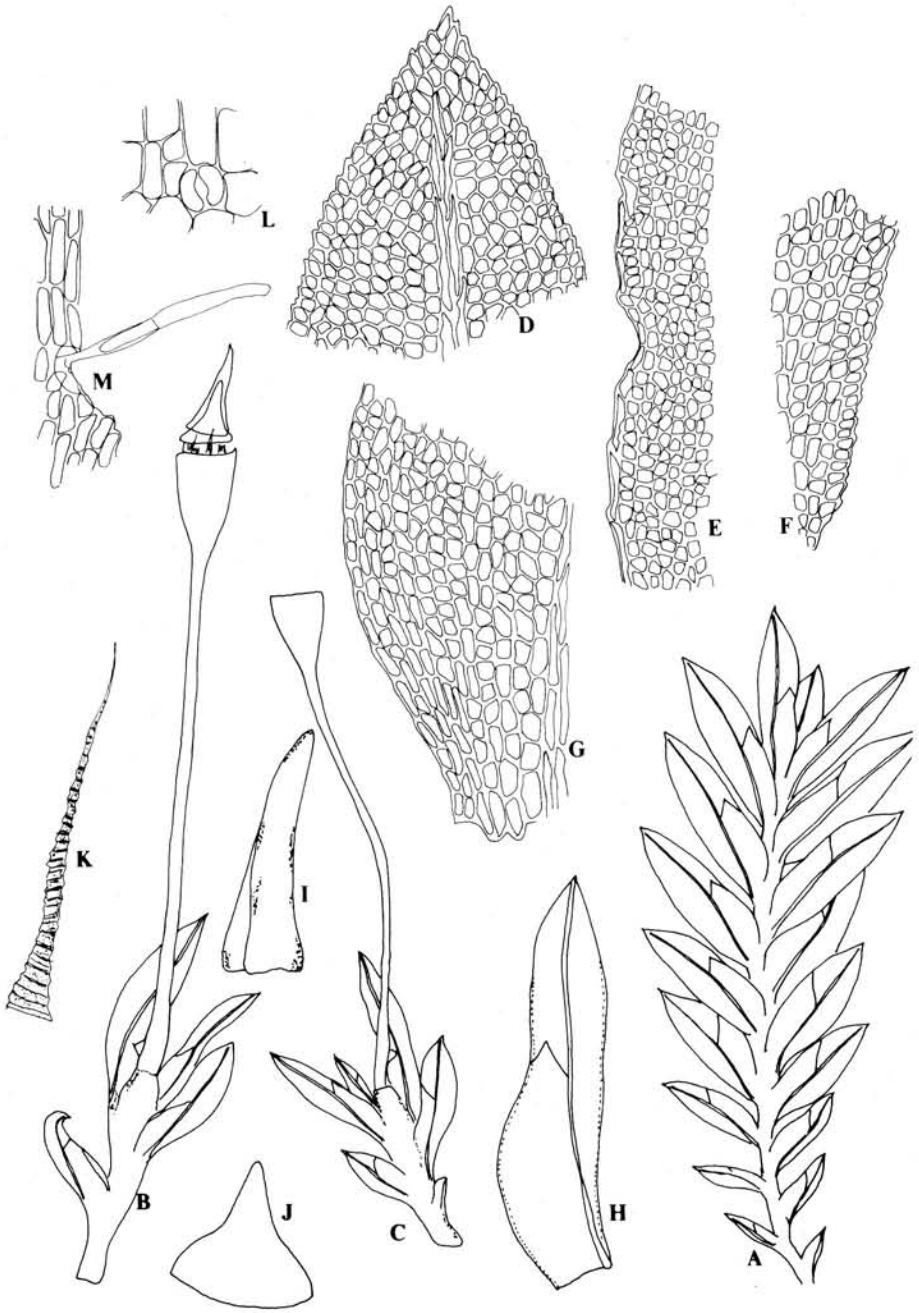

Plate XXVII. Fissidens esquirolii Thér. A-C, plants (×27). D, cells of leaf-apex (×265). E, cells of dorsal lamina of perichaetial leaf (×265). F, cells of base of dorsal lamina (×265). G, cells of vaginant lamina (×265). H, perichaetial leaf (×67). I, calyptra (×67). J, operculum (×67). K, peristome tooth (×265). L, stoma at base of capsule (×265). M, axillary hair of the stem (×265). (Drawn from *Chiang 18238*).

Hattori Bot. Lab. **51**: 361. 1982.

Fissidens yamamotoi Sak., Bot. Mag. Tokyo **56**: 218. 1942.

Specim. exam. Chiayi Hsien: Tzenwen Dam., Sept. 16, 1984, *T. Y. Chiang 6328*; Alishan, Fushan, on Alishan Highway, ca. 1000 m alt., on rock, Jan. 21, 1987, *T. Y. Chiang 18238*. Kaohsiung Hsien: Neiyingshan, July 1985, *T. Y. Chiang 10137*; Baiyuenshan, 600 m alt., at ravine, on rock, Jan. 17, 1987, *T. Y. Chiang 18126*. Pingtung Hsien: Lilungshan, 700 m alt., in ravine, on rock, Feb. 22, 1985. Nantou Hsien: Tsaoling, at ravine, on rock, Feb. 1986, *T. Y. Chiang 13403*.

Distribution: Taiwan, S. China, Japan.

Illustrations: Li 1985: 20. f. 9; Iwatsuki & Suzuki 1982: 361. pl. IX (as *F. bryoides* var. *esquirolii*)

The species was reported previously by Iwatsuki et Sharp (1970) as *F. yamamotoi* Sak. in Taiwan, which was combined to *F. bryoides* var. *esquirolii*.

Li (1985) revised the genus of China and he restored the specific status of *F. esquirolii* by the characters of limbidia on leaf, sexuality and perichaetial leaf. So far as the authors' examination of the specimens collected in Taiwan, they concur with Li's treatment.

The species is characterized by 1) the rhizoautoicous sexuality 2) the limbidia usually differentiated on vaginant laminae of perichaetial and perigonial leaves 3) the costa ceasing a few cells below the apex.

14. **Fissidens microcladus** Thwait. & Mitt. in Mitt., J. Linn. Soc. Bot. **13**: 324. 1873. (PL XXVIII)

Syn. *Fissidens garberi* Lesq. & James, Proc. Am. Ac. Arts Sci. **14**: 137. 1879.

Specim. exam. Chiayi Hsien: Tzen-wen Dam., at a valley, ca. 800 m alt., on a moist stone, Oct. 22, 1984, *T. Y. Chiang 6335*. Kaohsiung Hsien: Baiyuenshan, Dec. 16, 1984, *T. Y. Chiang 6523*; Paulai, Kaojon, in broad-leaved, secondary forest, on a stone (mixed with *Erpodium biseratum* (Aust.) Aust.), May 1985, *T. Y. Chiang 8021*; Neiyingshan, July 1985, *T. Y. Chiang 10146*.

Distribution: Taiwan, Japan, S. China, Philippines, Laos, Thailand, India, Nepal, Ceylon, Americas.

Illustration: Iwatsuki & Suzuki 1982: 377. pl. XIX.

This species was previously reported by Iwatsuki et Sharp (1970) as *F. garberi*, which was combined to *F. microcladus* by Iwatsuki et Suzuki (1982).

This species is characterized by the oblong-lanceolate leaves, the obtuse leaf-apex, the hyaline costa, the multi-papillose laminal cells and the localized differentiation of limbidia. This species can be easily distinguished from other species of the genus by these characters. But usually the authors found limibidia are lacking in vaginant laminae of sterile plants, which appear to be *F. brevinervis* Broth. The two affined species could be distinguished from each other by the differentiated cells of costa, which sharply differ from laminal cells.

The occurence of the species seems to be limited in the areas around the Tzen-wen Dam in W. Taiwan. No other collections were recorded out of the above area and Tailuko (Iwatsuki et Shap (1970)).

16. *Forrstroemia cryphacoides* Card. new to Taiwan

Forrstroemia cryphacoides Card., Bull. Soc. Bot. Geneve ser. 2, 1: 132. 1909; Stark, Journ. Hattori Bot. Lab. **63**: 149. *f. 8*. 1987. (PL XXIX, I.-T.)

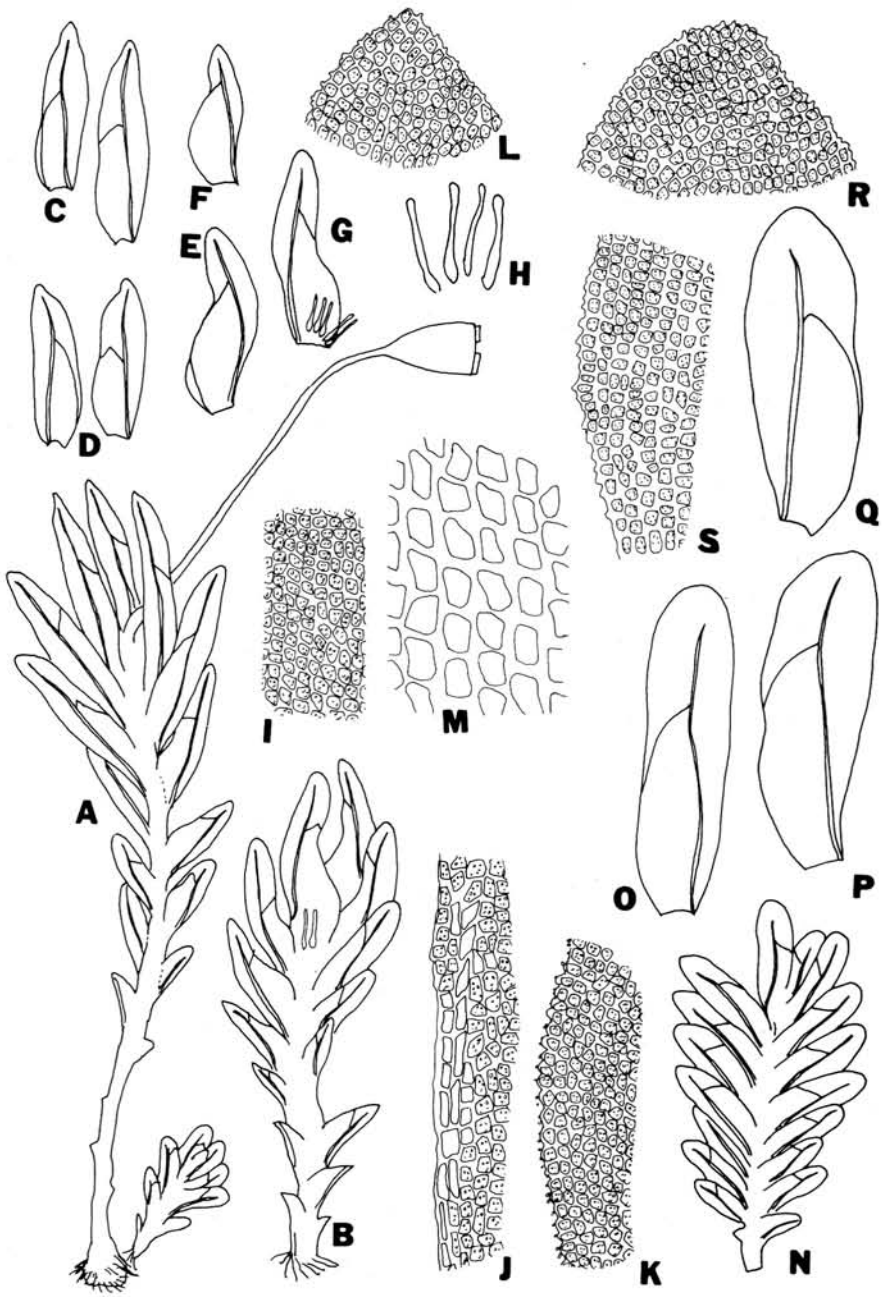

Plate XXVIII. Fissidens microcladus Thwait. & Mitt. A-B, fertile plants (×30). C-F, leaves (×30). G, perichaetial leaf (×30). H, archaegonia (×73). I, cells of apical lamina (×292). J, cells of vaginant lamina of fertile plant (×292). K, cells of dorsal lamina (×292). L, R, cells of leaf-apex (×292). M, exothecial cells (×292). N, sterile plant (×30). O-Q, leaves of sterile plant (×73). S, cells of vaginant lamina of sterile plant (×292). (Sterile plants drawn from *Chiang 8021*, fertile plants drawn from *Chiang 10146*).

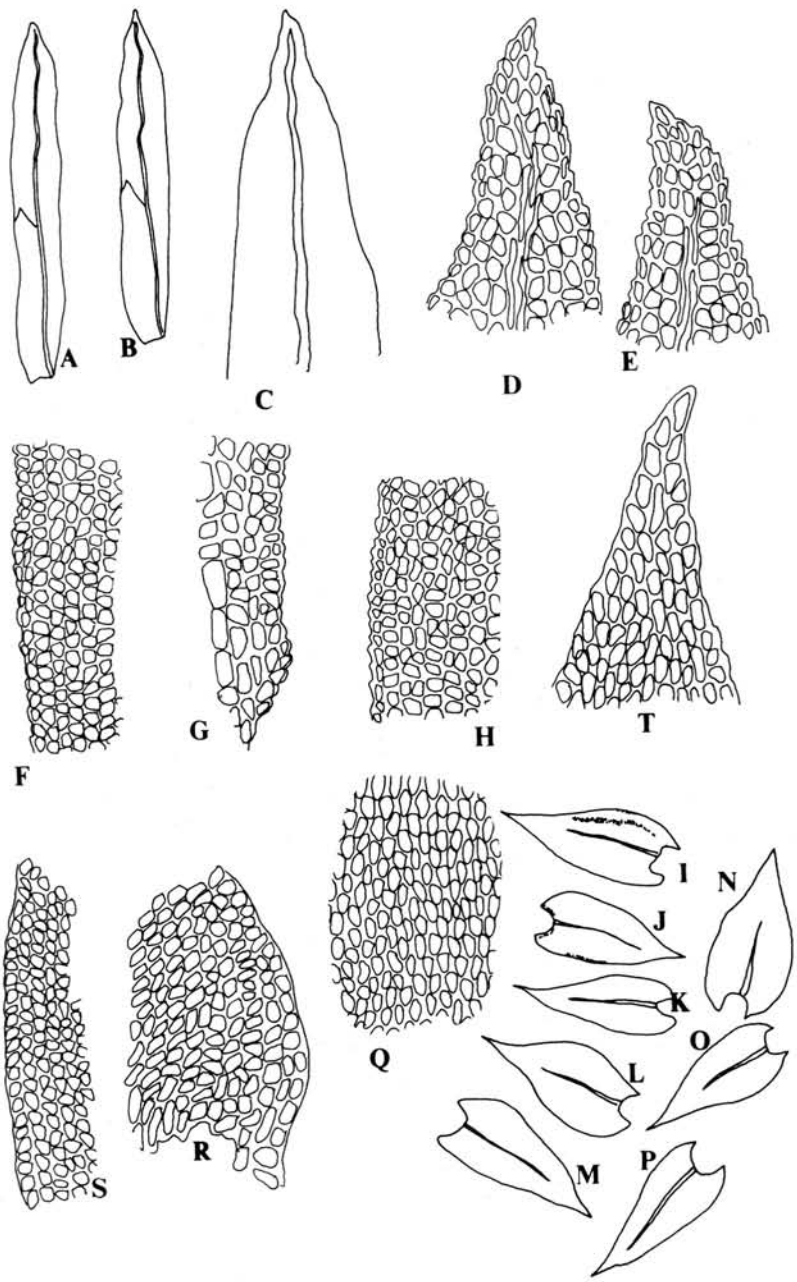

Plate XXIX. A-H, **Fissidens mangarevensis** Mont. I-T, **Forrstroemia cryphacoides** Card. A-B, leaves (×33). C, leaf apex (×80). D-E, cells of leaf-apex (×318). F, marginal cells of apical lamina (×318). G, cells of base of dorsal lamina (×318). H, median cells of dorsal lamina (×318). I-P, leaves (×33). Q. laminal cells (×318). R, basal cells (×318), S, maginal cells (×318). T. cells of leaf-apex (×318). (A-H drawn from *Chiang 22662*, I-T drawn from *Chiang 8925*).

Plants medium-sized, pinnately to regularly bipinnately branched, branches imbricately foliated. Leaves ovate-lanceolate, apex acute, costa single, 2/3 leaf-length, margins entire, Laminal cells isodiametric, 5.3–10.5 μm long.

Specim. exam. Kaohsiung Hsien: Likuan, 2000 m alt., on South-Cross-Island Highway, in original broad-leaved forest, on tree trunk, May 1985, *T. Y. Chiang 8925*.

Distribution: Taiwan, Japan, China, Korea.

Illustrations: Stark 1987: 151. f. 8.

This species resembles *F. indica* (Mont.) Par. in the leaf-shapes and the laminal cells, but the two species are separated from each other by the acute leaf-apex of the former and the filiform and twisted one of the latter.

17. Re-discovery of *Horikawaea nitida* Nog. in Taiwan

Horikawaea, a genus of the family Phyllogoniaceae, was established by Noguchi (1937). According to Lin (1983), the distributional range of the genus is restricted to Taiwan, Tibet and Vietnam. No other specimen of the type species *H. nitida* Nog. has been collected in Taiwan since the genus was established in 1937. According to Noguchi (1937), the type specimen was collected at "Sinten-Urai" in 1932, where the natural broad-leaved forests were developed. Most of the forests have been destroyed for the recent 50 years except fragmental forests developed on the cliffs and ridges of mountains in the areas. The authors had made searches for the species in the mentioned area for years and once thought the species might have been vanished. However, they are able to find the species at Sanhsia, on a shaded cliff at mountain ridge. The specimens were confirmed by the courtesy of Prof. Iwatsuki. This species is, however, hardly distinguished from *H. dubia* (Tix.) Lin by the flagelliform branches, the leaf-shapes, the laminal and alar cells. The two species seem to be conspecific, as Prof. Iwatsuki suggested (pers. comm.).

Horikawaea nitidia Nog., Journ. Sc. Hiroshima Univ. Ser. B, Div. 2, 3(4): 47. *f. 6.* 1937; Lin, Journ. Taiwan Museum 37(2): 23. *pl. 11.* 1983. (PL XXX)

Plants medium-sized, lustrous. Primary stems thread-like, with scale-like leaves; secondary stems erect, unbranched or branched sometimes, with flagella at apex, ca. 1 cm long, complanately foliated, more than 2 rows; pseudoparaphyllia filamentous, branched, smooth; propagula at the axil of leaves, spindle-shaped. Leaves of secoedary stem elliptic with acuminate and cucullate apex, concave, 2.0–2.9 mm long, 0.76–0.89 mm wide, costa single, 2/3–3/4 leaf-length, margins entire. Laminal cells vermiculate, 65.9–94.9 μm long, 1.58–3.95 μm wide; alar cells well differentiated, porous, coloured, inflated, rectangular.

Specim. exam. Taipei Hsien: Sanhsia, ca. 500 m alt., at mountain ridge, on cliff shaded by broad-leaved forest, Jan. 28, 1986, *T. Y. Chiang 23892*; Nov. 3, 1987, *T. Y. Chiang 23892.*

Distribution: Taiwan, China (Yunnan, Tibet).

Illustrations: Noguchi 1937: 47. f. 6.; Lin 1983: 23. pl. 11; Chen 1978: 86. f. 245.

According to the original description and illustration of Noguchi (1937), the plants may be flagelliform at ultimate portion of stolon, which were erroneously described by Lin (1984) as "never flagelliform". The authors checked the characters tabulated by Lin (1983) for comparing the two species and found that they seem to be obscure and indistinct.

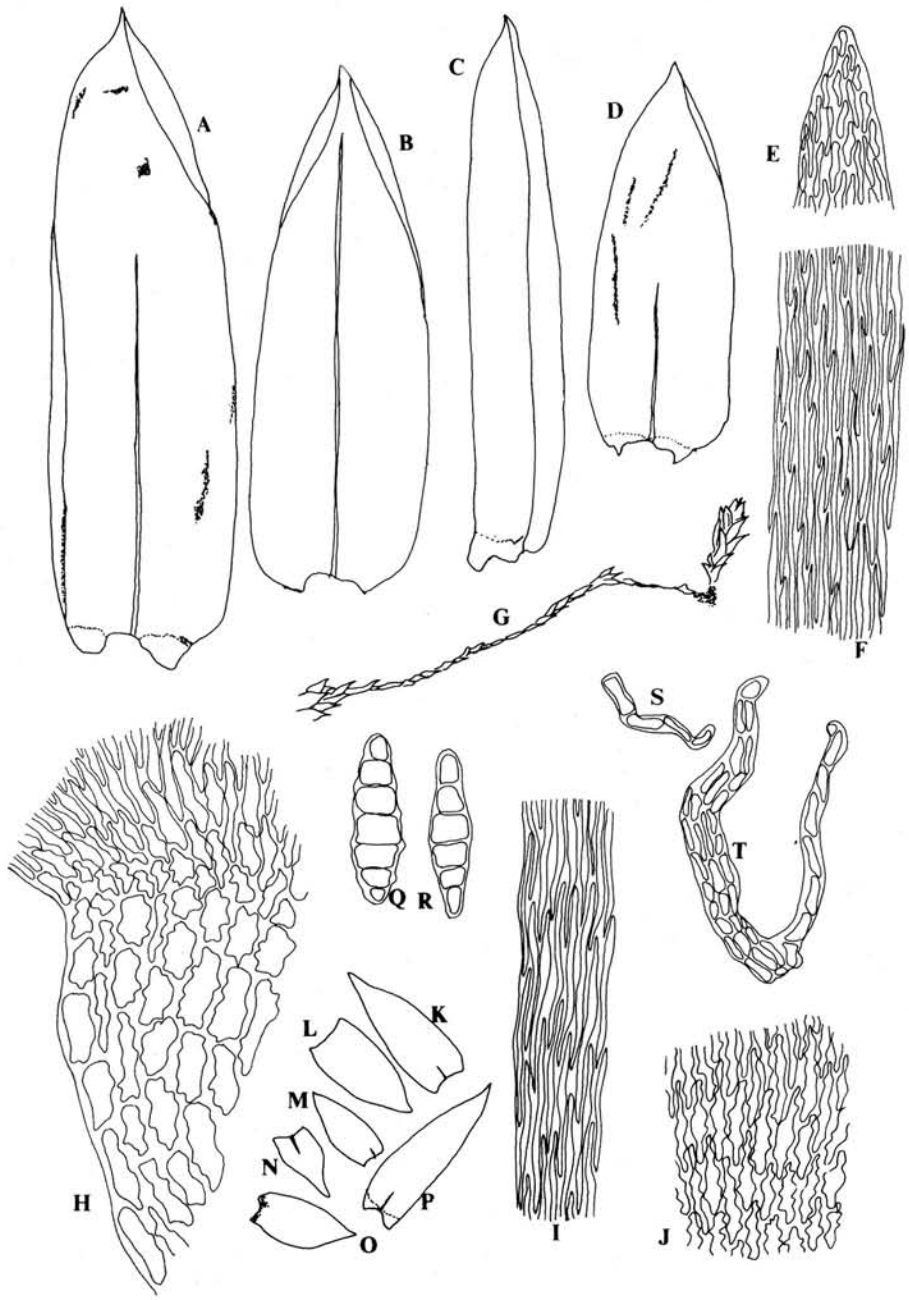

Plate XXX. **Horikawaea nitida** Nog. A-C, leaves (×35). D, leaf from the plant with filiform branch (×35). E, cells of leaf-apex (×265). F, laminal cells (×265). G, flagelliform branch with new bud (×1). H, alar cells (×265). I, marginal leaf cells (×265). J, basal cells (×265). K-P, leaves of flagelliform branch (×35). Q-R, propagula (×265). S-T, pseudoparaphyllia (×265). (Drawn from *Chiang 12940*).

18. *Hygrohypnum*, A genus new to Taiwan

Hygrohypnum, a genus of the family Amblystegiace, is mainly distributed in the temperate regions, with about 20 species in Asia. The study on the taxa of east Asia seems to be not sufficient, only Kanda (1976), Anonymous (1977) and Li *et al.* (1985) can be consulted. The genus is for the first time reported in Taiwan.

Hygrohypnum Lindb., Act. Soc. Sci. Fenn. **10**: 277. 1872.

Plants medium-sized; stem creeping, irregularly branched; branches erect to ascending; leaves ovate-oblong, obtuse or short apiculate at apex, costa single or forked; laminal cells linear-rhomboid; alar cells well differentiated, inflated, quadrate.

According to Kanda (1976), the genus is the most confusing one in the family Amblystegiaceae. In that report he divided the genus into 2 genera, *Hygrohypnum* and *Pseudohygrohypnum*, by habit of plants and character of costa, which seems to be variable even in the same individual. Further study on the taxonomic positions of the two genera must be made.

Hygrohypnum smithii (Sw.) Broth., Nat. Pfl. ed. 1, **III**: 1939. 1908; Anonymous, Fl. Musc. Chinae Bor.-Orient. 293. *f. 202.* 1977; Li *et al.*, Bryoflora of Xizang 355. pl. 152: 1-6. 1985. (PL XXXI, A.-H.)

Plants medium-sized; stems creeping, irregularly branched, fimbriately foliated. Leaves triangular-ovate, shortly cuspidate at apex, 0.9-1.4 mm long, 0.7-0.9 mm wide, margins crenulate above, costa single or forking, ca. 2/3 leaf-length; laminal cells linear, 42.2-65.9 μm long, 2.6-10.5 μm wide, smooth; alar cells well differentiated.

Specim. exam. Chiayi Hsien: Alishan, Tsushan, 2500 m alt., on moist rock, Apr. 24, 1983, *T. Y Chiang 3721.*

Distribution: Taiwan, China (Tibet, Heilungchiang, Chilin, Shanchi), USSR, Europe, N. America.

Illustrations: Li *et al.* 1985: 354. pl. 152; Anonymous 1977: 292. *f. 202.*

19. Notes on genus *Leucodon* of Taiwan

Leucodon, a genus of the family Leucodontaceae, was established by Schwager. (1816), with about 22 species distributed in southeast Asia.

The genus was ever divided into *Leucodon*, *Leucodontella* and *Macrosporiella* 3 genera by Noguchi (1947) in considering the ontogeny of the peristomes and the structure of spores. However Noguchi (1968) placed the latter genera as two subgenera of the genus *Leucodon*.

Three species were ever reported in Taiwan by Noguchi (1936, 1947). Akiyama (1987) revised the taxa of *Leucodon* from Taiwan and reported 3 new species, one new addition and excluded *L. secundus* (Harv.) Mitt. and *L. luteus* Besch. from the mossflora of Taiwan. Besides he separated *L. morrisonensis* from *L. subulatus* as two distinctly different species, which were ever considered to be identical by Noguchi (1968).

The authors consider *Leucodon formosanus* Akiyama may be conspecific with *L. exaltatus* C. Muell. *L. sinensis* Thér. is a new addition to the mossflora of Taiwan.

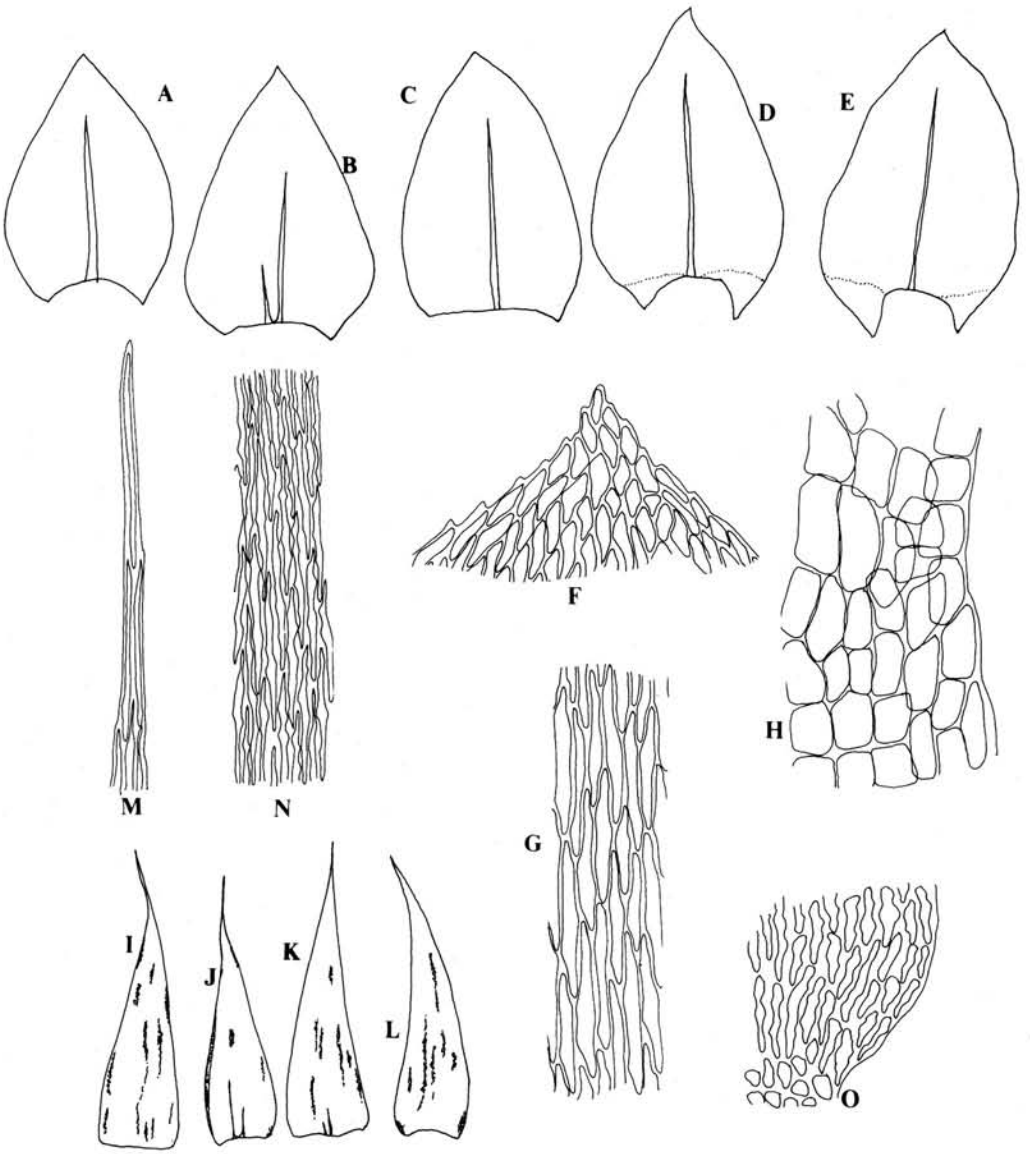

Plate XXXI. A-H, **Hygrohypnum smithii** (Sw.) Broth. I-O, **Orthothecium rufescens** (Brid.) B. S. G. A-C, branch-leaves (×33). D-E, stem-leaves (×33). F, cells of leaf-apex (×330). G, laminal cells (×330). H, alar cells (×330). I-L, leaves (×33). M, cells of leaf-apex (×330). N, laminal cells (×330). O, alar cells (×330). (A-H drawn from *Chiang 3721*, I-O drawn from *Chiang 4908*.

Leucodon Schwaegr., Spec. Musc. Suppl. 1(2): 1. 1816, *p.p.* Broth. in Engler-Prantl., Nat. Pflanz.-fam. p. 748. 1905.

Syn. *Macrosporiella* Dix. & Thér., Journ. Bot. **74**: 3. pl. 610. f. 2. 1936, emend. Noguchi, Journ. Hattori Bot. Lab. **2**: 39. 1947.
Leucodontella Nog., Journ. Hattori Bot. Lab. **2**: 39. 1947.

Plants large to medium-sized, yellowish-green to brownish-green, epiphytic or pendent. Primary stems creeping, secondary stems or branches ascending or erect, paraphyllia abscent. Leaves ovate-lanceolate to subulate, with longitudinal pleat, apex acute, leaf-margins entire to denticulate, costa abscent; laminal cells rhomboidal to linear, smooth to sinuous; basal cells porous, brownish; alar cells well differentiated.

Capsules ovate to globular, immersed or exserted.

Distribution: From 1500 to 3500 m alt., in forest or deforested places of this island.

Distinct characteristics: Leaves ecostate, longitudinally plicate, alar cells well differentiated, paraphyllia abscent.

1. **Leucodon exaltatus** C. Muell., Nuov. Giorn. Bot. Ital. n. ser. **3**: 112. 1896. (PL XXXII)

Leucodon giraldii C. Muell., l. c. 112. 1896.
Leucodon denticulatus Broth. in C. Muell., l. c. 113. 1896.

Plants brownish-green, stems creeping, branches ascending. Leaves lanceolate, 3.3-3.8 mm long, 0.7-0.8 mm wide, leaf-margins crenulate obviously at apex; cells rhomboidal at apex, medium and basal cells linear, 39-65 μm long, 2.1-5.2 μm wide, porous clearly, alar cells irregularly hexagonal, thick-walled.

Capsules cylidrical-globular, seta 0.9-1.3 cm long, urn ca. 1.5 mm long, brown.

Specim. exam. Kaohsiung Hsien: Kuhanoshinshan to Kuanshan, 3200 m alt., in *Tsuga* forest, Aug. 18, 1986, *T. Y. Chiang 16321*; Hsinchu Hsien: Tapachienshan, 3500 m alt., in *Abies* forest, May 23, 1983, *T. Y. Chiang 4834*; Ilan Hsien: Nanhutashan, 3500 m alt., July 1981, *T. Y. Chiang 12703*; Taitung Hsien: Chitoushan, 3000 m alt., in *Abies* forest, May 8, 1983, *T. Y. Chiang 4123*.

Distribution: Taiwan, S. China (Tibet, Kueichow).

Illustrations: Noguchi 1968: 458. f. 6; Li *et al.* 1985: 246. f. 107.

This species is characterized by lanecolate leaves, crenulate leaf-margins and porous laminal cells, which are shared by *L. formosanus*. It is difficult to distinguish between the two species.

2. **Leucodon sinensis** Thér., Bull. Ac. Int. Géogr. Bot. **17**: 252. 1908; Li *et al.*, Bryoflora of Xizang 246. pl. 107. 1985. (PL XXXIII)

Leucodon denticulatus Broth. in Hand.-Mazz., Symb. Sin. **4**: 74. 1929.
Leucodon subulatulus Broth. l. c. 75. 1929.

Plants yellowish, stem creeping, branches erect; leaves ovate-lanceolate, 2.1-2.4 mm long, 0.7-0.8 mm wide, apex attenuate, leaf-margins more or less crenulate at apex; cells linear at apex, thick-walled, medium cells linear, 42-65 μm long, 2.6-5.2 μm wide, basal cells porous, alar cells rectangular.

Capsules immersed.

Specim. exam. Taichung Hsien: Tayueling, 2500 m alt., in *Pinus* forest, on tree

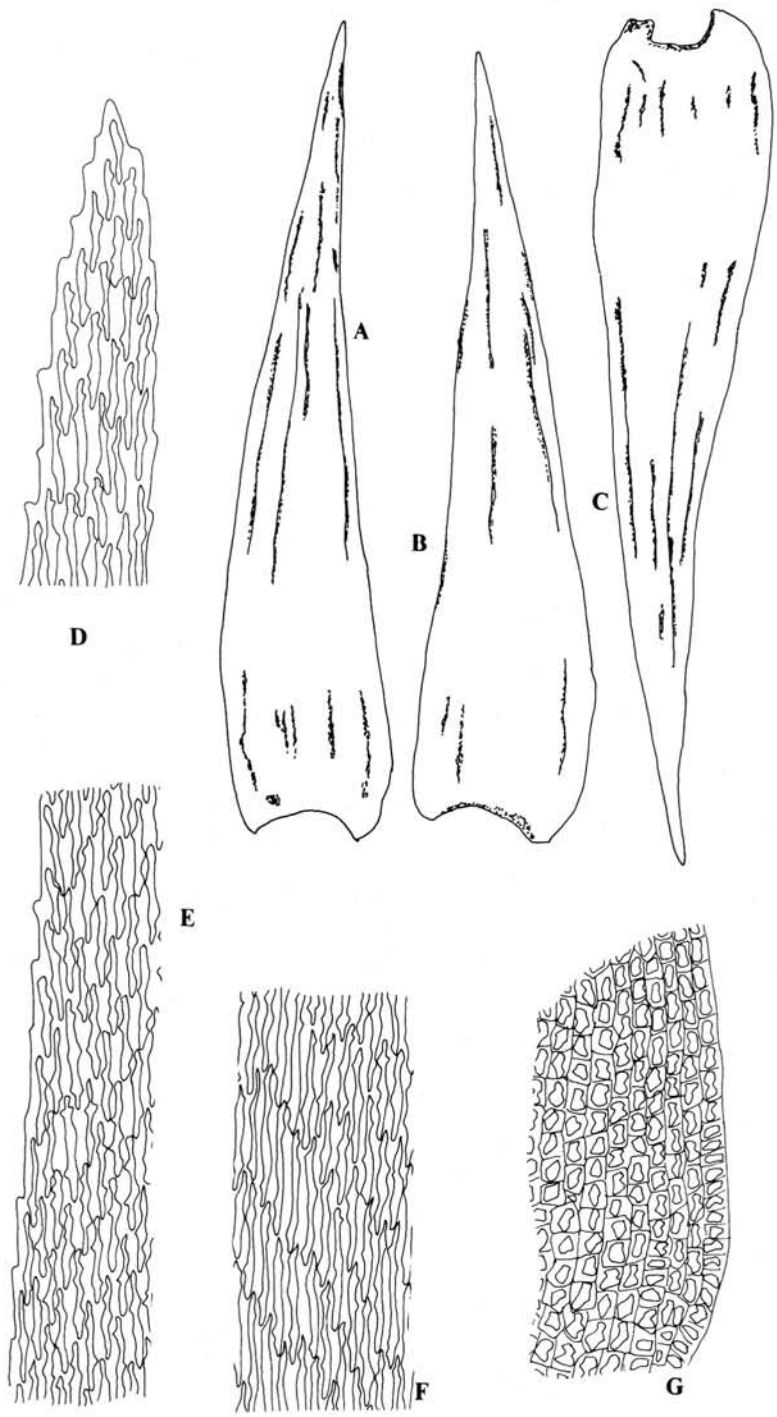

Plate XXXII. Leucodon exaltatus C. Muell. A-C, leaves (×29). D, cells of leaf-apex (×280). E, marginal cells (×280). F, laminal cells (×280). G, alar cells (×280). (Drawn from *Chiang 16321*).

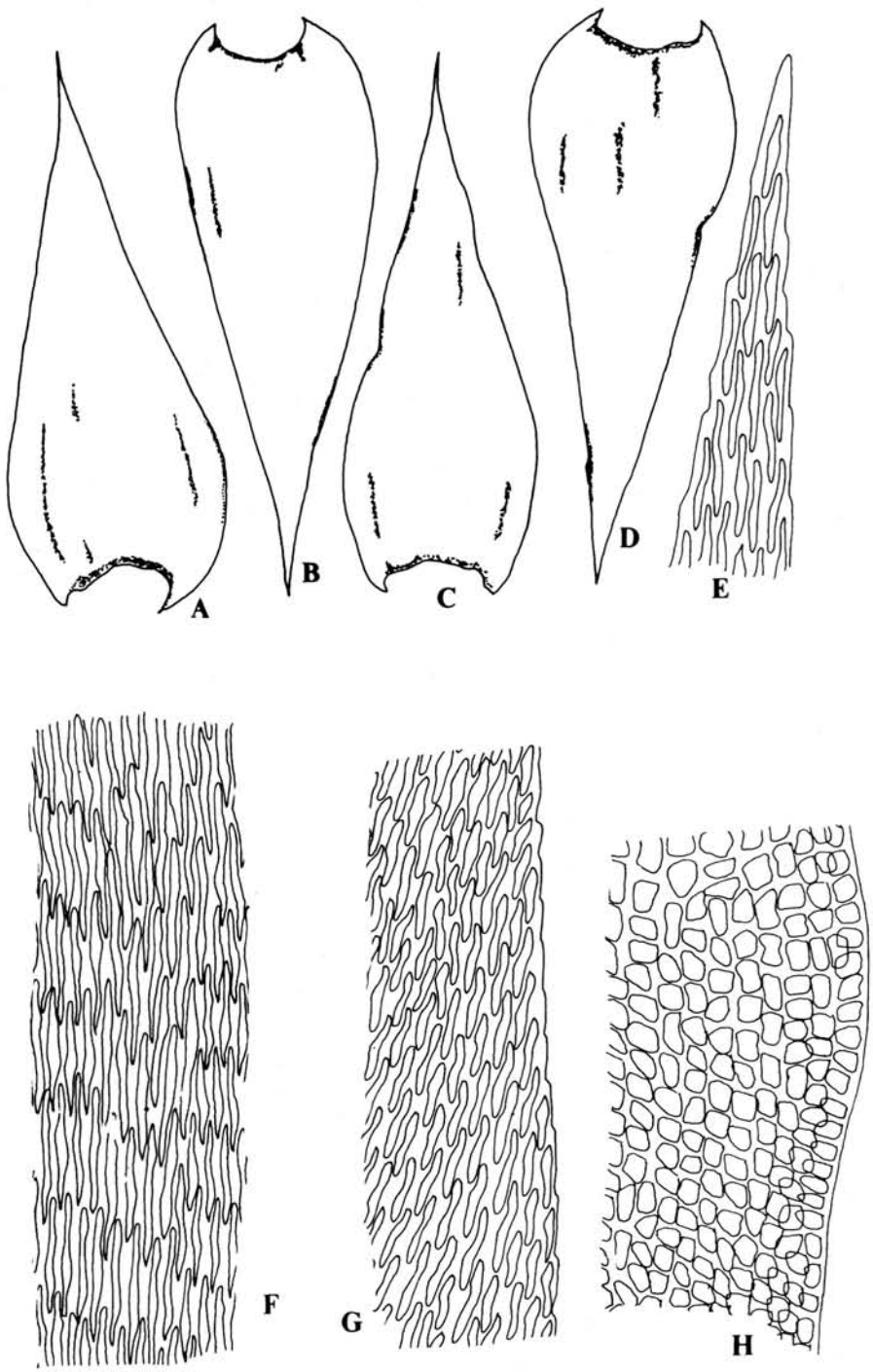

Plate XXXIII. Leucodon sinensis Thér. A-D, leaves (×34). E, cells of leaf-apex (×334). F, laminal cells (×334). G, marginal cells (×334). H, alar cells (×334). (Drawn from *Chiang 3188A*).

trunk, Apr. 1, 1983, *T. Y. Chiang 3118A* (mixed with *Macrocoma tenue* subsp. *sullivantii*); Apr. 2, 1983, *T. Y. Chiang 3375*.

Distribution: Taiwn, S. China.

Illustration: Li *et al.* 1985: 246. pl. 107.

The distinct characters of the species are the immersed capsules and alar regions occupying ca. 1/3 leaf-length.

20. Re-discovery of *Macromitrium uraiense* Nog. in Taiwan

Macromitrium, a genus of the family Orthotrichaceae, is mainly distributed in the tropical or subtropical regions, with about 400 species in the world. The study on the Asiatic taxa of the genus seems to be insufficient, and only Noguchi (1967) can be consulted. 14 species of the genus have been reported in Taiwan. *Macromitrium uraiense* Nog. was recently rediscovered since the original description in 1933.

Macromitrium uraiense Nog., Journ. Sci., Hiroshima Univ. Ser. B, Div. 2, **3**(9): 140. *Text.-fig. 3.* 1938. (PL XXXVII, L.-P.)

Plants yellowish-brown; stems creeping, branches ascending; leaves crisped when dry and more or less falcate when moist, lanceolate, fragile, 2.8–3,3 mm long, 0.3–0.4 mm wide at base, with acute apex, margins nearly entire. Laminal cells quadrate, with oval lumens, 7.9–10.5 μm long, mamillose; basal cells linear, with distinct uni-papillae; basal marginal cells linear to rectangular, smooth.

Capsules cylindric-globular, ribbed, 1.5–1.8 mm long, seta 6–9 mm long.

Specim. exam. Nantou Hsien: Chitou, 1800 m alt., on tree trunk, Apr. 24, 1983; *T. Y. Chiang 3870*; Taitung Hsien: Baiyuenshan, 2000 m alt., on tree trunk, Dec. 11, 1984, *T. Y. Chiang 6393*.

Distribution: Endemic to Taiwan.

Illustration: Noguchi 1938: 140. Text.-flg. 3.

This species is characterized by the mamillose but not papillose median laminal cells.

21. *Orthothecium*, a genus new to Taiwan

Orthothecium, a genus of the family Entodontaceae, is mainly distributed in the temperate regions, with 4 species in eastern Asia. The genus is for the first time reported in Taiwan. The plants of the genus grow on eroded and windy cliffs of high elevations.

Orthothecium rufescens (Brid.) B. S. G., Bryol. Eur. **5**: 108. *f. 457*. 1851; Iwatsuki in Iwatsuki & Mizutani, Col. Ill. Bryophytes Japan 224. *f. 461*. 1972. (PL XXXI, I.-O.)

Plants medium-sized, yellowish-brown; stems creeping, 4–6 cm long, irregularly branched. Leaves lanceolate, attenuate at apex, pleated, 1.1–1.7 mm long, 0.15–0.26 mm wide, costa double, obscure, leaf-margins entire; laminal cells linear, porous, 50–70 μm long, 2–4 μm wide; alar cells weakly differentiated, rectangular.

Specim. exam. Hsinchu Hsien: Tapachienshan, 3500 m alt., at ridge, on eroded rock, May 24, 1983, *T. Y. Chiang 4908*; Nantou Hsien: Patungkuan, 2800 m alt., on windy cliff, Nov. 30, 1987, *T. Y. Chiang 24152*.

Distribution: Taiwan, Japan, S. China (Tibet), N. America, Europe.

Illustration: Iwatsuki et Mizutani 1972: 224. f. 461.

The species is charactered by yellowish-brown plants, pleated leaves, porous laminal cell-walls.

22. *Plagiomnium confertidens* (Lindb. et Arn.) Kop. new to Taiwan

Plagiomnium, a genus of family Minaceae, was established by T. Koponen (1968), with about 17 species distributed in southeast Asia (Koponen 1981). The genus is characterized by plagiotropic shoots, Koponen (1968) divided the genus into 5 sections by leaf-shapes, operculum and other characters. 9 species, which belong separately to Sect. *Plagiomnium*, Sect. *Rosulata* and Sect. *Rostrata*, were ever reported in Taiwan. Sect. *Undulata* is reported as an new addition to the mossflora of Taiwan, with *Plagiomnium confertidens*.

Plagiomnium confertidens (Lindb. & Arn.) Koponen, Ann. Bot. Fenn. **5**: 146. 1968; Iwatsuki in Iwatsuki & Mizutani, Col. Ill. of Bryophytes Japan 122. *f. 234.* 1972; Koponen, Hikobia **7**(1-2): 7. *f. 46-54.* 1974. (PL XXXV, A.-G.)

Plagiotropic shoots absent; stems erect, unbranched. Leaves strongly crisped when dry, lingulate, 1.0-1.5 mm long, 0.2-0.3 mm wide, with acute apex, margins serrate above, decurrent at base, costa single, percurrent. Margins differentiated of 2-3 rows of elongate linear cells; laminal cells oblong, 10.5-15.8 μm long, 5.2-10.5 μm wide, smooth, collenchymous. Archegonium 0.4-0.5 mm long, paraphyses 0.38-0.46 mm long.

Specim. exam. Nantou Hsien: Lulinshan, 2600 m alt., in a ravine, on moist stone, June 27, 1988, *T. Y. Chiang 27415.*

Distribution: Taiwan, Japan, Korea, USSR, Mongolia.

Illustrations: Koponen 1974: 7. f. 46-54; Iwatsuki 1972: 122. f. 234.

The species is affined to *P. arbuscula* (C. Muell.) T. Kop., which is mainly distributed in South Asia. Noguchi (1966) synonimized *P. arbuscula* under *P. confertidens* when he treated the family Mniaceae of Eastern Himalayas. Koponen (1981) cited that it is difficult to distinguish between the both species but accepted them as seperate species temporarily. Further study with sufficient material is needed.

23. *Plagiothecium curvifolium* Schlieph. new to Taiwan

Plagiothecium B. S. G., a genus of the family Plagiotheciaceae, is characterized by glossy plants, complanately foliated and sometimes transversely undulate leaves with double costa and decurrent alar regions. The taxa of east Asia were ever revised by Iwatsuki (1970). Eight taxa of the genus were recorded in Taiwan. *Plagiothecium curvifolium* is a new addition to the mossflora of Taiwan.

Plagiothecium curvifolium Schlieph. & Limpr., Laubm. Deutschl. **3**: 269. 1897; Iwatsuki, Journ. Hattori Bot. Lab. **33**: 358. *f. 12.* 1970. (PL XXXIV)

Plants yellowish-green, small, glossy; stems creeping, irregularly branched, complanately foliated. Leaves ovate, strongly asymmetric, 1.28-1.54 mm long, 0.46-0.56 mm wide, with acute apex, margins plane or narrowly recurved, serrulate above, decurrent at base, costae double. Laminal cells linear, 92.3-137.2 μm long, 3.9-7.9 μm wide, smooth; alar cells rectangular.

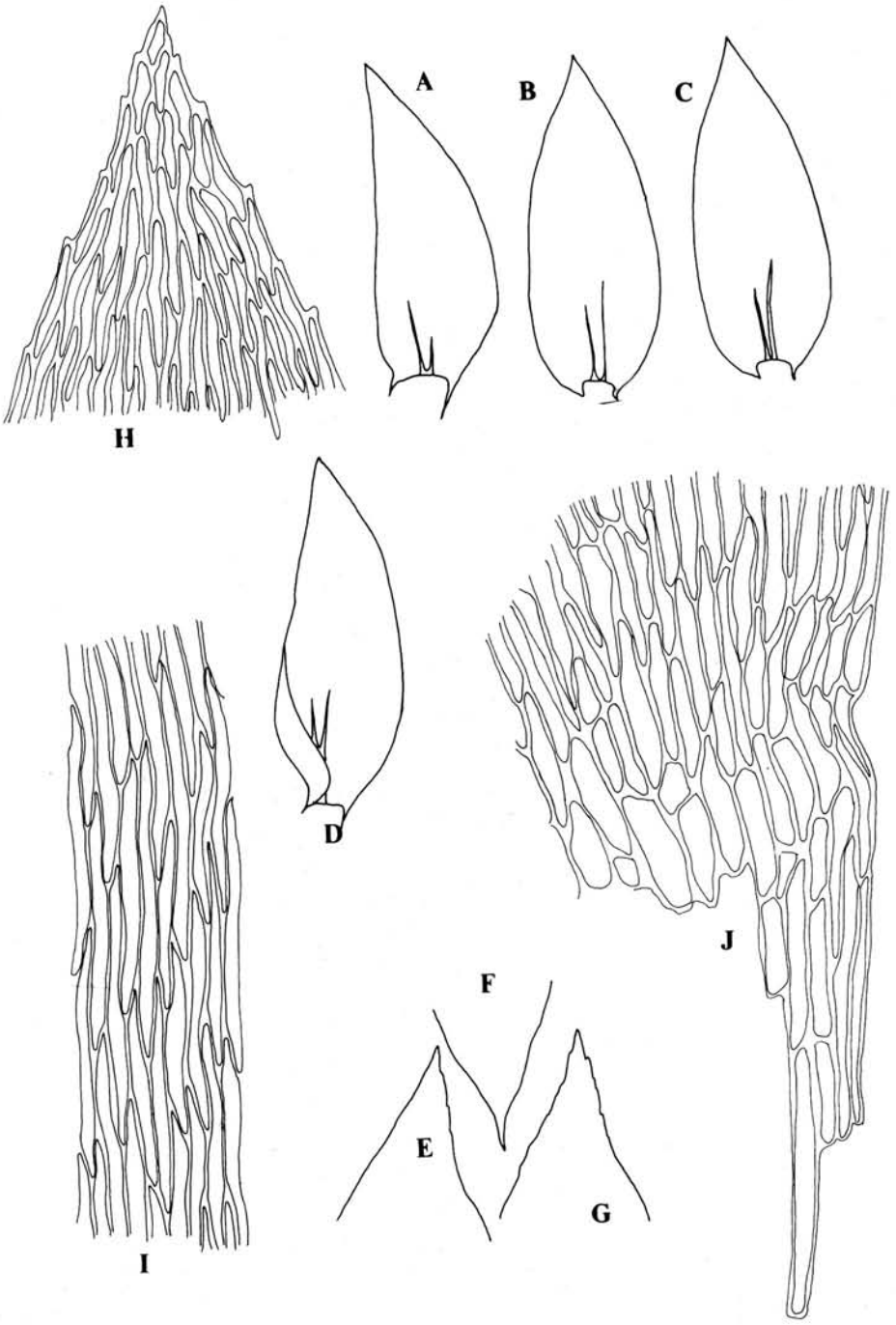

Plate XXXIV. Plagiothecium curvifolium Schlieph. ex Limpr. A-D, leaves (×33). E-G, leaf apex (×82). H, cells of leaf apex (×326). I, laminal cells (×326). J, alar cells (×326). (Drawn from *Chiang 14080*).

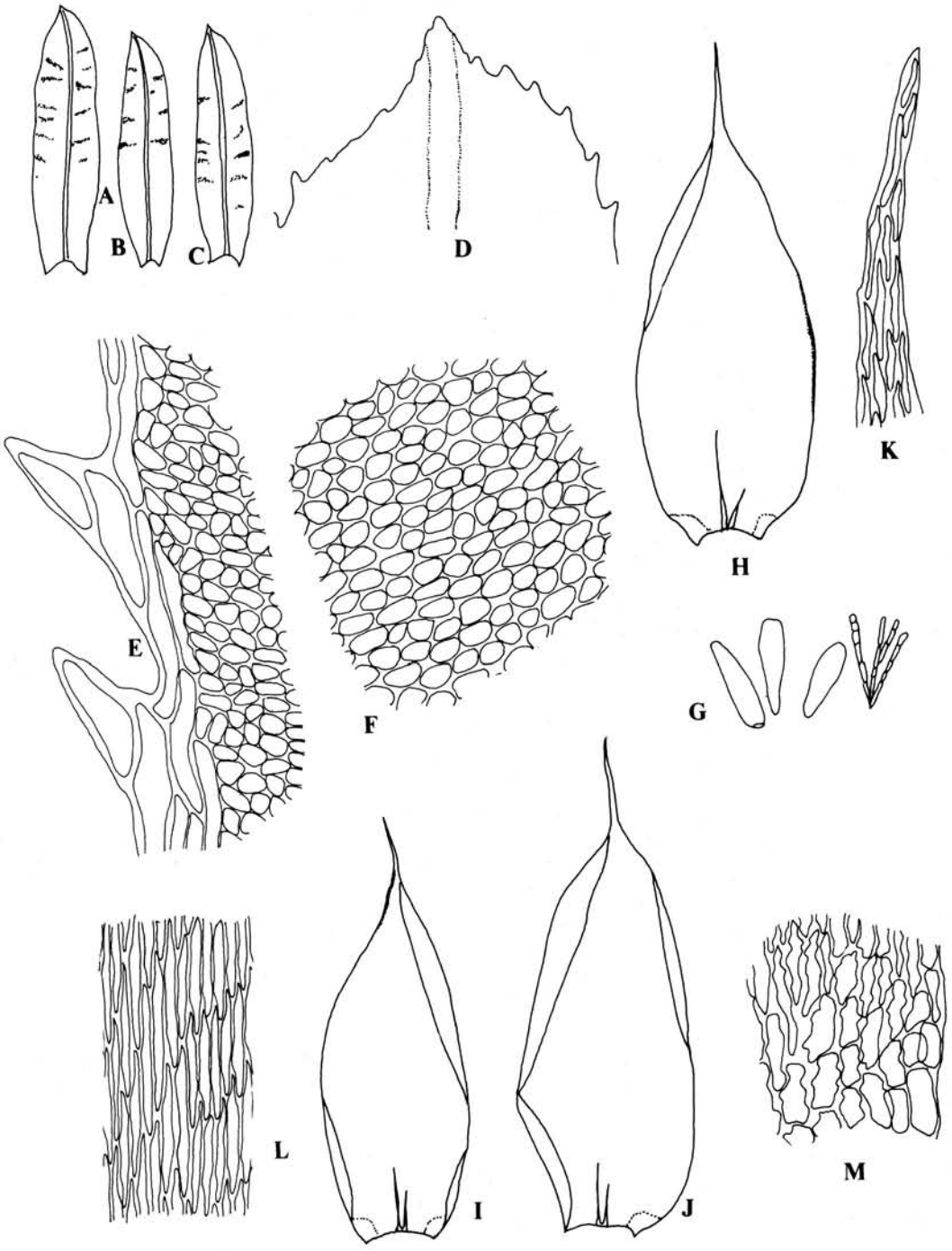

Plate XXXV. A-G, **Plagiomnium confertidens** (Lindb. & Arn.) Kop. H-M, **Pterobryopsis gedehensis** Fl. A-C, leaves (×32). D, leaf apex (×80). E, marginal cells (×311). F, laminal cells (×311). G, antheridia and paraphyses (×80). H-J, leaves (×32). K, cells (×311). M, alar cells (×311). (A-G drawn from *Chiang 27415*, H-M drawn from *Chiang 3185*).

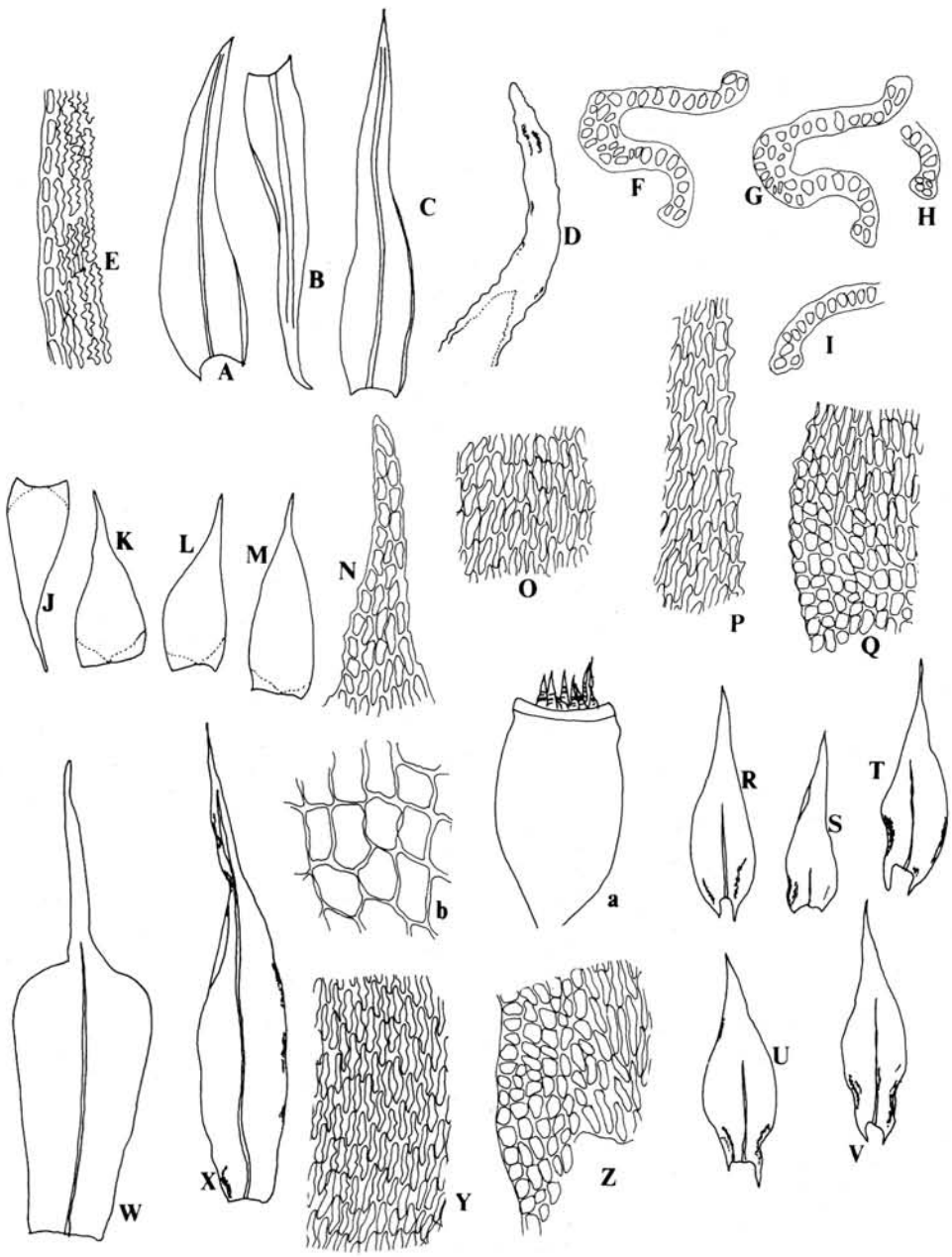

Plate XXXVI. A-I, **Racomitrium heterostichum** (Hedw.) Brid. var. **sudeticum** (Funck) Bauer J-Q, **Schwetschkeopsis fabronia** (Schwaegr.) Broth. R-Z & a-b, **Sphaerotheciella sphaerocarpa** (Hook.) Fleisch. A-C, leaves (×30). D, leaf apex (×73). E, alar cells (×292). F-I, cross-sections of leaves (×292). J-M, leaves (×30). N, cells of leaf-apex (×292). O, laminal cells (×292). P, marginal cells (×292). Q, alar cells (×292). R-V, leaves (×30). W-X, perichaetial leaves (×30). Y, laminal cells (×292). Z, alar cells (×292). a. capsule (×30). b. exothecial cells (×292). (A-I drawn from *Chiang 6056*, J-Q drawn from *Chuang 1088*, R-Z & a-b drawn from *Kuo et Chiang 12631*).

Specim. exam. Kaohsiung Hsien: Takuanshan, 2800 m alt., in broad-leaved forest, terrestrial, July 27, 1986, *T. Y. Chiang 14080*.

Distribution: Taiwan, Japan, Kurile Island, Europe, Africa.

Illustrations: Iwatsuki 1970: 358. *f. 12*; Iwatsuki et Mizutani 1972: 233. *f. 121*.

24. *Pterobryopsis gedehensis* Fl. new to mossflora of Taiwan

Pterobryopsis, a genus of the family Pterobryaceae, was established by Fleischer (1905) and it is mainly distributed in the tropical and subtropical regions of the world. The study of the genus of Asia seems to be remain insufficient. The fragmental works have been made by Noguchi (1935, 1936, 1947, 1972, 1986). The knowledge of the Taiwanese taxa is still limited, although seven species have been reported in this area. The plants of the genus are mainly epiphytic on tree trunks in broad-leaved forest of middle elevations. *Pterobryopsis gedehensis* Fl. is a new addition to the mossflora of Taiwan.

Pterobryopsis gedehensis Fleisch., Hedwigia **45**: 57. *f. 1*. 1905; Noguchi, Journ. Hattori Bot. Lab. **62**: 186. *f. 2*. 1987. (PL XXXV, H.-M.)

Syn. *Pterobryopsis clemensiae* Broth., Philip. Journ. Sc. **5**: 152. 1910.

Plants medium-sized, yellowish-green; stems creeping, irregularly branched; branches ascending, densely foliated. Leaves oblong, with abruptly narrowed elongate acumen, 1.9-2.3 mm long, 0.6-0.8 mm wide, cucullate at apex, margins nearly entire, costa double and short, not reaching 1/4 leaf-length; laminal cells linear, acute at both ends, smooth, thin-walled, 44.8-79.1 μm long, 2.6-5.3 μm wide; alar cells well differentiated, rectangular, porous.

Specim. exam. Hualien Hsien: Tayueling, 2500 m alt., in *Pinus* forest, on tree trunk, Apr. 1, 1983, *T. Y. Chiang 3185*.

Distribution: Taiwan, Philippines, Java, India.

Illustration: Noguchi 1987: 186. *f. 2*.

This species is clearly distinguished from other species of the genus of Taiwan by the double, short costae.

25. *Racomitrium heterostichum* (Hedw.) Brid. var. *sudeticum* (Funck) Bauer new to Taiwan

Racomitrium Brid., a genus of the family Grimmiaceae, is mainly distributed in frigid and temperate areas. The plants commonly grow on extremely dry and windy habitats of high elevations in Taiwan, with hyaline point at leaf-apex for the absorption of moisture in atmosphere (Noguchi 1974). Detailed studies on Japanese and Chinese taxa of the genus, Noguchi (1974), Anonymous (1977) and Li *et al.* (1985) can be consulted. 10 species were ever reported in Taiwan. *Recomitrium heterostichum* var. *sudeticum* is a variety new to the mossflora of Taiwan.

Racomitrium heterostichum (Hedw.) Brid. var. **sudeticum** (Funck) Bauer, Musc. Eur. Am. Exs. **43**: n. 2019. 1913; Noguchi, Journ. Hattori Bot. Lab. **38**: 363. *f. 13*. 1974. (PL XXXVI, A.-I.)

Plants medium-sized, black; stems ascending, regularly pinnately branched; leaves ovate-lanceolate. 1.4-1.6 mm long, 0.25-0.38 mm wide, with hair-point at apex,

margins recurved, entire, 2-stratose above, costa single, stout, percurrent, homogeneous in the cells of cross-section; laminal cells rectangular, sinuose.

Specim. exam. Taichung Hsien: Hsueishan, 3800 m alt., on windy rock, June 28, 1983, *T. Y. Chiang 6056*.

Distribution: Taiwan, S. China (Tibet), Japan, Europe, N. America.

Illustrations: Noguchi 1974: 363. *f. 13*; Iwatsuki & Mizutani 1972: 92. *f. 48*: 52.

The variety could be distinguished from *R. heterostichum* var. *heterostichum* by bistratose on upper margins.

26. *Rhaphidostichum stissophyllum* comb. nov., a new addition to the mossflora of Taiwan

Rhaphidostichum Fl. emend. Seki, a genus of the family Sematophyllaceae, is characterized by the uni-papillose leaf-cells. Three taxa were previously reported in Taiwan, whereas *R. piliferum* (Broth.) Broth., which was reported by Herzog et Noguchi (1955), must be excluded from the genus based on Seki's definition. The smooth porous leaf-cells reveal *R. piliferum* to be a member of the genus *Acroporium*. *Trichosteleum stissophyllum* (Hampe) Jaeg. was previously reported by Fleischer (1915-22) in Java. In the report the authors combined this species under genus *Rhaphidostichum* by the unipapillose leaf cells. Furthermore, the authors consider *R. macrostictum* (Broth. et Par.) Broth. may be conspecific with *R. stissophyllum*.

Rhaphidostichum stissophyllum (Hampe) T. Y. Chiang & C. M. Kuo, comb. nov. (PL XXXVII, A.-K.)

Basionym: *Hypnum stissophyllum* Hampe in C. Muell. Syn. II, p. 273. 1851; Bryol. Jav. II, p. 176. 1867.

Synonym *Trichosteleum stissophyllum* (Hampe) Jaeg., Adbr. II, p. 483. 1871-75; Fleisher, Musci Fl. Buitenzorg **4**: 1315. *f. 212*. 1915-22.

? *Rhaphidostichum macrostictum* (Broth. et Par.) Broth. in Engler & Prantl, Nat. Planzenfam. Univ. ed. 2, 11: 435. 1925; Seki, Journ. Hiroshima Sci., Ser. B, Div. 2, 12: 63. 1968.

? *Trichosteleum macrostictum* Broth. & Par., Bull. Herb. Boiss. ser. 2, 2: 933. 1902.

Plants green; stems creeping, irregularly to regularly branched; branches ascending, densely foliated. Leaves concave, oblong, cuspidate at apex, 1.6-2.1 mm long, 0.45-0.80 mm wide, costa none, margins crenulate above. Laminal cells narrow rhomboidal, 25-35 μm long, 3.5-10.2 μm wide, uni-papillose; alar cells well differentiated, one-row, coloured, inflated.

Capsules inclined, apophysis distinct, seta 5-6 mm long, papillose above.

Specim. exam. Taipei Hsien: Tataushan, Wulai, 500 m alt., in a ravine, on branches, Nov. 11, 1987, *T. Y. Chiang 23864, S. J. Moore 3701*.

Distribution: Taiwan, Java, Japan (?), Hongkong (?).

Illustration: Fleischer (1915-22) 4: 1315. *f. 212*.

As Seki (1968) mentioned *R. macrostictum* growing mainly in foggy mountains in Japan, the plants of the species are often epiphytic on twigs in ravines of low elevations in Taiwan.

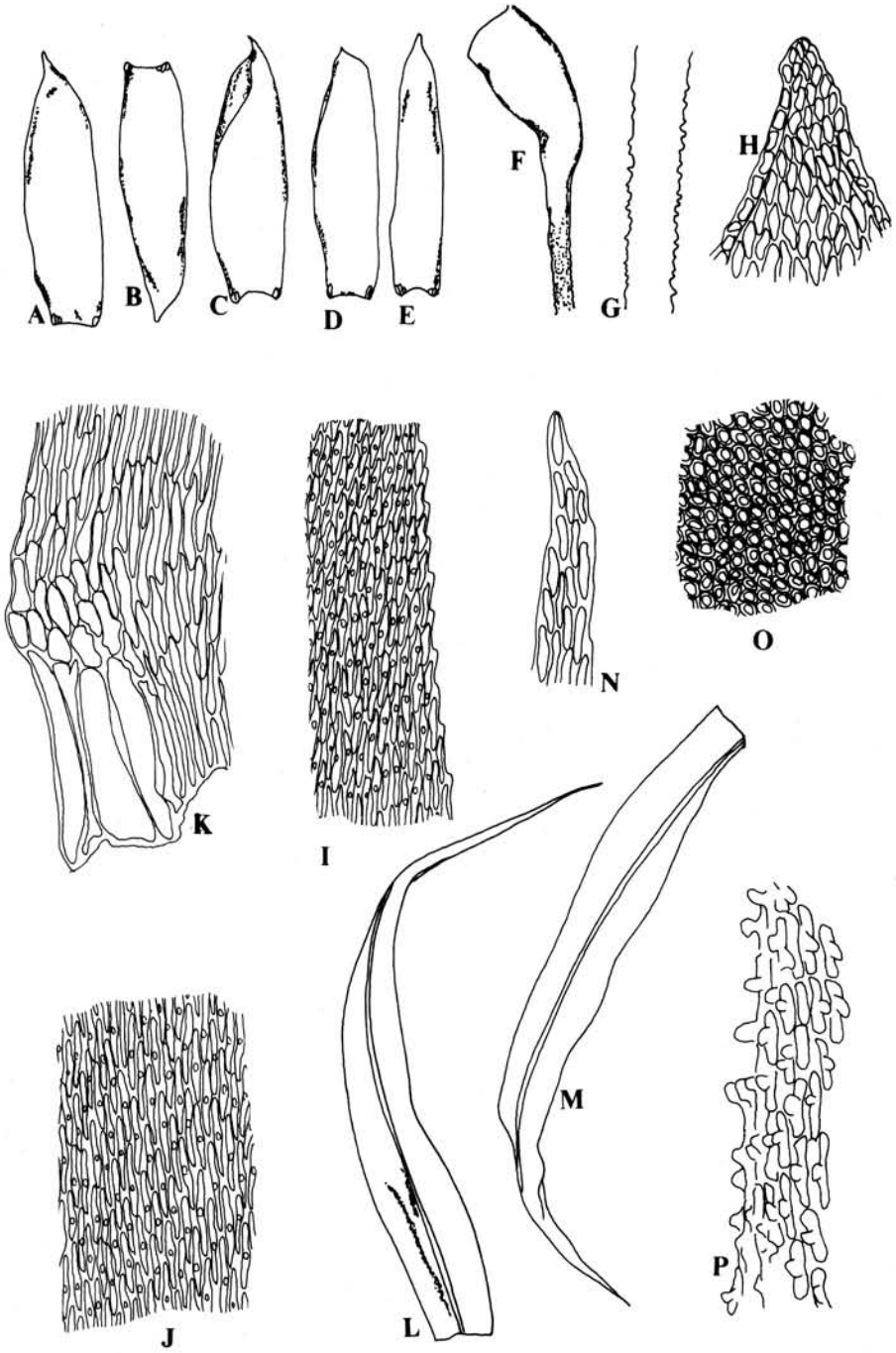

Plate XXXVII. A-K, **Rhaphidostichum stissophyllum** (Hpe.) Chiang & Kou L-P, **Macromitrium uraiense** Nog. A-E, leaves (×32). F, capsule (×32). G, a part of seta (×80). H, cells of leaf-apex (×311). I, marginal cells (×311). J, laminal cells (×311). K, alar cells (×311). L-M, laminal cells (×311). N, cells of leaf-apex (×311). O, laminal cells (×311). P, basal cells (×311). (A-K drawn from *Moore 3701*, L-P drawn from *Chiang 3870*).

27. *Schwetschkeopsis fabronia* (Schwaegr.) Broth. new to Taiwan

Schwetschkeopsis Broth. is a genus of the family Fabroniaceae, with about 3 species distributed in the temperate regions of Asia and N. America. Only *S. formosana* Nog. was ever reported in Taiwan based on the type specimen collected at Mt. Niitaka (ca. 3500 m alt.). *S. fabronia* (Schwaegr.) Broth. is a new record to the mossflora of Taiwan.

Schwetschkeopsis fabronia (Schwaegr.) Broth., Nat. Pfl.-fam. 1: 878. 1907; Iwatsuki & Sharp, Journ. Hattori Bot. Lab. **30**: 158. *f. 5. 6.* 1967; Noguchi, Misc. Bryol. Lichen. **5**: 45. *f. 152.* 1969; Iwatsuki in Iwatsuki et Mizutani, Coll. Illustr. Jap. Bryophytes 185. *f. 93.* 1972; Noguchi, Handbook of Japanese Mosses 191. *f. 55.* 1976; Taoda, Hikobia **8**: 312. *f. 11.* 1980. (PL XXXVI, J.-Q.)

Plants delicate; stems prostrate, irregularly pinnately branched; branches densely foliated. Leaves ovate-lanceolate, acuminate at apex, 0.7–0.9 mm long, 0.28–0.30 mm wide, serrulate at margins; costa double, faint or none. Laminal cells oblong-linear, obtuse at both end, 11.8–23.7 μm long, 2.6–5.3 μm wide; alar cells well-differentiated, rectangular.

Specim. exam. Kaohsiung Hsien: Shanping to Nanfengshan, 1200–1400 m alt., July 6, 1968, *C. C. Chuang 1088.*

Distribution: Taiwan, Japan, China (Manchuria), Nepal, N. America.

Illustrations: Iwatsuki 1972: 185. f. 93; Noguchi 1976: 191. f. 55; Taoda 1980: 312. f. 11.

The species is allied to *S. formosana* Nog. (cf. Noguchi 1951). The authors consider the two species may be identical, by the leaf-shapes, laminal cells and alar cells. Only by the distributions the two species could be separated. The type specimens must be examined and further study must be made if much material is available.

28. *Sphaerotheciella* Fl., a genus new to Taiwan

Sphaerotheciella Fl., a genus of the family Cryphaeaceae, is mainly distributed in Central America and Himalaya. The genus is first reported in Taiwan.

Sphaerotheciella sphaerocarpa (Hook.) Fl., Hedwigia **55**: 282. 1914; Chen, Genera Muscorum Sinicorum **II**: 29. *f. 209.* 1978; Li *et al.*, Bryoflora of Xizang 243. f. 106. 1985. (PL XXXVI, R.-Z. & a. b.)

Plants medium-sized; stems creeping, regularly pinnately branched, branches densely foliated. Leaves ovate-lanceolate, acute at apex, wrinkled at alar regions, base decurrent, 0.76–1.02 mm long, 0.23–0.33 mm wide, costa single, ca. 1/2 leaf-length, margins serrulate above; laminal cells linear, obtuse at both end, 13.1–23.7 μm long, 1.8–3.4 μm wide, smooth, thick-walled; alar cells subrectangular.

Capsules immersed, globular, ca. 1.0 mm long, exothecial cells rectangular, collenchymous; inner perichaetial leaves differentiated, ca. 2.0 mm long, 0.56 mm wide, costa up to upper portion of lamina.

Specim. exam. Ilan Hsien: Nahutashan, 3000 m alt., July 1981, *C. M. Kuo & T. Y. Chiang 12631.*

Distribution: Taiwan, S. China (Setzwan, Yunnan, Tibet), Nepal. Sikiim, Buhtan.

Illustrations: Chen *et al.* 1978: 29. f. 209; Li *et al.* 1985: 243. f. 106.

This species is similar to *Pilotrichopsis dentata* (Mitt.) Besch. in the leaf-shape and thick-walled leaf-cells, but distinguished from the latter by the shorter costa. In addition the species is allied to the genus *Forrstroemia* in sharing the similar sporophytic characters and habits of plants. Further study in the relationship between the genera must be necessary.

29. *Splachnobryum*, a genus new to Taiwan

The genus *Splachnobryum* was established by C. Mueller (1869), with about 11 species distributed mainly in tropical and subtropical Asia. The genus was ever placed in the family Pottiaceae by Robinson (1971) and Crum & Anderson (1981) or placed in a new family Splachnobryaceae, which was separated from family Splachnaceae by A. Koponen (1981). In this report the genus is for the first time discussed in Taiwan, with 2 species found recently.

Splachnobryum luzonense Broth., Philip. Journ. Sci., C, 8: 70. 1913; Bartram Philip. Journ. Sci. 68: 127. pl. 10. 1939; Miller *et al.*, Beih. Nov. Hedwigia 11: 29. *pl. 10.* 1963. (PL XXXVIII, I.-N.)

Plants small, stems 4-6 mm long, unbranched; leaves lingulate to spathulate, obtuse at apex, 0.89-1.41 mm long, 0.25-0.30 mm wide, margins crenate above by the projection of each marginal cells, costa ceasing below apex; marginal cells obviously smaller than median ones; median cells rhomboidal, rectangular. 21.1-31.6 μm long, 9.2-10.5 μm wide, smooth.

Specim. exam. Kaohsiung Hsien: Zenmay, 50 m alt., terrestrial on base of wall, Aug. 27, 1984, *T. Y. Chiang 5870.*

Distribution: Taiwan, Luzon, Caroline Island.

Illustrations: Bartram 1939: 127. pl. 10; Miller *et al.* 1963: 29. pl. 10.

The species is related to *Tayloria hornschuchii* (Grev. & Arnott) Broth. and *T. alpicoa* Broth. in leaf-shape, whereas the type of areolation in leaf of the species reveals the character of genus *Splachnobryum.*

Splachnobryum pacificum Dixon, Rev. Bryol. II, 1: 12. 1928; Miller *et al.*, Beih. Nov. Hedw. 11: 29. pl. 11. 1963. (PL XXXVIII, A.-H.)

Plants tiny, shorter than 5 mm; stems erect, laxly foliated. Leaves obovate, obtuse at apex, 0.4-0.5 mm long, 0.23-0.36 mm wide, costa single, ceasing below apex, crenate at upper margins. Laminal cells rhomboidal or rectangular, 15.8-19.0 μm long, 7.9-13.1 μm wide, smooth.

Specim. exam. Kaohsiung, Chouying, 30 m alt., Aug. 25, 1984, *T. Y. Chiang 5854.*

Distribution: Taiwan, Gilbert Island.

Illustration: Miller *et al.* 1963: 29. pl. 11.

30. Notes on species *Tayloria hornschuchii* in Taiwan

Tayloria, a genus of the family Splachnaceae, is widely distributed all over the world. The study on Asiatic taxa of the genus had been made by Reimers (1931), Koponen et Koponen (1974), Noguchi (1974) and Iwatsuki et Steere (1975). Three species have been recorded in Taiwan. The authors think *T. recurvimarginata* may be identical with *Tayloria hornschuchii.*

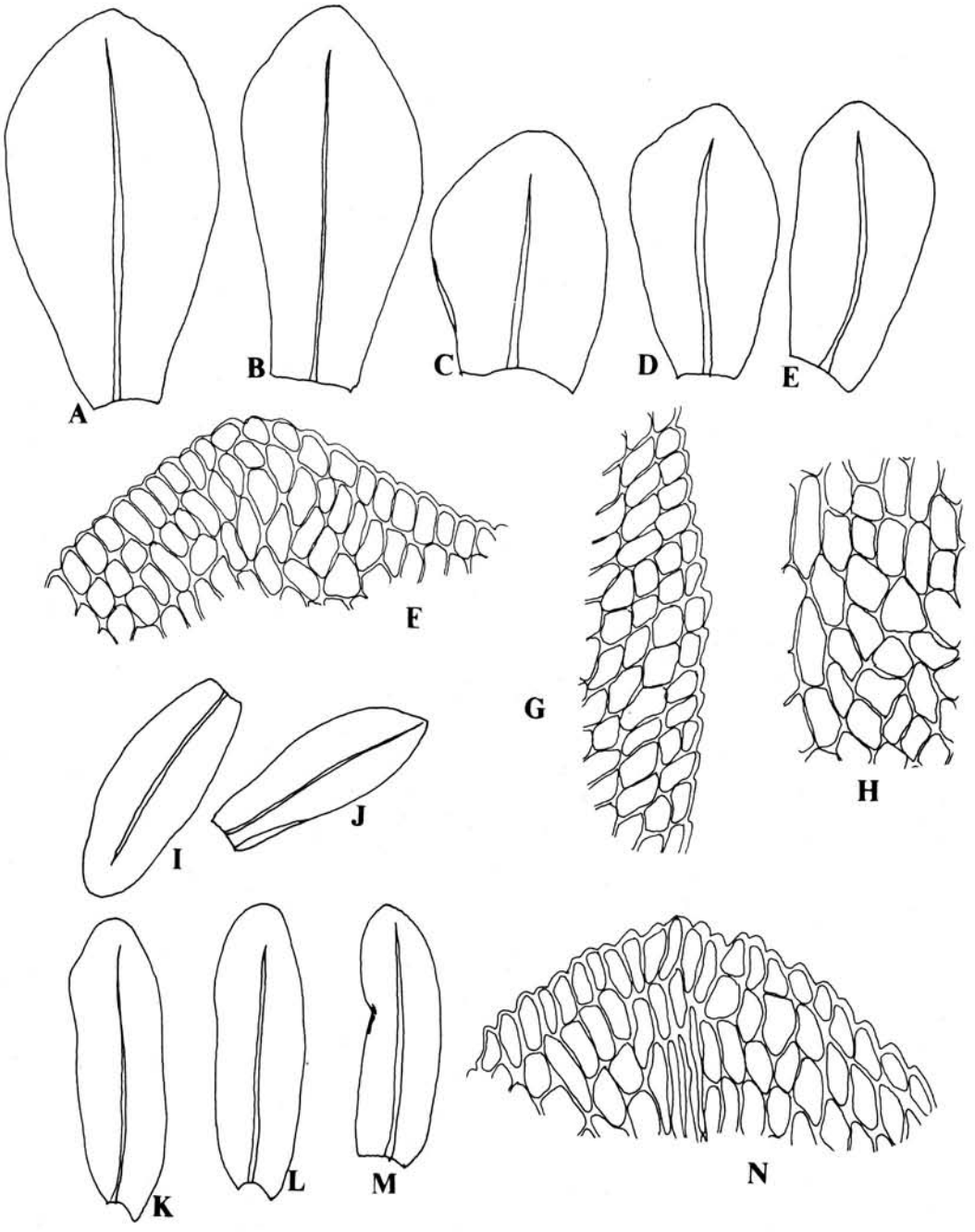

Plate XXXVIII. A-H, **Splachnobryum pacificum** Dixon I-N, **Splachnobryum luzonense** Broth. A-E, leaves (×38). F, cells of leaf apex (×38). F, cells of leaf apex (×368). G, marginal cells (×368). H, laminal cells (×368). I-M, leaves (×38). N, cells of leaf-apex (×368). (A-H drawn from *Chiang 5854*, I-N drawn from *Chiang 5870*).

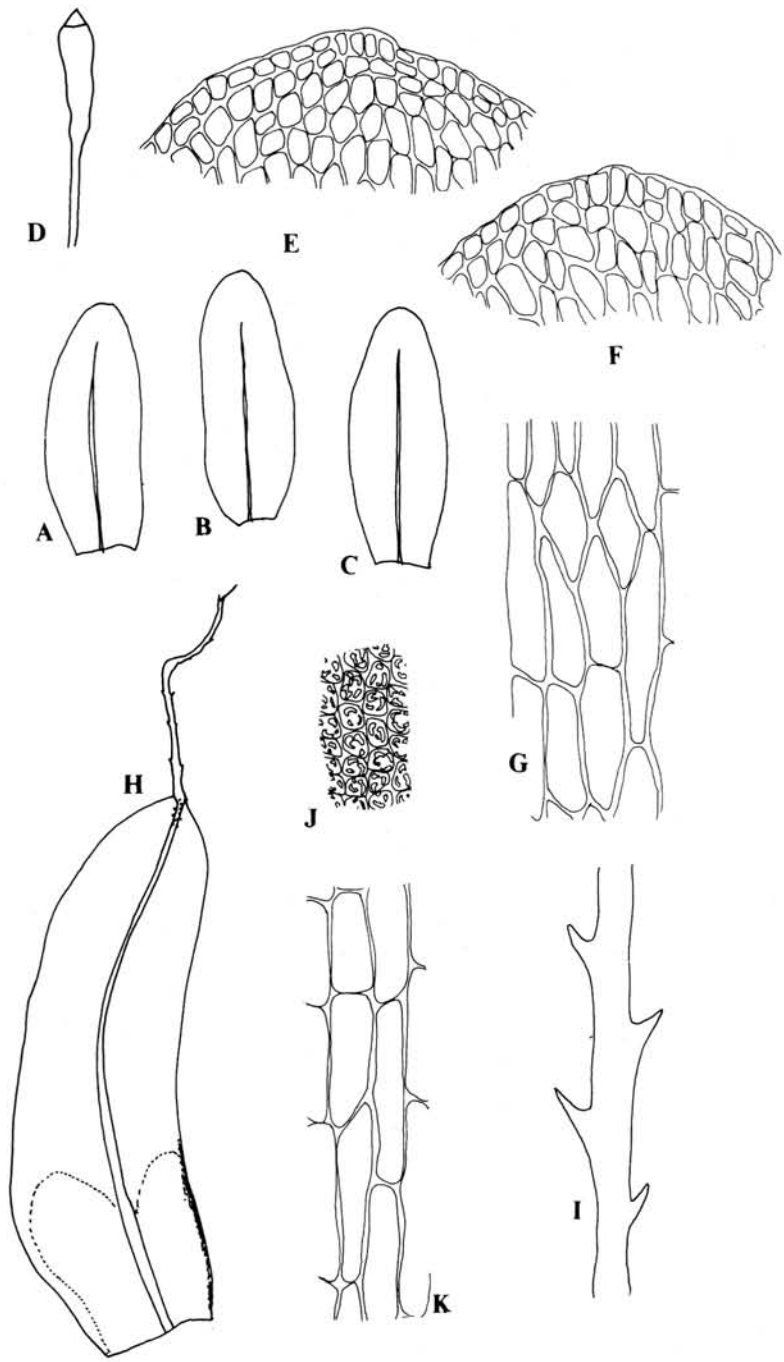

Plate XXXIX. A-G, **Tayloria hornschuchii** (Grev. & Arnott) Broth. H-K, **Tortula norvegica** (Web.) Lindb. A-C, leaves (×31). D, capsule (×31). E-F, cells of leaf-apex (×303). G, basal cells (×303). H, leaf (×31). I, a part of hyaline hair point (×26). J, laminal cells (×303). K, basal cells (×303). (A-G drawn from *Chiang 1721*, H-K drawn from *Chiang 19695*).

Tayloria hornschuchii (Grev. & Arnott) Broth., Nat. Pfl. 1(3): 502. 1903; Iwatsuki et Steere, Journ. Hattori Bot. Lab. **39**: 350. *f. IV.* 1975; Suzuki, Misc. Bryol. Lichenol. 8(8): 157. f. 1980. (PL XXXIX, A.-G.)

Plants small, light-green; stems erect, single, ca. 5 mm long. Leaves lingulate or oblong, 1.0–1.1 mm long, 0.2–0.4 mm wide, obtuse at apex, margins incurved, entire nearly, costa single, ca. 2/3–3/4 leaf-length. Laminal cells rectangular, 7.9–23.7 μm long, 7.9–10.5 μm wide, thin-walled, smooth.

Capsules cylindric, erect, apophyses distinct.

Specim. exam. Tainan Hsien: Hsinhua, Chouchen, Tsailiao, 300 m alt., terrestrial on badland, July 25, 1982, *T. Y. Chiang 1721.*

Distribution: Himalaya, Nepal, Taiwan, Japan.

Illustrations: Iwatsuki & Steere 1975: 350. f. 3; Suzuki 1980: 157.

According to Noguchi (1944), *T. recur-marginata* is affined to *T. horonschuchii*, one can distinguish between the two species only by the more or less inclined capsules of the former. But the distributions of the two species seem to be different obviously, which of *T. recur-marginata* is limited in high elevations based on the type specimen and of the other is in low elevations of the island. By the erect capsules and on the viewpoint of phytogeography, which *Tayloria hornschuchii* is mainly distributed in Himalaya and Nepal, the species is confirmed occuring in Taiwan. The relationship between the two species must be studied further.

31. *Tortula norvegica* (Web.) Lindb. new to the mossflora of Taiwan

Tortula, a genus of the family Pottiaceae, is characterized by leaves with hyaline hair point. Two species were discussed by Chuang (1973) in detail. The plants of the genus grow mainly in alpine zones in Taiwan. *Tortula norvegica* (Web.) Lindb. is newly found at Kuanshan.

Key to species of genus *Tortula*

1. Marginal cells of leaf-base differentiated ..... *T. norvegica*
1. Marginal cells of leaf-base not differentiated..... 2
2. Leaf-apex emarginate ..... *T. muralis*
2. Leaf-apex acute..... *T. nankomontana*

Tortula norvegica (Web.) Lindb., Oefv. K. Vet. Ak. Foerhr. **21**: 245. 1864; Saito, Bull. Natn. Sci. Mus. Tokyo, **16**(1): 85. f. 11. 1973; Saito, Journ. Hattori Bot. Lab. **39**: 524. 1975. (PL XXXIX, H.-K.)

Syn. *Tortula reflexa* Li, Acta Bot. Yunn. 3: 109. *f. 6.* 1981. hom. illeg. non Brid. (1806).

Plants medium-sized, yellowish-brown; stems erect, single or branched, 0.8–1.2 cm long; leaves crisped when dry, reflexed when moist, oblong, 2.3–2.5 mm long, 0.76–0.87 mm wide, margins entire, recurved, costa single, stout, excurrent, as a long, denticulate hyaline hair point, papillose on dorsal surface. Laminal cells quadrate, 5.2–13.1 μm long, with dense C-shaped multi-papillae; basal cells rectangular, elongate, 44.8–79.1 μm long, 7.9–18.4 μm wide, smooth, hyaline; basal marginal cells similar to upper ones.

Specim. eam. Kaohsiung Hsien: Kuanshan, 3500 alt., in *Juniperus* shrubs, terrestrial, May 24, 1987, *T. Y. Chiang 19695.*

Distributioe: Taiwan, S. China, Japan, Europe, Caucasus, N. America.

Illustrations: Saito 1973: 85. f. 11; Li *et al.* 1985: 126. f. 55. (as *T. reflexa*)

This species is characterized by the reflexed leaves and the reversed U-shaped basal part. It is a new addition to the mossflora of Taiwan.

32. *Pterigynandrum filiforme* Hedw. new to the mossflora of Taiwan

According to Buck (1980), a revised work on Entodontaceae and other affined families, *Pterigynandrum* is a monotypic genus of the family Pterigynandraceae, which was established by Schimper (1876). The genus is characterized by leaves with double costae and papillose laminal cells. The taxonomic position of the genus was discussed by Buck (1980) in detail. This genus is recorded for the first time in Taiwan.

Pterigynandrum filiforme Hew., Sp. Musc. 81 (1801); Mizushima, Journ. Hattori Bot. Lab. **22**: 97. 1960; Buck, Journ. Hattori Bot. Lab. **48**: 135. *f. 68-70.* 1980; Li *et al.*, Bryoflora of Xizang 376. f. 162. 1985. (PL. XL)

Plants small, yellowish-green, more or less glossy; stems creeping, laxely irregularly branched; branches ascending, julaceous; leaves ovate, imbricate, concave, 0.5-0.6 mm long, 0.2-0.3 mm wide, apex acute, more or less obtuse, margins serrulate, costa double or forked, short, ca. 1/4 leaf-length; lamina cells rhomboidal, papillose by projecting angles, 15.8-18.4 μm long, 3.9-7.9 μm wide; basal cells linear or vermicular, more or less porous; alar cells well differentiated, quadrate.

Specim. exam. Hualien Hsien: Tayuling to Hohuanshan, 3200 m alt., on tree trunk, Aug. 22, 1967, *C. C. Chuang 5907.*

Distribution: Taiwan. S. China, Japan, Caucasus, Kashmir, Europe, N. America, Australia.

Illustrations: Li *et al.* 1985: 376. *f. 162*; Buck 1980: 135. *f. 68-70*; Iwatsuki & Mizutani 1972: 224. *f. 117*; 460.

33. *Hampeella pallens* (Lac.) Fl. new to Taiwan

Hampeella, a genus of the family Ptychomniaceae, is characterized by lustrous, complanantely foliated plants, asymmetric leaves and smooth leaf-cells. The habits of plants seem to be similar to the family Sematophyllaceae and the decurrent leaves seem to be similar to the members of the family Plagiotheciaceae. But plants with foliate pseudoparaphullia show its taxonomic position is more affined to the genus *Taxiphyllum.* The taxonomic position of the genus seems to remain debatable.

The genus is mainly distributed in tropical Asia and Australia. No record were reported about the genus out of the mentioned areas in the past. The occurrence of *Hampeella pallens* in Taiwan is the northern limit even of the genus.

Hampeella pallens (Lac.) Fleisch., Musc. Fl. Buitenzorg **3**: 664. *f. 125.* 1908. (PL. XLI)

Plants medium-sized, yellowish-green, lustrous; stems ascending, single or laxely branched, complanately foliate; pseudoparaphyllia foliose; leaves lanceolate, more or less falcate, asymmetric, 1.6-1.8 mm long, 0.35-0.43 mm wide, margins

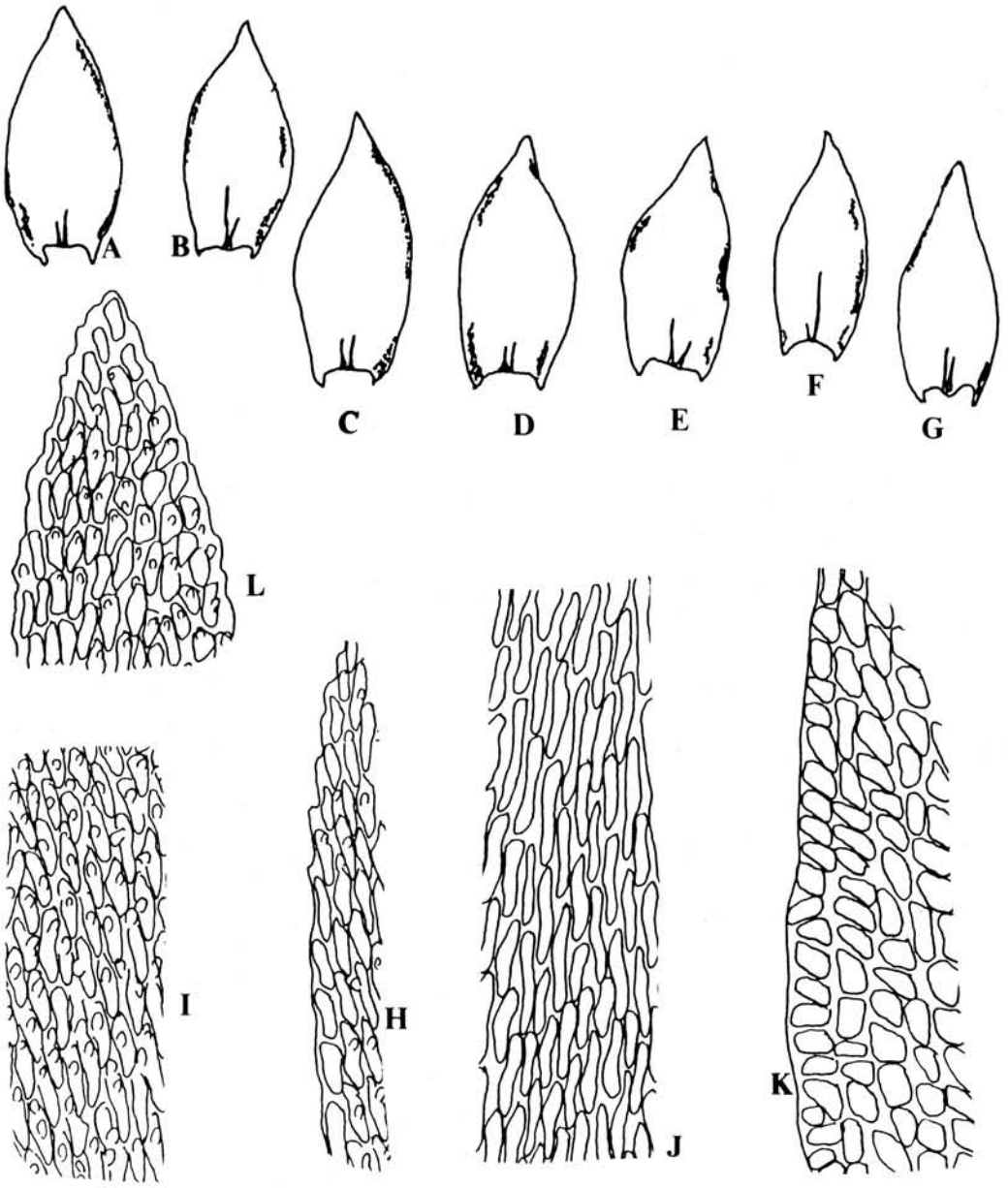

Plate XL. **Pterygynandrum filiforme** Hedw. A-G, leaves (×55). H, marginal cells (×534). I, laminal cells (×534). J, basal laminal cells (×534). K, alar cels (×534). L, Cells at apex (×534). (Drawn from *Chuang 5907*).

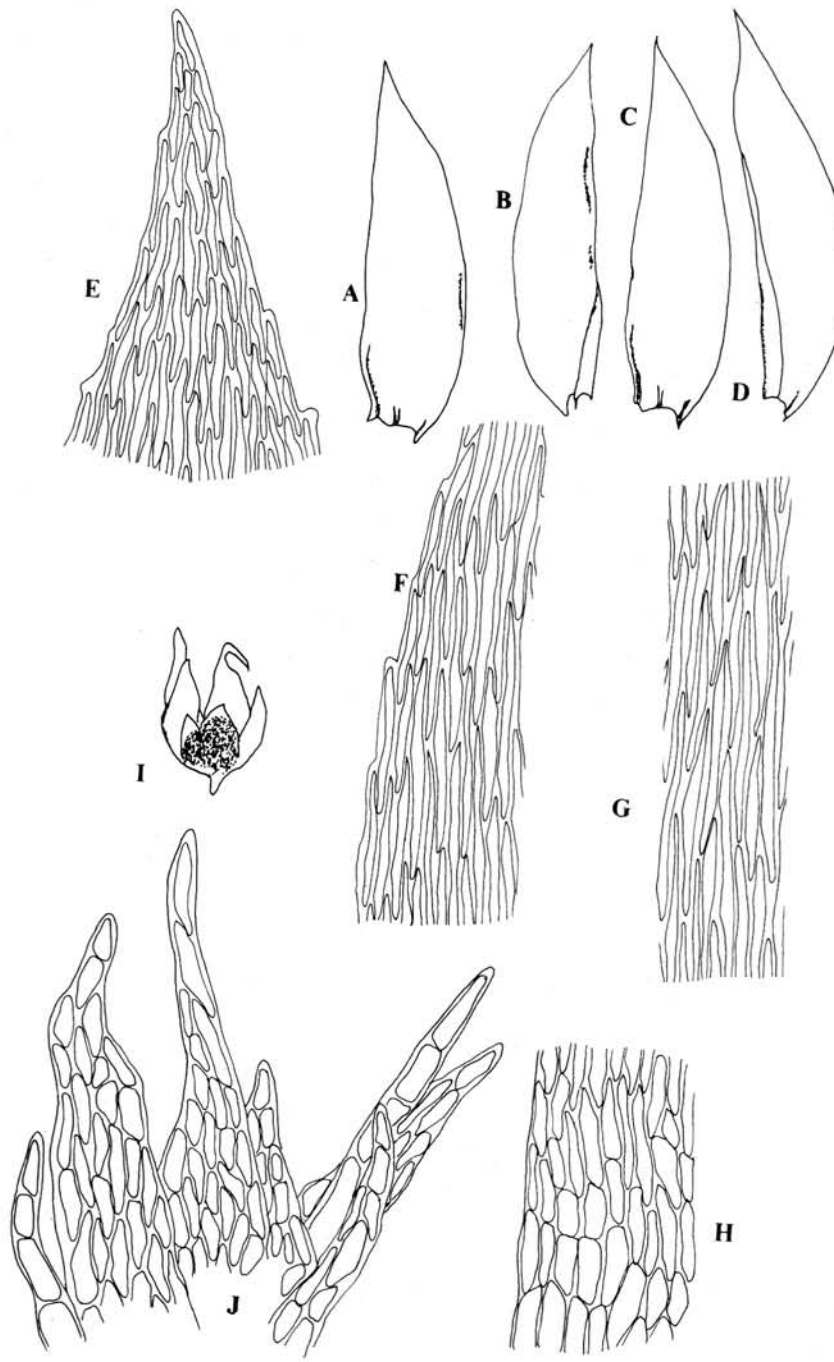

Plate XLI. Hampeella pallens (Lac.) Fleisch. A-D, leaves (×30). E, cells of leaf apex (×295). F, marginal cells (×295). G, laminal cells (×295). H, alar cells (×295). I, pseudoparaphyllia (×24). J, pseudoparaphyllia (×295). (Drawn from *Moore 3106*).

recurved usually at base in one side, serrulate, apex acute, costa none or double faintly; laminal cells linear, 73.8-131.9 μm long, 3.9-6.5 μm, wide, acute at both end, smooth, thin-walled; basal cells similar to median ones; alar cells weakly differentiated, rectangular, smooth.

Capsules cylindric, brown, erect, lateral, seta 7-10 mm long.

Specim. exam. Taipei Hsien: Wulai, 500 m alt., in ravine, on moist tree branches, May 1988, *S. J. Moore 3106*.

Distribution: Taiwan, Java, New Guinea.

Illustration: Fleischer (1908) 3: 664. *f. 125*.

The species is distributed in moist, foggy ravines of low elevations in Taiwan. At Wulai the plants are epiphytic on tree branches mixed with *Rhaphidostichum stissophyllum*.

34. *Daltonia angustifolia* Doz. et Molk. var. *gemmiphylla* Fleisch. new to the mossflora of Taiwan

Daltonia angustifolia Doz. & Molk. var. **gemmiphylla** Fleisch., Musci Fl. Buit. **3**: 959. *f. 165*. d. 1908. (PL. XLII, J.-W.)

Plants medium-sized, yellowish-green; stems erect or procumbent, single or branched; gemmae clavate, smooth; leaves oblong-lanceolate, 1.0-1.1 mm long, 0.20-0.30 mm wide, acute at apex, margins entire nearly, costa single, ca. 3/4 leaf length; median cells rhomboidal, 13.1-18.4 μm long, 5.2-9.2 μm wide, smooth; marginal cells differentiated, linear, 2-3 rows in the upper part, 3-4 rows in middle and basal part; alar cells weakly differentiated, coloured.

Capsules pyriform, ca. 1.1 mm long, 0.7 mm wide, apophyses distinct, papillose, operculum long rostrate, seta 7-10 mm long, papillose above.

Specim. exam. Taitung Hsien: Taipingshan, 1600 m alt., on open slope, on decaying wood, July 27, 1967, *C. C. Chuang 5057*.

Distribution: Taiwan, Java.

Illustration: Fleischer (1908) 3: 959. *f. 165*.

This variety is characterized by the clavate, smooth gemmae, which can be used to distinguish the other varieties.

35. *Aptychella brevinervis* (Fl.) Fl. new to the mossflora of Taiwan

Aptychella brevinervis (Fl.) Fl., Musci Fl. Buitenz. **4**: 1671. 1923; Iwatsuki *et al.*, Journ. Hattori Bot. Lab. **41**: 428. *f. II*. 1976. (PL. XLII, A.-I.)

Syn. *Clastobryopsis brevinervis* Fleisch., Musci Fl. Buitenz. **4**: 1185. 1923.

Plants lustrous; stems ascending, single or branched, caudate at ultimate portion, with filamentous, smooth gemmae; leaves oblong-lanceolate, acute at apex, 1.8-2.0 mm long, 0.33-0.46 mm wide, margins revolute, crenulate above, costa single, 1/2-2/3 leaf-length; laminal cells linear, more or less incrassate, 52.7-65.9 μm long, 2.6-3.9 μm wide, smooth; basal cells narrow rectangular, porous; alar cells well differentiated, rectangular, inflated.

Capsules not found.

Specim. exam. Taitung Hsien: Taipingshan, 1600 m alt., on open slope, on decaying wood, July 27, 1967, *C. C. Chuang 5057A*.

Distribution: Taiwan, Japan, Java.

Illustration: Iwatsuki *et al.* 1976: 428. *f. II*.

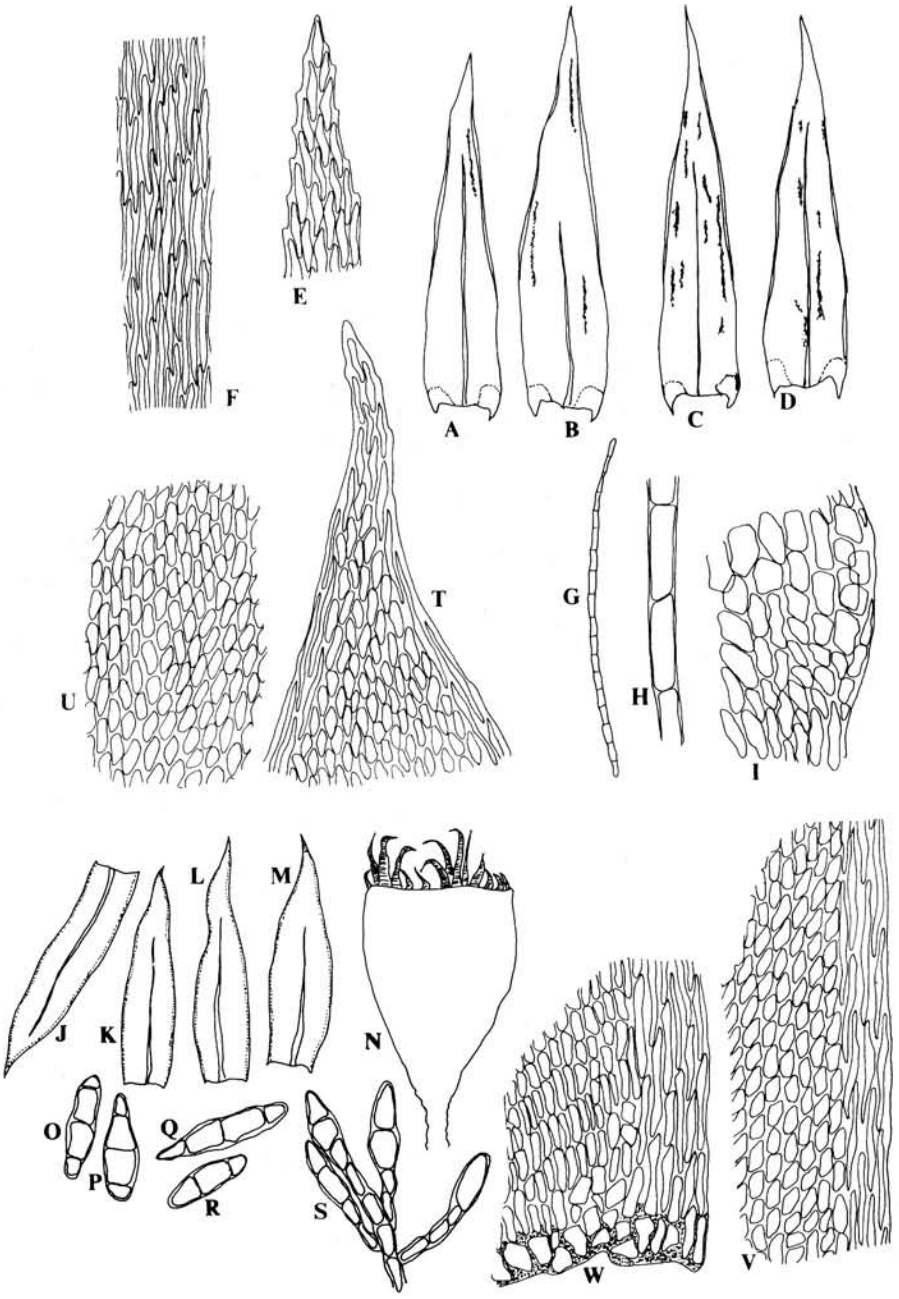

Plate XLII. A-I, **Aptychella brevinervis** (Fleisch.) Fleisch. J-W, **Daltonia angustifolia** Dozy & Molk. var. **gemmiphylla** Fleisch. A-D, leaves (×27). E, cells of leaf-apex (×265). G, gemma (×67). H, gemma (×265). I, alar cells (×265). J-M, leaves (×27). N, capsule (×27). O-S, propagula (×265). T. cells of leaf-apex (×265). U, laminal cells (×265). V, marginal cells (×265). W, alar cells (×265). (A-I drawn from *Chuang 5057*, J-W drawn from *Chuang 5057A*).

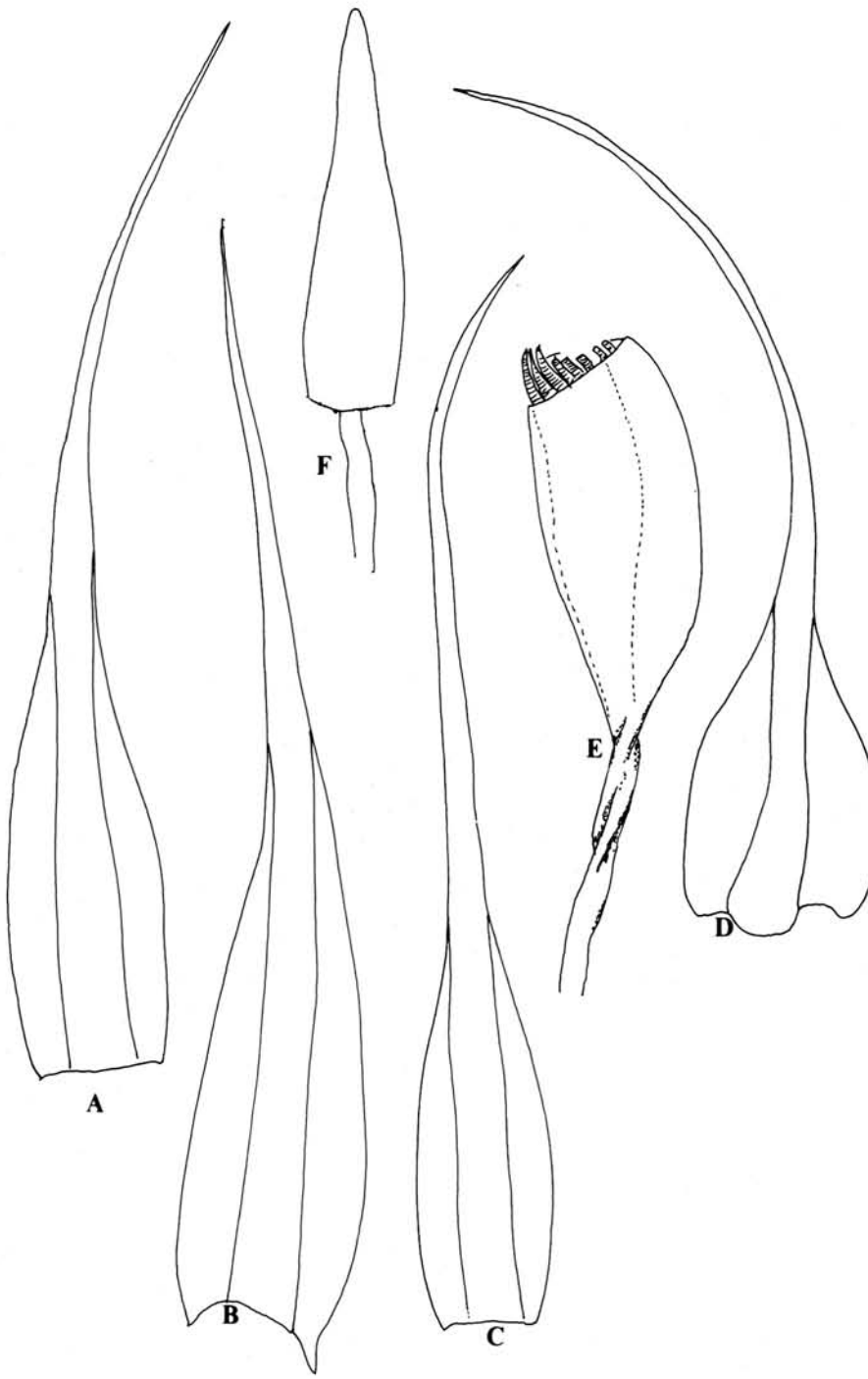

Plate XLIII. Campylopus gracilentus Card. A-D, leaves (×32). E, capsule (×32). F, calyptra (×32). (Drawn from *Chiang 14051*).

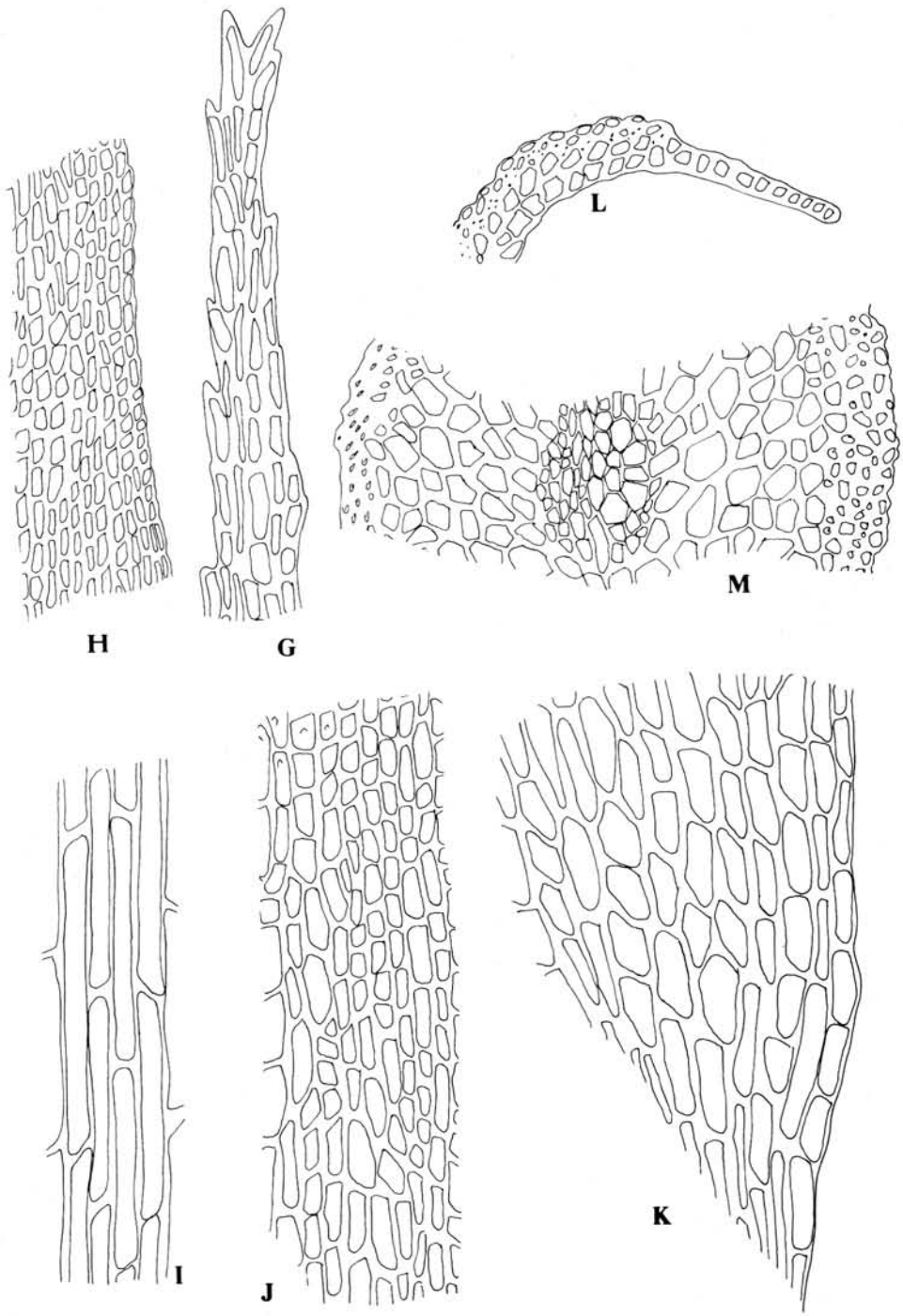

Plate XLIV. Campylopus gracilentus Card. G, cells of leaf-apex (×307). H, cells of upper part of leaf (×307). I, cells of costa (×307). J, median cells of leaf (×307). K, basal cells of leaf (×307). L, cross-section of leaf (×307). M, cross-section of stem (×307). (Drawn from *Chiang 14051*).

The authors consider that it is not accurate to place the species under *Aptychella*, *Clastobryopsis* or other genera of the family Sematophyllaceae by the characters of leaves with single costa and revolute margins. It seems to be more affined to the genus *Rozea* Besch. in sharing the same characters mentioned above and the bronze coloured plants. But in failure of checking the characters of sporophytes, the accurate position of the genus can't be ascertained.

The Taiwanese plants are much longer costae than those of Japan when compared with the illustration made by Iwatsuki *et al.* (1976).

36. Note on *Campylopus gracilentus* Card.

Campylopus gracilentus Card., Beih. Bot. Centralbl. **19**: 94. *f. 3.* 1905; Chuang, Journ. Hattori Bot. Lab. **37**: 452. 1973. (PL. XLIII & XLIV)

Specim. exam. Kaohsiung Hsien: Takuanshan, 2800 m alt., in *Yushania* grassland, terrestrial, July 27, 1986, *T. Y. Chiang 14057*.

Distribution: Endemic to Taiwan.

Illustration: Cardot 1905: 94. *f. 3.*

This species was established by Cardot (1905) and discussed by Chuang (1973). The authors reconfirmed the character of costa in Chuang's description, which has distinct steroids on the dorsal side. It is similar to *Campylopus fragilis* (Brid.) B. S. G. in sharing the leaf-shape, areolation on leaf and the character of costa. But the abundant gemmae on the plants of the latter is the main character to distinguish it from this species.

The species is distributed mainly in middle elevations of this island.

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臺灣苔蘚植物紀要 1-36

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摘　要

作者自 1981 年始，在臺灣各地及蘭嶼進行苔蘚植物採集及調查，主要沿橫貫公路、新中橫及其他林道及步道上登中央山脈及其支脈，低海拔之調查則以臺北盆地、曾文水庫及恒春半島爲中心，作者針對分類上有價值或具疑問的分類羣進行研究，提出探討一本報告中計有新種 1、新組合 1 及 1 個新分類階層，此外，有 2 個新紀錄科，11 個新紀錄屬及其他 25 種、3 個變種爲首次在臺發現，此外，3 個有價值的種類被再發現，作者並針對 7 個疑問種進行探討或確定。