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Article

Malesian *Chaetomitrium* (Symphyodontaceae, Musci): Type illustrations, taxonomical notes, and key to the species

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Abstract

This paper provides 47 type illustrations, and taxonomical notes for 36 species of *Chaetomitrium* from Malesia, based on morphological observation of type materials. Key to the species of 39 accepted names is also provided.

Key words: *Chaetomitrium*, Hookeriaceae, illustration, Symphyodontaceae, types.

Introduction

The genus *Chaetomitrium* Dozy & Molk. is a small genus formerly placed in the Hookeriaceae (Fleischer, 1908; Brotherus, 1925; Tan and Robinson, 1990; Mohamed and Robinson, 1991), Pilotrichaceae (Miller, 1971) and Hypnaceae (Buck, 1987; 1988), and now in the Symphyodontaceae. It is characterized by hairy calyptra, prorulate or prorate, rarely spinose lamina cells at upper ends, and often strongly toothed leaf margins, papillose to echinate setae, and long rostrate lids.

Chaetomitrium is mainly distributed in the Malesian region, but some extending into Africa, India, China, Indochina, Oceana and Australia. There are a total of 87 described taxa of *Chaetomitrium* worldwide, whereby 63 taxa (72%) are found in Malesia. New Guinea, the Philippines and Borneo are the center of diversity of this genus (Tan and Robinson, 1990; Akiyama and Suleiman, 2001). Most of the species of the genus grow mainly in lowland tropical forest, especially in riparian forests, but occasionally occurs in upper montane forest reaching to 3000 m.

There has been no revisional work, however, beside some local treatments on *Chaetomitrium* (Akiyama 1997, Akiyama and Suleiman 2001, Mohamed and Robinson 1991). This is partly due the lack of ample accumulation of specimens for most of the species, preventing critical evaluation of the variation within each species. As for the first step for revisional treatment of the genus, our present work provides type illustrations and taxonomical notes based on critical examination of the type materials of 36 species of the genus reported from Malesian region. All illustrations presented here are based on the type specimens except for some sporophytes, which were not found in the types. Key to the 39 accepted names in Malesian region is provided after the section for each species.

The following treatment includes 'type information',

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'other type illustrations', 'characteristic features', and short taxonomical 'notes' for each species. These 'characteristic features' are provided not intending to present diagnostic features of each species. They are totally based on examination of type specimens alone and listed to give complementary information for the illustrations of each species. Three species, namely *Chaetomitrium darnaedii* H.Akiyama & M.Suleiman (see Fig. 11a - f , Akiyama and Suleiman, 2001), *C. maryatii* H.Akiyama & M.Suleiman (see Fig. 17a - f, Akiyama and Suleiman, 2001), and *C. seramensis* H.Akiyama (see Fig. 1, Akiyama, 1999) are not included in the present treatment, but they are included in the "Key to the species of Malesian *Chaetomitrium*". Nine species of Malesian *Chaetomitrium* that are obviously synonymous with other species is excluded here and will be treated in a different paper: *C. auriculatum* Dixon & Herzog (= *C. paleatum* (Hampe) M.Fleisch.), *C. friedense* D.H.Norris & T.J.Kop. (= *C. perlaeve* Dixon), *C. integrifolium* E.B.Bartram (= *C. fimbriatum* (Dozy & Molk.) Bosch & Sande Lac.), *C. leptopoma* var. *massartii* Renauld & Cardot (= *C. leptopoma* (Schwägr.) Bosch & Sande Lac.), *C. macrohystrix* Müll.Hal. *in* M.Fleisch. (= *C. nanohystrix* Müll.Hal. *in* M.Fleisch.), *C. madagense* E.B.Bartram (= *C. torquescens* Bosch & Sande Lac.), *C. recurvifolium* M.Fleisch. (= *C. acanthocarpum* Bosch & Sande Lac.), *C. torquescens* Bosch & Sande Lac. var. *barbatum* Dixon (= *C. torquescens*), and *C. werneri* Herzog (= *C. papillifolium* Bosch & Sande Lac.).

Descriptions

The characteristic features and notes of 36 species of *Chaetomitrium* are presented below. Illustrations of type specimens of several synonyms are also included to show the variation within the species.

1. *Chaetomitrium acanthocarpum* Bosch & Sande Lac. (Plate 1)

Bryol. Jav. 2: 53 (1862).

Type: Indonesia, Seram, *de Vriese s.n.* (holotype L!).

Other type illustration: Bosch and Sande Lacoste (1862, Plate. 173).

Characteristic features: (1) Plants are densely branched; (2) branch leaves are squarrose and falcate, with strongly twisted apices; (3) leaf margins are undulate, strongly dentate in upper half and denticulate below with geminate teeth; (4) costae are strong; (5) lamina cells are spiculose-prorate above, prorate below; (6) setae are short, 6 mm long, setulose to the base; (7) capsules are inclined, with long hairs all over surface, hairs are up to 180 μm long; (8) calyptrae are mitriform, densely hispid on the surface, ciliate at the base.

Note: This is a well-defined and easily recognized species when it bears capsules, which are totally spinose or hairy. Sterile plants can be identified by the strongly falcate leaves and this feature separates it from any other squarrose-leaved taxa of Malesian *Chaetomitrium*.

2. *Chaetomitrium beccarii* Dixon (Plate 2)

J. Linn. Soc. Bot. 50: 108 (1935).

Type: Borneo, Damoes, *Hallier* 449 (holotype BM!, isotype GRO!).

Other type illustration: Dixon (1935, Pl. 3, Fig. 29).

Characteristic features: (1) Stems are long and creeping with regularly-pinnate and slightly flattened branches; (2) stem leaves are concave, strongly incurved at one side with strongly spinose-serrate and geminate margins; (3) lamina cells are strongly prorate and spiculose-prorate or spinose in upper half; (4) branch leaves are distinctly concave, with short-acuminate and constricted apices.

Note: *Chaetomitrium beccarii* is closely related to *Chaetomitrium orthorrhynchum* (Dozy & Molk.) Bosch & Sande Lac., differing in its marked spiculose to spinose leaf ornamentation on abaxial side.

3. *Chaetomitrium borneense* Mitt. (Plate 3)

Rep. Sc. Res. Voyage Challenger Bot. 1(4): 212 (1885).

Type: Borneo, *Motley* 4 (holotype NY!, isotypes FH!, S!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 10a - d, holotype of *C. seriatum* Broth).

Characteristic features: (1) Branches tumid with spirally arranged leaves; (2) stem leaves are imbricate-patent, broadly incurved above, deeply concave, ovate-oblong when flattened with cuspidate apices; (3) leaf margins are minutely denticulate with simple teeth; (4) lamina cells are prorulate, becoming more incrassate and shorter near apices; (5) lamina cells of branch leaves are more prorate than those of stem leaves; (6) calyptrae (immature) are small, mitriform, with long cilia at the base.

Note: This species bears sporophytes frequently and is easily recognized by the short and densely

papillose seta. Spiral arrangement of the leaves also helps to determine its identity.

4. *Chaetomitrium brassii* E.B.Bartram (Plate 4)

Brittonia 9: 49 (1957).

Type: New Guinea, Peria Creek, Kwagira River, 50 m, *Brass 24119* (holotype FH!).

Other type illustration: None.

Characteristic features: (1) Plants are regularly and pinnately branched with tumid branches; (2) branch leaves are recurved to squarrose, orbicular, apices are obtuse with short or acute apiculae; (3) leaf margins are slightly undulate above, denticulate to the base with geminate teeth; bordered with a single row of shorter cells; (4) lamina cells are incrassate, prorate to the base, spiculose-prorate above the mid-leaf, becoming gradually shorter towards apices; (5) setae are 8 - 9 mm long, setulose almost to the base; (6) capsules are erect to inclined and smooth; (7) calyptrae are mitriform, large, hispid over the surface, with long cilia at the base.

Note: The leaves are strongly undulate *in situ* but almost plane when removed and flattened.

5. *Chaetomitrium ciliatum* Bosch & Sande Lac. (Plate 5)

Bryol. Jav. 2: 46 (1862).

Type: Indonesia, Tjerimai, *Junghuhn s.n.* (holotype L!, isotype NY!).

Other type illustrations: Bosch and Sande Lacoste (1862, Pl. 168); Akiyama and Suleiman (2001, Fig. 12a-c).

Characteristic features: (1) Plants are sparsely branched, somewhat flattened; (2) branch leaves are deeply concave, plicate, and constricted below apices; (3) leaf margins are spinose-serrate above and denticulate below with simple erect teeth; (4) costae are strong, reaching 1/3 of leaf length; (5) laminal cells are thin-walled, slightly porose, laxly spinose-prorate above, prorulate below; (6) setae (immature) are setulose but smooth at the extreme base; (7) capsules are inclined and smooth; (8) calyptrae are cucullate, densely hispid all over the surface, with short hairs at the base.

Note: This species has similar appearance to *Chaetomitrium horridulum* Bosch & Sande Lac. except for the much denser, spinose-prorate lamina cells. It might be just a variant of the latter.

6. *Chaetomitrium ctenidioides* Broth. *in* Schum. & Lauterb. (Plate 6)

Fl. Deutsch. Schutzgeb. Südsee 94 (1900).

Type: New Guinea, *Lauterbach s.n.* (isotype S!).

Other type illustration: None.

Characteristic features: (1) Plants are very small and densely branched; (2) branches are slightly flattened; (3) stem leaves are acute, blunt and slightly constricted below; (4) leaf margins are bluntly denticulate with geminate teeth; (5) lamina cells are spiculose-prorate above and prorate below; (6) branch leaves smaller, ca. 0.5 mm long, ovate and apices shortly acute.

Note: This species has the size and habit of *Chaetomitrium leptopoma* (Schwägr.) Bosch & Sande Lac., but the latter has spiculose to spinose-prorate lamina cells and dentate upper leaf margins.

7. *Chaetomitrium elegans* Geh. (Plates 7 & 8)

Biblioth. Bot. 13: 6 (1889).

Type: New Guinea, Fly River, *Bäuerlen s.n.* (isotype S!).

Synonym: *Chaetomitrium pseudopapillifolium* E.B.Bartram, Brittonia 13: 375 (1961).Type: New Guinea, Wewak-Angoram, Sepik District, *Robbins 2172* (holotype FH!, isotypes L!, CANB!). fide Akiyama (1997).

Other type illustration: Geheeb (1889, Fig. 5).

Characteristic features: (1) Plants are moderately large with stems up to 11 cm long and laxly branched; (2) branches are simple, strongly complanate and laxly foliate; (3) stem leaves are ca. 2 mm long, with widely recurved margins on one side; (4) branch leaves are narrowly lanceolate, gradually acuminate, plane, hardly incurved and never constricted; (5) leaf margins are plane or folded on one side and denticulate with geminate teeth; (6) lamina cells are thin-walled, smooth or prorulate.

Note: This species is characterised by its strongly complanate foliation and narrowly lanceolate and plane leaves. *Chaetomitrium weberi* Broth. is closely related but most of its leaves are constricted or undulate and branches are usually sub-tumid.

8. *Chaetomitrium elmeri* Broth. (Plate 9)

Leafl. Philipp. Bot. 6: 1974 (1913).

Type: Philippines, Sibuyan Island, Mt. Giting-giting, *Elmer 12398* (isotypes BM!, FH!, G!, GOET!, NY!).

Other type illustrations: Bartram (1939, Pl. 20, Fig. 338); Akiyama and Suleiman (2001, Fig. 10i - l).

Characteristic features: (1) Branches are rigid, sub-erect, tumid and obtuse; (2) branch leaves are

imbricate-patent, lingulate, deeply concave, with obtuse or rounded apices; (3) leaf margins are strongly incurved and denticulate with simple teeth; (4) costae are strong; (5) lamina cells are linear and prorulate; upper half of the adaxial side have numerous large tuberculae, each up to 24 μm in diameter; (6) setae are 22 - 25 mm long, papillose above and smooth below; (7) capsules are sub-erect and smooth; (8) calyptrae are cucullate, densely hispid over the surface but naked at the base.

Note: This species is well characterized by the conspicuous large tuberculate lamina cells, which are absent in any other Malesian taxa of the genus.

9. *Chaetomitrium elongatum* (Dozy & Molk.) Dozy & Molk. (Plate 10)

Musci Fr. Ined. Archip. Indici 4: 119. 1846.

Type: Indonesia, Maluku, Boeroe, *Zippelius s.n.* (holotype L!).

Other type illustrations: Dozy and Molkenboer (1846, Tab. 38); Akiyama and Suleiman (2001, Fig. 13a - c).

Characteristic features: (1) Branches are recurved to incurved when dry, densely foliate, flattened to sub-tumid, often secund and blunt but sometimes cuspidate; (2) branch leaves are rugose above, deeply concave, and apices are rugose or recurved, mucronate to short-acute; (3) leaf margins are bluntly denticulate with geminate teeth but almost entire to denticulate across apices; (4) lamina cells are thick-walled, prorate, and sub-rhomboidal near apices; (5) calyptrae (immature) are hispid, with long cilia at the base.

Note: The prorate lamina cells of branch leaves separates it from related *Chaetomitrium laevifolium* Dixon *ex* E.B.Bartram and *Chaetomitrium pseudoelongatum* Broth. *in* Warb. The lamina of stem leaves is, however, weakly prorulate as reported by Dixon (1935). According to Akiyama and Suleiman (2001), this species has smooth lamina cells, which we cannot ascertain by examination of the holotype.

10. *Chaetomitrium fimbriatum* (Dozy & Molk.) Bosch & Sande Lac. (Plate 11)

Bryol. Jav. 2: 48. 1862.

Type: New Guinea, *Zippelius s.n.* (holotype, L!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 16a - f).

Characteristic features: (1) Plants are small and densely tufted, (2) branches are ca. 3-5 mm long, ca. 1 mm wide, and often attenuate at tips; (3) stem leaves are erect-spreading, with slightly auriculate bases and long-acuminate apices; (4) branch leaves erect-patent, much smaller than stem leaves, ca. 0.5 mm long, concave, plicate, and apices are acute to acuminate; (5) leaf margins entire or bluntly denticulate with simple teeth; (6) lamina cells are rather thick-walled, smooth but sparsely prorate to spiculose-prorate above; (7) setae are 11 mm long, and distantly pustulose or papillose above but smooth below; (8) calyptrae are cucullate and hispid, with a few scattered long and erect hairs appressed to the surface.

Note: This delicate, small species is easily distinguishable from other small Malesian members of the genus by the smooth or weakly denticulate leaf margins, almost smooth lamina cells, and calyptrae with long and erect hairs.

11. *Chaetomitrium horridulum* Bosch & Sande Lac. (Plate 12)

Bryol Jav. 2: 46 (1862).

Type: Indonesia, Java, *Zippelius s.n.* (holotype L! isotype S!).

Other type illustration: Bosch and Sande Lacoste (1862, Pl. 167).

Characteristic features: (1) Plants are robust, often tinged with red, and irregularly pinnate, (2) branches are generally sub-tumid; (3) branch leaves are deeply concave and strongly constricted below apices; (4) leaf margins are strongly spinose-serrate in upper half but only denticulate below; each tooth are simple, lax and almost perpendicular; (5) costae are very strong and terminated with a spine; (6) lamina cells are clearly porose, smooth but with a few scattered spines at the upper ends; (7) setae are 24 cm long and densely setulose to the base.

Note: The spines on abaxial side of leaves may be overlooked if not examined carefully.

12. *Chaetomitrium laevifolium* Dixon *ex* E.B.Bartram (Plate 13)

Philipp. J. Sc. 68: 272 (1939).

Type: Philippines, Palawan, 600 m, *Edano 80842* (holotype BM!, isotype FH!).

Other type illustrations: Bartram (1939, Fig. 345); Akiyama and Suleiman (2001, Fig. 15a - d).

Characteristic features: (1) Plants are densely branched; (2) branches are slightly flattened; (3) branch leaves are deeply concave, oblong-obovate, shortly acute and strongly constricted below apices; (4) leaf margins undulate, widely incurved in upper

half, denticulate near apices, serrate from shoulder to mid-leaf, denticulate below, with simple teeth; (5) costae are strong; (6) lamina cells are incrassate, smooth or only slightly prorulate, and becoming smaller towards the apices; (7) setae are 7 mm long, setulose half above and papillose below; (8) capsules are inclined, cylindrical, slightly rough; (8) calyptrae large, with long cilia at the base.

Note: This species is clearly distinct from its related taxa in the highly setulose setae. The shortly acute and serrate apices separate it from *Chaetomitrium warburgii* Broth. *in* Warb.

13. *Chaetomitrium laevisetum* Dixon (Plate 14)

J. Linn. Soc. Bot. 45: 488 (1922).

Type: New Guinea, 750 m, *Kloss 29* (holotype BM!).

Other type illustration: Dixon (1922, Pl. 28, Fig. 5).

Note: This species is identical to *C. roemeri* M.Fleisch. except for its shorter branch leaf acumen and the longer seta. The seta of the holotype of *C. roemeri* is only 10 mm, while those of *C. laevisetum* are reaching 25 mm in length. This species might be just a variant of *C. roemeri*. We temporarily treat it as a separate species here.

14. *Chaetomitrium lanceolatum* Bosch & Sande Lac. (Plate 15)

Bryol. Jav. 2: 49 (1862).

Type: Indonesia, Java, *Dozy & Molkenboer s.n.* (holotype L!).

Other type illustration: Bosch and Sande Lacoste (1862, Pl. 170).

Characteristic features: (1) Plants are small, densely branched; (3) stem leaves are somewhat flattened and concave with plane apices; (3) leaf margins are sharply denticulate to serrate with simple teeth; (4) lamina cells are laxly prorate to spiculose-prorate above and smooth below; (5) setae are 9 mm long, densely papillose but smooth at extreme base; (6) capsules are inclined to horizontal and rough; (7) calyptrae are cucullate, densely hispid, and naked at the base.

Note: This species is well distinguished from related taxa especially by the lanceolate branch leaves, not constricted below apices, sharply toothed margins, and laxly spiculose-prorate lamina cells.

15. *Chaetomitrium lancifolium* Mitt. (Plate 16)

Rep. Sc. Res. Voyage Chalenger Bot. 1(4): 212 (1885).

Type: Indonesia, Maluku, Aru Islands, *without collector name* (holotype NY!, isotype FH!).

Other type illustration: None.

Characteristic features: (1) Plants are rather laxly branched; filamentous propagules are abundant in leaf axils of branches; (2) stem leaves are often undulate at upper one-third; (3) branch leaves are flattened (some are divergent), and strongly constricted below apices; (4) leaf margins are distinctly and regularly denticulate to the base with deeply trifid or multifid teeth; (5) lamina cells are strongly prorate to spiculose-prorate and thick-walled; (6) inner perichaetial leaves are similar to stem leaves in length; (7) setae are 4.5-5.5 mm long, and densely papillose but smooth at the extreme base.

Note: Differences between *Chaetomitrium lancifolium* and *C. papillifolium* Bosch & Sande Lac. appear to be small, differing in the former having a shorter seta and its leaf apices are narrower and elongated. This taxon can be separated from *C. weberi* by its much narrower leaves and strongly prorate lamina cells.

16. *Chaetomitrium lauterbachii* Broth. *in* Schum. & Lauterb. (Plate 17)

Fl. Deutsch. Schutzgeb. Südsee 94. (1900).

Type: New Guinea, Moroka, 1300 m, *Loria 1663* (isotype FH!).

Other type illustration: None.

Characteristic features: (1) Plants are rather laxly branched; (2) branch leaves are slightly flattened, rather lax, concave, long-acuminate, and constricted below apices; (3) leaf margins are serrate above with simple teeth and denticulate below; (4) lamina cells are laxly spinose-prorate above and prorate below.

Note: This species is probably closely related to *Chaetomitrium ciliatum* Bosch & Sande Lac. and *C. spinosum* E.B.Bartram except for the narrowly long-acuminate leaves of *C. lauterbachii*.

17. *Chaetomitrium leptopoma* (Schwägr.) Bosch & Sande Lac. (Plates 18 & 19)

Bryol. Jav. 2: 52. 1862.

Type: Indonesia, Java, *Sande Lacoste s.n.* (isotype BM!).

Synonym: *Chaetomitrium cucullatum* Dixon , J. Linn. Soc. Bot. 50: 108 (1908). Type: Borneo, Sarawak, Gunung Balapan, Ulu Tinjar, *Richards 2395* (holotype BM!, isotype GRO!). fide Akiyama and Suleiman (2001).

Other type illustration: None.

Characteristic features: (1) Plants are small, and densely pinnately to bipinnately branched; (2) stem leaves are slightly flattened, sharply acute, and plane or slightly constricted below apices; (3) leaf margins are serrate to spinose-serrate with simple teeth; (4) lamina cells are spinose-prorate abaxially in upper half; (5) branch leaves are rigid, widely spreading to slightly recurved-spreading, tumid, much smaller than stem leaves, ca. 0.4 mm long, erect or recurved at apices and shortly apiculate; (6) setae are 7 mm long, densely papillose to the base except the extreme bases. (7) capsules are inclined and rough; (9) calyptrae are cucullate, densely hispid but naked at the base or with a few short hairs.

Note: Rigid branch leaves and abaxially spinose lamina cells distinguish this species from *Chaetomitrium ctenidioides*.

18. *Chaetomitrium nanohystrix* Müll.Hal. *in* M.Fleisch. (Plate 20)

Musci Fl. Buitenzorg 3: 1064 (1908).

Type: New Guinea, Moroka, 1300 m, *Loria s.n.* [There are four specimens we examined: *Loria 772* and *1619* (FH!); *Loria 1620* (BM!); *Loria 772* (FH!, G!, M!, NY!). Lectotype not selected.]

Other type illustration: None.

Characteristic features: (1) Plants are densely branched; (2) stem leaves are slightly flattened, with acuminate apices; (3) leaf margins are coarsely spinose-serrate above with often bifid to trifid teeth, and denticulate below; (4) costae are distinct; (5) lamina cells are densely spinose-prorate above, often with bifid to trifid tips at upper ends, and prorate below; (6) setae are 9-10 mm long, densely setulose almost to the base but smooth or sparsely papillose at extreme base; (7) capsules are inclined, with large and lax pustulae all over surface; (8) calyptrae mitriform, hispid all over, and fringed at the base with short hairs.

Note: The pustulate capsule is the most distinctive diagnostic feature of this species. Similar multicellular pustulae had been reported from *Dimorphocladon echinocarpum* H.Akiyama (Akiyama 2011). Sterile plants could be confused with *Chaetomitrium perarmatum* Broth. and *C. beccarii* but they have simple spines on their back.

19. *Chaetomitrium orthorrhynchum* (Dozy & Molk.) Bosch & Sande Lac. (Plates 21–23)

Bryol. Jav. 2: 45. 1862.

Type: Indonesia, Sumatra, *Korthals s.n.* (holotype L!).

Synonym: *Chaetomitrium everettii* Mitt. *ex* Dixon, J. Linn. Soc. Bot. 50: 109 (1935). Type: Borneo, Sarawak, Baram, *Everett s.n.* (holotype NY!, isotype BM!). fide Akiyama & Suleiman (2001).

Chaetomitrium finisterrae Dixon & Herzog, Hedwigia 66: 350 (1926).Type: New Guinea, *Eiffert s.n.* (holotype JE, isotypes BM!, GRO!, S!). fide Akiyama (1997).

Other type illustration: None.

Characteristic features: (1) Plants are irregularly pinnately to bipinnately branched, forming thin and rather flat mats; (2) stem leaves are slightly flattened, constricted below apices, and concave; (3) leaf margins are sharply serrate to spinose-serrate, and often with geminate teeth; (4) costae are strong; (5) lamina cells are strongly prorate; (6) setae are short, 8-9 mm long, densely setulose above, papillose below and smooth at extreme base; (7) capsules are horizontal, smooth and widest at the mouth; (8) calyptrae are mitriform, sparingly hispid above, strongly fringed below with long cilia.

Note: The type specimen of this species has sharply spinose-serrate leaf margins, with teeth reaching to 30 μm high. It could be confused with *C. papillifolium*, but the latter has incurved foliation of branches, denticulate leaf margins, and papillose seta.

20. *Chaetomitrium paleatum* (Hampe) M.Fleisch. (Plate 24)

Hedwigia 63: 215. 1922.

Type: Borneo, Sarawak, *Beccari 6* (holotype BM!, isotype GRO!).

Other type illustration: None.

Characteristic features: (1) Plants are small and densely tufted, (2) branches are 3–6 mm long, 0.8 mm wide, and tips are obtuse but sometimes cuspidate; (3) stem leaves are lanceolate with wide bases and acuminate apices; (4) branch leaves are smaller than stem leaves, deeply concave, ovate-lanceolate, ca. 0.5 mm long, with acute to obtuse apices; (5) leaf margins are incurved above, and smooth or bluntly denticulate above; (6) lamina cells are smooth but sparsely prorate above; (7) setae are 10-11 cm long, laxly papillose above, and smooth or distantly pustulose below; (8) capsules are inclined and smooth; (9) calyptrae (immature) are cucullate, sparsely hispid with a few long appressed erect hairs over the surface, and naked at the base.

Note: This species is very similar to *Chaetomitrium*

fimbriatum and might represent a variety of the latter species. It differs from *C. fimbriatum* only in its acute to obtuse branch leaf apices. We tentatively treat it as a separate species here.

21. *Chaetomitrium papillifolium* Bosch & Sande Lac. (Plate 25)

Bryol. Jav. 2: 50 (1862).

Type: Indonesia, Java, without collector name (holotype L!, isotype FH!).

Other type illustration: Bosch and Sande Lacoste (1862, Pl. 171).

Characteristic features: (1) Branches are erect or strongly incurved when dry, with filamentous propagules in leaf axils near the tips; (2) branch leaves are acuminate, slightly constricted below apices; (3) leaf margins are denticulate with geminate teeth; (4) lamina cells are linear, strongly prorate, thick-walled; (5) setae are 8 mm long, papillose above and smooth at the extreme base; (6) capsules are inclined with smooth surface; (7) calyptrae are mitriform, laxly setulose above, with long hairs below.

Note: The strongly incurled branches is one of the diagnostic features of this species. Other species that have curved branches when dry are *C. weberi* and *C. philippinense*. These two species, however, are much larger in plant size than *C. papillifolium*, with branches ca. 3 mm wide. In addition, their branch leaves are acute.

22. *Chaetomitrium perarmatum* Broth. (Plate 26)

Philippines J. Sc. 31: 290 (1926).

Type: Philippine, Apayao Subprovince, Luzon, *Fenix 28335* (isotypes BM!, FH!, GRO!, NY!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 13d - f).

Characteristic features: (1) Plants are simple or sparingly branched, gradually tapering, and slightly flattened; (2) branch leaves are moderately lax, deeply concave, with mucronate apices; (3) leaf margins are widely incurved on one side, coarsely dentate above and denticulate to the base with simple teeth; (4) costae are strong; (5) lamina cells are coarsely spinose above, occasionally tuberculate, to 14 μm in diameter, and strongly prorate to the base; (6) setae are 9 mm long, setulose, and papillose at the extreme base; (7) capsules inclined, smooth and widest below mouth; (8) calyptrae cucullate, hispid all over surface, gradually short and sparse towards the base, base naked but with a few short hairs.

Note: Resembling *Chaetomitrium elmeri* in habit, *C. perarmatum* differs in its coarsely dentate leaf margins, apiculate apices, spinose lamina cells, and shorter and setulose seta.

23. *Chaetomitrium perlaeve* Dixon (Plates 27–30)

J. Linn. Soc. Bot. 45: 489 (1922).

Type: New Guinea, 750 m, *Kloss 30* (holotype BM!, isotype GRO!).

Synonym: *Chaetomitrium parcesetulosum* E.B.Bartram, Lloydia 5: 281 (1942).Type: New Guinea, Bernhand Camp, Idenburg River, 50 m, Brass 13828 (holotype FH!, isotypes GRO!, L!, NY!). fide Tan (2000).

Chaetomitrium plicatum E.B.Bartram, Lloydia 5: 281 (1942).Type: New Guinea, Lake Habbema, 2800 m, *Brass* 10960 (holotype FH!). fide Tan (2000).

Chaetomitrium subplicatum E.B.Bartram, Bryologist 48: 122 (1945). Type: New Guinea, Yanem River, 1500 - 1800 m, *Clemens 12214* (holotype FH!). fide Tan (2000).

Other type illustrations: Dixon (1922, Pl. 28, Fig. 6); Akiyama (1997, Fig. 26a - c).

Characteristic features: (1) Plants are densely tufted, (2) branches are 5 - 7 mm long; (3) stem leaves are similar to branch leaves but apices are abruptly long-acuminate; (4) branch leaves are plicate, deeply concave, cymbifolium near apices and abruptly short-acuminate; (4) leaf margins are incurved both sides almost to the base, and entire or only bluntly denticulate above with simple teeth; (4) lamina cells are smooth and slightly porose; (5) setae are 17 -19 mm long, smooth or slightly rough above; (6) calyptrae are cucullate, almost smooth, with only a few scattered short hairs, hispid at extreme tips and bases are naked but with a few hairs; (7) capsules are inclined and smooth.

Note: Tan (2000) examined a number of specimens of *C. parcesetulosum, C. plicatum*, and *C. subplicatum* and treated them as synonyms of *C. perlaeve*. The type of *C. parcesetulosum* is characterized by (1) uniformly papillose calyptra all over surface, and (2) setae are 20–28 mm long, and smooth throughout. The type of *C. subplicatum* is characterized by (1) strongly recurved to reflexed apices of branch leaves, (2) setae are 30 - 35 mm long, smooth or minutely papillose above, and (3) calyptrae are smooth but sparingly setulose above and sometimes at the base. The type specimen of *C. plicatum* is characterized by (1) robust plant with branches up to 2 cm long, (2) branch leaves are spirally seriate in arrangement, (4) setae are reaching to 35 mm long, densely papillose

half above and smooth below, and (5) large calyptra, ca. 6 mm long, which is smooth except at the tips with a few short hairs.

24. *Chaetomitrium philippinense* (Mont.) Bosch & Sande Lac. (Plates 31 & 32)

Bryol. Jav. 2: 44 (1862).

Type: Indonesia, Java, *Zollinger* 115, as *Hookeria philippinense* (isotypes FH!, L!).

Synonym: *Chaetomitrium curvatum* Sande Lac. *in* M. Fleisch., Musci Fl. Buitenzorg 3: 1057 (1908). Type: Indonesia, Java, Mt. Pangerango, *Kuhl & Hasselt s.n.* (holotype FH! isotype L!).

Other type illustration: Bosch and Sande Lacoste (1862, Pl. 166).

Characteristic features: (1) Plants are robust and branches are cuspidate and homomallous; (2) branch leaves apices are often twisted and strongly constricted; (3) leaf margins are denticulate above with geminate teeth; (4) lamina cells are prorate.

Note: This is a species very similar to *Chaetomitrium elongatum* but the latter has oblong-obovate leaves. Akiyama (1997) also noted that *C. philippinense* resembles *C. papillifolium* and that they differ only in the shape of leaf apex.

25. *Chaetomitrium poecilophyllum* Dixon (Plate 33)

J. Bot. 79: 73 (1941).

Type: Borneo, Sarawak, *Everett E.518* (holotype BM!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 18a - e).

Characteristic features: (1) Plants are robust and densely pinnately branched; (2) branch leaves are flexuose, to 2.7 mm long, slightly plicate, apices are gradually long-acuminate and wavy; (3) leaf margins are incurved on one side, serrate above and denticulate below with simple teeth; (4) costae are distinct; (5) lamina cells are strongly thick-walled, porose and smooth; (6) setae are 15 mm long, slightly papillose above and gradually smooth below; (7) calyptrae cucullate, hispid all over, hairs gradually shorter below and bases are naked.

Note: This species has the widest branches, the longest leaves, and the largest perichaetial leaves among all the Malesian *Chaetomitrium* species.

26. *Chaetomitrium pseudoelongatum* Broth. *in* Warb. (Plate 34)

Monsunia 1: 47 (1899).

Type: Philippines, Tawi-tawi, *Warburg 13650* (isotypes FH!, S!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 13g - h).

Characteristic features: (1) Plants are densely tufted, (2) branches are sub-erect; (3) branch leaves slightly flattened, erect-patent, deeply concave, rugose above, widely obtuse or almost truncate with minute apiculus; (3) leaf margins are incurved above, forming constriction below apices, serrate above, denticulate below with simple teeth; (4) costae are strong; (5) lamina cells are thick-walled, smooth, and shorter at apex; (6) setae are 8-9 mm long, papillose half above but smooth below; (7) capsules inclined, pustulose below, and apophysis strongly rugose: (8) calyptrae hispid above, with long cilia at the base.

Note: This species might be confused with *Chaetomitrium warburgii*, *C. elongatum*, and *C. laevifolium* but differs in the markedly dentate margin near apices.

27. *Chaetomitrium robbinsii* E.B.Bartram (Plate 35)

Brittonia 13: 376 (1961).

Type: New Guinea, Sepik Province, Wewak-Angoram, Prince Alexander Ranges, *Robbins 2006* (holotype FH!, isotypes CANB!, GRO!).

Other type illustration: None.

Characteristic features: (1) Plants are small, sub-pendant, wiry, rigid, laxly branched; branches are tumid; (2) stem leaves are sub-quadrate, squarrose-recurved, wavy, widest at shoulder, and apices are widely obtuse to truncate apices and not apiculate; (3) leaf margins are plane, denticulate nearly to the base, with often minutely geminate teeth; (4) lamina cells are thick-walled, minutely prorulate to the base with sparsely blunt prorulae above, becoming much shorter at apical angles; (5) setae are short, ca. 1.5 mm long, sparsely papillose, smooth below; (6) capsules are sub-erect and slightly rough; (7) calyptrae are mitriform, with long cilia at the base, and spinose-hispid above.

Note: This elegant taxon is readily distinguished by the very short setae, wiry appearance, sub-rhomboidal branch leaves and sub-quadrate stem leaves.

28. *Chaetomitrium roemeri* M.Fleisch. (Plate 36)

Hedwigia 50: 283 (1911).

Type: Type: New Guinea, 750 m, *Von Römer 864* (holotype FH!, isotypes GRO!, NY!, L!).

Other type illustration: None.

Characteristic features: (1) Plants are small, densely and pinnately to bipinnately branched,

forming compact mats, (2) stem leaves are erect-spreading to recurved, sub-orbicular with abruptly acuminate apices, and plane or slightly constricted below apices; (3) leaf margins are slightly recurved near the base, denticulate with simple teeth; (4) lamina cells are coarsely spinose-prorate abaxially especially below apex, prorate below; (5) alar cells are sub-rectangular.

Note: This species is readily distinguished from any other allied taxa by its plane and not undulate leaves when flattened and smooth setae as well as abruptly acuminate leaf apices.

29. *Chaetomitrium schofieldii* B.C.Tan & H.Rob. (Plate 37)

Smithsonian Contr. Bot. 75:31 (1990).

Type: Philippines, Mindanoa, *Weber 1496* (Isotypes FH!, NY!).

Other type illustration: Akiyama and Suleiman (2001, Fig. 10e - h, of *C. schofieldii*).

Characteristic features: (1) Main stem are elongate, giving rise to long, sub-erect branches, (2) branches are simple or sparingly branched, spirally seriate and tumid; (3) branch leaves are obtuse, truncate or mucronate, minutely apiculate, deeply concave, and widely incurved above; (4) leaf margins are bluntly denticulate or almost smooth to the base with simple teeth; (5) lamina cells are moderately thick-walled, short and incrassate at extreme apices, smooth or prorulate; (6) margin of inner perichaetial leaves are denticulate to the base; (7) setae are 7 mm long, minutely papillose above and gradually smooth below; (8) capsules inclined and slightly rough below; (9) calyptrae mitriform, upper part with long erect hairs, with long cilia at the base.

Note: Tan and Mohamed (1990) proposed a new name, *Chaetomitrium schofieldii* to replace the illegitimate name of *C. seriatum* Broth. ex E.B.Bartram. It has very similar habit and appearance to *C. borneense*, but has obtuse leaf apices, longer and less papillose setae, and denticulate margins of inner perichaetial leaves of *C. schofieldii* are different from the latter; *C. borneense* has abruptly short-acuminate leaf apices, setae only 3 mm long and coarsely papillose, and the margins of inner perichaetial leaves are spinose-serrate. The rugose leaf apices of *C. elongatum* and *C. warburgii* can separate *C. schofieldii* when its seriate arrangement is not clear.

30. *Chaetomitrium setosum* Broth. *ex* Dixon (Plate 38)

Bull. Torrey Bot. Cl. 51: 237 (1924).

Type: Malaya, Perak, Tapah, *Ridley 169* (holotype BM!)

Other type illustration: Dixon (1924, Pl. 3, Fig. 13).

Characteristic features: (1) Plants are robust, densely branched, (2) branches are ca. 2.8 mm wide, often with seriate foliation; (3) stem leaves are deeply concave, plicate, abruptly acuminate, inrolled below; (4) leaf margins are inflexed and serrate above with geminate teeth, denticulate below and near the apex; (5) costae are strong; (6) lamina cells are distinctly prorate to the base, thick-walled and porose; becoming yellow near the base; (7) setae are short, 4 - 6 mm long, densely setulose above and smooth at extreme base; (8) capsules are horizontal and rough; (8) calyptrae are mitriform, densely pilose all over with very long basal hairs.

Note: The robust habit and highly setulose short setae of this species are characteristic along with the inflexed leaf margins and sharply serrate and strongly prorate lamina cells.

31. *Chaetomitrium spinosum* E.B.Bartram (Plate 39)

Britonnia 9: 49 (1957).

Type: New Guinea, Mt. Dayman, 1540 m, *Brass 22218* (isotype CANB!).

Other type illustration: None.

Characteristic features: (1) Plants are densely branched; (2) stem leaves are more or less rugose, and apices are strongly constricted or wavy; (3) leaf margins are incurved on one side, serrate on upper half with simple teeth, entire below, and denticulate near the apices; 4) costae are short; (5) lamina cells are laxly spinose-prorate above with simple spines on the back, smooth or distantly prorate below; (6) setae are 15 - 20 mm long, setulose almost to the base and papillose at extreme base; (7) calyptrae are cucullate, densely hispid all over and almost naked at the base.

Note: This species resembles *Chaetomitrium ciliatum* in the spinose-prorate lamina cells, setulose setae and hispid calyptrae, but differing in the shorter costae and serrate leaf margins. The densely spinose-prorate abaxial ornamentation of lamina cells of *C. nanohystrix* can easily distinguished it from *C. spinosum*.

32. *Chaetomitrium tahitense* (Sull.) Mitt. *in* Seem. (Plates 40 & 41)

Fl. Vit. 392. 1873["taitense"].

Type: Tahiti, *Sullivant and Schrader XXIII* (isotype

G!).

Synonym: *Chaetomitrium geheebii* Broth., Oefv. Finsk. Vet. Soc. Foerh. 37: 165. (1895), New Guinea, Simboug, *Nyaman 163*, of (isotypes FH!, NY!, G!, GRO!, GOET!).

Chaetomitrium tahitense var. *deplanchei* (Besch.) Wijk & Marg., Taxon 8: 72. 1959.Type: Thiebault, herb. Mus. Par., not seen. fide Streimann (1997).

Other type illustration: None.

Characteristic features: (1) Branch leaves are flattened, erect-spreading and concave; (2) leaf margins are closely denticulate to the base with geminate teeth; (3) costae are strong, to 360 μm long; (4) lamina cells are thick-walled, prorate, becoming smaller towards the margins and apical region; (5) inner perichaetial leaves cells are porose, thick-walled, spinose-prorate above, spines up to 17 μm high, prorate below; (6) setae are 7 mm long, densely papillose, smooth or rough at the extreme base; (7) capsules are sub-erect to inclined, smooth.

Note: We have not examined any specimens of this species from Malesia, although it has been know from the region (Wijk *et al*., 1959, 1969). *Chaetomitrium tahitense* appears to be closely related to *C. papillifolium* but the former has mostly acute branch leaf apices and stronger and longer costae.

33. *Chaetomitrium torquescens* Bosch & Sande Lac. (Plate 42)

Bryol. Jav. 2: 47 (1862).

Type: Seram, *Vriese s.n.* (holotype L!, isotype FH!).

Other type illustrations: Bosch and Sande Lacoste (1862, Pl. 169); Akiyama and Suleiman (2001, Fig. 16g - j).

Characteristic features: (1) Plants are small and densely branched; (2) branches are often with cuspidate tips; (3) stem leaves are short-lanceolate, distinctly constricted above, forming undulation above shoulder, and often twisted or inrolled spirally; (3) leaf margins are denticulate to serrate above, denticulate below with simple teeth; (4) costae are strong; (5) lamina cells are smooth to prorulate, with a few spines above; (6) branch leaves strongly plicate, flexuose or inrolled spirally; margins are more serrate than stem leaves; (7) setae are 7 - 8 mm long, densely papillose half above, and sparingly papillose below; (8) Calyptrae (immature) are cucullate, hispid all over surface, and bases are naked but with a few short hairs.

Note: This species is recognised by its flexuose leaves, and often twisted or inrolled upper branch leaves, and almost smooth lamina cells with a few spines abaxially. The spirally inrolled leaves are more pronounced in dry condition.

34. *Chaetomitrium vrieseanum* Bosch & Sande Lac. (Plates 43–45)

Bryol. Jav. 2:54 (1862).

Type: Indonesia, Seram, *Vriese s.n.* (holotype L!, isotype S!).

Synonym: *Chaetomitrium papuanum* E.B.Bartram, Brittonia 9: 49 (1957). Type: New Guinea, Mt. Dayman, 800 m, *Brass 23453* (holotype FH!). fide Akiyama (1997).

Chaetomitrium rigidulum Broth. *in* Schum. & Lauterb., Fl. Deutsch. Schutzgeb. Südsee 94 (1900). Type: New Guinea, Biemark Ebene, 150 m, *Lauterbach s.n.* (isotypes S!, FH!). fide Akiyama (1997).

Other type illustration: Bosch and Sande Lacoste (1862, Fig. 174).

Characteristic features: (1) Plants are small, densely branched, regularly and pinnately branched; (2) branches are short, only 4-6 mm long; (3) stem leaves are crowded, squarrose, orbicular, obtuse with sharp apiculus; (4) leaf margins are strongly undulate, closely denticulate to the base with geminate teeth; (4) lamina cells are thick-walled, prorate to spiculose-prorate above, distantly prorate below, becoming much shorter towards the apex, irregularly rhomboidal, strongly incrassate; (5) setae are 6 mm long and setulose to the base; (6) calyptrae (immature) are hispid all over the surface with long cilia below.

Note: This species can be distinguished from other species by the small, orbicular, shortly apiculate, and strongly undulate leaves. It is very close to *C. brassii* and the latter might be just a variant of *C. vrieseanum*.

35. *Chaetomitrium warburgii* Broth. *in* Warb. (Plate 46)

Monsunia 1: 48 (1899).

Type: Philippines, Mindanao, *Weber 1313* (isotypes NY!, BM!, S!)

Other type illustration: Akiyama and Suleiman (2001, Fig. 13i - l).

Characteristic features: (1) Plants are robust and densely branched; (2) branches are densely foliated and slightly flattened; (3) branch leaves oblong to oblong-obovate, erect-patent, deeply concave, and apices obtuse to truncate, rugose or recurved; (3) leaf margins are incurved, denticulate with simple

teeth; (4) lamina cells are slightly prorulate or almost smooth, moderately thin-walled, and sub-apical cells sub-rhomboidal and thick-walled; (5) inner perichaetial leaves are oblong, strongly laciniate with obtuse or even truncate apices; (6) setae are 8 - 9 mm long, papillose above, papillae low, smooth half below.

Note: The obtuse to truncate and strongly laciniate perichaetial leaves of this taxon are very distinct from any other Malesian taxa of the genus, except for *Chaetomitrium laevifolium*. The apices of the latter are, however, abruptly subulate or acuminate. The obtuse and not apiculate leaf apices distinguish it from *C. elongatum*.

36. *Chaetomitrium weberi* Broth. (Plate 47)

Philippine J. Sc. 8: 83 (1913).

Type: Philippines, Butuan Subprovince, Mindanao, 6 m, *Weber 1309* (isotypes BM!, FH!, NY!).

Other type illustrations: Bartram (1939, Pl. 20, Fig. 340); Akiyama and Suleiman (2001, Fig. 15e - h).

Characteristic features: (1) Plants are vigorous, laxly branched, with filamentous propagules in leaf axils near the branch tips; (2) branches are complanate to sub-tumid, and sometimes slightly secund; (3) branch leaves are widely lanceolate, plicate, apices are plane but often constricted below apices; (4) leaf margins are denticulate with geminate teeth; (5) lamina cells are prorulate to prorate; (6) inner perichaetial leaves are strongly laciniate at apex, broadly ovate-lanceolate, plicate, and margin serrate to the base; (7) setae (immature) are 11 mm long, papillose above, papillae low and sparse, smooth below; (8) calyptrae (immature) are mitriform, hispid with several long erect hairs over surface, and base ciliate.

Note: Plants of the isotype deposited in NY have branch leaves that are only slightly constricted.

Key to the species of Malesian Chaetomitrium

1. Branch leaves recurved to squarrose, orbicular to sub-orbicular. 2
1. Branch leaves erect-patent to spreading, ovate-lanceolate to oblong. 7
2. Leaves strongly falcate, apices twisted; capsule wall spinose. ..... (1) *C. acanthocarpum*
2. Leaves not falcate, apices plane; capsule wall smooth. 3
3. Leaf margins undulate. 4
3. Leaf margins plane. 5
4. Leaf apiculus sharp. ..... (34) *C. vrieseanum*
4. Leaf apiculus blunt. ..... (4) *C. brassii*
5. Laxly branched; stem leaves sub-quadrate, apex widely obtuse or truncate, hardly apiculate; seta 1.5 mm long, sparsely papillose. ..... (27) *C. robbinsii*
5. Densely branched; stem leaves orbicular, leaf apices obtuse with minute to short-acute apiculus; seta 10-25 mm long, smooth. 6
6. Branch leaf apices long-acuminate; seta 10 mm long. ..... (28) *C. roemeri*
6. Branch leaf apices mucronate to short-acuminate; seta 25 mm long. ..... (13) *C. laevisetum*
7. Leaf apices truncate or widely rounded. 8
7. Leaf apices acute to acuminate. 14
8. Abaxial side of leaf spinose to tuberculate. 9
8. Abaxial side of leaf smooth to prorate. 12
9. Abaxial side of leaf tuberculate. ..... (8) *C. elmeri*
9. Abaxial side of leaf spinose. 10
10. Upper lamina cells spines with germinate or stellate tips. ..... *C. seramensis*
10. Upper lamina cells spines simple. 11
11. Leaf margins crenulate, with germinate teeth; calyptra mitriform. ..... *C. darnaedii*
11. Leaf margins dentate, with simple teeth; calyptra cucullate. ..... (22) *C. perarmatum*
12. Branch leaves spirally seriate in arrangement. ..... (29) *C. schofieldii*
12. Branch leaves not spirally seriate. 13
13. Leaf margins strongly dentate across apices. ..... (26) *C. pseudoelongatum*

13. Leaf margins entire or crenulate. …… (35) *C. warburgii*
14. Lamina cells smooth, only slightly prorulate or with a few prorulae, never with tall spines. …… 15
14. Lamina cells distinctly prorate to spinose-prorate or with scattered tall spines. …… 21
15. Branch leaves clearly spirally seriate in arrangement. ……(3) *C. borneense*
15. Branch leaves not spirally seriate. …… 16
16. Leaf apices plane, hardly incurved, never constricted.……(7) *C. elegans*
16. Leaf apices mainly undulate, incurved or constricted. …… 17
17. Leaves obovate, widest above mid-leaf. …… (12) *C. laevifolium*
17. Leaves lanceolate or oblong-lanceolate, widest at or below mid-leaf.…… 18
18. Plants small, branches 1.0 mm wide. …… 19
18. Plants medium to robust, branches more than 1.5 mm wide. …… 20
19. Branch leaves ovate-lanceolate, apices acute to acuminate.…… (10) *C. fimbriatum*
19. Branch leaves ovate, apices obtuse. ……(20) *C. paleatum*
20. Leaf margins entire; calyptra smooth or with scattered hairs over surface. …… (23) *C. perlaeve*
20. Leaf margins denticulate to serrate; calyptra hispid all over surface. …… (25) *C. poecilophyllum*
21. Leaf marginal teeth germinate. …… 22
21. Leaf marginal teeth simple. …… 32
22. Branch leaves oblong-obovate.……(9) *C. elongatum*
22. Branch leaves lanceolate, ovate-lanceolate to oblong-ovate. …… 23
23. Leaf margins denticulate. …… 24
23. Leaf margins serrate to spinose-serrate. …… 28
24. Plants robust, branches ca. 3 mm wide. …… 25
24. Plants small to medium, branches ca. 2 mm wide or less. …… 26
25. Branch leaves complanate. ……(36) *C. weberi*
25. Branch leaves not complanate. …… (24) *C. philippinense*
26. Leaf apices mostly acuminate; branches often strongly incurled when dry. …… (21) *C. papillifolium*
26. Leaf apices mostly acute; branches erect when dry.…… 27
27. Plants very small, branch leaves ca. 0.5 mm long. …… (6) *C. ctenidioides*
27. Plants medium size, branch leaves ca. 1 mm long. ……(32) *C. tahitense*
28. Lamina cells porose, strongly thick-walled; branch leaves often seriate.…… (30) *C. setosum*
28. Lamina cells not porose, thin-walled to slightly thick-walled; branch leaves not seriate. …… 29
29. Lamina cells prorate to spiculose-prorate. …… 30
29. Lamina cells spinose-prorate. …… 31
30. Plants laxly branched; seta 4.5-5.5 mm long. ……(15) *C. lancifolium*
30. Plants densely bi-pinnately branched; seta 8-9 mm long.……(19) *C. orthorrhynchum*
31. Apices of ultimate branch leaves acuminate; capsule wall smooth. …… (2) *C. beccarii*
31. Apices of ultimate branch leaves acute to obtuse; capsule wall pustulose. ……(18) *C. nanohystrix*
32. Leaf margins strongly spinose. …… 33
32. Leaf margins denticulate to serrate. …… 34
33. Lamina cells smooth with only a few scattered tall spines above, marginal teeth lax and almost perpendicular; plants often tinge with red. ……(11) *C. horridulum*
33. Lamina cells distinctly spinose-prorate above, marginal teeth close and pointing forward; plants green. …… (5) *C. ciliatum*
34. Costa reaching 1/3 of the leaf length; upper branch leaves strongly spirally twisted. … (33) *C. torquescens*
34. Costa not reaching 1/3 of the leaf length; upper branch leaves not twisted. …… 35
35. Branch leaf apices plane, at most a few slightly constricted. …… 36
35. Branch leaf apices rugose or strongly constricted. …… 37
36. Branch leaves very small, ca. 0.4 mm long, ovate-lanceolate, often shortly apiculate or mucronate. …… (17) *C. leptopoma*
36. Branch leaves ca. 0.8 mm long, lanceolate, acute. …… (14) *C. lanceolatum*
37. Branch leaf apices finely acuminate. …… (16) *C. lauterbachii*

37. Branch leaf apices acute to broadly acuminate. …… 38
38. Lamina cells laxly spinose-prorate above, smooth or distally prorate below; branch leaves denticulate near apices. …… (31) *C. spinosum*
38. Lamina cells sharply prorate, some forming short spines; branch leaves serrate near apices. …… *C. maryatii*

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Index of scientific names: Valid species are in **boldface**, synonyms are in *italics*.

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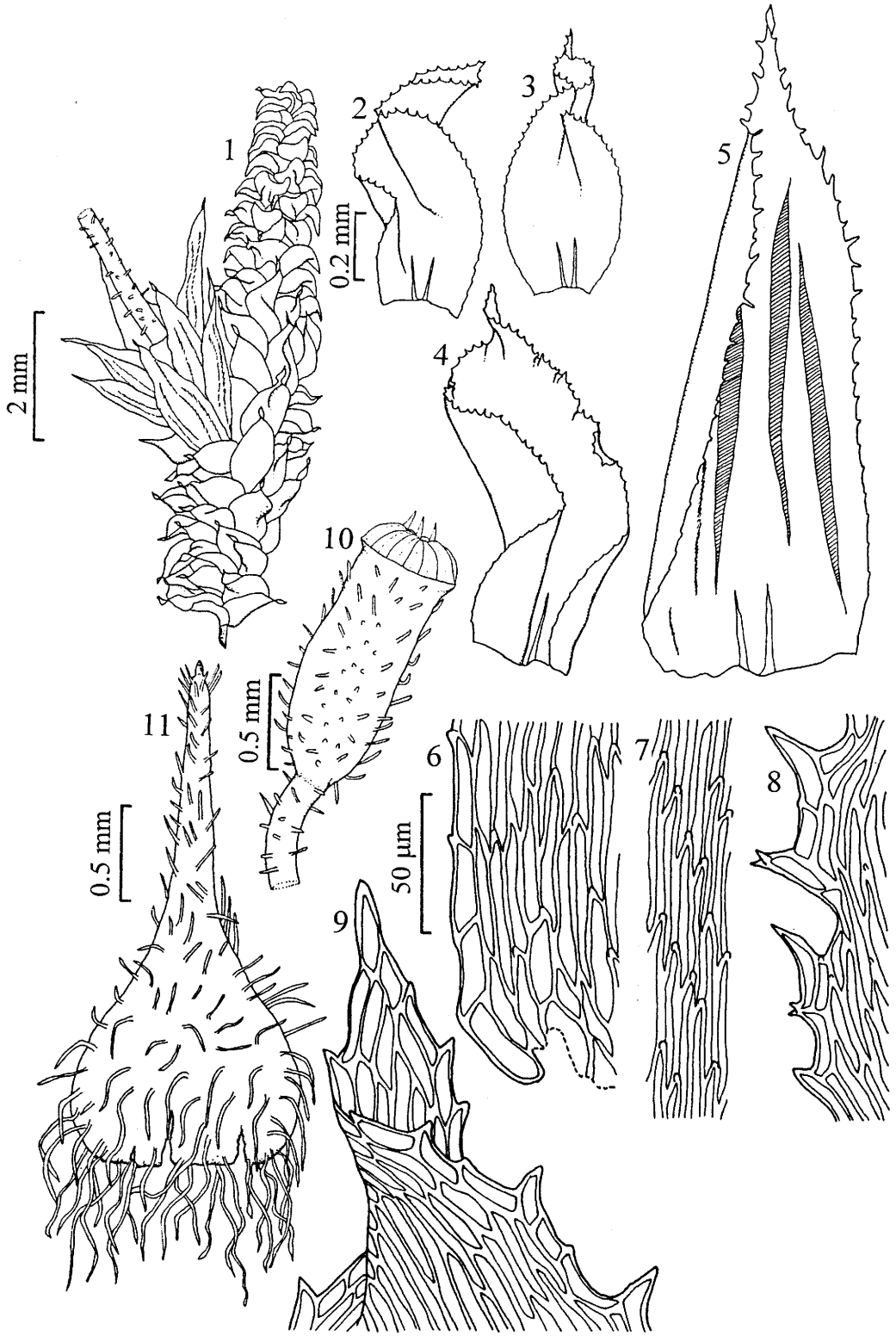

Plate 1. *Chaetomitrium acanthocarpum*. 1, plant. 2 & 3, branch leaves. 4, stem leaf. 5, inner perichaetial leaf. 6, alar region. 7, medial lamina cells. 8, leaf margin. 9, leaf apex. 10, capsule. 11, calyptra. 1–9 & 11 from *Vriese s.n.*, Seram (holotype), and 10 from *Janowsky 46*, New Guinea (FH).

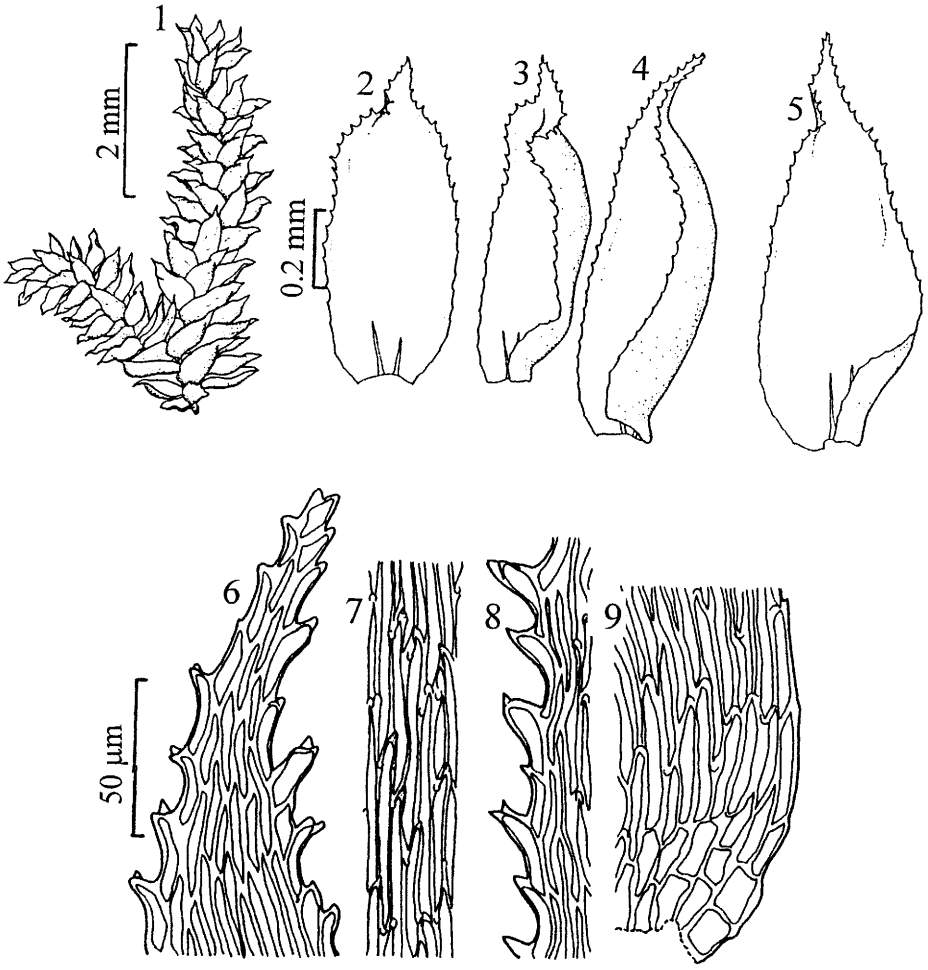

Plate 2. *Chaetomitrium beccarii*. 1, plant. 2 & 3, branch leaves. 4 & 5, stem leaves. 6, leaf apex. 7, medial lamina cells. 8, leaf margin. 9, alar region. All from *Hallier 449*, Borneo (holotype).

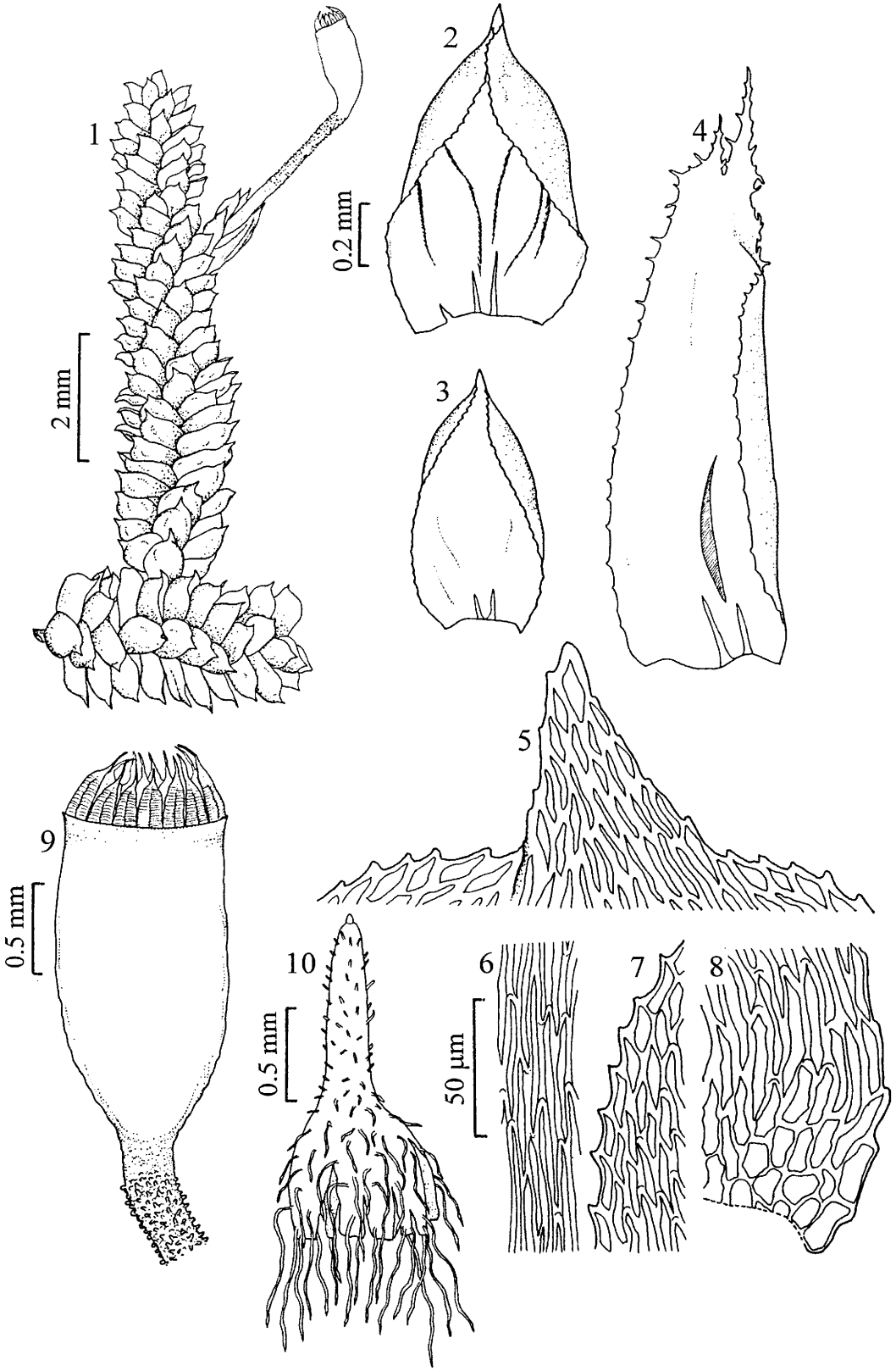

Plate 3. *Chaetomitrium borneense*. 1, plant. 2, stem leaf. 3, branch leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. 1–8 from *Motley 4*, Borneo (isotype), and 9 &10 from *Manuel 2630*, Malaya (KLU).

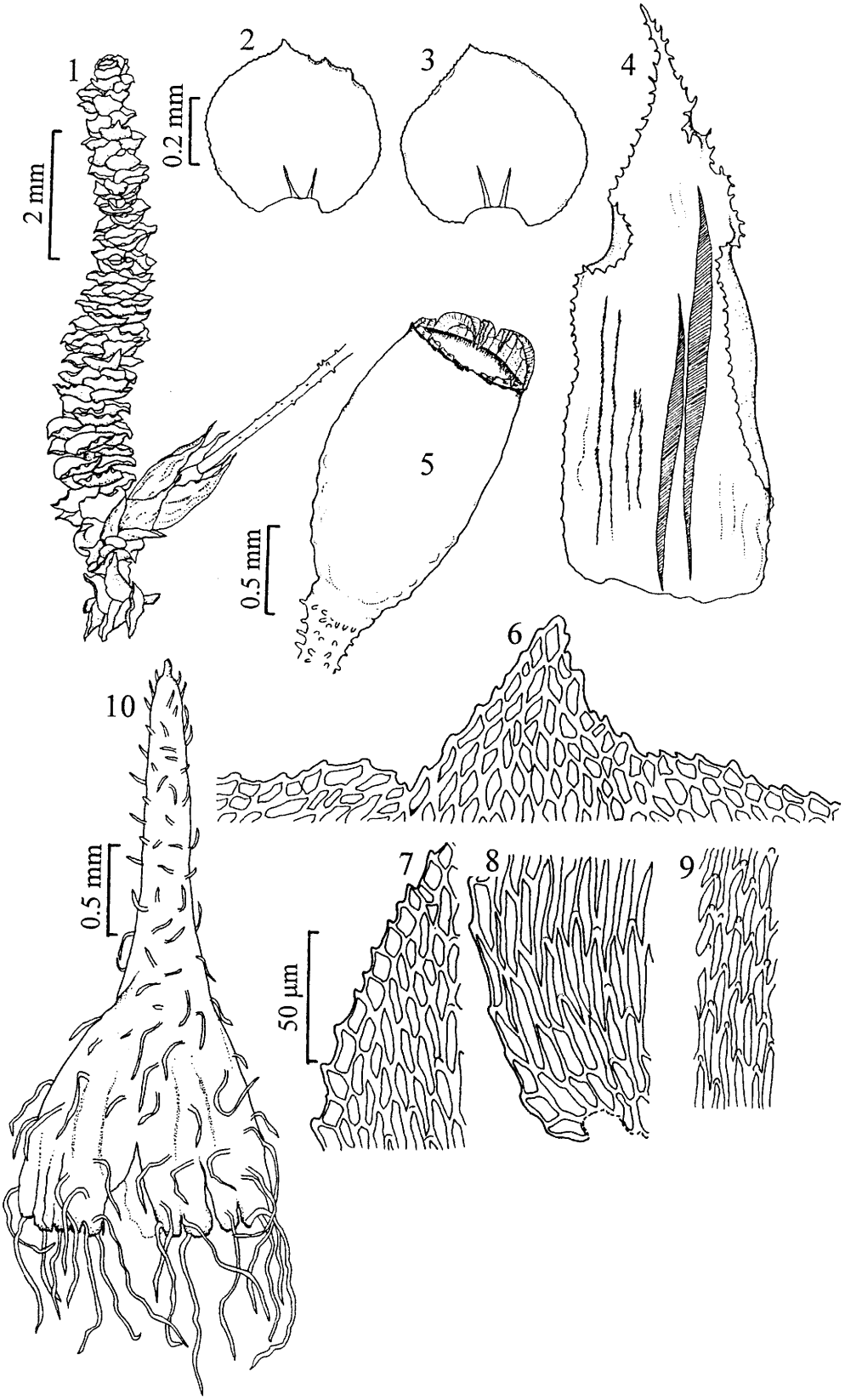

Plate 4. *Chaetomitrium brassii*. 1, plant. 2,3, branch leaves. 4, inner perichaetial leaf. 5, capsule. 6, leaf apex. 7, leaf margin. 8, alar region. 9, medial lamina cells. 10, calyptra. All from *Brass 24119*, New Guinea (holotype).

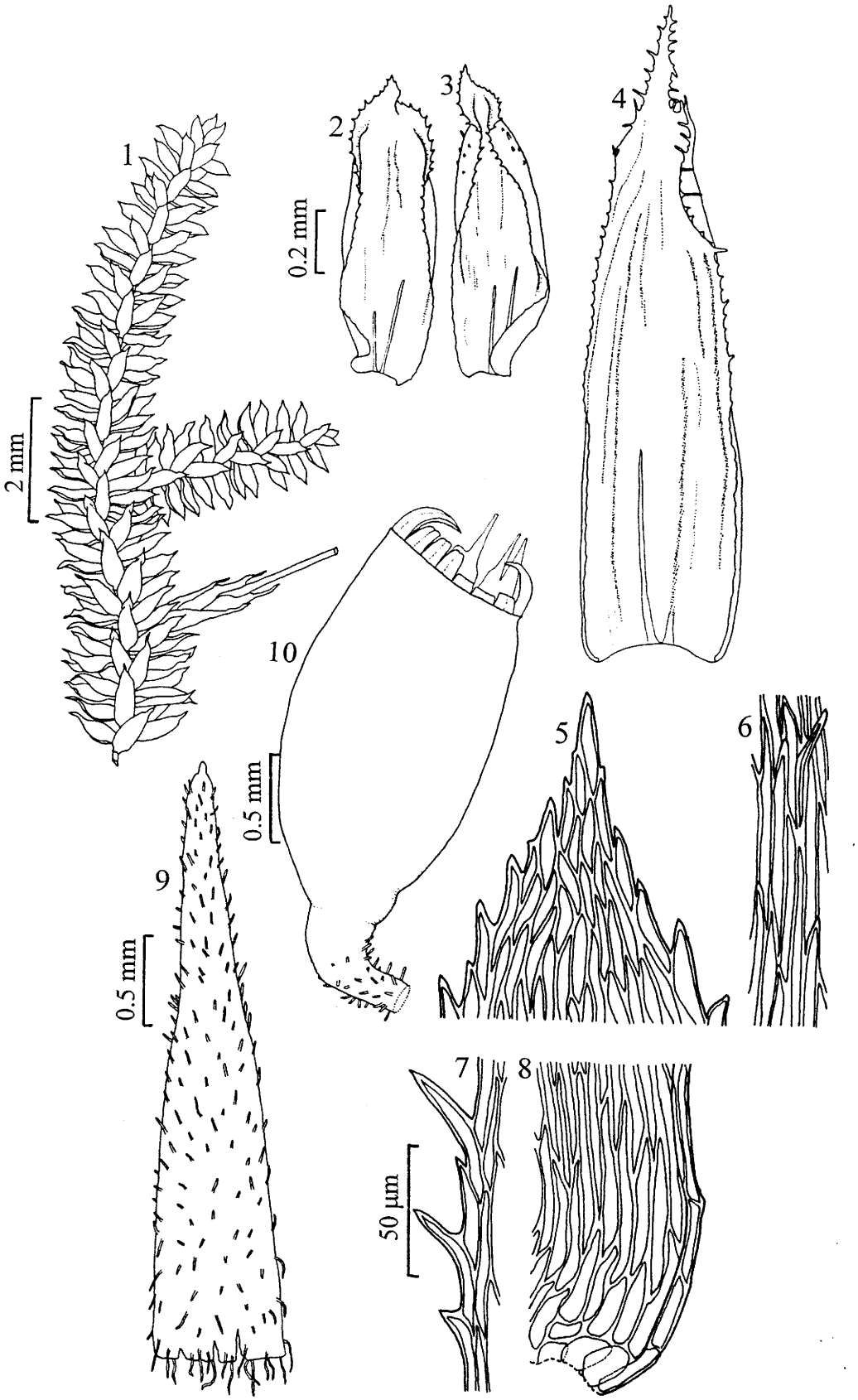

Plate 5. *Chaetomitrium ciliatum*. 1, plant. 2,3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. 1–9 from *Junghuhn s.n*, Java (holotype), and 10 from *Schiffner 12.866*, Java (L).

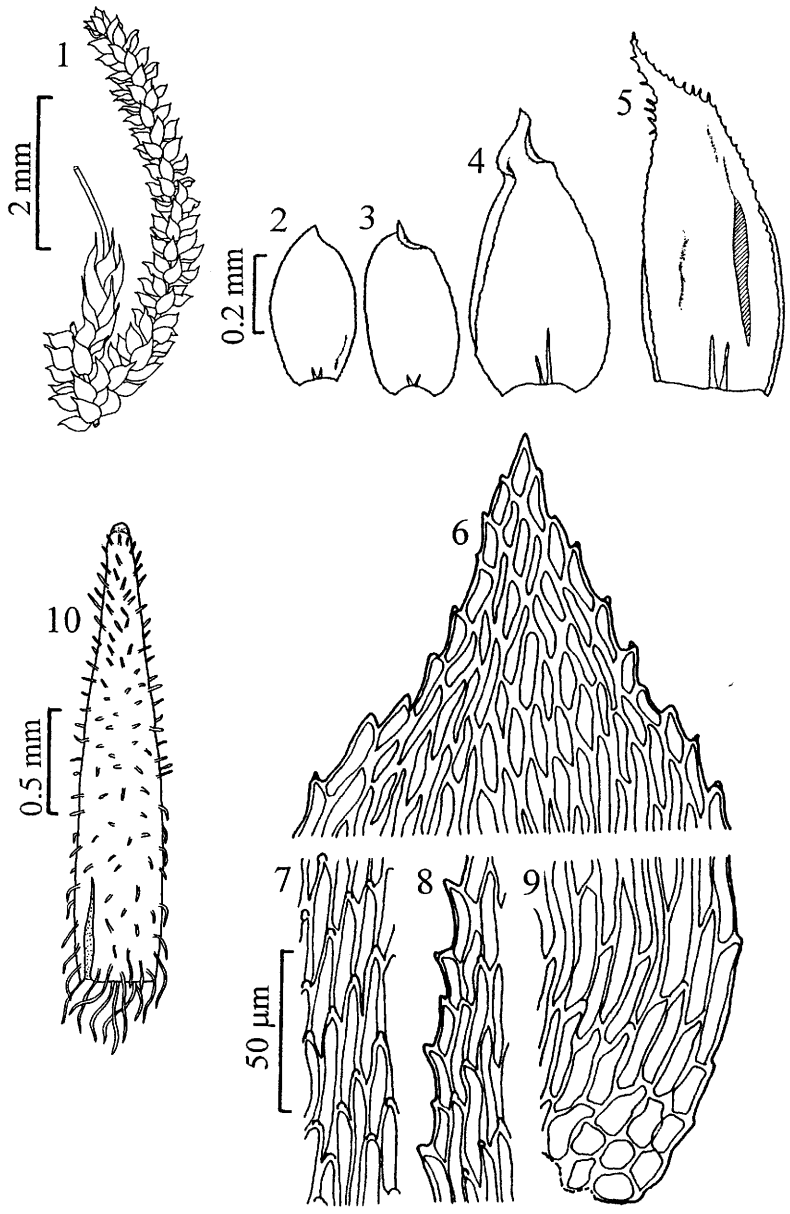

Plate 6. *Chaetomitrium ctenidiodes*. 1, plant. 2 & 3, branch leaves. 4, stem leaf. 5, inner perichaetial leaf. 6, leaf apex. 7, medial lamina cells. 8, leaf margin. 9, alar region. 10, calyptra. 2–9 from *Lauterbach s.n.*, New Guinea (isotype), and 1 & 10 from *Warburg s.n.*, Sulawesi (FH).

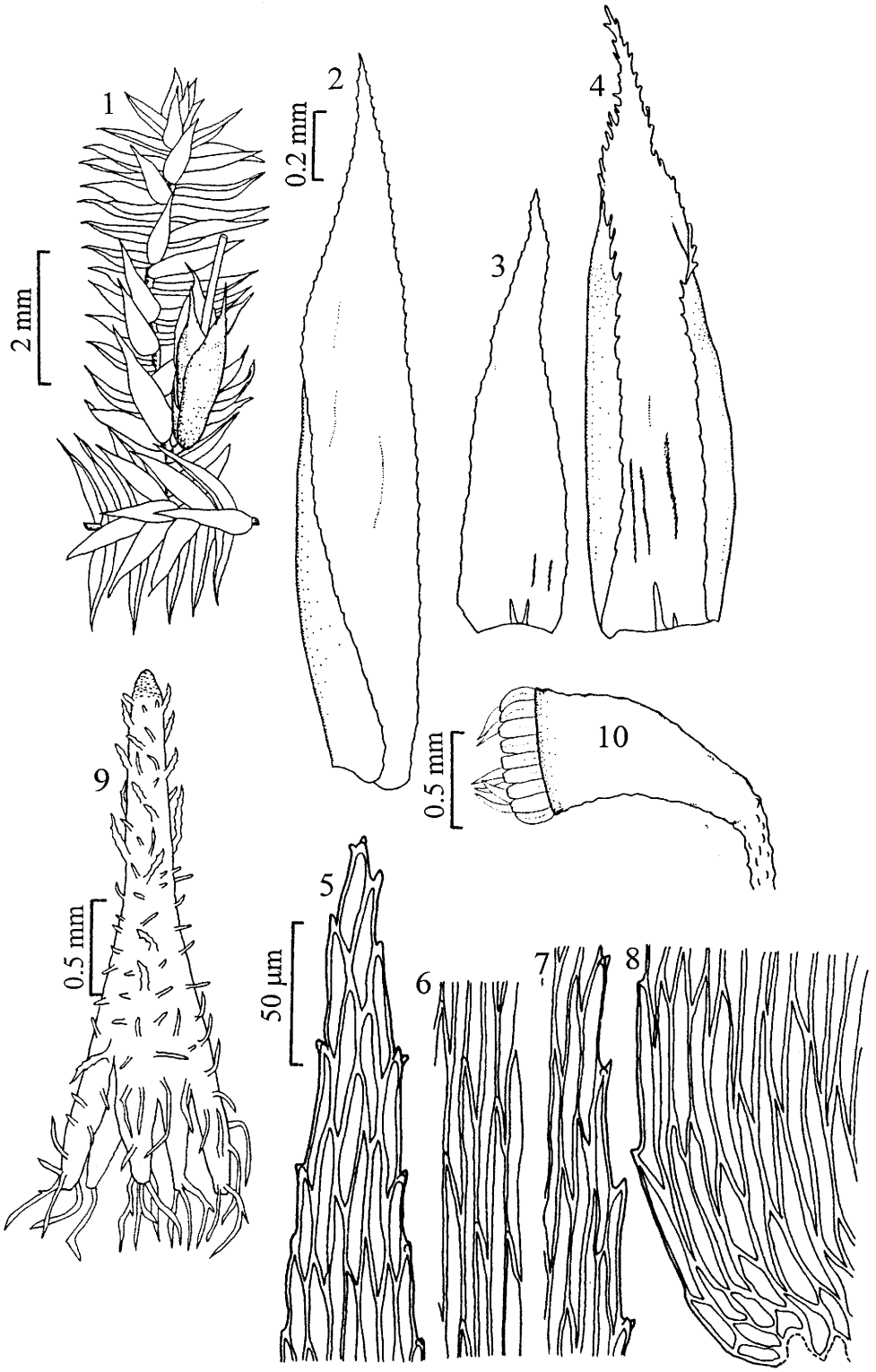

Plate 7. *Chaetomitrium elegans* (1). 1, plant. 2, stem leaf. 3, branch leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar cells. 9, calyptra. 10, capsule. 3 & 5–8 from *Bäuerlen s.n.*, New Guinea (isotype), and 1–4, 9 & 10 from *Pullen 7672*, New Guinea (L).

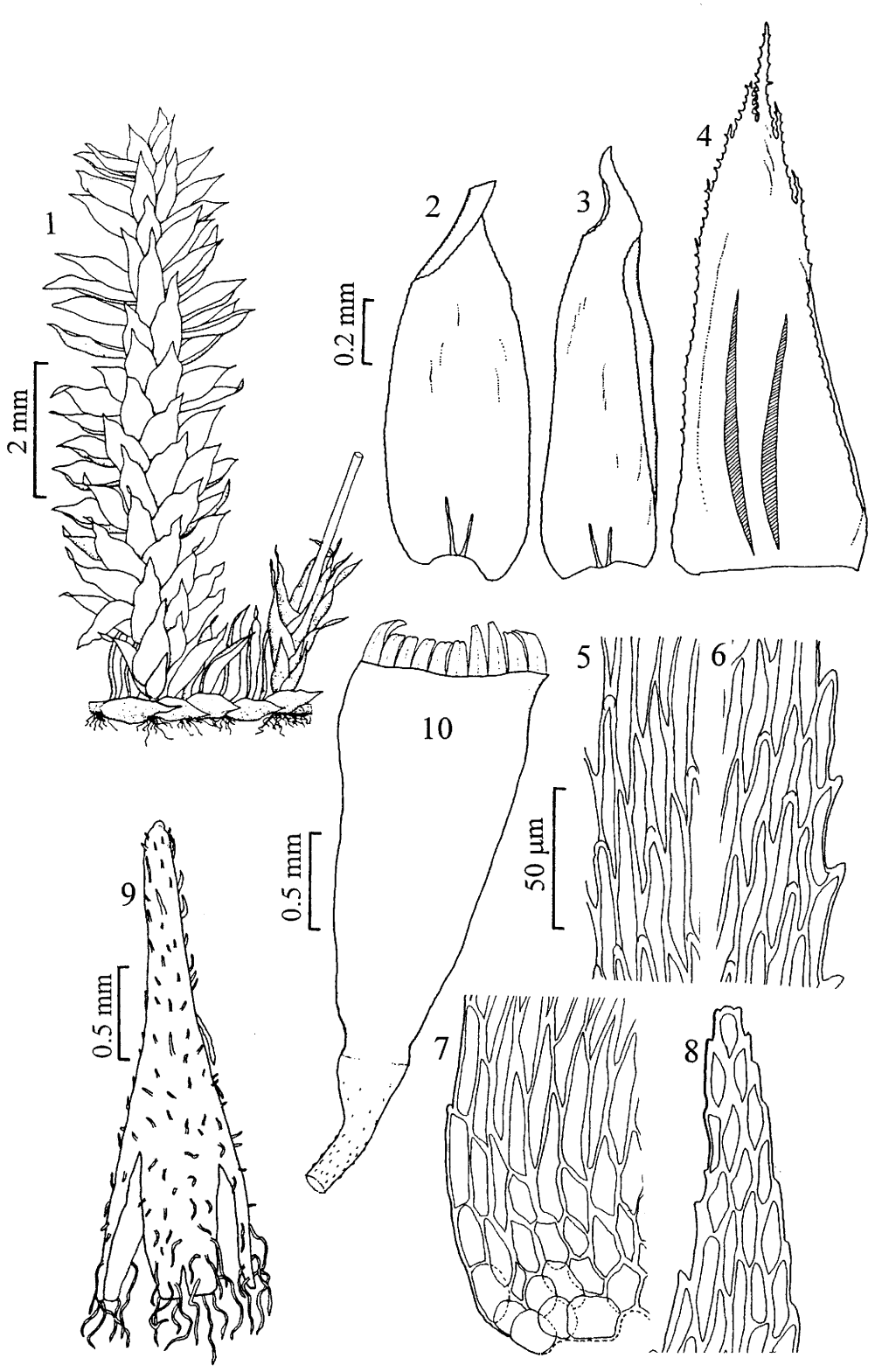

Plate 8. *Chaetomitrium elegans* (2). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, medial lamina cells. 6, leaf margin. 7, alar region. 8, leaf apex. 9, calyptra. 10, capsule. 1–8 from *Robbins 2172*, New Guinea (isotype of *C. pseudopapillifolium*), and 9–10 from *Robbins 2496*, New Guinea (CANB, GRO).

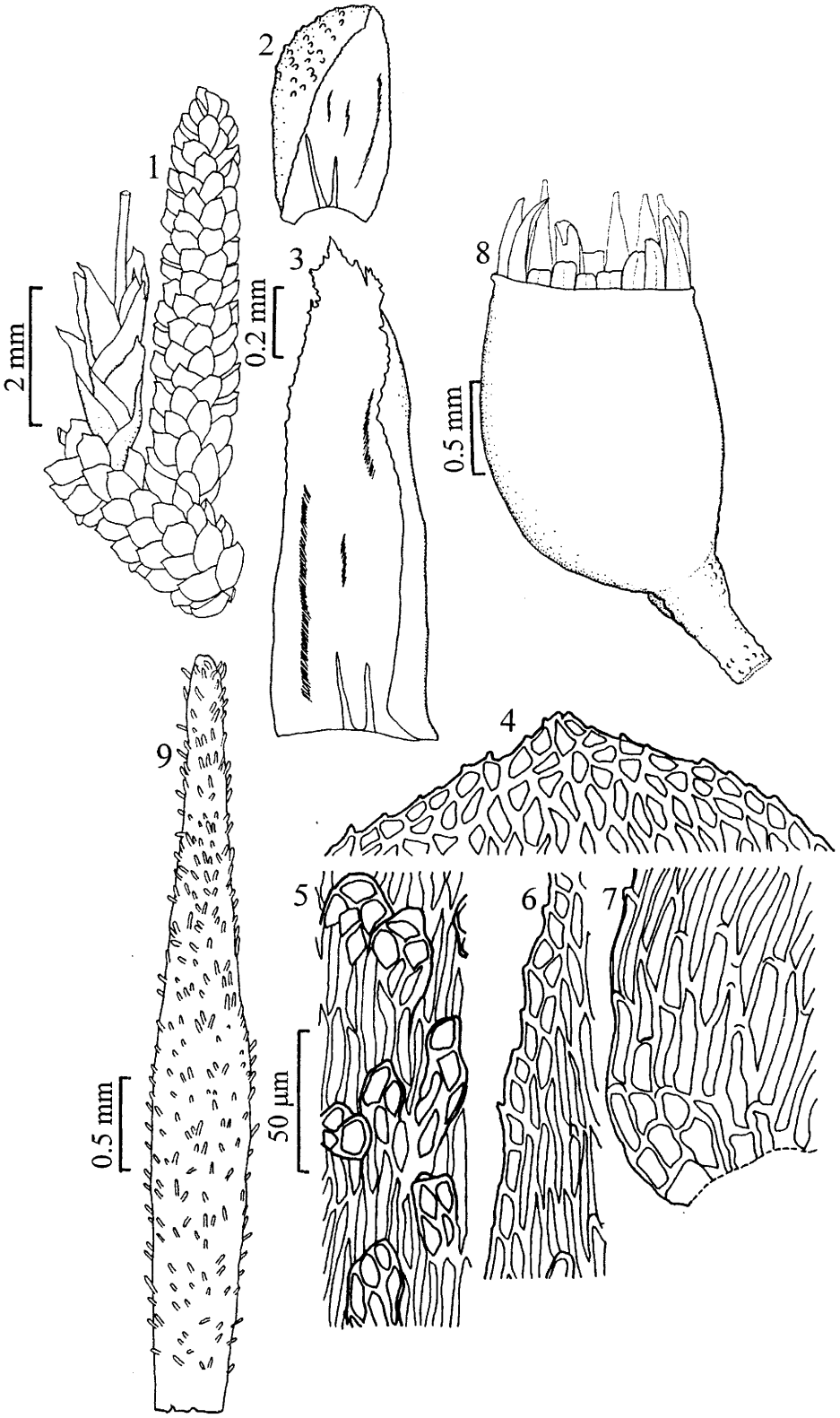

Plate 9. *Chaetomitrium elmeri*. 1, plant. 2, branch leaf. 3, inner perichaetial leaf. 4, leaf apex. 5, medial lamina cells. 6, leaf margin. 7, alar region. 8, capsule. 9, calyptra. All from *Elmer 12398*, Philippines (isotype).

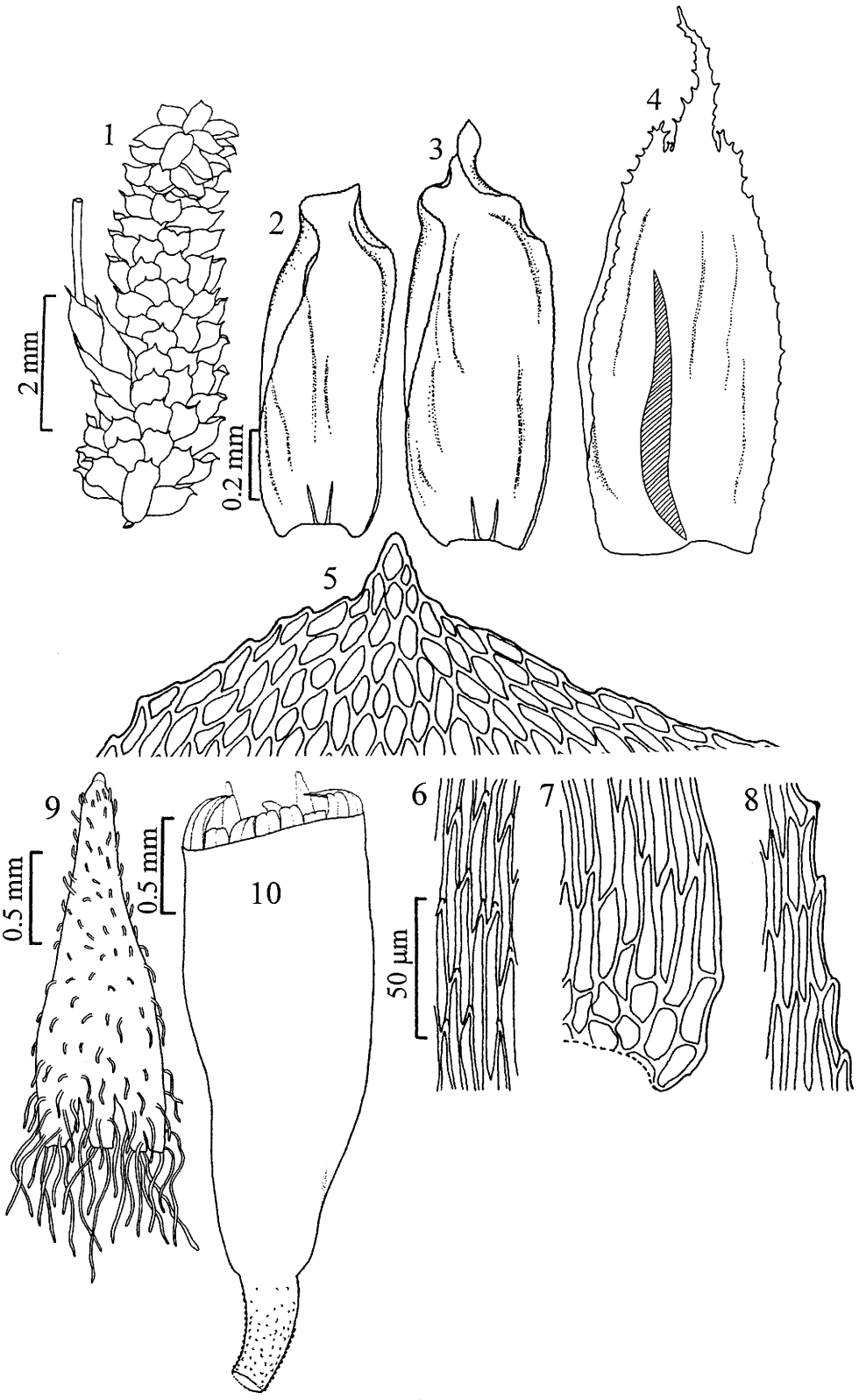

Plate 10. *Chaetomitrium elongatum*. 1, plant. 2,3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, alar region. 8, leaf margin. 9, calyptra. 10, capsule. 1–3 & 5–8, from *Zippelinus s.n.*, Maluku (holotype). 4 & 9 from Weber 1292 (NY), Philippines, and 10 from *Zippelinus s.n.*, Java (L).

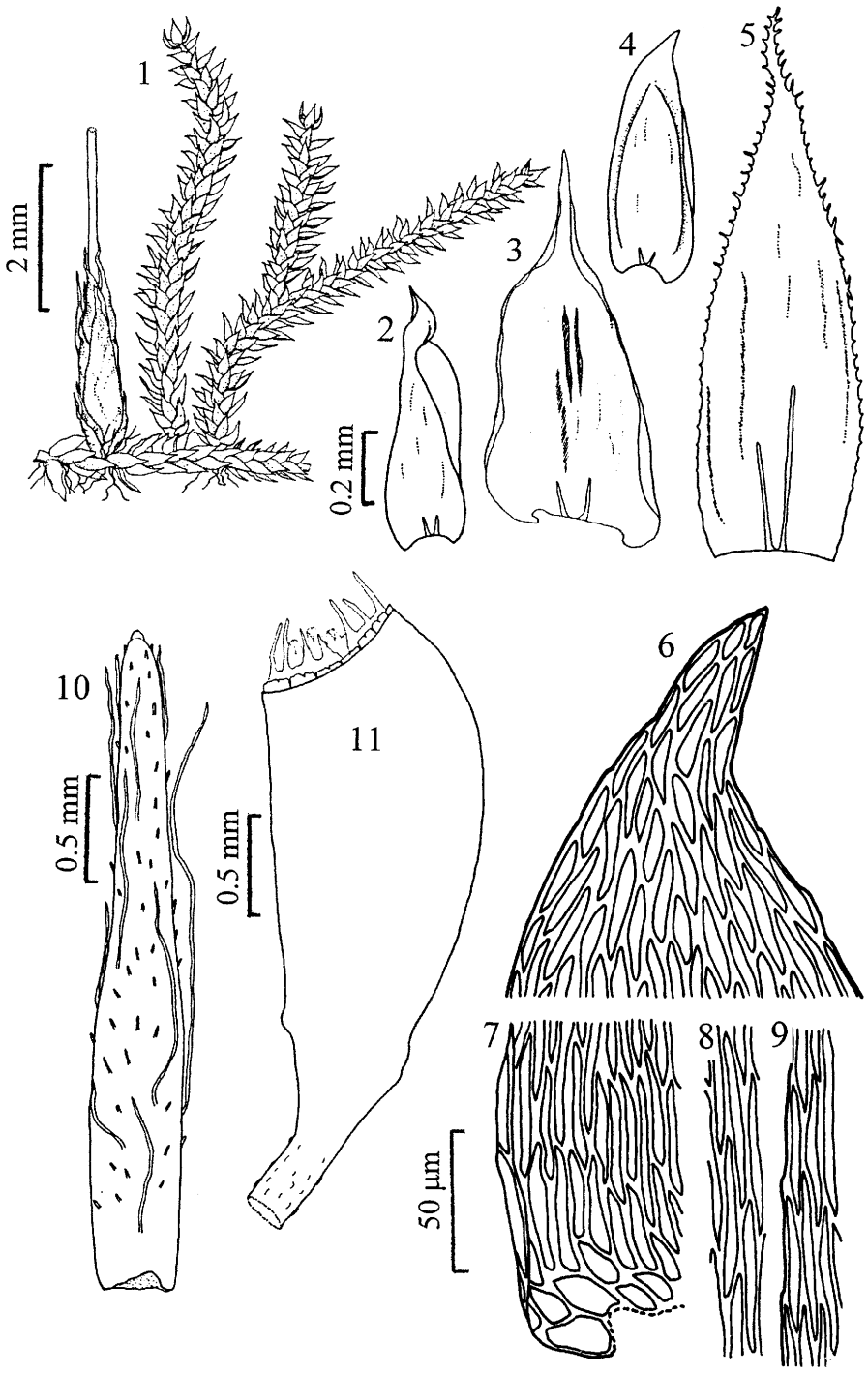

Plate 11. *Chaetomitrium fimbriatum*. 1, plant. 2 & 4, branch leaves. 3, stem leaf. 5, inner perichaetial leaf. 6, leaf apex. 7, alar region. 8, medial lamina cells. 9, leaf margin. 10, calyptra. 11, capsule. 1–10 from *Zippelius s.n.*, New Guinea (holotype), and 11 from *Hoogland 8831*, New Guinea (L).

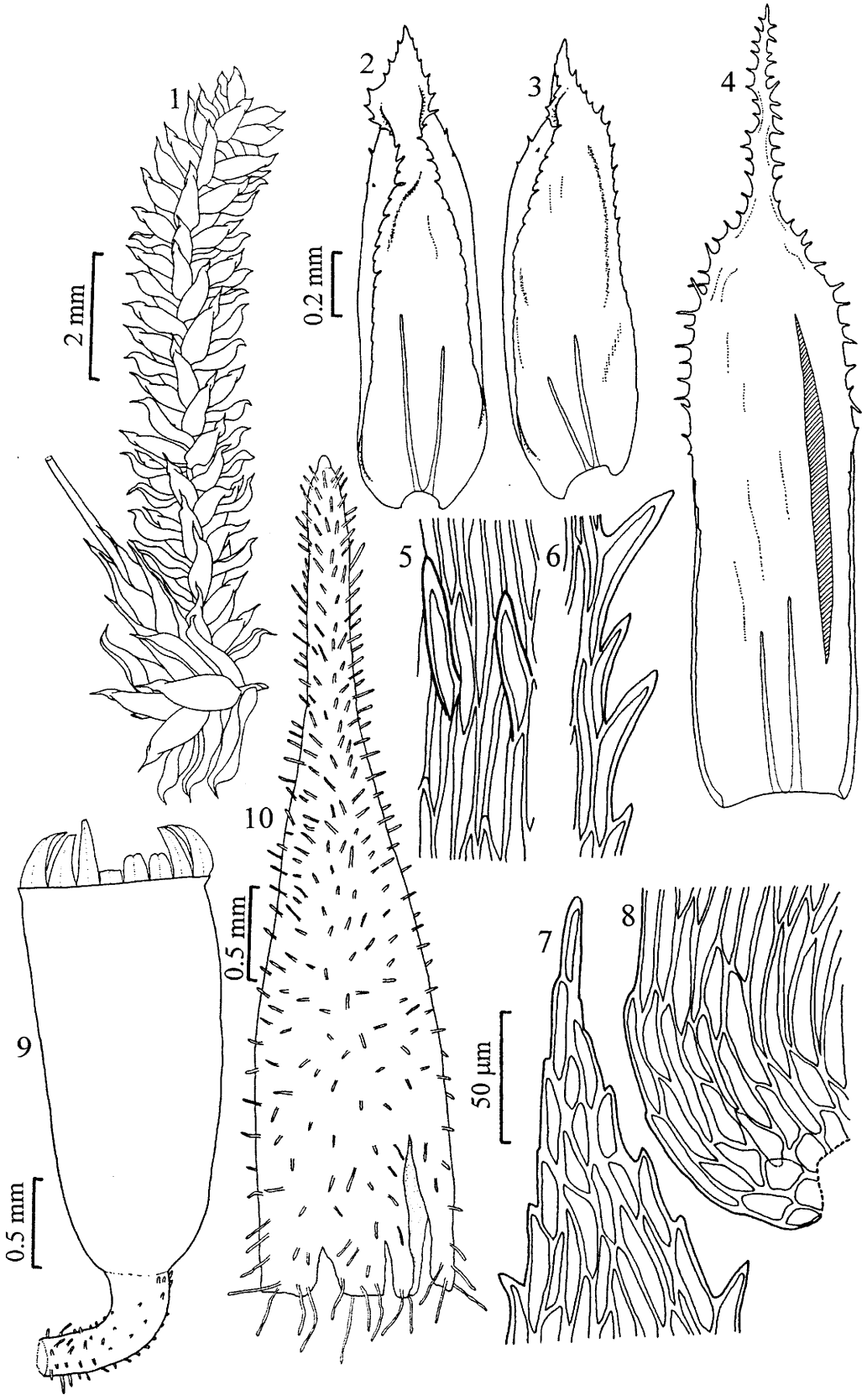

Plate 12. *Chaetomitrium horridulum*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, medial lamina cells. 6, leaf margin. 7, leaf apex. 8, alar region. 9, capsule. 10, calyptra. 1–8 from *Zippelius s.n.*, Java (holotype), 9 from *Noerta & Soekar 2343*, Java (GRO), and 10 from *Fleischer 248*, Java (MANCH).

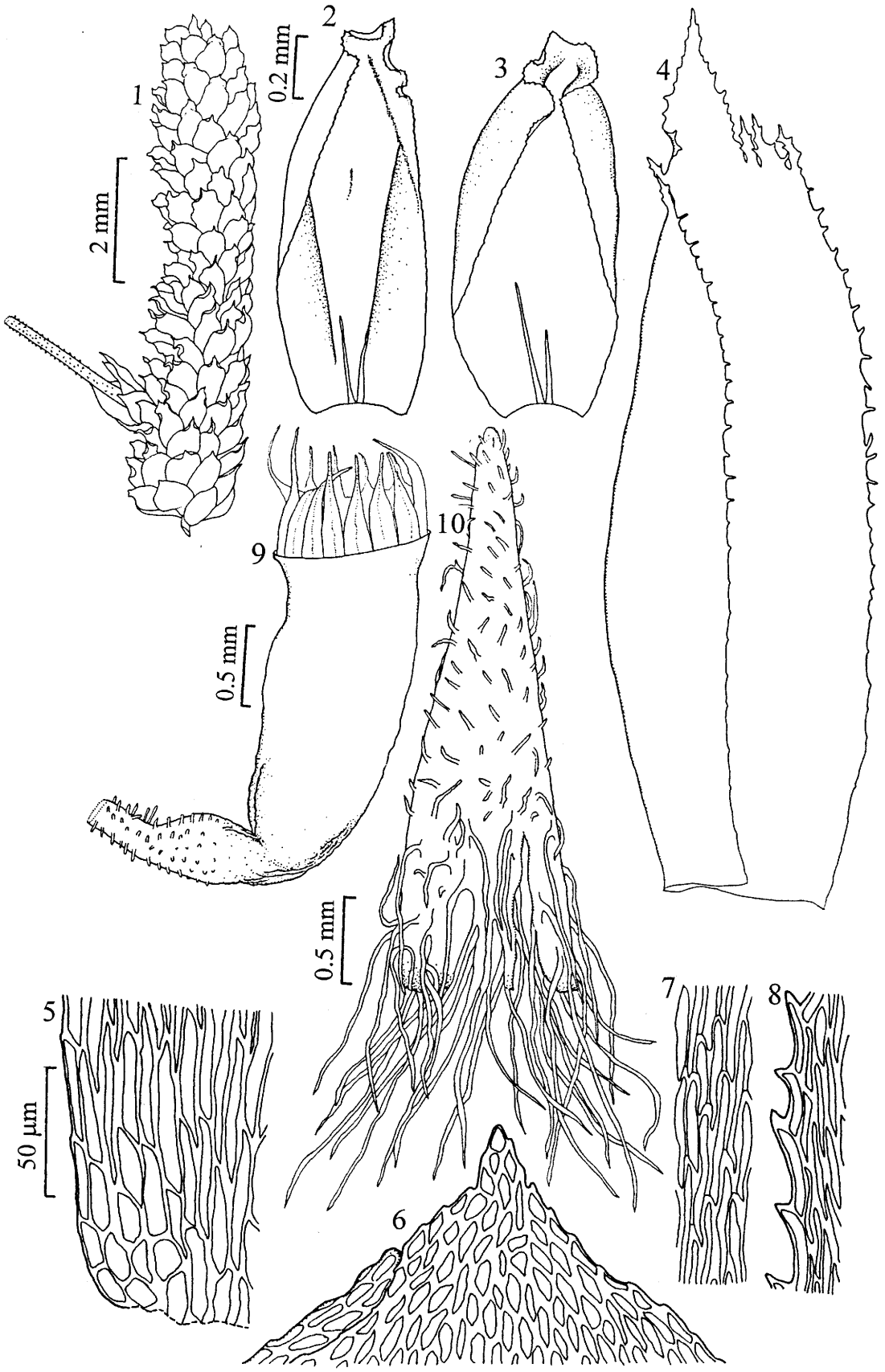

Plate 13. *Chaetomitrium laevifolium*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, alar region. 6, leaf apex. 7, medial lamina cells. 8, leaf margin. 9, capsule. 10, calyptra. All from *Edano 80842*, Philippines (isotype) .

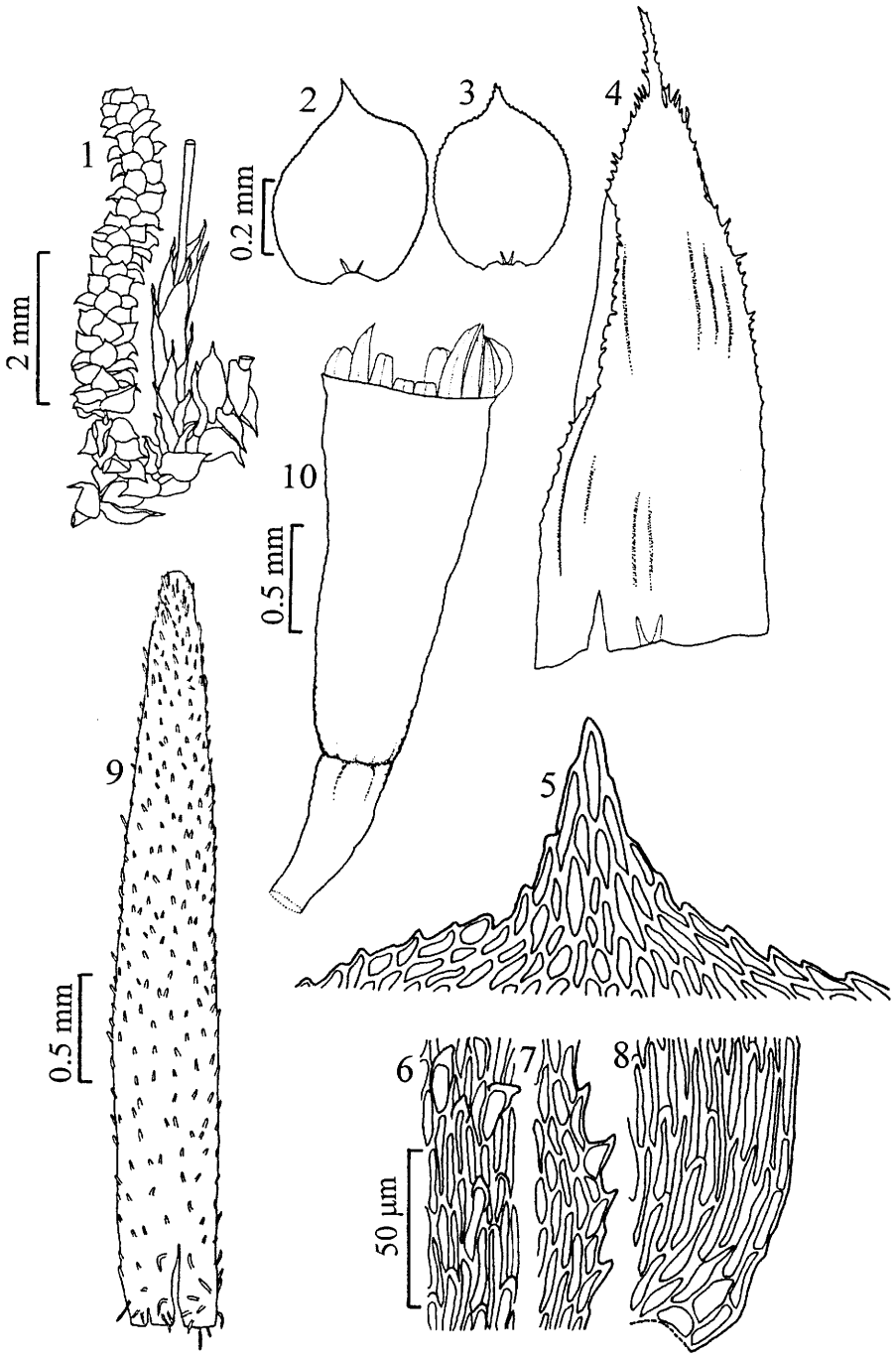

Plate 14. *Chaetomitrium laevisetum* 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Kloss 29*, New Guinea (holotype).

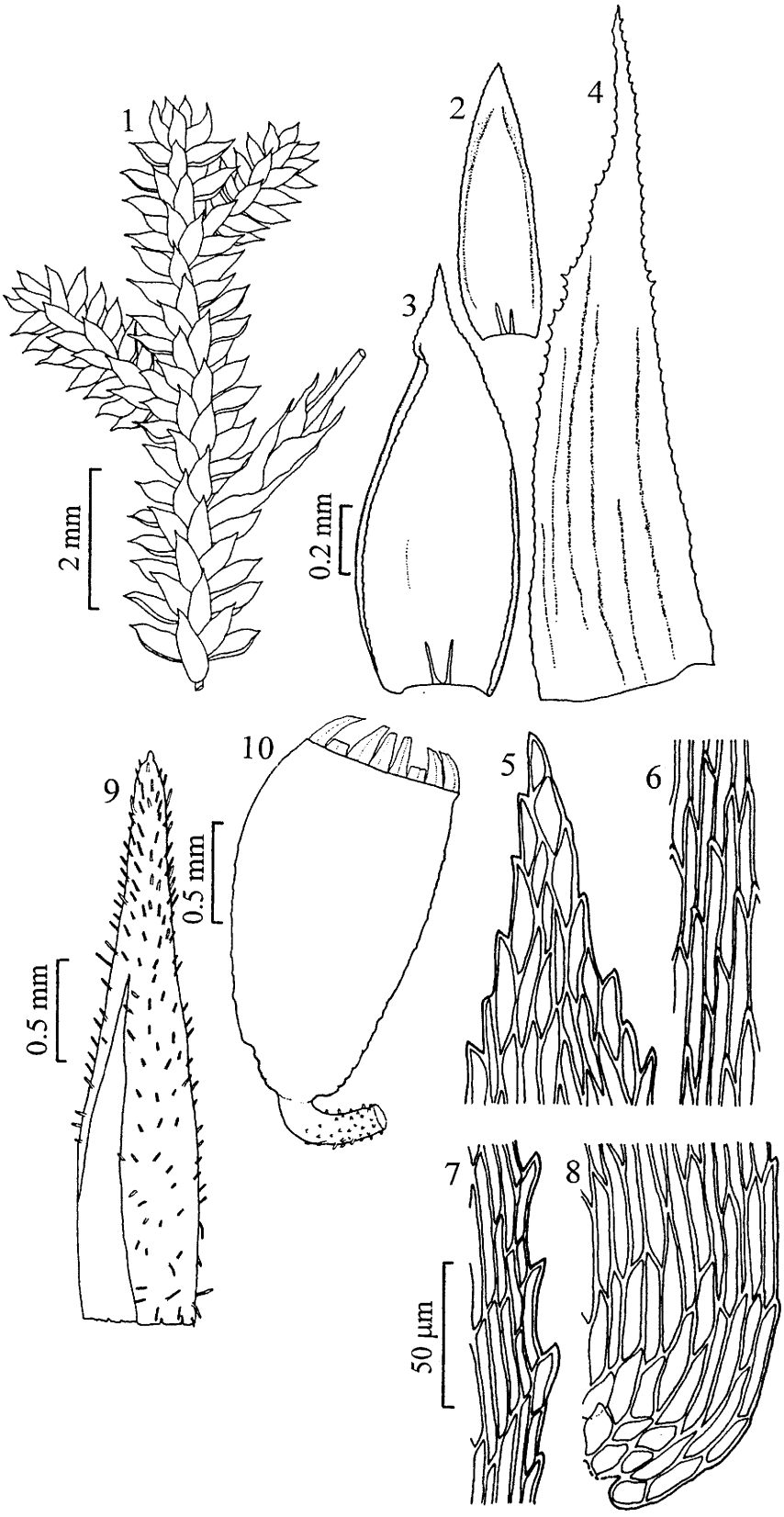

Plate 15. *Chaetomitrium lanceolatum*. 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Dozy & Molk. s.n.*, Java (holotype).

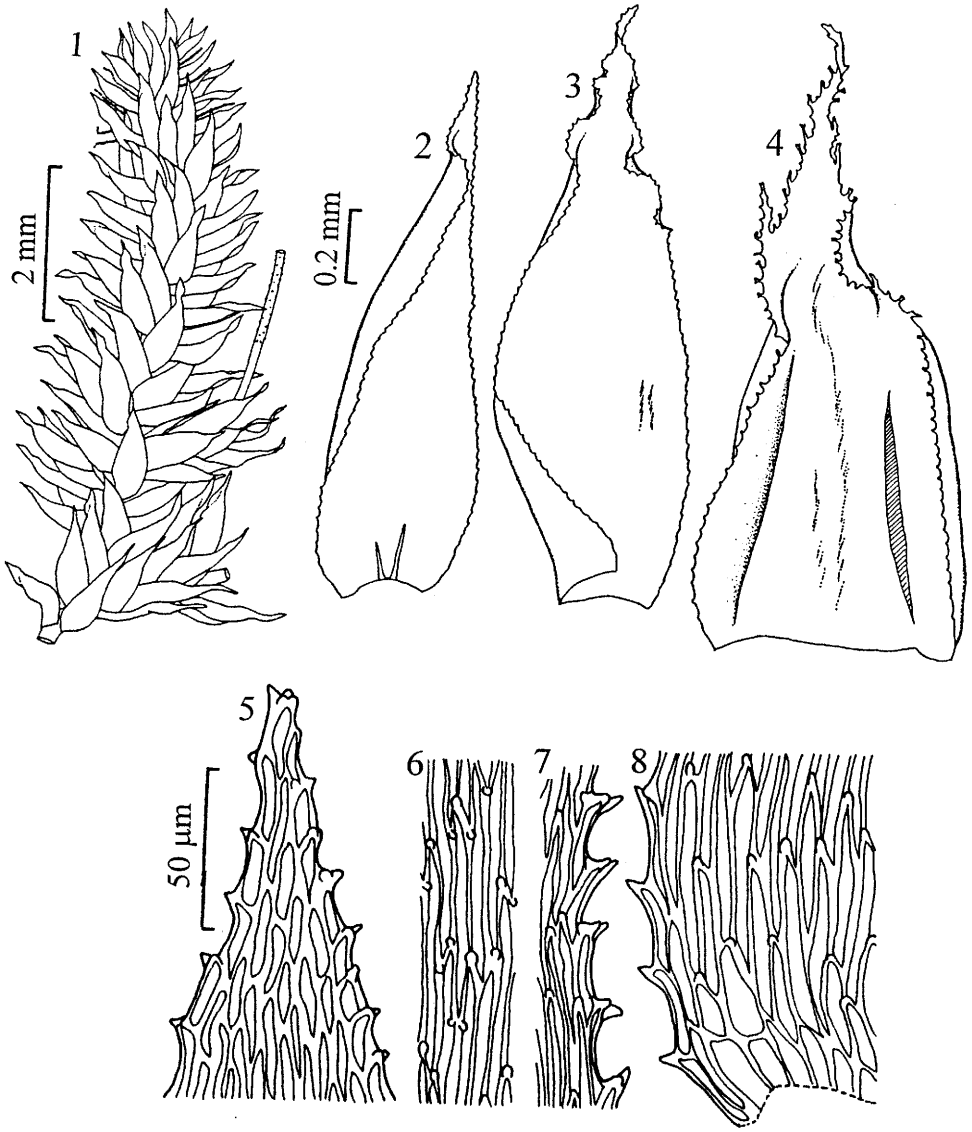

Plate 16. *Chaetomitrium lancifolium*. 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. All drawn from collector unknown, Maluku (holotype).

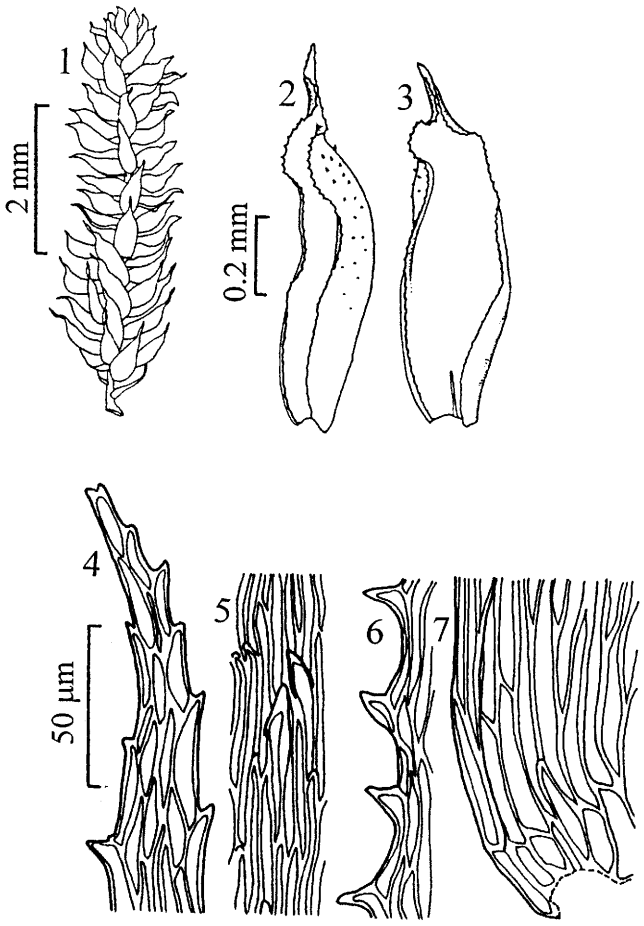

Plate 17. *Chaetomitrium lauterbachii*. 1, plant. 2,3, branch leaves. 4, leaf apex. 5, medial lamina cells. 6, leaf margin. 7, alar region. All from *Loria 1663*, New Guinea (isotype).

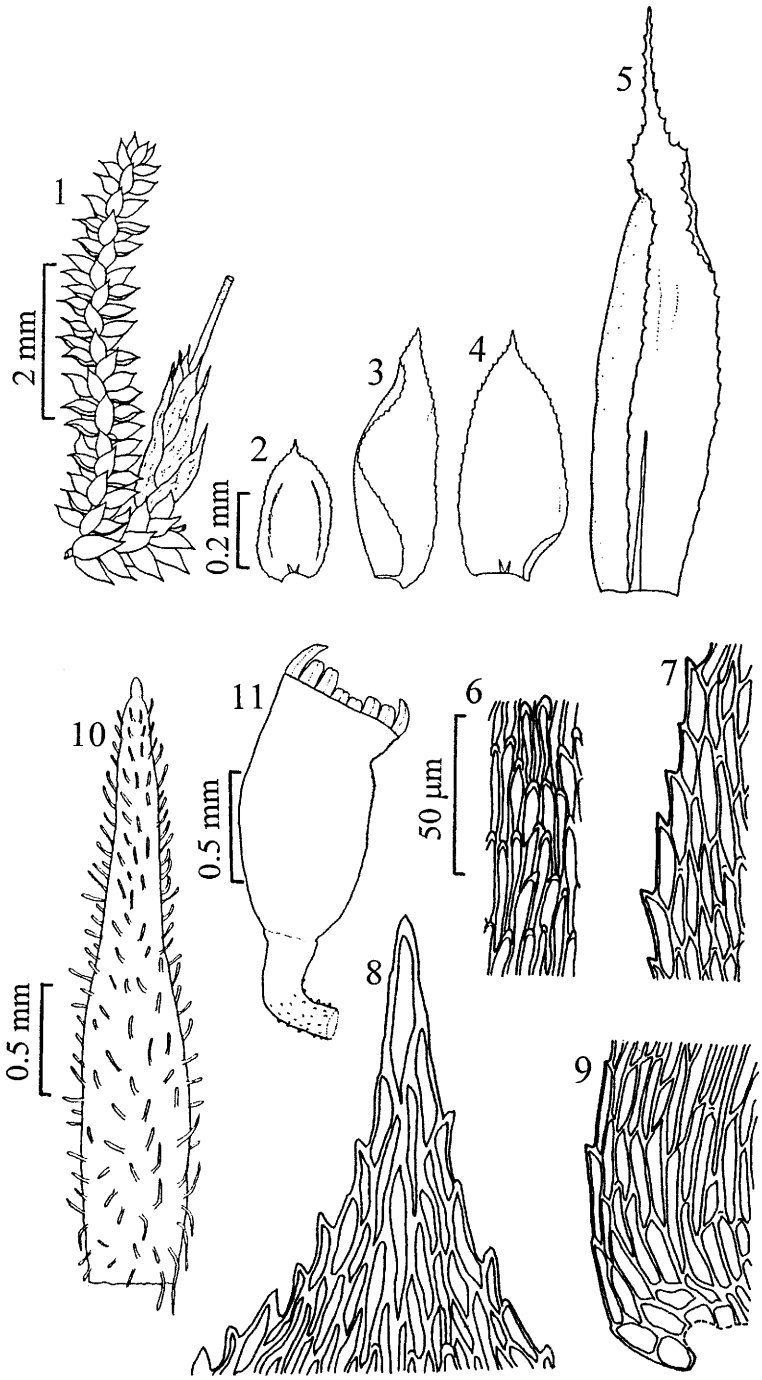

Plate 18. *Chaetomitrium leptopoma* (1). 1, plant. 2, branch leaf. 3 & 4, stem leaves. 5, inner perichaetial leaf. 6, medial lamina cells. 7, leaf margin. 8, leaf apex. 9, alar region. 10, calyptra. 11, capsule. All from *Lacoste s.n.*, Java (isotype).

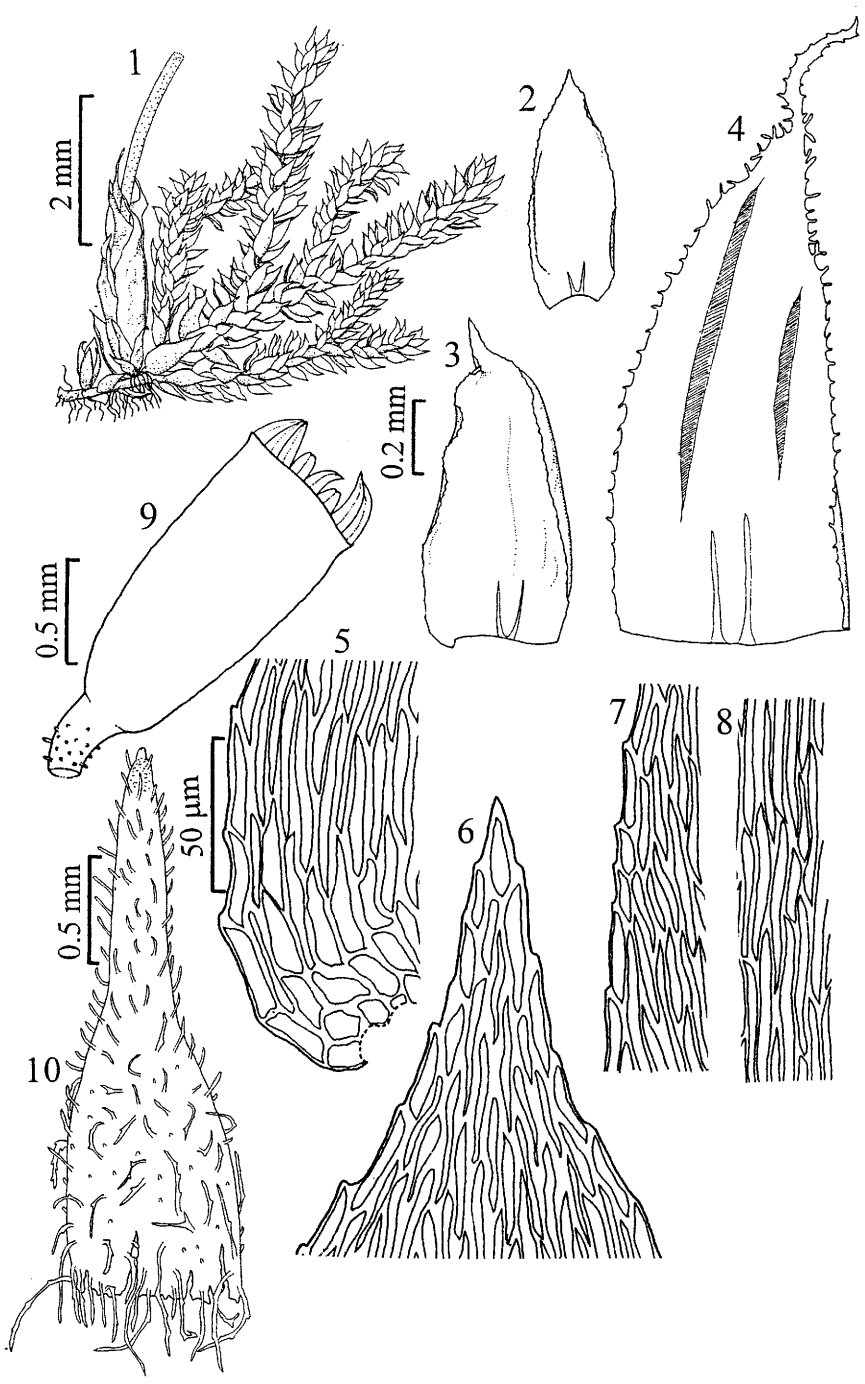

Plate 19. *Chaetomitrium leptopoma* (2). 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, alar region. 6, leaf apex. 7, leaf margin. 8, medial lamina cells. 9, capsule. 10, calyptra. All from *Richards 2395*, Borneo (isotype/ holotype of *C. cucullatum*).

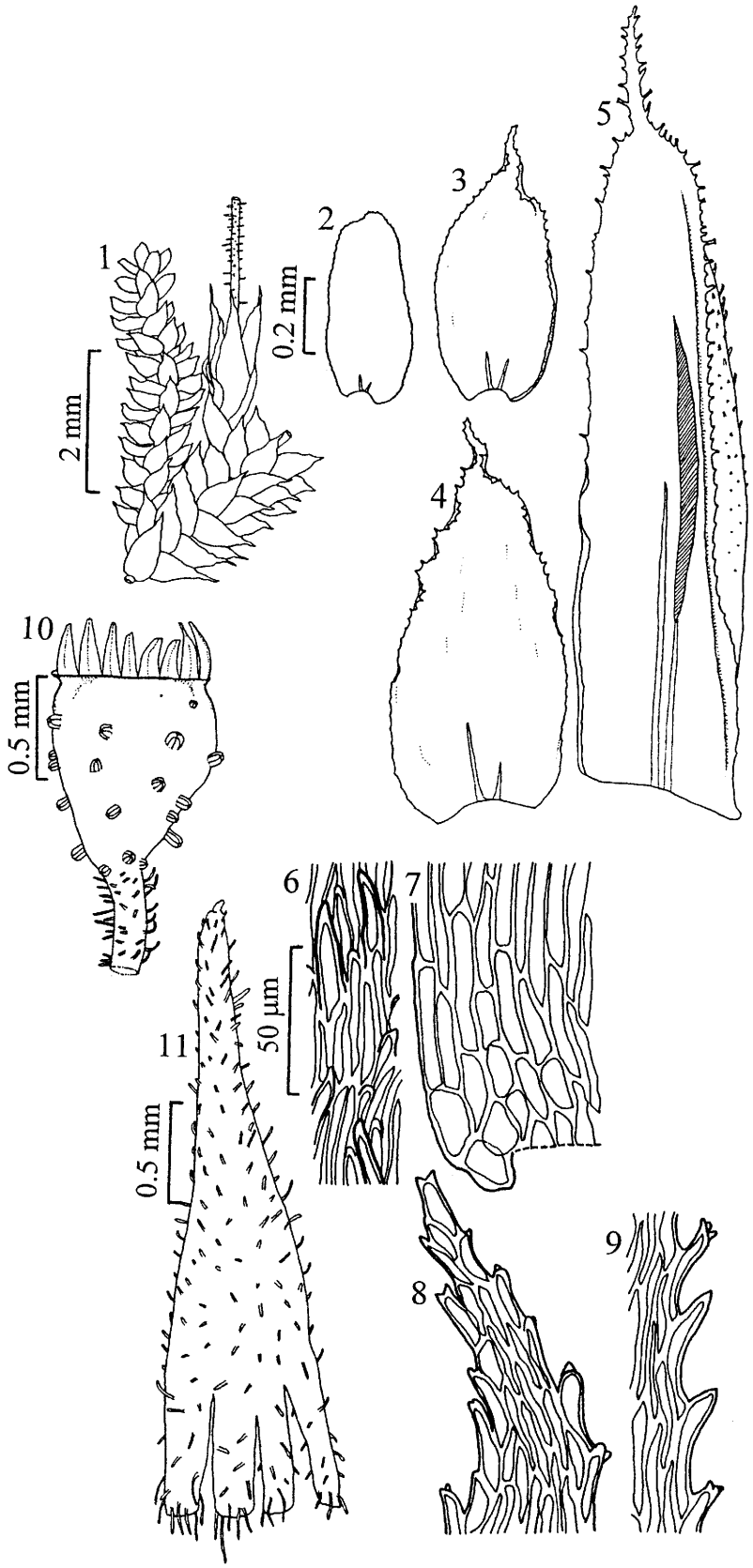

Plate 20. *Chaetomitrium nanohystrix*. 1, plant. 2 & 3, branch leaves. 4, stem leaf. 5, inner perichaetial leaf. 6, medial lamina cells. 7, alar region. 8, leaf apex. 9, leaf margin. 10, capsule. 11, calyptra. 1 & 3–11 from *Loria 772*, New Guinea (isotype), and 2 from *Loria 725*, New Guinea (FH).

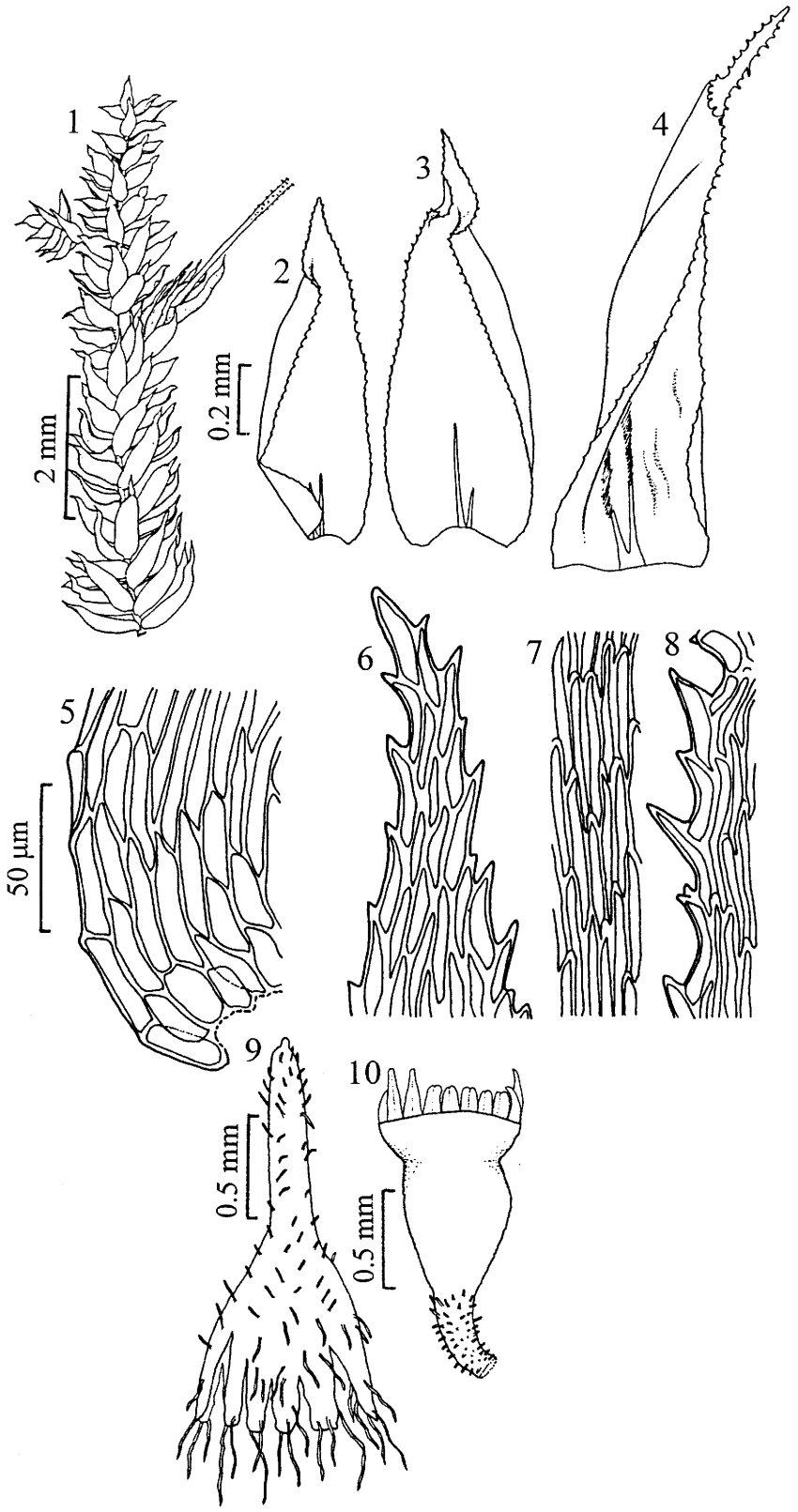

Plate 21. *Chaetomitrium orthorrhynchum* (1). 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, alar region. 6, leaf apex. 7, medial lamina cells. 8, leaf margin. 9, calyptra. 10, capsule. All from *Korthals s.n.*, Sumatra (holotype).

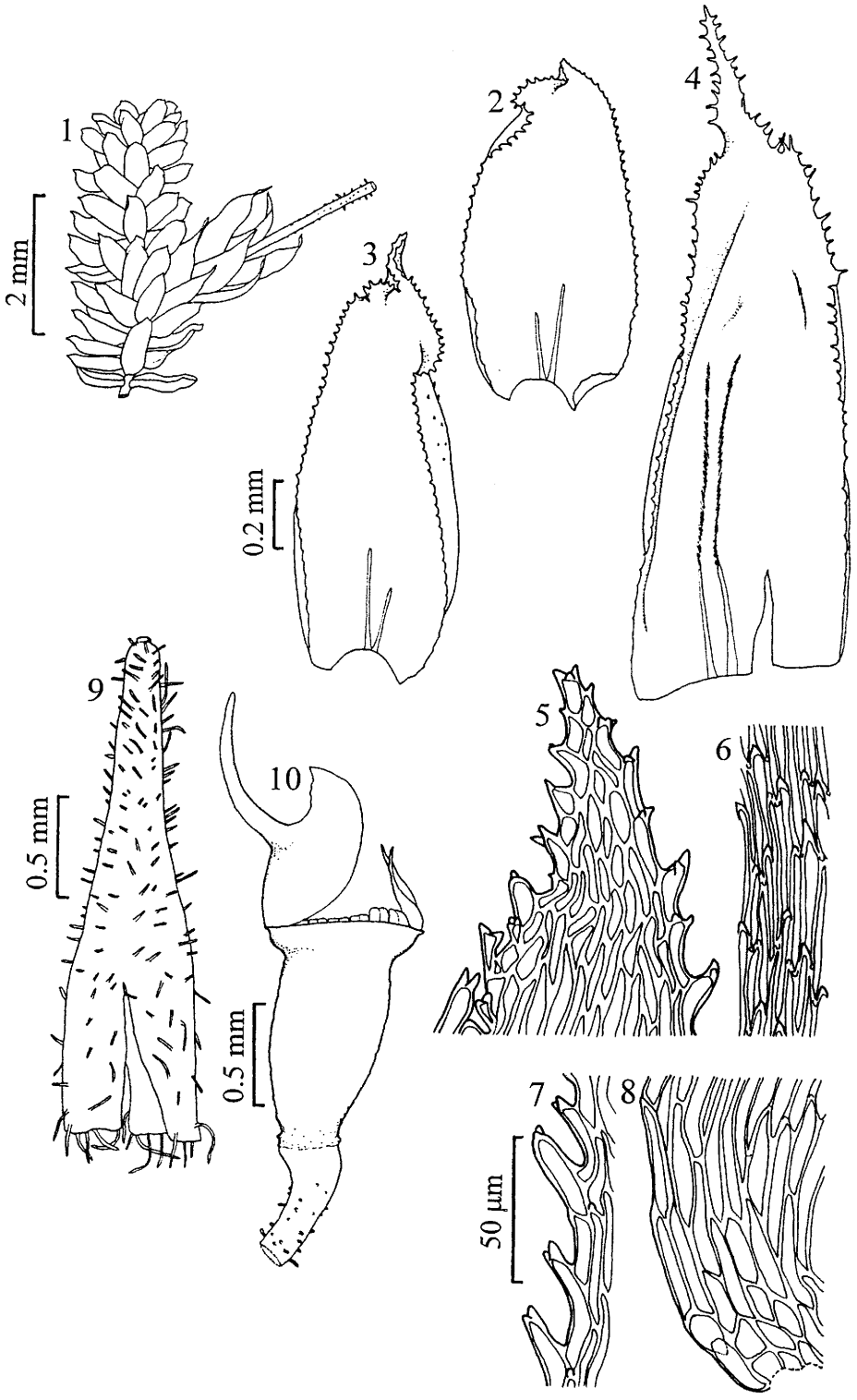

Plate 22. *Chaetomitrium orthorrhynchum* (2). 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Everett s.n.*, Borneo (holotype of *C. everettii*).

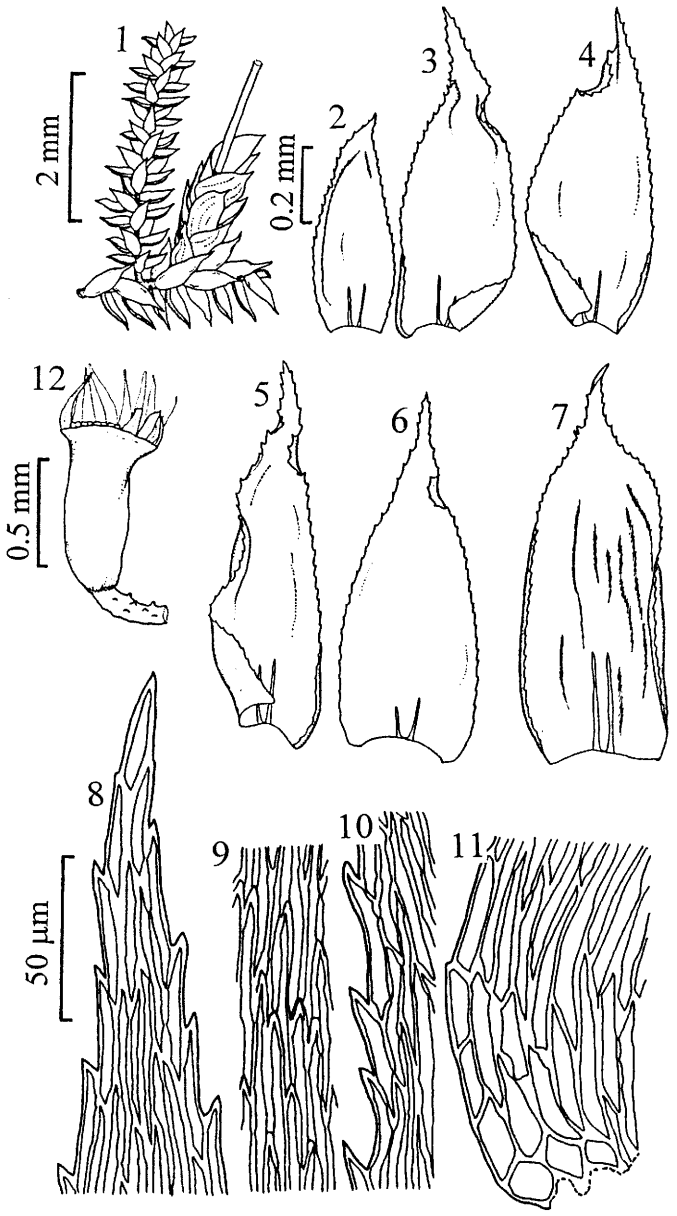

Plate 23. *Chaetomitrium orthorrhynchum* (3). 1, plant. 2, branch leaf. 3-6, stem leaves. 7, inner perichaetial leaf. 8, leaf apex. 9, medial lamina cells. 10, leaf margin. 11, alar region. 12, capsule. All from *Eiffert s.n.*, New Guinea (isotype of *C. finisterrae*).

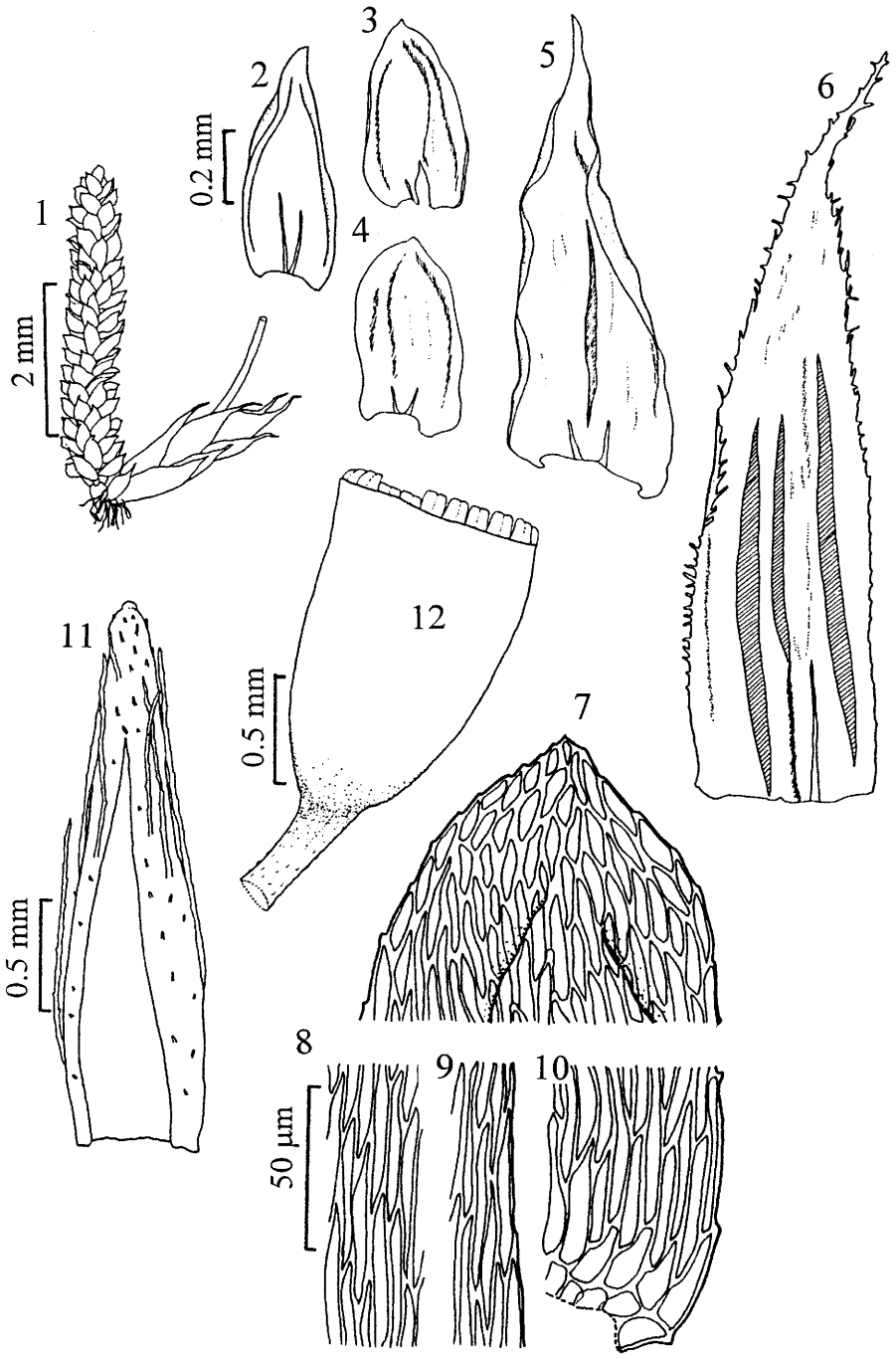

Plate 24. *Chaetomitrium paleatum*. 1, plant. 2–4, branch leaves. 5, stem leaf. 6, inner perichaetial leaf. 7, leaf apex. 8, medial lamina cells. 9, leaf margin. 10, alar region. 11, calyptra. 12, capsule. 1, 2 & 6–10 from *Beccari 6*, Borneo (holotype), 3–5 from *Wegner s.n.*, Sumatra (BM), and 11–12 form *Beccari 29*, Borneo (GRO).

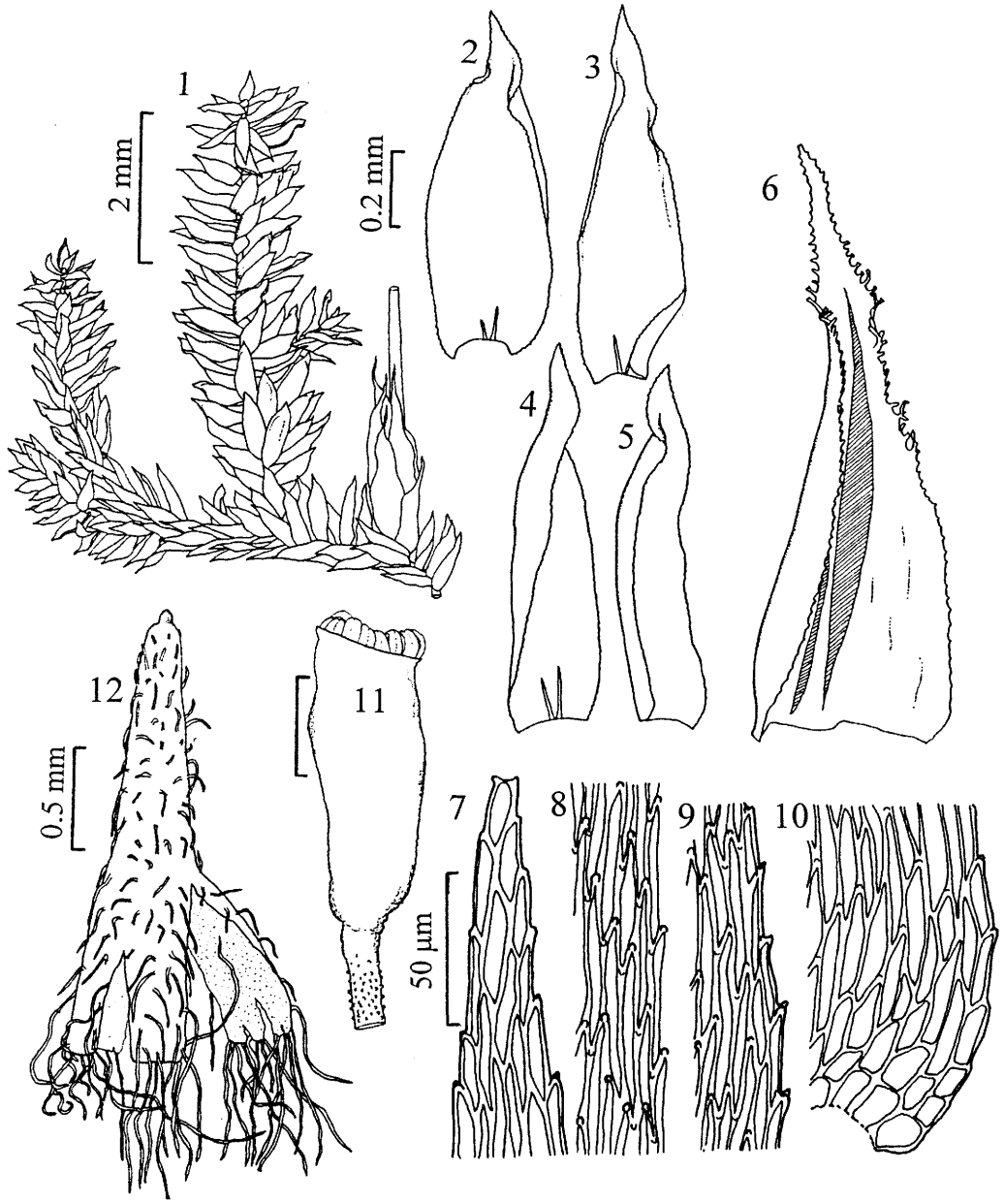

Plate 25. *Chaetomitrium papillifolium*. 1, plant. 2–5, branch leaves. 6, inner perichaetial leaf. 7, leaf apex. 8, medial lamina cells. 9, leaf margin. 10, alar region. 11, capsule. 12, calyptra. 1–10 from collector unknown, Java (holotype), and 11–12 from *Werner* 6, Malaya (JE, S).

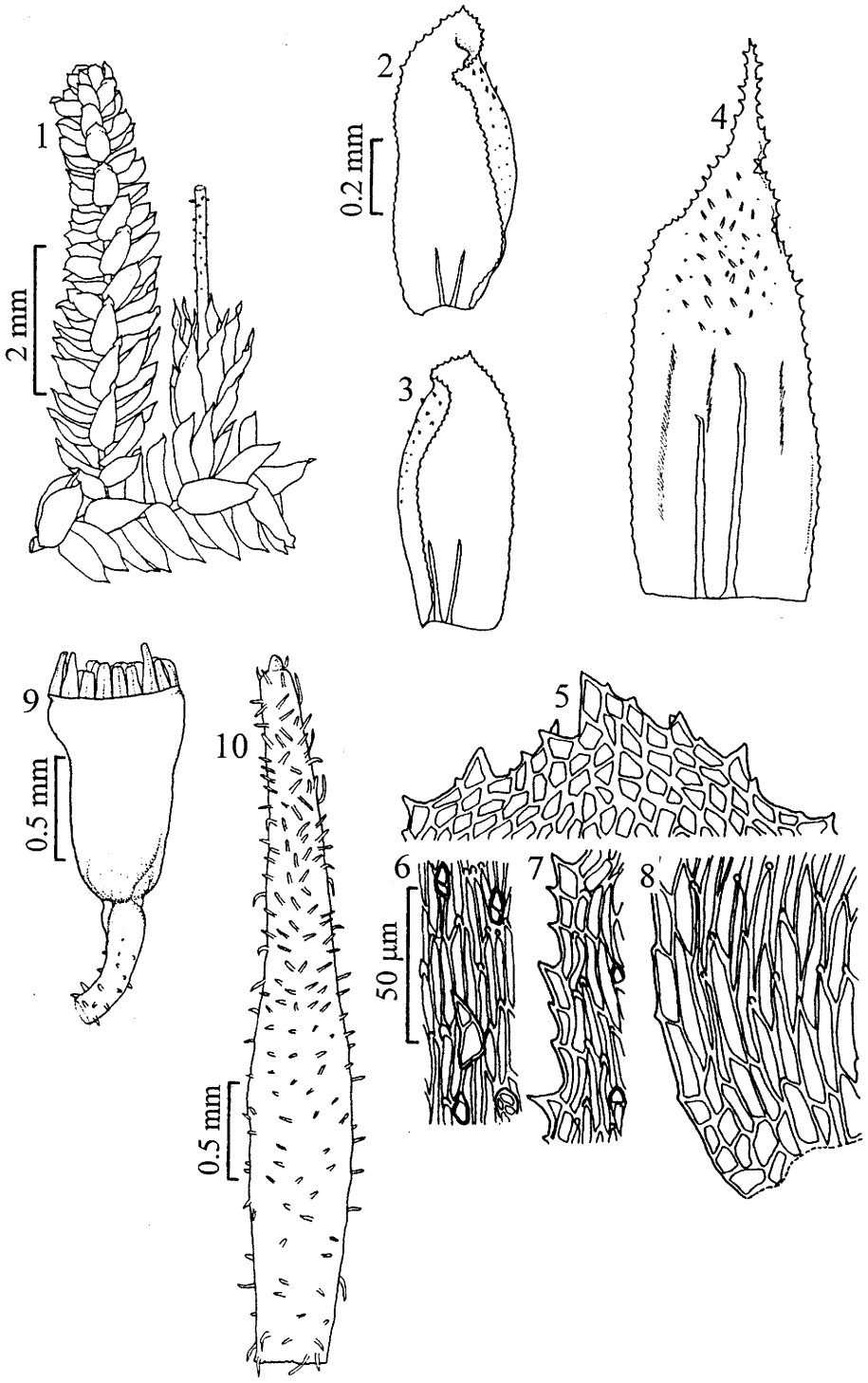

Plate 26. *Chaetomitrium perarmatum*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. All from *Fenix 28335*, Philippines (isotype).

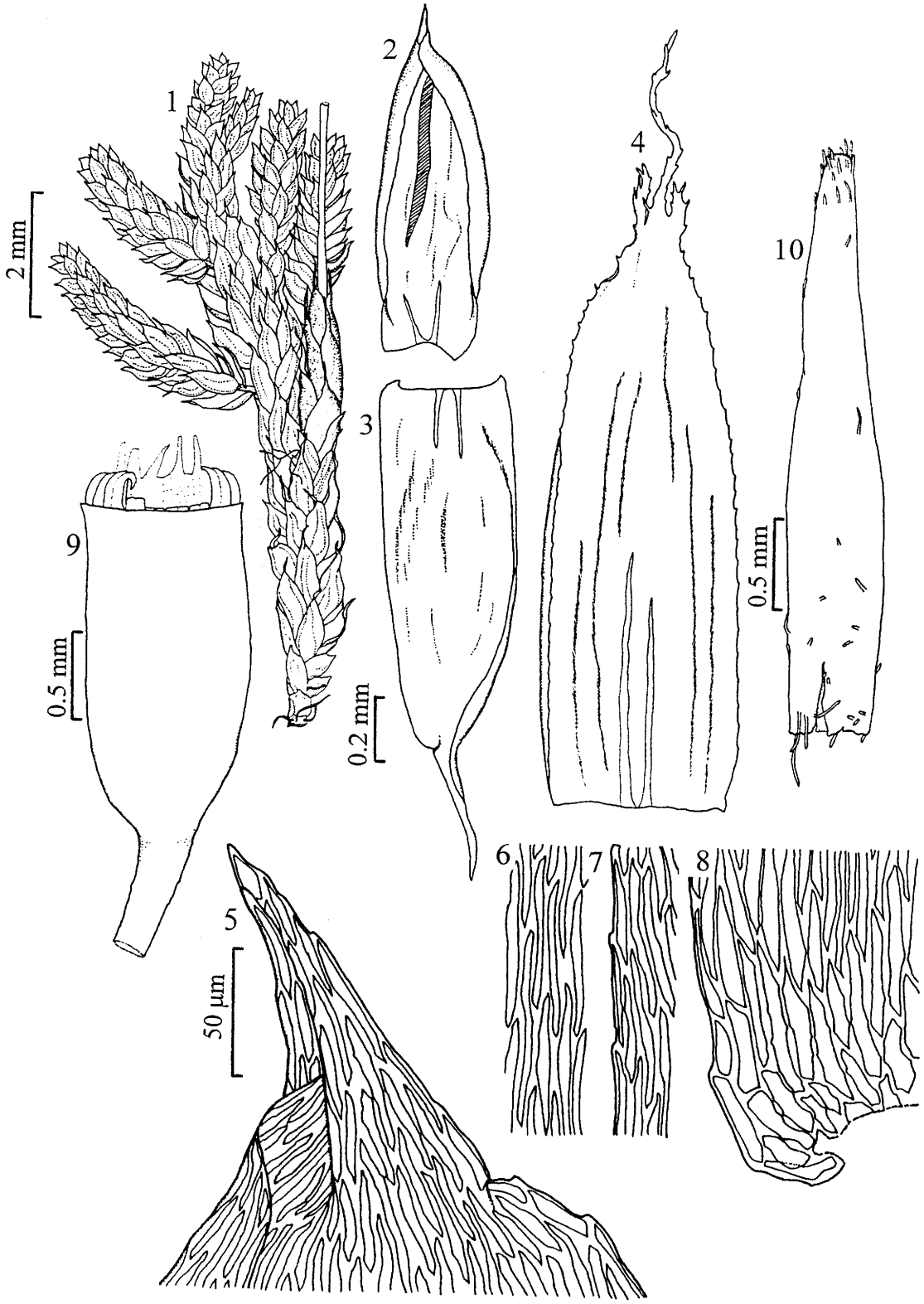

Plate 27. *Chaetomitrium perlaeve* (1). 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. All from *Kloss 30*, New Guinea (holotype).

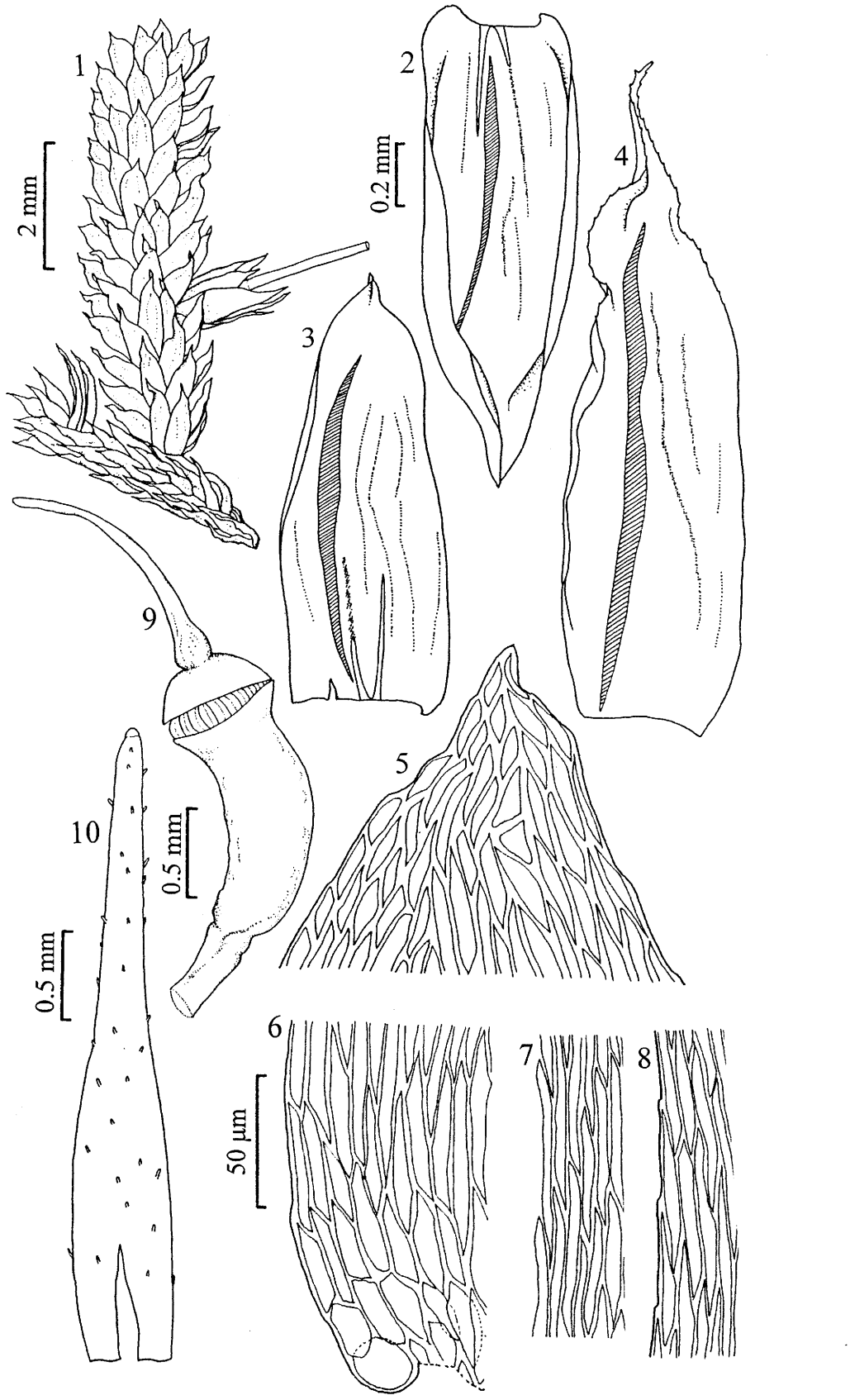

Plate 28. *Chaetomitrium perlaeve* (2). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, alar region. 7, medial lamina cells. 8, leaf margin. 9, capsule. 10, calyptra. All from *Brass 13828*, New Guinea (isotype of *C. parcesetulosum*).

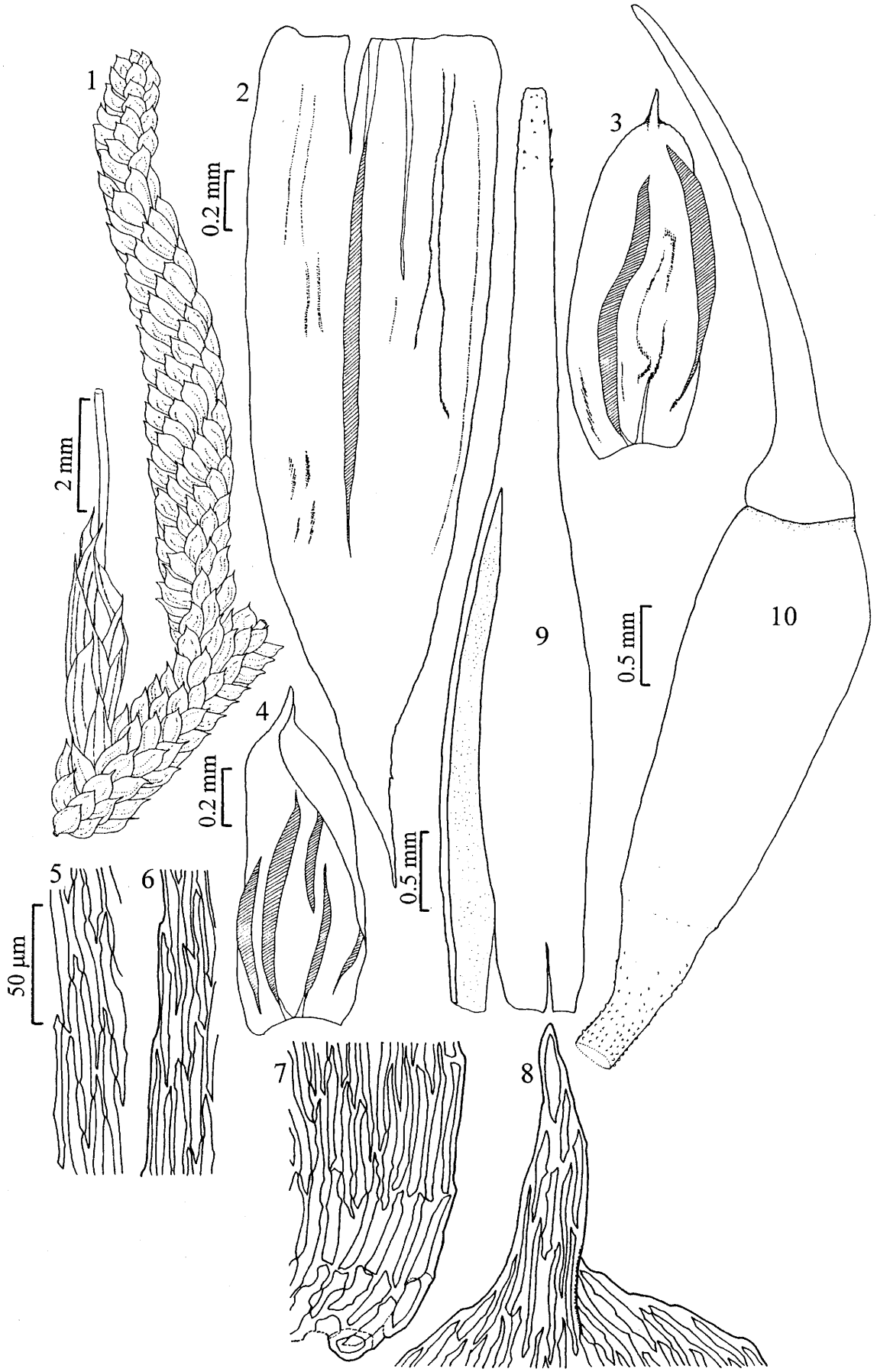

Plate 29. *Chaetomitrium perlaeve* (3). 1, plant. 2, inner perichaetial leaf. 3 & 4, branch leaves. 5, medial lamina cells. 6, leaf margin. 7, alar region. 8, leaf apex. 9, calyptra. 10, capsule. All from *Brass 10960*, New Guinea (holotype of *C. plicatum*).

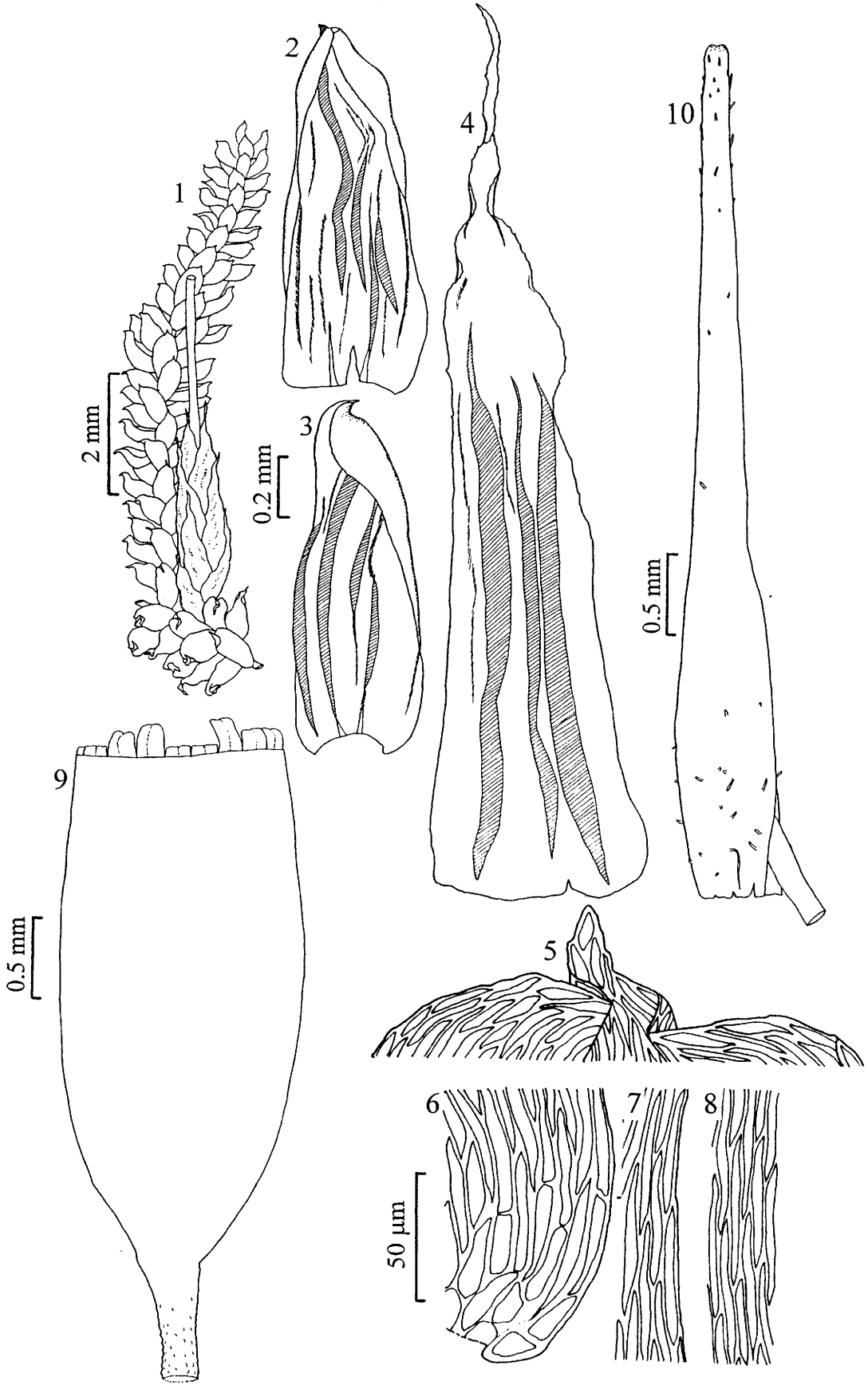

Plate 30. *Chaetomitrium perlaeve* (4). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, alar region. 7, leaf margin. 8, medial lamina cells. 9, capsule. 10, calyptra. 1–9 from *Clemens 12214*, New Guinea (holotype of *C. subplicatum*), and 10 from *Jacobs B1000*, New Guinea (L).

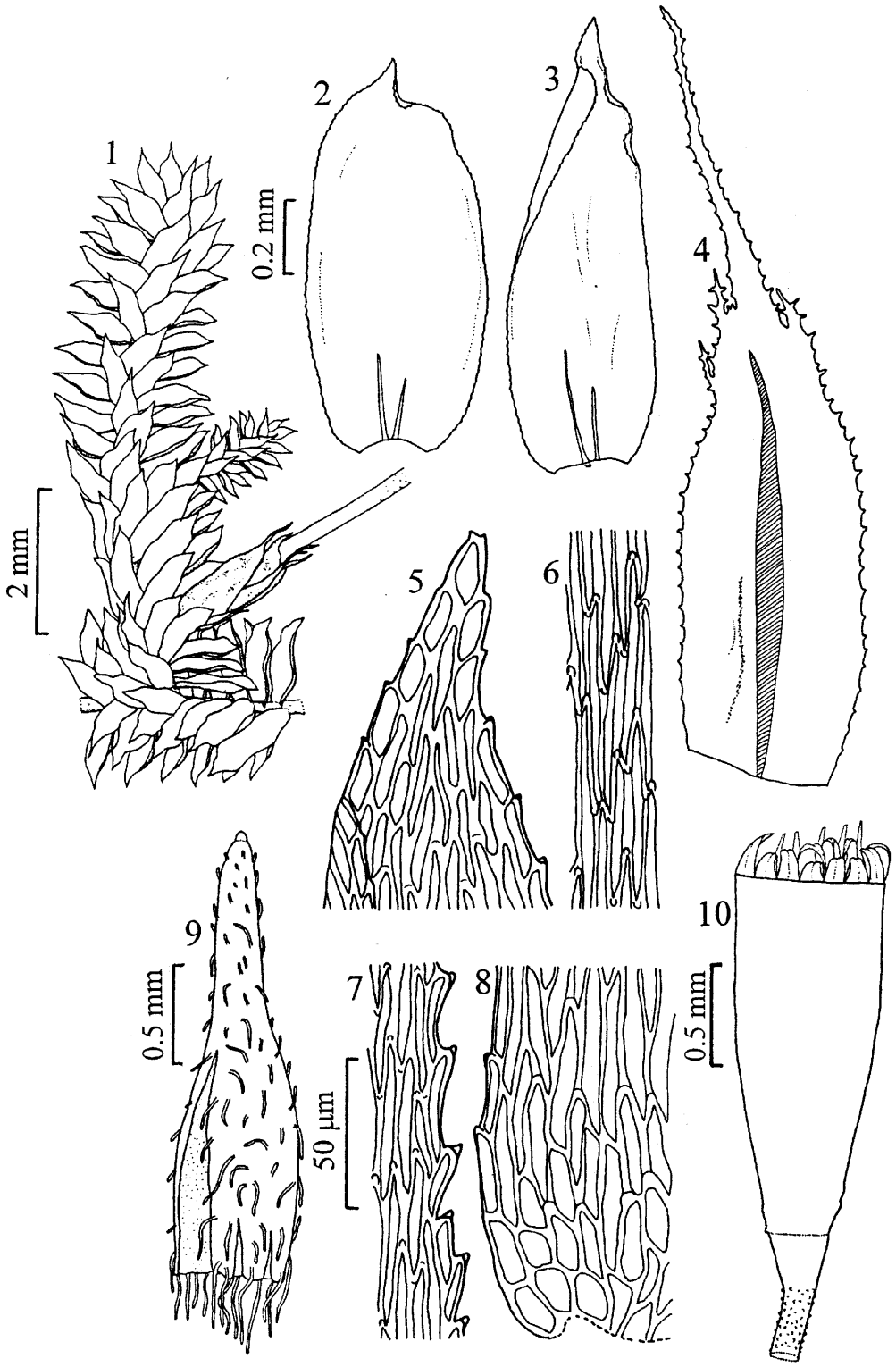

Plate 31. *Chaetomitrium philippinense* (1). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. 1–9 from *Hookeria philippinense, Zollinger* 115, Java (isotype), and 10 from *Mohamed 9558*, Malaya (KLU).

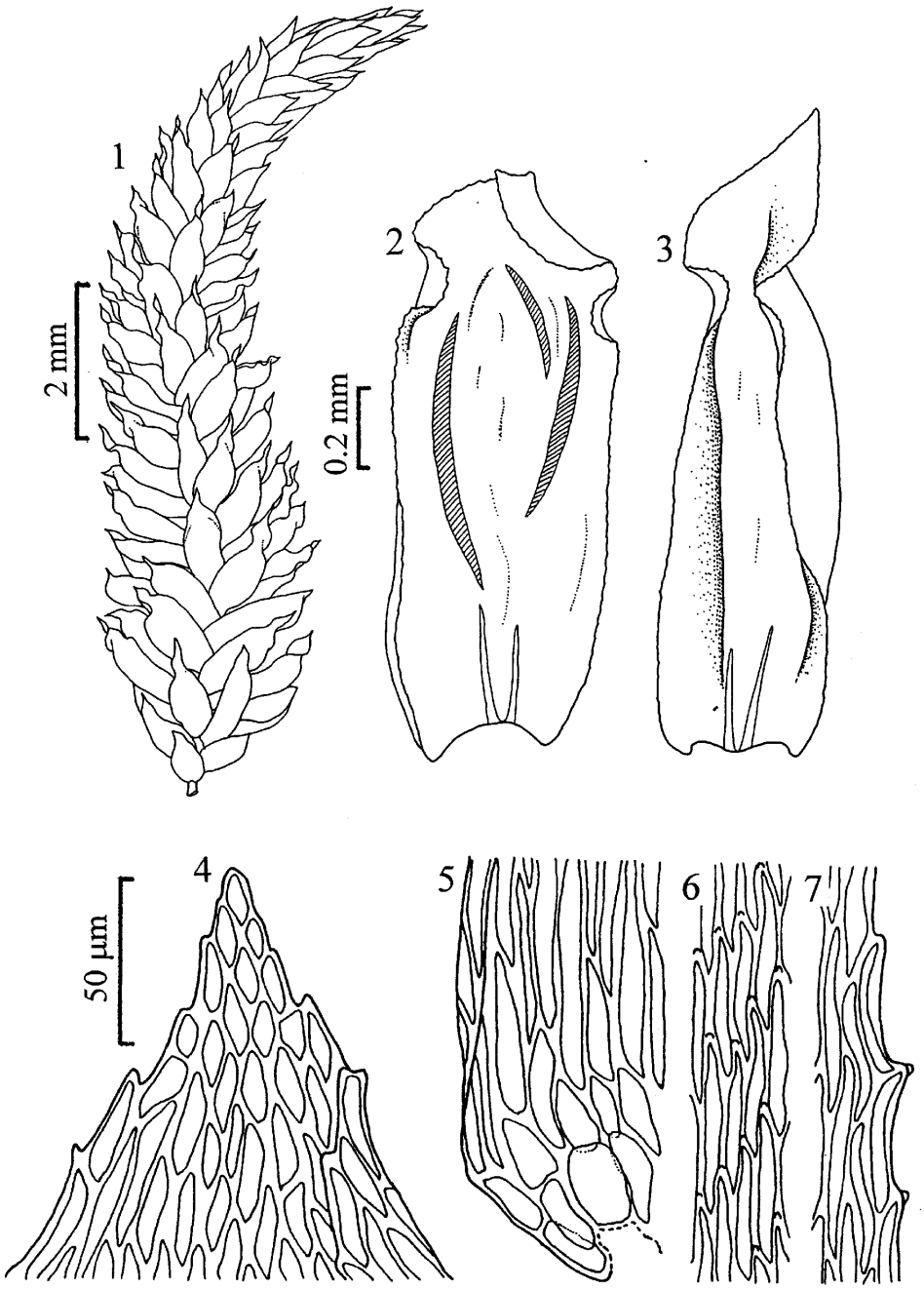

Plate 32. *Chaetomitrium philippinense* (2). 1, plant. 2 & 3, branch leaves. 4, leaf apex. 5, alar region. 7, medial lamina cells. 8, leaf margin. All from *Kuhl & Hasselt s.n.*, Java (isotype of *C. curvatum*).

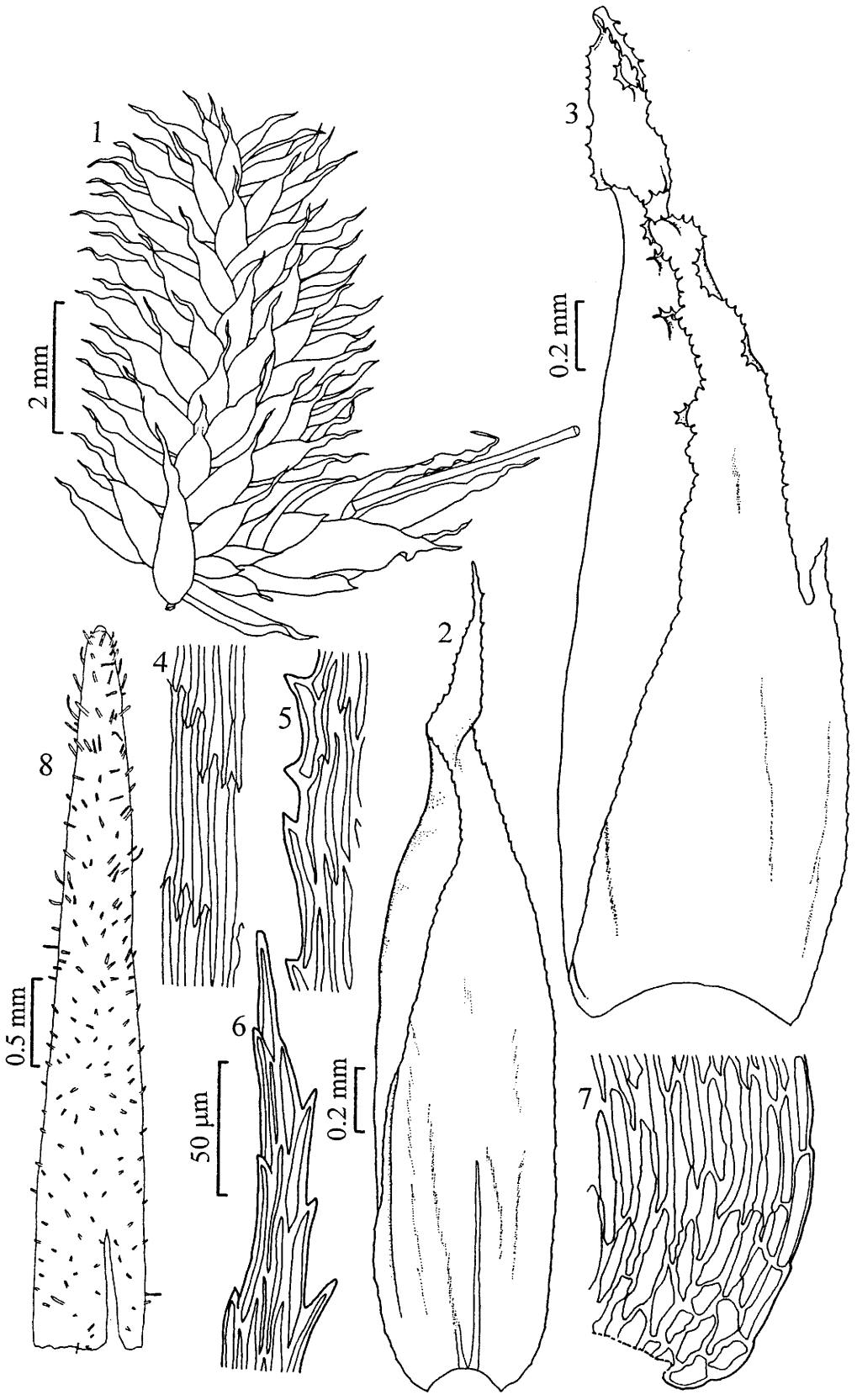

Plate 33. *Chaetomitrium poecilophyllum*. 1, plant. 2, branch leaf. 3, inner perichaetial leaf. 4, medial lamina cells. 5, leaf margin. 6, leaf apex. 7, alar region. 8, calyptra. All from *Everett E.518*, Borneo (holotype).

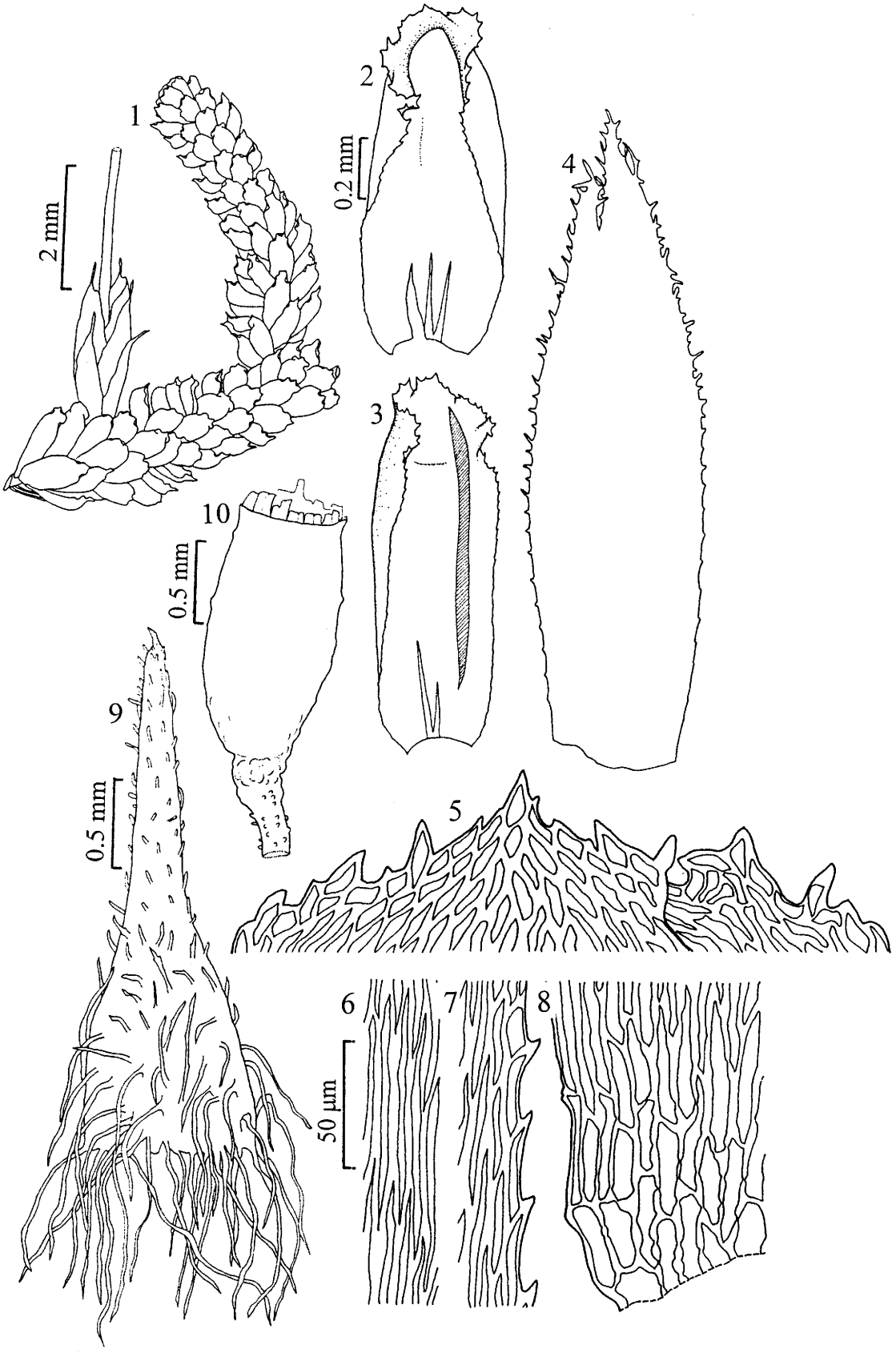

Plate 34. *Chaetomitrium pseudoelongatum*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Warburg 13650*, Philippines (isotype).

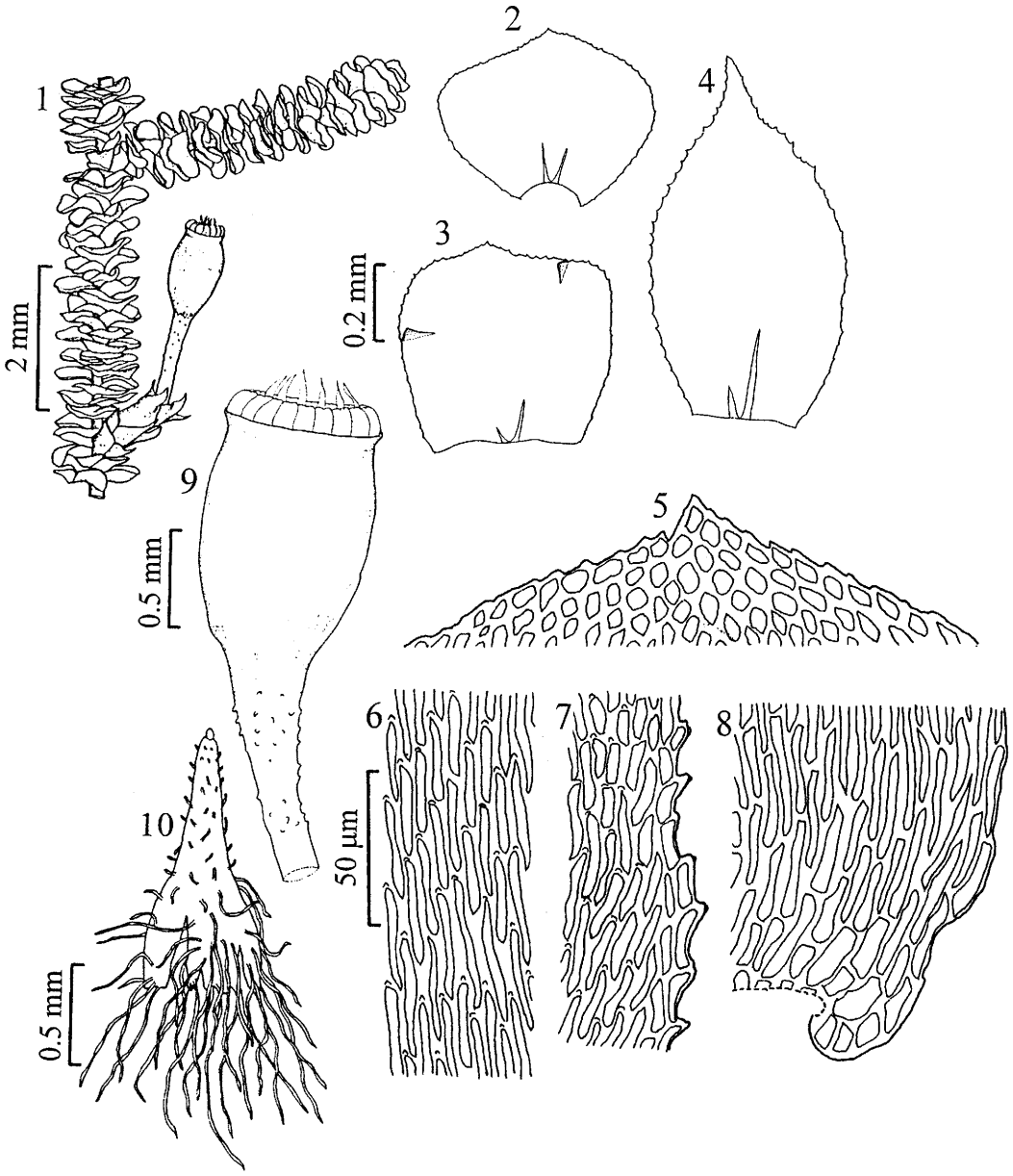

Plate 35. *Chaetomitrium robbinsii*. 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. All from *Robbins 2006*, New Guinea (isotype).

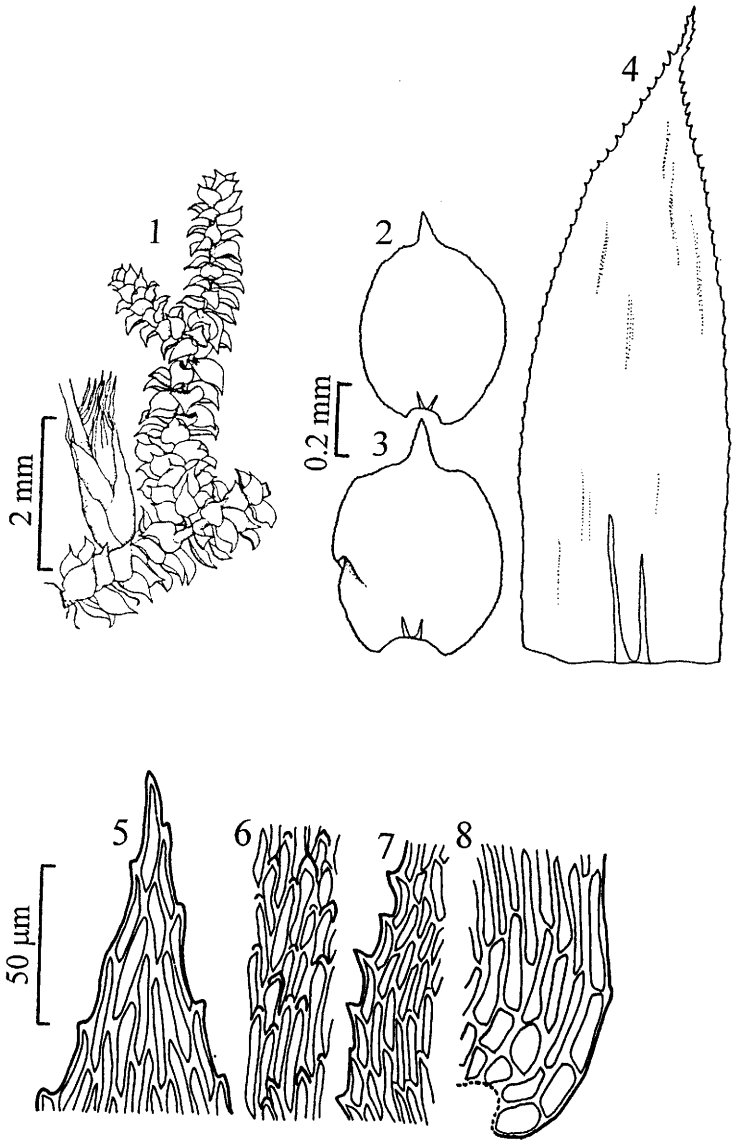

Plate 36. *Chaetomitrium roemeri*. 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. All from *Römer 864*, New Guinea (isotype).

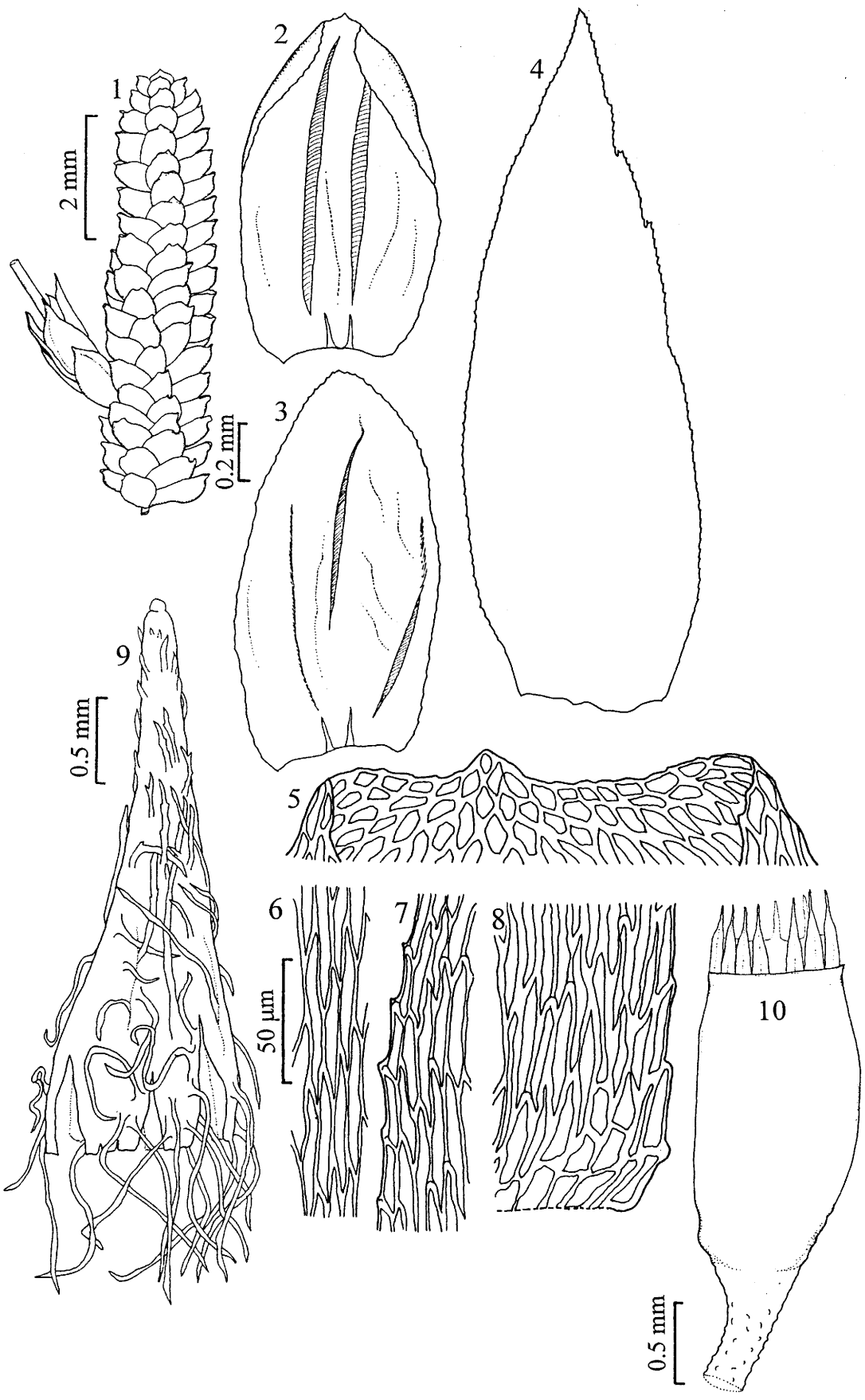

Plate 37. *Chaetomitrium schofieldii*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaves. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Weber 1496*, Philippines (isotype of *C. seriatum*).

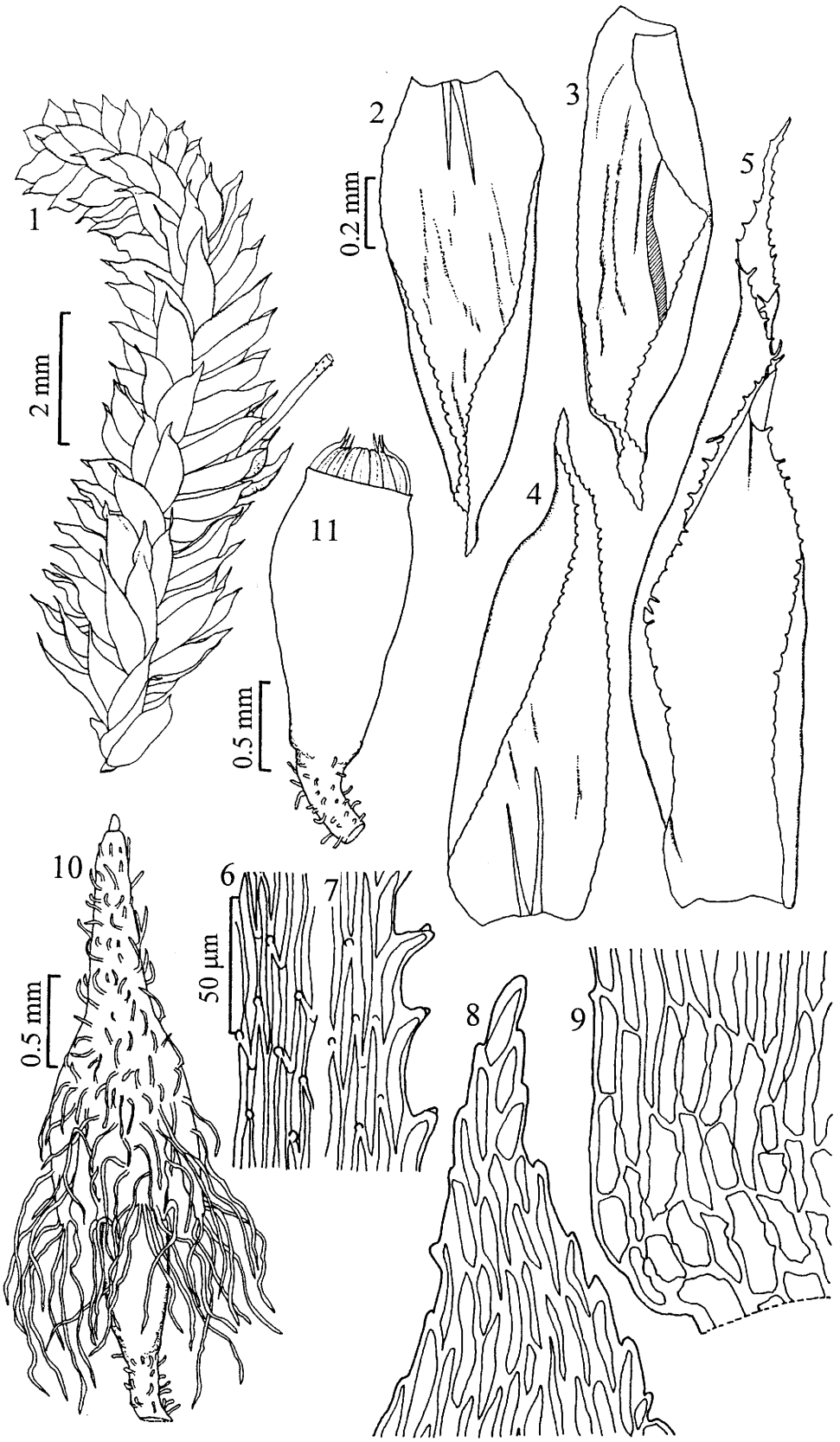

Plate 38. *Chaetomitrium setosum*. 1, plant. 2& 3, branch leaves. 4, stem leaf. 5, inner perichaetial leaf. 6, medial lamina cells. 7, leaf margin. 8, leaf apex. 9, alar region. 10, calyptra. 11, capsule. 1–10 from *Ridley 169*, Malaya (holotype), and 11 from *Richards M1144*, Borneo (BM).

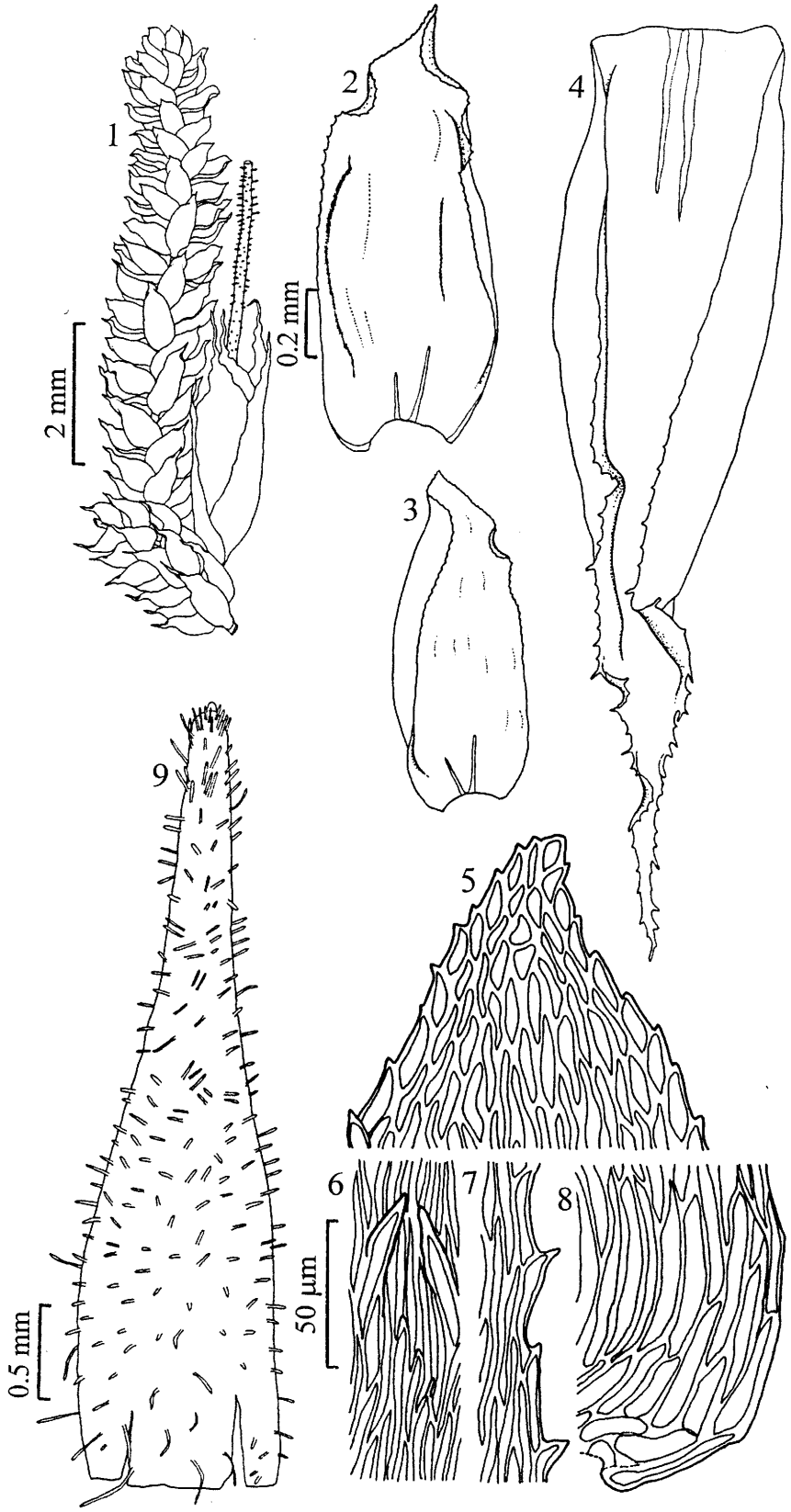

Plate 39. *Chaetomitrium spinosum.* 1, plant. 2, stem leaf. 3, branch leaf. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. All from *Brass 22218*, New Guinea (isotype).

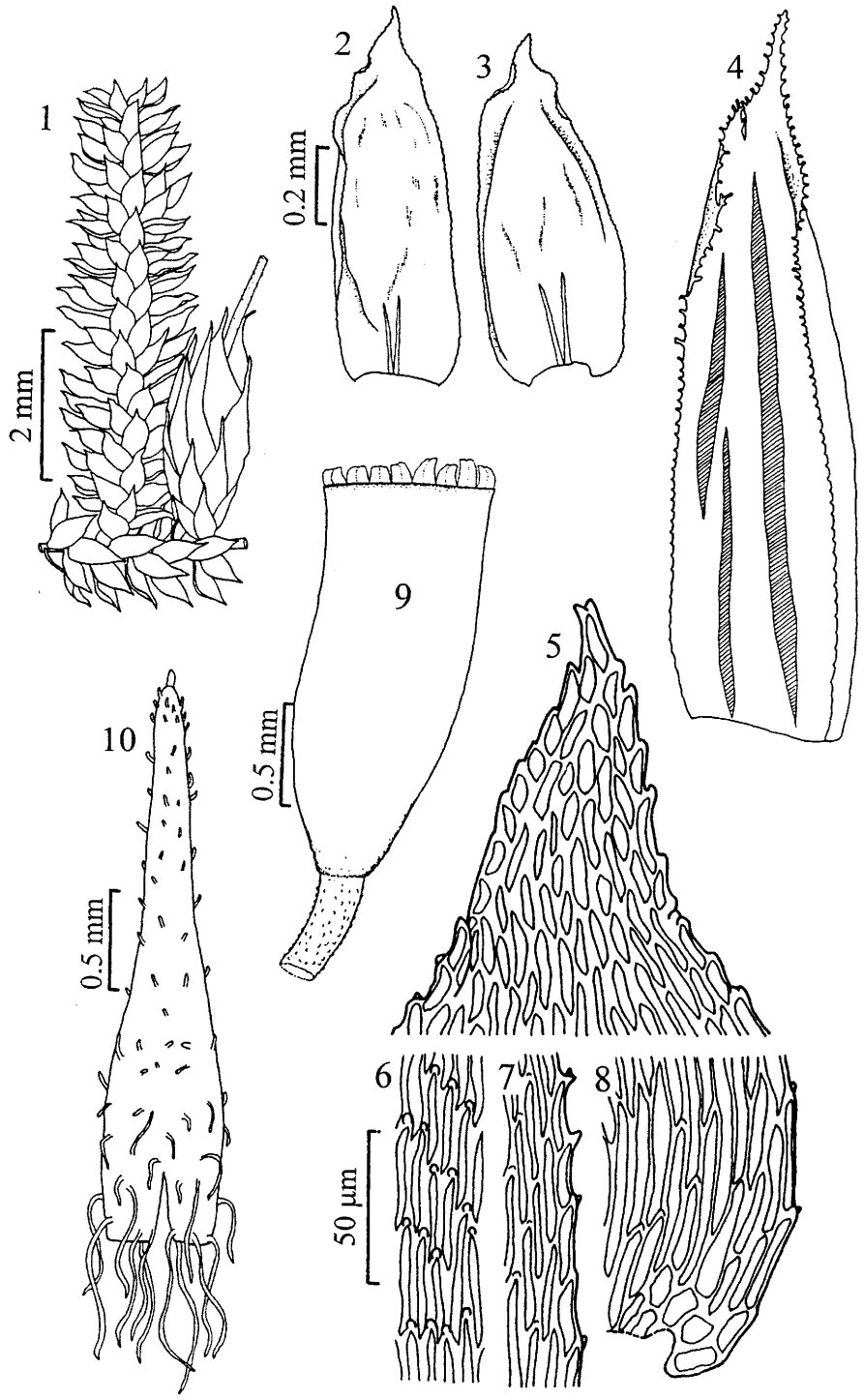

Plate 40. *Chaetomitrium tahitense* (1). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. 1–9 from *Sullivant & Schrader XXIII*, Tahiti (isotype), and 10 from *Juillet s.n.*, Society Island (NY).

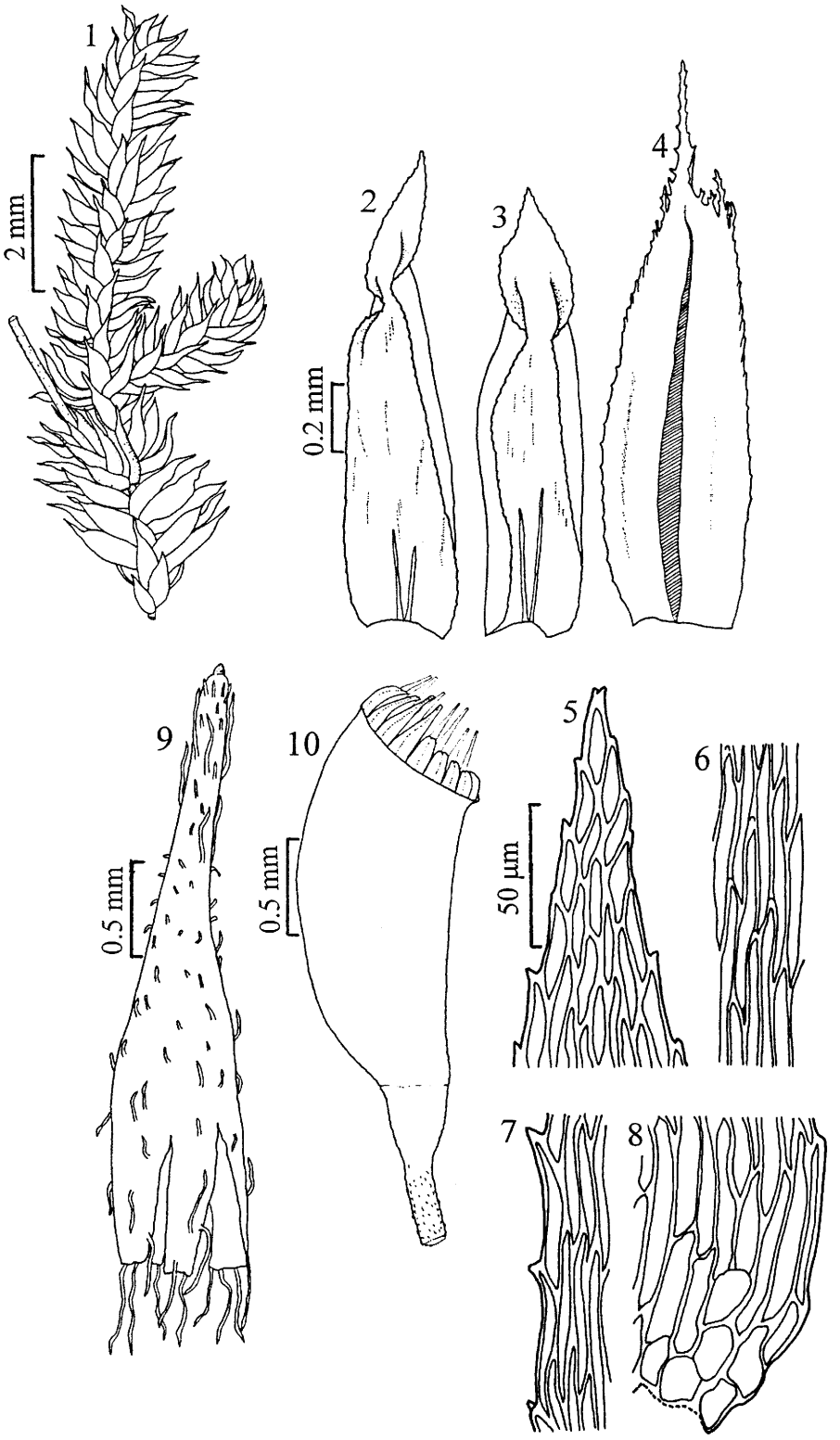

Plate 41. *Chaetomitrium tahitense* (2). 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, calyptra. 10, capsule. All from *Nyaman 163*, New Guinea (isotype of *C. geheebii*) .

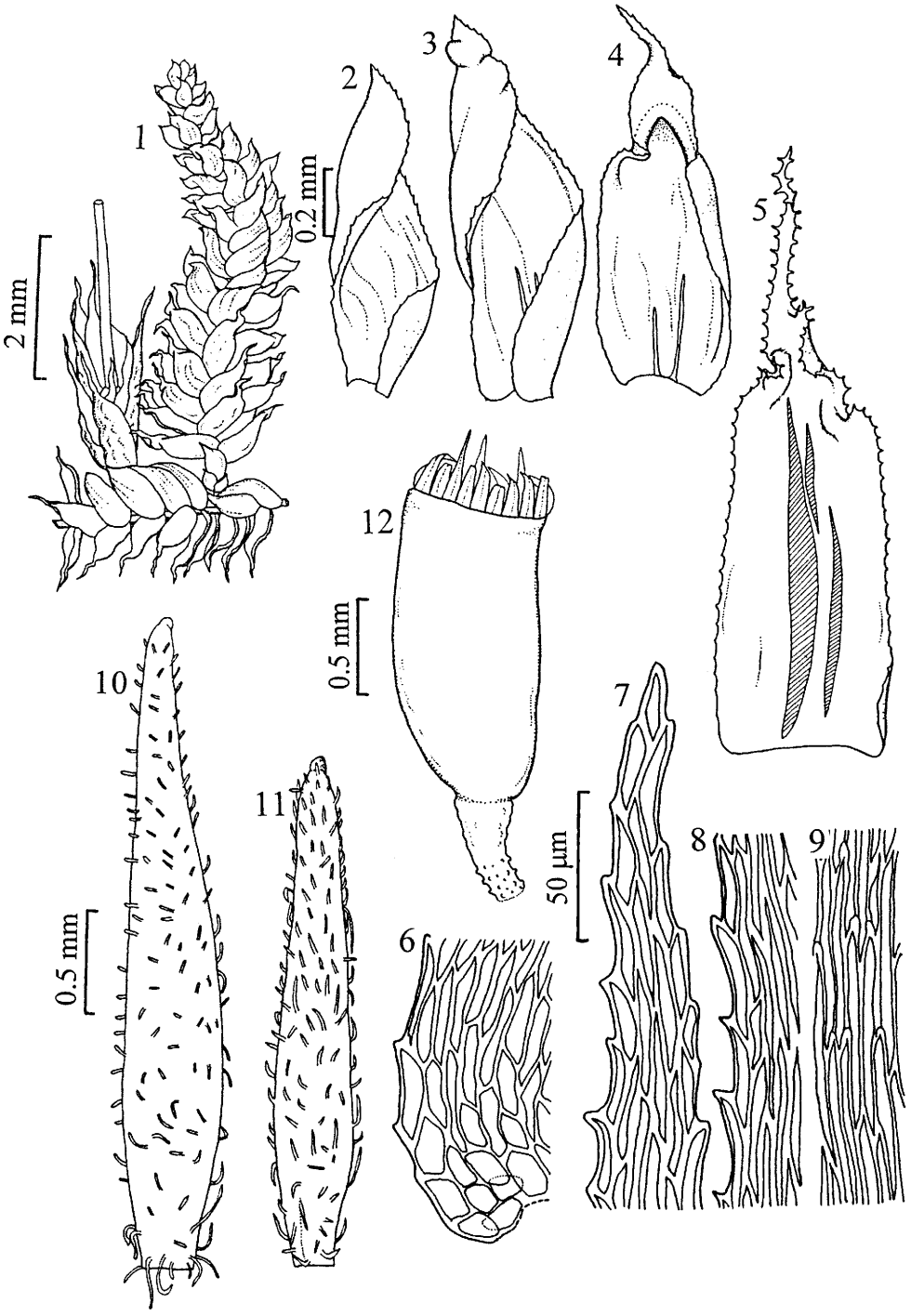

Plate 42. *Chaetomitrium torquescens*. 1, plant. 2 & 3, branch leaves. 4, stem leaf. 5, inner perichaetial leaf. 6, alar region. 7, leaf apex. 8, leaf margin. 9, medial lamina cells. 10,11, calyptrae. 12, capsule. 1–9 & 11 from *Vriese s.n.*, Seram (holotype), and 10 &12, *Carr 12176*, New Guinea (BM).

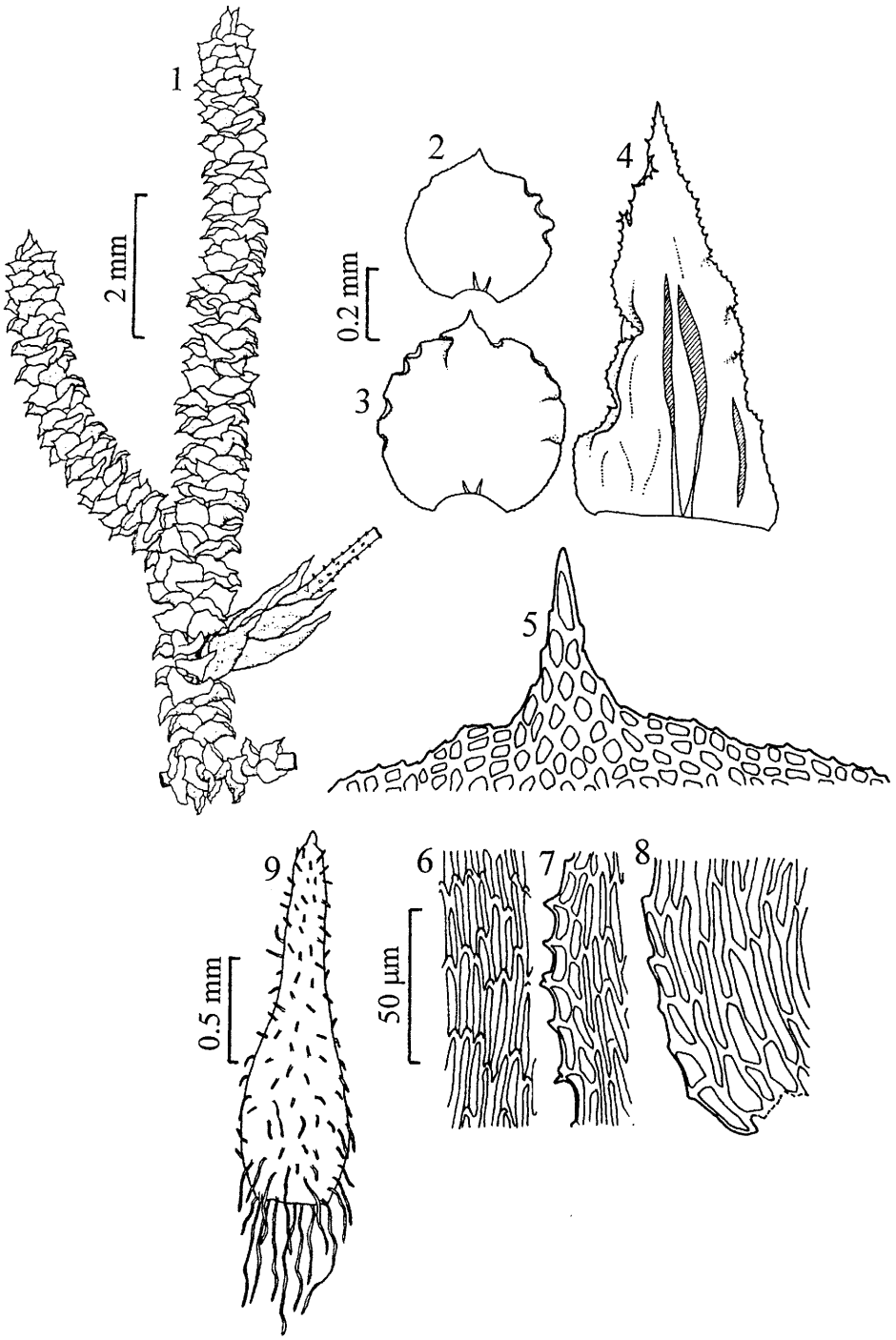

Plate 43. *Chaetomitrium vrieseanum* (1). 1, plant. 2, branch leaf. 3, stem leaf. 4, inner perichaetial leaf (immature). 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar cells. 9, calyptra. All from *Vriese s.n.*, Seram (holotype).

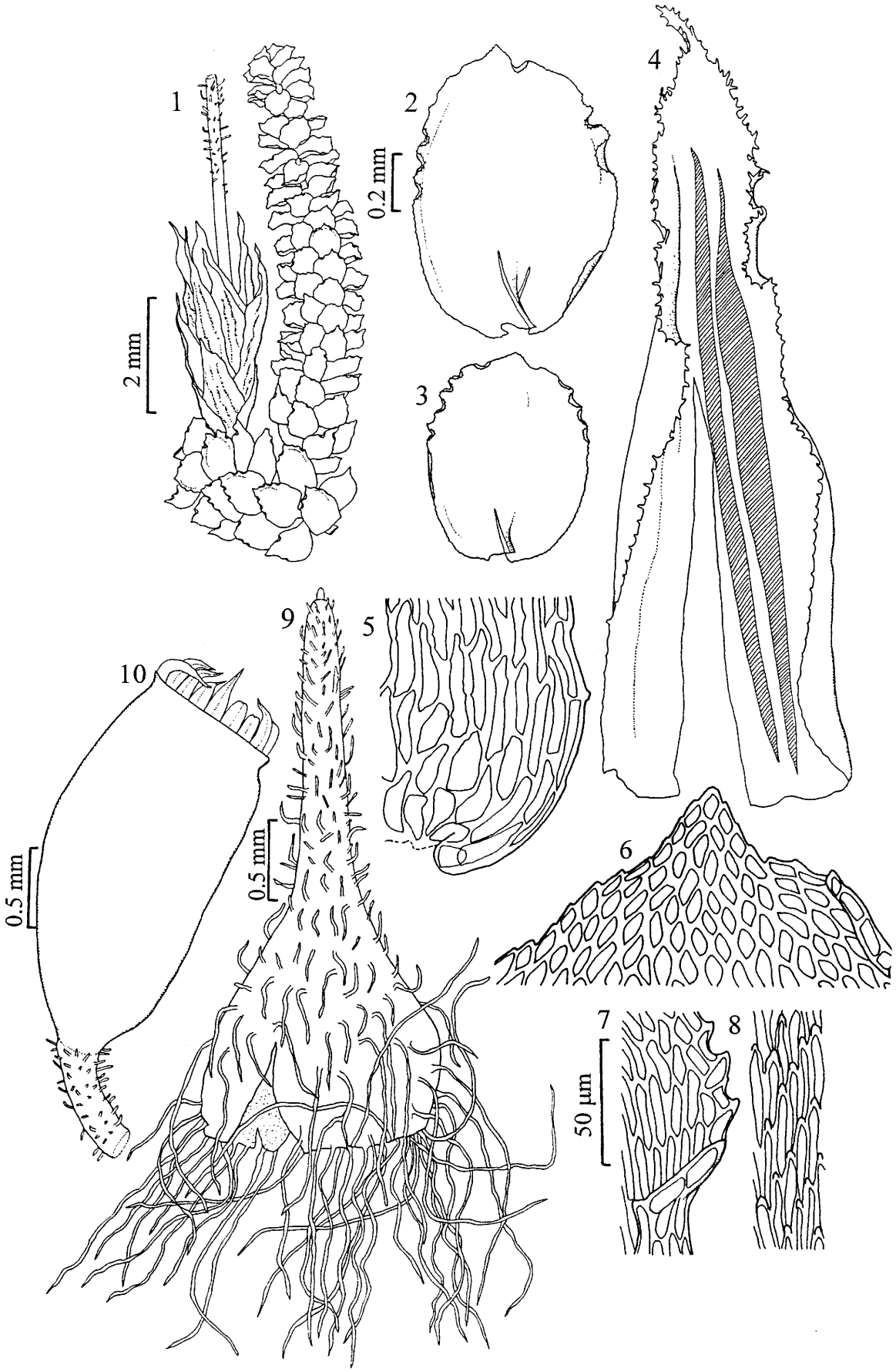

Plate 44. *Chaetomitrium vrieseanum* (2). 1, plant. 2, stem leaf. 3, branch leaf. 4, inner perichaetial leaf. 5, alar region. 6, leaf apex. 7, leaf margin. 8, medial lamina cells. 9, calyptra. 10, capsule. All from *Brass 23453*, New Guinea (holotype of *C. papuanum*).

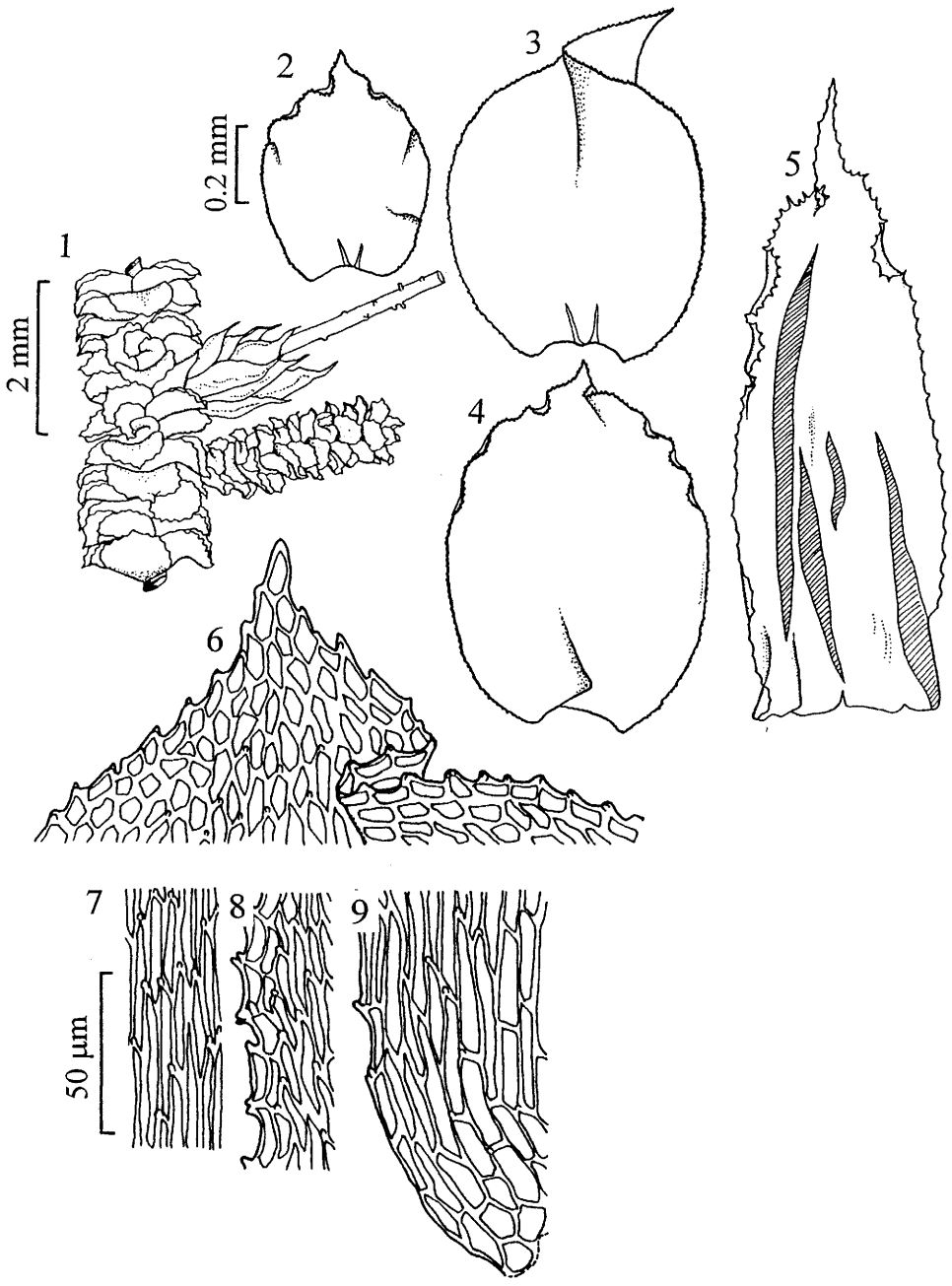

Plate 45. *Chaetomitrium vrieseanum* (3). 1, plant. 2, branch leaf. 3 & 4, stem leaves. 5, inner perichaetial leaf. 6, leaf apex. 7, medial lamina cells. 8, leaf margin. 9, alar region. All from *Lauterbach s.n.*, New Guinea (isotype of *C. rigidulum*).

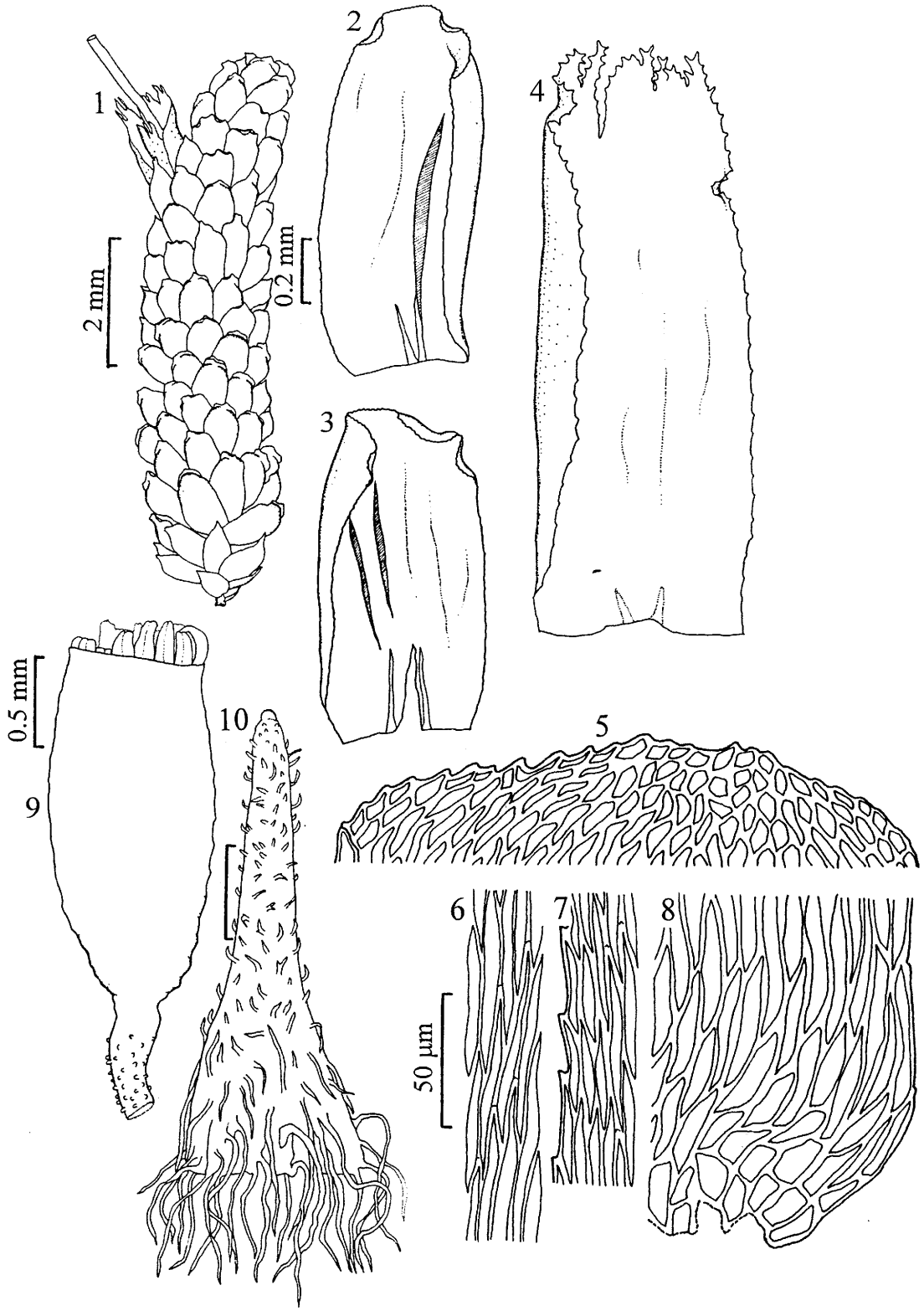

Plate 46. *Chaetomitrium warburgii*. 1, plant. 2 & 3, branch leaves. 4, inner perichaetial leaf. 5, leaf apex. 6, medial lamina cells. 7, leaf margin. 8, alar region. 9, capsule. 10, calyptra. 1–8 from *Weber 1313*, Philippines (isotype), and 9 &10 from *McGregor 10513*, Philippines (NY).

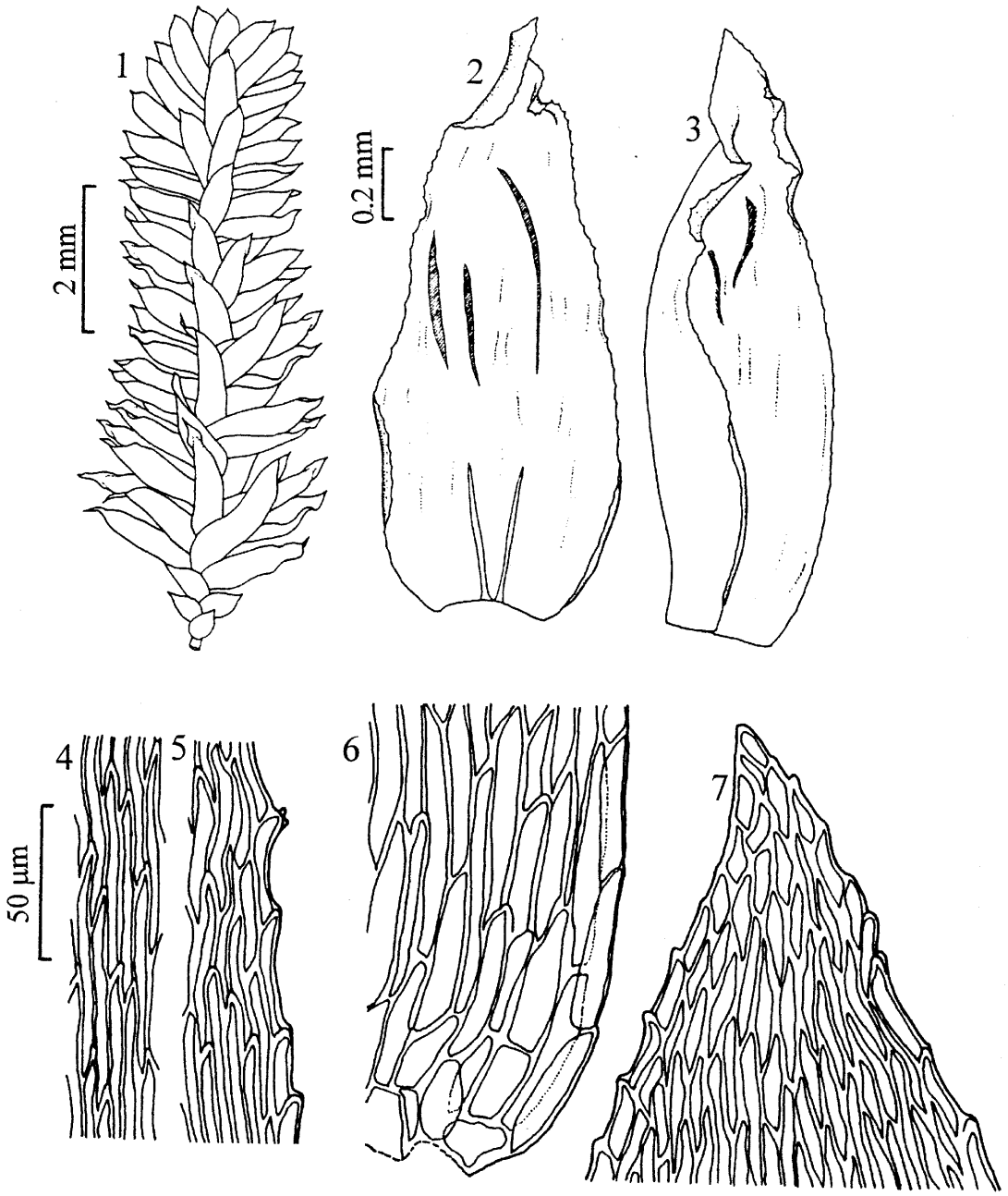

Plate 47. *Chaetomitrium weberi*. 1, Plant. 2 & 3, branch leaves. 4, medial lamina cells. 5, leaf margin. 6, alar region. 7, leaf apex. All from *Weber 1309*, Philippines (isotype).

マレシア地域のアブラハイゴケ属（蘚類コモチイトゴケ科）：タイプ標本の図示，分類学的ノートならびに種への検索表

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本論文ではマレシア地域からこれまでに報告されたアブラハイゴケ属 Chaetomitrium45 種 1 変種のタイプ 標本を検討し図示するとともに，形態的な特徴，分類学的なノートを記載した．また我々が独立種として認 める 40 種について，種への検索表を提示した．