

CONTRIBUTION TO THE MOSSES OF GOBIND NATIONAL PARK, UTTARANCHAL, INDIA

SUJEET KUMAR AND D.K. SINGH

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ABSTRACT

The paper deals with the morphotaxonomical studies on nine species of mosses, viz. *Atrichum undulatum* (Hedw.) P. Beauv. var. *hausknechtii* (Jur. & Mild.) Frye (Polytrichaceae), *Macromitrium moorcroftii* (Hook. & Grew.) Schwaegr. (Orthotrichaceae), *Timmia megapolitana* Hedw. (Timmiaceae), *Pohlia gedeana* (Bosch & Lac.) Gangulee (Bryaceae), *Bartramidula bartramiioides* (Griff.) Wijk & Marg. (Bartramiaceae), *Claopodium prionophyllum* (C. Muell.) Broth. (Thuidiaceae), *Plagiothecium neckeroidium* B.S.G. (Plagiotheciaceae), *Hypnum cupressiforme* Hedw. (Hypnaceae) and *Regmatodon orthostegius* Mont. (Leskeaceae), from Gobind National Park in Uttarkashi district of Uttaranchal, India. This constitutes the first record of bryophytes from this protected area situated in the Garhwal Himalaya. *Pohlia gedeana* (Bosch & Lac.) Gangulee, so far known from Bhutan and Indo-Malayan region, has been recorded for the first time from the country.

INTRODUCTION

Taxonomic studies on the mosses of western Himalaya have received considerable attention in Indian bryology (Chopra, 1975; Chopra & Kumar, 1981; Vohra, 1983). Yet no significant systematic study has so far been carried out on the mosses of the Protected Areas in this region, except a recent contribution on the bryoflora of Great Himalayan National Park in Himachal Pradesh (Narayan & *al.*, 2000).

The Gobind National Park is situated in Uttarkashi district of Uttaranchal state in North West Himalaya. The park covers an area of about 953 km² with the altitude ranging from 1300-6230 m above mean sea level. The area comprises two river valleys, viz. the Rupin and Supin, two major tributaries of river Tons which ultimately drains into river Yamuna. Vegetation in the park

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ranges from subtropical coniferous forests through moist mixed temperate forests, dry temperate forests to alpine scrubs and meadows. The over all topography and climate facilitate a luxuriant growth of bryophytes, both mosses and liverworts, especially between the altitudes 1300-3600 m.

The materials for the present study were collected by one of us (DKS) during a People's Biodiversity Register (PBR) awareness campaign amongst the inhabitants inside the park during the month of June, 2001. The results presented here constitute the first record of bryophytes from this National Park. *Pohlia gedana* (Bosch & Lac.) Gangulee so far known from Bhutan, Thailand and Indonesia (Gangulee, 1974) has been recorded for the first time from India.

The families have been arranged following Vit's (1984) classification. All the specimens have been deposited in the Cryptogamic section of the herbarium of the Botanical Survey of India, Northern Circle, Dehra Dun (BSD).

ENUMERATION

POLYTRICHACEAE

1. ***Atrichum undulatum*** (Hedw.) P. Beauv. var. ***hausknechtii*** (Jur. & Mild.) Frye in Grout in Moss Fl. N. Am. 1 : 103. 1937. *A. hausknechtii* Jur. & Mild. In Verh. Zool. Bot. Ges. Wien 20 : 598. 1870.

Fig.I (1-8)

Plants medium, yellow green to green with simple stems, 30-34 mm long, 14-18 mm broad. Leaves highly contorted and curled when dry; lower leaves smaller 2.4-2.8 mm in length, 1.4-1.6 mm wide, upper leaves erectopate to spreading, carinate and wavy, 5.0-5.5 mm long, 1.6-2.1 mm broad; lamina with rough teeth in oblique rows giving appearance of veins (hence variety *hausknechtii*); leaf base cells, 24.25-26.35 μ m in length, 14.5-15.5 μ m wide; upper cells rounded to sub hexagonal, 16.0-20.0 μ m wide; margin cartilagenous with 2-3 rows of cells, 60.0-72.0 μ m long, 20.0-24.0 μ m wide; costa ends just below the apex, spines present on back surface. Gametangia not seen.

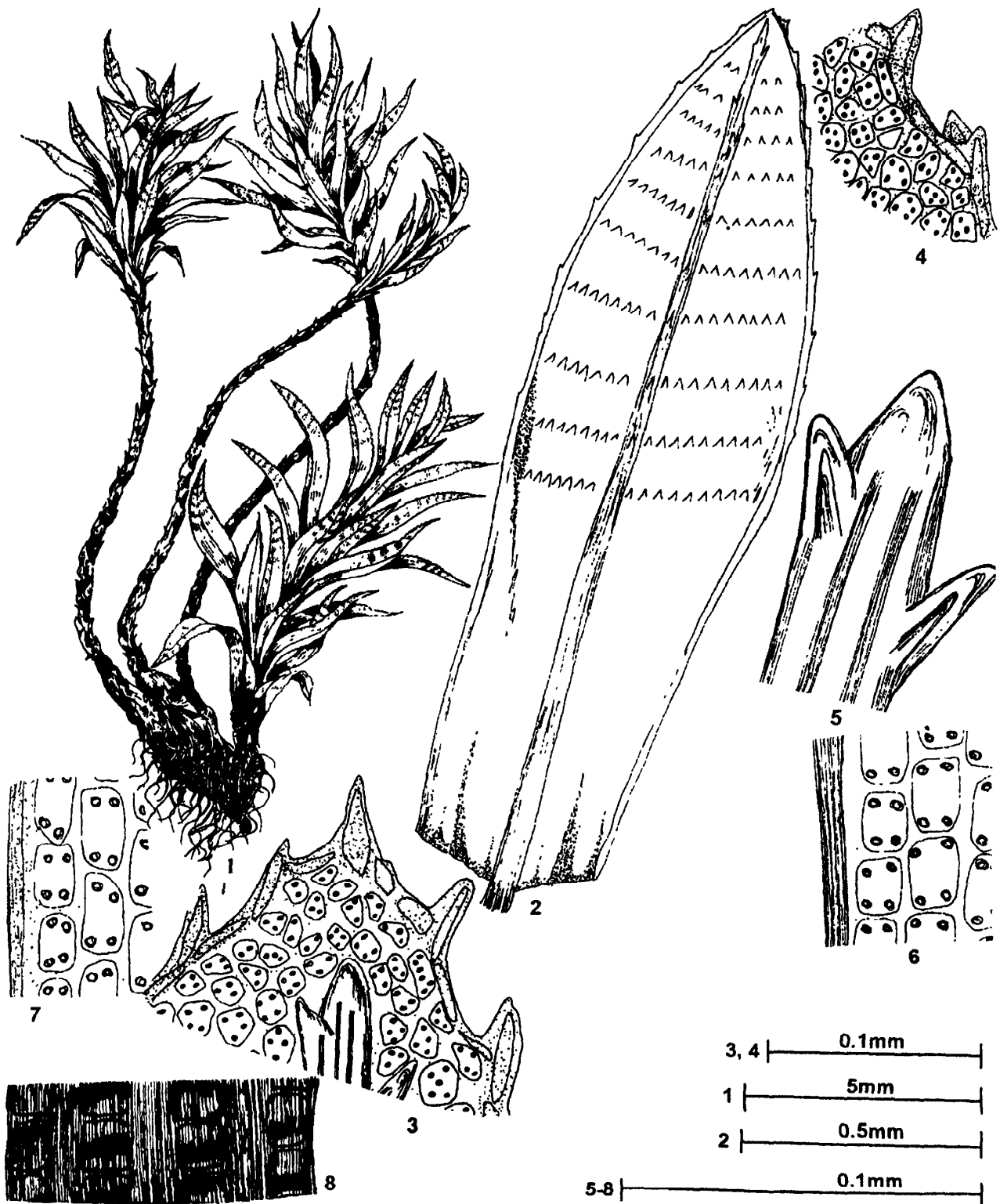


Fig.1 (1-8) : *Atrichum undulatum* var. *hausknechtii* (Jur. et Mild.) Frye 1. Habit; 2. An upper leaf; 3. Apical cells of the leaf; 4. Marginal cells of the leaf showing bidentation; 5. Ventral surface of costa showing dentations; 6. Basal cells of the leaf along costa; 7. The same along margin; 8. Nerve cells.

Specimens examined : Terrestrial, growing along with other mosses like *Plagiothecium neckeroidium*, etc. Taluka, Uttarkashi (2200 m), D.K. Singh 98553-b (BSD).

Distribution : India : Western Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttaranchal); Nepal, Japan, C.I.S., Europe; North America.

ORTHOTRICHACEAE

2. **Macromitrium moorcroftii** (Hook. & Grev.) Schwaegr. in Sp. Musc. Suppl. 2 (2): 67. 1826. *Orthotrichum moorcroftii* Hook. & Grev. in Edin. J. Sc. 1: 116. 1824.

Fig.II (1-7)

Plants robust, green; main shoot 60.0-40.0 mm; secondary branches 8.0-11.0 mm in height. Leaves dense, erectopate, curled when dry, lanceolate, plicate at basal portion, 3.4-3.6 mm long, 0.6-0.65 mm wide; apex acute, pointed, margin revolute at places with heavy bulging of upper marginal cells; leaf cells thick walled, papillose; upper cells 12.0-14.0 μ m long, 8-11 μ m wide; middle cells 14.0-16.0 $\times$ 4.5-6.8 μ m; extreme basal cells rectangular, elongated, 28.0-30.0 $\times$ 10.0-12.0 μ m; costa reaches up to apex. Sporophytes apical; seta 6-6.5mm in length; capsule erect, ovoid, 3.0-3.5mm long, 0.8-1.0mm in diameter; operculum rostrate; endostome lacking; calyptra mitriform, covering almost whole of the capsule.

Specimens examined : Terrestrial, growing along with *Timmia megapolitana*. Seema, Uttarkashi (2200 m), D.K. Singh 98552-b (BSD).

Distribution : India : Eastern Himalaya (Sikkim, West Bengal, Meghalaya), Western Himalaya (Uttaranchal); Western Ghats (Tamil Nadu); Nepal, Myanmar, China (Yunnan).

TIMMIACEAE

3. **Timmia megapolitana** Hedw., Sp. Musc.: 176. 1801

Fig.III (1-7)

Plants robust, yellow green to green, look like members of Polytrichaceae; shoots erect unbranched, 2.8-5.0 mm long, 1.0-1.2 mm wide, gradually shorter

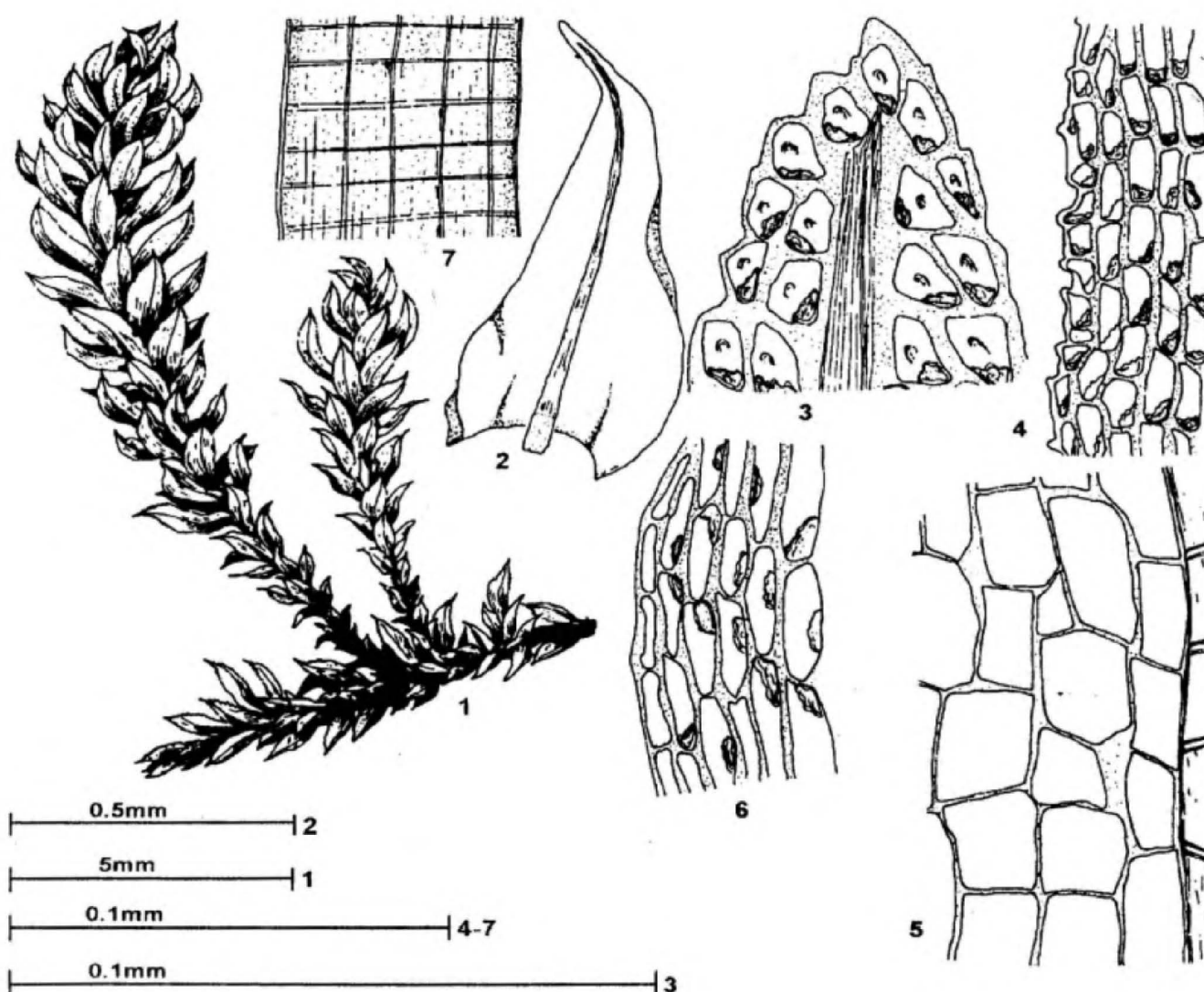


Fig.II (1-7) : *Macromitrium moorcroftii* (Hook. & Grev.) Schwaegr. 1. Habit; 2. A leaf; 3. Apical cells of the leaf; 4. Marginal cells of the leaf; 5. Basal cells of the leaf along costa; 6. The same along margin; 7. Nerve cells.

towards base. Leaves sheathing at base, narrow, lanceolate above, 1.5-2.2 mm long, 0.6-0.8 mm wide, carinate, stiff, highly curled when dry, apiculate with serrate margin from tip to little down the base; basal cells thin walled, yellowish, rectangular, 37.0-48.0 μm long, 7.5-8.5 μm wide cells at apex 12.4-13.6 $\times$ 10.0-12.0 μm ; apical spine cell 36.0-39.0 $\times$ 20.0-24.0 μm ; costa very strong, percurrent, reddish, in transverse section shows deuter cells row between stereid patches, ventral cells of costa mamilliose. Sporophytes apical; seta erect, bent at tip, purplish brown, 24.0-27.0 mm; capsules horizontal,

row between stereid patches, ventral cells of costa mamilllose. Sporophytes apical; seta erect, bent at tip, purplish brown, 24.0-27.0 mm; capsules horizontal, furrowed in dry state, 2.5-3.0 mm long, 1.1-1.3 mm in diam.; outer peristome 540.0-580.0 μ m long, 100.0-115.0 μ m wide; spores 10.0-12.0 μ m in diameter papillose.

Specimens examined : Terrestrial, growing along with bryophytes like *Targionia indica*, *Pohlia gedeanana* and *Macromitrium moorcroftii*. Seema, Har ki Dun, Uttarkashi (2700 m), D.K. Singh 98551-d, 98552-d, 98555-b (BSD).

Distribution : India : Western Himalaya (Jammu & Kashmir, Uttaranchal); Bhutan, China, Japan, C.I.S., Europe (Central & West), North America.

BRYACEAE

4. ***Pohlia gedeanana*** (Bosch & Lac.) Gangulee, Moss. E. India and adjacent regions 2(4) : 927. 1974. *Bryum gedeanum* Bosch & Lac. in Bryol. 1: 147. 1860.

Fig.IV (1-7)

Plants in loose tufts, branched, 5.0-6.0 mm high. Lower leaves smaller, distantly placed; upper leaves erectopatent, narrowly lanceolate, acuminate, 1.8-2.4 mm long, 0.4-0.45 mm broad, margin entire below and serrated above, cells unboardered, hexagonal to linear, 78.0-114.0 $\times$ 9.2-9.6 μ m, cells shorter at tip, longer in middle; basal cells irregularly rectangulate, 70.0-78.0 $\times$ 18.0-24.0 μ m near vein, 70.0-74.0 $\times$ 8.0-12.0 μ m near border; costa strong, excurrent in an awn like structure with stiff tip. Gametangia not seen.

Specimens examined : Terrestrial, growing along with other bryophytes like *Targionia indica* and *Timmia megapolitana*. Seema, Uttarkashi (2200 m), D.K. Singh 98551-c (BSD).

Distribution : India: Western Himalaya (Uttaranchal); Bhutan, Thailand, Indonesia.

BARTRAMIACEAE

5. ***Bartramidula bartramioides*** (Griff.) Wijk & Marg. in Taxon 7: 289. 1958.

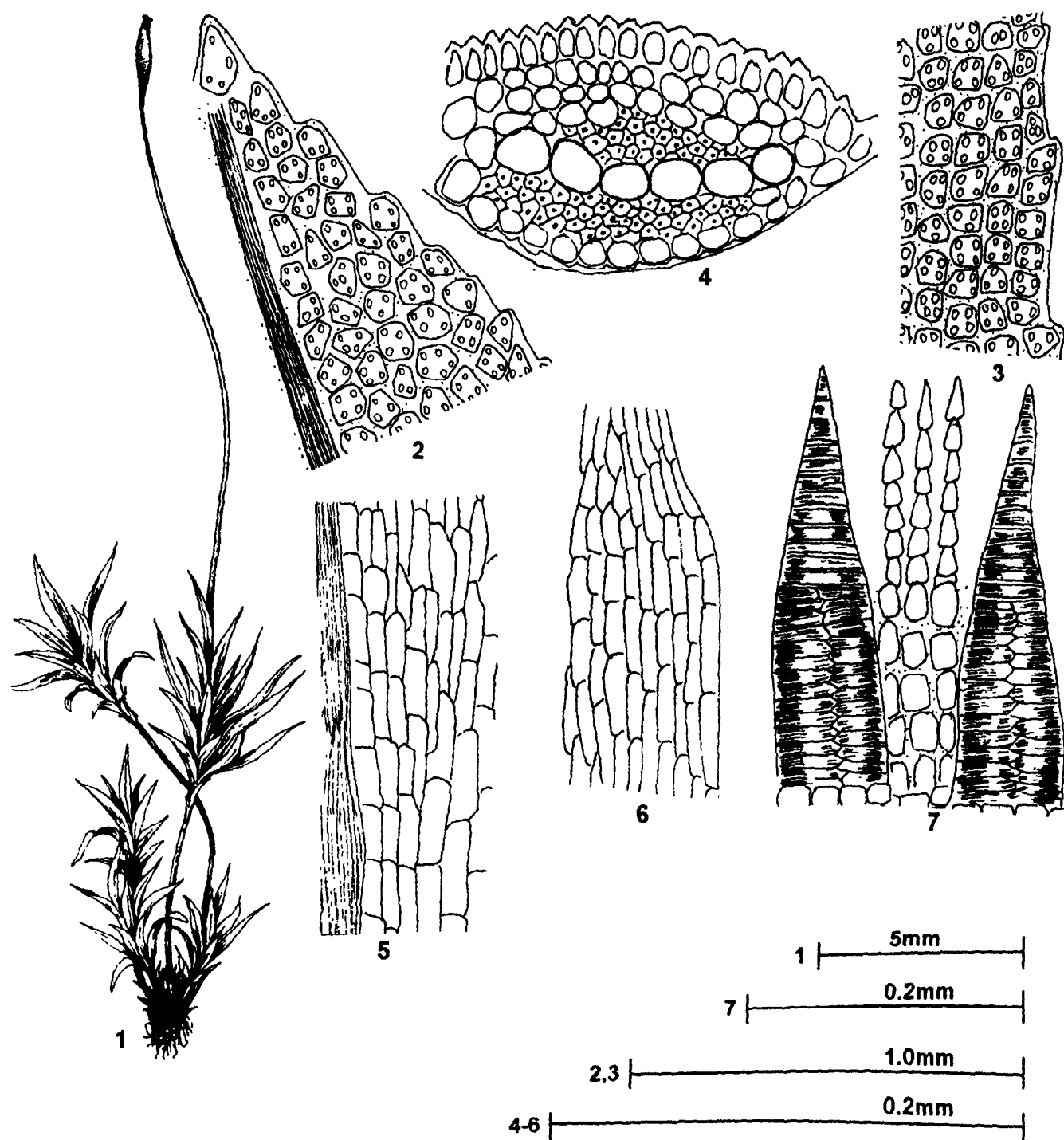


Fig.III (1-7) : *Timmia megapolitana* Hedw. 1. Habit; 2. Apical cells of the leaf; 3. Marginal cells of the leaf; 4. T. S. leaf showing deuter cells; 5. Basal cells of the leaf along costa; 6. The same along margin; 7. Peristome teeth.

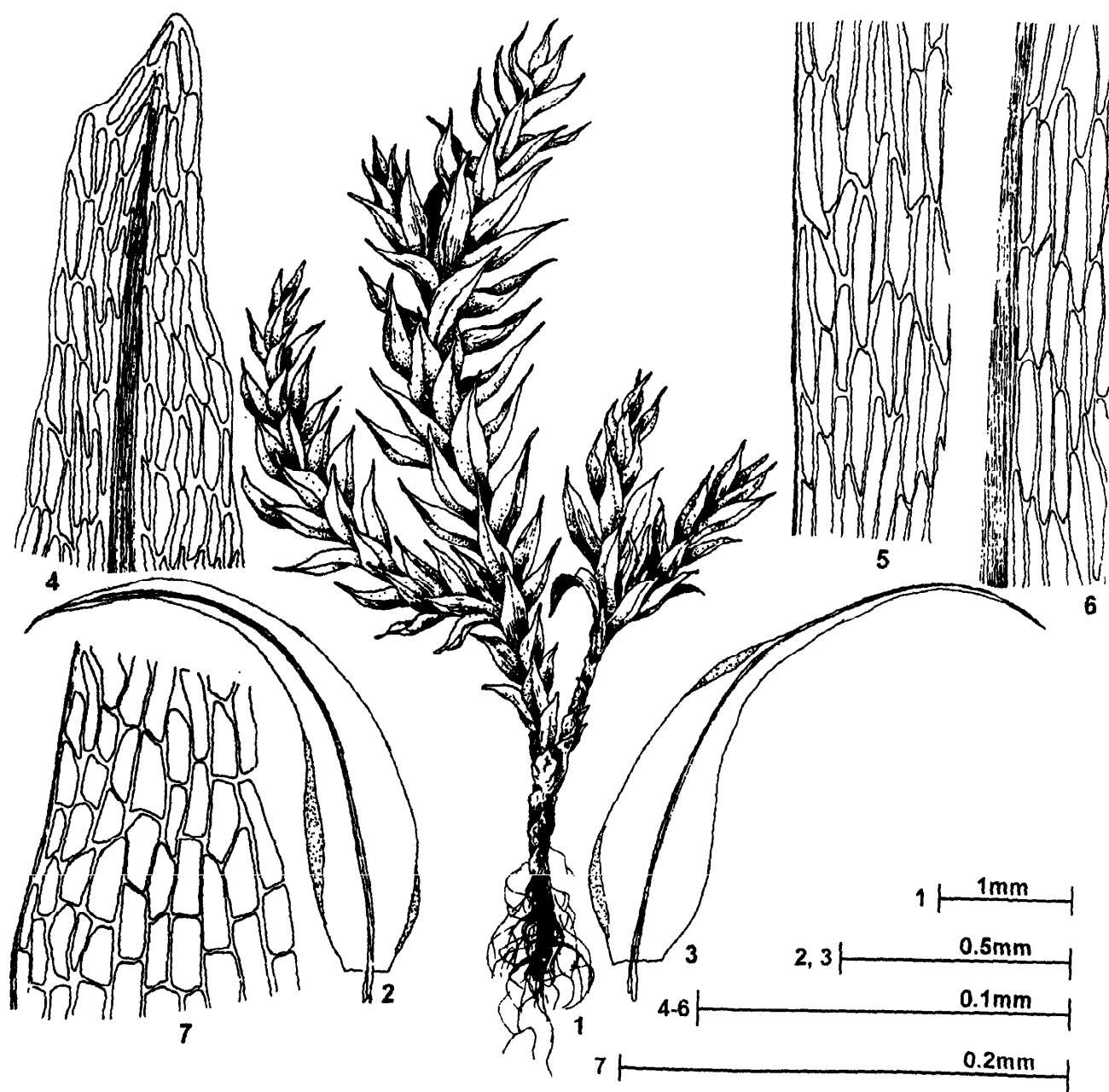


Fig.IV (1-7) : *Pohlia gedana* (Bosch & Lac.) Gangulee 1. Habit; 2, 3. Leaves; 4. Apical cells of the leaf; 5. Marginal cells of the leaf; 6. Median cells of the leaf along costa; 7. Basal cells of the leaf.

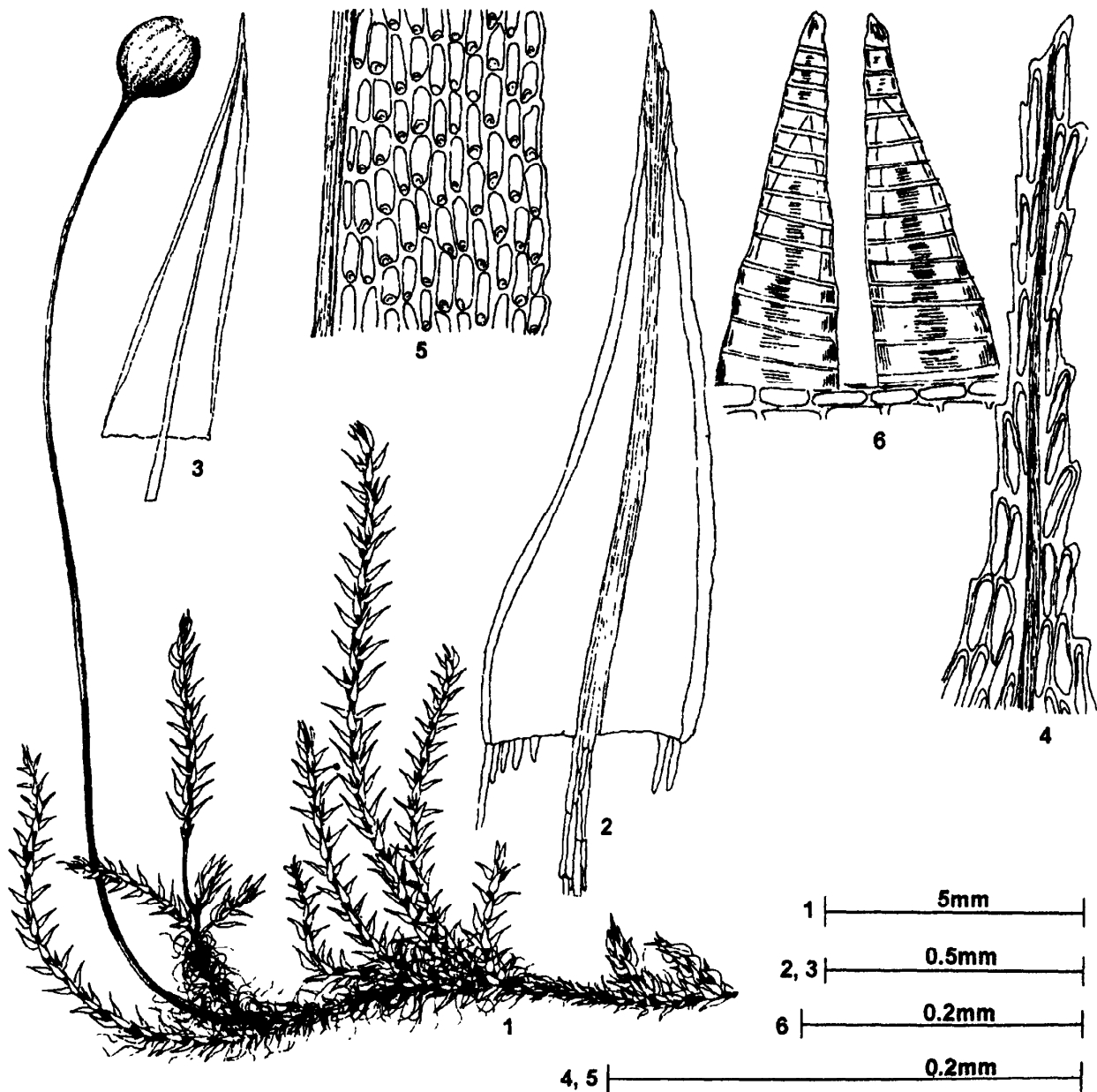


Fig.V (1-6) : *Bartramidula bartramioides* (Griff.) Wijk. & Marg. 1. Habit. 2. A leaf from main stem leaf. 3. A leaf from branch. 4. Apical cells of the leaf. 5. Marginal cells of the leaf. 6. Peristome (exostome only).

Weisia bartramioides Griff. In Cal. J. Nat. Hist. 2 : 489. 1842.

Fig.V (1-6)

Plants small, green, caespitose. Stem slender, 3.4-3.6 mm long, with many subfloral innovations of equal size, covered with leaves, thickly

tomentose below. Leaves variable in size, linear, lanceolate, 2.24-2.3 mm, acuminate, margin inrolled throughout, sharply dentate at tip; branch leaves smaller, $1.1-1.2 \times 0.13-0.15$ mm; cells thin walled, narrow, elongated, mamillate towards apex, $34-36 \times 6.2-6.8$ μm at apex, $28.4-29 \times 10.2-10.8$ μm at base. Seta apical, erect, 15.0-16.0 mm high; capsules erect, ovoid, $2.0-2.3 \times 1.0-1.1$ mm, wrinkled; exostome 160.0-174.0 μm high, 24.0-30.0 μm wide.

Specimens examined : Terrestrial, growing in moist, shaded conditions along with *Dumortiera hirsuta*. Himri, Uttarkashi (1500 m), D.K. Singh 98546-b (BSD).

Distribution : India : Western Himalaya (Uttaranchal), Eastern Himalaya (West Bengal, Sikkim, Assam, Meghalaya, Nagaland), Gangetic Plains (Bihar); Eastern Ghats (Orissa), Western Ghats (Maharashtra); Myanmar, Indonesia, Philippines, Taiwan, Japan.

THUIDIACEAE

6. ***Claopodium prionophyllum*** (C. Muell.) Broth. in Nat. Pfl. 1(3): 1009. 1908. *Hypnum prionophyllum* C. Muell. Syn., 2 : 481. 1851.

Fig.VI (1-6)

Plants yellow to yellow green, phyllocladous, in dense tufts with main stem creeping with distant leaves and pinnate branching. Paraphyllia present. Leaves on main stem larger cordate, lanceolate, 1.8-2.0 mm long, 0.6-0.7 mm wide; those on branches spreading, 1.0-1.2 mm long, 0.24-0.28 mm wide, with narrow tip, margin distinctly dentate; cells ovate-hexagonal, $6.0-8.0 \times 4.0-6.0$ μm in size with single papilla on lumen; marginal cells larger, $22.0-24.0 \times 6.0-8.0$ μm ; middle cells $16.0-19.0 \times 6.0-8.0$ μm ; costa strong and percurrent. Gametangia not seen.

Specimens examined : Epiphytic, growing along with *Metzgeria hamata*. Taluka, Uttarkashi (2200 m), D. K. Singh 98549-b (BSD).

Distribution : India : Eastern Himalaya (Sikkim, West Bengal, Arunachal

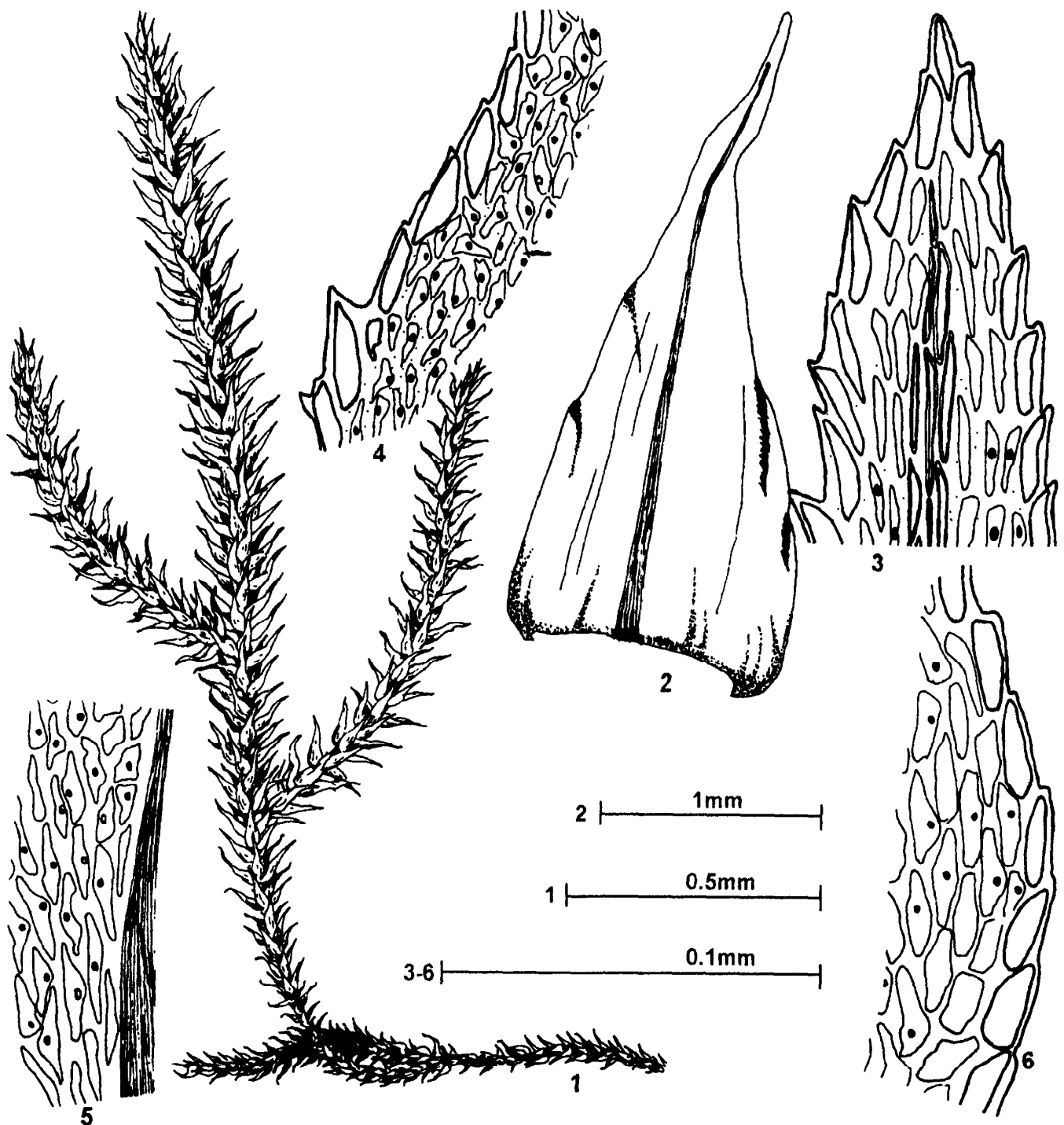


Fig. VI (1-6) : *Claopodium prionophyllum* (C. Muell.) Broth. 1. Habit; 2. A leaf; 3. Apical cells of the leaf; 4. Marginal cells of the leaf; 5. Basal cells along costa; 6. The same along margin.

Pradesh, Meghalaya, Nagaland), Western Himalaya (Uttaranchal), Western Ghats (Tamil Nadu, Kerala); Nepal, Bhutan, Sri lanka, China (Yunnan), Korea, Japan, Taiwan, Philippines, Fiji.

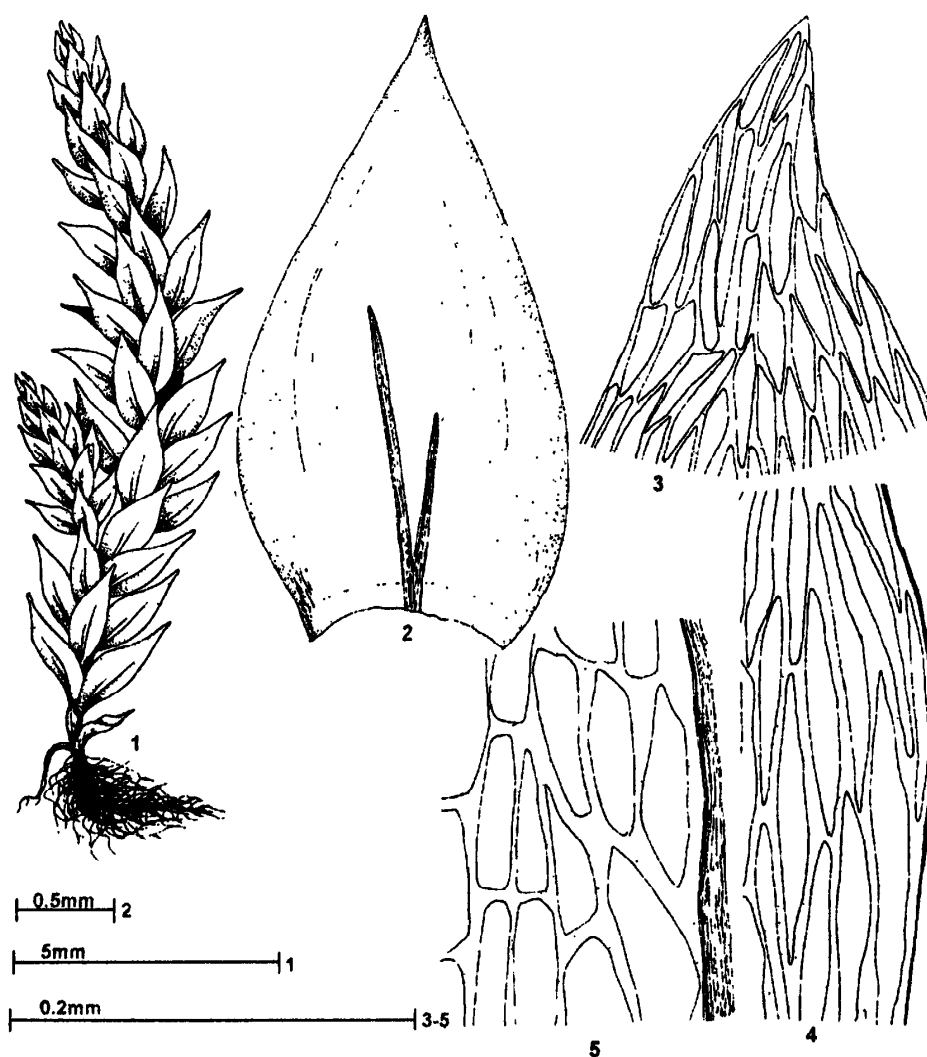


Fig.VII (1-5) : *Plagiothecium neckeroidium* B. S. G. 1. Habit; 2. A leaf; 3. Apical cells of the leaf; 4. Marginal cells along midleaf; 5. Basal cells of the leaf along costa.

PLAGIOTHECIACEAE

7. *Plagiothecium neckeroideum* B.S.G. in Bryol. Eur. 5: 195. 1851.

Fig.VII (1-5)

Plants robust, yellow green, glossy with main stem creeping, without central strand, pinnately branched, branches erect, complanate. Leaves erectopatent, concave, ovate-lanceolate, 3.4-3.6 mm long, 1.0-1.35 mm broad, narrowed at base cells elongated, $65.0-74.0 \times 9.2-12.4 \mu\text{m}$, becoming wider below alar cells; at basal angles quadrate to rectangular $34.0 \times 24.6 \mu\text{m}$ in size; nerves two, unequal in size, one reaches up to middle of the leaf while other up to two third of the leaf. Gametangia not seen.

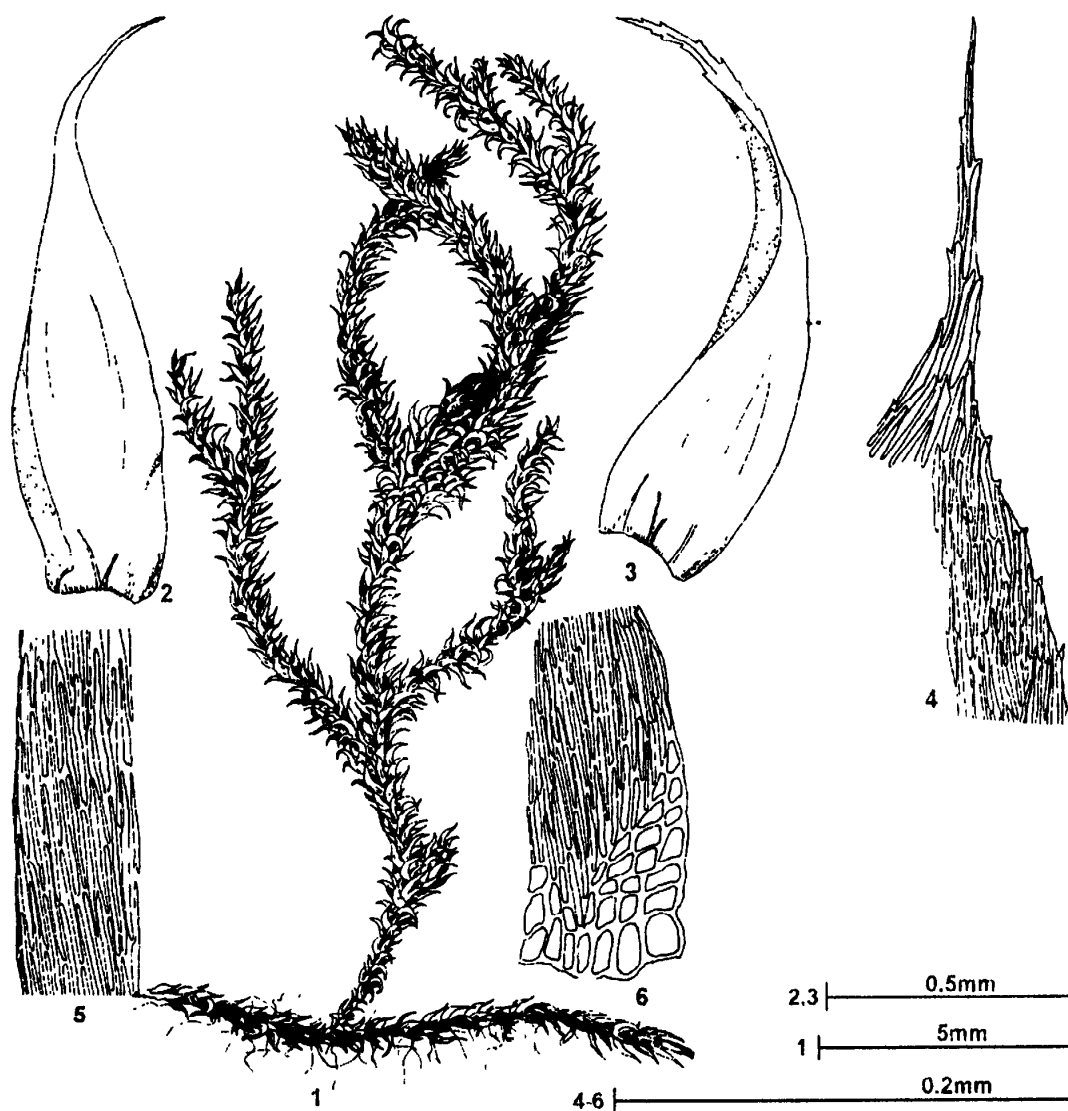


Fig.8 (1-6) : *Hypnum cupressiforme* Hedw. 1. Habit; 2, 3. Leaves; 4. Apical cells of the leaf; 5. Marginal cells; 6. Alar cells.

Specimens examined : Terrestrial, growing along with *Reboulia hemisphaerica* and *Atrichum undulatum* var. *hausknechtii*. Taluka, Uttarkashi (2200 m), D.K. Singh 98553-d (BSD).

Distribution : India : Eastern Himalaya (Sikkim, West Bengal), Western Himalaya (Uttaranchal), Western Ghats (Tamil Nadu); Nepal, Bhutan, China (Yunnan), Indonesia, New Guinea, Philippines, Taiwan, Japan, C.I.S., Europe.

HYPNACEAE

8. *Hypnum cupressiforme* L. ex Hedw., Sp. Musc.: 291 1801

Fig.8 (1-6)

Plants highly variable in morphology, mostly robust, light green to greyish green in colour, glossy in appearance, 4.0-7.0 mm long; branching irregularly pinnate, branches spreading or may be ascending or very often curved. Leaves highly imbricate, strongly falcate, concave, ovate or oblong-lanceolate, 1.0-1.2 mm long, 0.4-0.54 mm wide, margin faintly denticulate at apex; cells linear, $52.0-64.0 \times 6.0-8.0 \mu\text{m}$ at apex and middle portion; alar cells highly developed, represented by quadrate to subquadrate cells, $24.0-28.0 \times 18.0-20.0 \mu\text{m}$ in size; costa very short, double but hardly visible. Gametangia not seen.

Specimens examined : Terrestrial, growing along with *Conocephalum conicum*. Taluka, Uttarkashi (2200 m), D.K. Singh 98548-b (BSD).

Distribution : India : Eastern Himalaya (Sikkim, Meghalaya), Western Himalaya, (Jammu & Kashmir, Uttaranchal), Western Ghats (Tamil Nadu); Central Asia; C.I.S., China(Yunnan), Africa, Europe; Canada, U.S.A., Australia, New Zealand.

LESKEACEAE

9. *Regmatodon orthostegius* Mont. in Ann. Sc. Nat. Bot. ser. 2, 17: 248. 1842.

Fig.9 (1-9)

Plants julaceous, forming dense tufts, dark-green, 11.0-15.0 mm long, repeatedly pinnately branched. Leaves dense, imbricate, ovate-apiculate, 1.2-1.4 mm long, 0.5-0.68 mm broad; cells irregularly rhomboidal, incrassate, $12.0-15.0 \times 6.0-7.0 \mu\text{m}$ at apex; sub-hexagonal $7.0-9.0 \times 10.12 \mu\text{m}$ in size at base; shorter, rectangulate, $10.0-12.0 \times 7.0-8.0 \mu\text{m}$ towards lamina; costa reaches up to 2/3 of leaf, cells elongated, $18-20 \times 4-5 \mu\text{m}$. Seta smooth, 1.2-1.5 mm long; capsule, 2.8-3.2 mm long, 0.65-0.68 mm in diameter; inner peristome 560.0-585.0 μm high; operculum conical; spores dark brown, globose, $22.0-44.0 \mu\text{m}$ in diameter.

Specimens examined : Epiphytic, growing along with *Porella campylophylla*. Seema, Uttarkashi (2200 m), D.K. Singh 98550-b (BSD).

Distribution : India : Eastern Himalaya (Sikkim, West Bengal, Meghalaya), Western Himalaya (Uttaranchal); Western Ghats (Tamil Nadu); Nepal, Bhutan, Sri Lanka, China, (Yunnan), Pakistan.

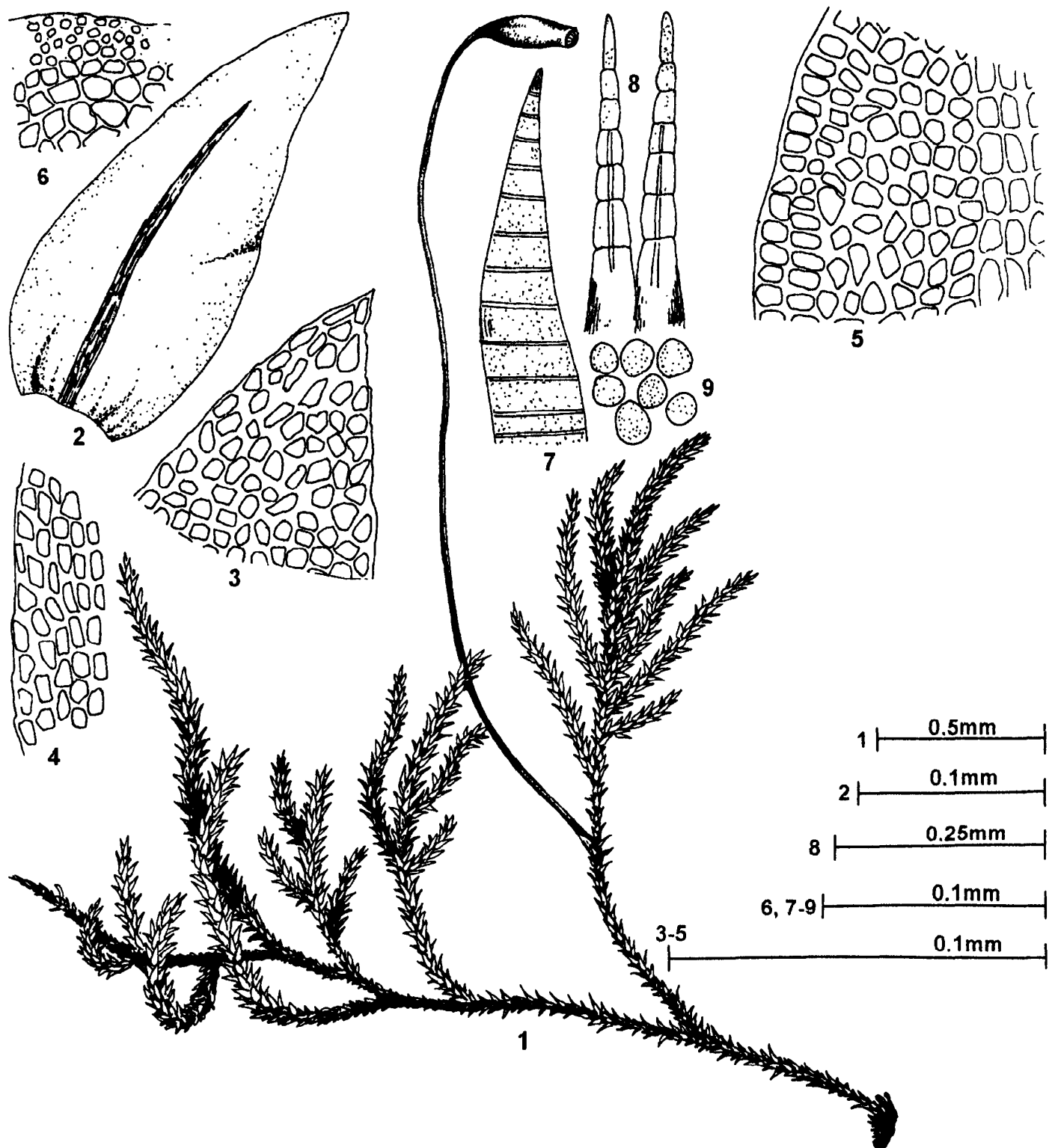


Fig.9 (1-9) : *Regmatodon orthostegius* Mont. 1. Habit; 2. A leaf; 3. Apical cells of the leaf; 4. Marginal cells; 5. Basal cells along margin; 6. T. S. Stem (a portion); 7. Exostome; 8. Endostome; 9. Spores.

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