Bryophyta of Guam and Northern Micronesia

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The cryptogamic flora of Guam and northern Micronesia has received less attention than the vascular flora although it is not less interesting either taxonomically or phytogeographically. Reports of collections date back to Gaudichaud (1828) but the bryophyte flora has remained little known. Merrill (1914) listed ten liverworts and thirteen mosses from Guam. During the period of Japanese control after World War I, several Japanese botanists collected in Micronesia at Ponape, Palau, and Yap. In the 1930's Yoshiwo Horikawa of Hiroshima began a series of field trips to northern Micronesia. His several contributions (see Miller, 1960) added new records to the flora as well as several new species and the genus *Boninoleptocolea*. Some smaller unreported Japanese collections are known and these will be studied as they become available. Following World War II with the establishment of Micronesia as a United Nations protectorate, entry for valid scientific purposes was possible and American biologists undertook the study of the flora and fauna. In 1960, I was able to make collections on Guam enroute to and from the Carolines and in 1965 I collected on Guam, Rota, and Saipan. Study of these collections is just begun so the following lists are also somewhat incomplete. Even so, at least 85% of any general bryophyte collection from Guam and northern Micronesia should be placed to genus accurately with the following keys. The chance of finding a species still unreported is greater than that for locating an unreported genus.

The keys provided here have been prepared for taxa reported, observed, or, to some extent, expected in Guam and northern Micronesia. For some hepatics, satisfactory specific determinations have not been established yet and names could not be assigned in this enumeration. A comprehensive bryoflora of Micronesia which will contain revisions of the present list is now in early stages of preparation. Materials which cannot be identified with the aid of the keys can be sent to the author or be deposited with a tentative identification in the College of Guam herbarium which will be reviewed prior to a comprehensive publication on Micronesian bryophytes. Much exploration and collecting remains to be done throughout Micronesia and encouragement is given to undertake it even in a seemingly modest way.

Because of their small size and the ease of preservation, bryophytes long have been popular among amateur naturalists. Some of these amateurs have become very skilled at the identification of mosses and liverworts and have made significant contributions to bryology. Edwin B. Bartram, for instance, who studied Guam mosses, was a retired business man who had sustained a long interest in mosses. He published manuals for the identification of mosses of such diverse places as Hawaii, Guatemala and the Philippines and was highly respected by professional botanists as well as amateurs. The study and exchange of broyphytes is still pursued

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by over 200 amateur members of the American Bryological Society. There are nearly as many amateur bryologists in Japan.

Mosses and liverworts grow on soil, rock, bark, humus, leaves, or even may be pendant from branches of trees. As much of the substrate and debris is removed from the plants as possible after they are collected, and the plants may be air dried or dried over low heat. It is most convenient if the plants are arranged to fit inside a packet and are dried under *light* pressure so that they are thinner and store more easily. Epiphyllous, as well as some corticolous, twig-inhabiting and terrestrial species are best left in association with the substrate because of their small size, and the difficulty of removal of undamaged plants in adequate numbers. Mixtures of species need not be disturbed unless desired—the usual method is to separate representatives of species in admixture into separate "micropackets" inserted with the mixture. Rare of otherwise significant specimens from mixtures are usually isolated and packeted separately. No specimen is complete without a proper label and collectors are encouraged to be as specific as possible about the locality, altitude, vegetational structure, and substrate. Labels should be legibly written in permanent black ink or typewritten originals from a black ribbon on a high grade paper with good rag content.

Packets folded to outside dimensions of $5^1/_2\times 4$ inches from standard $8^1/_2\times 11$ or $8\times 10^1/_2$ inch paper are suitable for most purposes and are easily filed in 4×6 inch card cabinets or shoe boxes. They should be a good grade of bond paper, 100 per cent rag is best, of about 20 pound weight. Lighter papers do not hold their shape so well and are apt to lose a portion of the contents. Several methods of folding packets have been advocated, and each has some feature to recommend it, but a satisfactory packet can be made by first folding the bottom of a sheet up 4 inches and the top down over it so that the former lower edge of the paper ends right at the upper fold. Equal flaps are then folded back to close the ends of the packet. The label data may be typed directly on the upper flap or the label may be attached to it with a good grade of non-staining glue. "Micropackets" used to separate species in mixtures may be of any size and are usually prepared as needed. I prefer a small triangular micropacket folded about $^1/_4$ inch off a bisecting diagonal of a square paper. The flaps to close the two open sides of the packet are formed by the unequal folding. Very small specimens or useful dissections should be folded into a small piece of filter paper before being placed in the micropacket.

Preservation requires only that the plants be kept dry. Insects, as certain dermestid beetles, silverfish, and roaches, rarely damage the specimens themselves, except for some moss sporophytes, although they may eat the labels and packets. As for any herbarium, some effort should be made to prevent insect and fungus damage to the specimens.

A compound microscope capable of magnifications of about $100\times$ and $400\times$ is necessary for identification of bryophytes and a low power $10\times$ to $50\times$ stereoscopic microscope makes things easier. With practice a $15\times$ to $20\times$ hand lens can be used for field identifications with a high degree of reliability. Leaves can be removed for study by holding the plant just behind the tip with a fine pointed forceps and stripping leaves away from the tip with a flattened and somewhat sharpened dissecting needle. Either leaves or whole plants should be mounted in a drop of water on a slide with a coverslip over the top. Dissections are best made when the plants are wetted first. They imbibe water quickly, especially if it is hot, and resume approximately their natural aspect. I have observed this "recovery" in specimens collected as early as 1792 and so age of the specimen seems to have little effect upon the imbibition. Specimens may be wetted and dried any number of times without ill effects.

Collecting bryophytes requires attention to microhabitats which provide unique niches of special conditions necessary for development of certain species. Because of their relatively small size, it is difficult to detect every species in the field directly. Collection from each microhabitat increases the representation of the flora being studied. No terrestrial microhabitat is too exotic or severe for some bryophytic growth. Explore everywhere. The habitat notes given will indicate where certain bryophytes have been found but doubtless many species are still undetected on Guam because collectors have not yet discovered all the niches.

Many bryophytes are seasonal, so collecting should be conducted throughout the year. The fruiting times of mosses are still little known and records for Micronesian species are completely lacking—in fact, many Micronesian bryophytes are known only in the sterile condition. Specimens with sporophytes are much desired for identification of certain groups, but the apparent absence of capsules should not discourage collecting. Most mosses and liverworts can be accurately identified from vegetative material and the keys are so constructed. Some hepatics, especially Lejeuneaceae, usually have perianths and so these easily observed features are used in that section of the key.

The Division Bryophyta has been recognized for over 100 years as a more or less natural group of rather primitive, non-vascular, archegoniate plants. Bryophytes share a pattern of well-defined alternation of generations with the monoploid gametophyte being a green autotrophic, usually perennial, plant which may be either a thallus or a stalked "leafy" plant. The sporophyte usually contains chlorophyll at some point in its life cycle, but there is considerable evidence that the photosynthetic rate is not great enough to support the sporophyte independently. Thus, development of the sporophyte and spore production is dependent to some degree upon the excess photosynthate produced in the gametophyte.

Gametes are produced within multi-cellular sterile-jacketed, usually stalked, gametangia—the antheridia and archegonia. The antheridia are spherical to oblong-cylindric and rupture distally, often by forming a capped pore which opens on maturation of sperm under favorable conditions for release. Archegonia are flask-shaped, contain a single, large, abundantly cytoplasmic, egg cell, and open by a distal pore upon maturation when conditions are favorable for fertilization. Although several archegonia are produced in a cluster, usually only one fertilized egg develops into a sporophyte from each sexual bud.

The monoploid spores are usually unicellular, sculptured and free from the tetrad when mature. Upon germination, a chlorophyllose filament, called a protonema, is formed. The developing filament may almost immediately elaborate into a plant body as with Hepaticae, a chlorophyllose plate as with Sphagnopsida, or an extensively branched filament as in many Musci. A single plant develops from the protonema in all but the mosses where several leafy gametophyte buds may be produced with each becoming a separate plant.

Class ***Hepaticae***—Common names applied to members of the group include "hepatic," "liverwort" or "scale-moss." Although there is considerable diversity in gametophyte morphology, the overall homogeneity and numerous transitional types between diverse forms suggests that a single Class, Hepaticae (Hepatopsida), is represented. The structure of the determinate hepatic sporophyte varies even less than that of the gametophyte.

Primitive hepatics, as *Mastigophora*, have a central axis, and three ranks of subequal leaves. Two major patterns of gametophyte development evolved and each has achieved a high degree of specialization in tissue organization. In one instance, the thallus has become a prostrate, complexly organized and differentiated expanded leafless plant as *Marchantia*. Erect, prostrate, or pendent hepatics with simply organized, mostly leafy, thalli comprise the second evolutionary pattern, and are most abundantly represented in our area.

Class ***Musci***—The "mosses" are diverse with three distinct groups best distinguished by their sporophytic structure, although there are corollary gametophytic differences.

The peat mosses, unknown in Micronesia, produce a spherical capsule with a simple distal pore, a very short seta, and an expanded foot buried in an elongate gametophytic pseudopodium. The large leaf cells which are dead, porose, and internally reinforced by spiral bands of secondary wall, are capable of absorbing and storing a great deal of water. These large porose cells are bounded by much smaller, narrowly elongate, living, chlorophyllose cells. The protonema is a unistratose chlorophyllose thallus.

The true mosses produce a capsule with (usually) a subopercular hygroscopic peristome, an elongate seta and an expanded foot buried directly in the vegetative gametophyte. Leaf cells are usually heavily chlorophyllose and uniform throughout most of the blade. The protonema is an alga-like branched chlorophyllose filament.

The rock mosses, unknown in Micronesia, superficially resemble the Musci but the capsule is borne on a pseudopodium and opens by means of four vertical slits. Leaf cells are uniform and very thick-walled. The protonema is at first cylindrical becoming strap-like somewhat resembling that of *Sphagnum.*

Class ***Anthocerotae***—The "hornworts" have a simply organized chlorophyllose thallus bearing antheridia in surface cavities, buried archegonia, and indeterminate sporophytes. The presence of primitive tracheid-like cells in parts of the columella in some species suggests that the anthocerotes have evolutionary ties with vascular plants.

Key to Classes of Bryophytes

Plants leafy, mostly radially symmetrical, but, if flattened, with elongate cells or a costa in the leaves, sporophyte determinate, persistent with a distinct cap which falls off preceding the release of spores ....Class ***Musci*** (p. 52)

Plants thallose or leafy, mostly bilaterally symmetrical, flattened, with isodiametric cells in the ecostate leaves, sporophyte determinate, evanescent, and opening explosively into four valves.....................Class ***Hepaticae*** (p. 68)

Plants thallose, flattened and sometimes winged, sporophyte green, persistent, and indeterminate with a basal meristem, valves two..Class ***Anthocerotae*** (p. 68)

MUSCI

I have attempted to account for the names of mosses reported for Guam and the islands to the north. Many species are reported on the basis of a single record and may have been erroneously assigned. It has been impossible in this compilation to do more than provide short descriptions and keys based upon Bartram's (1939) "Mosses of the Philippines" and other publications. Where the names given here differ from those previously reported, a short explanation is given. Probably about half the species of mosses to be found on Guam have been reported and many problems will be encountered in identification. By expanding the keys somewhat to include the northern islands it is hoped that genera not yet known but present on Guam have been included.

Key to the Genera of Mosses of Guam and Northern Micronesia

1. Plants erect, dichotomously branched if at all, acrocarpous 2

1. Plants prostrate or pendant, pinnately branched, pleurocarpous 18
2(1). Plants flattened with leaves in two rows, the upper half of the blade double toward the base .... *Fissidens*
2(1). Plants radially symmetrical with leaves in several rows, blade not conduplicate 3
3(2). Plants white or pale glaucous green, leaves several cells thick with large empty, porose hyaline cells 4
3(2). Plants green yellowish to brownish or black, with leaves one cell thick in the blade 6
4(3). Leaves strap-shaped with an abruptly cuspidate tip, margin bordered only on basal lamina .... *Octoblepharum*
4(3). Leaves lanceolate, acute to acuminate, margin bordered above the basal lamina 5
5(4). Border several cells thick, costa often toothed on back near tip, costa with a median row of stereid cells in cross-section .... *Leucophanes*
5(4). Border one cell thick, costa smooth, costa lacking a median row of stereid cells in cross section .... *Leucobryum*
6(3). Leaves with a sharply defined group of enlarged, thin-walled rectangular hyaline cells on either side of the costa in the leaf base 7
6(3). Leaves with unmodified basal cells or, if enlarged, not in a sharply defined group and hyaline 9
7(6). Leaves unbordered or, if bordered, with the border submarginal or with marginal cells of a thickened border essentially isodiametric... *Calymperes*
7(6). Leaves bordered with a marginal band of thick-walled elongate cells. 8
8(7). Leaves broadly ovate with the border in the basal region more than 6 cells wide becoming narrower above ..... *Thyridium*
8(7). Leaves linear to ligulate-lanceolate with a narrow border extending the length of the leaf .... *Syrrhopodon*
9(6). Cells of the leaf blade isodiametric 10
9(6). Cells of the leaf blade elongate, rhomboidal to linear 15
10(9). Leaves with a distinct border of fusiform thick-walled cells.. 13
10(9). Leaves unbordered 12
11(10). Leaves crisped, confluence of the borders forming an apiculus, plants pale yellow-green .... *Distichophyllum*
11(10). Leaves plane, costa penetrating the apiculus if present, plants green to dark green .... *Mnium*
12(10). Closely spaced leafy branches arising from a leafless prostrate stem, mostly epiphytic, rarely over rock .... *Macromitrium*
12(10). Plants separate, dichotomously branched if at all, mostly on soil or on damp rock 11
13(12). Leaf apex mucronate or with an abruptly constricted apiculus ... *Barbula*
13(12). Leaf apex rounded above or broadly pointed 14
14(13). Leaves narrowly lingulate, margin crenulate, convex lamina cells .... *Weisiopsis*
14(13). Leaves oblong-elliptic to ovate, margin denticulate above, cells lightly papillose .... *Hyophila*

15(9). Cells rectangular, papillose by projecting ends of the cells...... *Philonotis*
15(9). Cells rhomboid, smooth 16
16(15). Leaves ecostate or with costa short and double .... *Hookeria*
16(15). Leaves with a single long costa............................ 17
17(16). Leaves contorted when dry, bordered or with cells somewhat elongate toward margins, blade cells rhomboidal to 65 μ long .... *Bryum*
17(16). Leaves appressed when dry, unbordered, blade cells narrowly rhomboidal 70–90 μ long.................................. *Brachymenium*
18(1). Costa single.. 19
18(1). Costa double, usually short, or none........................ 27
19(18). Leaves smooth 20
19(18). Leaves papillose... 23
20(19). Leaves strongly dimorphous, costa long excurrent ..... *Rhacopilum*
20(19). Leaves not or scarcely dimorphous, costa shorter than the blade 21
21(20). Leaves bordered with a band of elongate cells, median leaf cells isodiametric, hexagonal .... *Distichophyllum*
21(20). Leaves unbordered, median leaf cells rhomboid to linear............ 22
22(21). Plants fine, wiry, margins strongly serrate, cells rhomboidal, leaf base normal.. *Fabronia*
22(21). Plants robust, margins serrulate, cells linear, leaf base auriculate.. *Calyptothecium*
23(19). Stem leaves ± broadly triangular, cells isodiametric 24
23(19). Stem leaves lanceolate, cells oblong to linear 26
24(23). Plants irregularly pinnate, paraphyllia absent from stems ... . *Claopodium*
24(23). Plants regularly bi-tri-pinnate, filiform paraphyllia present on stems 25
25(24). Plants delicate, wiry, bipinnately branched, calyptra campanulate, seta rough, stem leaves to 0.7 mm long .... *Pelekium*
25(24). Plants medium to large with ascending branches, calyptra cucullate, seta smooth, stem leaves 1.0+mm long .... *Thuidium*
26(23). Leaf cells pluripapillate with papillae over both walls and lumen.. *Papillaria*
26(23). Leaf cells seriate-papillate with papillae in a row over the lumen.. *Floribundaria*
27(18). Robust, flattened, pendant pale green plants with broadly pointed undulate leaves .... *Neckeropsis*
27(18). Smaller, terete to somewhat complanate plants attached to the substrate 28
28(27). Alar cells differentiated, often much inflated and pigmented. 29
28(27). Alar cells scarcely distinct, sometimes a single cell at the decurrent angle may be somewhat inflated 33
29(28). Leaf cells smooth 32
29(28). Leaf cells papillose by projecting ends of cells or seriate-papillose ... 30
30(29). Cells seriate-papillose .... *Taxithelium*
30(29). Cells papillose by projecting ends of cells 31

31(30). Branches with clusters of brood-filaments at tips, alar cells quadrate, 10 μ, numerous, yellowish .... *Clastobryella*
31(30). Branches normal, alar cells inflated, to 20 μ or more, 2-4 at base, hyaline or colored .... *Meiothecium*
32(29). Leaves curved, 3-4 inflated alar cells .... *Sematophyllum*
32(29). Leaves straight, numerous quadrate alar cells .... *Entodon*
33(28). Leaf cells papillose by projecting ends of cells .... *Chaetomitrium*
33(28). Leaf cells smooth 34
34(33). Plants unbranched or nearly so, stems with leaves nearly 1 cm wide .... *Hookeria*
34(33). Plants frequently branched, stems with leaves 1.0-3.5 mm wide 35
35(34). Areolation lax, cells 15-18 μ wide .... *Vesicularia*
35(34). Aerolation firm, cells 3-7 μ wide 31
36(35). Leaves asymmetrical, often curved .... *Ectropothecium*
36(35). Leaves symmetrical. usually straight................ *Isopterygium*

Fissidentaceae

Represented by the single genus *Fissidens* in our area.

FISSIDENS Hedwig

Small to medium plants with distichous equitant leaves flattened in one plane, the basal portion of the upper half of the leaf blade split into two blades which clasp the stem or the base of the leaf above. Leaf cells uniform, in one layer, hexagonal or rounded. Costa usually present, ending in or below apex. Setae terminal or lateral. Capsule erect or inclined with a single peristome of 16 teeth split to or below middle into two narrow forks. Spores small, smooth and hyaline but with chloroplasts.

Moist rocks, soil banks or, often, tree roots are substrates for *Fissidens*. The plants are often small, scattered, and exasperating to collect because of the time and care which must be taken to get relatively small amounts of material. It is a large genus of about 800 species, mostly tropical.

1. Leaves ecostate, plants 2-3 mm high, known only from Hahajima in Micronesia .... *F. hyalinus* Wilson & Hooker
1. Leaves costate 2
   2. Small plants 5-6 mm high, leaves not bordered, margins crenulate, cells small, coarsely papillose ......*F. braunii* (C. Müller) Dozy & Molkenboer
   2. Larger plants to 40 mm high, leaves with a thickened border, margins irregularly toothed, cells small, minutely papillose ......*F. nobilis* Griffith

Leucobryaceae

Small to robust, pale green or whitish plants often tinged with brown. Leaves crowded, often fragile, strict or curved; costa broad, in cross-section showing a median row of small chlorophyllose cells (chlorocysts) covered on both sides by one or more layers of large hyaline cells (leucocysts), porose on inner walls, cells of true lamina large, hyaline, mostly confined to basal portion of leaf near margins. Seta erect, solitary; capsule erect and subcylindric or inclined, asymmetrical and strumose; peristome teeth 8 or 16, entire or cleft above; lid rostrate, calyptra cucullate.

Leucobryum Hampe

The only species known from our area is *Leucobryum boninense* described by Sullivant & Lesquereux in 1859 and known only from that collection. The plants are described with linear-lanceolate leaves, somewhat convoluted above, with the tip serrate on the margins and smooth on the back.

Leucophanes Hampe

Leaves narrowly lanceolate, strongly keeled; costa broad and thin with a median strand of stereid cells; bordered all around with a narrow band of very elongate cells with thickened yellowish walls.

Humus substrate, as coconut husks, logs, and tree trunks, is always associated with *Leucophanes*. The plants form extensive deep tufts when well developed and may serve as a "seed bed" for many epiphytic vascular plants because of their great water holding capacity. The following key *may* serve to distinguish the species reported.

1. Leaves linear-lanceolate, tips acuminate with fine teeth .... *L. smaragdinum* (Mitten) Jaeger.
1. Leaves lanceolate, tips acute with coarse, sometimes double, teeth .... *L. subglaucescens* C. Müller *in* Dixon

Gaudichaud's report of *Syrrhopodon rigescens* probably belongs here.

Octoblepharum Hedwig

The widely spreading, strap-shaped, whitish, shiny leaves give the individual plants a stellate aspect not shared with other members of the family. The peristome of 8 teeth is distinctive as are the minute, axillary male buds. In addition to growing on humus, tufts are often found in lower crotches of large trees. The first Micronesia collection was made on Guam or Rota by Gaudichaud in 1818 and it was next collected in 1965 in the windward cliff forests of northern Guam.

Calymperaceae

Small or robust tufted plants, mostly on trees, with erect dichotomously branched stems. Leaves crowded, sheathing at base, often with a hyaline or thickened border; costa strong, convex on back, often papillose or spinose on one or both sides, ending near apex to excurrent, frequently with clusters of spindle shaped 6–10 celled propagula at tip; interior cells of leaf base (cancellinae) large, rectangular or quadrate, hyaline, changing abruptly to the small rounded or hexagonal often papillose cells of the leaf blade. Capsule erect, peristome single, of 16 deeply inserted teeth, or none. Sporophytes rare.

Syrrhopodon Schwaegrichen

Leaves crowded, strict or contorted, lanceolate, linear-lanceolate to narrowly linear from an erect, clasping, whitish base, usually with a narrow hyaline border;

more rarely with a thickened concolorous border or unbordered; costa strong ending in or near apex; upper cells small usually more or less papillose, changing abruptly to cancellinae.

1. Cancellinae extending to or beyond mid-leaf 2
1. Cancellinae confined to leaf base 3
   2. Leaves erect, appressed when dry chlorophyllose cells smooth .... *S. revolutus* Dozy & Molkenboer
   2. Leaves with spreading flexuose points when dry, chlorophyllose cells papillose .... *S. rufescens* Hooker & Greville
3. Small plants, margins long ciliate, plants often scattered .... *S. ciliatus* (Hooker) Schwaegrichen
3. Robust plants with linear leaves, margins entire or toothed, plants loosely gregarious .... *S. croceus* Mitten

The last two species are not reported from our area but they should be found there.

Thyridium Mitten

Primary stems creeping with branches sometimes erect, the branching pattern sometimes suggestive of a pleurocarpous moss but clearly dichotomous. Leaves yellowish, crowded, crispate when dry, broadly oblong or lingulate from an erect hyaline, sheathing base, with a broad shiny hyaline border 10–30 elongated cells wide below and disappearing above; upper cells small, thick-walled, papillose.

1. Hyaline margin 12–15 cells wide at widest point, margins somewhat serrate, leaf apex acute .... *T. fasciculatum* Mitten
1. Hyaline margin 25–30 cells wide at widest point, margins nearly entire, leaf apex flared at the tip .... *T. constrictum* (Sullivant) Mitten

The second species not yet confirmed as being present in our area but known in Ponape, Palau, many other Pacific Islands, and the Philippines.

Calymperes Swartz *in* Schwaegrichen

Leaves crispate when dry, lanceolate or ligulate from a broader whitish base; costa stout, usually percurrent, or excurrent in the propaguliferous ("abnormal") leaves forming a thick point with apical clusters of propagula; lamina cells small, in one layer or frequently forming a narrow, thickened, serrate border, changing abruptly at the cancellinae, often with narrow intramarginal bands of elongate cells (teniolae) extending through leaf shoulders upward into the blade.

1. Leaves without teniolae or a thickened border 2
1. Leaves with teniolae or a thickened border 4
   2. Cancellinae scalariform, extending up the costa in a tapered band.... .... *C. hyophilaceum* C. Müller
   2. Cancellinae obovate to rounded above, not extending along the costa. 3
3. Leaf base broader than blade, costa without stereid cells.. *C. dozyanum* Mitten
3. Leaf base about the same width as blade, costa with stereid cells........ .... *C. tenerum* C. Müller
   4. Cancellinae scalariform, extending up the costa in a tapered band.... .... *C. semperi* Hampe

4. Cancellinae rounded above, not extending along the costa 5
5. Leaves with a triangular thickened border, leaf base not expanded....... .... *C. tahitense* (Sullivant) Mitten
5. Leaves with leaf border not thickened, leaf base obovate and abruptly narrowed to blade.............................. *C. mollucense* Schwaegrichen

The most common Micronesian species, *C. dozyanum*, is not yet confirmed for our area.

Pottiaceae

Small or medium-sized densely tufted plants growing on soil or rock. Stems erect, dichotomously branched, if at all. Leaves crowded, more or less crispate when dry, costa strong, excurrent or ending near apex; upper cells small, papillose, often obscure, basal cells larger, rectangular, frequently hyaline. Seta erect, elongate, smooth; capsule erect, cylindric or ovoid-cylindric, symmetrical; peristome, when present, of 16 erect or spirally twisted, sometimes split, teeth from a short cylindrical basal membrane.

Hyophila Bridel

Tufts dark green above, reddish brown below. Stems erect, 1–1.5 mm high, leaves uniform throughout. Leaves contorted when dry, widely spreading when moist, up to 3 mm long and nearly 1 mm wide, oblong-lingulate, concave from a clasping base, blunt at the apex; margins strongly involute when dry, erect or lightly inflexed when moist, irregularly denticulate toward the apex; costa often brownish-red, strong, tapering, smooth, percurrent; upper cells rounded, somewhat thick-walled, faintly papillose, basal cells rectangular pellucid, shorter and subquadrate toward the margins.

Represented in our area by collections of *Hyophila involuta* (Hooker) Jaeger from along the Ugum River and at the north end of Tumon Bay. It normally grows on damp rocks in shaded areas and is widely distributed from India to Hawaii. The widely spread, broad leaves with a darker costa and an irregularly toothed margin are distinctive.

Weisiopsis Brotherus

The plants are green, very short stemmed, and densely foliate. Leaves curled-crispate when dry, erect-spreading when moist, narrowly lingulate, rounded obtuse, to 2 mm×0.4 mm, margins crenulate; costa ending in the tip of the leaf; cells of the base oblong, hyaline, thin-walled, about 16 μ wide; cells of the lamina round, mammilose-papillate. Seta 7–9 mm long, red, capsule erect, oblong-cylindrical, brown, 1.5 mm long.

This small genus of eight species is represented in our area only by *Weisiopsis hollandii* Bartram collected from "Limestone forest about 6 mi. N of Agana, 2 mi. inland from W coast, on rock 5 in. in diameter."

"A unique species characterized by the narrow, lingulate leaves, crenulate margins, and the large chlorophyllose, convex lamina cells" (Bartram, 1960).

Barbula Hedwig

Slender, tufted plants usually tinged with brown. Leaves lanceolate or ligulate, contorted when dry; costa percurrent or short excurrent; basal cells rectangular, not sharply differentiated from the lamina cells which are usually small, rounded or subquadrate, and papillose. Capsules erect, cylindric, on slender, elongate setae; peristome with 16 teeth split into 32 thread-like spirally twisted segments extending from a basal membrane; lid conic rostrate.

1. Leaf apex bluntly acute or obtuse, leaves to 1.5 mm long, peristome teeth oblique but not twisted .... *B. indica* (Schwaegrichen) Bridel
1. Leaf apex obtuse but mucronate, leaves ca. 2.0 mm long, peristome long and twisted .... *B. obscuriretis* Dixon

Bartram indicates *Barbula indica* "seems to find a congenial habitat on city walls," and it should be sought in such places in our area.

Bryaceae

Plants of variable size, usually tufted. Stems erect, often with subfloral innovations. Lower leaves small, upper larger, lanceolate; costa ending in or near apex; cells linear to rhomboidal, thin-walled, smooth, often narrower in several rows at margins. Seta elongate; capsule inclined or pendulous, rarely erect, clavate or pyriform with a distinct tapering neck; peristome normally double, outer composed of 16 lanceolate teeth, inner rudimentary or composed of 16 keeled segments alternating with teeth from a high basal membrane, usually with intermediate cilia; lid short, conical; calyptra usually cucullate.

The Bryaceae is a large family of closely related genera and species which are sometimes very difficult to distinguish except by extremely fine technical differences employed by highly skilled specialists. As many of these differences depend upon peristome and other sporophytic features, the identifications of several species from our area must be considered tentative at best. Fertile specimens are very much needed for more positive identifications.

Brachymenium Schwaegrichen

Small to medium-sized, tufted plants. Stems erect with numerous subfloral branches. Leaves erect or spreading, ovate, acuminate; costa excurrent; cells rhomboidal or linear, smooth. Seta elongate; capsule suberect; peristome double, teeth 16, papillose, basal membrane of inner peristome high, segments short and rudimentary, cilia none.

The sterile moss believed to be *Brachymenium indicum* has been illustrated in the "Bryoflora of the Atolls of Micronesia."

Bryum Hedwig

Small or medium-sized plants. Stems erect, usually with subfloral innovations. Lower leaves small and scattered, upper larger, often in comal tufts; cells smooth, rhomboidal, usually narrower in several rows at margins; costa percurrent or excurrent, rarely shorter. Seta elongate, curved or hooked at tip; capsule generally pendulous, pyriform or clavate with a tapering neck, peristome double, outer of 16 entire teeth, inner pale with a high basal membrane bearing 16 keeled segments alternating with teeth and 1 to 3 intermediate cilia; lid convex, apiculate.

1. Plants silvery, upper leaf cells hyaline .... *B. argenteum* Hedwig
1. Plants green or reddish, leaf cells chlorophyllose 2

2. Leaves unbordered or with one row of elongated cells, leaves lightly contorted when dry .... *B. coronatum* Schwaegrichen
2. Leaves clearly bordered with several rows of elongated cells, leaves spirally contorted when dry .... *B. capillare* Hedwig

Mniaceae

Represented in our area by a single genus.

Mnium Hedwig

Rather large, broad leaved plants forming lax mats or patches. Fertile stems erect with upper leaves crowded in rosulate tufts, sterile branches often prostrate and equally complanate-foliate. Leaves crispate when dry, oblong, short pointed, usually bordered; margins serrate with single or paired teeth; costa stout, percurrent; cells short, smooth, hexagonal, parenchymatous. Seta terminal, elongate; capsule horizontal or pendulous; peristome double, cilia, when present, nodose; calyptra small cucullate; lid rostrate.

The species, *M. maximoviczii* Lindberg and *M. kawadei* Okamura *in* J. Matsumura have been reported for the Bonins but I have been unable to determine anything about the collections. Apparently the only description of *M. kawadei* is the original which has been unavailable, and so I have not been able to compare it with *M. maximoviczii*, a species known from Japan.

Bartramiaceae

Represented in our area by a single genus.

Philonotis Bridel

Usually slender yellow green plants growing on dripping banks or rocks in moderately dense tufts or mats. Stems mostly elongate, laxly erect, with subfloral whorls of innovations, often densely tomentose below. Leaves ovate-lanceolate, acuminate; margins toothed; costa percurrent or excurrent; cells rectangular, normally sharply papillose near apical or basal walls. Seta solitary, terminal, erect, elongate; capsule subglobose, strongly furrowed when dry; peristome double or none; lid broadly convex or flat.

The only collection reported came from wet rocks along a tributary of the Sigua River, and was tentatively referred to *Philonotis asperifolia* Mitten. The specimens were sterile and a positive identification was impossible.

Orthotrichaceae

Represented in our area by a single genus.

Macromitrium Bridel

Medium-sized, brown to golden, plants growing on trees or rocks. Primary stems creeping, mostly leafless, branches usually numerous, erect, forming dense mats or cushions. Leaves crowded, ligulate or lanceolate, acuminate to bluntly pointed with an excurrent costa; upper cells small, rounded, often papillose and opaque, basal cells elongate, smooth, and thick-walled. Seta erect, 6–10 mm in our species, smooth or scabrous; capsule erect, smooth, plicate at mouth, rarely ribbed to base; peristome variable; calyptra large, plicate, normally campanulate, naked or pilose, usually fringed at base.

Gaudichaud's (1828) report of *Macromitrium urceolatum*, an African species, is probably based on *M. semipellucidum* Dozy & Molkenboer, reported from Guam by Bartram (1960). The habit, color, and, when fruiting, the conspicuous pilose calyptra are features which will quickly set *M. semipellucidum* apart from all other mosses on Guam.

Rhacopilaceae

Represented in our area by a single genus.

Rhacopilum Palisot de Beauvois

Medium-sized olive green to brownish plants in mats, usually over rocks. Stems elongate, prostrate, subpinnately branched, laxly foliate. Leaves dimorphous; lateral rows widely spreading, ovate, cuspidate by excurrent costa; cells rounded, smooth papillose, elongate and laxer toward the base; dorsal row (amphigastria) smaller, narrow, erect appressed. Seta elongate; capsule inclined, furrowed when dry; peristome double, lid beaked; calytra cucullate, hairy.

The two species reported from Guam are close and there is some question that they are specifically distinct from one another. The following key incorporates the differences attributed to the taxa.

1. Cells rounded, nearly smooth ....*R. cuspidigerum* (Schwaegrichen) Mitten
2. Cells elongate-hexagonal, usually somewhat papillose ....
   .... *R. pacificum* Bescherelle

Meteoriaceae

Slender or robust plants, often pendant from trees in feathery masses. Primary stems filiform, creeping, secondary stems elongate, flexuose, branched, densely foliate. Leaves ovate-lanceolate, acuminate, costa usually single, slender, ending below apex; cells elongate, often papillose, alar group rarely well-defined. Capsule usually exserted on a slender short seta. Sporophytes rare and unknown in our area.

Papillaria Jaeger & Sauerbeck

Slender plants without lustre. Secondary stems more or less terete, numerous, often pendant in intricate masses. Leaves erect, laxly or closely imbricated, more or less plicate, acuminate, often auriculate at basal angle, costa single, to or beyond mid-leaf; cells narrowly elliptical, incrassate, obscure, finely papillose overall, basal cells pellucid, smooth near costa.

Our only species is *Papillaria intricata* (Mitten) Jaeger which is also known from Fiji, Samoa, and the Solomon Islands.

Floribundaria C. Müller

Slender pale-green plants growing in loose feathery masses. Stems long, prostrate, pinnately branched, branches short or, elongate, flattened. Leaves widely spreading, narrowly ovate-lanceolate, acuminate; costa single, faint and short; cells linear, seriate-papillose.

Floribundaria aurea is known only from Rota in our area and *F. floribunda* only from Guam. Both species are probably present on all the Marianas.

1. Branches feathery-leaved, leaves more or less transparent, mostly with shallow-notched marginal teeth ...... *F. floribunda* (Dozy & Molkenboer) Fleischer
1. Branches sparingly leaved, leaves very heavily papillose, not transparent, mostly sharply toothed .... *F. aurea* (Griffith) Brotherus

Neckeraceae

Usually robust, glossy plants. Primary stems filiform, creeping; secondary stems erect or pendulous, subpinnate, strongly flattened. Leaves complanate, often transversely undulate, short pointed; costa usually single, rarely double and short; cells smooth rhomboidal above, linear toward the base. Sporophyte lateral on branches of secondary (leafy) stems; capsule immersed or exserted; peristome double, endostome with narrow segment, usually from a well-developed basal membrane.

Calyptothecium Mitten

Robust, glossy plants with pinnate branching; branches flattened, blunt at ends. Leaves crowded, in 8 rows, often transversely undulate and usually conspicuously auriculate, oblong to ovate-lanceolate, short acuminate, serrate; costa slender, ending above mid-leaf; cells linear, smooth, laxer and more porose across insertion.

Our species, *Calyptothecium recurvulum* (C. Müller) Brotherus, is reported from Australia, New Guinea and the Marianas without further elaboration by Brotherus (1924–25). Confirmation of this distinctive species with a large auriculate leaf base is desired.

Neckeropsis Reichardt

Robust glossy plants with long, sparingly branched, very flat secondary stems in pendant masses from trees or growing loosely over rocks. Leaves in 4 rows, horizontally spreading, usually undulate, broadly rounded or truncate at apex; costa short and double; cells smooth, short rhomboidal above, more elongate below.

Gaudichaud's reported of *Neckera undulata* from Guam is almost surely our *Neckeropsis lepineana* (Montagne) Fleischer which is locally very abundant in limestone areas and elsewhere on Guam (Stone, 1964).

Hookeriaceae

Small or medium-sized, often flaccid plants with branched more or less flattened stems. Leaves variable in outline, often bordered; costa single or double, usually ending well below apex; cells smooth, often wide and lax, alar group not differentiated. Seta elongate, smooth or scabrous; capsule inclined or horizontal, rarely erect; peristome double, teeth often with a wide median furrow, papillose or striolate; calyptra mitriform, usually lobed or fringed at base, scabrous or pilose.

DISTICHOPHYLLUM Dozy & Molkenboer

Medium-sized to robust plants with somewhat flattened, sparingly branched stems. Leaves dimorphous, dorsal and ventral rows differentiated, crowded, complanate, ovate or spathulate, entire, pointed or rounded at apex, with a narrow border of elongated cells; cells hexagonal, smooth, laxer at base; costa single, ending near or above midleaf.

Both *Distichophyllum fasciculatum* and *D. imbricatum* reported from the "Marioninsel" are from the African region according to the "Index Bryologicus." It is not unlikely that *Distichophyllum* will be found in our area in a wet forest area—and the genus is already known from Ponape, the Philippines, and most of the Pacific Islands.

HOOKERIA Smith

Robust medium green plants with flattened, procumbent, sparingly branched stems. Leaves large, ovate, acute, ecostate or with costa faint, short and double, entire, indistinctly bordered; cells rhomboid, hexagonal, very large and easily discernible with a 10× hand lens.

Hookeria nipponensis (Bescherelle) Brotherus is known from Chichijima in the Bonins. Additional collections should be sought in shady moist grottos as one might find under a waterfall or a steep dripping bank.

CHAETOMITRIUM Dozy & Molkenboer

Medium-sized to small plants growing in dense tufts or mats on trees. Stems elongate, creeping, more or less regularly pinnate, frequently with axillary clusters of brood filaments on ultimate branches. Leaves widely spreading, ovate, concave, short acuminate or rounded, denticulate to strongly toothed, costa short and double or none; cells linear, shorter near apex, papillose at apical angles. Perichaetium large; seta elongate, papillose or setose; capsule more or less inclined; lid long rostrate; peristome teeth striolate, not furrowed; calyptra always strongly hispid or spinose-ciliate, usually fringed at base.

Our species, *Chaetomitrium weberi* Brotherus was thought to be endemic to the Philippines until discovered on Guam. The plants are pale golden green, glossy, complanate, and the short acuminate leaf tip is somewhat contracted below. It was discovered in the limestone forests but should be sought elsewhere as well.

Fabroniaceae

Represented in our area by a single genus.

FABRONIA Raddi

Very slender delicate, almost thread-like plants in thin mats on rocks or trees in somewhat shaded areas. Stems creeping, densely branched, branches ascending. Leaves minute, spreading on all sides, ovate-lanceolate, long acuminate, finely toothed above; costa single, slender; upper leaf cells rhomboidal, quadrate in several rows at basal angles. Seta short, slender; capsule erect, minute; peristome single, teeth in 8 pairs, inserted below rim, endostome none; lid conical, short.

Our single record of *Fabronia marianna* Schwaegrichen *in* Gaudichaud has not been confirmed but the name is recognized as valid in the "Index Muscorum." It is not at all unlikely that *Fabronia* is present on Guam where most of the forest areas would provide suitable habitats.

Thuidiaceae

Slender or robust plants without lustre. Stems copiously branched, often regularly 2- or 3-pinnate, usually with paraphyllia. Leaves often dimorphous, branch leaves smaller and well differentiated, ovate, concave, short-pointed; costa single, stout; cells small, rounded, papillose. Seta elongate smooth to papillose; capsules mostly horizontal, seldom erect, peristome double, perfect, hypnoid in structure; lid conic rostrate; calyptra usually naked, rarely pilose or hispid.

Claopodium (Lesquereux & James) Renauld & Cardot

Slender plants in thin mats over moist to inundated stones. Stems prostrate, more or less irregularly pinnate, paraphyllia minute or none, branches sometimes ascending. Stem and branch leaves similar, ovate, slenderly acuminate, serrulate; costa stout, usually percurrent or short excurrent; cells oval-hexagonal, papillose.

Noguchi (1964) did not review the report of *Claopodium assurgens* (Sullivant & Lesquereux) Cardot but it would not seem unreasonable to find this species, which is unusual in being epiphytic, with its strongly excurrent costa in the Bonins. It is also known from Assam, Java, China, Formosa, Ryukyu, and Japan.

Pelekium Mitten

Rather slender, laxly tufted, wiry, dull yellowish green plants on logs or dead wood, sometimes rock. Stems elongate creeping, regularly bi-pinnate, paraphyllia abundant. Stem leaves distant, filiform-acuminate; branch leaves ovate, concave, blunt, crenulate; costa pectinate on back; cells strongly uni-papillate.

On the atolls *Pelekium velatum* Mitten fruits often so the very rough seta and campanulate, hairy calyptra are available as diagnostic features. It can be recognized when sterile by its loose and somewhat irregular bi-pinnate branching, as well as small size with stem leaves only about 0.7 mm long.

Thuidium Bruch & Schimper

Robust to medium-sized plants with a dull aspect growing in feathery mats over rocks and logs with secondary stems sometimes ascending. Primary stems creeping, bi- to tri-pinnate with abundant paraphyllia. Leaves dimorphous polymorphous with stem leaves larger, from a broad cordate base, long-acuminate; branch leaves smaller on secondary and still smaller on ultimate branches, ovate, concave, short-pointed, costa single, cells rounded, papillose.

Thuidium plumulosum (Dozy & Molkenboer) Dozy & Molkenboer is not uncommon on Guam and will soon be recognized by the arching, very regular bi-pinnate branching. Gaudichaud's report of *Hypnum* (now *Thuidium*) *delicatulum* is probably based on *T. plumulosum*. In the Bonins, *Thuidium micropteris* Bescherelle is a much smaller plant which might be confused with *Pelekium* but the seta is smooth and the cells have numerous low papillae.

1. Plants robust with arching branches, cells uni-papillate .... *T. plumulosum*
1. Plants delicate with branches flattened, cells pluripapillate...... *T. micropteris*

Entodontaceae

Represented in our area by a single genus.

Entodon C. Müller

Glossy green to yellow-green plants in extensive mats over organic substrate. Stems creeping, subpinnately branched, branches usually flattened. Leaves ovate, entire or minutely toothed above, costa short and double or none; cells linear, smooth, subquadrate in a conspicuous alar group. Seta elongate, smooth; capsule erect, cylindric; peristome teeth inserted below rim, often striolate; lid conical.

Entodon cernuus (C. Müller) Jaeger has been reported from Rota and should be present on Guam as well. The species is known otherwise only from Java and our material may be eventually assigned to another species. The shiny, concave, acutely pointed leaves and distinctive alar group 5–7 cells high and 6–9 cells wide will assist in identification.

Sematophyllaceae

Slender to robust plants in dense mats or tufts, often glossy. Stems creeping or ascending, irregularly or pinnately branched. Leaves ovate, mostly acuminate; costa short and double or none; cells linear, smooth or papillose, large and often inflated at basal angles in a conspicuous colored group. Seta elongate, smooth or papillose; capsule small, mostly inclined or horizontal, peristome usually double and perfectly developed; lid rostrate, rarely conical; calyptra cucullate.

Clastobryella Fleischer

Slender, glossy, tufted plants. Stems creeping, densely branched, branches short and suberect, often with clusters of papillose brood filaments toward tips. Leaves ecostate, ovate-lanceolate, acuminate, sharply serrate above; cells linear, smooth or papillose, differentiated and colored at basal angles. Seta smooth or papillose above; capsule erect.

Clastobryella tenella Fleischer reported from Rota is a very small, delicate, yellow green, almost dull moss with leaves almost julaceous. Leaf cells papillose by the thickened angles of the cell wall. Alar cells differentiated, yellowish and inflated.

Meiothecium Mitten

Slender or medium-sized plants in dense tufts or mats, yellowish green, glossy. Stems creeping, branches ascending, blunt, densely foliate. Leaves ovate, concave, ecostate, entire, usually short-pointed; cells oval-rhomboidal, longer below, often obliquely oval in numerous rows toward basal margins, alar cells usually large and inflated. Perichaetium small; seta short, often curved, smooth or slightly pustulate above; capsule erect or inclined; peristome single, teeth usually papillose, endostome none; lid small, conic-rostrate; calyptra small.

The Guam species, *Meiothecium microcarpum* (Harvey) Mitten, is medium-sized and was growing on trees in moist limestone forests. In addition to having 3–4 large inflated alar cells, a group of subrectangular cells extends obliquely up the margin 10–12 cells above the alar group.

Sematophyllum Mitten

Rather small glossy plants in dense mats over logs or trees. Stems creeping, branches crowded, ascending, densely foliate. Leaves erect-spreading, concave, ovate-lanceolate, ecostate, entire or weakly toothed above; cells elongate, smooth, alar cells large and inflated. Seta smooth; capsule small, erect to horizontal, exothecial cells strongly collenchymatous; peristome teeth striolate, with a fine zigzag median line, segments of endostome keeled from a high basal membrane; lid long and slenderly beaked.

The endemic species *Sematophyllum parvifolium* Bartram was collected 5–10 feet up on the bark of *Pandanus* in the limestone forest region. The shiny leaf-bearing stems are 2–3 cm long, irregularly and shortly pinnately branched with leaves somewhat curved when dry but widely spreading when moist, about 1.0 mm long, 0.5 mm wide; cells linear 4–5 μ wide, 40–50 μ long and shorter toward the base, alar cells 3–4, oblong, hyaline. Sporophytes are still unknown.

Taxithelium Spruce

Slender plants growing on bark or logs in thin mats or tufts. Stems creeping, more or less regularly pinnate, branches complanate-foliate. Leaves ovate or ovate-lanceolate, short to long acuminate, usually minutely toothed above, lateral rows spreading and asymmetrical, dorsal and ventral rows slightly smaller and more appressed, ecostate or nearly so; cells linear, seriate-papillose over lumens, rarely smooth, usually differentiated in alar region. Perichaetium small; seta elongate, smooth; capsule ovoid, inclined or horizontal. peristome double, teeth striolate, with a slender zigzag median line, endostome with a high basal membrane; lid conical, short.

1. Leaves short acuminate, 1.0 mm long and 0.4 mm wide, strongly papillose, alar cells 2, inflated yellowish .... *T. instratum* (Bridel) Brotherus
1. Leaves slenderly acuminate, 1.1 mm long and 0.25 mm wide, faintly papillose, alar cells few, slightly inflated, hyaline ... *T. vernieri* (Duby) Bescherelle

These species are easily separable by the characteristics given in the key. Both are known from the limestone forest areas. Micronesian reports of *Taxithelium lindbergii*, an illegitimate name, are properly *T. vernieri*.

Hypnaceae

Small or moderately robust, usually glossy plants growing in intricate mats. Stems creeping, often pinnate or subpinnately branched. Leaves ovate or ovate-lanceolate, acuminate, often falcate-secund; costa short and double or none; cells mostly linear, prosenchymatous, smooth or slightly papillose, alar cells small and poorly differentiated although a decurrent cell at the basal angle may sometimes be enlarged. Seta elongate, slender, smooth; capsule ovoid, more or less asymmetrical, usually horizontal or pendulous; peristome usually double, teeth striolate, segments of endostome keeled, from a high basal membrane, usually with intermediate cilia; lid short, apiculate; calyptra cucullate.

Ectropothecium Mitten

Glossy plants in extensive thin mats often on sandy soil as well as rocks, logs, and trees. Stems more or less regularly pinnate. Leaves symmetrical, usually falcate-secund, ovate-lanceolate, acuminate. costa none or short and double; cells linear, small and poorly differentiated at basal angles. Seta smooth, elongate; capsule horizontal or pendulous, short, ovoid, strongly constricted under mouth when dry; peristome double, normal; lid conical, apiculate; calyptra cucullate.

1. Leaf cells papillose by projecting ends of walls, margin coarsely toothed by a marginal row of short rhomboidal cells, lateral branches 5–8 mm or more long, seta 25 mm long... *E. incubans* (Reinwardt & Hornschuch) Jaeger var. *scaberulum* (Brotherus) Fleischer
1. Leaf cells smooth, margin serrulate, lateral branches 2–8 mm long, seta up to 15 mm long.. 2
   2. Cells of the lamina 6–14: 1, leaves 3–5 times longer than broad, the apex acuminate but slightly falcate, lateral branches 2–4 mm long seta 6–8 mm long .... *E. monumentorum* (Duby) Jaeger
   2. Cells of the lamina 9–20: 1, leaves 5–6 times longer than broad, the apex long acuminate, strongly falcate-secund, lateral branches 4–8 mm long, seta 15 mm long .... *E. dealbatum* (Hornschuch & Reinwardt) Jaeger

The genus *Ectropothecium* is a large one with the differences between species being based upon highly technical criteria to some extent but also on aggregates of individually variable characters. Taxonomic difficulties are many and treatments so far proposed are frustrating to amateur and professional alike. The keys provided should give some basis for provisional assignment of northern Micronesian collections.

Taxiphyllum Fleischer

Medium-sized, shiny, pale green plants. Stems creeping, irregularly branched, very complanate-foliate. Leaves ovate-lanceolate, acuminate, serrulate nearly to base; cells linear-rhomboidal, usually minutely papillose at apical angles. Seta slender, capsule ovoid, inclined; lid rostrate.

Only the type from the Bonin Islands is known for *Taxiphyllum eximium* (Sullivant & Lesquereux) Iwatsuki who noted the presence of foliose pseudo-paraphyllia, and the small leaves, 0.5–0.7 mm long, on the type of *Hypnum eximium*.

Isopterygium Mitten

Mostly slender, glossy, plants growing in flat mats usually on trees or logs. Stems creeping, irregularly branched, branches usually complanate-foliate. Leaves ovate-lanceolate, often asymmetrical, entire or minutely toothed above; costa double and short or none, cells linear, rarely papillose at apical angles, alar group poorly differentiated. Seta smooth elongate; capsule small, nodding; peristome double, usually perfect; lid conical.

1. Branch leaves brownish-green, narrow, nearly symmetrical, about 1.0 mm long and 0.2 mm wide .... *I. multirameum* (C. Müller) Jaeger
1. Branch leaves whitish-green, ovate-lanceolate, asymmetrical, about 0.9 mm long and 0.25 mm wide .... *I. albescens* (Schwaegrichen) Jaeger var. *smallii* (Sullivant & Lesquereux) Iwatsuki

Hypnum subalbidum Sullivant & Lesquereux was assigned by Mitten to *Isopterygium* but it may not belong there. For the present, it is not possible to adequately account for this species. The loose feathery aspect of *Isopterygium* will soon become familiar in the field and, though the distinctions are to some extent matters of degree, the two species keyed should be separable.

VESICULARIA (C. Müller) C. Müller

Medium-sized, usually dull-green plants in extensive mats. Stems elongate, mostly regularly pinnate, branches short, widely spreading, complanate-foliate. Leaves ovate, short to long acuminate, entire or weakly toothed; costa faint or none; cells lax, oval-rhomboidal, chlorophyllose, smooth.

Only *Vesicularia perangusta* Dixon has been confirmed from Guam. Gaudichaud's report of *Hypnum scaturiginum*, an African species of *Vesicularia*, may belong here. Our plant is described as robust, densely branched with crowded, spreading, somewhat falcate, but not complanate, leaves about 1.5 mm long and 0.5 mm wide. The leaves are broadly lanceolate, gradually narrowly acuminate, entire, and ecostate with cells very narrow, 130 μ long, 16 μ wide, gradually more lax below. The sporophyte is unknown. Stone (1964) reported *V. montagnei* (Bel.) Fleisch. from Harmon Field, Guam.

HEPATICAE AND ANTHOCEROTAE

Liverworts and hornworts are much less known from Guam and northern Micronesia than the mosses. In fact, no Anthocerotae have been reported until now and their inclusion is based upon field observations only because the specimens are somewhere in a mass of thousands of collections yet to be studied in detail. The same situation exists with the hepatics. There is no useful or fairly reliable treatment of liverworts from a nearby tropical area that can be drawn upon in the manner possible with Bartram's "Mosses of the Philippines." Therefore, the following treatment is abbreviated and must be considered to be most preliminary. I trust it can, and will, be useful until our studies are farther along and the hepatics begin to receive the attention which has been given the mosses.

KEY TO THE GENERA OF HEPATICAE AND ANTHOCEROTAE OF GUAM AND NORTHERN MICRONESIA

1. Plants thallose, lacking well defined stems and leaves, thallus several cells thick in the middle 2
1. Plants with stems and leaves in either 2 or 3 ranks, leaves one cell thick. 11
   2(1). Plants with erect horn-like or whip-like, indeterminate green sporophytes with a basal meristem, usually fertile (*Anthocerotae*) .. 3
   2(1). Plants with a globose capsule on a determinate, short-lived, hyaline stalked, sporophyte 6

3(2). Spores yellow, brown, or black 5
3(2). Spores green 4
   4 (3). Plants small, 2–5 mm wide with a broad unistratose wing.. *Dendroceros*
   4(3). Plants larger, lacking or with a narrow wing .... *Megaceros*

5(3). Spores yellow and verruculose .... *Phaeoceros*
5(3). Spores brown and coarsely eroded or reticulate ridged .... *Anthoceros*
   6(2). Thallus with a well-defined central strand and a broad unistratose wing 7
   6(2). Thallus convex on one or both sides, central strand lacking, unistratose wing narrow and tapering or absent 9

7(6). Central strand of a few cells only, upper epidermis over central strand 2–4 cells across, plants small 1–2 mm broad .... *Metzgeria*
7(6). Central strand of thick-walled tracheid-like cells surrounded by several

layers of parenchymatous cells, plants large, 3–10+mm broad 8

8(7). Female involucre funnel-shaped and fringed ....*Pallavicinia*

8(7). Female involucre composed of 1–2 bifid to bis-bifid scales..*Symphyogyna*

9(6). Plants small, 1–3 mm wide, uniformly parenchymatous throughout the the thallus, ventral scales absent ....*Riccardia*

9(6). Plants larger 4–20 mm wide, internally differentiated with open air spaces beneath the upper epidermis, ventral scales present........... 10

10(9). Ventral scales in two rows, hyaline and without appendages.*Dumortiera*

10(9). Ventral scales in four rows, reddish and two rows with expanded distal appendages......................................*Marchantia*

11(1). Plants with leaves plane or nearly so.............................. 1

11(1). Plants with unequally bilobed leaves with the lower lobule folded under the upper lobe or, if pendant, then saccate 22

12(11). Plants with three ranks of leaves, the lower (underleaves) usually reduced.. 13

12(11). Plants with two ranks of leaves, underleaves absent or tiny evanescent remnants on the vegetative stem.......................... 20

13(12). Leaves and underleaves similar, deeply bilobed to bis-bifid..*Mastigophora*

13(12). Underleaves reduced, leaves entire or toothed or shallowly bilobed... 14

14(13). Leaves succubous.. 18

14(13). Leaves incubous... 15

15(14). Underleaves entire or shallow bifid, sometimes with a small lateral tooth on each segment.....................................*Calypogeia*

15(14). Underleaves irregular, trifid, or if bifid, with filamentous segments... 16

16(15). Underleaves entire or irregularly and shallowly dentate ....*Bazzania*

16(15). Underleaves deeply segmented................................ 17

17(16). Stem cells in cross-section of about equal diameter throughout, leaf insertion more or less plane..................................*Lepidozia*

17(16). Stem cells in cross-section much larger in the single cortical layer than in the medulla, leaf insertion oblique to squarrose ....*Acromastigum*

18(14). Male branches with reduced saccate, nearly transverse bracts subtending the antheridia.................................*Lophocolea*

18(14). Male branches with scarcely reduced bracts with antheridia in the axil of a small dorsal flap 19

19(18). Underleaves rounded, about equally 6–8 ciliate, leaves broadly ovate, usually entire...*Chiloscyphus*

19(17). Underleaves more or less rectangular, usually bis-bifid, leaves rectangular, often distally ciliate ....*Heteroscyphus*

20(12). Leaves orbicular or nearly so, margin entire, cortical stem cells thin-walled...*Plectocolea*

20(12). Leaves elongate to triangular or emarginate bilobed, cortical stem cells thick-walled with a relatively small lumen 21

21(20). Leaves ciliate-margined.......................................*Plagiochila*

21(20). Leaves entire but shallowly bilobed......................*Anastrophyllum*

22(11). Rhizoids attached from the midpoint of each lobule, underleaves absent, lobule plane or nearly so ....*Radula*

22(11). Rhizoids attached to the stem or the base of an underleaf, underleaves present or absent, if absent then lobule inflated at least in the basal portion 23
23(22). Lobule plane, oblong, approximately parallel to the stem, neither inflated or saccate, somewhat resembling the underleaf in size and outline .... *Porella*
23(22). Lobule inflated and adnate to the stem or free and cylindrical saccate 24
24(23). Lobule free and cylindrical saccate, underleaves one per pair of lateral leaves .... *Frullania*
24(23). Lobule adnate to the stem, underleaves present either one per pair of lateral leaves, or one per leaf, or none 25
25(24). Underleaves one per pair of lateral leaves 26
25(24). Underleaves one per leaf or absent entirely 44
26(25). Underleaves bifid 37
26(25). Underleaves undivided 27
27(26). Underleaves reniform more than twice broader than long and larger than leaves, deeply inserted .... *Symbiezidium*
27(26). Underleaves orbicular to subreniform and not larger than leaves, insertion transverse or shallow 28
28(27). Female inflorescence without innovations, borne terminally on a short lateral branch 29
28(27). Female inflorescence terminal with one or two innovations which develop into a main branch or stem 31
29(28). Perianth smooth without a fringed or toothed keel, in cross-section round with 3–10 smooth, weakly inflated, keels .... *Ptychocoleus*
29(28). Perianth flattened in cross-section with 3–4 angled keels.............. 30
30(29). Perianth almost flat with 4 keels in cross-section, keel winged or strongly toothed, lobule without a clear apical tooth, cells of lobe ordinarily somewhat strongly thickened .... *Lopholejeunea*
30(29). Perianth 3 keeled with smooth or toothed keels, lobule extending beyond the well-defined tooth, cells of lobe with nodular trigones and intermediate thickenings .... *Caudalejeunea*
31(28). Perianth with a well-defined ventral keel, in cross-section 3 angled... 32
31(28). Perianth lacking a ventral keel or with more than 3 keels, in cross-section flat or 4–10 angled 33
32(31). Bracts, bracteoles, and perianth keels both toothed ..... *Thysananthus*
32(31). Bracts, bracteoles, and perianth keels entire .... *Mastigolejeunea*
33(31). Bracts and bracteoles somewhat toothed in the female inflorescence, leaves and underleaves often toothed as well 36
33(31). Bracts, bracteoles, leaves and underleaves always entire.............. 34
34(33). Perianth more or less rounded, 5–10 keeled .... *Brachiolejeunea*
34(33). Perianth clearly 4 keeled with 2 lateral and 2 sharp ventral keels. 35
35(34). Androecia terminal or intercalary on stems or main branches, secondary stems distinctive, plant dark .... *Archilejeunea*
35(34). Androecia on short side-branches only present near the base of the underleaf, primary and secondary stems little differentiated, plants

pale . . . . *Leucolejeunea*

36(33). Perianth many angled even in the young stages . . . . *Ptychanthus*

36(33). Perianth three keeled in young stages later, because of secondary folding, with more angles . . . . *Spruceanthus*

37(26). Leaf lobes acutely pointed or toothed, underleaves with filamentous segments or with segments at least attenuated 38

37(26). Leaf lobes entire and rounded, underleaves rounded with broad, never attenuated, segments 40

38(37). Underleaf segments 3 or more cells broad at the base, perianth with 3 rounded keels, female bracts and bracteole entire. *Taxilejeunea*

38(37). Underleaf segments 1-2 cells broad at the base, perianth sharply 5 keeled, female bracts and bracteole toothed 39

39(38). Underleaves bounded by enlarged, elongate-rectangular cells, basal disc rectangular, segments acicular, female inflorescence on a short lateral branch . . . . *Leptolejeunea*

39(38). Underleaves with marginal cells little differentiated, basal disc usually rounded, segments filamentous but somewhat broader at the base, female inflorescence terminal on a main stem or branch . . *Drepanolejeunea*

40(37). Leaf lobes with a hyaline border 3-6 cells wide . . . . *Tuyamella*

40(37). Leaf lobes unbordered 41

41(40). Lobule nearly half the size of the lobe or larger, plants very small, stem somewhat sinuate . . . . *Microlejeunea*

41(40). Lobule mostly $^1/_4$ the size of the lobe or less, plants medium with straight stems 42

42(41). Tooth of lobule 3-4 cells long, trigones and intermediate thickenings strong . . . . *Cheilolejeunea*

42(41). Tooth of lobule a single cell, trigones and intermediate thickenings weak or absent 43

43(42). Cells of the lobe thin-walled, underleaves bifid about half . . . . . . *Lejeunea*

43(42). Cells of the lobe with somewhat irregularly thickened walls, underleaves bifid about $^1/_4$ . . . . *Hygrolejeunea*

44(25). Underleaves one per leaf, leaves with a reduced orbicular lobe and an enlarged subcylindrical to cylindrical lobule, plants almost always epiphyllous . . . . *Colura*

44(25). Underleaves absent, sometimes a tuft of rhizoids at the site of an underleaf, plants mostly epiphytic or epiphyllous . . . . . *Cololejeunea*

ANTHOCEROTAE

Anthocerotaceae

The genera *Anthoceros* and *Phaeoceros* usually grow on moist mineral soil in fairly bright light as found on the clay banks near the base of Talofofo Falls. *Megaceros* is usually found on mosit humus in a shaded place or on a dripping bank. I collected a *Dendroceros* on the bases of dwarf shrubs and even tall grass on the exposed summit of Mt. Togpachao, Saipan. It is possible that *Notothylas* in the Notothylaceae will be found in old pastures on disturbed mineral soil, as cow tracks, in the rainy season. It is recognizable because the sporophyte is short and inclined rather than erect. Anthocerotae on mineral soil tend to be ephemeral, appearing only in the latter part of the rainy season.

HEPATICAE

Ptilidiaceae

MASTIGOPHORA Nees ab Esenbeck

Robust yellow-brown to dark brown plants in deep tufts on logs or trees. Branches almost fasicled, intercalary, often tapering becoming flagelliform. Leaves and underleaves nearly alike; bifid about half with prominent lateral teeth or auricles near the base. *Mastigophora diclados* (Bridel) Nees is known from the Bonins as well as high islands of the Carolines and Indo-Malaysia.

Lepidoziaceae

BAZZANIA S. F. Gray; ACROMASTIGUM Evans; LEPIDOZIA DuMortier.

Small to medium green plants, becoming yellow on drying, with incubous dentate to shallowly lobed leaves and reduced toothed or segmented underleaves. Branches intercalary in the axil of the underleaves usually microphyllous and flagelliform but occasionally becoming normal. These are plants of humus soil or a rough plant surface as a tree fern trunk. *Bazzania intermedia* (Gottsche & Lindenberg) Trevisan and *B. platycnema* (Schwaegrichen *ex* Stephani) Miller are reported from the Marianas. Both *Lepidozia* and *Acromastigum* have been observed.

Calypogeiaceae

CALYPOGEIA Raddi

Horikawa collected *Calypogeia arguta* Nees on Chichijima but no other records are known for Micronesia. The incubous leaves with a rounded notch at the tip and the bis-bifid underleaves a little wider than the stem serve to distinguish this species. As entire leaved species are not uncommon on moist, often humus, soil in shady places, these may be discovered but they should key correctly.

Lophocoleaceae

LOPHOCOLEA DuMortier; CHILOSCYPHUS Corda; HETEROSCYPHUS Schinffer

Only *Heteroscyphus argutus* (Nees) Schiffner (as *Chiloscyphus*) is reported from our area on the basis of a collection from Hahajima. Although reliable differences are given in the key, *Lophocolea* and *Chiloscyphus* can usually be separated by the following variable vegetative characters: *Lophocolea*—leaves shallowly bifid with two sharp points or at least bi-ciliate; underleaves distant to approximate, bis-bifid to bifid with basal disc small, plants often brown when dry; *Chiloscyphus*—leaves rounded to emarginate, underleaves imbricate to approximate, often with two or more lateral teeth on each segment with basal disc larger, plants usually greenish to pale yellow when dry.

Lophoziaceae

ANASTROPHYLLUM (Spruce) Stephani

Our representative, *Anastrophyllum subcomplicatum* (Lehmann & Lindenberg)

Stephani, is described as being small, reddish, sparsely branched with stems about 15 mm long. Leaves crowded, erect, often imbricate, somewhat obcordate with the apex to 1/3 emarginate with the lobes broadly triangular, subequal with the upper a little smaller. This has apparently not been collected since before 1838 and its rediscovery would be welcomed.

Jungermanniaceae

Plectocolea Mitten

The genus *Plectocolea*, represented in our area by *P. boninensis* (Horikawa) Miller (=*Eucalyx boninensis* Horikawa. Journ. Sci. Hiroshima Univ., Ser. B, Div. 2, 2: 142. 1934), is often considered a subgenus of *Jungermannia* but seems amply distinct in the twisted perianth, more flaccid leaves, stem anatomy and leaf insertion. At least one *Plectocolea* occurs on moist mineral clay soil in the vicinity of Talafofo Falls and others should be sought. The smaller more squarrose-leafed *Solenostoma*, which would key here, might also be encountered. I have not been able to place *Jungermannia diversifolia* Lehman & Lindenberg (Pugillus 7: 5. 1838) exactly but it has been compared with *J. decipiens*, now *Adelanthus*, and the plant probably should be called properly *Adelanthus diversifolia*. The 2–3 ciliate margins would set it off at once from *Plectocolea*.

Plagiochilaceae

Plagiochila DuMortier

The single species of *Plagiochila* reported from our area, Hahajima, is now called *P. acanthophylla* Gottsche subsp. *japonica* (Sande Lacoste) Inoue. Other species should be discovered in moist forest areas on trees or rotting logs. The ciliate-margined succubous leaves on secondary stems arising from a prostrate leafless rhizome distinguish *Plagiochila* from most other hepatic genera.

Radulaceae

Radula DuMortier

The genus *Radula* is one of the best known of all major genera as a result of the painstaking monographic work by Castle (1966 and previously). He confirms *Radula javanica* Gottsche on Guam. The rather large plants are yellow-brown and form loose pendant mats on exposed roots in the forest. I believe I have observed at least two species, one smaller, on Guam.

Porellaceae

Porella Linnaeus

The genus *Porella* is referred to as *Madotheca* by some authors reluctant to accept the Linnaean name. It is a curiosity in botanical names that *Madotheca parvistipula* Stephani reported from Hahajima should become *Porella grandiloba* Lindberg but the case seems clear. These are mostly robust, epiphytic hepatics which may form dense extensive masses over moist rocks as well. The underleaves similar to lobules are so distinctive that confusion with other genera is unlikely.

Frullaniaceae

FRULLANIA Raddi

Although *Plagiochila* is the largest genus of hepatics, *Frullania* is nearly as large and is much more abundantly represented on Guam. The free cylindrical to helmet-shaped lobules (water sacs) are found only on this genus in our area. Verdoorn (1930, et seq.) included Micronesia in his revision of the genus and it is possible to prepare a provisional key to the species reported from our area:

1. Saccate lobule pendant from lobe with the open end toward the stem tip .... *F. nodulosa* (Reinwardt, Blume & Nees) Nees
1. Saccate lobule parallel to the stem, or at an angle to it, but with the open end always away from the stem tip 2
   2. Lobule about as broad as long, helmet-shaped........................ 3
   2. Lobule longer than broad, cylindrical to clavate...................... 5
3. Lobes of leaves squarrose when wet, some lobules not completely closed to form a sac....................... *F. squarrosa* (Reinwardt, Blume & Nees) DuMortier fo. *ericioides* Nees
3. Lobes of leaves plane or nearly so when wet, lobules mostly closed to form a water sac 4
   4. Underleaves nearly as large as leaves, lobules hidden beneath them .. .. *F. grandistipula* Lindenberg
   4. Underleaves smaller than leaves, lobules at least partially exposed. .... *F. viridis* Horikawa
5. Lobule conical-papillate and about $^1/_4$ the size of the lobe, plants small, 0.6 mm wide with leaves............................ *F. curiosissima* Horikawa
5. Lobule smooth or nearly so, proportionately smaller, plants larger, not less than 0.8 mm wide with leaves 6
   6. Underleaves 3–4× the diameter of the stem, auriculate at the insertion, lobule very small, approximate to stem ..*F. gaudichaudii* Nees & Montagne
   6. Underleaves 1–2× the diameter of the stem, insertion transverse and simple, lobule larger and distant from the stem a lobule width or more. 7
7. Leaves with an unmistakable apiculate tip, underleaves about twice the stem width and bifid about $^1/_3$ .... *F. apiculata* (Reinwardt, Blume & Nees) Du Mortier
7. Leaves with a rounded tip, underleaves a little wider than the stem and bifid about $^1/_2$ .... *F. boninensis* Horikawa

Previously reported species and their equivalents in the above list follow:

Jungermannia (later *Frullania*) *lagenifera* Schwaegrichen *in* Gaudichaud
=*F. squarrosa* fo. *ericioides* (*fide* Verdoorn, 1930)
F. mertensiana Lindenberg=*F. apiculata*
F. apiculiloba Stephani=*F. grandistipula*
F. replicata Spruce=*F. nodulosa*
F. thuilleri Nees=*F. nodulosa*
F. cognata Lindenberg=*F. nodulosa*
F. dapitana Stephani=*F. nodulosa*
F. secundiflora Montagne=*F. nodulosa*

In general, the *Frullaniae* are epiphytic—some forming great clumps on branches as *F. nodulosa* or *F. apiculata* and others growing tightly adnate to bark as *F. boninensis*, which, from the drawings, looks suspiciously like *F. meyeniana* Lindenberg. Some of the smaller species of *Frullania* are restricted almost to the tips of branches and that would be a likely place to hunt for *F. curiosissima*.

Lejeuneaceae

Approximately one fourth of all species of Hepaticae belong in this single family of about 75 presently recognized genera. The family is characterized by the presence of a lobule of varying shapes, dimensions and ornamentation folded under the lower margin of the incubous leaf and attached to the stem. Underleaves are present, or, in *Cololejeunea*, replaced by a tuft of rhizoids. The beaked, angular perianth is subtended by a pair of bracts which are usually larger than the leaves and often much more ornamented. The bracteole, absent in *Cololejeunea*, is a much enlarged underleaf and it, too, is often toothed, ciliate, or otherwise modified.

As most of the genera are represented on Guam by one or two species, only a list is given with each subfamily. In those genera believed to be present on Guam as based on field observations, but not reported, only the generic name is given.

SUBFAMILY TUYAMAELLOIDEAE: *Tuyamaella* Hattori.

Tuyamaella molischii (Schiffner) Hattori includes *Pycnolejeunea molischii* Schiffner and *Pycnolejeunea boninensis* Horikawa, reported from the Bonins.

SUBFAMILY LEJEUNEOIDEAE: (HOLOSTIPAE) *Brachiolejeunea* Stephani; *Ptychocoleus* Trevisan; *Ptychanthus* Nees; *Thysananthus* Lindenberg; *Spruceanthus* Verdoorn; *Mastigolejeunea* Stephani; *Lopholejeunea* (Spruce) Stephani; *Symbiezidium* Trevisan; *Caudalejeunea* Stephani; *Archilejeunea* Stephani; *Leucolejeunea* Evans; (SCHIZOSTIPAE) *Hygrolejeunea* (Spruce) Stephani; *Taxilejeunea* Stephani; *Cheilolejeunea* (Spruce) Stephani; *Drepanolejeunea* Stephani; *Leptolejunea* (Spruce) Stephani; *Lejeunea* Libert; *Microlejeunea* Stephani.

Brachiolejeunea sandvicensis (Gottsche) Evans is known from the Bonins, and should be on Guam.

Ptychocoleus sp. forms reddish brown cushions near base of moist coconut trunks.

Ptychanthus sp. is unreported but should be in our area.

Thysanathus sp. will probably be found on trunks of trees in moist forest.

Spruceanthus polymorphus (Sande Lacoste) Verdoorn is reported from the Bonins —should be on Guam.

Mastigolejeunea humilis (Gottsche) Stephani is known from Guam and records for *M. guahamensis* Stephani should be included here.

Lopholejeunea subfusca (Nees) Stephani has been reported (as *L. brunnea* Horikawa) from the Bonins, is common on the atolls, and I believe I have seen it often on Guam. A second species, *L. eulopha* (Taylor) Schiffner (as *L. toyoshime* Horikawa), has been reported from the Bonins. The shiny black color of *Lopholejeunea* on bark, or rarely, on rock, is distinctive under low magnification. Plants with leaves markedly broader than long are usually *L. eulopha* and those with nearly round leaves *L. subfusca*.

Symbiezidium sp. often grows near beaches on the bases of rough barked trees in Palau. The large size, medium green color, and tightly appressed habit are distinctive.

Caudalejeunea reniloba (Gottsche) Stephani is known from Guam and the Marianas. Records of *C. recurvistipula* (Gottsche) Stephani belong under this species.

Archilejeunea mariana (Gottsche) Stephani was described from a Mertens collection in the Marianas. *A. bidentula* Horikawa from the Bonins may be the var. *bidentula* of *A. mariana* described by Schiffner.

Leucolejeunea xanthocarpa (Lehmann & Lindenberg) Evans is included here because of an old unconfirmed record of *Lejeunea xanthocarpa*. Its discovery, though not surprising, would be noteworthy.

Hygrolejeuna sordida (Nees) Stephani has had a checkered nomenclatural history which is still not clear or resolved and so it seems best for the moment to use this name. The plant was described from Guam and additional collections, especially of fertile specimens, would be helpful in determining its affinities.

Taxilejeunea umbilicata (Nees) Stephani is included because of an old record of *Omphalanthus umbilicatus* Nees from the Marianas. It is known from Java and Kusaie.

Cheilolejeunea sp. are bark inhabiting species, medium-size to small, with a pale yellow-green color. Plants presumably belonging to this genus have been observed often on Guam.

Drepanolejeunea tenuis (Reinwardt, Blume & Nees) Schiffner is reported from Hahajima and other species are doubtless present on Guam. They are plants of rotting coconut husks or logs, or they are occasionally found intermixed with other bryophytes on bark. Some species are epiphyllous.

Leptolejeunea vitrea (Nees) Stephani was reported from Guam (as *Lejeunea*) and *L. subacuta* Stephani is known from Chichijima. These are mostly epiphyllous species, many with strong and characteristic odors which disappear on drying, with erect perianths standing out from the prostrate stems.

Lejeunea boninensis Horikawa is reported from Hahajima. Species of *Lejeunea* have been observed at Guam on bark, old coconut husks, and rotting logs. The genus differs when dry from *Cheilolejeunea* under low magnifications in being shiny instead of dull and in having cells which appear to be larger and more lax. Other *Lejeuneae* reported belong in diverse genera as noted in those genera.

Microlejeunea cucullata (Reinwardt, Blume & Nees) Stephani and *M. lunulatiloba* Horikawa both occur on Guam. They can be quickly separated by the underleaf segments being 3-4 cells broad at the base in *M. cucullata* and 2 cells broad at the base in *M. lunulatiloba*.

SUBFAMILY PARADOXAE: (DIPLASIAE) *Colura* DuMortier; (APHYLLIAE) *Cololejeunea* (Spruce) Stephani.

Colura is not yet reported from our area but I have seen it from Minami Iwo Jima, to be reported elsewhere, and some species should be present in damp shaded places on Guam. The plants are small, white when dry, and seem to prefer the groove of the mid-vein of fern pinnae for their niche. A hand lens may be necessary to see them in the field at first.

Cololejeunea is abundantly represented in our area on old coconut husks, aerial roots of coconuts, leaves, and branches. The Lejeuneaceous lobule and the lack of an underleaf set the genus apart at once. I should not be surprised if 10 species were found on Guam. A provisional key follows:

1. Leaves lanceolate or at least acuminate tipped .... *Cololejeunea drepanolejeuneoides* (Horikawa) Schuster
1. Leaves rounded 2
   2. Leaves with a silvery band of hyaline cells on the outer margin 3
   2. Leaves with a normal, undifferentiated margin 4
3. Hyaline margin 3-4 cells broad ....*C. nakaii* Horikawa
3. Hyaline margin 1 cell wide.........................*C. minutilobula* Horikawa
   4. Leaf lobe plane with a central row of much enlarged cells extended to about the middle...............................*C. falcata* Horikawa
   4. Leaf lobe concave lacking a central row of cells 5
5. Lobule $^1/_2$ or more the size of lobe ....*C. minutissima* (Smith) Schiffner
5. Lobule about $^1/_4$ the size of the lobe.........*C. micronesica* Miller & Bonner

Cololejeunea (*Boninoleptocolea*) *drepanolejeuneoides* superficially resembles *C. wightii* but differs in having an obcordate, not obovoid, perianth and irregularly thickened leaf cells. Both *C. tonkinensis* and *C. kapingaensis* are close to *C. nakaii* and all might occur on Guam. I have collected *C. micronesica* from trees at Agaña Springs and it is probably found elsewhere in moist places.

Pallavicineaceae

Pallavicinia S. F. Gray; Symphyogyna Nees & Montagne

These plants grow on wet rocks or banks in shady areas. Sometimes the margins are pale and the thallus tinged with red. *Pallavicinia lyellii* (Hooker) S. F. Gray, a widespread species, has been reported from Chichijima but no *Symphyogyna* is yet known from our area. Hymenophyllaceous ferns are sometimes mistaken for this family but rhizomes are not present in these hepatics.

Riccardiaceae

Riccardia S. F. Gray

At least four species of *Riccardia* are known from the atolls and some have been observed on Guam. The plants should be sought on old coconut husks, rotting logs, damp humus banks, and among other hepatics. Plants resembling *Riccardia* but with large convex cells containing many discoid chloroplasts are fern prothallia. The genus is a difficult one and needs much technical study.

Metzgeriaceae

Metzgeria Raddi

Metzgeria furcata (Linnaeus) Lindenberg has been reported from Hahajima. The genus is usually found in wet forests on the exposed roots of trees or among other hepatics. The small, strap-like, veined, thalli with hairy margins are unmistakable. Kuwahara (1966) has prepared an excellent monograph of *Metzgeria* that should be consulted before applying any specific names to Guam collections.

Marchantiaceae

MARCHANTIA Linnaeus; DUMORTIERA Nees

The old report of *Marchantia platycnemos* Schwaegrichen (=*M. papillata* Raddi), a Brasilian species, is probably in error. Apparently, Stone's recent collection from Tarzan Falls, and mine in the same bryologically rich area, are the first since Gaudichaud's visit. It is hoped that fertile material, which will assist in making a positive identification, will be discovered soon. *Dumortiera hirsuta* (Swartz) Reinwardt, Blume & Nees is reported from the Bonins but there is no reason it should not be on steep shaded dripping banks or on rotting logs which are partially submerged in water on Guam. The large size, smooth dark green surface, and bristle-covered sexual branches are very distinctive.

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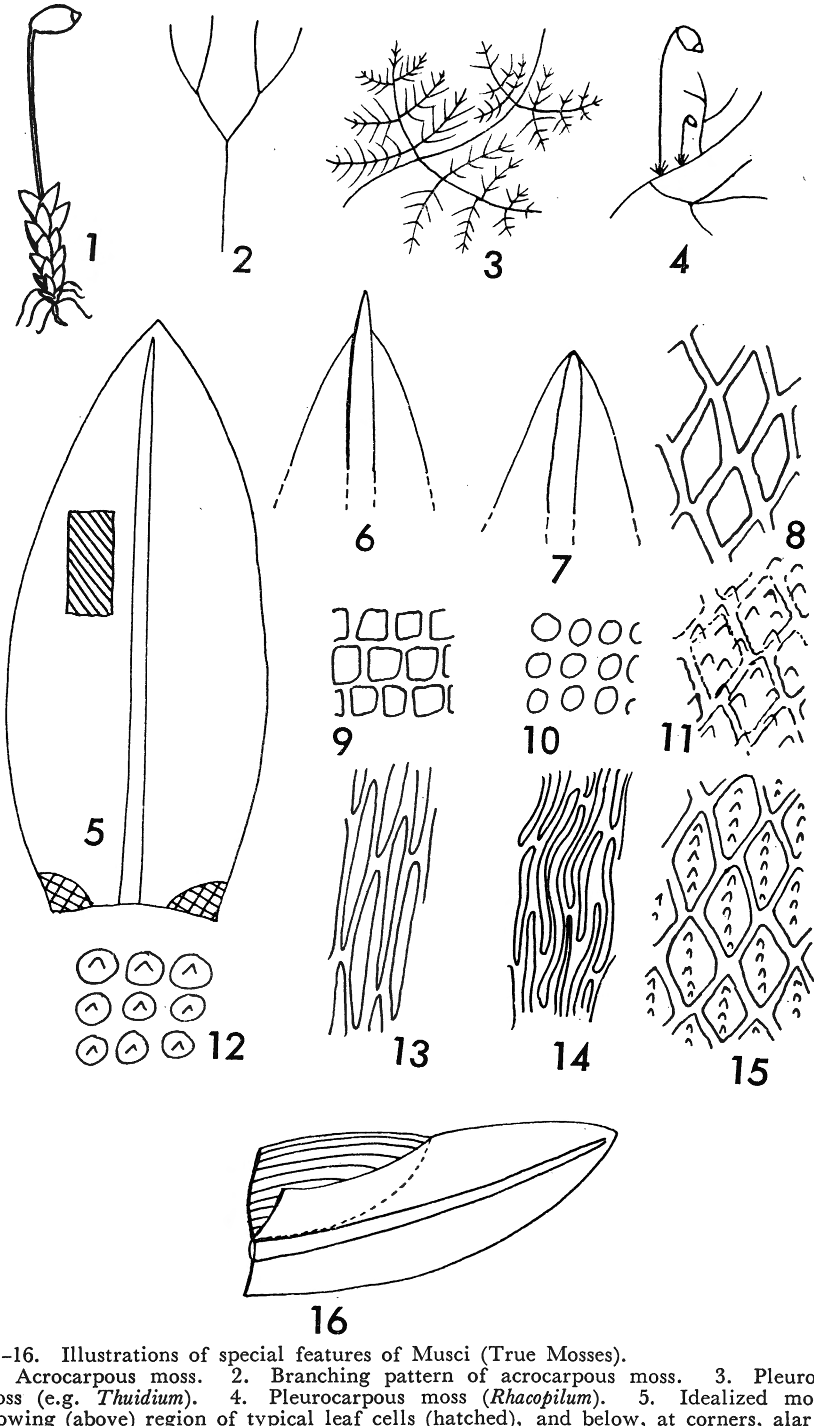
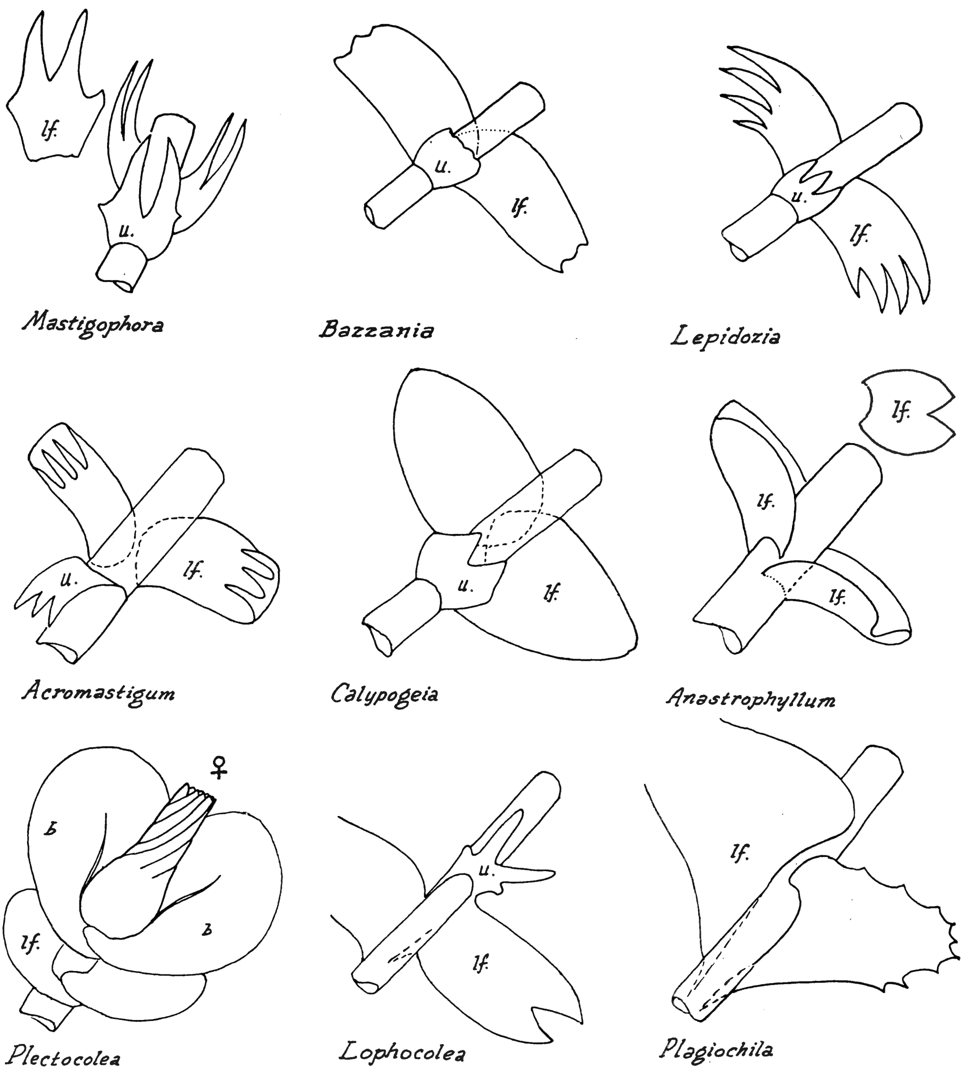
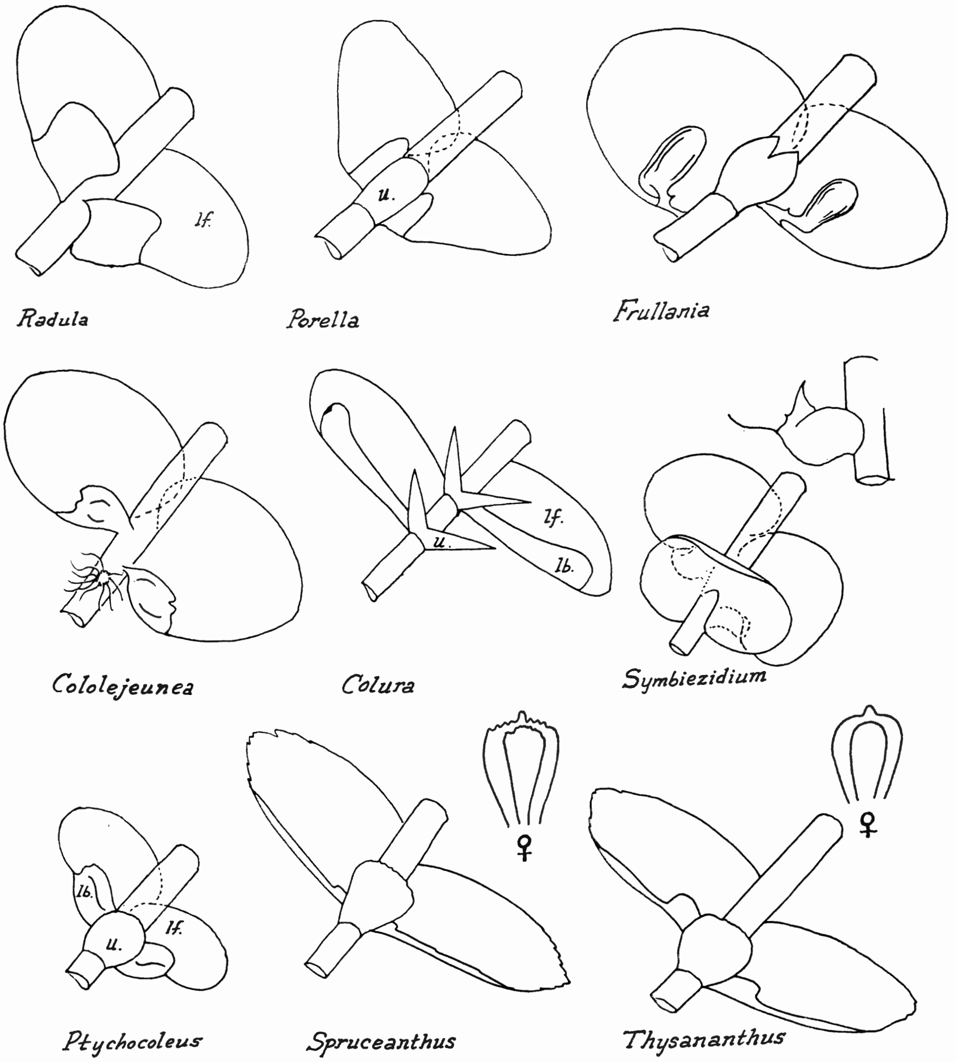
Author's note: This preliminary treatment was prepared without illustrations. The figures appended by the editor are generalized sketches I hastily prepared in 1965 for class handouts at the College of Guam. They should not be interpreted to represent any single species.



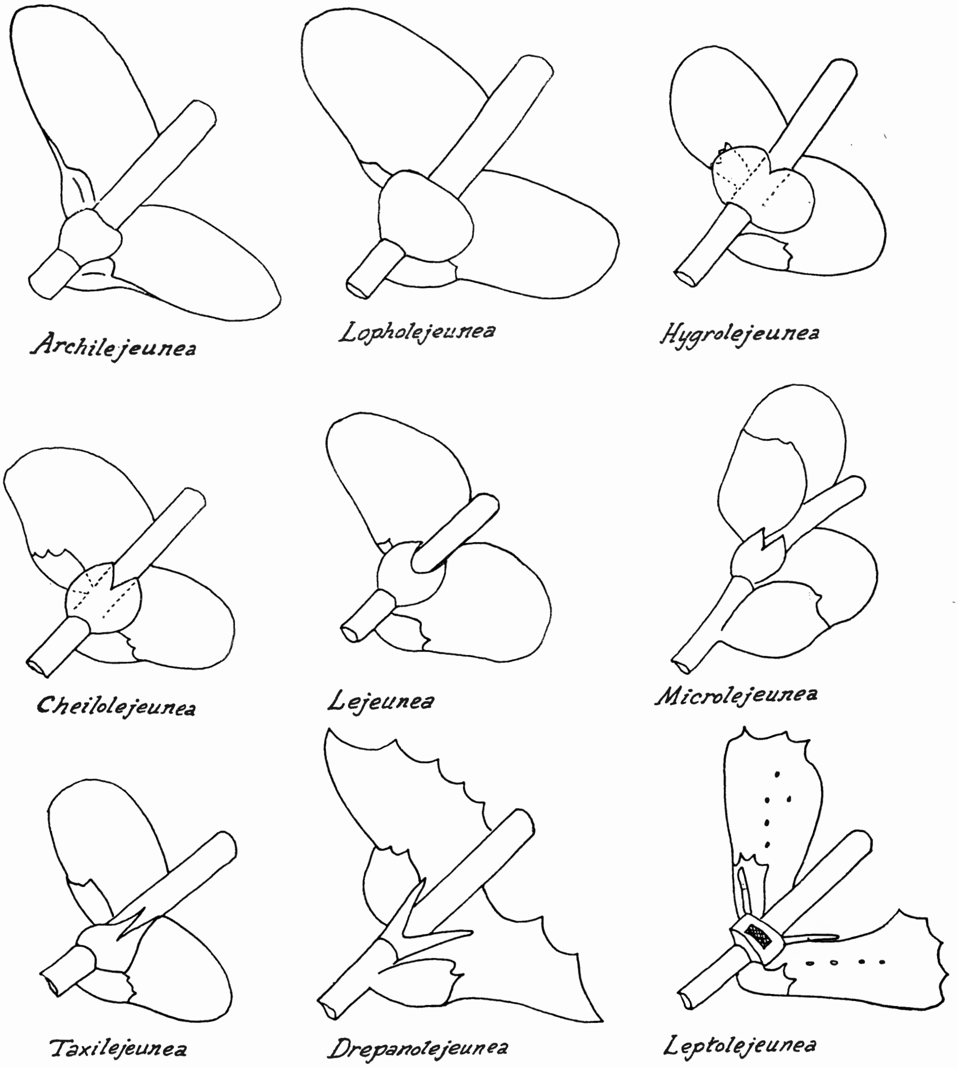
Figs. 1–16. Illustrations of special features of Musci (True Mosses).
1. Acrocarpous moss. 2. Branching pattern of acrocarpous moss. 3. Pleurocarpous moss (e.g. *Thuidium*). 4. Pleurocarpous moss (*Rhacopilum*). 5. Idealized moss leaf, showing (above) region of typical leaf cells (hatched), and below, at corners, alar region. 6. Excurrent costa. 7. Percurrent costa. 8. Rhomboid cell type. 9. Quadrate cell type. 10. Round cell type. 11. Papillose surface. 12. Conic or rounded papillae. 13. Linear cell type. 14. Vermicular cell type. 15. Seriate-papillose surface. 16. Leaf of *Fissidens*.



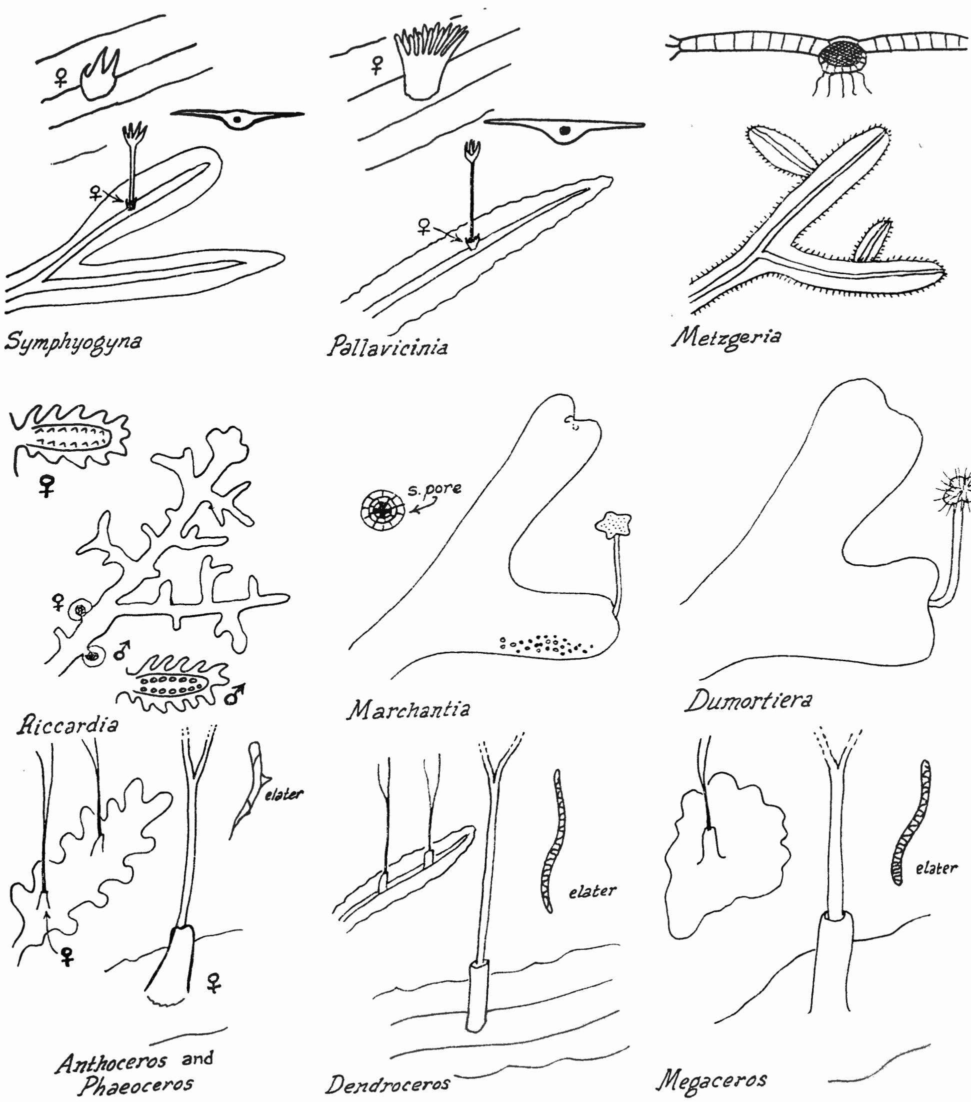
Figs. 17–25. Illustrations of features of Hepatic genera.
17. Mastigophora. 18. Bazzania. 19. Lepidozia. 20. Acromastigum. 21. Calypogeia. 22. Anastrophyllum. 23. Plectocolea. 24. Lophocolea. 25. Plagiochila.
lf. = leaf; u. = underleaf; b. = bract.



Figs. 26–34. Illustrations of features of Hepatic genera.
26. Radula. 27. Porella. 28. Frullania. 29. Cololejeunea. 30. Colura. 31. Symbiezidium. 32. Ptychocoleus. 33. Spruceanthus. 34. Thysananthus.
lf. = leaf; u. = underleaf; lb. = lobule.



Figs. 35–43. Illustrations of features of Hepatic genera.
35. Archilejeunea. 36. Lopholejeunea. 37. Hygrolejeunea. 38. Cheilolejeunea. 39. Lejeunea. 40. Microlejeunea. 41. Taxilejeunea. 42. Drepanolejeunea. 43. Leptolejeunea.



Figs. 44–52. Illustrations of features of Hepatic and Anthocerotid genera. 44. Symphyogyna. 45. Pallavicinia. 46. Metzgeria. 47. Riccardia. 48. Marchantia. 49. Dumortiera. 50. Anthoceros and Phaeoceros. 51. Dendroceros. 52. Megaceros.
s. pore=surface pore, top view. Elaters shown very much enlarged.