

# Bryophyte flora of the Huon Peninsula, Papua New Guinea. LXX. Sematophyllaceae (Musci) 1. *Acanthorrhynchium*, *Acroporium*, *Clastobryophilum*, *Pseudopiloecium*, *Radulina* and *Trichosteleum*

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The family Sematophyllaceae (Musci) of western Melanesia, mainly Papua New Guinea, is revised based on recent collections preserved at the Botanical Museum of the University of Helsinki. For western Melanesia, 18 genera and ca. 80 species of Sematophyllaceae have been reported in the literature. Of these, six genera, *Acanthorrhynchium* M. Fleisch. (one species), *Acroporium* Mitt. (16 species), *Clastobryophilum* M. Fleisch. (one species), *Pseudopiloecium* Bartr. (one species), *Radulina* W.R. Buck & B.C. Tan (four species), and *Trichosteleum* Mitt. (seven species), are treated in this paper. *Trichosteleum streimannii* B.C. Tan, T.J. Kop. & D.H. Norris is described as new for science. Three new combinations are made and 12 new synonyms proposed (indexed). *Trichosteleum sematophylloides* Dix. is lectotypified. Six taxa are reported as new to Papua New Guinea: *Acroporium adpersum* (Hampe) Broth., *A. microcladon* (Dozy & Molk.) B.C. Tan var. *burleyii* B.C. Tan, *A. rigens* (Dix.) Dix., *A. stramineum* (Reinw. & Hornsch.) M. Fleisch. var. *hamulatum* (M. Fleisch.) B.C. Tan, *Pseudopiloecium acroporoides* (Dix.) B.C. Tan, T.J. Kop. & D.H. Norris, and *Radulina hamata* (Dozy & Molk.) W.R. Buck & B.C. Tan var. *scaberula* (Mont.) B.C. Tan, T.J. Kop. & D.H. Norris. In addition, 14 taxa are reported as new to the Solomon Islands (indexed). A key to all species dealt with is provided, and illustrations provided for the new species and species not previously illustrated. The taxonomy, habitat ecology, and distribution in western Melanesia, as well as total ranges, are given for every species. A selection of previously published illustrations and an index of epithets of taxa dealt with are given.

Key words: *Acanthorrhynchium*, *Acroporium*, *Clastobryophilum*, distribution, Musci, nomenclature, *Pseudopiloecium*, *Radulina*, Sematophyllaceae, taxonomy, *Trichosteleum*

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## Introduction

This paper is a revision of genera traditionally placed in the Sematophyllaceae, and is based on the collections made by the second and third authors from the Huon Peninsula of Papua New Guinea in 1981 (Koponen & Norris 1983), and the collections from Papua New Guinea sent to Helsinki by the late H. Streimann (1938–2001). Some collections made by D. H. Norris on Fiji and the Solomons are included. The specimens studied are deposited principally at the Botanical Museum of the University of Helsinki (H), and in other herbaria as indicated. In addition, other species of this family reported from New Guinea by other authors, such as Dixon (1922), Fleischer (1923), Bartram (1942), Schultze-Motel (1963), and van Zanten (1964) were studied whenever types or the historical specimens were available during the revision. Sematophyllaceae, with about 18 genera and more than 80 species, is one of the largest groups of pleurocarpous mosses in the Huon Peninsula collections. The revision will be done in three parts.

Part 1 of this revision includes *Acanthorhynchium*, *Acroporium*, *Clastobryophilum*, *Pseudopiloecium*, *Radulina*, and *Trichosteleum*, while parts 2 and 3 will include *Brotherella*, *Clastobryum*, *Clastobryopsis*, *Heterophyllum*, *Macrohymenium*, *Mastopoma*, *Meiotheciopsis*, *Meiothecium*, *Papillidiopsis*, *Rhaphidostichum*, *Trismegestia*, *Warburgiella*, and *Wikia*. A key to the genera of Sematophyllaceae of Huon Peninsula, a discussion of the floristic and phytogeographic relationships of this family in New Guinea and neighbouring islands, and maps of altitudinal distributions of various species in the study area will be presented in part 3 to conclude the revision.

The presentation of the genera and species in this paper follows an alphabetical order. The overall format of the species description, as well as the scheme of abbreviations of locality, total range, and specimen citations, is principally the same as that used in all previous papers of the series (Koponen & Norris 1983, Koponen 1990). However, in a few species treatments, some morphological details, such as the condition of sexuality, and some sporophytic features, such as the peristome ornamentation and spore characters,

have been left out because of lack of specimens to substantiate the needed first-hand information. Considering also the fact that a number of specimens studied in this revision were distributed to other herbaria and cited in publications, e.g., Brotherus (1925), van Zanten (1964) and Norris and Koponen (1985), we have indicated further the names on these specimens inside parentheses, when we have differed from the original determination.

We give the ranges of taxa (1) on the Huon Peninsula, based on the specimens collected during the Koponen-Norris expedition in the order of coded collection localities (Koponen & Norris 1983), (2) the ranges in western Melanesia (Irian Jaya, Papua New Guinea, Solomon Islands) in the order of administrative areas, such as provinces (*see* fig. 5 in Koponen and Norris 1983), based on studied specimens and previous literature, and (3) total ranges citing countries in the order of floristic areas used in *Index Muscorum*.

Over the years the floristic and taxonomic results of the project have been published in *Annales Botanici Fennici* and *Acta Botanica Fennica*. Lists of previous parts of the “Huon Peninsula” series were published by Koponen (1990, 2000, 2003) and Koponen *et al.* (1991, 1992). The immediately preceding issue of the series were those by Gradstein *et al.* (2002) and Tan *et al.* (2005). In parts 1–68 of the “Huon Peninsula” series we had the opportunity to publish the illustrations of most of the western Melanesian taxa we dealt with. For economic reasons we cannot continue that practice. Instead, we refer to illustrations already published in earlier revisions and floras.

## Family Sematophyllaceae Broth. 1908

The Sematophyllaceae are a mainly tropical moss family consisting of many diverse and probably homoplastic genera defined often by a single character, or by a suite of overlapping characters that makes it difficult to circumscribe a natural or monophyletic grouping in many cases. Since the time of Fleischer (1923) and Brotherus (1925), the main character that unites all the genera placed under the family is the much enlarged and

coloured alar cells. Supplementary characters used in the family delimitation are: (1) presence of filamentous gemmae in leaf axils, (2) long-rostrate operculum, and (3) collenchymatous exothelial cells. However, the family definition, infra-familial groupings, and generic revision have undergone a series of changes based on new characters and molecular evidence in recent years (Seki 1968, Tan & Buck 1989, Hedenäs & Buck 1999, Tsubota *et al.* 2001). In spite of new discoveries, there is still a lack of taxonomic and systematic consensus of this family among the specialists. Therefore, it should not be surprising that some genera and species defined in this revision are different from the opinions provided by other researchers, past and present.

### Genus *Acanthorrhynchium* M. Fleisch.

This is a small genus with two species in Malaysia and Oceania. The genus is characterized by somewhat flattened branches and small hair-pointed leaves with unipapillose leaf cells and much enlarged and thin-walled alar cells. It differs from the other genus with unipapillose leaf cells in the family, *Trichosteleum*, in having non-collenchymatous exothelial cells and a short conic operculum. Its systematic position in the family is problematic because recent molecular sequence data show it to be distantly related to *Trichosteleum* and occupying a position outside the clade that constitutes the subfamily Sematophylloideae (Tsubota *et al.* 2001).

### *Acanthorrhynchium papillatum* (Harv.) M. Fleisch.

Musci Flora Buitenzorg 4: 1331. 1923. — *Hypnum papillatum* Harv. in Hooker, Icon. Pl. Rar. 1: 23. 1837.

*Hypnum substigosum* Müll. Hal., Bot. Jahrb. 5: 86. 1883, *syn. nov.* — *Trichosteleum substigosum* (Müll. Hal.) Kindb., Enum. Bryin. Exot. 104. 1891. — *Taxithelium substigosum* (Broth. & Geh.) Broth., Nat. Pflanzenfam. 1(3): 1092. 1908. — *Acanthorrhynchium substigosum* (Müll. Hal.) M. Fleisch., Musci Flora Buitenzorg 4: 1335. 1923. — TYPE: Papua New Guinea. Dr. Naumann from S.M.S. "Gazelle" Expedition (not seen).

Plants small, variable, yellowish green, forming intricate mats. Stems creeping, pinnate to

bipinnate, branches ascending, complanate. Leaves dimorphic, stem leaves appressed to erect, lanceolate to oblong, acuminate, but with branch leaves laterally spreading, pseudo-distichous, ovate-lanceolate, strongly constricted at base, rather abruptly contracted to a filiform acumen, 1–1.25 mm long and 0.3–0.5 mm wide, concave, margins plane, serrulate to base, sometimes with irregularly positioned teeth near the leaf apex. Laminal cells oval to rhomboidal, occasionally shortly elongate, 15–40  $\mu\text{m}$  long and 4–6  $\mu\text{m}$  wide, with firm walls, with a large or indistinct single papilla on each cell lumen, except in the marginal row of cells that are shorter and smooth, forming a somewhat inconspicuous leaf border; alar cells large, hyaline, thin-walled. Polyoicous. Perichaetial leaves large, erect, 2.5 mm long, gradually narrowed to a long and coarsely serrate point. Setae long, 1 to 3.5 cm, smooth. Capsules ovoid-oblong, asymmetrically curved and gibbous at base, ca. 1.5 mm long. Opercular lid short conic. Spores 10–15  $\mu\text{m}$ , greenish, papillose.

ILLUSTRATIONS: Dozy & Molkenboer 1870: t. 270 (as *Hypnum papillatum*); Fleischer 1923: 1333 (fig. 216); Bartram 1939: pl. 26 (fig. 441); Gangulee 1980: 1918 (fig. 982); Ramsay *et al.* 2002: 19 (fig. 8).

*Acanthorrhynchium papillatum* is rather polymorphic. The stem and branch leaves can be strongly dimorphic and complanate, or slightly different and laxly appressed in their attachment. The latter form had been named *Hypnum substigosum*. The plants can be large or small, varying in branching patterns and in the length of constricted leaf acumina. The filiform leaf tip, the single leaf cell papilla, plus the slightly differentiated leaf border with irregular serration near the leaf apex, are diagnostic. It is probably the most common species of Sematophyllaceae on Huon Peninsula.

Like with many of the species described by Carl Müller, the type of *Hypnum substigosum* probably does not exist today. The herbarium specimens so-named, including a collection from British New Guinea (Cloudy Mountains, 1894, *W. Micholitz 107*), which was labelled *Trichosteleum substigosum* by Brotherus (H-BR), are all variations of *Acanthorrhynchium papillatum*.

The Koponen-Norris collections from Huon Peninsula contain only one specimen of *A. papil-*

*latum*. This may be due to the collecting done mostly at high elevations above the range where the species normally occurs. The rich material sent by H. Streimann tells us that the species is rather common below 1000 m elevation in lowland rainforests and in lower montane forests. His lowest collection came from the sea level and the highest from 1400 m. Some of Streimann's label descriptions are given below in full to characterize the habitats of the species. Streimann collected *A. papillatum* from a wide variety of substrates, most often from rotten stumps and logs and roots and stems of trees, but also from humus-rich ground, creek bank, shrub and vine.

RANGE ON HUON PENINSULA: 5c. In very rich rainforest, 900–1100 m, on moist shaded log, *Norris 66037*; Kaiser Wilhelms Land, Sattelberg, 850 m, 1899 E. *Nyman 125* (H).

RANGE IN WESTERN MELANESIA: West Irian. Sorong (Bartram 1951); Manokwari (Müller 1883, 1889 as *Hypnum substigmosum*, Gepp 1917 as *Taxithelium s.*, Bartram 1960a); Merauke (van Zanten 1964). Papua New Guinea. British New Guinea, Cloudy Mountains, XI.1894 W. *Micholitz* (HBR, as *Trichosteleum substigmosum*). — East Sepik (Bartram 1961b); Frieda River, *Koponen 36175, 36177, 36186* (H, see *Norris & Koponen 1985*). — West Sepik. (Bartram 1961b); *ibid*, *Koponen 35604, 36008, 36017, 36051, 36061, 36078, 36081, 36107* (H, see *Norris & Koponen 1985*), and: 3 km before Bevani station at Vanimo, *Naoni 32* (CBG, H). — Morobe (Brotherus 1901 as *Trichosteleum substigmosum*, Fleischer 1919); Sangkwep Logging area, NE of Lae, on tree trunks, living branches and leaves of undergrowth, at 270 m, *Touw 14694* (H, L); Herzog Mt., *Streimann & Umba 10917* (CBG, H); Gabensis Creek Valley, *Streimann & Umba 11206* (CBG, H); Labu Swamp, fresh water *Stemonurus* and *Metroxylon* swamp forest, alt. 1 m, *Streimann 25545* on tree stump, 25565 on a shrub (CBG, H); Heads Hump, 6 km SE of Bulolo, *Streimann 17367, 17391* (CBG, H); Nawata Banda, *Castanopsis acuminatissima* dominated forest, alt. 1400 m, *Streimann 19532, 19542, 22331, 22530, 22531, 24862, 24881* (CBG, H); Markham River, *Streimann 22518, 24853* (CBG, H); Markham Point, *Streimann 17746* (CBG, H); Mt. Missim Track, *Streimann 22881, 22886* (CBG, H); Busu-Butubum Ridge, *Streimann 22678* (CBG, H); Busu River, lowland rainforest in river flats, on rotting log, 100 m, *Streimann 19998, 20030* (CBG, H); ridge between Busu and Butubum Rivers, *Streimann 19975* (CBG, H); Gabensis Creek Valley, *Streimann & Umba 11218* (CBG, H). — Eastern Highlands (Bartram 1965). — Western (Brotherus 1900 as *Trichosteleum p.*, Bartram 1943). — Central (Dixon 1922 as *Taxithelium substigmosum*, Bartram 1961a); Kuriva Logging area, *Streimann 14354, 14357, Streimann & Vinas 14388* (CBG, H); Varirata National Park, Sogeri, *Streimann & Vinas 14525, 14563* (CBG, H); Narirogi Creek, Varirata National Park Road, remnant lowland forest on sides of stream, on shaded tree trunk, 440 m, *Streimann & Naoni 15073* (CBG,

H); road to Musgrave River, 18 km E of Sogeri, *Streimann & Naoni 15233, 15938* (CBG, H); near Dabamura on Ower's Corner Road, 40 km NE of Port Moresby, *Streimann & Naoni 14852, 14938* (CBG, H); K.B. Sawmill, Ehu Creek, *Streimann & Naoni 16440, 16592* (CBG, H); Bereina-Angabanga River Road, *Streimann & Naoni 16308* (CBG, H); Angabanga River, lowland forest on ridge with remnant *Cycas*, *Streimann & Naoni 16191* on tree roots, 16223 on tree buttress (CBG, H); head of Goldie River, lower montane *Hopea*, *Sloanea*, and *Castanopsis* dominated forest on side of ridge, *Streimann & Naoni 14738, 14758, 14761, 14827* (CBG, H). — Milne Bay (Bartram 1957); Woodlark Island near Mt. Kabati, swamp forest with *Endospermum*, *Syzygium*, and *Pandanus*, *Kumei 87* on *Syzygium* trunk, 119 on a rotting log (CBG, H). — Papuan Islands (Bartram 1957, 1960b). — Bougainville (Bartram 1938). — Solomon Islands (first record): Guadalcanal. Mt. Austin SE of Honiara, in second-growth rainforest, moist shaded log, 350 m, *Norris & Roberts 48774* (H). — Kolombangara, Vanga River, *Norris & Roberts*, in rainforest on middle slopes of mountain on ridge, 1000–1200 m; *Norris & Roberts 49828*, moist, shaded bark of tree; *Norris & Roberts 49843*, moist, rather shaded boulder; *Norris & Roberts 49895*, moist, diffusely lit base of tree, in rainforest on lower slopes of mountain, 300–900 m; *Norris & Roberts 49908*, moist, shaded bark of tree; *Norris & Roberts 49917, 49937*, moist shaded log; *Norris & Roberts 49982*, moist shaded bark of shrub, in lowland forest, 0–100 m; *Norris & Roberts 50021*, moist, diffusely lit stump (H). — San Cristobal: In low elevation rainforest along Maghoha River near village of Manitatama, moist, rather sunny rock, 60 m, *Norris & Roberts 48805* (H).

TOTAL RANGE: As 3: Kampuchea, Thailand, Vietnam. As 4: Philippines, Malaysia, Indonesia, Brunei Darussalam, Indonesia, PNG. Austr 1 (Queensland). Oc: Fiji Islands. Viti Levu, E of Suva in rainforest, on moist shaded log, 300 m, *Norris 44344, 44350* (H).

## Genus *Acroporium* Mitt.

The genus is characterized by plants with concave to involute or tubulose leaves on the stem and branches, with (1) a single conspicuous basal row of large and often thin-walled alar cells with the outermost or marginal ones curved like a bean; (2) laminal cells elongate with blunt ends, incrassate and pitted; (3) smooth or infrequently unipapillose leaf cells; (4) perichaetial leaves with an expanded, sheathing base and an abruptly acute to cuspidate, serrate to denticulate apex; and (5) setae only distally papillose. Among the foliar features, the perichaetial leaf morphology is considered important taxonomically in differentiating species or infra-specific taxa (Tan 1994). In the Huon Peninsula and the island of New Guinea, *Acroporium* is the larg-



est genus in the family with 17 species, three of which are endemics: *A. angustum*, *A. plicatum* and *A. seriatum*, and one endemic variety: *A. convolutum* var. *horridulum*.

Many species of this genus are difficult to define by morphology alone. There are pairs of sister species differentiated by their sizes, such as *A. secundum* and *A. stramineum*, and *A. johannis-winkleri* and *A. rigens* (Tan 1994). Others are species pairs where the only critically diagnostic character is the presence or absence of one character, such as leaf cell papilla. Examples are *A. johannis-winkleri* (smooth leaf cells) and *A. convolutum* var. *horridulum* (unipapillose leaf cells). Still, there are species whose leaves can be smooth and occasionally papillose, as in the case of *A. diminutum* and *A. lamprophyllum*. Consequently, the definition of species of *Acroporium* may seem tenuous and untenable in a number of cases. Nevertheless, even for these problematic taxa, the identity of specimens, thus far, appears discernible morphologically. We are therefore accepting these taxa until new evidence, such as new collections or new molecular evidence, proves otherwise.

Nearly all species of *Acroporium* studied in this revision were collected from tree trunks and branches; a few were indicated to be from mossy forest undergrowth or humic cover on boulders. Most populations appear to be epiphytes at high elevations above 800 m. Likewise, most species produce spores greenish when released from the capsule.

**Key to the species of *Acroporium* in western Melanesia (modified from Tan 1994)**

- 1. Plants small; leaves mostly 1–2 mm long and less than 0.5 mm wide ..... 2
- 1. Plants medium to large; leaves mostly more than 2 mm long and ca. 0.75–1.5 mm wide ..... 10
- 2. Gemmiferous rhizoids growing on leaf surface ..... 3
- 2. No gemmiferous rhizoids growing on leaf surface ..... 4
- 3. Stem and branch leaves narrowly ovate-lanceolate to oblong-lanceolate, acuminate, subtubulose ..... *A. convolutum* var. *horridulum*
- 3. Stem and branch leaves broadly ovate to ovate-lanceolate, acute to short acuminate, not subtubulose ..... *A. adspersum*
- 4. Stem and branch leaves broadly ovate to ovate-lanceolate, acute to short acuminate, with a broad cordate base ..... *A. secundum*

- 4. Stem and branch leaves narrowly ovate-lanceolate to oblong-lanceolate, acuminate or subulate, without a well defined broad cordate base ..... 5
- 5. Plants forming many erect and attenuate terminal shoots with somewhat appressed leaves ..... *A. lamprophyllum*
- 5. Plants not forming erect and attenuate terminal shoots .. 6
- 6. Leaves somewhat appressed or falcate; laminal cells smooth ..... 7
- 6. Leaves erect-spreading to widely divergent; laminal cells papillose ..... 8
- 7. Leaves narrowly ovate-lanceolate to oblong-lanceolate, falcate, often homomallous, with slender, sharp acuminate tip; apical cells elongate to linear ..... *A. rufum*
- 7. Leaves elliptic- or narrowly lanceolate, appressed to erect, with broad, acuminate tip; apical cells ovoid to oblong ..... *A. microcladon*
- 8. Leaves mostly acicular or tubular, nearly smooth or with low papilla ..... *A. diminutum*
- 8. Leaves often oblong-lanceolate, concave to convolute but not acicular, clearly papillose ..... 9
- 9. Leaves convolute, long acuminate ..... *A. convolutum* var. *horridulum*
- 9. Leaves concave, acute to short acuminate ..... *A. microcladon* var. *burleyii*
- 10. Stem and branch leaves narrowly ovate-lanceolate to oblong-lanceolate, long acuminate, without a broad cordate base; if with cordate base, then apices subulate or cuspidate ..... 11
- 10. Stem and branch leaves broadly ovate, ovate-lanceolate, acute to short acuminate, usually with a broad cordate base ..... 15
- 11. More than half of leaf lamina tubulose, more than 3 mm long ..... 12
- 11. Leaves tubulose at upper 1/3, mostly less than 3 mm long ..... 13
- 12. Leaf margins entire, except at the very tip; perichaetial leaves with contracted long and serrate to serrulate acumen ..... *A. rigens*
- 12. Leaf margins clearly denticulate in the tubulose upper 1/3; perichaetial leaves gradually narrowed to a long and strongly toothed acumen ..... *A. angustum*
- 13. Stems long pendent, branches laxly pinnate, short; leaves appressed, more or less complanate ..... *A. warburgii*
- 13. Stems irregularly branched, not long and pendent, branches long; leaves erect spreading to widely divergent ..... 14
- 14. Synoicous; leaves lanceolate, acuminate ..... *A. sigmatodontium*
- 14. Autoicous; leaves narrowly lanceolate, long acuminate . ..... *A. strepsiphylum*
- 15. Leaves arranged conspicuously in rows ..... *A. seriatum*
- 15. Leaves not arranged in conspicuous rows ..... 16
- 16. Leaves strongly plicate, wet and dry ..... *A. plicatum*
- 16. Leaves not plicate, at most wrinkled ..... 17
- 17. Synoicous; leaves ovate-lanceolate to broadly lanceolate ..... *A. hermaphroditum*
- 17. Autoicous; leaves broadly ovate-lanceolate ..... *A. stramineum*

***Acroporium adpersum* (Hampe) Broth.**

Nat. Pflanzenfam. ed. 2, 11: 436. 1925. — *Hypnum adpersum* Hampe, Nuovo Giorn. Bot. Ital. 4: 284. 1872. — HOLOTYPE: Malaysia. Borneo, Sarawak, Mt. Mattan, *Beccari 15* (BM!; isotype H-BR!).

*Acroporium novae-guineae* Bartr., Brittonia 13: 377. 1961, *syn. nov.* — Holotype: Papua New Guinea. Sepik District, Wewak-Angoram Area, Passam Road, E end of Prince Alexander range, *R.G. Robbins 2139* (FH!).

Plants densely caespitose, yellowish green. Stem and leaves small, branches irregular, short; leaves erect spreading, slightly appressed at stem or branch tip, ovate to ovate-lanceolate, 1–1.5 mm long and ca. 0.5 mm wide, acute to short acuminate, concave, margins entire, leaves becoming smaller, lanceolate and tubulose at branch tip and covered with matted, reddish brown gemmiferous rhizoids. Laminal cells elongate to linear, moderately thick-walled, about 38–65  $\mu\text{m}$  long and 2.5–4  $\mu\text{m}$  wide, unipapillose; alar cells enlarged, colored, typically acroporioid. Perichaetial leaves broadly oblong-ovate, somewhat sheathing, constricted to acute or short acuminate apex, serrate. Seta 6–8 mm long, papillose above. Capsules small, somewhat erect, about 0.5–0.75 mm long.

ILLUSTRATION: Tan 1994: 262 (figs. 7–9).

This species is distinctive in developing many gemmiferous rhizoids on the leaf surface. Among the small sized species of *Acroporium*, this has ovate-lanceolate leaves with a broad cordate base and unipapillose leaf cells.

The type of *A. novae-guineae* has patent, broadly ovate-lanceolate leaves that measure only 1.5 mm long. On the basis of its synoicous sexuality and smooth leaf cells, Bartram (1961b) compared his new species to *A. sigmatodontium* (Müll. Hal.) M. Fleisch. The latter, although synoicous, has oblong-lanceolate leaves with long acuminate apices. However, our examination of the type specimen clearly shows that the sexuality of *A. novae-guineae* is not synoicous, but either autoicous or dioicous, the leaf cells are unipapillose, and more significantly, have many gemmiferous rhizoids covering the leaf surfaces. We conclude therefore that *A. novae-guineae* is conspecific with the Bornean *A. adpersum*.

RANGE ON HUON PENINSULA: None

RANGE IN WESTERN MELANESIA: Papua New Guinea. East Sepik (*see* type information of *Acroporium novae-guineae*). — Solomon Islands (first record). San Cristobal, 1977, *Norris & Roberts 48866*, in rainforest along Maghoha River near village of Manitatama, 60 m (H!).

TOTAL RANGE: AS 4: Peninsular Malaysia, Sarawak (Mt. Mattan, Mulu, and Murude, *Oxford Expedition 2676*, BM!), PNG (new record).

***Acroporium angustum* (Broth.) Broth.**  
(Fig. 1)

Nat. Pflanzenfam. ed. 2, 11: 436. 1925. — *Sematophyllum angustum* Broth., Öfv. Finsk. Vet.-Soc. Förh. 42: 134. 1900. — HOLOTYPE: Papua New Guinea. British New Guinea, Milne Bay in montibus pr. Mita, 2000 ft, ad truncos arborum, II.1895 *W. Micholitz* (H-BR!).

Plants medium sized for the genus, caespitose or forming tufts. Stems long, to 6–7 cm in length, somewhat pinnately branched, branches ascending, to 1.5 cm long, densely foliate, with curved tips. Leaves erect-spreading to erect-imbricate, sometimes stiff-looking, narrowly lanceolate, gradually long acuminate to an acicular tip, concave to subtubulose, margins entire or crenulate, plane at base, gradually inflexed to involute and clearly denticulate near upper 1/3. Laminal cells narrowly elongate to linear, (55–)65–95  $\mu\text{m}$  long and 4–5  $\mu\text{m}$  wide, smooth, thin- to moderately thickened walls, lightly pitted, arranged in oblique rows; alar cells large, coloured, thin-walled. Dioicous. Perichaetial leaves small, ovate lanceolate, gradually long acuminate with a broadly elongate and strongly toothed acumen, laminal cell walls thickly incrassate. Setae short for the plant size, ca. 10 mm long, smooth, pustulose distally. Capsules small, ovoid, less than 1 mm long. Spores small, 15–23  $\mu\text{m}$ , papillose.

OTHER ILLUSTRATIONS: None.

This is an endemic species in New Guinea. With only two known collections available for our study, it is difficult to interpret the species boundary. The plants are intermediate in habit and leaf morphology between *A. rigens* and *A. strepsiphyllum* var. *divaricatum*. The type has somewhat divergent and subtubulose leaves like

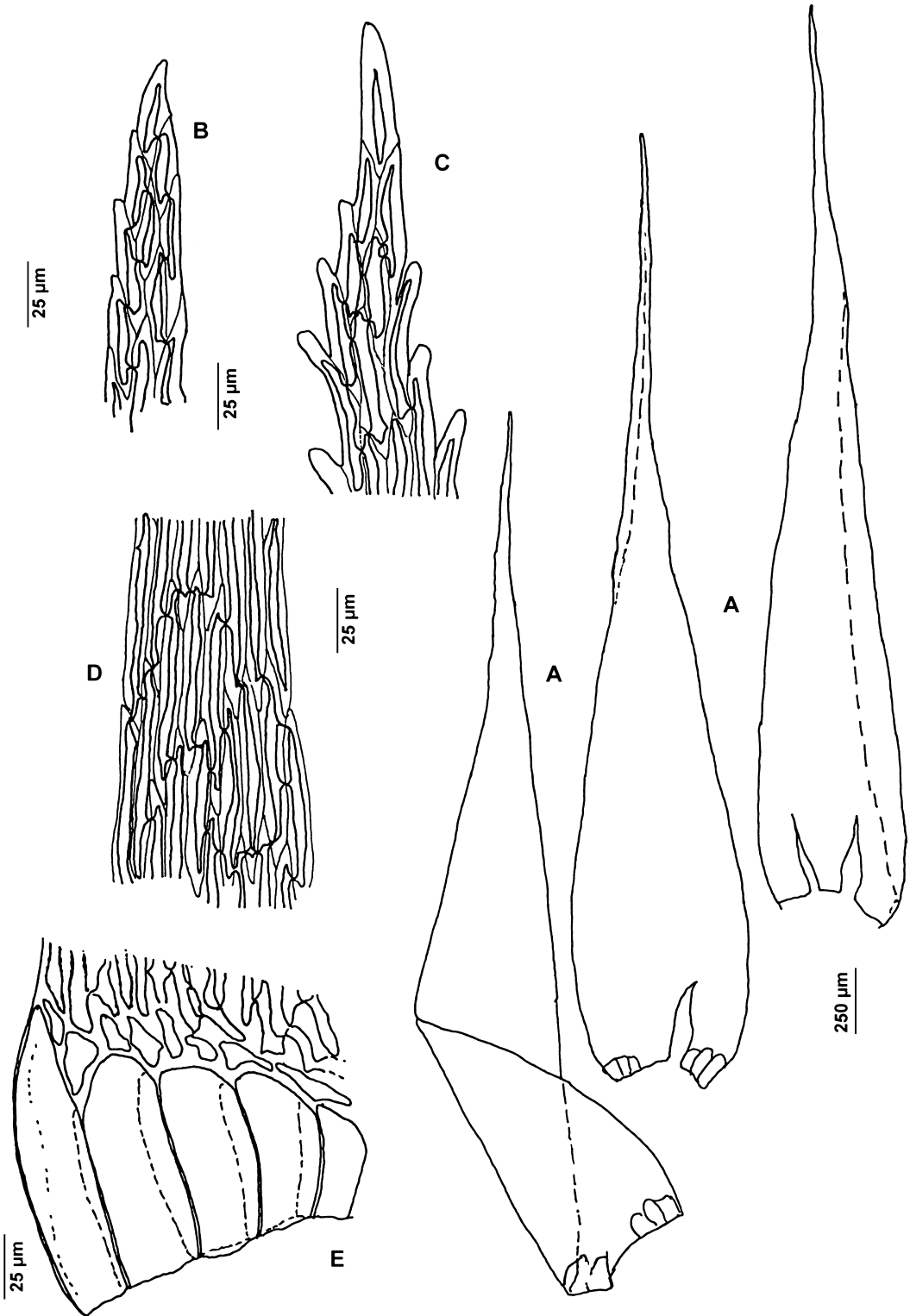


Fig. 1. *Acroporium angustum* (from type collection, H-BR). — A: Leaves. — B and C: Leaf tips. — D: Median laminal cells. — E: Alar cells.



*A. rigens*, yet the individual leaves, upon close examination, exhibit a twisted outline. *Acroporium angustum* is best separated from *A. rigens* by its vegetative leaves with denticulate apices and by a clearly expanded leaf base. The leaves of *A. rigens* quickly become subtubulose above the leaf insertion.

In the protologue, Brotherus (1900) compared and affiliated *Sematophyllum angustum* with *S. bogoricum* (= *Clastobryophilum bogoricum*). However, in the latter, the narrowly oblong-lanceolate leaves are neither markedly concave, nor tubulose at upper 1/3. The leaf cells of *Clastobryophilum bogoricum* (see below) are not always smooth, but occasionally unipapillose. Although in the protologue Brotherus (1900) described the leaf cells of *S. angustum* as “subpapillosis”, we did not see any trace of papillae on the leaves of the type specimen.

From all other species of *Acroporium* with narrowly lanceolate and long acuminate leaves, *A. angustum* can be identified by its unique perichaetial leaves, which have a broad ovate base (not expanded and sheathing) that gradually (not abruptly) narrows into a long, sharply and strongly toothed (not serrulate nor denticulate), acuminate apex.

In the Brotherus Herbarium at H, there is a specimen from former German New Guinea labelled wrongly as *Sematophyllum scabriusculum*, a species today considered a member of the Oceania flora. Superficially this specimen looks like *A. stramineum* var. *turgidum*, but the leaves are somewhat divergent (not closely imbricate), long, slightly twisted, with acuminate to subtubulose apices that are clearly denticulate. In *A. stramineum* var. *turgidum*, the leaf apices are short acuminate and entire. We think this specimen represents a smaller variation of *A. angustum*.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Morobe. Deutsch New Guinea. Simbang, II.1907, H. Zahn (labelled by Brotherus as *Sematophyllum scabriusculum*). — Milne Bay, type locality of *Sematophyllum angustum*.

TOTAL RANGE: Endemic to New Guinea.

***Acroporium convolutum*** (Bosch & Sande Lac.) M. Fleisch. var. ***horridulum*** (Bartr.) B.C. Tan, T.J. Kop. & D.H. Norris, ***comb. nova***

BASEONYM: *Trichosteleum horridulum* Bartr., *Lloydia* 5: 287, pl. 4, fig. 55a, b. 1942. — HOLOTYPE: Indonesia. Jayawijaya, 15 km SW of Bernhard Camp, Idenburg River, 1600 m. *Brass* 12316 (FH!; isotypes FH!, H!).

Plants small, caespitose. Stem prostrate, with many lateral branches, more or less ascending. Leaves dimorphic, narrowly lanceolate, subtubulose and widely spreading near lower part of branch and ovate-lanceolate, at times slightly falcate near branch terminal, 1–2 mm long and 0.25–0.5 mm wide, often with gemmiferous rhizoids growing on the leaf surface. Laminal cells elongate, 45–80  $\mu\text{m}$  long and 2–3  $\mu\text{m}$  wide, strongly unipapillose, incrassate and pitted, becoming narrowly oblong at leaf tip; alar cells large, coloured, thin-walled. Perichaetial leaves similar in size to the vegetative leaves, broadly ovate-lanceolate with a much expanded base, abruptly contracted into a long subula, margins toothed, and irregularly dentate at leaf shoulder, laminal cells smooth. Setae short to long, 7–12 mm long, smooth below and papillose half way up. Capsules small, ovoid to oblong, mouth constricted below the flaring peristome. Spores small, 2–5  $\mu\text{m}$ , slightly papillose.

ILLUSTRATION: Bartram 1942: 286 (figs. 55a, b, as *Trichosteleum horridulum*).

This variety looks much like *A. convolutum* var. *convolutum*, a widespread species in West Malesia, which has not yet been collected in New Guinea. The latter has less tubulose and more falcate leaves and is without gemmiferous rhizoids growing on leaf surfaces. The var. *convolutum* should be sought for in New Guinea.

*Acroporium convolutum* var. *horridulum* is distinctive among the small-sized species of *Acroporium* in having widely spreading to erect-divergent, nearly tubulose leaves with profuse gemmiferous rhizoids growing on the adaxial

surface of many leaves. However, this gemmiferous rhizoidal feature, though not commonly seen in the genus, is also known from *A. adpersum* (see above), occasionally from *A. diminutum* (see below), and also found in *A. microcladon* var. *rhizogemmae* in Queensland of Australia (Tan et al. 1998). The formation of segmented rhizoidal tips, which may serve as asexual reproductive propagules, appears to be a response to the extremely humid condition of local habitats.

In West Malesia, *A. convolutum* is a rather variable species forming many morphs. Therefore, the var. *horridulum* may eventually be proven not worthy of taxonomic recognition. When the var. *convolutum* is discovered in New Guinea, a critical comparison should be made between the two varieties to gain fresh insight into the taxonomic status of the var. *horridulum* in New Guinea.

There are two packets of the type specimen of *Trichosteleum horridulum* at FH with the same field label and collector number. One packet contains a handwritten description and notes by E. B. Bartram and is designated here as the holotype, with the other packet treated as the isotype.

Two of our collections were taken in heavily cut montane rainforest and one of them in very rich primary-growth rainforest at 350–1900 m altitudes.

RANGE ON HUON PENINSULA: *4d*. 66389, on moist sunny bark of tree. *10i*. 29148, on fallen branch. *10p*. 60107, on moist diffusely lit log.

RANGE IN WESTERN MELANESIA: West Irian. Manokwari. Mt. Arfak, 1875 *O. Beccari s.n.*, (H, as *Sematophyllum scabrellum*). — Jayawijaya (Bartram 1942). Papua New Guinea. Morobe. Present report, and: Sattelberg, XI.1898, *Biro* (H-BR, as *Sematophyllum scabrellum*). — Milne Bay. North slopes of Mt. Dayman, Maneau Range, low on trees, 1540 m, *Brass 22206a* (H, FH, det. as *Trichosteleum horridulum*, Bartram 1957). — Central. Moresby Distr., Moroko, 1300 m, VIII.1893 *L. Loria*, ex Bryotheca E. Levier (H-BR, det. as *Pungentella* sp. C. Müll., on lit. 1895); road to Musgrave River, 18 km E of Sogeri, 600 m, *Streimann & Naoni 15224* (H-BR).

TOTAL RANGE: Endemic to New Guinea.

### ***Acroporium diminutum* (Brid.) M. Fleisch.**

Musci Flora Buitenzorg 4: 1274. 1923. — *Dicranum diminutum* Brid., Bryol. Univ. 1: 814. 1826. — TYPE: Indonesia.

Java, inter *Dicrani blumii* (B, not seen).

*Hypnum subulatum* Hampe, Icones Musc., pl. 9. 1844. — *Acroporium subulatum* (Hampe) Dix., J. Linn. Soc. Bot. 45: 508. 1922. — HOLOTYPE: Philippines. Luzon, Manila, Meyen (BM!).

*Hypnum scabrellum* Sande Lac., Bryol. Jav. 2: 214, pl. 315A. 1869. — *Sematophyllum scabrellum* (Sande Lac.) Paris, Ind. Bryol. 1169. 1898; Renault & Cardot, Prodr. Fl. Bryol. Madag. 233. 1898. — *Acroporium scabrellum* (Sande Lac.) M. Fleisch., Musci Flora Buitenzorg 4: 1273. 1923. — LECTOTYPE: Indonesia. Sumatra, *Korthals* (L!, selected by Tan 1994).

Plants small, forming mats of laxly intertwined branches; branches short or long, 3–5 mm long. Leaves narrowly lanceolate, often rigidly erect-spreading, convolute when dry, at times falcate, not crowded, to 1.75 mm long and 0.3–0.5 mm wide, gradually narrowed to needle-like point, entire or minutely denticulate at tip. Laminal cells linear, 45–60  $\mu\text{m}$  long and 2–5  $\mu\text{m}$  wide, smooth or papillose; alar cells large, hyaline, thin-walled. Dioicous. Perichaetial leaves slightly larger than the vegetative leaves, narrowly ovate lanceolate, abruptly contracted into a long and subentire subula. Setae to 15 mm long, mostly smooth. Capsules small, ovoid, horizontal. Spores ca. 15  $\mu\text{m}$ , lightly papillose.

ILLUSTRATIONS: Hampe 1844: pl. 9 (as *Hypnum subulatum*); Dozy & Molkenboer 1869: pl. 313 (as *Hypnum subulatum*); t. 315 (as *Hypnum scabrellum*); Bartram 1939: pl. 25 (fig. 422).

This is the smallest species of *Acroporium* found in the Huon Peninsula. The species, as here defined, is a variable taxon consisting of two major facies (see Tan 1994). Accordingly, the “*diminutum*” facies has more or less tubulose leaves with smooth cells, while the “*scabrellum*” facies has narrowly lanceolate leaves that are at times falcate and occasionally with papillose leaf cells. However, intermediate forms between these two facies occur frequently in the Malesian region. The leaves in Papua New Guinean populations of *A. diminutum* seem to be longer and more frequently papillose than those in West Malesian populations.

*Acroporium diminutum* can be confused with small specimens of *A. lamprophyllum* that are of nearly equal size. Norris and Koponen (1985) reported many collections of *A. diminutum* from Frieda River, some of which are re-interpreted

by us as *A. lamprophyllum* in this revision. The latter consistently has numerous well-developed, erect and elongate branch shoots with convolute leaves, and the laminal cells are nearly always unipapillose.

In the study area, *A. diminutum* can be separated from *A. convolutum* var. *horridulum* by its smaller stature. A few large specimens of *A. diminutum* with leaves also having gemmiferous rhizoids are difficult to separate from *A. convolutum* var. *horridulum*. In such cases, *A. convolutum* var. *horridulum* can be identified by having more individual leaves that are ovate-lanceolate and strongly concave. The single papilla seen on the leaf cells of *A. convolutum* var. *horridulum* is invariably more strongly developed than in *A. diminutum*.

Our specimens from Huon Peninsula were taken from disturbed and primary rainforests, and in an extensively cultivated garden area. All specimens are from tree trunks, although the same species has been collected in West Malesia from humic soil on boulder.

RANGE ON HUON PENINSULA: 4d. 66286. 5c. 66039, 66073, 66135, 66165. 10k. 59267.

RANGE IN WESTERN MELANESIA: West Irian. Manokwari (Geheeb 1898 as *Sematophyllum scabrellum*). Papua New Guinea. Madang (Bartram 1961b). — Morobe. *Schumann & Lauterbach* (1905 as *Sematophyllum scabrellum*), Bartram (1945), and present report. — Eastern Highlands (Bartram 1965). — Central (Dixon 1943), and: Moroko, Moresby Distr., 1300 m, VIII.1893 *L. Loria s.n.*, ex Bryotheca E. Levier (H, det. as *Pungentella* sp., in lit., 1898). — Milne Bay (Bartram 1957). — Papuan Islands (Bartram 1960b, van Zanten 1968, Smith 1976). — New Ireland (van Zanten 1968). Solomon Islands (first record). Kolombangara, 1977, *Norris & Roberts 49419*, in rainforest on upper slopes of Mt. Veve, moist shaded bark of vine, 1200–1400 m; *Norris & Roberts 49677*, 1400–1600 m, moist shaded bark of tree; *Norris & Roberts 49618*, in elfin forest at top of Mt. Veve, 1600–1760 m, moist, shaded trunk of tree; *Norris & Roberts 49626*, moist, rather shaded bark of tree.

TOTAL RANGE: As 2: China. As 3: India, Kampuchea, Thailand, Vietnam. As 4: Philippines, Malaysia, Indonesia, PNG. Oc: Solomons.

***Acroporium hermaphroditum* (Müll. Hal.)  
M. Fleisch. (Fig. 2)**

Musci Flora Buitenzorg 4: 1292. 1923. — *Hypnum hermaphroditum* Müll. Hal., Syn. Musc. Frond. 2: 388. 1851. — TYPE: Indonesia. Celebes, Mt. Klabat, *Reinwardt* (L., not seen).

Plants large, caespitose or forming tall tufts, golden green. Stems and branches long, to 2 cm, densely aggregated, irregular in branching pattern, with sharp cuspidate tips. Leaves crowded, erect spreading, broadly oblong-lanceolate or broadly ovate-lanceolate from a broad cordate-auriculate base, 2–3 mm long and 1 mm wide, strongly concave, acute to short acuminate, margins entire, involute in the upper half of the leaf. Laminal cells linear, 80–115  $\mu\text{m}$  long and 2–3  $\mu\text{m}$  wide, thick-walled, pitted, smooth, becoming elongate at the curved leaf tip; alar cells large, thin-walled, coloured. Synoicous. Perichaetial leaves much smaller than the vegetative leaves, with much expanded, sheathing base and contracted to a short and nearly entire subula. Setae long, to 3 cm in length, pustulose above. Capsules oblong, about 1 mm long, inclined. Spores large, 22–29  $\mu\text{m}$ , markedly papillose, greenish.

ILLUSTRATIONS: Dozy & Molkenboer 1869: pl. 305 (as *Hypnum hermaphroditum*); Bartram 1939: pl. 25 (fig. 428); Tan 1994: 264 (figs. 18–21).

According to Bartram (1939), this species is well characterized by the divaricately spreading, short acuminate leaves, long setae, and the synoicous inflorescence. To that we can add the shortly acute and nearly entire margins of the perichaetial leaves. The tips of the vegetative leaves of this species are curved to one side, and is another unique feature of this species. This is well illustrated in Dozy and Molkenboer (1870: t. 305).

This species is not difficult to identify because the ascending branches often have numerous perichaetial buds available for a confirmation of its synoicous sexual condition. Morphologically this species is the synoicous “counterpart” of *A. stramineum*, which is either autoicous or dioicous.

The collection *Koponen 28632* from Rawlinson Range on the Huon Peninsula is noteworthy in forming a large compact cushion, instead of the typical tufts. The cushion character is reminiscent of *A. condensatum*, an endemic in the mountains of northern Philippines. The specimens, however, are too large for the alleged range of leaf length of *A. condensatum* and the leaves are so widely spreading as to rule out *A.*

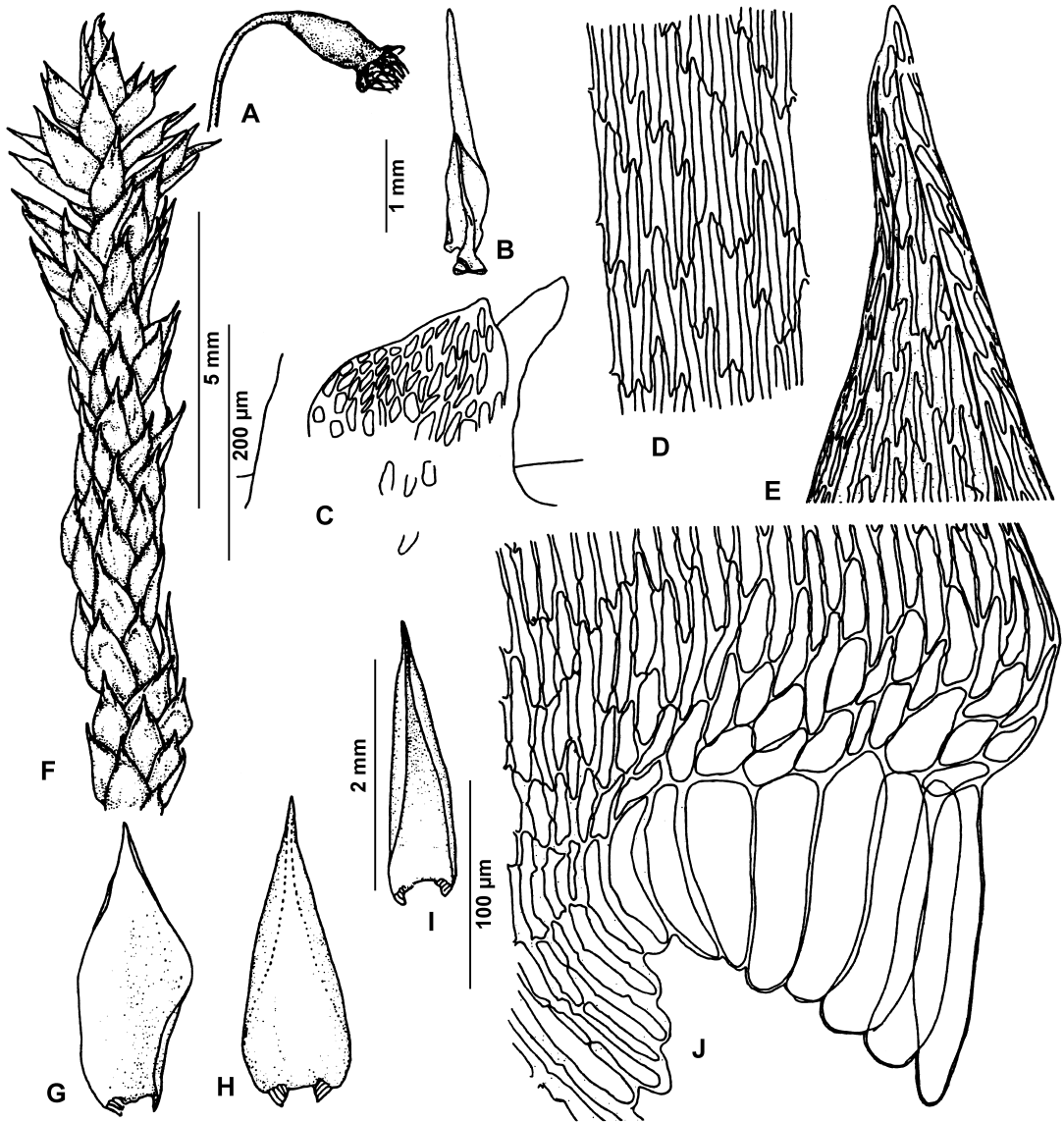


Fig. 2. *Acroporium hermaphroditum* (from Koponen 31083, H). — A: Capsule. — B: Calyptra. — C: Pseudoparaphyllia. — D: Median laminal cells. — E: Leaf tip. — F: Habit of branch. — G–I: Leaves. — J: Alar region.

*hermaphroditum*. This collection probably can serve as a piece of evidence indicating that the two species may eventually need to be combined as ecological variants of a single species as already suggested by Tan (1994).

On Huon Peninsula *A. hermaphroditum* was collected most often in primeval montane rainforests and mossy forest and once in badly disturbed rainforest at 1450–2000 m. It seems to be mostly epiphytic and was taken from bark of tree

(1 specimen), bush (3), climber (2) and fallen rotten log (1).

RANGE ON HUON PENINSULA: 3a. 29290, 29373, 29385, 29392. 3b. 29505. 7b. 65510. 8b. 31083. 10c. 28632.

RANGE IN WESTERN MELANESIA: West Irian. Manokwari (Bartram 1951). — Paniai (Dixon 1922, as *Sematophyllum hermaphroditum*). — Jayawijaya (Bartram 1960a, van Zanten 1964). Papua New Guinea. West Sepik. Frieda River, Koponen 35805 (as *Acroporium rufum* in Norris & Koponen 1985). — Morobe. Present report. — Simbu (Bartram 1959). — Milne Bay (Bartram 1957). — Papuan Islands



(Bartram 1957, van Zanten 1964). Solomon Islands (first record). Kolombangara, rainforest in upper slopes of mountain near Mt. Veve, moist shaded bark of tree, 870–880 m, *Norris & Roberts 49651* (H).

TOTAL RANGE: As 4: Malaysia, Indonesia (Borneo, Celebes, Java), Philippines, PNG. Oc: Solomons.

### ***Acroporium lamprophyllum* Mitt. var. *lamprophyllum***

J. Linn. Soc. Bot. 10: 183. 1868. — *Sematophyllum lamprophyllum* (Mitt.) Mitt. in Seem. Fl. Vit. 398. 1873, *hom. illeg.* — *Trichosteleum lamprophyllum* (Mitt.) W.R. Buck, *Brittonia* 35: 310. 1983. — HOLOTYPE: Samoa. Upolu, *Powell 114* (NY!).

*Hypnum braunii* Müll. Hall. var. *oxyporum* Sande Lac., *Bryol. Jav.* 2: 212. 1869. — *Acroporium oxyporum* (Sande Lac.) M. Fleisch., *Musci Flora Buitenzorg* 4: 1289. 1923. — LECTOTYPE: Indonesia. Java, Mt. Pangerango, *Junghuhn* (L., selected by Tan 1994).

*Sematophyllum punctuliferum* Thwaites & Mitt., J. Linn. Soc. Bot. 13: 318. 1873. — *Acroporium punctuliferum* (Thwaites & Mitt.) M. Fleisch., *Musci Flora Buitenzorg* 4: 1274. 1923. — HOLOTYPE: Sri Lanka (“Ceylon”). *Thwaites s.n.* (NY!).

Plants small, caespitose, forming mats of ascending branches with attenuate and penicillate shoots of 2–3 mm long. Leaves, except those at the penicillate branch shoot, narrowly lanceolate to oblong-lanceolate, erect-spreading, concave to subulate when dry, a few falcate, to 1.5 mm long and 0.3–0.5 mm wide, gradually narrowed to a long acuminate point, entire or minutely denticulate at tip. Laminal cells elongate, 30–60  $\mu\text{m}$  long and 2–5  $\mu\text{m}$  wide, thin- to thick-walled, unipapillose, at times smooth; alar cells hyaline, not coloured, thin-walled. Dioicous. Perichaetial leaves slightly larger than the vegetative leaves, narrowly ovate lanceolate with sheathing base, abruptly contracted into a long and denticulate subula. Setae to 1.5 mm long, mostly smooth. Capsules small, ovoid, horizontal. Spores ca. 12–15  $\mu\text{m}$ , lightly papillose.

ILLUSTRATIONS: Fleischer 1923: 1290 (fig. 206, as *Acroporium oxyporum*); Tan 1994: 276 (figs. 42–46).

The justification for keeping this species in *Acroporium*, and not in *Trichosteleum*, was presented by Tan (1994). In fact, the species had been synonymized with *Acroporium diminutum* in past publications (cf. Dixon 1916). As com-

pared with *A. diminutum*, *A. lamprophyllum* is distinctive in being larger with many well-developed, erect and slender terminal shoots. In the Huon Peninsula, *A. lamprophyllum* can be confused with small plants of *A. adspersum*. The latter does not produce erect and penicillate terminal shoots.

Our only collection on Huon Peninsula was obtained in very rich primary-growth montane rainforest at 1800–1900 m. On the basis of previous reports and other collections (*see below*) it seems to be an epiphyte on tree trunks, branches, and climbers, and also grows on rotten wood.

RANGE ON HUON PENINSULA: *10p. Norris 60005*, on moist, diffusely lit log.

RANGE IN WESTERN MELANESIA: West Irian. Jayawijaya (van Zanten 1964, as *Acroporium hermaphroditum* and *A. oxyporum*). — Merauke (van Zanten 1964). Papua New Guinea. West Sepik, *Koponen 35018, 35908*, (H, as *A. diminutum* in Norris & Koponen 1985), *Koponen 35946* (H, as *A. cf. novae-guineae* in Norris & Koponen 1985). — Morobe. Present report. — Western (Bartram 1943, as *A. oxyporum*). — Central (Fleischer 1923, as *A. oxyporum*, Dixon 1922, as *Sematophyllum lamprophyllum*). — Papuan Islands (Bartram 1957, 1960b). — Bougainville (Bartram 1938). Solomon Islands (first record). Kolombangara, in elfin forest at top of Mt. Veve, moist, diffusely lit branches high in tree, 870–890 m, *Norris & Roberts 49489* (H).

TOTAL RANGE: As 3: Sri Lanka, Kampuchea, Thailand, Vietnam. As 4: Malaysia, Philippines, Indonesia (Java, Irian Jaya), PNG. Oc: Samoa, Solomon Islands, Fiji (Viti Levu, in dense rainforest on lower slopes of Mt. Victoria, on moist rather shaded tree, 800–1000 m, *Norris 44747*, H).

### ***Acroporium lamprophyllum* Mitt. var. *percaudatum* (Bartr.) B.C. Tan, H.P. Ramsay & W.B. Schofield**

*Austr. Syst. Bot.* 9:321. 1996. — *Acroporium percaudatum* Bartr., *Brittonia* 13: 377. 1961. — HOLOTYPE: Papua New Guinea. Madang Dist., Lower Ramu-Atitau Area, above Mombasop Village on way to Asai Valley, on tree, forest at 2500 ft, 7.VIII.1958 *R.G. Robbins 1377* (FH!). — PARATYPE: Mombasop to Asai Valley, foothills Schrader Range, corticolous at 2000 ft, 7.VIII.1958 *R.G. Robbins 1365* (FH!).

Plants densely caespitose. Stems irregular to pinnately branched, branches slender, ascending, with attenuate tip. Leaves widely spreading, ovate-lanceolate, acuminate, concave, 1.5 mm long, ecostate, margins entire, plain below, involute above, with a few small teeth. Leaves on attenuate branchlets small, erect to appressed,



smaller, 1 mm long, narrowly lanceolate, short acuminate. Laminal cells oblong-linear, 35–60  $\mu\text{m}$  long and 5–6  $\mu\text{m}$  wide, smooth; alar cells large, vesiculose. Perichaetia and sporophytes not seen.

ILLUSTRATION: Ramsay et al. 2004: 9 (fig. 3).

The plants of this variety look very much like a large expression of *A. lamprophyllum*, with many erect, attenuate branch shoots. The main difference lies in the divergent, ovate-lanceolate leaves below the long, attenuate shoot in the present variety, while the divergent leaf counterparts of the typical variety are narrowly lanceolate and subulate. In the var. *percaudatum*, the erect and attenuate shoots were described by Bartram (1961) to have reduced leaves, but this is not seen in the type specimens that we examined. The var. *percaudatum* is best identified by the luxuriant development of the erect and attenuate shoots. Here, the caducous shoots can become 10–12 mm long, serving perhaps as a means of vegetative reproduction. A similar variety is found in Samoa and in Queensland of Australia (Tan et al. 1996).

Interestingly, the paratype specimen of *A. percaudatum* (cf. Bartram 1961) is closer to the typical variety having only rather shortly attenuate distal branches, but still with divergent ovate-lanceolate leaves below the attenuate shoot.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea, Madang (see type information).

TOTAL RANGE: AS 4: PNG, Austr 1 (Queensland), Oc: Samoa.

***Acroporium microcladon* (Dozy & Molk.)  
B.C. Tan var. *microcladon***

Trop. Biodiv. 4: 236. 1997. — *Hypnum microcladon* Dozy & Molk., Ann. Sci. Nat. Bot. sér. 3, 2: 308. 1844. — *Trichosteleum microcladon* (Dozy & Molk.) A. Jaeger, Ber. Gall. Naturw. Ges. 1876–1877: 421 (Adumbr. 2: 487). — *Sematophyllum microcladon* (Dozy & Molk.) Broth., Nat. Pflanzenfam. ed. 2, 11: 431. 1925, *hom. illeg.* — *Sematophyllum microcladiellum* M. Fleisch., Musci Flora Buitenzorg 4: 1266. 1923. — TYPE: Indonesia. Borneo (Kalimantan).

Plants small, mat forming, often caespitose.

Stem long creeping, branches ascending, about 2–3 mm long. Leaves erect to appressed, mostly imbricate, a few slightly divergent, narrowly lanceolate to oblong, slightly auriculate at base, acuminate, concave, ecostate, margins entire, weakly denticulate or crenulate above. Laminal cells oblong to elongate near apex, linear below, (35–)45–70(–80)  $\mu\text{m}$  long and 2–2.5  $\mu\text{m}$  wide, thick-walled, incrassate and slightly pitted, smooth; alar cells enlarged, often thick-walled. Perichaetia and sporophytes not seen among Huon Peninsular collections.

ILLUSTRATION: Dozy & Molkenboer 1866: t. 242 (as *Hypnum microcladon*).

Brotherus (1925) reported this species from Borneo, Celebes and New Guinea. The species is distinctive among members of *Acroporium* by its rather straight and often thick-walled alar cells. As discussed by Tan et al. (1997), its placement in *Sematophyllum* or *Clastobryum* is unsatisfactory by virtue of its leaf areolation, smooth leaf cells, perichaetial leaf outline, and collenchymatous exothecial cells. On the other hand, the perichaetial leaves were illustrated in Dozy and Molkenboer (1866) to have a contracted leaf acumen with strong marginal serration. This type of perichaetial morphology is commonly seen in the genus *Acroporium*. In Fleischer (1923), the seta was reported to be 15 mm long.

The var. *rhizogemmae* (Tan et al. 1998) of this species is not confined to Queensland, Australia. Our examination of a specimen, dated 1858–1860, of *A. microcladon* from Celebes (leg. *De Vriese*) preserved at H also shows rhizoidal outgrowth on many leaf surfaces.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Solomon Islands (first record). San Cristobal, in essentially undisturbed rainforest at top of ridge S of Manighai, moist shaded bark of tree, 600–720 m, Norris & Roberts 49067 (H).

TOTAL RANGE: AS 4: Indonesia (Borneo, Celebes), Austr. 1 (Queensland), Oc: Solomon Islands.

***Acroporium microcladon* (Dozy & Molk.)  
B.C. Tan var. *burleyii* B.C. Tan**

in B.C. Tan, A.C. Church & F.I. Windadri, Trop. Biodiv. 4:

236. 1997. — HOLOTYPE: Indonesia. Kalimantan Tengah, Indah-NSF 996 (FH!; isotype SINU).

*Trichosteleum novae-guineae* Bartr., Brittonia 9: 52. 1957, *syn. nov.* — ISOTYPE: Papua New Guinea. Milne Bay, Peria Creek, Kwagira River, high branches of tree in rainforest, 50 m, Brass 24186 (H!).

According to Tan *et al.* (1997), *A. microcladon* var. *burleyii* differs from var. *microcladon* in having more narrowly lanceolate leaves and clearly developed unipapillose leaf cells. The perichaetial leaves of var. *burleyii* also differ in being slightly to moderately toothed marginally, quite unlike the strongly toothed, and at times, incised perichaetial leaves of the var. *microcladon*. We think that these differences deserve only varietal recognition. Although the isotype of *Trichosteleum novae-guineae* examined by us has no perichaetium, its vegetative leaf morphology compares very well with the type specimen of var. *burleyii*.

ILLUSTRATIONS: Tan *et al.* 1997: 237 (fig. 1).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Eastern Highlands (Bartram 1965, as *Trichosteleum novae-guineae*). — Milne Bay (*see type information of Trichosteleum novae-guineae*).

TOTAL RANGE: As 4: Indonesia (Borneo), PNG (first record).

### ***Acroporium plicatum* Bartr.**

Lloydia 5: 283, pl. 4, fig. 49. 1942. — HOLOTYPE: Indonesia. Irian Jaya, Bernhard Camp, Idenburg River, common on trees of flood plain rainforest, 50 m, Brass 13912 (FH).

Plants forming dense cushion, caespitose. Stems and branches ascending, 3–4 cm tall, with obtuse branch tip. Leaves erect to imbricate when wet, ovate-oblong to broadly ovate-lanceolate, 2 mm long and 0.5 mm wide, concave, strongly plicate, short acuminate, margins plain, reflexed and toothed at leaf tip. Laminal cells narrowly linear, strongly incrassate, porose; alar cells large. Dioicous. Perichaetial leaves broadly acuminate, strongly toothed in the narrowed leaf acumen. Setae to 2 cm long, deeply reddish, mostly smooth. Capsules inclined or horizontal, reddish brown, 1–1.2 mm long. Spores not seen.

ILLUSTRATION: Bartram 1942: 286 (fig. 49).

According to Bartram (1942), this is a very sharply marked species in the small, short pointed, deeply plicate leaves that are closely imbricate when dry. The tumid and suberect stems are also a unique feature.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Indonesia. Irian Jaya, Jayawijaya (*see type information*).

TOTAL RANGE: Endemic to Irian Jaya of Indonesia.

### ***Acroporium rigens* (Broth. ex Dix.) Dix.**

Bull. Torrey Bot. Club 51: 252. 1924. — *Sematophyllum rigens* Broth. ex Dix., J. Linn. Soc. Bot. 43: 321. 1916. — HOLOTYPE: Malaysia. Borneo, Sarawak, Matang, *St. V. Down s.n.* (BM!; isotype H-BR!).

*Acroporium rigens* var. *dicranolomoides* Broth. ex Dix., Bull. Torrey Bot. Club 51: 252. 1924. — HOLOTYPE: Malaysia. Malay Peninsula, Gunong, Berumban, Pahang, *Ridley 131* (BM!, synonymized by Tan 1994).

Plants caespitose, at times forming low tufts. Stems and branches dense, mostly ascending, to 2 cm long. Leaves erect-divergent, narrowly lanceolate-linear, concave, 4.5–5 mm long, margins entire, nearly entirely tubulose, slightly crenulate above. Laminal cells narrowly elongate to sublinear, 45–80  $\mu\text{m}$  long and 4–7  $\mu\text{m}$  wide, smooth, thick-walled, pitted, smooth; alar cells much enlarged, thin-walled, coloured. Perichaetia and sporophyte not seen.

ILLUSTRATIONS: Dixon 1916: pl. 27 (figs. 18a–c, as *Sematophyllum rigens*); Dixon 1924: pl. 3 (fig. 10, as *A. rigens* var. *dicranolomoides*); Tan 1994: 276 (figs. 50–52).

The ascending and acrocarpous-like branching habit of this *Acroporium*, coupled with erect, divergent and subtubulose leaves, is unmistakable. It is quite distinct by the long and rigid leaves that measure to 5 mm long. It differs from *A. angustum*, which has somewhat similarly long leaves with tubulose apices, in that in *A. rigens* the leaves are subtubular and convolute from above the insertion. In *A. angustum* the leaf has an expanded base. In addition, the leaf margins of *A. rigens* are nearly entire throughout, whereas the margins of the long, narrowly pointed leaf apices of *A. angustum* are clearly denticulate.

*Acroporium rigens* is reported here as new to New Guinea. It is disjunctive between West Malasia (Peninsular Malaysia and Borneo) and Papua New Guinea.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik, *Koponen 34982*, as *Acroporium rufum* in Norris and Koponen (1985).

TOTAL RANGE: As 4: Malaysia (Peninsular Malaysia, Sarawak), PNG (first record).

***Acroporium rufum* (Reinw. & Hornsch.) M. Fleisch.**

Musci Flora Buitenzorg 4: 1672. 1923. — *Leskea rufa* Reinw. & Hornsch., Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 14: 716. 1829. — TYPE: Indonesia. Java, Malabar (L, not seen).

*Hypnum Braunii* Müll. Hal., Syn. Musc. Frond 2: 687. 1851. — *Acroporium braunii* (Müll. Hal.) M. Fleisch., Musci Flora Buitenzorg 4: 1278. 1923. — TYPE: Indonesia. Java, Blume (as *Leskea secunda*, ex Herb. Al. Braun) (not seen).

*Acroporium braunii* var. *falcatulum* M. Fleisch., Musci Flora Buitenzorg 4: 1280. 1923. — ISOTYPE: Indonesia. W Java, am Gedeh bei Kadang-Badak, Fleischer's *Musci Frond. Archipel. Indici 492* (H-BR!).

Plants caespitose, dense, stems and branches short, less than 3 mm long. Leaves small, ovate lanceolate, long acuminate, slightly erect, at times falcate, branch leaves often homomalous distally, 1–1.75 mm long including the leaf tip, concave, margins plane, involute and weakly toothed at the tip. Laminal cells narrowly elongate to linear, 45–70  $\mu\text{m}$  long and 2–4  $\mu\text{m}$  wide, smooth, thick-walled, pitted; alar cells large, inflated, thin-walled, coloured. Perichaetial leaves oblong-lanceolate with expanded, sheathing base, contracted to a long and denticulate subula, strongly toothed at leaf shoulder. Setae short, 7–15 mm long, markedly papillose distally. Capsules oblong, less than 1 mm long. Spores large for the small plant size, 25–35  $\mu\text{m}$ , slightly papillose, greenish.

ILLUSTRATIONS: Dozy & Molkenboer 1870: t. 312 (as *Hypnum braunii*); Bartram 1939: pl. 25 (fig. 424, as *Acroporium braunii*); Tan 1994: 278 (figs. 53–59).

According to Tan (1994), this is the most difficult species to interpret and circumscribe within

*Acroporium*. This observation remains true with the specimens from the Huon Peninsula. Hence, the distribution and occurrence of *A. rufum* listed below should be accepted as only tentative.

The species is best identified as a small expression of the falcate form of *A. strepsiphyl- lum*. Because of its small size, it can be easily confused with large specimens of *A. diminutum* that have at times papillose leaf-cells, or with small plants of *A. strepsiphyl- lum* that have falcate leaves. For a discussion of the history of this difficult species and its distinctions from similar and allied taxa in the genus, consult Tan (1994).

Because we did not have the chance to study the original specimen of *Leskea rufa* for this revision, we follow here the species concept of *A. rufum* presented by Tan (1994), which is based upon the herbarium specimens so determined by the contemporaries of Reinwardt and Hornschuch. Admittedly, the species concept of this species in Tan (1994) is based, to a large extent, on *A. braunii* (see synonymy above).

One of the Huon Peninsula specimens was collected in primary-growth rainforest at 750–800 m and the other in open cut forest at 1250 m. On the basis of the scarce habitat ecological information it seems to be a true epiphyte growing high up on trees.

RANGE ON HUON PENINSULA: *10j*. 28950, fallen branch of tree. *14e*. 59056, moist, sunny limb of fallen tree.

RANGE IN WESTERN MELANESIA: West Irian. Jayawijaya (van Zanten 1964). Papua New Guinea. Morobe (present report). — Papuan Islands (Bartram 1960b). Solomon Islands (first record). Kolombangara, in rainforest on upper slopes of mountain near Mt. Veve, 870–880 m, moist, diffusely lit bark high in tree, *Norris & Roberts 49692, 49700*, moist shaded log (H).

TOTAL RANGE: As 3: Kampuchea. As 4: Indonesia (Java), Malaysia (Malay Peninsula, Sarawak), Philippines, PNG. Oc: Solomons.

***Acroporium secundum* (Reinw. & Hornsch.) M. Fleisch.**

Musci Flora Buitenzorg 4: 1283. 1923. — *Leskea secunda* Reinw. & Hornsch., Nova Acta Phys. Med. Acad. Caes. Leop.-Carol. 14: 717. 1829. — ISOTYPE: Indonesia. Java, sub *Leskea secunda* Hornsch., *Reinwardt* (H-BR!).

*Sematophyllum brevipes* Broth., Philipp. J. Sci. C (Bot.) 8: 95. 1913. — *Acroporium brevipes* (Broth.) Broth., Nat. Pflanzenfam. ed. 2, 11: 437. 1925. — HOLOTYPE: Philippines.

Luzon, Benguet Province, 1500 m, *Merrill 7865* (H-BR!).

Plants small, forming dense but low yellowish green cushions. Stems and branches ascending, slightly cuspidate at tip. Leaves erect spreading, ovate-lanceolate to broadly oblong-lanceolate, short acuminate, ecostate, concave, to 2 mm long and 0.75 mm wide, margins entire, inflexed near apex. Laminal cells narrowly elongate to sublinear, 50–85  $\mu\text{m}$  long and 2–4  $\mu\text{m}$  wide, smooth, with firm incrassate walls, pitted; alar cells large, yellowish, thin-walled. Autoicous. Perichaetial leaves ovate lanceolate and quickly narrowed into a long acuminate and toothed tip. Setae 8–15 mm long, slightly pustulose above. Capsules small, ovoid-oblong, urn less than 1 mm long, suberect. Spores not seen.

ILLUSTRATIONS: Bartram 1939: pl. 25, fig. 433 (as *Acroporium brevipes*); Tan 1994: 278 (figs. 60–65).

This species looks like a small expression of *A. stramineum*. Unfortunately, the binomial has until recently been misapplied in many old publications to another species having narrowly ovate-lanceolate to oblong-lanceolate leaves with long acuminate apex, which should be called *A. strepsiphillum* (see below).

All Huon Peninsula specimens were collected either in primary montane rainforest (six localities), or in moderately to badly disturbed forests (two localities) at 900–2400 m. It is epiphytic, growing on twigs (3 specimens) and on trunks of trees (3 specimens). Three specimens were taken from recently fallen trees or branches and one specimen from log.

RANGE ON HUON PENINSULA: 4a. 445. 4g. 66718. 5c. 66103. 6a. 63694. 6p. 33025. 10d. 28730. 10l. 59348. 10p. 60029.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Morobe. Present report. — Eastern Highlands (Bartram 1965). Milne Bay (Bartram 1957). — Papuan Islands (Bartram 1957). — Bougainville (Bartram 1938).

TOTAL RANGE: As 2: China. As 3: India?, Thailand. As 4: Indonesia (Java), Malaysia, Philippines, PNG (see Tan 1994).

### *Acroporium seriatum* Bartr.

Lloydia 5: 284, pl. 4, fig. 50. 1942. — HOLOTYPE: Indonesia.

Irian Jaya, 10 km SW of Bernhard Camp, Idenburg River, on mossy forest undergrowth, 1800 m, *Brass 12336* (FH).

Plants robust, forming cushions. Stems and branches suberect, densely foliate, with broad cuspidate tip. Leaves erect-patent to widely spreading, neatly arranged in 6–7 rows, broadly ovate, 3 mm long and 1.5 mm wide, from a cordate base, concave, somewhat wrinkled when dry, short acuminate, margins entire, broadly incurved near leaf apex, ecostate. Laminal cells narrowly linear, smooth, strongly incrassate, porose; alar cells large, vesiculose. Dioicous? Perichaetial leaves erect, abruptly narrowed into a long cuspidate and denticulate acumen. Setae to 2 cm long, smooth below, minutely pustulose above. Capsules inclined, oblong, ca. 1.5 mm long.

ILLUSTRATION: Bartram 1942: 286 (fig. 50).

According to Bartram (1942), the distinctly seriate ranking of leaves is distinctive although the overall plant habit approaches *A. turgidum* (= *A. stramineum* var. *turgidum*).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Indonesia. Irian Jaya, Jayawijaya (see type information).

TOTAL RANGE: Endemic to Irian Jaya of Indonesia.

### *Acroporium sigmatodontium* (Müll. Hal.) M. Fleisch.

Musci Flora Buitenzorg 4: 1281. 1923. — *Hypnum sigmatodontium* Müll. Hal., Syn. Musc. Frond. 2: 687. 1851. — *Sematophyllum sigmatodontium* (Müll. Hal.) A. Jaeger, Ber. S. Gall. Naturw. Ges. 1876–1877: 382. 1878 (Adumbr. 2: 448). — TYPE: Indonesia. Java, *Blume*, ex Herb. Al Braun (not seen).

Plants medium size for the genus, caespitose to formally dense tufts. Stems irregularly branched, branches laxly erect, slender, ascending, to 4 cm long, cuspidate at tips. Leaves crowded, flexuose spreading to falcate-second, narrowly ovate lanceolate, slenderly and sharply acuminate, 2.3 to 3 mm long and ca. 0.5 mm wide, concave, margins plane, entire, involute, tubulose near apex. Laminal cells elongate to linear, (45–)55–80  $\mu\text{m}$  long and 2–5  $\mu\text{m}$  wide,

thick-walled, pitted, smooth; alar cells large, coloured, thin-walled. Synoicous. Perichaetial leaves small, broadly ovate to ovate-lanceolate, with large expanded sheathing base contracted suddenly to a small or long, denticulate acumen, about 0.75–1.25 mm long. Setae 6–12(–20) mm long, smooth below, papillose in upper 1/3. Capsules small, ovoid, less than 1 mm, inclined. Spores large for the small size of the capsule, 23–30  $\mu\text{m}$ , nearly smooth.

ILLUSTRATIONS: Dozy & Molkenboer 1869: t. 311 (as *Hypnum sigmatodontium*); Bartram 1939: pl. 25 (fig. 427); Tan 1994: 290 (figs. 88–90).

Without the synoicous inflorescence, it is difficult to separate *A. sigmatodontium* from the smaller forms of *A. strepsiphylum*. According to Tan (1994), the leaves of the former are far more widely flexuose spreading than the leaves of *A. strepsiphylum*, which are essentially erect to falcate. Also the size of *A. sigmatodontium* is more slender and not as stout as in *A. strepsiphylum*.

*Acroporium sigmatodontium* is also similar to the widespread neotropical species, *A. pungens* in size, leaf morphology and sexuality. The observed similarity is based on the comparison of herbarium specimens, short of the type specimen of the latter. Pending a world monograph of the genus, we are recognizing this old world tropical species.

On Huon Peninsula *A. sigmatodontium* grows epiphytically on climbers (two specimens), bushes (1), fallen branches (1) and on fallen rotten logs (2) at 1750–2000 m. Two of the localities were primeval montane rainforest or mossy forest and one of them was a heavily cut montane forest.

RANGE ON HUON PENINSULA: 3a. 29234, 29307, 29383. 10i. 29151, 29170. 10p. 60009.

RANGE IN WESTERN MELANESIA: West Irian. Manokwari (Geheeb 1898, as *Sematophyllum sigmatodontium*). — Jayawijaya (Fleischer 1912, as *Sematophyllum sigmatodontium*, Bartram 1942, van Zanten 1964). Papua New Guinea. Morobe. Present report, and: Nuselang, Sattelberg, 1893 *L. Kaernbach* (H-BR!), and Brotherus 1901, as *Sematophyllum macrorrhynchum*. — Eastern Highlands (Bartram 1965). — Central (Dixon 1922, as *Sematophyllum sigmatodontium*). — Milne Bay (Fleischer 1923, Bartram 1957). — Papuan Islands (Bartram 1957, van Zanten 1964). Solomon Islands (first record). Kolombangara, in elfin forest at top of Mt.

Veve, moist, rather shaded bark of tree, 1600–1760 m, Norris & Roberts 49532 (H).

TOTAL RANGE: As 3: Vietnam. As 4: Indonesia (Java), Malaysia, Philippines, PNG. Oc: Hawaii, Solomons (see Tan 1994).

### ***Acroporium stramineum* (Reinw. & Hornsch.) M. Fleisch.**

Musci Flora Buitenzorg 4: 1301. 1923. — *Leskea straminea* Reinw. & Hornsch., Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. 14: 717. 1829. — SYNTYPES: Indonesia. Java, Mt. Gede; Celebes, Mt. Klabat (not seen).

In his revision of the species of *Acroporium* in West Malesia, Tan (1994) recognized three varieties under a single polymorphic species. All the three varieties are found among the collections of *Acroporium* from Huon Peninsula. A key to the varieties is therefore presented below to help in the recognition.

### **Key to the varieties of *Acroporium stramineum* on Huon Peninsula (modified from Tan 1994)**

1. Plants complanate, main branches mostly long with few lateral branches, leaf tips mostly hamate, especially near ends of branch ..... var. *hamulatum*
1. Plants not complanate, branches irregular, not long, leaf tips mostly straight ..... 2
2. Stem and branches nearly equal in length, leaves imbricate ..... var. *turgidum*
2. Stem longer than the branches, leaves erecto-patent to falcate ..... var. *stramineum*

### ***Acroporium stramineum* (Reinw. & Hornsch.) M. Fleisch. var. *stramineum***

*Hypnum hyalinum* Reinw. ex Schwägr., Spec. Musc. Suppl. 3(1), fig. 227b. 1828. — *Acroporium hyalinum* (Schwägr.) Mitt., J. Linn. Soc. Bot. 10: 183. 1868. — *Sematophyllum hyalinum* (Schwägr.) A. Jaeger, Ber. S. Gall. Naturw. Ges. 1876–1877: 383. 1878 (Adumbr. 2: 449). — TYPE: Indonesia. Java. Mt. Gede, Reinwardt; Celebes, Mt. Klabat, Reinwardt (not seen).

*Hypnum monoicum* Sande Lac., Bryol. Jav. 2: 207. 1869. — *Acroporium monoicum* (Sande Lac.) M. Fleisch., Musci Flora Buitenzorg 4: 1287. 1923. — LECTOTYPE: Indonesia. Java, Mt. Pangerango, *Jungluhn* (L!), selected by Tan 1994).

*Sematophyllum ramosissimum* Broth. in Schum. & Lauterb., Flora Deutsch. Schutzgeb. Südsee 101. 1901, *syn. nov.* — *Acroporium ramosissimum* (Broth.) M. Fleisch., Musci Flora Buitenzorg 4: 1288. 1923. — TYPE: Papua New



Guinea. Morobe, Sattelberg, Nuselang Station, 8.XII.1893 *L. Kaernbach* 41 (H-BR!).

Plants large, forming dense but low yellowish green tufts. Stems decumbent, irregularly branched, branches cuspidate at tip. Leaves erect spreading, ovate-lanceolate to broadly oblong-lanceolate, short acuminate, ecostate, concave, to 2.5 mm long and 1 mm wide, margins entire, inflexed but not tubulose, near apex. Laminal cells narrowly elongate to sublinear, 55–90  $\mu\text{m}$  long and 2–4  $\mu\text{m}$  wide, smooth, with incrassate walls, pitted; alar cells large, yellowish, thin-walled. Autoicous, dioicous and pseudoautoicous. Perichaetial leaves ovate- to oblong-lanceolate and quickly narrowed into a short to long acuminate and toothed tip. Setae long, 10–25 mm in length, papillose above. Capsules oblong, urn more than 1 mm long, suberect. Spores large, 30–35  $\mu\text{m}$ , greenish.

ILLUSTRATIONS: Reinwardt & Hornschuch 1829: t. 40 (fig. a, as *Leskea straminea*); Dozy & Molkenboer 1869: t. 306 (as *Hypnum monoicum*); Bartram 1939: pl. 25 (fig. 431); Tan 1994: 282 (figs. 69–71).

As compared with other species of *Acroporium*, *A. stramineum* var. *stramineum* seems very common on Huon Peninsula. The var. *stramineum* is also much more common than the other two varieties. It is larger than *A. secundum* which has a similar leaf morphology and foliation. The erect-spreading, broadly lanceolate leaves with short acuminate tips best establish its identity (cf. Tan 1994).

In Tan (1994), the species definition of *A. stramineum* var. *stramineum* was expanded to include also the autoicous and phyllodioicous taxa, including *A. monoicum* and *A. hyalinum*, but not the synoicous *A. hermaphroditum*. It is this broadly defined concept that we are adopting here for the present species.

*Acroporium ramosissimum* was treated by the compilers of *Index Muscorum* as a synonym of *A. hermaphroditum*. The sexuality of the type of *A. ramosissimum* at H-BR is here confirmed to be autoicous and the name should therefore be removed from the synonymy of *A. hermaphroditum*.

*Acroporium hermaphroditum*, which is a more robust plant than *A. stramineum* in many

parts of West Malesia (see also Dozy & Molkenboer 1861–1870, Bartram 1939), does not develop such a size difference on Huon Peninsula. In fact, many specimens of *A. stramineum* look just like *A. hermaphroditum* externally until their leaf shape and sexuality are examined and compared.

On the Huon Peninsula *A. stramineum* var. *stramineum* was collected both in primary growth and second growth rainforests, and in badly disturbed or cut forests at 1000–2200 m. Three of the sites were classified as mossy forests. According to our substrate statistics it is an epiphyte in primary growth forests: on tree trunk or bark of tree (six specimens), trunk of tree fern (1), trunk of betel palm (1), twigs (3), bush (2), climber (2). The variety can also survive after disturbances such as in forest cutting, on fallen log or trunk (nine specimens), rotten tree trunk (1), and fallen branch. It was once collected on soil of trail bank.

RANGE ON HUON PENINSULA: 3a. 29289, 29315, 29319. 3i. 60518, 60557. 4e. 66434, 66463. 5c. 66210. 7a. 65311. 7d. 65730. 9a. 30012, 30022. 9j. 61232, 61262, 61265. 10a. 28403. 10d. 28662, 59647. 10f. 28865. 10h. 29109. 10i. 29159. 10j. 28942, 28988, 28960, 28986, 28998. 10l. 59349. 10o. 59881. 10n. 59791.

RANGE IN WESTERN MELANESIA: West Irian. Jayawijaya (Fleischer 1912 as *Sematophyllum hyalinum*, Bartram 1942). Papua New Guinea: East Sepik (Bartram 1961b), Morobe (Bartram 1945), Present report, and: Nuselang (Brotherus 1901 as *Sematophyllum ramosissimum*, Fleischer 1923, as *Acroporium monoicum*; see type locality information of *Acroporium ramosissimum*); Mt. Kaindi, advanced secondary forest beside road, on moist shaded road cutting, 2360 m, *Streimann 17712* (CBG, H). — Western Highlands (Bartram 1953, 1961a), and: Jimi-Waghi Divide, regrowth and bamboo on ridge, on tree stem, 2400 m, *Streimann 22302* (CBG, H). — Papuan Islands (Bartram 1960b, 1958). — New Ireland (van Zanten 1968). Solomon Islands (first record). Kolombangara, in elfin forest at top of Mt. Veve, bark of tree, 1600–1760 m, *Norris & Roberts 49494, 49590*.

TOTAL RANGE: As 2: South China. As 3: Kampuchea, Thailand, Vietnam, Sri Lanka. As 4: Indonesia (Java), Malaysia, Philippines, PNG. Oc: Solomons.

***Acroporium stramineum*** (Reinw. & Hornsch.) M. Fleisch. var. ***hamulatum*** (M. Fleisch.) B.C. Tan

Willdenowia 24: 285. 1994. — *Sematophyllum hamulatum* M. Fleisch., Hedwigia 44: 316. 1905. — *Acroporium hamu-*

*latum* (M. Fleisch.) M. Fleisch., Musci Flora Buitenzorg 4: 1294. 1923. — LECTOTYPE: Indonesia. Java, am Gedeh bei Tjiburrum, Fleischer's *Musci Frond. Archipel. Indici* 325 (FH, selected by Tan 1994).

Plants forming lax mats. Stems and primary branches long, to 7–8 cm in length, more or less complanate. Leaves erect to slightly spreading, broadly ovate-lanceolate, short acuminate, with hamate apices, especially near the distal portion of the branches. Laminal cells as in var. *stramineum*. Perichaetial leaves and sporophyte not different from that of var. *stramineum*.

ILLUSTRATIONS: Fleischer 1923: 1295 (fig. 207, as *Acroporium hamulatum*); Bartram 1939: pl. 25 (fig. 430, as *Acroporium hamulatum*); Tan 1994: 282 (figs. 66–68).

As a species or a variety, *A. stramineum* var. *hamulatum* has not been correctly interpreted in many herbarium specimens. This is because the hamate or hook-like leaf apex can also be found in some leaves of other *Acroporia*, such as *A. stramineum* var. *stramineum* and *A. hermaphroditum*. In the var. *hamulatum* the hamate leaf apices are more frequently developed. Besides, the var. *hamulatum* has its own distinct, more or less complanate, plant habit, quite different from that of var. *stramineum*, although the superficial leaf morphology of these two varieties is rather similar. In spite of its widespread occurrence in West Malesia, the var. *hamulatum* was only reported for the first time from New Guinea by Norris and Koponen (1985).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik, Frieda River, Koponen 35283, 35322, 35936 (H, as *Acroporium hamulatum* in Norris & Koponen 1985). Solomon Islands (first record). Kolombangara, in elfin forest at top of Mt. Veve, bark of tree, 1600–1760 m, Norris & Roberts 49528 (H).

TOTAL RANGE: As 3: Peninsular Malaya. As 4: Indonesia (Borneo, Java), Philippines, PNG. Oc: Solomons.

***Acroporium stramineum*** (Reinw. & Hornsch.) M. Fleisch. var. ***turgidum*** (Mitt.) B.C. Tan

Willdenowia 24: 286. 1994. — *Hypnum turgidum* Dozy & Molk., Ann. Sci. Nat. Bot., sér. 3, 2: 309. 1844, *nom. illeg.* — *Acroporium turgidum* Mitt., J. Linn. Soc. Bot. 10: 183.

1868. — LECTOTYPE: Indonesia. Java, Sederatoe, Korthals (L., selected by Tan 1994).

Plants large, forming thick cushions. Stems and primary branches long, to 5 cm in length, tumid and turgid. Leaves mostly imbricate to slightly erect-spreading, broadly ovate-lanceolate to lanceolate, strongly concave, wrinkled, short acuminate, few widely spreading. Laminal cells as in *A. stramineum* var. *stramineum*. Perichaetial leaves and sporophyte not different from that of the var. *stramineum*.

ILLUSTRATIONS: Dozy & Molkenboer 1869: t. 303 (as *Hypnum turgidum*); Fleischer 1923: 1300 (fig. 209, as *Acroporium turgidum*); Tan 1994: 282 (figs. 72–77).

Of the three varieties, this one is the least distinctive and also the most variable. The leaves of *A. stramineum* var. *turgidum* can have moderately long acuminate apices and become confused with stout plants of *A. strepsiphyllum*. Individual stems and branches of var. *turgidum* with a few widely spreading leaves are difficult to tell apart from var. *stramineum*. It seems that the best character to recognize the var. *turgidum* is its imbricate leaves and the tight cushion plant habit. The latter character, unfortunately, often is not shown in dry and pressed herbarium specimens. Tan (1994) interpreted the var. *turgidum* as a hydric ecotype of *A. stramineum*. Among the dozens of specimens of *A. stramineum* from the Huon Peninsula, only one collection can be reliably named as var. *turgidum*.

RANGE ON HUON PENINSULA: 9k. In moderately well-developed moss forest on W-facing slope, moist, rather sunny limbs of fallen tree, 2200–2300 m, Norris 61917.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Morobe. Present report. — Enga (Bartram 1961a). — Papuan Islands (Bartram 1960b, Tixier 1974).

TOTAL RANGE: As 2: China. As 3: Kampuchea, Sri Lanka. As 4: Indonesia (Java), Philippines, Malaysia (*see* Tan 1994), PNG. Oc: Samoa (*see* Fleischer 1923).

***Acroporium strepsiphyllum*** (Mont.) B.C. Tan

in A. Touw, J. Hattori Bot. Lab. 71: 353. 1992. — *Hypnum strepsiphyllum* Mont., London J. Bot. 3: 632. 1844. — LECTOTYPE: Indonesia. Java, Buitenzorg, *ex Herb. Miguel* (PC!, selected by Tan 1994).

This is another very common species of *Acroporium* found on Huon Peninsula. Like the broad-leaved “counterpart”, *A. stramineum*, *A. strepsiphillum*, which has narrowly lanceolate and long acuminate leaves, is equally variable in its patterns of branching and foliation. In this treatment, we follow Tan (1994) in accepting two varieties as shown by the identification key below.

In the past century this species, unfortunately, has been mislabelled as *A. secundum* auct. non Reinwardt & Hornschuch nec Montagne. See Tan (1994) for the clarification of the misapplication of the binomial and also the choice of a lectotype at PC.

Like *A. stramineum*, this also is a polymorphic species. Its variability is evident in the varietal names published in literature (cf. Fleischer 1923, Dixon 1926, 1935).

### Key to the varieties of *Acroporium strepsiphillum* on Huon Peninsula

1. Leaves mostly falcate, at times erect and slightly spreading ..... var. *strepsiphillum*
1. Leaves strongly divaricate or widely spreading .....  
..... var. *divaricatum*

### *Acroporium strepsiphillum* (Mont.) B.C. Tan var. *strepsiphillum*

*Sematophyllum falcifolium* M. Fleisch., Hedwigia 44: 318. 1905. — *Acroporium falcifolium* (M. Fleisch.) M. Fleisch., Musci Flora Buitenzorg 4: 1296. 1923. — HOLOTYPE: Indonesia. Java, Tjibodas, Fleischer’s *Musci Frond. Archipel. Indici* 326 (FH!).

*Sematophyllum tubulosum* Broth., Philipp. J. Sci. C (Bot.) 8: 94. 1913. — *Acroporium tubulosum* (Broth.) Broth., Nat. Pflanzenfam. ed. 2, 11: 437. 1925. — LECTOTYPE: Philippines. Negros, Mt. Canlaon, Merrill 6819 (H-BR!), selected by Tan 1994).

*Acroporium secundum* (Reinw. & Hornsch.) M. Fleisch. var. *angustifolium* M. Fleisch., Musci Flora Buitenzorg 4: 1285. 1923. — HOLOTYPE: Indonesia. W Java, am Gedeh bei Tjiburrun, Fleischer’s *Musci Frond. Archipel. Indici* 323 (FH!).

Plants medium to large, caespitose, at times forming tall tufts. Stems irregularly branched, branches ascending, to 4 cm long, cuspidate and frequently curved at tip. Leaves widely spreading, often falcate, narrowly ovate lanceolate to

oblong-lanceolate, concave, long acuminate, subtubulose to tubulose in the upper 1/3, about 2–3.5 mm long and 1 mm wide, margins plain, entire nearly throughout, slightly toothed at the very tip. Laminal cells narrowly elongate to linear, 45–80  $\mu\text{m}$  long and 2–3  $\mu\text{m}$  wide, broader at leaf base, smooth, moderately thick-walled, pitted; alar cells much enlarged, inflated, thin-walled, coloured. Perichaetial leaves smaller, broadly ovate to lanceolate with a large sheathing base and contracted to a short to relatively long and toothed acumen. Setae 2–3 cm long, mostly smooth, pustulose distally. Capsules small to large, ovoid-oblong, urn to 1 mm long, inclined to horizontal. Spores not seen.

ILLUSTRATIONS: Dozy & Molkenboer 1869: t. 310 (as *Hypnum strepsiphillum*); Bartram 1939: pl. 25 (fig. 425, as *A. secundum*); Tan 1994: 287 (figs. 78–87).

Among the Huon Peninsular collections, *A. strepsiphillum* var. *strepsiphillum* is often seen growing with other species of the same genus, such as *A. diminutum*, *A. lamprophyllum* or *A. stramineum*. In a number of collections where the plant size is smaller than the average, the specimens can be confused with *A. rufum* whose leaves normally are less than 2 mm long. Slender and more falcate forms can be mistaken for *A. sigmatodontium*, which, by our definition, is a synoicous species, while *A. strepsiphillum* var. *strepsiphillum* is either autoicous or dioicous.

Some of the collections on Huon Peninsula were made in lowland rainforest below 1000 m altitude, but most of them came from primeval montane rainforest, mossy forests and forest on mountain ridges at 1000–2300 m. Only once was it collected in secondary growth rainforest and once in totally cut river valley from twigs of fallen tree. The substrate statistic shows it to be an obligatory epiphyte: bark of tree or tree trunk (16 specimens), twigs (7), climber (3), bush (3), trunk of tree fern (1), bamboo (1), base of tree (1), log or fallen trunk (5), fallen branch (1). On Solomons it inhabits similar habitats and substrates (*see* below).

RANGE ON HUON PENINSULA: 3a. 29235. 29298a, 29363, 29367. 3h. 60115, 60117, 60135, 60137. 4a. 468. 5b. 65962. 5c. 66038, 66171. 6A. 63658, 63664, 63698. 7a. 65405. 9a. 29893. 9j. 61162, 61191, 61216, 61222, 61223, 61272.

9k. 61747. 9l. 62010. 10a. 28404. 10f. 28873. 10g. 29044, 29106. 10j. 28985 (with *Meiothecium hamatum*). 10l. 59344. 10n. 59748. 10o. 59823, 59903, 59917, 59926. 10p. 60015, 60023. 14d. 58908. 14e. 59091.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik. Frieda River, *Koponen 35754* (H, as *Acroporium rufum* in Norris & Koponen 1985). — Morobe. Present report. — Papuan Islands (Bartram 1960b, as *A. secundum* var. *angustifolium*). Solomon Islands (first record). Kolombangara, in lowland rainforest along ridge N of Vanga River, moist, diffusely lit shrub overhanging river, 780–800 m, *Norris & Roberts 49285*; in rainforest on upper slopes of mountain near Mt. Veve, moist shaded bark of tree, 1200–1400 m, *Norris & Roberts 49406*; at 1400–1600 m, moist shaded twigs, *Norris & Roberts 49640, 49694*; on moist, shaded bark of tree, *Norris & Roberts 49713*; in moist diffusely lit bark of tree, *Norris & Roberts 49480, 49529, 49592*; moist, shaded twigs, *Norris & Roberts 49552, 49575*.

TOTAL RANGE: As 2: China. As 3: Thailand, Vietnam. As 4: Indonesia, Malaysia, Philippines, PNG. Oc: Solomons.

***Acroporium strepsiphllum* (Mont.) B.C. Tan var. *divaricatum* (Bartr.) B.C. Tan**

Willdenowia 24: 289. 1994. — *Acroporium divaricatum* Bartr., Lloydia 5: 284, pl. 4, fig. 51. 1942. — HOLOTYPE: Indonesia. Netherlands New Guinea, Bernhard Camp, Idenburg River, *Brass 12686* (FH!).

*Acroporium antarensense* Zanten, Nova Guinea Bot. 16: 337, pl. xxxii, fig. 1. 1964. — TYPE: Indonesia. Irian Jaya, Mt. Antares, Camp 39a, 1500 m, on branches, 27.VI.1959 *B.O. van Zanten 393* (L!), synonymized by Tan 1994).

*Acroporium platycladum* Dix., J. Bot. 80: 31. 1942. — TYPE: Papua New Guinea. The Gap, range above Port Moresby, *C.E. Carr 80a* (BM!), synonymized by Tan 1994).

Plants medium to robust, forming dense and tall tufts. Stems to 8 cm in length, irregularly branched, branches also ascending, shorter, about 3 cm long, with long cuspidate tip. Leaves widely divergent, narrowly lanceolate, long acuminate, subtubulose, to 3 mm long, ca. 1 mm wide, margins plane below, inflexed to involute in upper to 1/3. Laminal cells narrowly elongate to linear, (55–)65–110  $\mu\text{m}$  long and 2–3  $\mu\text{m}$  wide, smooth, incrassate, porose; alar cells much enlarged, coloured, thin-walled. Phyllodioicous. Perichaetial leaves broadly lanceolate with expanded, sheathing base, narrowed abruptly to long acuminate, denticulate tip. Setae very long, often reaching 3–4 cm in length, smooth below and papillose above. Capsules oblong, ca. 1 mm long, inclined. Spores rather small for the large plant size, 19–24  $\mu\text{m}$ , nearly smooth.

ILLUSTRATIONS: Bartram 1942: pl. 4 (fig. 51); van Zanten 1964: pl. xxxii (fig. 1a–c, as *Acroporium antarensense*).

This variety seems distinctive in its widely divergent and stiff-looking leaf habit. Some specimens, however, have less divergent leaves and can be even with a few falcate-secund leaves. It is on the basis of these intermediate forms that we are treating the taxon as a variety of *A. strepsiphllum* that shares a similar leaf outline.

Some smaller specimens may be confused with *A. angustum* and *A. rigens*, which have similar divergent and erect-spreading leaves. From both *A. angustum* and *A. rigens*, the present variety differs mainly in having larger size and leaves with subtubulose apices equal to about 1/3 of the leaf length. In the latter two species, the leaves are narrower and more tubulose from half way up to the apex. See under *A. angustum* and *A. rigens* for additional comments between these taxa and *A. strepsiphllum* var. *divaricatum*.

Zanten (1964) reported this variety (as *A. antarensense*) to be phyllodioicous with a good illustration of dwarf male plants.

All our Huon Peninsula collections of *A. strepsiphllum* var. *divaricatum* came from primeval montane rainforests or mossy forests at 1700–2600 m. It is an epiphyte found on tree trunks or bark of trees (eight specimens), tree root (1), bush (1), fallen trunk or log (4), stump (1), and diffusely lit soil (1).

RANGE ON HUON PENINSULA: 6a. 63610. 8d. 31159, 31191. 8b. 30911. 8h. 31441, 31494. 9a. 29918, 29939, 29976. 9b. 30109. 9c. 30189. 9f. 30498. 9k. 61887, 61905. 9l. 61932. 10f. 29038.

RANGE IN WESTERN MELANESIA: West Irian. Jayawijaya (types of *Acroporium antarensense* and *A. divaricatum*). Papua New Guinea. Morobe (present report).

TOTAL RANGE: As 4: Malaysia (Sabah, Sarawak), Indonesia (Irian Jaya), Philippines, PNG.

***Acroporium warburgii* (Broth.) M. Fleisch.**

Musci Flora Buitenzorg 4: 1299. 1923. — *Sematophyllum Warburgii* Broth., Monsunia 1: 50. 1899. — HOLOTYPE: Indonesia. Celebes, Pik von Bonthain, *Warburg* (H-BR!).

*Sematophyllum pinnatum* M. Fleisch., Hedwigia 44: 320. 1905. — *Acroporium pinnatum* (M. Fleisch.) M. Fleisch., Musci Flora Buitenzorg 4: 1298. 1923. — ISOTYPE: Indonesia. West Java, am Gedeh auf dem Pangerangogipfel, 3060 m, 18.VII.1898, Fleischer's *Musci Frond. Archipel*.



*Indici 327* (H-BR!). — Synonymy *vide* Dixon (1935).

Plants large, stem long pendent, somewhat pinnate, lateral branches short, laxly arranged, more or less complanate, becoming slenderly pointed at tip with imbricate leaves. Stem and branch leaves mostly erect, at times laterally spreading, narrowly ovate-lanceolate, long acuminate, 2–3 mm long, concave, slightly wrinkled when dry, ecostate, margins entire, slightly toothed at tip, involute. Laminal cells nearly linear throughout, 45–90  $\mu\text{m}$  long and 2–5  $\mu\text{m}$  wide, smooth, incrassate, pitted; alar cells large, coloured, thin-walled. Dioicous. Perichaetial leaves small, shortly ovate-lanceolate with sheathing base, gradually short to long acuminate, plain, denticulate. Setae 15 to 20 mm long. Capsules ovoid-oblong, ca. 1 mm long, somewhat erect or subpendulous. Spores ca. 15  $\mu\text{m}$ , punctate.

ILLUSTRATIONS: Tan 1994: 290 (figs. 91–94).

With its long, pendent stem and laxly pinnately branching habit, *A. warburgii* is a distinctive species. The more or less complanate foliation with erect to appressed and only few laterally spreading leaves is the other diagnostic feature. In plant habit, *A. warburgii* can be mistaken for *A. longicaule*. The latter is a species of Java and Sulawesi that is larger and has well-developed alar cells consisting of a number of coloured and large supra-alar cells. This type of alar is rarely seen in the leaves of *A. warburgii*. The few lateral branches of *A. longicaule* also give the species a more strongly meteoriaceous appearance. It is possible that the laxly and pinnately branched *A. warburgii* and the more meteoriaceous looking *A. longicaule* may prove to be conspecific with more field observations of these two taxa. Both are found growing pendent on branches and twigs inside forest.

*Acroporium pinnatum* was listed as a synonym of *A. stramineum* var. *stramineum* by mistake in Tan (1994).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Milne Bay (Bartram 1957). Solomon Islands (first record). Kolombangara, in elfin forest at top of Mt. Veve, moist shaded twigs, 1600–1760 m, Norris & Roberts 499585 (H!).

TOTAL RANGE: As 4: Indonesia (Amboina, Borneo, Celebes, Ceram, Java), PNG. Oc: Solomons.

### Genus *Clastobryophilum* M. Fleisch.

*Clastobryophilum* was reviewed and revised by O'Shea (2000), who accepted only a single, widespread species in Malesia, and a second one, *Clastobryophilum balansaeianum* (Bosch & Sande Lac.) M. Fleisch., in New Caledonia. The genus is identified by its long and narrow leaves with slightly unipapillose cells and equally narrowly lanceolate, but markedly toothed, perichaetial leaves. The seemingly oblique arrangement of thick-walled laminal cells across the blade is also diagnostic.

### *Clastobryophilum bogoricum* (Bosch & Sande Lac.) M. Fleisch.

Musci Flora Buitenzorg 4: 1201. 1923. — *Hypnum Bogoricum* Bosch & Sande Lac., Bryol. Jav. 2: 217. 1870. — *Sematophyllum bogoricum* (Bosch & Sande Lac.) A. Jaeger, Ber. S. Gall. Naturw. Ges. 1876–1877: 385. 1878 (Adumbr. 2: 451). — LECTOTYPE: Indonesia. Java, in Mt. Salak, 5500 ft, Kurz s.n. (L, selected by O'Shea 2000).

Plants medium sized for the family, greenish, or at times reddish, mat and tuft forming, densely foliate, somewhat shiny. Stems ascending, not profusely branched. Leaves narrowly oblong-lanceolate, gradually tapering to a long acuminate, somewhat flexuose tip, slightly concave, margins plane, slightly crenulate due to the incrassate walls of marginal cells, ecostate. Laminal cells arranged in regularly oblique rows, narrowly oblong to elongate, 40–85  $\mu\text{m}$  long and 6–9  $\mu\text{m}$  wide, becoming short oblong at leaf tip, moderately incrassate, pitted, with invariably low unipapilla per cell; alar cells enlarged, frequently coloured. Dioicous. Perichaetial leaves ovate-lanceolate, half the length of vegetative leaves, laminal cells similarly incrassate, arranged in distinct rows, margins strongly toothed to base, no alar cell differentiation. Setae verrucose. Capsules oblong, exothecial cells colenchymatous. Peristome teeth striate and trabeculate. Spores large, 11–17  $\mu\text{m}$ , papillose.

ILLUSTRATIONS: Dozy & Molkenboer 1870: t. 318 (as



*Hypnum bogoricum*); Fleischer 1923: 1202 (fig. 198); Tixier 1977: 404 (fig. 1).

In SE Asia, *C. bogoricum* is an uncommon epiphyte on tree trunks and vines. Its very narrow, long and twisted leaves when dry are characteristic.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. Morobe (Tixier 1977), and: Wagau-Malolo Track, *Castanopsis* dominated slope, on tree trunk, 1550 m, *Streiman 19682* (H). Solomon Islands (first record). San Cristobal, in essentially undisturbed rainforest at top of ridge S of Manighai, 600–720 m, *Norris & Roberts 48992* in moist, shaded bark of vine; *Norris & Roberts 49076* in moist, diffusely lit bark of tree (H).

TOTAL RANGE: Afr 3: Madagascar, Seychelles. As 3: Sri Lanka, Kampuchea, Thailand. As 4: Malaysia, Philippines, Indonesia (Java, Borneo), PNG. Oc: Solomons.

### Genus *Pseudopiloecium* Bartr.

The genus *Pseudopiloecium* was described by Bartram (1943) to accommodate a *Piloecium*-like moss with plicate leaves, but with clearly *Acroporium*-type of alar cells. Other diagnostic characters include a seta strongly scabrous distally and a capsule coarsely tuberculate at base. Additionally, the leaf cells are narrowly oblong to elongate, incrassate, porose, and infrequently exhibit a low single papilla over the cell lumen.

This monotypic genus resembles *Piloecium* only superficially. While *Piloecium*, with its numerous quadrate alar cells, looks like a member of Myuriaceae, *Pseudopiloecium* is a bona fide member of the Sematophyllaceae. In our opinion, *Pseudopiloecium* is intermediate between *Acroporium* and *Trichosteleum* in its morphology. It is also somewhat close to *Clas-tobryophilum*. In fact, a number of herbarium specimens of this taxon have been misidentified as *C. bogoricum*, and vice versa.

### *Pseudopiloecium acroporioides* (Dix.) B. C. Tan, T.J. Kop. & D.H. Norris, **comb. nova**

*Piloecium acroporioides* Dix., J. Linn. Soc. Bot. 50: 132, pl. 3, fig. 37. 1935. — *Myurium pseudorufescens* (Hampe)

Maschke ssp. *acroporioides* (Dix.) Maschke, Bryophyt. Biblioth. 6: 148. 1976. — TYPE: Malaysia. Borneo, Sarawak, Marudi, *Oxford Exped. 2672* (BM!).

*Pseudopiloecium scabrisetum* Bartr., Farlowia 1: 45, figs. 26–28. 1943, *syn. nov.* — HOLOTYPE: Papua New Guinea. Western, Palmer River, 2 miles below junction with Black River, matted on tree trunks, VII.1936 *Brass 7301* (FH!).

*Pseudopiloecium mamillisetum* Zanten, Nova Guinea Bot. 16: 336, pl. xxxi, fig. 2. 1964, *syn. nov.* — HOLOTYPE: Indonesia. Jayawijaya, Sibil Valley, Basis Camp, on bark of tree trunk, 1300 m, 15.VIII.1959 *van Zanten 862a* (L).

Plants forming short to tall tufts. Stems to 5 cm tall, irregularly branched, branches ascending, to 2 cm long. Stem cross-section with thick epidermal cells, thin-walled cortical cells and without a central strand. Leaves erect, at times erect-spreading, ovate lanceolate, acuminate to narrowly long acuminate, entire, sometimes markedly serrulate above, plicate wet or dry, 3–4 mm long and 0.5–0.75 mm wide near base; laminal cells narrowly oblong to elongate, (45–)50–75(–103)  $\mu\text{m}$  long and 6.5–9  $\mu\text{m}$  wide, lowly unipapillose on some cells, moderately thick-walled to incrassate, pitted; alar cells enlarged, slightly coloured, thin- to thick-walled. Perichaetial leaves smaller than vegetative leaves, oblong-lanceolate to subulate, acuminate, strongly toothed half way above. Seta reddish, 15 mm long, strongly papillose above. Capsule oblong, tuberculate at base, exothecial cells colenchymatose, strongly mammillose; opercular lid rostrate. Calyptra cucullate. Spores ca. 12–15  $\mu\text{m}$  in diameter, distinctly papillose.

ILLUSTRATIONS: Dixon 1935: pl. 3 (fig. 37, as *Piloecium acroporioides*); Bartram 1943: 47 (figs. 26–28, as *Pseudopiloecium scabrisetum*); van Zanten 1964: pl. xxxi (fig. 2 as *Pseudopiloecium mamillisetum*).

There are differences in a few vegetative characters seen among the specimens of this taxon collected from Borneo, Irian Jaya, and Papua New Guinea. The Bornean specimen tends to have longer laminal cells, while the Irian Jaya plant has more strongly serrulate apical leaf margins. But the variations observed, in addition to the thickness of the laminal and alar cell walls, are without a clear pattern; in a few plants all the variations can be seen to occur together. We have concluded that the three taxa represent one spe-

cies exhibiting a certain degree of morphological plasticity.

It is truly a taxonomic coincidence that this unique taxon was given three different names by three experienced bryologists who knew the regional moss flora well, with two of them emphasizing the plicate leaves as a generic character (Dixon 1935, Bartram 1943), while the other two giving synonymous species epithets such as “*mamillisetum*” (Zanten 1964), or “*scabrisetum*” (Bartram 1943), in reference to the diagnostic character observed on the seta.

*Pseudopiloecium acroporioides* is disjunctively distributed in Borneo and New Guinea. In Malesia, moss species that are disjunctive between Borneo and New Guinea are uncommon, but not rare. Other examples documented in this treatment are *Acroporium adpersum* and *A. microcladum* var. *burleyii* (see above).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Indonesia. Irian Jaya, Jayawijaya (type information of *Pseudopiloecium mamillisetum*). Papua New Guinea. Western (type information of *Pseudopiloecium scabrisetum*).

TOTAL RANGE: As 4: Indonesia (Irian Jaya), Malaysia (Sarawak, type of *Piloecium acroporioides* and: Bau Limestone Park, on rock, *J.J. Stephen, SBC 6454, SINU!*), PNG (first record).

## Genus *Radulina* W.R. Buck & B.C. Tan

This distinctive genus is the former section *Thelidium* of *Trichosteleum*, which was segregated on the basis of pluripapillose leaf cells (Buck & Tan 1989). *Radulina* probably has 3–4 species across Malesia and Oceania, including one from Society Islands, i.e., *R. orthophylla* (Tan *et al.* 2005). Three species are reported here for western Melanesia.

### Key to the species of *Radulina* in western Melanesia

1. Laminal cells smooth, prorate, to weakly 2–3-papillose at leaf base ..... 2
1. Laminal cells markedly pluripapillose throughout from leaf base to acumen ..... 3
2. Upper laminal cells weakly to moderately pluripapillose; calyptra nitrate ..... *R. laevi-hamata*
2. Upper laminal cells mostly unipapillose; calyptra cucul-

- late ..... *R. weidenii*
3. Leaves mainly or somewhat falcate-secund, gradually short to long acuminate ..... *R. hamata*
3. Leaves mainly erect-spreading, at most slightly falcate, abruptly long acuminate to cuspidate ..... *R. pendens*

## *Radulina hamata* (Dozy & Molk.) W.R. Buck & B.C. Tan

*Radulina hamata* is a polymorphic species. Many forms can be seen among the collections made from the Huon Peninsula and other parts of New Guinea, but they are always found with intermediates. Across the Malesian and Polynesian regions, there is probably only one morphologically plastic taxon in spite of many names sharing similar characters of falcate-secund leaves with pluripapillose cells and much enlarged hyaline alar cells. In our opinion, the three varieties proposed below are worth recognizing. We cannot find any differences between *R. hamata* and *R. borbonica* from Africa (Tan *et al.* 2005).

### Key to the varieties of *Radulina hamata* recognized in this treatment

1. Plants with ovate-lanceolate leaves, falcate secund to circinate ..... 2
1. Plants with narrowly lanceolate to seemingly linear leaves, erect spreading to weakly falcate .....  
..... var. *elegantissima*
2. Middle to upper leaf cells elongate to linear, papillae small, more than 4 per cell ..... var. *hamata*
2. Middle to upper leaf cells along to elliptic, papillae stout, (1–)2–3(–4) per cell ..... var. *scaberula*

## *Radulina hamata* (Dozy & Molk.) W.R. Buck & B.C. Tan var. *hamata*

Acta Bryolichenol. Asiatica 1: 10. 1989 [1990]. — *Hypnum hamatum* Dozy & Molk., Ann. Sci. Nat. Bot. sér. 3, 2: 307. 1844. — *Trichosteleum hamatum* (Dozy & Molk.) A. Jaeger, Ber. S. Gall. Naturw. Ges. 1876–1877: 420. 1878 (Adumbr. 2: 486). — TYPE: Indonesia. Borneo, Sumatra (isotype NY, cf. Buck & Tan 1989).

*Leskea borbonica* Bél., Voyag. Ind. Oc. Bot. 2 (Crypt.): 97. 1846, *syn. nov.* — *Radulina borbonica* (Bél.) W.R. Buck, Trop. Bryol. 8: 208. 1993.

*Hypnum hamatum* var. *semimammosum* Müll. Hal. in Geheeb, Bibl. Bot. 13: 11. 1889. — *Trichosteleum hamatum* var. *semimammosum* (Müll. Hal.) Paris, Ind. Bryol. 1311. 1898. — TYPE: Papua New Guinea. Central, Astrolabe Range,

*W.G. Lawes* (not seen; synonymy *vide* Bartram 1939).

Plants very variable, forming tufts or mats, pale yellow to lurid green, somewhat glossy. Stems creeping, irregularly branched, branches usually hooked at tip due to the circinnate leaves. Stem and branch leaves crowded, erect-spreading to strongly falcate-secund, gradually short to long acuminate from a concave ovate to lanceolate leaf base, ecostate, 2 to 2.5 mm long and about 0.3–0.5 mm wide; margins erect, at times involute, entire below, becoming dentate or serrate, often sharply serrate, near leaf apex. Laminal cells oblong, narrowly elliptic to linear, 34–58  $\mu\text{m}$  long and 4–6  $\mu\text{m}$  wide, more or less pitted, thin to moderately thick-walled, bi- to pluripapillate, forming 1–2 rows of weak to stout papillae per cell over the lumina or along cell walls; alar cells, inflated, much enlarged, hyaline, thin-walled. Autoicous. Perichaetial leaves ovate-lanceolate, quickly becoming long-acuminate, sharply toothed, leaf cells occasionally also pluripapillose. Setae short to long, 1–2.5 cm in length, smooth below and papillose distally. Calyptra cucullate. Capsules small, ovoid to oblong, horizontal, constricted at mouth when dry, at times with well enlarged neck region as wide as the urn; opercular lid needle-like, longer than urn. Peristome teeth striate, trabeculate. Spores 9–16  $\mu\text{m}$ , papillose.

ILLUSTRATIONS: Dozy & Molkenboer 1867: t. 275 (as *Hypnum hamatum*); Brotherus 1925: 348 (fig. 741); Bartram 1939: pl. 15 (fig. 435, as *Trichosteleum hamatum*); Gangulee 1980: 1913 (fig. 979, as *Trichosteleum hamatum*).

Most of our specimens from Huon Peninsula were collected in primeval montane rainforests at 1100–2300 m, except a couple of specimens from disturbed lowland rainforest. The substrates were twigs (4 specimens), trunk of *Pandanus* (1), diffusely lit log (4), and on humus (1). The Streimann collections extend the range of this species from mangrove forest at sea level to lowland and montane rainforest zones, and some specimens were collected in plantation forests. Most of the Streimann collections were taken from rotten wood such as logs and the same substrate is given on labels of the Solomon Islands specimens.

RANGE ON HUON PENINSULA: 4a. 467. 4b. 698. 4e. 66448. 4g. 66784, 66806. 5a. 65736. 9c. 30204. 9l. 62098. 10o. 59885, 59886. 10p. 60032.

RANGE IN WESTERN MELANESIA (old reports as *Trichosteleum hamatum* unless stated otherwise): West Irian. Manokwari (Bartram 1960a). — Fakfak (Bartram 1951). — Jayawijaya (Bartram 1942). — Merauke (van Zanten 1964). Papua New Guinea. West Sepik. Frieda River, *Koponen 35981* (as *Trichosteleum grosso-mamillosum* in Norris & Koponen 1985). — East Sepik (Bartram 1961b). — Madang (Bartram 1961b). — Morobe (Brotherus 1901, as *T. hamatum* var. *semi-mamillosum*), present report, and: Mt. Kaindi Road, montane forest on moderate slope, 1450 m, *Streimann 33386* on rotting log and *Streimann 33395* on rotting wood (CBG, H); near Nauti Village, Upper Watut River, advanced *Castanopsis* regrowth on broad ridge, rotting log, 880 m, *Streimann 13396*; 11 km SW of Bulolo, *Araucaria* dominated lower montane forest, fallen rotting log, 1200 m, *Streimann & Kairo 17270* (CBG, H); Labu, 3 km W of Lae, swamp dominated by *Rhizophora* and *Bruguiera*, on dead *Rhizophora* log, at sea level, *Rau 689B* (CBG, H); Herzog Mt., *Castanopsis* and Dipterocarpaceae dominated lower montane forest, rotting log with numerous mosses, 760 m, *Streimann & Umba 10851* (CBG, H); Ekuti Range, Bulolo-Aseki Road, advanced regrowth on ridge dominated by emergent *Pandanus*, rotting log, 2060 m, *Streimann 20388*, montane forest on ridge, on log, 2200 m, *Streimann 23175* (CBG, H); Labutali Village, 5 km SW of Lae, in mangrove swamp, rotting log, *Bellamy 189* (CBG, H). — Western Highlands (Bartram 1957), and: Mt. Hagen, Karpenna Plantation, *Eucalyptus* plantation, 1580 m, *Streimann 21901* on stump and log, and *Streimann 21918* on base of *Eucalyptus* trunk (CBG, H). — Southern Highlands. Batteri, Fara Range, poor forest on limestone, 1800 m, *Streimann 23383* on dead shrub branch, and *Akivi 11* on dead log in advanced regrowth on slope (CBG, H). — Western (Bartram 1943). — Central (type locality of *Hypnum hamatum* var. *semimamillosum*), and: Fleischer (1918), Dixon (1922); Varirata National Park, Sogeri, *Castanopsis* and *Schizomeria* dominated disturbed forest, rotting log, 600 m, *Streimann & Vinas 14587* (CBG, H); Musgrave River, 16 km E of Sogeri, Dipterocarpaceae–*Castanopsis* dominated forest on side of ridge, rotting log, 700 m, *Streimann & Naoni 15971, 15949* (CBG, H); road to Morehead from Balamuk, swamp forest, *Leach UPNG 3850* (CBG, H); Angabanga River, 39 km ENE of Bereina, lowland forest on ridge with some remnant *Cycas*, rotting log, 400 m, *Streimann & Naoni 16178* (CBG, H). — Milne Bay (Brotherus 1901, as *Trichosteleum hamatum* var. *semi-mamillosum*; also Bartram 1957). — Papuan Islands (Bartram 1957, 1960b). — New Britain (Brotherus 1901, as *T. hamatum* var. *semi-mamillosum*). — New Ireland (van Zanten 1968). — Bougainville (Brotherus 1901, as *T. hamatum* var. *semi-mamillosum*). Solomon Islands (first record). Kolombangara, in rainforest on middle slopes of mountain N of Vanga River, moist, shaded log, 1000–1200 m, *Norris & Roberts 49795*; in rainforest on upper slopes of mountain near Mt. Veve, moist, diffusely lit log, 1200–1400 m, *Norris & Roberts 49450*; moist, shaded log at 1400–1600 m, *Norris & Roberts 49701*; elfin forest at top of Mt. Veve, diffusely

lit stem of bamboo, 1600–1760 m, *Norris & Roberts 49503* (H).

TOTAL RANGE: Afr 2, A2: China, Japan. As 3: Kampuchea, Laos, Thailand, Vietnam. As 4: Indonesia, Malaysia, Singapore, Philippines, Brunei Darussalam, PNG. Oc: Fiji (Tavouni, Cakaudrove Prov., dense rainforest at top of ridge, moist shaded tree, 600–900 m, *Norris 45057*, H), Solomon Islands. Austr 1 (Northern Territory and Queensland).

***Radulina hamata*** (Dozy & Molk.) W.R. Buck & B.C. Tan var. ***elegantissima*** (M. Fleisch.) B.C. Tan, T.J. Kop. & D.H. Norris

Ann. Bot. Fennici 42: 232. 2005. — *Trichosteleum elegantissimum* M. Fleisch., Musci Fl. Buitenzorg 4: 1326. 1923. — *Radulina elegantissima* (M. Fleisch.) W.R. Buck & B.C. Tan, Acta Bryolichenol. Asiatica 1: 10. 1989 [1990]. — SYNTYPES: Indonesia. West-Java, *Fleischer*; Ost-Java, *Fleischer*; Sumatra, *Fleischer* (FH!).

Plant habit and leaf areolation similar to *Radulina hamata* var. *hamata*, except that the plant size is half as large, and the leaves are somewhat erect-spreading, but not strongly falcate-secund at the tip of the branches. Autoicous. Perichaetial leaves narrowly lanceolate, gradually long acuminate. Setae short to long, mostly 6–10 mm long, rarely reaching 15 mm long. Capsule small, less than 1 mm long. Spores 8–10  $\mu\text{m}$ , slightly papillose.

ILLUSTRATIONS: *Fleischer* 1923: 1327 (fig. 215, as *Trichosteleum elegantissimum*); *Bartram* 1939: pl. 25 (fig. 434, as *T. elegantissimum*).

Both *Fleischer* (1923) and *Bartram* (1939) discussed the morphological distinctions between *Trichosteleum hamatum* and *T. elegantissimum*. Except for the differences in the minute plant size and the more or less erect-spreading leaves seen in *T. elegantissimum*, the other characters mentioned are not so constantly manifested to warrant a separation of the two species. The leaves of *Radulina hamata* var. *elegantissima* normally are narrowly lanceolate with long acuminate tips, measuring 1.2 to 1.4 mm long and 0.25 mm wide, while the ovate-lanceolate leaves of var. *hamata* measure about 2 mm long and 0.3–0.5 mm wide. However, some populations of var. *hamata* from Papua New Guinea are small in plant size albeit with strongly circinate

foliation (see also var. *scaberula*). In such cases, the linear leaf cells of the upper part of the leaf would indicate it as a member of the var. *hamata*. Likewise, some large specimens of var. *hamata* have somewhat erect-spreading and only weakly falcate-secund leaves.

*Radulina hamata* var. *elegantissima* grows on Huon Peninsula both in lowland rainforests and in montane forests, including moss forests at 500–2400 m. Most of the habitats were primeval, but additional specimens were taken also in disturbed and in badly logged areas as well. It is both epiphytic and epiphyllitic, but grows preferably on rotten wood in diffusely lit or shaded conditions. The substrate information includes log (11 specimens), bark of tree (3), nodes of bamboo (1), and moist shaded leaf (1).

RANGE ON HUON PENINSULA: 4a. 460. 4d. 66364. 4g. 66705. 5a. 65769, 65770. 5b. 65873, 65922, 65926, 65974. 5c. 66147. 7b. 65430. 9j. 61376. 9l. 62011. 10e. 28774. 10p. 60082. 14b. 58859. 14d. 58799.

RANGE IN WESTERN MELANESIA: West Irian. Jayapura (van Zanten 1964, as *Trichosteleum elegantissimum*). Papua New Guinea. Morobe (present report), and: Near Nauti Village, Upper Watut River, *Castanopsis* forest on broad ridge, rotting log, 880 m, *Streimann 13378* (CBG, H); 15 km E of Bulolo, *Castanopsis-Galbulimima* dominated forest on gentle slope, rotting log, *Streimann & Bellamy 13175* (CBG, H). — Central (Dixon 1922, 1942, as *T. grosso-mamilosum*). — Papuan Islands (*Bartram* 1957, as *T. grosso-mamilosum*). — New Britain. Galai 25 km SE of Kimbe, oil palm plantation, rotting log, 50 m, *Suarim II* (CBG, H). Solomon Islands (first record). Kolombangara, in lowland forest along Vanga River, moist rather shaded log, 0–100 m, *Norris & Roberts 49992* (H).

TOTAL RANGE: As 4: Indonesia (Bali, Java), Philippines, PNG. Oc: Solomon Islands.

***Radulina hamata*** (Dozy & Molk.) W.R. Buck & B.C. Tan var. ***scaberula*** (Mont.) B.C. Tan, T.J. Kop. & D.H. Norris (Fig. 3)

Ann. Bot. Fennici 42: 232. 2005. — *Hypnum scaberulum* Mont., Lond. J. Bot. 3: 633. 1844. — *Radulina scaberula* (Mont.) W.R. Buck & B.C. Tan, Acta Bryolichenol. Asiatica 1: 10. 1989 [1990]. — TYPE: Indonesia. Java, 1843, ex Herb. Miguel (isotype NY!).

*Trichosteleum aequoreum* M. Fleisch. ex Dix., J. Linn. Soc. Bot. 43: 320. 1916; M. Fleisch., Musci Flora Buitenzorg 4: 1328. 1923, syn. nov. — *Radulina aequorea* (M. Fleisch. ex Dix.) W.R. Buck & B.C. Tan, Acta Bryolichenol. Asiatica 1: 10. 1989 [1990]. — TYPE: Papua New Guinea. Bismarck



Archipelago, Mioko Is., Fleischer's *Musci Archiper. Ind. et Polyn. Exsicc.* 446 (also as *Kryptogamae Exsiccatae* 1899, H!).

*Trichosteleum grosso-mamillosum* Müll. Hal. in Paris, Ind. Bryol. 1311. 1898, *nom. nud.* — *Trichosteleum grosso-mamillosum* Paris ex Dix., J. Linn. Soc. Bot. 45: 507. 1922, *syn. nov.* — TYPE: Papua New Guinea. New Guinea orientalis Brit., in montosis Moroka, 1300 m, distr. Moresby, 1893 *Loria* (Bryoth. E. Levier 697, not seen).

Plants small, forming dense mats. Leaves lanceolate, 1–1.25 mm long and 0.25 mm wide, slightly concave, short acuminate, falcate to strongly circinate; margins plain and serrate. Laminal cells mostly elliptic to shortly elongate, 20–25  $\mu\text{m}$  long and 4–7  $\mu\text{m}$  wide, except at leaf base where the cells become elongate-linear, papillae 1–4, mostly 2–3, per cell, stout and dense; alar cells inflated, large, thin-walled. Autoicous? Setae short, about 5–7 mm long, nearly smooth throughout. Capsules not seen.

OTHER ILLUSTRATION: None.

Aside from being smaller, *R. hamata* var. *scaberula* is distinguished by having falcate to circinate leaves without the long and sharply acuminate apices commonly seen in the var. *hamata* and var. *elegantissima*. The cells also are rather consistently oblong-elliptic in the upper half of the leaf, rarely becoming linear apically as in the var. *hamata*. The papillae are also very stout and conspicuously developed in the var. *scaberula*. *Koponen 35609* from Frieda River (H!) is an exceptionally large specimen approximating the typical size of var. *hamata*.

The type of *Trichosteleum aequoreum* is similar to *Radulina hamata* var. *scaberula* in having a few stout and large papillae on each of the elliptic leaf cells. We reproduce below the original diagnosis of *Trichosteleum grosso-mamillosum* for comparison with the description of *Radulina hamata* var. *scaberula*. There is nothing critical in the protologue that can distinguish it from var. *scaberula*; hence, the proposed new synonymy between these two taxa.

“*Habitu* [Trichosteleum] *hamatum simillimum, sed minus, foliorum structura longe aliena, cellulis haud incrassatis, bi-pluri-papillois, papillis grossiusculis, cellulis marginalibus laevibus; folia brevius acuminata, superne grosse, dense, argute dentata.*” (Dixon 1922).

In Huon Peninsula *R. hamata* var. *scaberula* was collected only once, but previous collections from West Sepik and other places (see below) give the impression that its altitudinal range is lower than the ranges of the var. *hamata* and var. *elegantissima*, and it is limited to the lowland rain forests, while the other varieties extend their ranges to montane rainforests. All collections seen were collected from rotten wood, while the two other varieties grow also epiphytically.

RANGE ON HUON PENINSULA: 5c. In very rich rainforest, moist, rather shaded log, 900–1100 m, *Norris 66002*.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik, Frieda River, *Koponen 35982, 35983, 34988, 35609, 35615, 35644, 35645, 35223, 35235* (as *Trichosteleum grosso-mamillosum* in *Norris & Koponen 1985*). — Morobe (present report). — Central (type of *Trichosteleum grosso-mamillosum*). — New Britain. Bismarck Archipelago (see type specimen); Willaumez Peninsula, 26 km NE of Talasea, flat, logged-over site, dead log, 25 m, *Kolema 29* (CBG, H). — Milne Bay. Goodenough Island, *Castanopsis* forest, on rotting wood, 1400 m, *L.J. Brass 24698* (as *Trichosteleum grosso-mamillosum*, FH, H).

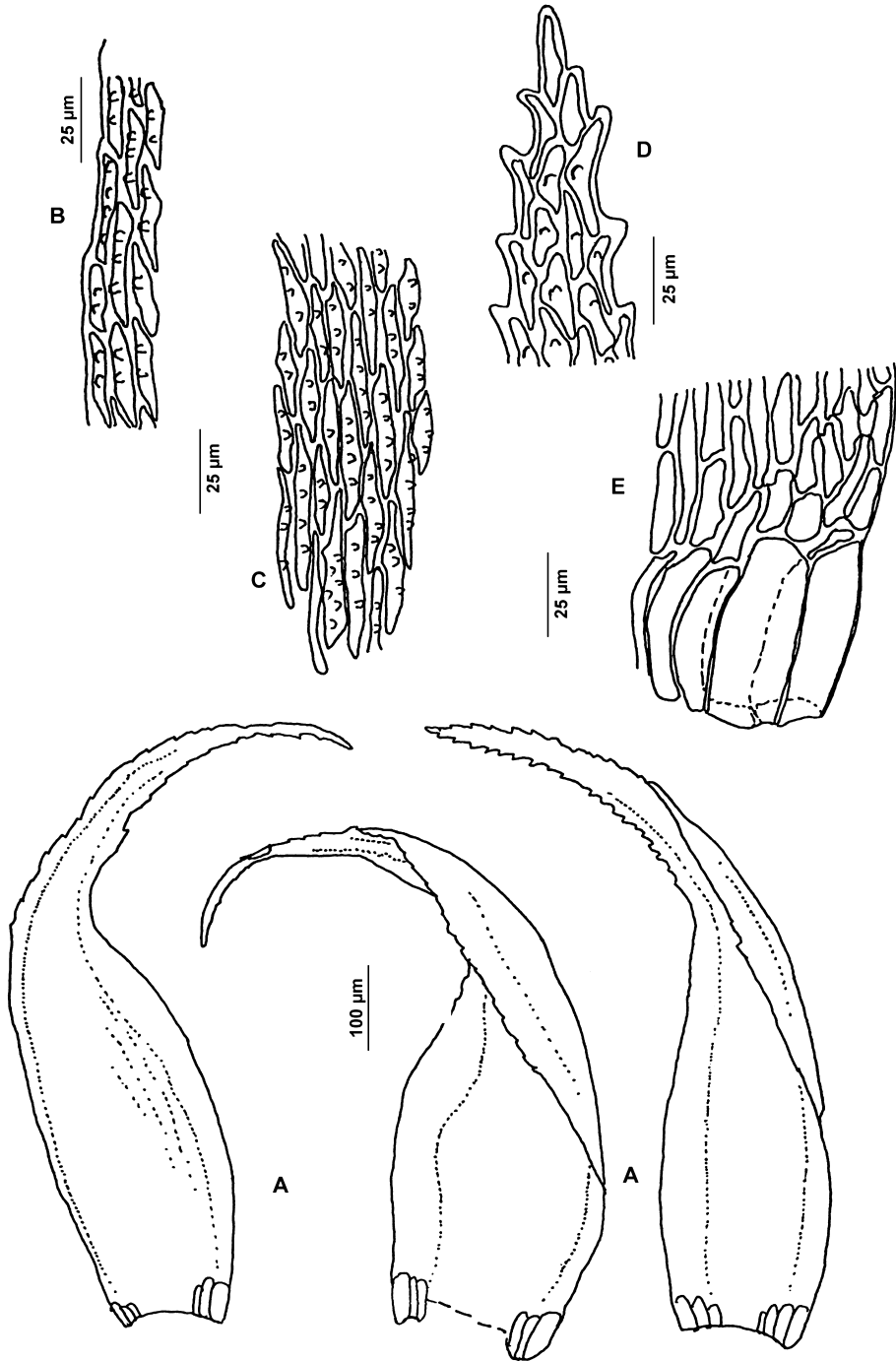
TOTAL RANGE: As 4: Malaysia (Sarawak, Bau Limestone Park, *Connie et al, SBC 6251*, SINU), Philippines (Negros, Dumaguete, 1958 *Brown*, NY!), PNG (first record).

### *Radulina laevi-hamata* (Dix.) B.C. Tan, T. J. Kop. & D.H. Norris (Fig. 4)

Ann. Bot. Fennici 42: 232. 2005. — *Trichosteleum laevi-hamatum* Dix., J. Bot. 80: 31. 1942. — TYPE: Papua New Guinea. Central, The Gap, range above Port Moresby, 2450 m, *C.E. Carr 13823* (BM).

Plants mat-forming. Stem irregularly branched, branches somewhat ascending, strongly curved at tip because of circinate leaves. Leaves lanceolate-linear, 1.5 to 2 mm long, falcate-secund to strongly circinate, slenderly acuminate, margins entire below, convolute, weakly toothed to crenulate at tip. Laminal cells narrowly oblong to linear, 35–46  $\mu\text{m}$  long and 5–7  $\mu\text{m}$  wide, thin- to thick-walled, prorate at leaf base, at times smooth or weakly pluripapillose, becoming clearly pluripapillose at leaf acumen; alar cells large, thin-walled, hyaline. Autoicous? Perichaetial leaves larger than vegetative leaves, broadly ovate-lanceolate, narrowed to the long acuminate and markedly toothed apex, laminal cells linear, smooth. Calyptra mitrate, smooth. Setae 2–2.5





**Fig. 3.** *Radulina hamata* var. *scaberula* (from type of *Trichosteleum aequoreum*, H). — **A:** Leaves. — **B:** Margin at midleaf. — **C:** Median laminal cells. — **D:** Leaf tip. — **E:** Alar region.

cm long, papillose 2/3 from tip to near base. Capsules oblong with large neck region nearly equal the size of the urn, horizontally inclined. Spores 11–14  $\mu\text{m}$ , lightly papillose.

OTHER ILLUSTRATION: None.

The type has no sporophyte (cf. Dixon 1942). The description of the sporophyte is based on *Brass* 24893 identified by Bartram and confirmed by us. Admittedly, the species is an odd member in the genus, being the only one with a mitrate calyptra. Since mitrate, campanulate and cucullate calyptrae are all present in species of *Warburgiella*, maybe the same pattern of evolution of calyptrae is repeated in *Radulina*. Equally enigmatic, the leaf cells of *Trichosteleum laevi-hamatum* are prorate, smooth, unipapillose, or weakly pluripapillose below, and become clearly pluripapillose at the slender leaf acumen. The capsule of *T. laevi-hamatum* with a large and thick neck region about the same size as the urn is also reminiscent of *Warburgiella*. In spite of that, we think that the overall leaf shape and the weakly to clearly pluripapillose apical leaf cells point to a closer relationship with *Radulina*. Its correct generic placement in the family may need molecular evidence to resolve. In many ways, this species can serve as a link between *Radulina* and *Warburgiella*. Many of the spores examined appeared to be aborted.

RANGE ON HUON PENINSULA: 7a. In open rainforest on crest of ridge along trail, moist, diffusely lit twigs, 1900–2100 m, *Norris* 65336 (H).

RANGE IN WESTERN MELANESIA: Papua New Guinea. Morobe (present report). — On W-facing slope of Mt. Buruman, E of Wantoap River, ca. 9 km NNW of Wantoat, 1850–2000 m, *Koponen* 29353 (H). — Eastern Highlands (Bartram 1965). — Central (type of *Trichosteleum laevi-hamatum*). — Milne Bay (Bartram 1957 as *T. laevi-hamatum*). — Papuan Islands (Bartram 1957): Goodenough Island, on dead wood, 1600 m, *Brass* 24893 (FH, H).

TOTAL RANGE: As 4: Known only from Papua New Guinea.

***Radulina pendens*** (D.H. Norris & T.J. Kop.)  
B.C. Tan, T.J. Kop. & D.H. Norris

Ann. Bot. Fennici 42: 232. 2005. — *Trichosteleum pendens* D.H. Norris & T.J. Kop., Ann. Bot. Fennici 22: 388, fig. 10. 1985. — HOLOTYPE: Papua New Guinea., West Sepik, Frieda

River, 1100 m, 8.VIII.1981 *Koponen* 35847 (H!).

Plants growing pendent on tree trunk, branches long, to 4–5 cm, not attenuate at tip. Leaves erect spreading, slightly falcate, ovate- to oblong-lanceolate, markedly concave, slightly wrinkled when dry, constricted to a well defined long, narrow and sharp acumen to about 1/3 of leaf length, margins plane and entire below, serrulate in the acumen. Laminal cells linear, thickened at cell ends, 65–95  $\mu\text{m}$  long and 6–8  $\mu\text{m}$  wide, with 2–4 papillae in a row over the lumen, basal leaf cells smooth; alar cells large, inflated, hyaline, thin- to thick-walled. Perichætia and sporophytes not seen.

ILLUSTRATION: Norris & Koponen 1985: 388 (fig. 10, as *Trichosteleum pendens*).

This is another odd species of *Radulina* found in Papua New Guinea. Generic placement remains a problem. The non-falcate, oblong-lanceolate and somewhat cuspidate leaf outline is different from all species of *Radulina*. Yet, its pluripapillate leaf cell character certainly precludes a placement in *Trichosteleum*.

In Irian Jaya (formerly Dutch New Guinea), there is another species with slender, flexuose stem habit, coupled with straight leaves and uniseriately papillate leaf cells, *Trichosteleum sematophylloides*. According to Norris and Koponen (1985), as compared with *Radulina pendens*, *Trichosteleum sematophylloides* has a more dentate leaf margin and a more gradually formed long acumen, in addition to smaller plant size. We have concluded that *Trichosteleum sematophylloides* is conspecific with the polymorphic *Wijkia extenuata*, a very widespread Australasian species (Tan et al. 2005).

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik. Frieda River, *Koponen* 35847 (type), 35424 (as *Trichosteleum pendens* in Norris & Koponen 1985).

TOTAL RANGE: Endemic to Papua New Guinea.

***Radulina weidenii*** (Zanten) B.C. Tan, T.J.  
Kop. & D.H. Norris

Ann. Bot. Fennici 42: 232. 2005. — *Warburgiella weidenii* Zanten, Nova Guinea Bot. 16: 330, pl. xxii, fig. 5. 1964.

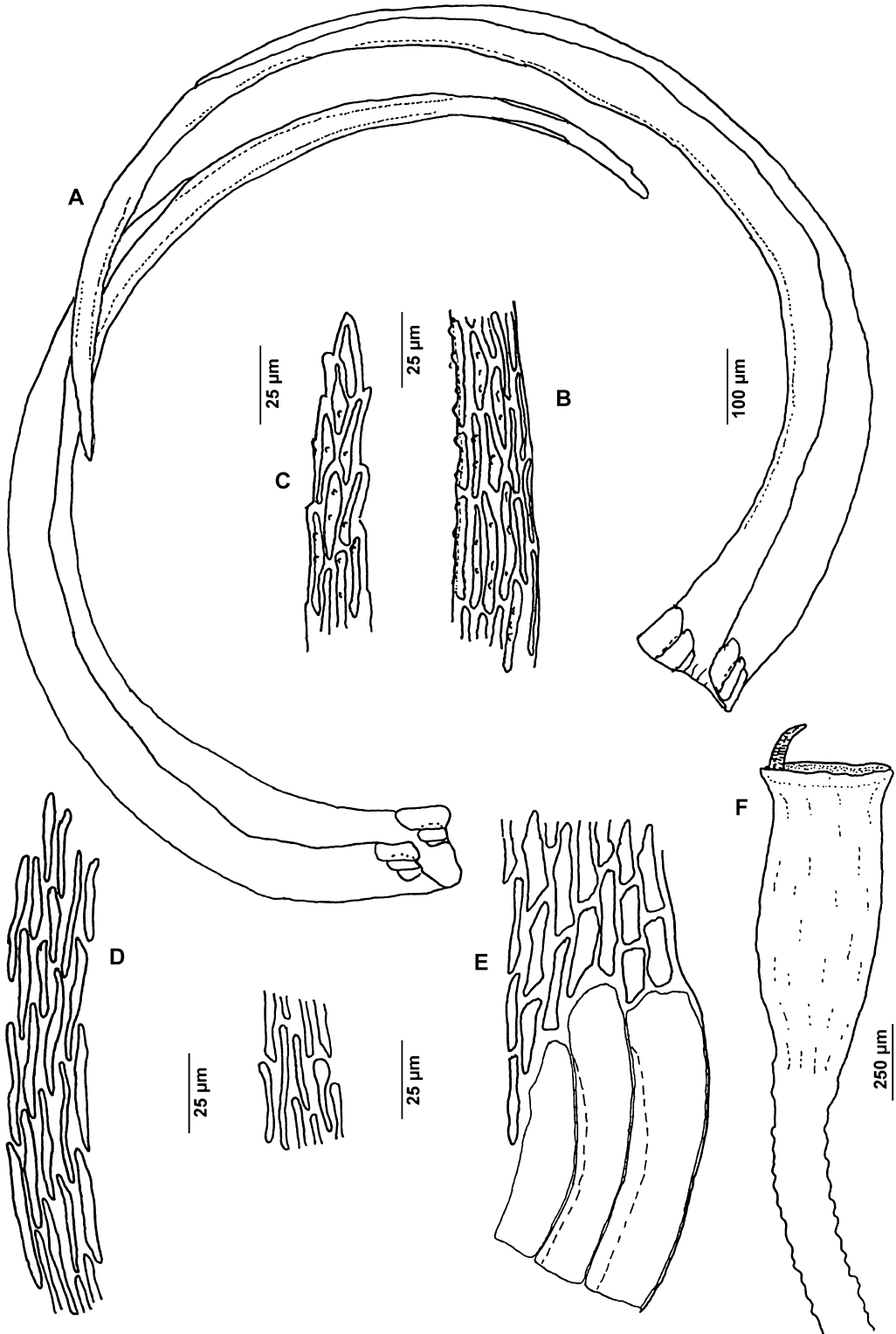


Fig. 4. *Radulina laevi-hamata* (from C.E. Carr 13823, BM). — A: Leaves. — B: Margin and leaf surface at midleaf. — C: Leaf tip. — D: Median laminal cells. — E: Alar region. — F: Capsule (with damaged peristome).

— HOLOTYPE: Indonesia. Irian Barat, Woropko, 100 m, *van Zanten 206* (L!). — PARATYPE: Indonesia. Tanah Merah, 50 m, *van Zanten 111* (L!).

Plants mat-forming, yellowish green. Stems creeping, irregularly branched, branches usually curved at tip due to the falcate leaves. Stem and branch leaves erect-spreading to falcate-secund, gradually long acuminate from ovate to lanceolate leaf base, ecostate, 1–1.5 mm long and about 0.25–0.4 mm wide, slightly concave; margins erect, denticulate to base, becoming sharply serrate near apex. Laminal cells oblong and short fusiform in the upper half, narrowly elliptic to elongate near base, (10–)23–50(–60)  $\mu\text{m}$  long and 4–7  $\mu\text{m}$  wide, moderately thick-walled, pitted, unipapillose, papillae very strong, rarely with 2 papillae per cell over the lumen, at times with 3–4 papillae at leaf base; alar cells inflated, much enlarged, hyaline, thin-walled. Autoicous? Perichaetial leaves slightly smaller than the vegetative leaves, narrowly ovate-lanceolate, gradually becoming long-acuminate, sharply toothed, leaf cells at time smooth, occasionally also unipapillose. Setae short, 6–8 mm in length, smooth below and weakly papillose from middle to distal end. Calyptra cucullate. Capsules small, ovoid, less than 1 mm long, horizontal, constricted at mouth when dry; opercular lid needle-like. Spores 9–14  $\mu\text{m}$ , slightly papillose.

ILLUSTRATION: van Zanten 1964: pl. xxix (fig. 5).

This species, in many respects, looks more like *Radulina* than *Warburgiella*. In the first place, the stout, single papilla on upper leaf cells of some leaves is not observed in any species of *Warburgiella* in the Malesian region. Nonetheless, basal leaf cells in many leaves of the type of *R. weidenii* are observed to develop weakly 2–3 papillae similar to the papillosity seen in *Radulina*. The paratype specimen of *R. weidenii* has more narrowly lanceolate and more falcate leaves with more cells having more than 3–4 papillae per cell as compared with the holotype specimen.

*Warburgiella weidenii* was reduced to a synonym of *Radulina scaberula* (= *R. hamata* var. *scaberula*) by Buck and Tan (1989). Because of its uniquely and predominantly unipapillose cells

in the upper part (but not the lower half) of the leaves, the taxon is hereby resurrected as a species closely related to *R. hamata* var. *scaberula*.

This species is distinctive in *Radulina* by having strongly unipapillose upper leaf cells. Even here, there is a tendency to develop more than one large papilla in some leaf cells. The other special feature of leaf cell papillae in this species is their presence on both abaxial and adaxial surfaces of the lamina. In *R. hamata*, the seriate leaf cell papillae are formed only on the abaxial surface of the leaf. In addition, the strongly serrate leaf margin, which consists of oblong and smooth cells, is also diagnostic for *R. weidenii*. The species, with its strongly falcate leaves and predominantly unipapillose leaf cells, is a link between *Trichosteleum* and *Radulina*.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: West Irian (the type locality). Papua New Guinea. Central, near Dabamura on Owers Corner Road, 40 km NE of Port Moresby, on rotting log in *Castanopsis* dominated forest, 580 m, *Streimann & Naoni 14857* (H!, CBG).

TOTAL RANGE: As 4: Endemic to New Guinea.

### Genus *Trichosteleum* Mitt.

The genus as defined by Buck and Tan (1989) includes those species of the Sematophyllaceae that have erect to flexuose leaves, either flat or concave, with unipapillose, oblong to linear, thin- to thick-walled laminal cells. Alar cells are hyaline, thin-walled and very enlarged. Perichaetial leaves also have often unipapillose cells. Setae are papillose or pustulose distally. Exothelial cells of capsule are strongly collenchymatous, and markedly mammillose when dry.

Below we report seven species of *Trichosteleum*, which we accept in this revision. Of these, two are endemic, namely *T. fuscescens* and *T. streimannii*, and the latter is new to science. *Trichosteleum singaporense*, *T. robbinsii* and *T. piliferum* are three new synonyms proposed.

Of the remaining species reported from New Guinea, *Trichosteleum horridulum* and *T. novoguineae* are synonyms of species of *Acroporium*. *Trichosteleum perfalcatum* is better placed in *Warburgiella*. *Trichosteleum pallidum* *hom. illeg.* was removed to *Warburgiella* as *W. sub-*

*leptorrhynchoides* by Bartram (1961a), while *Trichosteleum cymbiforme* and *T. brongersmae* belong in *Papillidiopsis* (forthcoming part 2 of this revision).

### Key to the species of *Trichosteleum* in Papua New Guinea

1. Leaf cells weakly to moderately unipapillose to almost smooth ..... 2
1. Leaf cells strongly unipapillose ..... 5
2. Leaves smaller, less than 1.5 mm long and ca. 0.25 mm wide ..... 3
2. Leaves large, 1.5–2 mm long and ca. 0.5 mm wide ..... 4
3. Capsules strongly mammillose-papillose, tuberculate ..... *T. mammosum*
3. Capsules at most mammillose, not tuberculate ..... *T. stigmosum*
4. Plants with obtuse or broadly acute leaf apices; distal apical leaf cells mostly oblong ..... *T. fuscescens*
4. Plants with long acuminate and sharply pointed leaf apices; distal apical leaf cells mostly linear ..... *T. saproxylophilum*
5. Plants large with long branches reaching 2–3 cm long, leaves wrinkled when dry ..... *T. streimannii*
5. Plants smaller, branches less than 1.5 cm long, leaves not wrinkled when dry ..... 6
6. Leaves ovate-lanceolate, apices abruptly acute to short or long acuminate ..... 7
6. Leaves lanceolate to lanceolate-oblong, apices gradually long acuminate ..... *T. stigmosum*
7. Capsules strongly mammillo-papillose, tuberculose ..... *T. mammosum*
7. Capsules at most mammillose, not tuberculose ..... 8
8. Leaf apical margins often recurved on one or two sides, marginal teeth serrate to serrulate, the width of leaf acumen near midpoint wide, more than 4 cells ..... *T. boschii*
8. Leaf apical margins plane, marginal teeth sharply dentate, the width of leaf acumen near midpoint narrow, 2–3(–4) cells wide ..... *T. pseudomammosum*

### *Trichosteleum boschii* (Dozy & Molk.) A. Jaeger

Ber. S. Gall. Naturw. Ges. 1876–1877: 421. 1878 (Adumbr. 2: 487). — *Hypnum Boschii* Dozy & Molk., Ann. Sci. Nat. Bot. sér. 3, 2: 306. 1844. — *Rhaphidostichum boschii* (Dozy & Molk.) Seki, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 12: 58. 1968. — TYPE: Indonesia. Borneo (not seen).

*Trichosteleum basilanense* Broth., Philipp. J. Sci. C (Bot.) 1113: 220. 1918. — TYPE: Philippines. Basilan, Cumarang, Reillo, Bur. Sci. 6268 (H!). — Synonymized by Bartram (1939).

*Hypnum thelidictyon* Sull. & Lesq., Proc. Amer. Acad. Arts Sci. 4: 280. 1859. — *Rhaphidostichum boschii* ssp. *theli-*

*dictyon* (Sull. & Lesq.) Seki, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 12: 55. 1968. — LECTOTYPE: China. Hong-Kong, rocks in ravines, C. Wright 25 (FH, selected by Seki 1968).

Plants variable in size, forming dense mats and low tufts, yellowish green, slightly glossy. Stems creeping, irregularly branched, branches laxly ascending, slightly complanate. Branch leaves erect-spreading, ovate-lanceolate, broadly lanceolate to elliptic-lanceolate, 2 mm long and less than 0.5 mm wide, concave, often abruptly acute to short acuminate, ecostate, margins denticulate below, becoming serrulate to serrate above, especially at the leaf acumen, plane, at times recurved or reflexed near apex. Laminal cells occasionally oblong, mostly elongate-linear, thin-walled, 4–5  $\mu\text{m}$  wide and 40–60  $\mu\text{m}$  long, with a single large papilla per cell; alar cells large, inflated, at times reddish brown. Autoicous. Perichaetial leaves smaller, ovate lanceolate, with longer and narrower leaf acumen, dentate throughout, often unipapillose also. Setae short to long, 5–18 mm long, curved and pustulose at tip, smooth below. Capsules small, funnel shaped, mouth constricted below the peristome teeth, horizontal or pendulous, exothecial cells mammillose. Spores 18–10  $\mu\text{m}$ , round, smooth.

ILLUSTRATIONS: Bartram 1939: pl. 26 (fig. 40); Seki 1968: 60–61 (fig. 24); Gangulee 1980: 1910 (fig. 977).

This species is very variable and many herbarium specimens are differently identified by various people. The ranges of variation seen in leaf outline, marginal denticulation, apical acumen, laminal cell dimension, and seta papilosity were well illustrated by Seki (1968). However, we disagree with Seki (1968) in including *T. singaporense* and related taxa that have gradually long acuminate leaf apices in the synonymy of *T. boschii*. For example, his illustration (fig. 24H) is our species concept of *T. stigmosum* in this treatment. Similarly, we have excluded the taxon in fig. 24A in Seki (1968), which has low papillae, from our species concept of *T. boschii*.

In our definition, the typical form of *T. boschii* has a broad ovate-lanceolate outline with acute to short acuminate tips, and with strongly unipapillose leaf cells. Often, leaves with acuminate apices can be observed growing among



the more typical leaves with acute apices on the same stem. Rarely will one encounter a population of *T. boschii* with mostly elliptic leaves with long acuminate apices. In such cases, the species can be identified by the somewhat abrupt formation of the leaf acumen portion, whether it be acute or acuminate. Unlike *T. stigmosum*, the acuminate leaf acumen of *T. boschii* never exceeds one third of the length of the blade. Additionally, the reflexed or recurved margin(s) along the leaf acumen seems like a dependable diagnostic character for *T. boschii*.

Seen in this light, a specimen at H named *T. cymbiforme* (Koponen 34782 from Frieda River in West Sepik Province) is an “oversized” *T. boschii*. As compared with the type of *T. cymbiforme* (FH), the leaves in Koponen 34782 are more longly acuminate and less concave. In the protologue, Bartram (1942) remarked that the laxly patulose, deeply concave and short-pointed (“*breviter acuminata*”) leaves of *T. cymbiforme* are the distinct characters. In our interpretation, *T. cymbiforme* is a member of *Papillidiopsis* and close to *P. ramulina*.

RANGE ON HUON PENINSULA: *10p*. In very rich primary growth rainforest approaching moss forest, moist, rather sunny log, 1800–1900 m, Norris 60079. *15c*. Along stream in nearly primeval tropical rainforest, rotten log, 200–250 m, Koponen 28250 (little material).

RANGE IN WESTERN MELANESIA: West Irian. Jayapura (Fleischer 1912). — Jayawijaya (Bartram 1942). — Merauke (van Zanten 1964). Papua New Guinea. West Sepik. Frieda River, Koponen 35271, 35648, 36100 (see Norris & Koponen 1985), 34782 (as *Trichosteleum cymbiforme* in Norris & Koponen 1985). — Morobe. Wau-Salamaua Track, *Castanopsis*, *Nothofagus* and Podocarpaceae dominated ridge, on ground, 2000 m, Streimann 25635 (CBG, H). — Central. Angabanga River, lowland forest on ridge with some remnant *Cycas*, rotting log, 400 m, Streimann & Naoni 16193 (CBG, H). — Western (Bartram 1943). — Milne Bay. North slope of Mt. Dayman, Maneau Range, dead bamboo stub, 1540 m, Brass 22216 (H, as *Trichosteleum pseudomamosum* in Bartram 1957). — Papuan Islands (Bartram 1960b, van Zanten 1964). Solomon Islands. Kolombangara, in rainforest on ridge N of Vanga River, shaded soil of stump throw, 300–900 m, Norris & Roberts 49984; at 1000–1200 m, Norris & Roberts 49877, moist rather shaded boulder; Norris & Roberts 49888, moist, shaded rocks in river (H).

TOTAL RANGE: As 2: China, Japan, Korea. As 3: India, Sri Lanka. As 4: Indonesia, Malaysia, Singapore, Philippines, PNG. Oc: Hawaii, Solomon. Austr 1 (Queensland).

***Trichosteleum fuscescens* D.H. Norris & T.J. Kop. var. *fuscescens***

Ann. Bot. Fennici 22: 386, fig. 9. 1985. — HOLOTYPE: Papua New Guinea. West Sepik Province, Frieda River, 500 m, Koponen 35973 (H!)

Plants sparingly branched, forming mats, somewhat purplish. Lateral branches long, 1–1.5 cm long, not attenuate at stem and branch apices. Leaves erect-spreading, or falcate at tip of branches, slightly concave, oblong-lanceolate, gradually contracted to the broadly acute or obtuse apex, forming a long and narrow tongue-shaped acumen, 2–2.25 mm long and ca. 0.5 mm wide, margins plane throughout, serrulate, becoming serrate at tip of acumen. Laminal cells narrowly elongate, 45–70  $\mu\text{m}$  long and 3–4  $\mu\text{m}$  wide, moderately thick-walled, pitted, nearly smooth, occasionally with low central papilla over the lumen; alar cells large, thin-walled, hyaline, at times yellowish. Autoicous. Perichaetial leaves much smaller, ovate-lanceolate and contracted into a long and narrow leaf acumen, serrulate to serrate, at times ligulate-lanceolate. Setae to 8(–10) mm long, smooth below, papillose distally. Capsules pendulous or horizontal, urn oblong, to 1 mm long; exothecial cells mammillose.

ILLUSTRATION: Norris & Koponen 1985: 387 (fig. 9).

The purplish color of the plant, the peculiar “ligulate” leaf outline, where the narrowed leaf acumen becomes an elongate strip ending in an obtuse and toothed tip, is very distinctive. The low single papilla on some leaf cells is another diagnostic character.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik, known only from the type locality.

TOTAL RANGE: Endemic to Papua New Guinea.

***Trichosteleum fuscescens* D.H. Norris & T.J. Kop. var. *ovatus* (D.H. Norris & T.J. Kop.) B.C. Tan, T.J. Kop. & D.H. Norris, *comb. et stat. nov.***

*Glossadelphus ovatus* D.H. Norris & T.J. Kop., Ann. Bot. Fennici 22: 380, fig. 6. 1985. — HOLOTYPE: Papua New

Guinea. West Sepik. Frieda River, Mt. Ekvaidebom, 1250–1300 m, 6.VIII.1981 *Koponen 35575* (H!).

Plants similar to *Trichosteleum fuscescens* both in coloration, branching habit and leaf formation, but smaller in overall dimension. Leaves ovate lanceolate, with short and acute acumen, occasionally having an obtuse tip, ca. 1.5 mm long; the “ligulate” acumen seen in var. *fuscescens* is only slightly to moderately developed here. Perichaetial leaves small, ovate lanceolate, with long acuminate, serrate and acute tip. Setae to 8 mm long, nearly smooth throughout. Capsules ovoid-oblong, less than 1 mm long, exothecial cells mammillose.

ILLUSTRATION: Norris & Koponen 1985: 381 (fig. 6, as *Glossadelphus ovatus*).

*Trichosteleum fuscescens* var. *ovatus* was originally placed in *Glossadelphus*, but its much enlarged and thin-walled alar cells and occasionally unipapillose leaf cells point to *Trichosteleum*. Besides, the description and illustrations of *G. ovatus* compared well with those of *T. fuscescens* (Norris & Koponen 1985). Interestingly, the bluntly acute and toothed tip of the elongate leaf acumen of *T. fuscescens* can also be seen in a few large leaves of the type specimens of *G. ovatus*. The prolonged leaf outline, leaf areolation and the low single papilla found occasionally on some leaf cells of *G. ovatus* are the other shared characters with *T. fuscescens*. We think that it is best to combine these two taxa and recognize the existing morphological differences at the varietal level. The var. *ovatus* may represent a stunted form of *T. fuscescens* growing at much higher elevations in the study area.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: Papua New Guinea. West Sepik. Frieda River, *Koponen 35575* (as *Glossadelphus ovatus* in Norris & Koponen 1985).

TOTAL RANGE: Endemic to Papua New Guinea

### *Trichosteleum mammosum* (Müll. Hal.) A. Jaeger

Ber. S. Gall. Naturw. Ges. 1876–1877: 421.1878 (Adumbr. 2: 487). — *Hypnum mammosum* Müll. Hal., Syn. Musc. Frond. 2: 684. 1851. — TYPE: Indonesia. Java, *Blume* (Hb.

Al. Braun, not seen).

Plants forming light green mats. Stems irregularly branched, lateral branches 8–10 mm long. Leaves oblong-lanceolate or narrowly ovate-lanceolate, 1–1.25 mm long and 0.4–0.5 mm wide, moderately constricted into acute to acuminate acumen, very concave, ecostate, margins plane, entire and crenulate below, becoming denticulate and reflexed above, especially at leaf acumen. Laminal cells elongate to linear, thin-walled, 30–50  $\mu\text{m}$  long and 4–5  $\mu\text{m}$  wide, strongly to occasionally weakly unipapillose; alar cells large, thin-walled, coloured. Autoicous. Perigonial buds numerous, leaves broadly ovate and sheathing. Perichaetial leaves slightly smaller than vegetative leaves, ovate-lanceolate to elliptic lanceolate, long acuminate, entire below, serrulate and reflexed distally. Setae to 10 mm long, smooth. Capsules short ovoid, constricted at mouth when dry, exothecial cells strongly mammillose and tuberculate. Spores ca. 15  $\mu\text{m}$ , smooth, greenish.

ILLUSTRATION: Dozy & Molkenboer 1867: t. 273 (as *Hypnum mammosum*).

The strongly tuberculate capsules of this species are a remarkable diagnostic character and without those identification is uncertain. The tubercles are produced by the strongly mammillose and at the same time sharply papillose exothecial cells. Reports of this species from the tropics are many and should be accepted with reservation. The Chinese (Hainan) records of *T. mammosum*, based on sterile plants, were questioned by Tan and Jia (1999).

The concave leaves with slightly constricted acumina, plus the leaf cell papillae, appear to indicate a relationship with members of *Papillidiopsis*, but the walls of laminal cells and alar cells are only thin-walled, much like in *Trichosteleum*. The development of leaf cell papillae of *T. mammosum* can range from moderate to strong. In the study area, *T. mammosum* is often found growing with other species of *Trichosteleum*, such as *T. stigmosum*.

RANGE ON HUON PENINSULA: 9c. Along ridge in montane rainforest, tree trunk, 2100–2200 m, *Koponen 30194* (H). 9j. Moderately well-developed moss forest along ridge, moist,

diffusely lit twigs, 2100–2200 m, *Norris 61387*(H).

RANGE IN WESTERN MELANESIA: West Irian. Merauke (van Zanten 1964). Papua New Guinea. Morobe (present report). — Central. Dieni, Ononge Road, bark of dead tree, 500 m, *Brass 3902a* (FH!, H!).

TOTAL RANGE: As 3: Kampuchea?, Thailand. As 4: Malaysia, Singapore?, Indonesia, PNG.

***Trichosteleum pseudomammosum* M. Fleisch.**

Musci Flora Buitenzorg 4: 1319, fig. 213. 1923, “*pseudomammosum*”. — SYNTYPE: Indonesia. West Java, Tjibodas, *Fleisher s.n.* (FH!).

*Trichosteleum robbinsii* Bartr., Brittonia 13: 378. 1961, *syn. nov.* — HOLOTYPE: Papua New Guinea. Madang, Bangsop, Lower Ramu-Atitau area, *Robbins 1645* (FH!).

Plants mat-forming, light green. Lateral branches 6–8 mm long. Leaves oblong-lanceolate or narrowly ovate-lanceolate, 1–1.25 mm long including the long acumen and 0.3–0.4 mm wide, quickly constricted into a long and narrow acumen of 2–3(–4) cells wide (“pfriemlicher Spitz”), concave, ecostate, margins plane, denticulate below and becoming sharply dentate above, especially along the leaf acumen. Laminal cells elongate to linear, thin-walled, 30–50  $\mu\text{m}$  long and 4–5  $\mu\text{m}$  wide, strongly unipapillose; alar cells large, thin-walled, coloured. Perichaetial leaves ovate-lanceolate to elliptic lanceolate, with equally long, narrow and sharply toothed apices, laminal cells strongly unipapillose. Setae rather long, to 10 mm long. Capsules short ovoid, constricted at mouth when dry, exothecial cells mammillose. Spores 8–10  $\mu\text{m}$ , nearly smooth.

ILLUSTRATION: Fleischer 1923: 1320 (fig. 213).

This species has not been correctly interpreted by many and often confused with *Trichosteleum boschii* in herbarium specimens. The Chinese records were corrected and excluded by Tan and Jia (1999). The long and narrow leaf acumina provided with sharp teeth, seen in vegetative and perichaetial leaves, are distinctive. The type specimen of *T. robbinsii* is a rather typical expression of this species. Although implied by the epithet, *T. pseudomammosum* is not related to *T. mammosum*, but to *T. boschii*.

RANGE ON HUON PENINSULA: None.

RANGE IN WESTERN MELANESIA: West Irian. Jayapura, Jayawijaya, and Merauke (van Zanten 1964). Papua New Guinea. East Sepik, Frieda River, *Koponen 35272* (as *T. boschii* in Norris & Koponen 1985). — Madang (type of *T. robbinsii*). — West Sepik, Frieda River, *Koponen 36157* (as *T. boschii* in Norris & Koponen 1985). — Morobe. Herzog Mt., alongside small gully near ridge in *Castanopsis* and *Dipterocarpaceae* forest, on moist, large, rotting log, 760 m, *Streimann & Umba 11120* (H). — Milne Bay (Bartram 1957). — Papuan Islands (Bartram 1957, 1960b, van Zanten 1964).

TOTAL RANGE: As 4: Indonesia (Java, Kalimantan), PNG.

***Trichosteleum saproxylophilum* (Müll. Hal.) B.C. Tan, W.B. Schof. & H.P. Ramsay**

Nova Hedwigia 67: 220. 1998. — *Hypnum saproxylophilum* Müll. Hal., Syn. Musc. Frond. 2: 334. 1851. — *Sematophyllum saproxylophilum* (Müll. Hal.) M. Fleisch., Musci Flora Buitenzorg 4: 1266. 1923. — TYPE: Indonesia. Java, *Zollinger 243z*. (not seen).

Plants in dense tufts, pale green, glossy. Stems creeping, irregularly branched, branches to more than 10 mm long. Leaves erect-spreading, narrowly lanceolate, gradually and sharply acuminate or subulate, to 2 mm long, ecostate, margins plane, weakly serrulate distally. Laminal cells linear throughout, 65–105  $\mu\text{m}$  long and 2.5–5  $\mu\text{m}$  wide, thin- to moderately thick-walled, nearly smooth, occasionally a low papilla developed on some cells; alar cells large, thin-walled, supra alar cells also differentiated. Perichaetial leaves larger than the vegetative leaves, more or less abruptly long subulate-acuminate, irregularly toothed near base of the long acumen, laminal cells mostly elongate. Setae nearly smooth, to 10 mm long. Opercular lid long rostrate. Capsules oblong, to 1 mm long, inclined, exothecial cells weakly mammillose. Spores not seen.

ILLUSTRATIONS: Dozy & Molkenboer 1870: t. 317 (as *Hypnum saproxylophilum*); Bartram 1939: pl. 24 (fig. 418, as *Sematophyllum saproxylophilum*).

With its erect-spreading foliation, somewhat flat and long acuminate leaf apices, linear laminal cells with sharp ends, and low leaf cell papillae, this species is probably the most un-*Trichosteleum*-like among the congeners. It is not sur-

prising that it had been placed in *Sematophyllum* until recently (Tan *et al.* 1998). Its leaf morphology, which is atypical of the genus, however, is now shared with *T. fuscescens*, another recently (Norris & Koponen 1985) described species (*see above*) from the study area.

Although a distinctive species, *T. saproxylophilum* was only reported from New Guinea from the Vogelkop Peninsula by Bartram (1960a).

RANGE ON HUON PENINSULA: 5b. In virgin forest of very large low elevation trees in valley of small river, moist diffusely lit bamboo, 300–500 m, Norris 65953, 65954, 65955, 65957.

RANGE IN WESTERN MELANESIA: West Irian. Sorong (Bartram 1960a, as *Sematophyllum saproxylophilum*). Papua New Guinea. Morobe (present report).

TOTAL RANGE: AS 3: Thailand (as *Sematophyllum saproxylophilum*). AS 4: Malaysia, Indonesia (Irian Jaya, Java), Philippines, PNG. Austr 1 (Queensland).

### *Trichosteleum stigmatosum* Mitt. (Fig. 5)

J. Linn. Soc. Bot. 10: 181. 1868. — TYPE: Samoa. Upolu, Matafao, 1000 ft, Powell 21 (NY).

*Trichosteleum singaporense* M. Fleisch., Hedwigia 44: 325. 1905, *syn. nov.* — HOLOTYPE: Singapore Botanic Garden, 4.III.1898, Fleischer's *Musci Frond. Archipel. Indici* 333 (FH!, isotype in H!).

*Trichosteleum piliferum* Bartr., Blumea 10: 148. 1960, *hom. illeg.*, *syn. nov.* — TYPE: Papua New Guinea. Papuan Islands, Rossel Is., Abaleti, on rotten log in rainforest, 5 m, 30.IX.1956 Brass 28268B (FH!).

*Trichosteleum sepikense* Bartr., Brittonia 13: 378. 1961. — HOLOTYPE: Papua New Guinea. West Sepik Province, Robbins 2580 (FH!, *fide* Tan 1993).

Plants bigger than *T. boschii*, forming mats, also caespitose, light green. Stems and branches mostly creeping, irregularly branched, more or less complanate. Leaves erect spreading, a few falcate, ovate-lanceolate to oblong-lanceolate, 1–2 mm long and ca. 0.5 mm wide, slightly concave, gradually narrowed into long acuminate, the acumen portion about 1/3 to 1/2 the length of the blade, margins plane, denticulate, occasionally becoming serrate in leaf acumen. Laminal cells elongate to linear, 50–80  $\mu\text{m}$  long and 4–6  $\mu\text{m}$  wide, thin- to thick-walled, unipapillose, at times with low papillae, alar cells large, thin-walled, colored. Perichaetial leaves smaller than the vegetative leaves, oblong-lanceolate,

long acuminate, serrate to serrulate, laminal cells linear, with low papillae to none. Setae 10–12 mm long, nearly smooth throughout. Capsules small, ovoid, slightly less than 1 mm long, pendulous, exothecial cells mammillose. Operculum long rostrate. Spores 10–13  $\mu\text{m}$ , papillose.

OTHER ILLUSTRATION: None.

According to Tan (1993), *T. stigmatosum* was unjustifiably reduced to a synonym of *Acanthorhynchium papillatum* by Dixon (1926) and the species had gone unnoticed for decades.

In their treatment of the Chinese flora of Sematophyllaceae, Tan and Jia (1999) separated *T. stigmatosum* from *T. singaporense* by the presence of strong papillae on the leaves of the former. Our re-examination of the isotype specimen of *T. singaporense* at H, however, shows that the leaf papillae in this species can also be strongly developed. This new observation has obscured the species definition between these two taxa. Other differences such as leaf margin serration and leaf concavity are not consistently manifested in the many specimens studied from the Huon Peninsula. We are, therefore, combining these two taxa into one polymorphic species. As compared with *T. boschii*, *T. stigmatosum* (including *T. singaporense*) can be distinguished by the less concave leaf habit, less serrate leaf margins and nearly smooth setae, in addition to the longer, gradually (not abruptly) elongate, and more acuminate leaf acumina. Intriguingly, the populations in the type locality in Singapore today have only low papillae on the leaves. Seki (1968) had synonymized *T. singaporense* with *Raphidostichum boschii* (= *Trichosteleum boschii*; *see* the discussion under the latter species).

Specimens of *T. stigmatosum* with strongly papillose leaf cells, such as the type of *T. piliferum*, can be difficult to tell apart from *T. pseudomammosum*. In such cases, it is best to use the perichaetial leaf characters for a correct species determination. The perichaetial leaf margins of *T. pseudomammosum* are very strongly and sharply toothed, while those of *T. stigmatosum* are only serrate. In addition, the cells of perichaetial leaves of *T. pseudomammosum* are often also strongly papillose, which is not the case in *T.*

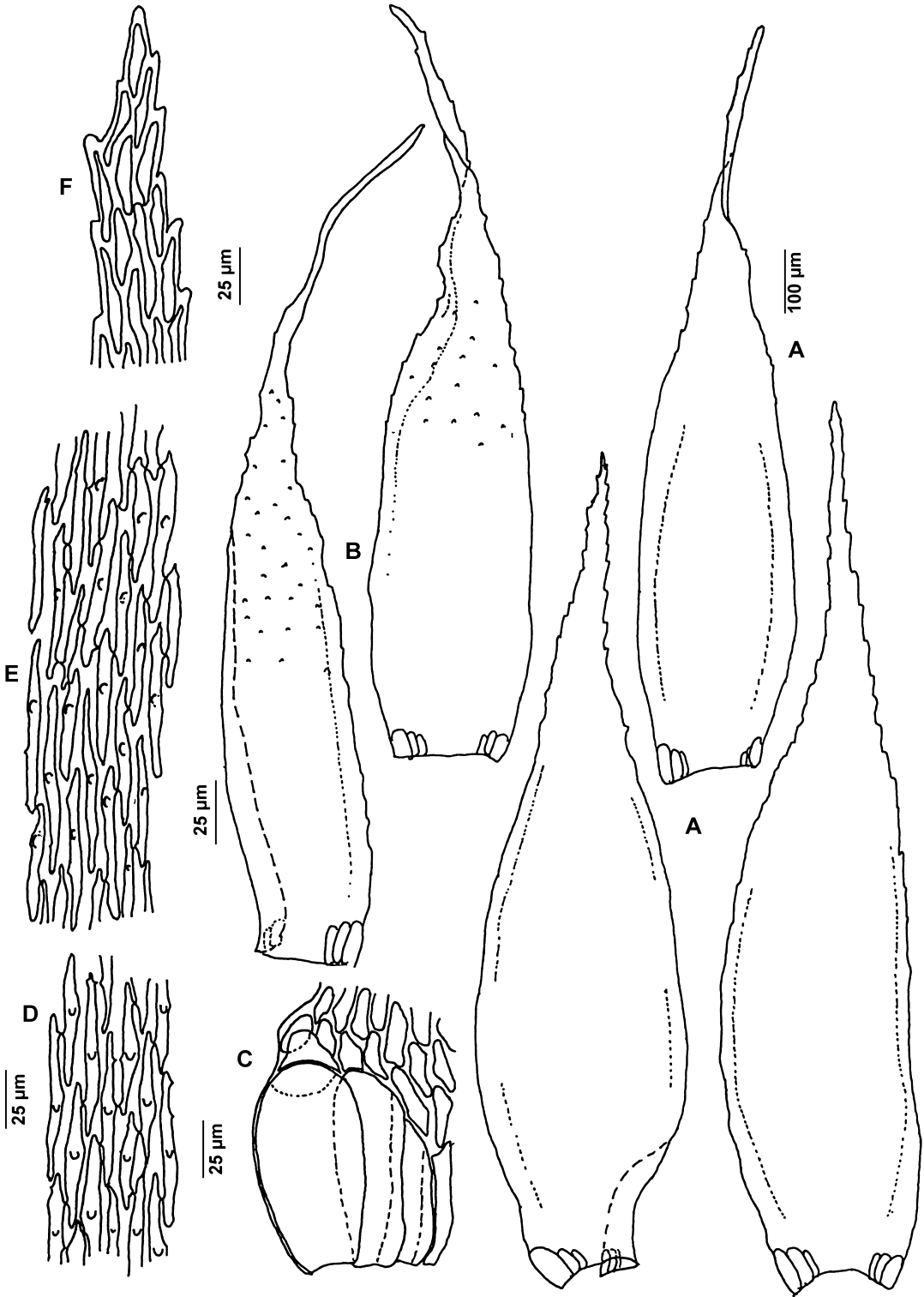


Fig. 5. *Trichosteleum stigmatosum* (from type of *T. singaporensis*, H). — **A** and **B**: Leaves. — **C**: Alar region. — **D** and **E**: Median laminal cells. — **F**: Leaf tip.



*stigosum*. On the other hand, with leaves that are only weakly papillose, *T. stigosum* can be confused with *T. saproxylophilum*, but the latter is a larger plant and has less concave leaves with nearly entire margins and long acuminate, pointy leaf tips. The cells also are long and narrow throughout in the leaves of *T. saproxylophilum*, while the cells are elongate-linear in the leaves of *T. stigosum*. The distal cells of leaf acumen of *T. stigosum* are mostly oblong to fusiform, and not linear as in *T. saproxylophilum*.

The Huon Peninsula specimens were collected in primeval montane rain forests at 1800–2800 m. Two of the specimens were taken from tree roots, and the others from shaded twigs (one specimen) and diffusely lit log (1).

RANGE ON HUON PENINSULA: 2s. 64024. 3a. 35092. 4b. 751. 9l. 61988. 10o. 59889.

RANGE IN WESTERN MELANESIA: Papua New Guinea. East Sepik (type locality of *Trichosteleum sepikense*), and: Frieda River, *Koponen 36159, 36170* (H, as *Trichosteleum boschii* in Norris & Koponen 1985). — West Sepik. Frieda River, *Koponen 34804* (as *Trichosteleum boschii* in Norris & Koponen 1985). — Morobe (present report), and: Labutali Village, mangrove swamps, on rotting logs, sea level, *Bellamy 187, 194* (CBG, H); Wagau-Malolo Track, Podocarpaceae-Lauraceae dominated montane forest, on shaded ground, 1700 m, *Streimann 19573* (CBG, H). — Papuan Islands (type of *T. piliferum*).

TOTAL RANGE: As 3: China. As 4: Indonesia (Java), Singapore, Philippines, PNG.

***Trichosteleum streimannii*** B.C. Tan, T.J. Kop. & D.H. Norris, *sp. nova* (Fig. 6)

*Plantae magnae generis, tegetes formantae, rami laterales longi, ad 3–4 cm in longitudine. Folia erecto-patentes, ovata ad late lanceolata, 1.5–1.75 mm longa et 0.5–0.75 mm lata, rugosa in statu sicco, concava, acuta ad breve acuminata, margines omnino denticulatae, planae vel leviter recurvatae ad apicem folii. Cellulae laminales omnino lineares, parietibus tenuibus ad crassis, 80–105 µm longae et 3–7 µm latae, valde unipapillosae, cellulae alares parietibus tenuibus, leviter coloratae. Sporophytum non visum.*

HOLOTYPE: Papua New Guinea. Morobe District. Mt. Kaindi, vicinity of Wau, on roadside cutbanks, often with seepage water, 5000–6000 ft, 19.VI.1968 W.A. Weber & D. McVean B-34823 (H!; isotype COLO).

Plants large for the genus, forming mats, lateral branches long, to 3–4 cm in length. Leaves erect spreading, ovate to broadly lanceolate, 1.5–1.75 mm long and 0.5–0.75 wide, wrinkled when dry, concave, acute to short acuminate, margins denticulate throughout, plane or slightly recurved at leaf tip. Laminal cells linear throughout, thin to thick-walled, 80–105 µm long and 3–7 µm wide, strongly unipapillose; alar cells large, thin-walled, slightly colored. Sporophyte not seen.

The new species is dedicated to Dr. Heinar Streimann (1938–2001), a prolific and excellent collector of Papua New Guinea bryophytes.

The species is distinctive in its large size for the genus and the wrinkled and concave leaves when dry. The short acuminate tip is disproportionately small for the large leaf. Its habitat on roadside cutbank may indicate a species of open and disturbed sites and ergo should not be rare locally. The collection site is further reported to be seepy and the leaf papillae may become weakly developed in some individual plants. The leaves of holotype specimen, however, consistently show strongly developed, small but tall papillae. Among its congeners in Malesia, it is closest to *T. fleischeri* from Singapore and Malaysia. The latter species is also found along trail margins and in open disturbed sites.

RANGE ON HUON PENINSULA: None.

RANGE ON WESTERN MELANESIA: Papua New Guinea. See type information.

TOTAL RANGE: Endemic to Papua New Guinea.

## Doubtful and excluded names

The following taxa, of which we have not seen specimens, have been recorded for western Melanesia.

***Acroporium punctuliferum*** (Thwait. & Mitt.) Fleisch.

Musci Fl. Buitenzorg 4: 1274. 1923. — *Sematophyllum punctuliferum* Thwait. & Mitt., J. Linn. Soc. Bot. 13: 318. 1873.

This taxon was listed for “Neuguinea” by Brotherus (1925).

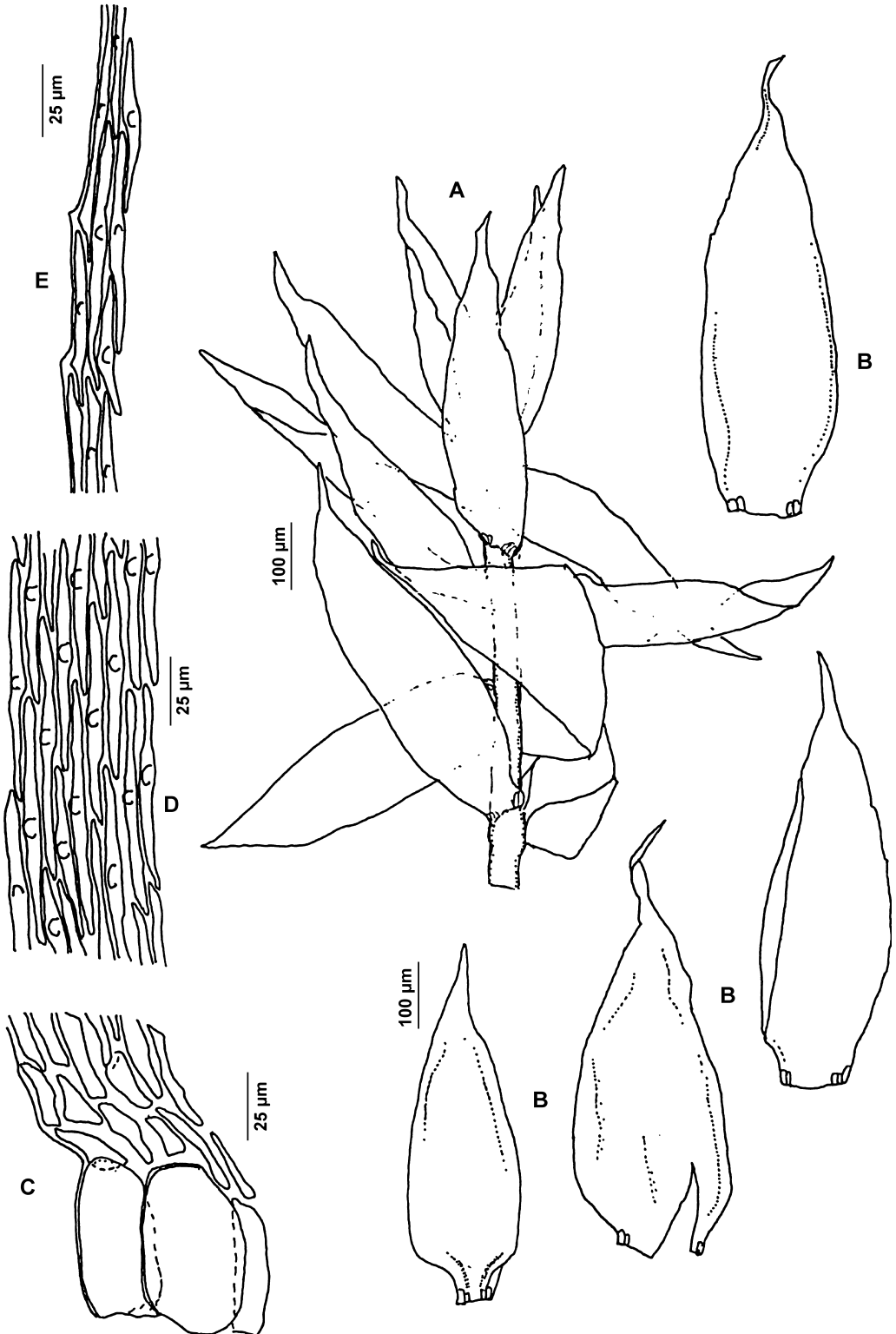


Fig. 6. *Trichosteleum streimannii* (from holotype, H). — A: Habit of branch tip. — B: Leaves. — C: Alar region. — D: Median laminal cells. — E: Margin at midleaf.

***Trichosteleum trachyamphorum* (Müll. Hal.) Kindb.**

Enum. Bryin. Exot. 104. 1891. — *Hypnum trachyamphorum* Müll. Hal., Bot. Jahrb. 5: 85. 1883.

This taxon was given for New Ireland of Papua New Guinea by Brotherus (1901).

## Acknowledgements

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## Index to scientific names

The accepted names of the taxa present in the area are in boldface. The names proposed as new synonyms are marked with *syn. nov.*, and new combinations made by *comb. nova*. The taxa marked by an asterisk (\*) are newly reported for Solomon Islands

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