

# *PORELLA CAMPYLOPHYLLA* (LEHM. & LINDENB.) TREV. COMPLEX IN INDIA\*

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## Abstract

*Porella campylophylla* (Lehm. & Lindenb.) Trev. forms a complex and is widely distributed in Himalaya and hills of south India. Besides the phenomenal plasticity the taxon shows certain stable variants in Indian population. In the Himalaya the species is represented by two distinct varieties: *P. campylophylla* var. *ligulifera* (Tayl.) Hatt. and *P. campylophylla* var. *ptychantha* var. nov. *P. campylophylla* subsp. *lancistipula* (St.) Hatt. is endemic to South India.

## Introduction

Stephani (1910) and Kashyap (1932) described only *P. campylophylla* from India but later on Hattori (1978) described *P. campylophylla* with a variety, *P. campylophylla* var. *ligulifera* and a subspecies *P. campylophylla* subsp. *lancistipula*.

During a comprehensive monographic study of the genus *Porella* some fertile plants were collected from Himalayas which are referable to *P. campylophylla* but show certain characteristic variations which on critical evaluation deserve the status of a new variety, *P. campylophylla* var. *ptychantha*. This is based on the plants earlier described as *P. ptychantha* (Mitt.) Hatt. by Hattori (1971) and which was turned out to be a synonym of *P. campylophylla* (Hattori, 1975, 1978).

The present study is based on several collections made from different localities of eastern, and western Himalaya and south India along with the type specimens of these taxa located in Conservatoire et jardin Botaniques, Geneva (G).

Detailed and illustrated account of all Indian taxa of *P. campylophylla*—complex is given here. The asexual reproduction usually not common in the genus *Porella* is demonstrated in *P. campylophylla*.

In *P. campylophylla* the cells of outer-

most layer of capsule wall and in *P. campylophylla* var. *ligulifera* cells of inner layer of capsule wall show a peculiar pattern of thickening, not known so far in any other species of *Porella*.

## Taxonomic description

1. *Porella campylophylla* (Lehm. & Lindenb.) Trev., Mem. Real. Istit. Lambardo Ser. 3, 4: 408 (1877).

Syn.: *Jungermannia campylophylla* Lehm. & Lindenb. in Lehm., Pugillus 6:40 (1884); *Madotheca campylophylla* (Lehm. & Lindenb.) Gott. et al., Synop. Hep.: 265 (1845); *Madotheca gollanii* St., Sp. Hepat. 4:303 (1910); *Madotheca indica* St., Sp. Hepat. 6:524 (1924); *Madotheca maduraensis* St., Sp. Hepat. 6:525 (1924); *Madotheca denticulata* Kashyap, Liverw. W. Himalayas & Punjab Pl. Part. II: 31-32 (1932).

Pl. 1, figs 1-4; Text-fig. 1—1-17; Text-fig. 2—1-5; Text-fig. 3—1-11

Plants medium sized to large, pinnately branched, branching *Frullania-Ptychanthus* type, rarely *Frullania-Jubula* type; cortical cells in 2-4 rows, 7-20 × 8-29 μm, thick-walled, medullary cells 8-40 × 11-35 μm, thin-walled, trigonous. Leaves densely imbricate, incubous,

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leaf-lobes usually ovate to oblong-ovate, 1.5-2.5 × 0.9-1.6 mm, apex sub-truncate, rounded, obtuse or acute, usually with 3-10 sharp teeth. Leaf-cells trigonous, apical cells 15-28 × 15-20 μm, marginal cells 20-30 × 18-25 μm, median cells 20-45 × 18-35 μm, basal cells 35-56 × 20-35 μm. Some branches with oval, small and entire leaves. Leaf-lobule lanceolate or ligulate, 0.8-1.4 × 0.3-0.4 mm, apex obtuse, acute to acuminate or sometimes slightly notched, often with 1-4 small teeth; base longly decurrent, narrowly incurved, usually entire or sometimes more or less crispate, few branches with very small leaf-lobules. Underleaves oblong-ovate, 0.8-1.3 × 0.3-0.5 mm, apex obtuse, truncate or sometimes acute, with 1-4 small teeth, base longly decurrent, narrowly incurved, entire or sometimes crispate or irregularly laciniate. Regenerants often copious on both surfaces of leaf-lobes attached to axis, 2-celled to multicellular, globose, germinating into juvenile plants, juvenile leaves small, oval and usually entire. Androecium terminal on very short lateral branches or intercalary, oblong, bracts densely crowded, entire, antheridia not seen. Female plants with female inflorescences on short lateral branches, bracts usually in 1-2 pairs, with dentate margin, sometimes small and deformed, bracteole 1-2, margin usually dentate. Perianth campanulate, pluriplicate, plicae smooth at margin, usually with a slightly narrow mouth. Sporophyte with distinct foot, seta and capsule. Foot anchor-shaped. Seta massive, cells thin walled. Capsule ovoid, capsule wall 3-4 layers of cells thick, epidermal cell of the upper half of the capsule wall with trigonous thickenings at the angles and of lower half of the capsule wall with sheet-like thickenings on radial walls; the cells of innermost layer of capsule wall with irregular thickenings on radial walls often extending on tangential walls. Spores 38-70 μm in diameter, yellow, finely papillose. Elaters free, elongated, rarely branched, with blunt ends, spirals usually 2 or 3, sometimes becoming unispirate at the ends.

*Habitat*—Grows on bark or rock surface, either in pure patch or in association of *P. campylophylla* var. *ligulifera*, *P. densifolia* subsp. *appendiculata*, *P. hattorii*, *Plagiochila* sp. and mosses.

*Distribution range*—India (Kurseong, Pynursala, U. Chera, Jorpokhari, Mungpoo, Darjeeling, Sikkim, Cherrapunji, Mawphlang,

Manebhanjang, Shillong, Gangtok, Tiger hill, Tanglu, Kameng, W. Siang: eastern Himalaya; Mussoorie, Ranikhet, Nainital, Pindari: western Himalaya; Avalanche, Shembaganur: Tamil Nadu); Nepal, Bhutan, Burma, Indo-China.

*Specimens examined*—G. 21507 (Type), *Madotheca campylophylla* Lehm. & Lindenb., (Ex herb. Rome), Loc.: Nepal; G. 21506, *M. campylophylla* Lehm. & Lindenb. Loc.: Kurseong (alt. ca 1000 m), Parcissime inter muscos, Leg.: Bretandean (269 Herb. Levier), 1895; G. 21508 (No. 208), *M. campylophylla* Lehm. & Lindenb., Loc.: Mussoorie, western Himalaya, Leg.: F. Duthie, Oct., 1895; G. 21513 (No. 328), *M. campylophylla* Lehm. & Lindenb., Loc.: Mussoorie (alt. ca 2000 m), Leg.: R. S. Chopra, Oct., 1930 (Hep. Selec. et Criticae); *M. campylophylla* Lehm. & Lindenb. (No. 328), Loc.: Mussoorie (alt. ca 2000 m), Leg.: R. S. Chopra, Oct., 1930, in Herb. G; G 21519 (Type), *M. gollanii* St., Herb. Levier No. 3196, Loc.: Mussoorie, Respana Valley, on tree above Mossey falls (alt. ca 1700 m) Leg.: W. Gollan, Sept. 14, 1900; G. 12608 (Syntype), *M. gollanii* St., Herb., Levier No. 3197, Loc.: Mussoorie, Respana valley, on trees below Mossey falls (alt. ca 1600 m) Leg.: W. Gollan, Sept. 25, 1900; G. 21527 (Type), *M. indica* St., Loc.: India Orientalis, Leg.: Pfeleiderer No. (37) 31; G. 16790 (Type), *M. madurensis* St., Fondation Stephani No. 20H, Loc.: Shembaganur, Madura, Leg.: R. P. G. Foreau, 1911; G. 21510, *M. campylophylla* Lehm. & Lindenb., Loc.: India Orientalis, Leg.: Khairuddin, 1901; G. 21511, *M. campylophylla* Lehm. & Lindenb., Loc.: India orientalis, Calcutta, Leg.: Griffith, 1815; G. 21512, *M. campylophylla* Lehm. & Lindenb., Loc.: Nepal, Leg. Lehm. dulit, 1900; G. 21514, *Porella campylophylla* (Lehm. & Lindenb.) Trev., Loc.: East Nepal, between Dor and Chauke (alt. ca 2750 m), Leg.: Z. Iwatsuki, No. 433 a, June 7, 1972; BM. 5033a, *P. campylophylla* (Lehm. & Lindenb.) Trev., Loc.: Sanguri Danda, By path to Dhankuta, Nepal (alt. ca 1200 m), Leg.:?, Sept. 17, 1916, Det.: R. Udar, S. C. Srivastava & F. Shaheen; BM. 5132, *P. campylophylla* (Lehm. & Lindenb.) Trev., Loc.: Mahe, Nepal (alt. ca 2000 m), Leg.:? Sept. 20, 1961, Det.: R. Udar, S. C. Srivastava and F. Shaheen; BM 5393, *P. campylophylla* (Lehm. & Lindenb.) Trev., Loc.: Kham La Lung (alt. ca 2000 m), Nepal, Leg.:?, Sept. 24, 1961, Det.: R.

Udar, S. C. Srivastava & F. Shaheen; BM. 5455, *P. campylophylla* (Lehm. & Lindenh.) Trev., Loc.: Kham La Lung (alt. ca 2100 m), Nepal, Leg.:?, Sept. 25, 1961, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. 1355B/41, Loc.: Jorpokhari, Darjeeling (alt. ca 1200 m), Leg.: S. K. Pande, 1941, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. Nos. 6851/64, 6852/64, Loc.: Pynursala, Meghalaya, Leg. V. B. Singh, Sept., 1964, Det.: R. Udar, S. C. Srivastava and F. Shaheen; LWU No. 6850/64, Loc.: U. Cherra, Meghalaya, Leg.: V. B. Singh, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 10F/65, Loc.: Tanglu (alt. ca 3500 m), Leg.: S. Chandra & V. Nath, April 24, 1965, Det.: R. Udar, S. C. Srivastava & F. Shaheen, LWU Nos. 71/72, 6824/72, Loc.: H. M. I. Road, Darjeeling (alt. ca 1200 m), Leg.: R. Udar & party, May 8, 1972, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 50c/72, Loc.: Tiger Hill, Darjeeling (alt. ca 2500 m) Leg.: R. Udar & party, Oct. 13, 1972, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. 308/77, Loc.: Nathula Road, Gangtok, Sikkim (alt. ca 2000 m), Leg. U. S. Awasthi & A. Kumar, Dec. 28, 1977, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 3344/78, Loc.: Mungpoo, Darjeeling (alt. ca 2000 m), Leg.: A. Kumar & U. S. Awasthi, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. Nos. 5375/81, 5376/81, Loc.: Cherrapunji, Meghalaya (alt. ca 1358 m), Leg.: D. K. Singh, April, 1981, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. Nos. 6827/82, 6828/82, 6829/82, Loc.: On way to Thungrei from Rupa (alt. ca 1600 m), Kameng, Arunachal Pradesh, Leg.: D. K. Singh, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 6835/82, Loc.: Nechipu, Kameng, (alt. ca 1750 m), Arunachal Pradesh, April 20, 1982, Det.: R. Udar, S. C. Srivastava & F. Shaheen; BSI 832, Loc.: On way to Mechuka from Rego, W. Siang, Arunachal Pradesh, Leg.: D. K. Singh, Dec. 21, 1984, Det.: S. C. Srivastava & F. Shaheen; LWU 1020B/36, Loc. Pindari, Almora (alt. ca 3658 m), Leg.: S. K. Pande, Sept.-Oct., 1936, Det. R. Udar, S. C. Srivastava & F. Shaheen; LWU 5366/81, Loc.: Nainital (alt. ca 2000 m), Leg.: S. D. Tewari March 30, 1981, Det.: R. Udar, S. C. Srivastava & F. Shaheen. LWU Nos. 6550/82, Loc.: Mallital, Nainital (alt. ca 2000 m), Leg.: U. S. Awasthi, Nov. 7, 1982, Det.: R. Udar, S. C. Srivastava & F. Shaheen;

LWU Nos. 6687/82, 6688/82, 6689/82, 6690/82, 6703/82, 6715/82, Loc.: Kalika, Ranikhet, Leg.: U. S. Awasthi, Nov. 9, 1982, Det.: R. Udar; S. C. Srivastava & F. Shaheen; LWU 66SE/72, Loc.: On way to Avalanche (alt. ca 2400 m), Leg.: R. Udar & party, Jan., 2, 1972, Det.: R. Udar, S. C. Srivastava & F. Shaheen.

2. *Porella campylophylla* var. *ligulifera* (Tayl.) Hatt., J. Hattori Bot. Lab. 32:333 (1969).

Syn: *Madotheca ligulifera* Tayl., in Lehm. Pugill. Pl. 8; 10 (1844).

Text-fig. 4—1-15, Text-fig. 5—1-20.

Plants large, reddish brown in herbaria, bipinnately branched, branching *Frullania-Plychanthus* type, rarely *Frullania-Jubula* type; Cortical cells in 2-4 rows; 11-25 × 8-28 μm, thick-walled, medullary cells 11-36 × 17-34 μm, thin-walled, trigonous. Leaves densely imbricate, incubous, leaf-lobes triangular-ovate, margin with 3-8 sharp teeth, 1.2-1.8 × 0.8-1.2 mm, apex usually acute to acuminate, ventral margin strongly recurved and prominently arched at the base near keel. Microphyllous branches with small, triangular or ovate entire leaves with apices acute or obtuse. Leaf-cells trigonous, apical cells 8-14 × 8-14 μm, marginal cells 11-22 × 8-14 μm, median cells 17-42 × 8-17 μm, basal cells 28-56 × 14-22 μm. Leaf-lobules lanceolate, canaliculate, 0.5-1 × 0.2-0.3 mm, apex obtuse or rounded, often with 1-5 small teeth, lateral margin recurved, base long decurrent and ampliate, microphyllous branches often with saccate leaf-lobules. Underleaves oblong, ovate, sometimes triangular, 0.8-1.1 × 0.3-0.7 mm, apex obtuse to truncate with 2-6 or more strong teeth, lateral margins recurved, often repand, longly decurrent, microphyllous branches with small, entire, sometimes semicircular underleaves. Androecium terminal on short lateral branches, oval, spikate, bracts delicate, densely crowded, antheridia produced singly in the axil of bracts. Female plants with numerous female inflorescences on short lateral branches. Bracts in 1-2 pairs with dentate margin, bracteole large, dentate at margin. Perianth elongated pluriplicate, plicae crenulate at margin, usually with a narrow and dentate mouth, sometimes wide mouth. Sporophyte with distinct foot, seta and capsule. Foot anchor-shaped. Seta massive, cells thin walled. Capsule

ovoid, capsule wall 3-4 layers of cells thick, epidermal layer of capsule wall with trigonous thickenings at the angles, cells of inner layer of capsule wall with semi-annular thickenings. Spores 30-55  $\mu\text{m}$  in diameter, yellow and finely papillose. Elaters free, elongated or short and stumpy, sometimes branched, with blunt ends, spirals usually 2-3, sometimes partially single at the ends.

*Habitat*—Grows on soil over rock or epiphytic on angiospermic tree, either in pure patch or in association of *P. campylophylla*, *Lejeunea* sp., *Plagiochila* sp., *Ptychanthus striatus*, *Cheilolejeunea* sp., *Frullania wallichiana*, *F. ericoides*, *F. physantha*, *Lopholejeunea* and mosses.

*Distribution range*—India (Sikkim, Gangtok, Shillong, Jowai, Jarain, Cherrapunji, Mawphlang, Manebhanjang, Tindharia, Thungeri, Sessa: eastern Himalaya, Mussoorie, western Himalaya), Nepal, Thailand.

*Specimens examined*—BM. 5114, *Porella campylophylla* var. *ligulifera* (Tayl.) Hatt., Loc.: From Mahe to Chipne (alt. ca 1800 m), Nepal, Leg.:? Sept. 20, 1961, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU, 6825, Loc.: Sikkim (alt. ca 2100 m), Leg.: S. K. Pande, Det.: R. Udar, S. C. Srivastava & F. Shaheen (preserved in alc.); LWU 3149/77, Loc.: Nathula Road, Gangtok (alt. ca 1900 m), Leg.: A. Kumar & U. S. Awasthi, Dec. 28, 1977, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU Nos. 8835/85, 8836/85, 8837/85, 8840/85, 8852/85, 8855/85, 8857/85, 8859/85, Loc.: Gangtok (alt. ca 1900 m), Leg.: U. S. Awasthi, Nov. 26, 1986, Det.: S. C. Srivastava & F. Shaheen; LWU Nos. 8869/85, 8870/85, 8877/85, Loc.: Gangtok (alt. ca 1900 m), Leg. U. S. Awasthi, Nov. 27, 1985, Det.: S. C. Srivastava & F. Shaheen; LWU 8946/85, Loc.: Singhik, Sikkim, Leg.: U. S. Awasthi, Nov. 29, 1985, Det.: S. C. Srivastava & F. Shaheen; LWU 4015/79, Loc.: Jowai (alt. ca 1600 m), Leg.: A. Kumar & U. S. Awasthi, Nov. 11, 1979, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 5375/81 Loc.: Cherrapunji (alt. ca 1358), Leg.: D. K. Singh, April, 1981, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 6830/82, Loc.: Bundrima forest (Thungeri), Kameng (alt. ca 1300 m), Arunachal Pradesh, Leg.: D. K. Singh, April 26, 1982, Det.: R. Udar, S. C. Srivastava & F. Shaheen.

3. *Porella campylophylla* var. *ptychantha* var. nov.

Syn: *Madotheca ptychantha* Mitt.: J. Proc. Linn. Soc. London 5: 108 (1861); *Porella ptychantha* (Mitt.) Hatt., J. Hattori Bot. Lab. 34: 426-428 (1970).

Text-fig. 6—1-26.

Varietas diversus e *P. campylophylla* in folia densa imbricata cum apice 2-6(-9) deminutus dentibus et folia inferiora late-ovatus cum 1-3 vel plus deminutus dentibus.

Plants medium-sized, bipinnately branched, branching *Frullania-Ptychanthus* type; cortical cells in 2-3 or more rows, 11-20  $\times$  7-21  $\mu\text{m}$ , thick-walled, medullary cells 14-22  $\times$  11-28  $\mu\text{m}$ , thin-walled, trigonous. Leaves very densely imbricate, incubous, leaf-lobes usually ovate-oblong, 1.6-2.6  $\times$  1.2-1.8 mm, apex obtuse or rarely sub-truncate, with 2-6(-9) very reduced, blunt teeth, rarely almost entire. Microphyllous branches usually with small, oval, entire or sometimes dentate leaves. Leaf-cells trigonous, apical cells 11-22  $\times$  11-22  $\mu\text{m}$ , marginal cells 11-28  $\times$  11-22  $\mu\text{m}$ , median cells 21-40  $\times$  15-25  $\mu\text{m}$ , basal cells 30-60  $\times$  25-35  $\mu\text{m}$ . Leaf-lobules ligulate, 1-1.6  $\times$  0.4-0.7 mm, apex obtuse, rarely with 1-2 small teeth or sub-acute to apiculate, base shortly decurrent and strongly recurved, few branches with small, broad and saccate leaf-lobules. Underleaves widely oblong 1-1.8  $\times$  0.8-1.2 mm, apex obtuse or ligulate, weakly 1-3 or more toothed, base longly decurrent with strongly recurved lateral margins. Microphyllous branches with small, entire and triangular underleaves. Female plants with numerous female inflorescences on short lateral branches. Bracts and bracteoles in a single pair and usually with dentate margins. Perianth obpyriform, pluriplicate, Plicae crenulate at margin, mouth narrowed with small teeth.

*Habitat*—Grows on bark in association with mosses.

*Distribution range*—Endemic to Himalaya (Loharkhet: western Himalaya; Kurseong, Pynursala: eastern Himalaya).

*Specimens examined*—LWU 20/72, Loc.: Loharkhet, Leg. R. Udar & party, May 8, 1972, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. 6853/64, Loc.: Pynursala, Leg.: V. B. Singh, Sept. 21, 1964, Det.: R. Udar, S. C. Srivastava & F. Shaheen.

4. *Porella campylophylla* subsp. *lancistipula* (St.) Hatt., J. Hattori Bot. Lab. 44: 102 (1978).

Syn: *Madotheca lancistipula* St., Sp.

Hepat. 5: 525 (1924); *Porrella lancistipula* (St.) Hatt., J. Hattori Bot. Lab. 30: 138-140 (1967).

Text-fig. 7—1-10, Text-fig. 8—1-16

Plants medium sized, pinnately branched, branching *Frullania-Ptychanthus* type; cortical cells in 2-4 rows, 11-17 × 8-22  $\mu\text{m}$ , thick-walled, medullary cells 14-28 × 14-28  $\mu\text{m}$ , thin-walled, trigonous. Leaves densely imbricate, incubous, leaf-lobes usually oblong-ovate or sometimes oval, 0.7-2.6 × 0.8-1.7 mm, apex usually obtuse, occasionally acute, with 2-6 or more dentitions, when oval, apex usually entire. Microphyllous branches usually with oval, small and entire leaves. Leaf-cells trigonous, apical cells 11-22 × 11-28  $\mu\text{m}$ , thick-walled, marginal cells 11-28 × 14-22  $\mu\text{m}$ , walls thick, median cells 22-42 × 17-28  $\mu\text{m}$ , basal cells 28-56 × 22-34  $\mu\text{m}$ . Oil-bodies numerous per cell, spherical, 3-6  $\mu\text{m}$  in diameter, elongated or spindle shaped, 4-6 × 2-4  $\mu\text{m}$ , with faint granules. Leaf-lobules densely oriented, lanceolate, usually entire, 0.7-2.6 × 0.8-1.7 mm, apex acuminate or acute, rarely shortly apiculate, sub-acute or obtuse, sometimes with 2 or more small subapical teeth, base strongly recurved and shortly decurrent, few branches with very large and wide or saccate leaf-lobules. Underleaves densely oriented, ovate-triangular or oblong, usually entire, 1-1.6 × 0.4-0.9 mm, apex acuminate, acute, rarely obtuse or narrowly truncate, sometimes with 2 more small subapical teeth or entire, lateral margins recurved with short decurrent base. Branch-underleaves usually with acuminate apex. Microphyllous branches with small, entire, triangular or oblong underleaves usually with obtuse apices. Androecium terminal on very short lateral branches, oblong or oval, densely crowded, entire, antheridia not seen. Female plants with numerous female inflorescences on short lateral branches. Bracts in 1-2 pairs, usually with dentate margin, bracteole 1 or 2 with dentate margin. Perianth obpyriform, pluriplicate, plicae crenulate at margin, mouth narrow, dentate. Capsule oval, epidermal layer of capsule wall with trigonous thickenings at the angles of cells, cells of inner layer of capsule wall with irregular thickenings on radial walls often extending on tangential walls. Spores 34-56  $\mu\text{m}$  in diameter, yellow, finely papillose. Elaters free, elongated, rarely branched, with blunt

ends, spirals usually 2, rarely stumpy with irregularly oriented spiral bands.

*Habitat*—Grows on bark either in pure patch or in association with *P. hattori*, *P. perrottetiana*, *P. caespitans* var. *setigera*, *Frullania* sp., *Plagiochila* sp., *Lejeunea* sp., *Dicronolejeunea* sp. and mosses.

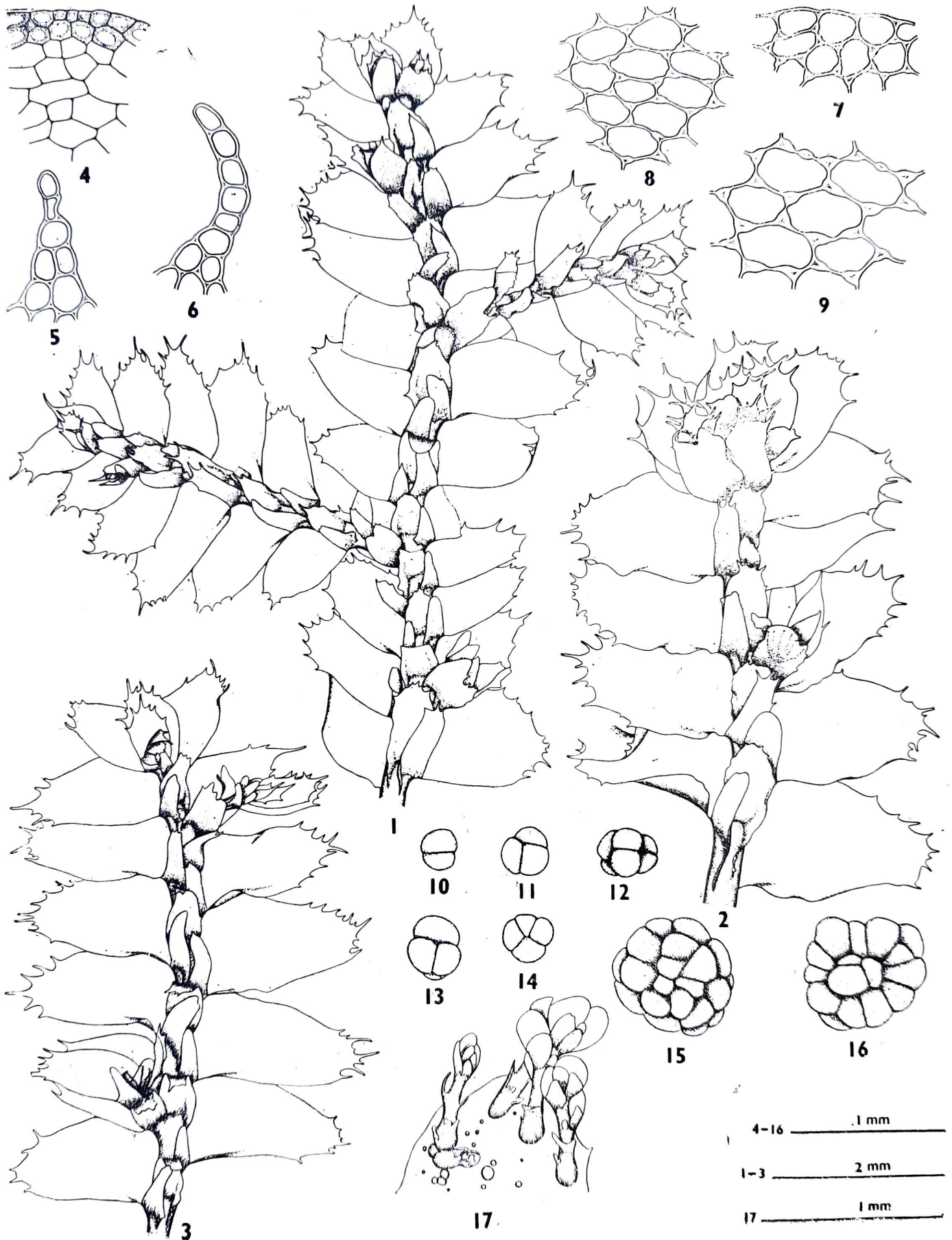
*Distribution range*—Endemic to India (Nyamakad, Vagavurrai, Devicolam: Kerala; Mercara, Abbi falls, Kudremukh: Karnataka; Avalanche, Naduvattam: Tamil Nadu).

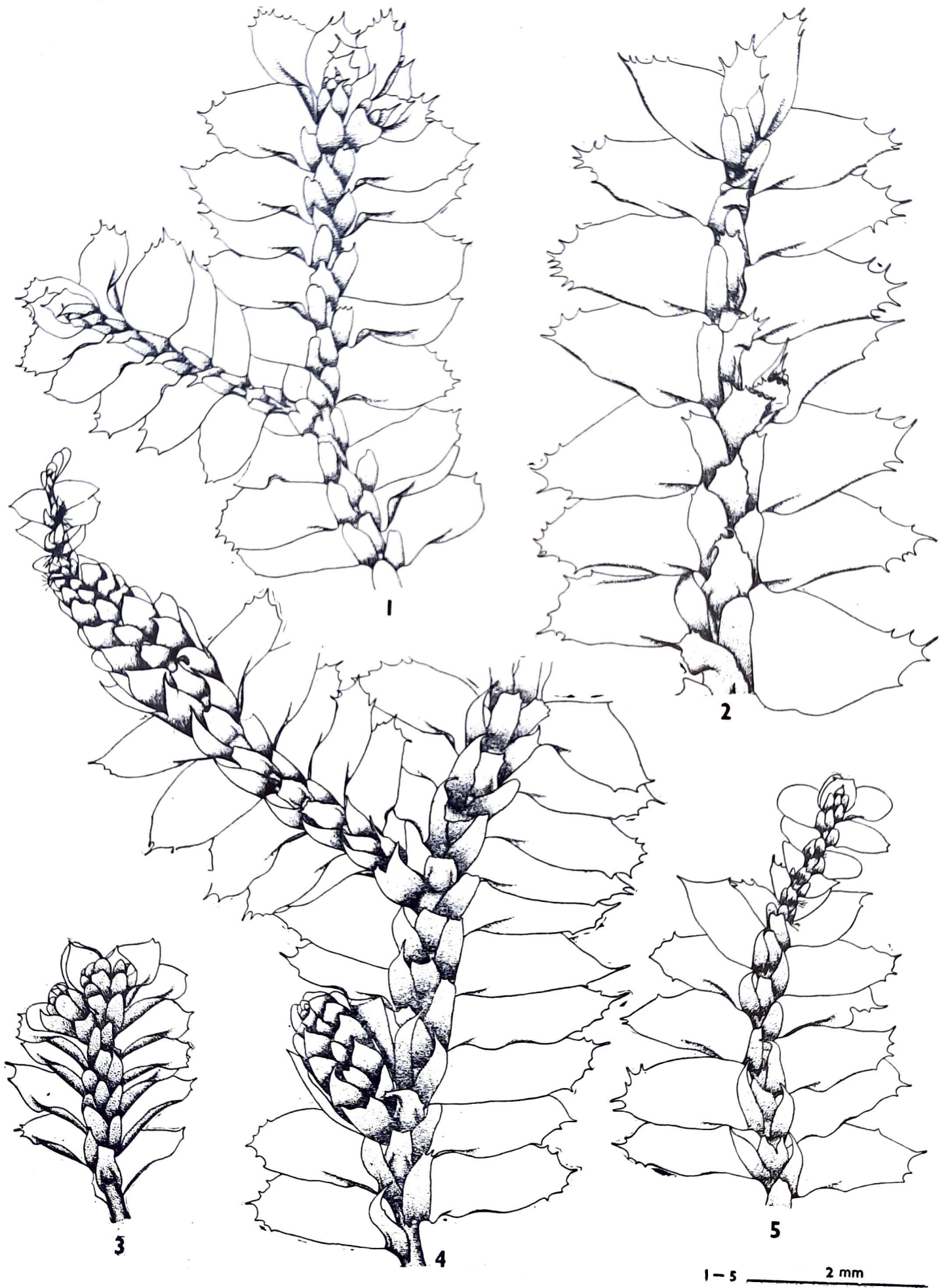
*Specimens examined*—*G. Madotheca indica* St., Loc.: Kudremukh (alt. ca 1800 m), Madura, Leg.: I. Pfeleiderer, April 1913, Det.: Stephani, LWU. Nos. 57 S/72, 83S/72, Loc.: Avalanche (alt. ca 2400 m), Leg.: R. Udar & party, Jan. 2, 1972, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. Nos. 124 S/72, 125 S/72, Loc.: Naduvattam (alt. ca 1982 m), Leg.: R. Udar & party, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU 4574/81, Loc.: Abbi falls (alt. ca 700 m), Karnataka, Leg.: A. Kumar, Dharendra Kumar & U. S. Awasthi, April 30, 1981, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU Nos. 4620/81, 4638/81, Loc.: Mercara (alt. ca 700 m), Karnataka, Leg.: A. Kumar, Dharendra Kumar & U. S. Awasthi, May 1, 1981, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. 5920/82, Loc.: Devicolam (alt. ca 1907 m), Kerala, Leg.: R. Udar & party, Sept. 24, 1982, Det.: R. Udar, S. C. Srivastava & F. Shaheen; LWU. Nos. 6056/82, 6069/82, 6096/82 Loc.: Vagavurrai (alt. ca 1524 m), Kerala, Leg.: R. Udar & party, Sept. 25, 1982, Det.: R. Udar, S. C. Srivastava & F. Shaheen.

## Discussion

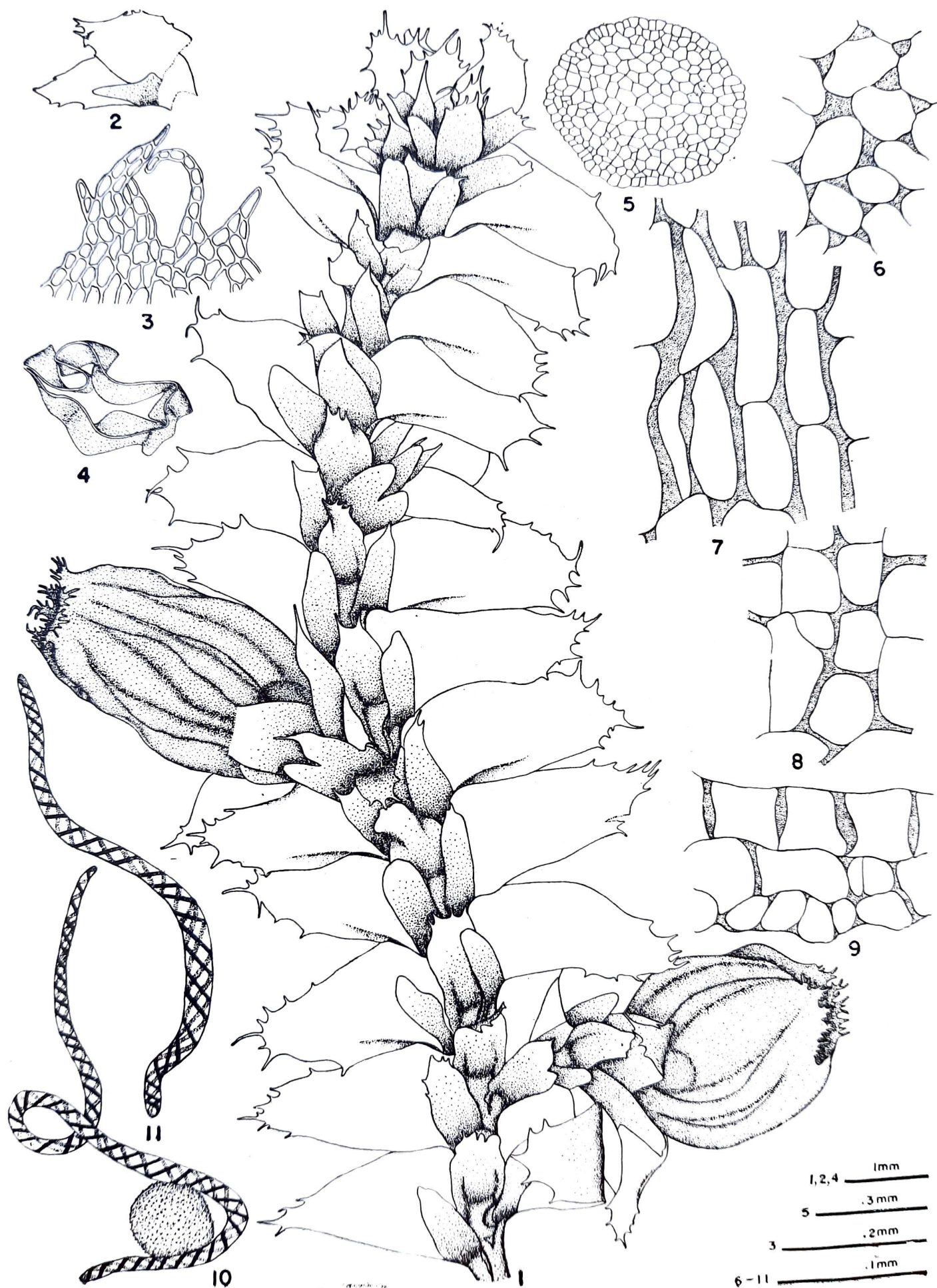
*Porrella campylophylla* shows phenomenal plasticity because of which the plants have elicited creation of several species which are all synonymous with it. Apart from the phenomenal plasticity, the taxon shows certain stable variants localized in the Himalaya and south India. These on critical evaluation have revealed a distinct subspecies, *P. campylophylla* subsp. *lancistipula* and two distinct varieties, *P. campylophylla* var. *ligulifera* and *P. campylophylla* var. *ptychantha*.

*P. campylophylla* is closely related to *P. acutifolia* and *P. caespitans* but differs from these in a few characters. In *P. campylophylla* the leaf-lobes are comparatively wider than long (ovate to oblong-ovate) and the apices



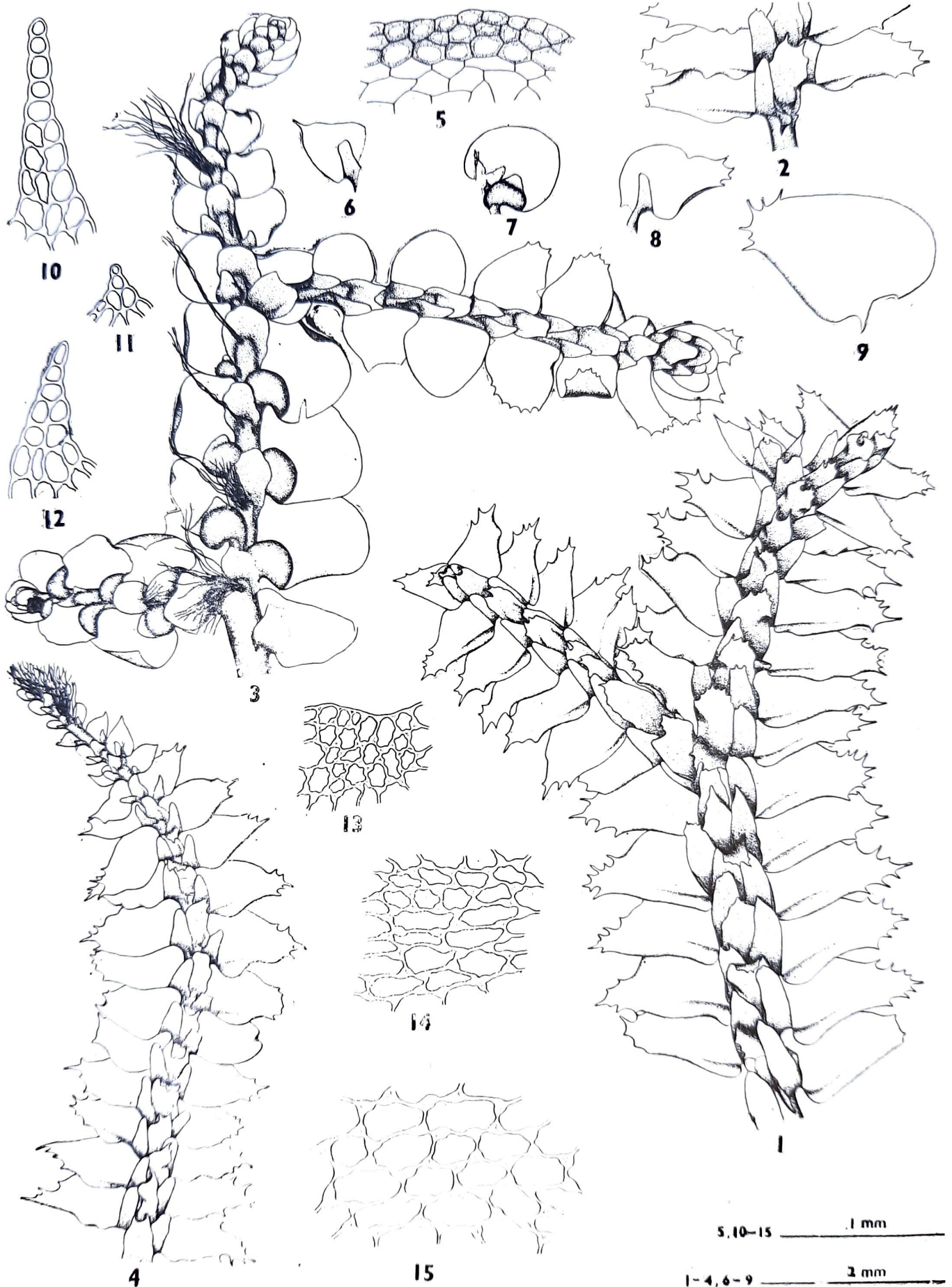


Text-figure 2

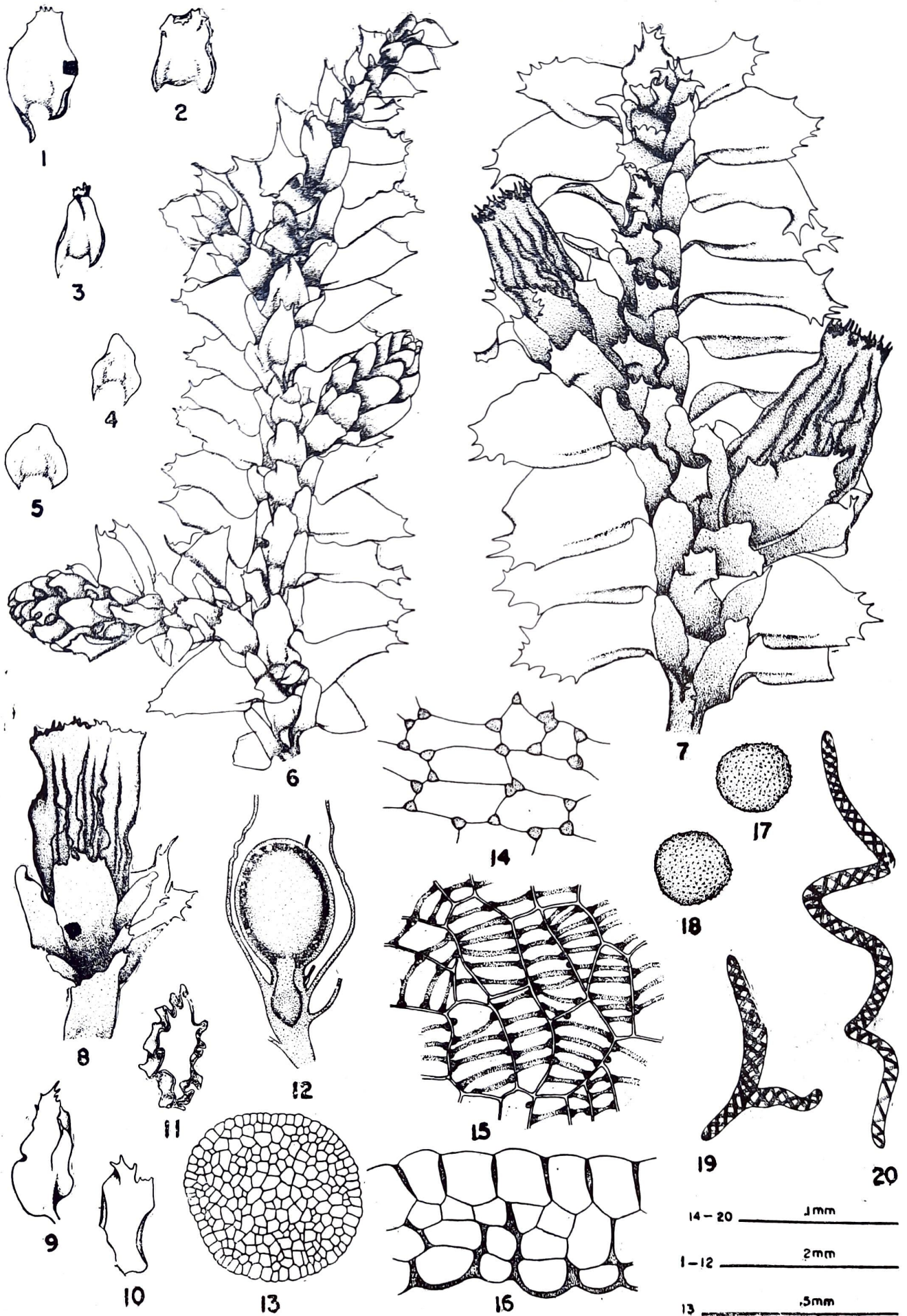


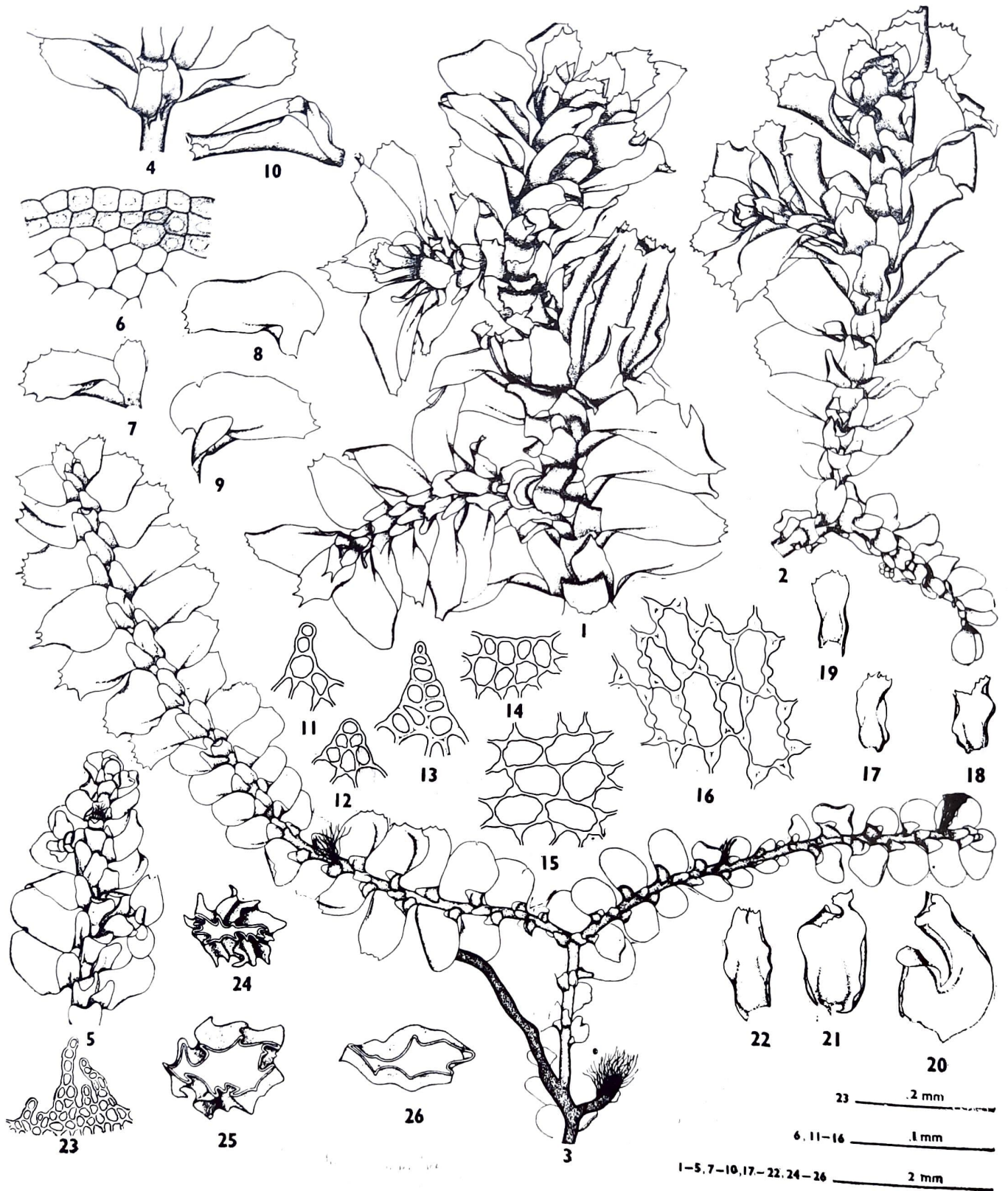
Text-figure 3



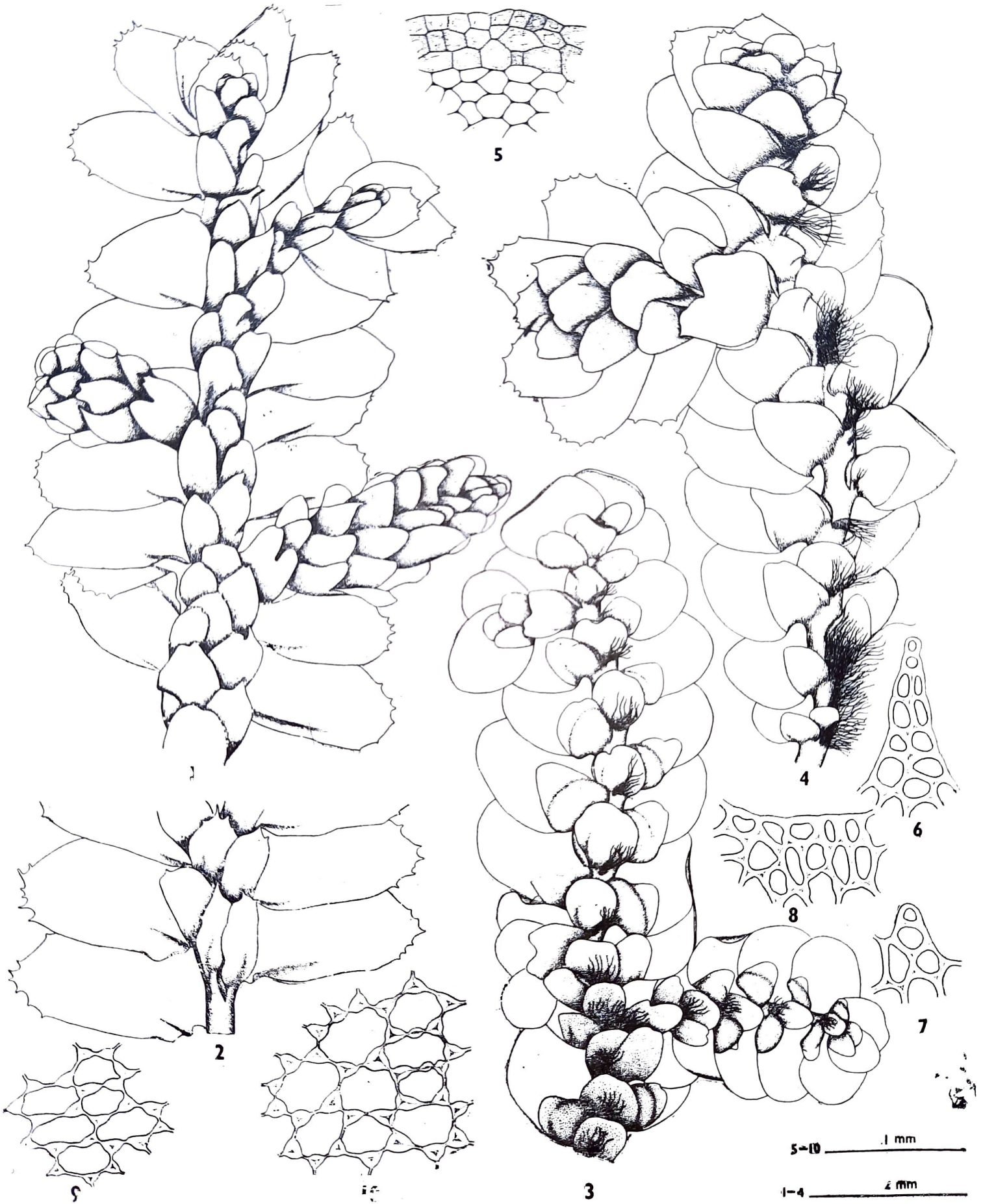


Text-figure 4

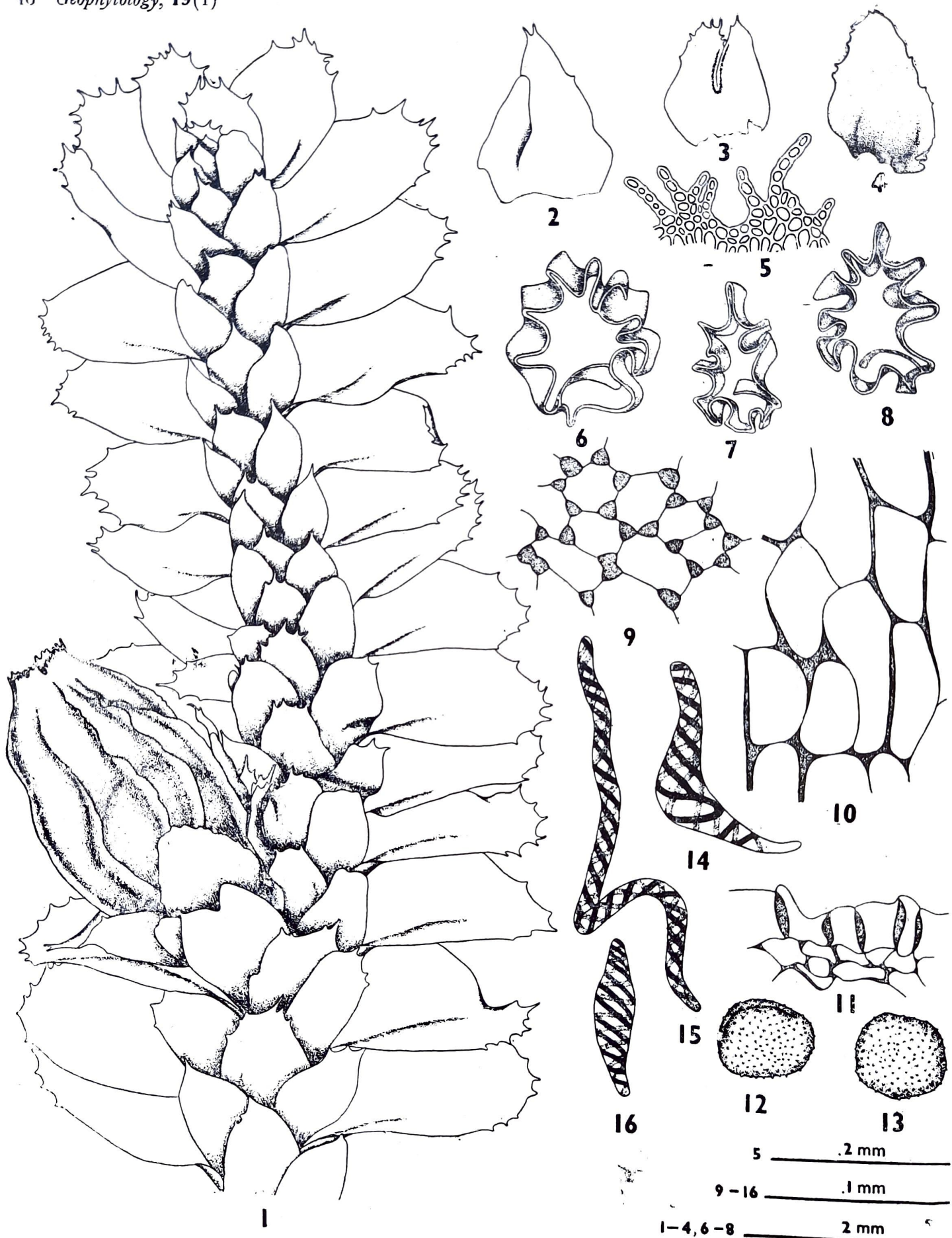




Text-figure 6



Text-figure 7



Text-figur 8

Text-figure 1—1-17. *Porella campylophylla* (Lehm. & Lindenb.) Trev. 1-3. Portions of plants (ventral view); 4. Cross-section of stem (a portion); 5, 6. Teeth of leaf-lobe; 7. Marginal cells of leaf; 8. Median cells of leaf; 9. Basal cells of leaf; 10-16. Stages in the development of regenerants; 17. A leaf with regenerants and germinating plant-lets.

Text-figure 2—1-5. *Porella campylophylla* (Lehm. & Lindenb.) Trev. 1-3. Portion of plants (ventral view). 4. A portion of plant with male inflorescence; 5. A portion of microphyllous branch.

Text-figure 3—1-11 *Porella campylophylla* (Lehm. & Lindenb.) Trev. 1. A portion of plant with female inflorescence; 2. Female bract and bracteole; 3. Cross-section of perianth; 4. Perianth cells at mouth; 5. Cross-section of seta; 6. Cells of outer layer of capsule wall (at the upper half); 7. Cells of the outer layer of capsule wall (at the lower half); 8. Cells of inner most layer of capsule wall; 9. Cross-section of capsule wall; 10. Spore and elater; 11. Elater.

Text-figure 4—1-15. *Porella campylophylla* var. *ligulifera* (Tayl.) Hatt. 1. A portion of plant (ventral view); 2. A portion of plant showing attachment of leaf-lobule and underleaf; 3. A portion of plant showing abnormally developed entire leaf-lobes and saccate leaf-lobules; 4. A portion of microphyllous branch; 5. Cross section of stem (a portion); 6-9. Leaves; 10-12. Teeth of leaf-lobe; 13. Marginal cells of leaf. 14. Median cells of leaf. 15. Basal cells of leaf.

Text-figure 5—1-20. *Porella campylophylla* var. *ligulifera* (Tayl.) Hatt. 1-5. Underleaves. 6. A portion of plant with male inflorescences (ventral view); 7. A portion of plant with female inflorescences (a portion); 8. Female inflorescence; 9. Female bract; 10. Female bracteole; 11. Cross-section of perianth; 12. Vertical longitudinal section of perianth through sporophyte; 13. Cross-section of seta; 14. Cells of outer layer of capsule wall; 15. Cells of inner layer of capsule wall; 16. Cross-section of capsule wall (a portion). 17, 18. Spores; 19, 20. Elaters.

Text-figure 6—1-26. *Porella campylophylla* var. *Ptychantha* var. nov. 1. A portion of plant with female inflorescence (ventral view); 2. A portion of plant with microphyllous branch; 3. A portion of plant showing abnormally developed leaf-lobes, saccate leaf-lobules and small underleaves; 4. A portion of plant showing attachment of leaf-lobule and underleaf; 5. A portion of plant showing abnormally developed entire underleaves; 6. Cross-section of stem (a portion); 7-10. Leaves; 11-13. Teeth of leaf-lobe; 14. Marginal cells of leaf; 15. Median cells of leaf; 16. Basal cells of leaf; 17-19. Underleaves; 20. Female bract, 21-22. Female bracteoles. 23. Perianth cells at mouth; 24, 25. Cross-sections of perianth (at middle); 26. Cross-section of perianth (at base).

Text-figure 7—1-10. *Porella campylophylla* subsp. *lancistipula* (St.) Hatt. 1. A portion of plant with male inflorescences (ventral view); 2. A portion of plant showing attachment of leaf-lobules and underleaves; 3. A portion of plant showing abnormally developed leaf-lobes, saccate leaf lobules and spherical underleaves; 4. A portion of plant showing abnormally developed leaf-lobes, large and very broad leaf-lobules and broad underleaves; 5. Cross-section of stem (a portion); 6, 7. Teeth of leaf-lobe; 8. Marginal leaf-cells; 9. Median leaf-cells; 10. Basal leaf-cells.

Text-figure 8—1-16. *Porella campylophylla* subsp. *lancistipula* (St.) Hatt. 1. A portion of plant with female inflorescence (ventral view); 2, 3. Female bract; 4. Female bracteole; 5. Perianth cells (at mouth); 6-8. Cross-sections of perianth; 9. Cells of outer layer of capsule wall; 10. Cells of inner layer of capsule wall; 11. Cross-section of capsule wall (a portion); 12, 13. Spores; 14-16. Elaters.

are truncate, obtuse, rounded or rarely subacute, with many teeth. In *P. acutifolia* the leaf-lobes are longer than broad, oblong or, narrowly oblong-ovate and the apices are acute with few sub-apical teeth restricted to 1/4 distal portion and in *P. caespitans* the leaf lobes are shorter, triangular to triangular-ovate, with pilose apical tooth, usually without sub-apical teeth, and, if present, restricted to apical portion.

In a recent collection of fertile *P. campylophylla* from west Siang, Arunachal Pradesh, the capsule wall shows a peculiar pattern of thickening in its epidermal cells which is uncommon in other taxa of the genus. The cells of the upper half capsule wall have trigonous thickenings at its angles but the cells of lower half portion have sheet-like thickenings only on radial walls, but the end walls usually remain thin.

A population of *P. campylophylla* collected from Nainital showed copious development of regenerants on both surfaces of leaves which lead to the development of plantlets (Pl. 1, figs. 3, 4). *P. campylophylla* var. *ligulifera* has been reported from eastern and western Himalaya by Hattori (1969) but we could collect this plant only from eastern Himalaya. It appears that eastern Himalaya provides a more congenial home for its growth and proliferation.

The plants collected from Gangtok and Singhik were copiously fertile. The capsule wall shows unique type of thickenings in the cells of inner layer, not known so far in any other taxon of the genus *Porella*. The cells have semi-annular thickening bands on tangential wall in spite of irregular thickenings on radial walls.

*P. campylophylla* var. *ligulifera* can be distinguished from *P. campylophylla* in having triangular-ovate leaf-lobes with usually acute to acuminate apices and recurved ventral margin, prominently arched at the base near keel, crenulate margin of the perianth plicae, trigonous thickenings at angles in epidermal cells of capsule wall at basal half and semi-annular thickenings in the cells of the inner most layer of capsule wall.

*P. campylophylla* var. *ptychantha* can be distinguished from *P. campylophylla* in having leaf-lobes with reduced and blunt teeth, shortly decurrent leaf-lobule base, widely ovate underleaves and crenulate margin of the perianth plicae, whereas in *P. campylophylla* the leaf-lobes are with sharp teeth, the base of leaf-lobules and underleaves are long decurrent, the underleaves are oblong-ovate and the perianth plicae are smooth margined. Further, *P. campylophylla* var. *ptychantha* approaches *P. campylophylla* var. *ligulifera* in certain features but differs from the latter in the presence of ovate-oblong leaf-lobes with obtuse or sub-truncate apices, reduced and blunt teeth and obpyriform perianth having narrow mouth. *P. campylophylla* subsp. *lancistipula* can be distinguished

from *P. campylophylla* in having acute to acuminate apices, shortly decurrent bases of leaf-lobules and underleaves and crenulate margin of the perianth plicae.

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### Explanation of Plate

#### Plate 1

1—4. *Porella campylophylla* (Lehm. & Lindenb.) Trev.

1. Regnerants on leaf surface. x 140. Initial stages (dedifferentiated darker cells).
2. A germinating regnerant. x 74.
3. Developing plantlets. x 77.
4. Developing plantlets. x 75.

