

Mosses Found in the China Fir Plantations in Taiwan¹

Chung-kuei Wang² and Sang-hsiung Lin³

All the collections studied here are concerned of the mosses which inhabit in the plantations of China fir, *Cunninghamia lanceolata* (Lamb.) Hook., at several localities where the junior author visited respectively during last three years. The plantations of China Fir in Taiwan are rather widely distributed in lowland areas between the elevation 500 m and 1800 m. Inasmuch as the authors have observed, the climate at such altitude and under such canopy of China Fir plantations is usually warm and dry, and the light intensity is also very poor. As is known, the humidity, probably the most essential factor among all environmental ones in affecting the microhabitats to which the development of the bryophytic community is extremely sensitive, is indeed at comparatively lower degree. Therefore, under such circumstances, the components of the bryophytic flora in the area are restricted correspondently. In addition, the paucity of the materials gathering from the tree trunks or branches of China fir may also show the poor capacity of bark in retaining water or moisture. Among the 132 packets, there are 28 species having been identified. It is regrettable that almost half of the collections are sterile and shift greatly in their attributes of both life form and leaf shape, and, therefore, identification of these specimens can not be done presently. Nevertheless, they may be referred to the genera *Ectropothecium*, *Isopterygium*, *Taxiphyllum*, *Brachythecium* and *Hypnum*. However, according to the field observation and the numbers of the collections they seem to be the most abundant taxa in the China fir plantations, especially both *Ectropothecium* and *Isopterygium*.

The following key to species and a small scaled sketch of each species concerned are provided for those who may engage in further study of the moss flora of the area.

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2. Department of Biology, Tunghai University.

Key to the Species Found in the China Fir Forest of Formosa

1. Plants erect, simple or dichotomously branched; seta terminal on stems2
1. Plants prostrate, irregularly or regularly branched; seta lateral on main stems or secondary branches21
2. Leaves equitant, with a dorsal blade; all leaf margin crenate by the protuberance of each cell; superior lamina gradually narrowing downwards and ending above the base1. *Fissidens incrassatus*
2. Leaves not equitant, without a dorsal blade3
3. Leaf blade nearly all costa, with one layer of chlorocysts and 6 or 10 layers of leucocysts4
3. Leaf blade with narrow costa, without differentiating as above5
4. Chlorocysts triangular; leucocysts 3-5 layers on both sides of chlorocysts 11. *Octoblepharum albidum*
4. Chlorocysts quadrangular; leucocysts 2-3 layers on both sides of chlorocysts 2. *Leucobryum neilgherrense*
5. Leaf blade with lamellae composing of 6-8 cells; marginal cells in surface view rounded; calyptra densely hairy6. *Pogonatum junghuhnianum*
5. Leaf blade without lamellae; calyptra smooth or rarely hairy6
6. Leaves with cancellinae, longly ciliate at shoulder of leaf margin 10. *Syrhodon larminatii*
6. Leaves without cancellinae7
7. Laminal cells with a papilla on the upper end19. *Philonotis socia*
7. Laminal cells with a papilla or papillae on lumen or smooth8
8. Laminal cells papillate on lumen9
8. Laminal cells smooth11
9. Leaf margin recurved; leaves ovate-lanceolate, with few papillae on lumen of leaf cells9. *Barbula unguiculata*
9. Leaf margin plane or incurved; leaves spatulate or oblong, with a papilla on lumen of leaf cells10
10. Leaves distinctly serrate on margin of upper half, oblong12. *Hyophila involuta*
10. Leaves entire, spatulate7. *Hyophila propagulifera*
11. Leaves spatulate, broader, abruptly pointed; leaf cells large, mostly quadrate or subquadrate12
11. Leaves lanceolate or oblong-ovate, narrower, elongately acuminate or acute; leaf cells smaller, rhomboid-hexagonal or linear-hexagonal or rectangular13
12. Capsules globoid, symmetric14. *Physcomitrium sphaericum*
12. Capsules elongato-pyriform, asymmetric15. *Funaria hygrometrica*
13. Peristome single; leaves lanceolate with broad sheath at base; leaf cells rectangular14
13. Peristome double; leaves oblong-ovate, or lanceolate without sheath at base; leaf cells

- rhomboid-hexagonal or linear-hexagonal18
14. Capsules immerse; calyptra roughly scabrous3. *Garckea comosa*
14. Capsules longly exerted; calyptra not scabrous15
15. Capsule neck slender, twice the length of the urn; capsule curved.....
..... 4. *Trematodon longicollis*
15. Capsule neck indistinct, shorter than the urn16
16. Alar cells strongly differentiated13. *Brothera leana*
16. Alar cells not or poorly differentiated17
17. Peristome teeth cleft above8. *Dicranella coarctata*
17. Peristome teeth cleft to base.....5. *Ditrichum difficile*
18. Stem julaceously foliate; leaves strongly imbricated, concave when moist
..... 21. *Anomobryum filiforme* var. *concinatum*
18. Stem not julaceously foliate; leaves erect-patent when moist19
19. Leaves dorsiventral flattened, tinged with red colour, dimorphous, with two rows of lateral
leaves larger and one row of dorsal leaves smaller18. *Epipterygium tozeri*
19. Leaves not dorsiventral flattened. uniform, green20
20. Leaves oblong-ovate, concave; costa ending far below apex; leaf cells rhomboid-hexagonal,
less than 4 : 120. *Bryum cellulare*
20. Leaves narrowly lanceolate, plane; costa ending below apex; leaf cells linear-hexagonal,
longer than 4 : 116. *Pohlia flexuosa*
21. Leaves in three rows23
22. Primary stems prostrate, with secondary stem erect; branches pinnate on one plane;
leaves composing of two rows of lateral leaves and one row of ventral leaves; costa
ending below apex; leaf cells rhomboid; leaf margin bordered
..... 27. *Hypopterygium formosanum*
22. Stems prostrate, flexuous, irregularly branched, with two rows of lateral leaves and
one row of dorsal leaves; costa excurrent; leaf cells hexagonal or quadrate; leaf
margin not differentiated28. *Rhacopilum aristatum*
23. Paraphyllia abundant24
23. Paraphyllia absent26
24. Plants autoicous; leaf cells with a papilla on the upper end, quadrate to rectangular;
stems regularly pinnated.....24. *Haplocladium angustifolium*
24. Plants dioicous; leaf cells with a papilla on lumen, ovate to ovate-oblong; stems
tripinnately branched25
25. Stem leaves with acute to acuminate chlorophyllose apices; costa ending below apex
.....26. *Thuidium recognitum* var. *delicatulum*
25. Stem leaves with a filiform hyaline acumen composing of a single row of usually 6-15
cells; costa filling acumen25. *Thuidium cymbifolium*
26. Primary stems prostrate; secondary stem erect; from a stipelike base to bipinnate
or tripinnate branches above in a compact glossy frondose head; leaf cells smooth
.....23. *Homaliodendron microdendron*

26. Stems prostrate, irregularly or pinnately branched; leaf cells unipapillate27
27. Plants tough, with branches parallelly spreading; stems and branches obtuse; leaf apex broadly acute, crisp; costa ending below apex; leaf cells rhomboid
.....17. *Duthiella wallichii*
27. Plants slender, with branches flexuously spreading; stems and branches tenuate; leaf apex longly acuminate; costa ending far below apex; leaf cells linear-hexagonal
..... 22. *Pseudobarbella assimilis*

Enumeration of Species Collected

1. *Fissidens incrassatus* Sull. et Lesq., Proc. Am. Ac. Arts Sc. 4: 276 (1859). (Fig. 1, a-d)

This moss may be one of the common species of this genus in Formosa. It distributes at lower elevation and may grow in sunny places. Although the sporophytes are absent in the authors' collections, the sterile plants can still be recognized and referred to this species by their superior lamina gradually narrowing downwards and ending above the base, all leaf margin crenate by the protuberance of each cell, percurrent costa flexuous at upper part and not differentiated border.

Collections: *Lin-548*; on soil wall, at warm and moist place; Chi-tou, Nan-tou Hsien; alt. 1150 m; July 11, 1971. *Lin-663*; on shaded stone along road side; Wu-liau, San-hsia Town, Taipei Hsien; alt. 250 m; Aug. 12, 1971. *Lin-2971*; on stone along road side, in the way of Giau-li-ping to Yun-tan waterfall, Mei-san Hsiang, Chia-i Hsien; alt. 1000 m; April 2, 1973. *Lin-3060* & *3070*; on stones; Luei-li, Mei-san Hsiang, Chia-i Hsien; alt. 1000 m; April 4, 1973.

2. *Leucobryum neilgherrense* C. Muell., Bot. Zeit. 12: 556 (1854). (Fig. 2, a-d)

Plants whitish green in colour. In cross-section of the leaves, 2-6 layers of leucocysts and one layer of tetragonal chlorocysts present. The basal leaves sometimes have numerous rhizoids at apical points which may have no taxonomic significance. The strongly incurved upper margin of leaf and smooth back of it also characterize this species.

Collections: *Lin-469* & *470*; on basal portion of tree trunk of China fir; Chi-tou; alt. 1150 m; July 11, 1971. *Lin-3097*; on soil; Luei-li; alt. 1000 m; April 4, 1973.

3. *Garckea comosa* (Doz. et Molk.) Wijk et Marg., Taxon 9: 190 (1960). (Fig. 3, a-g)

From the collections only one locality has been known in this area. Plants up to 1.3 cm long; stem in cross-section showing a developed, yellowish pale, central strand, irregular small cortical cells with thick brownish wall, and with the medullary cells larger than the former; upper leaves forming a comal tuft; lower leaves smaller, lanceolate to longly triangular, sometimes up to 1.3 X 0.24 mm; sporophytes about 7 mm long; capsules immerse, several (1-3); calyptra roughly scabrous, conic-campanulate, with a long hair-like remnant at apex; operculum conical; peristome present.

Collections: *Lin-499*, *505* & *506*; on the upper soil wall, at warm and moist habitat; Chi-tou; alt. 1150 m; July 11, 1971.

4. *Trematodon longicollis* Michx., Fl. Bor. Am. 2: 289 (1803). (Fig. 4, a & b)

The most distinct characteristic may be the length of the neck about twice that of the capsule from which this species can be readily recognized. In addition, the costa does not fill the awn, the peristome is lanceolate, perforated and vertically striated, papillate at the upper portion; capsule cylindrical curved and inclined; calyptra cucullate.

Collections: *Lin-505*; on soil wall along road side; Chi-tou; alt. 1150 m; July 1, 1971. *Lin-678*; on stone along road side in shady place; Wu-liau; alt. 250 m; Aug. 12, 1971. *Lin-1016*; on the damaged brownish-yellow soil around the water-storaging pool; Sun-moon Lake, Nau-tou Hsien; Oct. 24, 1971.

5. *Ditrichum difficile* (Dub.) Fl., Musci Fl. Buitenz. 1: 300 (1904). (Fig. 5, a-d)

Plants up to 1 cm high; stem erect, 3 mm high; leaves including subula 3-4 mm long; costa at base about 115 u wide; leaf cells at shoulder narrowly linear, 56 X 5 u, with basal cells rectangular, 45 X 8.4 u; subula five times as long as the leaf sheath.

The sterile collections are of little assistance in identification. Hence further examination and comparison of this plant is required when available materials gathered.

Collections: *Lin-549 & 505*; on soil wall, at warm and moist habitat; Chi-tou; alt. 1150 m; July 11, 1971.

6. *Pogonatum junghuhnianum* (Doz. et Molk.) Doz. et Molk., Bryol. Jav. 1: 41, Pl. 31 (1856). (Fig. 6, a-e)

Very common and distinct plants, usually growing on damaged soil at lowland. From the genus *Polytrichum* the genus *Pogonatum* can be clearly separated by its 32 teeth and not ridged capsules. The species has the following attributes which sometimes share with another closely allied species *P. akitense* Besch.: Leaf margin unistratose; terminal cells of lamellae in cross-section variable, from rounded, truncate to retuse, but always longer than wide and larger than other cells, rounded in surface view; lamellae 6-7 cells high, rarely 8.

It is very similar to *P. akitense* Besch. var. *akitense*, but the latter has lamellae 4-6 cells high, while the former has 5-8 cells high. However, as mentioned by Osada (1965) the two species need much more inspection.

Collections: *Lin-503, 504, 506, 543, 544 & 549*; on the upper soil wall along road side, at sunny and moist habitat; Chi-tou; alt. 1150 m; July 11, 1971. *Lin-1019*; on the damaged brownish-yellow soil around a water-storaging pool; Sun-moon Lake; Oct. 24, 1971.

7. *Hyophila propagulifera* Broth. Hedwigia 38: 212 (1899). (Fig. 7, a-e)

Plants small; leaves obovate-spatulate, with entire margin plane or slightly curved at one side of the leaf base; leaf cells quadrate-rounded, about 5-6 u in diam., mamillate, rectangular and hyaline at base; costa percurrent or excurrent; leaf apex usually mucronate. Collection: *Lin-3101*; on soil; Luei-li; alt. 900 m; April 4, 1973.

8. *Dicranella coarctata* (C. Muell.) Bosch et Lac., Bryol. Jav. 1: 84, t. 70 (1858). (Fig. 8, a-j)

Leaves from broad sheath suddenly becoming slender awn; leaf margin entire, unistratose, sometimes bistratose; costa not filling the awn; basal cells larger; capsule oval-elliptical; peristome teeth lanceolate, brown, divided above, densely papillose, slightly papillose at ventral side; exothecial cells smooth.

Collections: *Lin-506, 546 & 549*; on the upper soil wall and at warm and moist habitat; Chi-tou; alt. 1150 m; July 11, 1971.

9. *Barbula unguiculata* Hedw., Spec. Musc. 118 (1801). (Fig. 9, a-j)

Plants up to 6 mm high; leaves lanceolate, 2. 1-2.4 x 0.55-0.6 mm, with the reversed margin unistratose; leaf cells pluripapillate on both surfaces, quadrate, about 7-9 u in diam.; costa excurrent, with the sclereid band on two sides of guide cells respectively; inner perichaetial leaves small; peristome filamentous, twisted; densely papillose; capsule cylindrical, smooth, 1.2 x 0.48 mm; seta 6 mm long; annulus absent.

This moss is distinguished from other Formosan species of this genus by its excurrent costa and lanceolate leaves.

Collection: *Lin-1018*; on damaged reddish-yellow soil; Sun-moom Lake; Oct. 24, 1971

10. *Syrrhopodon larminatii* Par. et Broth., Rev. Bryol. 28: 125 (1901). (fig. 10, a-f)

This species always inhabits on the bases of tree trunks of China fir and *Cryptomeria japonica* (Linn. f.) D. Don. Leaves without teniolae and with cancellineae in 4 rows of cells at either side of costa; marginal cells at the base of leaf shoulder linear, distinctly different from cancellineae; leaf margin ciliate at shoulder; costa spinose-hispid on dorsal face; leaf cells quadrate-rounded, mamilllose; sometimes brood bodies presented.

Under microscope the beautiful leaves of this species can be immediately recognized from other mosses by its leaf shoulders with 4-8 long spine-like cilia and conspicuously developed cancellineae.

Collections: *Lin-469 & 470*; on the basal portion of tree trunk of China fir and *Cryptomeria japonica* (Linn. f.) D. Don; Chi-tou; alt. 1150 m; July 11, 1971. This plant usually associates with *Brothera leana* (Sull.) C. Muell.

11. *Octoblepharum albidum* Hedw., Spec. Musc. 50 (1801). (Fig. 11, a-f)

Plants rossete-like, whitish, usually growing on tree trunks or on *Cyathea* sp.; leaves lingulate with rounded apiculate apex, curved strongly; costa without sclereid cells; leaves in cross-section with one layer of triangular chlorocysts and with 9-10 layers of leucocysts; leaf margin unistratose.

The triangular chlorocysts and 10 layers of leucocysts are characterized for this species.

Collection: *Lin-1020*; on the tree trunk of *Cyathea* sp., in full-shaded China fir plantation; Sun-moon Lake; Oct. 24, 1971.

12. *Hyophila involuta* (Hook.) Jaeg., Ber. S. Gall. Naturw. Ges. 1871-72: 354 (1873). (Fig. 12, a-e)

From the former species, *Hyophila propagulifera* Broth., this plant can be distinguished easily by its upper leaf margin with distinct serration, while that of the last-mentioned species is entire.

Collection: *Lin-3070*; on stone; Luei-li; alt. 1000 m; April 4, 1973,

13. *Brothera leana* (Sull.) C. Muell., Gen. Musc. Fr. 259 (1900). (Fig. 13, a-e)

As described by Takaki (1968), the structures of leaf-costa and stems in cross-section are most important for the separation of *Brothera* from its many allied genera of Dicranaceae and Leucobryaceae. According to his study, the genus has cortex and medullary layer

composed of thin-walled cells in all, and lacks both guide cells and stereid bands, and has middle row of incrassate cells and both ventral and dorsal layers of large thin-walled cells and not differentiated alar parts of leaves.

It can be separated from another species, *B. himalayana*, which has been found in Sikkim only, by its shorter awn and smaller laminal cells and not differentiated perichaetial leaves.

Collections: *Lin-469 & 470*; on the basal portion of tree trunks of China fir; Chitou; alt. 1150 m; July 11, 1971. Usually associated with *Syrrhopedon larminatii* Par. et Broth.

14. *Physcomitrium sphaericum* (Ludw.) Fuernr. in Hampe, Flora 20: 285 (1837). (Fig. 14, a-g)

The globoid appearance of the capsule and the base of the calyptra 3-5-lobed and well differentiated operculum are so striking even without microscope examination that this genus can be easily separated from other genera of the family.

This moss grows on moist soil of semi-shady place, also on soil in green house or on soil in pot. It is remarkable for its indistinct leaf border, spherical capsules with a beak-like apiculus and large spores.

Collections: *Lin-2948 & 2949*; on the soil wall, Giou-li-ping; alt. 1000 m; April 2, 1973. This species often mixed with *Epipterygium tozeri* and other mosses.

15. *Funaria hygrometrica* Hedw., Spec. Musc. 172 (1801). (Fig. 15, a-e)

A cosmopolitan species consisting of different races or some infraspecific taxa. It is not difficult to recognize them in the field even without the assistance of magnifier. The characters of gametophyte and sporophyte are very distinct especially in the elongato-pyriform and arcuate capsule which has conspicuous striae and oblique mouth. Under the microscope the leaf margin is entire, the costa is percurrent and the border is not of thick-walled cells. All these characters can be used in separating this species from *F. japonica* Broth.

Collections: *Lin-1014 & 1017*; on damaged reddish-yellow soil around a water-storing pool; Sun-moon Lake; Oct. 24, 1971.

16. *Pohlia flexuosa* Hook. Icon. Pl. 1: 19, f. 5 (1836). (Fig. 16, a-j)

Assignment of this collection to this species is primarily based on the plants without distinct lustre, capsules without necks, leaves lanceolate, leaf cells linear, more than 4 : 1, and cilia absent. However, the author fail to find out gemmae and reddish costa in his collection. The seta in the only specimen is up to 5 cm long.

Collection: *Lin-3106*; on hard moist soil; Luei-li; alt. 1000 m; April 4, 1973,

17. *Duthiella wallichii* (Mitt.) C. Muell. in Broth., Nat. Pfl. 1: 1010 (1908). (Fig. 17, a-f)

Plants robust, dull, yellowish green; stems more or less pinnately branched; branches horizontally spreading; stems and branches obtuse; leaves broadly acuminate, longitudinally plicate, crisp near apex; leaf base not auriculate; costa single, ending before apex, flexuous; leaf margin serrulate; leaf cells rhomboid, more or less isodiametrical, 16-20 x 5.6-8.5 μ , unipapillate; alar cells smaller, quadrate; juxtacostal cells towards base; basal cells porose distinctly.

This species is characterized by its unipapillate rhomboid cells and broadly ovate leaves with acuminate and crisp apex.

Collections: *Lin-3061* & *3062*; on stone of the hardwood and China fir mixed forest; Luei-li; alt. 1000 m; April 4, 1973.

18. *Epipterygium tozeri* (Grev.) Lindb., Oefv. Svensk. Vet. Akad. Foerh. 21: 576 (1865). (Fig. 18, a-c)

Plants soft, 1-1.5 cm long, distantly foliate; leaves ovate, assymetrical, reddish, softly complane; costa single, slightly flexuous, red, ending far before apex; areolation lax; leaf cells longly hexagonal, thin-walled.

This moss can be readily known by its appearance and colour in the field.

Collections: *Lin-2949* & *2950*; on soil wall; Giou-li-ping; alt. 1000 m; April 1, 1973. associated with *Physcomitrium sphaericum* (Ludw.) Fuernr.

19. *Philonotis socia* Mitt., J. Linn. Sco. Bot. 8: 151 (1864). (Fig. 19, a-d)

This collection is characterized by its distinct papilla at the upper end of leaf cells on both surfaces, not recurved leaf margin with clear serrulation, percurrent costa and somewhat quadrate marginal cells at leaf base. Hence the authors place this plant in the species, although he can find certainly no the probably significant attribute that the papilla on upper end of the ventral leaf cells and on the lower end of the dorsal leaf cells as described by Iwatsuki in his Col. III. Bry. Japan (1972), p. 131, pl. 18.

In addition, this moss also shares some characteristics with *Philonotis turneriana* (Schwaegr.) Mitt. except those of the papillae on leaf cells and of the shape of the basal cells of leaf margin.

Collections: *Lin-505*, *507*, *544* & *551*; on the upper soil wall along road side; Chi-tou; July 11, 1971. *Lin-682*; on the boulder by stream under a bridge, at sunny place; Wu-liau; alt. 250 m; Aug. 12, 1971. *Lin-2948*; on the soil wall; Giou-li-ping; alt. 1000 m; April 2, 1973.

20. *Bryum cellulare* Hook. in Schwaegr., Spec. Musc. Suppl. 3: 214a (1827). (Fig. 20, a-c)

Only the sterile plants have been gathered in this area. It seems to be a species of *Bryum cellulare* Hook. after consideration of the following attributes: Plants less than 1 cm high; leaves crowded in apex forming a terminal comal tuft, broadly ovate, with obtuse or acute apex or shortly acuminate, strongly concave, 0.9-1.4 mm long, 0.45-0.5 mm wide; leaf margin entire, with narrower border cells; laminal cells rhomboidal-hexagonal, lax, thin-walled; costa reddish, flexuous, ending below apex, sometimes shortly branched at middle.

Collections: *Lin-680* & *682*; on stone by stream in open area; Wu-liau; alt. 250 m; Aug. 12, 1971.

21. *Anomobryum filiforme* var. *concinatum* (Spr.) Loeske, Rev. Bryol. Lich. 5: 200 (1933). (Fig. 21, a-d)

The authors think there is no doubt that the collections are assigned to this taxon based largely on the following observation: Sterile plants up to 2 cm high, fertile ones only 0.5 cm high; leaves elliptical-ovate, 1.2-1.4 x 0.6-0.7 mm, with red brood bodies in the axiles of the leaves of the sterile plants, denticulate at leaf apex; costa percurrent, flexuous

towards apex; leaf cells longly hexagonal, 73-118 x 9-10 μ ; seta up to 2.5 cm long; endostome as long as exostome, distinctly perforate; basal membrane 1/2-1/3 length of exostome; cilia well-developed, with large appendages, also as long as endostome.

Collections: *Lin-507*; on soil wall, at moist and warm place; Chi-tou; alt. 1150 m; July 11, 1971. *Lin-2948*; & 2949 on soil wall; Giou-li-ping; April 1, 1973.

22. *Pseudobarbelle assimilis* (Card.) Nog., Journ. Hatt. Bot. Lad. 2: 81 (1947). (Fig. 22, a-e)

After comparing the collection with the description and figures of this species which was established by Cardot (1905) and then combined by Noguchi (1947), the authors incline to place the specimen under this name. Plants dirty-yellow, with soft texture; stem elongate, densely interwoven, irregularly longly branched; branches attenuate, more or less flattened; stem leaves ovate, 2 x 0.54 mm long, attenuately to long and narrow apex; branch leaves longly triangular, acute at apex, 1.7 x 0.4 mm long; costa over the middle of the leaves, thin; leaf cells linear, thin-walled, unipapillate on cell lumen; a group of brown subquadrate larger cells sometimes forming a defined area near leaf margin at each basal angle of leaves.

Collection: *Lin-545*; on soil; Chi-tou; alt. 1150 m; July 11, 1971.

23. *Homaliodendron microdendron* (Mont.) Fl., Hedwigia 45: 78 (1906). (Fig. 23, a-d)

Plants glossy. Primary stem prostrate; secondary stem erect, from a stipelike base to bipinnate or tripinnate branches above in a compact frondose head; leaf apex more or less wider than the rest, widely obtuse or rounded, crenulate, not strongly incised or dentate as in *H. scalpellifolium* (Mitt.) Fl. and *H. flabellatum* (Smith) Fl.; costa ending above midleaf; branch leaves smaller.

Collection: *Lin-3117*; on stone; Luei-li; alt. 1000 m; April 4, 1973.

24. *Haplocladium angustifolium* (Hampe et C. Muell.) Broth., Nat. Pfl. 1: 1008 (1907). (Fig. 24, a-e)

This species seems to be characterized by its distinct papilla on the upper end of quadrate or subquadrate leaf cells, by lanceolate paraphylliae or simple ones with two cells wide at base, by stem leaves from broadly ovate base gradually tapering into lanceolate acumen, by costa longly excurrent, by smooth seta and entire perichaetial leaves.

Collection: *Lin-2966*; on stone; on the way from Giou-li-ping to Yun-tan waterfall; alt. 1000 m; April 1, 1973.

25. *Thuidium cymbifolium* (Doz. et Molk.) Doz. et Molk., Bryol. Jav. 2: 115, pl. 221 (1865). (Fig. 25, a-g)

Stem leaves with hyaline, filiform apices composed of a single row of cells which are usually more than 6; stem leaves and branch leaves with a spinuous papilla on each cell lumen; paraphylliae abundant, branched, lanceolate to filiform, with several papillae on apical cells.

Th. recognitum var. *delicatulum* (Hedw.) Warnst. is another species of the same genus found in the area. It can be known from *T. cymbifolium* by its stem leaves with acute to acuminate chlorophyllose apices.

Collection: *Lin-3119*; on stone; Luei-li; alt. 1000 m; April 4, 1973.

26. *Thuidium recognitum* var. *delicatulum* (Hedw.) Warnst., Bot. Centralbl. 5: 185 (1881).

(Fig. 26, a-g)

The collection is apparently tripinnately branched, and with stout primary stems. It has the branch leaves of which the apical cells are crowned with several papillae, far from being only one papilla as in *Th. tamariscinum* (Hedw.) B. S. G. Paraphylliae rich, filiform to foliose, branched; stem leaves broadly ovate, acuminate and slightly plicate. On account of these features under the absence of the sporophyte, the authors look upon it as this variety. However this is easily confused with *Th. glaucinoides* Broth. if without the assistance of the perichaetial leaves. Therefore, the ramification seems to be the only conspicuous feature for separation of the two taxa at the present time.

Collections: *Lin-3060*; on the exposed roots of China fir or on soil covering the roots of China fir; Luei-li; alt. 900 m; April 4, 1973. *Lin-3101*; on soil; others as above.

27. *Hypopterygium formosanum* Nog., Trans. Nat. Hist. Soc. Formosa 26: 40 pl. 3 (1936). (Fig. 27, a-d)

Very lovely mosses. The genus *Hypopterygium* can be known from other genera of the same family by its complanately pinnately branches and the costa ending before apex. Under the microscope this species is remarked by its entire leaf margin, the two rows of elongate border cells, acuminately short apex of lateral leaves and orbicular ventral leaves with short apicula.

Collection: *Lin-3069*; on stone; Luei-li; alt. 1000 m; April 4, 1973.

28. *Rhacopilum aristatum* Mitt., J. Linn. Soc. Bot. 8: 155 (1864). (Fig. 28, a-d)

Plants prostrate on rocky or stone substrates, bright green; stems irregularly pinnately branched; leaves dimorphic; dorsal leaves large, elliptic-oval, with longly excurrent costa, sometimes slightly flexuous near apex; leaf cells hexagonal or more or less quadrate, elongate at leaf base, smooth; leaf margin slightly serrulate at apex; dorsal leaves smaller, triangular-ovate; costa longer than that of the lateral leaf.

Collection: *Lin-3072*; on moist rock; Luei-li; alt. 1000 m; April 4, 1973.

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臺灣本島廣葉杉林內苔類植物之研究

王忠魁 林善雄

本文就臺灣數處廣葉杉林內之苔類植物做初步的採集與鑑定，加以整理，並附檢索表，小圖及重要特徵，以便日後進一步研究之用。在132包採集中，半數分別隸屬28種，其餘半數標本，則因沒有孢子體，葉形與體形受環境的影響變化極大，所以種名暫不予發表，待日後有更完整的標本時，再行比較鑑定。雖然如此，但他們配子體方面的特徵顯示他們分別屬於下列幾屬：長菱苔屬 (*Ectropothecium*)，小棉苔屬 (*Isopterygium*)，扁枝棉苔屬 (*Taxiphyllum*)，青木苔屬 (*Brachythecium*) 及灰苔屬 (*Hypnum*)。其中長菱苔屬及小棉苔屬在此類林內最爲常見。就比較上而言，此類森林內的苔類植物，不論種類及個體的數量，均顯得稀少有限，這可能與該類森林之低海拔分佈，較低的濕度，不良的林內光線以及保水力較差的杉木樹皮有密切的關係。

Explanation of Figures

- Fig. 1. *Fissidens incrassatus* Sull. et Lesq. a. Leaf apex, $\times 325$. b. Basal part of dorsal lamina, $\times 325$. c. Leaf, $\times 7$. d. Middle margin of dorsal lamina, $\times 325$.
- Fig. 2. *Leucobryum neilgherrense* C. Muell. a and b. Cross-section of basal portion of leaf, $\times 84$. c. Cross-section of middle portion of leaf, $\times 30$. d. Leaf, $\times 15$.
- Fig. 3. *Garckea comosa* (Doz. et Molk.) Wijk et Marg. a. Lower leaf, $\times 30$. b and c. Upper leaves or perichaetial leaves, $\times 30$. d. Calyptra, $\times 30$. e. Capsule, $\times 30$. f. Leaf margin, $\times 325$. g. Plant, $\times 0.7$.
- Fig. 4. *Trematodon longicollis* Michx. a. Leaf, $\times 15$. b. Plant with sporophyte, $\times 0.7$.
- Fig. 5. *Ditrichum difficile* (Dub.) Fl. a. Laminal cells, $\times 163$. b. Leaf margin, $\times 163$. c. Leaf, $\times 15$. d. Plant, $\times 0.7$.
- Fig. 6. *Pogonatum junghuhnianum* (Doz. et Molk.) Doz. et Molk. a. Plant, $\times 0.7$. b. Marginal cells of lamellae (surface view), $\times 325$. c. Leaf, $\times 15$. d. Cross-section of leaf margin, $\times 325$. e. Cross-section of leaf, $\times 84$.
- Fig. 7. *Hyophila propagulifera* Broth. a and b. Leaves, $\times 15$. c. Laminal cells, $\times 325$. d. Plant, $\times 0.7$. e. Leaf apex, $\times 163$.
- Fig. 8. *Dicranella coarctata* (C. Muell.) Bosch et Lac. a. Cross-section of leaf, $\times 325$. b. Plant, $\times 0.7$. c. Leaf, $\times 15$. d. Cross-section of stem, $\times 325$. e. Cross-section of leaf margin, $\times 325$. f. Laminal cells, $\times 325$. g. Capsule, $\times 15$. h. Leaf, $\times 7$. i. Cross-section of leaf, $\times 30$. j. Cross-section of leaf margin, $\times 325$.
- Fig. 9. *Barbula unguiculata* Hedw. a. Leaf, $\times 15$. b. Leaf apex, $\times 325$. c. Perichaetial leaf, $\times 30$. d. Capsule, $\times 30$. e. Cells of leaf base, $\times 163$. f. Laminal cells, $\times 660$. g and h. Plants, $\times 0.7$. i. Cross-section of leaf, $\times 325$. j. Cross-section of leaf, $\times 15$.
- Fig. 10. *Syrrhopodon larminatii* Par. et Broth. a. Cross-section of leaf, $\times 163$. b. Cross-section of leaf base, $\times 163$. c. Leaf shoulder, $\times 84$. d. Leaf, $\times 15$. e. Leaf shoulder,

×84. f. Laminal cells, ×660.

- Fig. 11. *Octoblepharum albidum* Hedw. a. Leaf, ×7. b and c. Leaf apex, ×84. d. Cross-section of leaf, ×325. e. Plant, ×0.7. f. Cross-section of leaf margin, ×84.
- Fig. 12. *Hyophila involuta* (Hook.) Jaeg. a. Leaf apex, ×84. b. Leaf margin, ×325. c. Plant, ×0.7. d and f. Leaves, ×7. e. Laminal cells, ×325.
- Fig. 13. *Brothera leana* (Sull.) C. Muell. a. Cross-section of leaf margin, ×325. b and c. Plants, ×0.7. d. Leaf, ×15. e. Cross-section of leaf, ×325.
- Fig. 14. *Physcomitrium sphaericum* (Ludw.) Fuernr. in Hampe a. Calyptra, ×15. b. Leaf apex, ×84. c and e. Capsule, ×15. d. Leaf, ×15. f. Laminal cells, ×84. g. Spore, ×325.
- Fig. 15. *Funaria hygrometrica* Hedw. a. Laminal cells, ×84. b. Leaf apex, ×84. c. Capsule, ×7. d. Leaf, ×15. e. Young capsule with calyptra, ×7.
- Fig. 16. *Pohlia flexuosa* Hook. a. Capsule, ×7. b. Operculum, ×15. c and d. Leaves, ×15. e. Laminal cells, ×163. f. Leaf apex, ×163. g. Plants, ×0.7. h. Exostome, ×84. i. Exothecial cells, ×84. j. Endostome, ×84.
- Fig. 17. *Duthiella wallichii* (Mitt.) C. Muell. in Broth. a. Leaf margin, ×325. b. Laminal cells, ×325. c. Leaf apex, ×163. d. Leaf, ×15. e. Basal angle of leaf, ×325. f. Part of plant, ×0.7.
- Fig. 18. *Epipterygium tozeri* (Grev.) Lindb. a. Leaf, ×15. b. Plant, ×0.7. c. Laminal cells, ×84.
- Fig. 19. *Philonotis socia* Mitt. a. Leaf, ×7. b. Laminal cells, ×325. c. Leaf apex, ×325. d. Plants, ×0.7.
- Fig. 20. *Bryum cellulare* Hook. a. Laminal cells, ×84. b and d. Leaves, ×15. c. Leaf margin, ×84.
- Fig. 21. *Anomobryum filiforme* var. *concinatum* (Spr.) Loeske. a. Laminal cells, ×163. b. Leaf, ×15. c. Plant, ×0.7. d. Leaf apex, ×30.
- Fig. 22. *Pseudobarbella assimilis* (Card.) Nog. a. Stem leaf, ×7. b. Branch leaf, ×7. c. Laminal cells, ×325. d. Alar group of leaf, ×84. e. Plant, ×0.7.
- Fig. 23. *Homaliodendron microdendron* (Mont.) Fl. a. Branch leaves, ×7. b. Leaf at the base of branch, ×7. c. Laminal cells, ×325. d. Leaf apex, ×163.
- Fig. 24. *Haplocladium angustifolium* (Hamp. et C. Muell.) Broth. a. Perichaetial leaf, ×15. b. Laminal cells, ×325. c. Stem leaf, ×30. d. Leaf margin, ×325. e. Paraphyllum, ×325.
- Fig. 25. *Thuidium cymbifolium* (Doz. et Molk.) Doz. et Molk. a. Apical cells of stem leaf, ×325. b. Stem leaf, ×30. c. Lateral view of dorsal side of leaf, ×325. d and e. Paraphyllia, ×325. f. Laminal cells, ×325. g. Paraphyllum, ×163.
- Fig. 26. *Thuidium recognitum* var. *delicatulum* (Hedw.) Warnst. a. Paraphyllum, ×84. b. Lateral view of dorsal side of leaf, ×325. c. Paraphyllum, ×163. d. Laminal cells, ×325. e. Branch leaf, ×325.
- Fig. 27. *Hypopterygium formosanum* Nog. a. Leaf margin, ×163. b. Lateral leaf, ×15. c. Plant, ×0.7. d. Amphigastria, ×15.
- Fig. 28. *Rhacopilum aristatum* Mitt. a. Lateral leaf, ×15. b. Laminal cells of dorsal leaf, ×325. c. Dorsal leaf, ×15. d. Apex of dorsal leaf, ×84.



