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Three new species of *Scapania* (Hepaticae) from India and China

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Three new species of *Scapania* (Dumort.) Dumort., *S. davidii* Potemkin, *S. sinikkae* Potemkin, and *S. schljakovii* Potemkin are described from collections of Dr. David G. Long (Edinburgh, Scotland) from India and China. The species are illustrated in line drawings. Their infrageneric position and diagnostic characters are discussed.

Key words: hepatics, *Planifoliae, Plicaticalyx, Scapania,* taxonomy

Scapania davidii Potemkin, *sp. nova* (Fig. 1)

Scapania davidii differt a Scapania ornithopoidi (With.) Waddell foliis subaequilobis cum lobis semicirculariter convexis fortiterque recurvatis; lobis dorsalibus foliorum subrotundis; dentibus marginalibus folii constanter fusce coloratus.

TYPE: India. Sikkim, West District, Between Dzongri and Prek Chhu, 27°29´N, 88°10´E, dense *Rhododendron* shrub; on mossy bank, alt. 4080 m, 18.VII.1992 *Long 22647* (holotype LE; isotypes E, F, H).

Plants 1.5–1.8(–2.0) mm wide × (20–)40–60(–100) mm long, yellowish brown, with fuscous marginal leaf sectors, rather frequently ventral intercalary branched. Cortex 2–4-stratose of strongly thick-walled cells with deeply pigmented middle lamellae; cortical layer often interrupted ventrally by several tiers of rather thin-walled cells; outer cortical cells more thick-walled and with smaller cavities than internal cells, flattened tangentially; mycorrhizal infection unknown. Leaves regularly spinose-dentate from apex to base, with longer basal teeth. Dorsal lobe (0.65–)0.85–0.95 of ventral (areas of lobes difficult to compare because of strong convexity and divergence), strongly to slightly divergent with it, divergent from stem at angle ca. 0–10°, subrotund to broadly oblong, broadly obovate or broadly ellipsoid, seeming more narrow because of strong hemispherical convexity, broadly rounded to blunt, sporadically with a point, ± extending beyond further edge of stem, × 1.0–1.33 as wide as long, arcuately inserted and rather long-decurrent. Ventral lobe divergent with stem at angle ca. 60–90°, turned

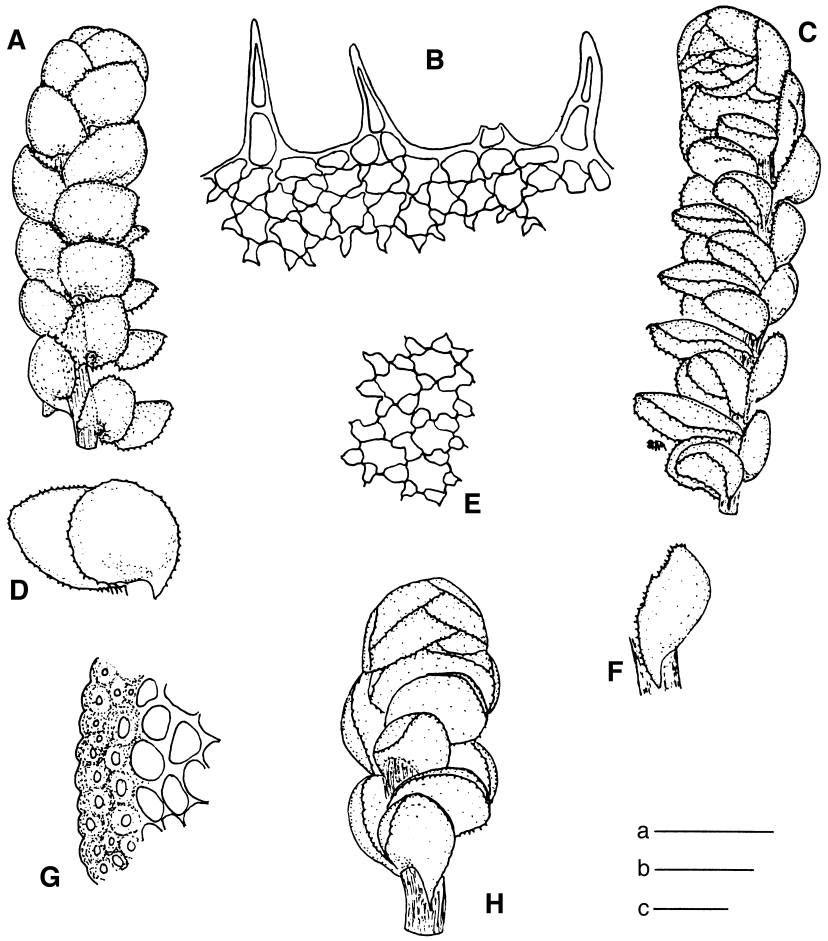

Fig. 1. *Scapania davidii* Potemkin (from the holotype). — **A**: Shoot sector, antical aspect. — **B**: Sector of postical margin of ventral lobe. — **C**: Shoot sector, ventro-lateral aspect. — **D**: Leaf. — **E**: Median cells of ventral lobe. — **F**: Dorsal lobe on stem. — **G**: Sector of stem cross section. — **H**: Shoot sector, postical aspect. Scale bars: a = 1 mm (**D**, **F**, **H**); b = 50 μm (**B**, **E**, **G**); c = 1 mm (**A**, **C**).

backward so strongly that lobes of opposite leaves situated one over the other and ± perpendicular to stem and virtually forming one ventral row, ovate to broadly ellipsoid, strongly almost hemispherically convex, blunt to rounded, when flattened about × (0.85–)0.95–1.0 as wide as long, decurrent below keel insertion, with not differentiated basal sector of postical margin. Keel acute from base to sinus, very short, to 0.1 ventral lobe length, straight to slightly arched; wing bearing some spinose teeth or solitary cilia. Marginal teeth spinose, mostly fuscous, 1(–2) cells at base, 1–2 cells long distally and medially, to 4 cells long near leaf base, with 1–2(–4)-celled uniseriate ends and terminal cells × (2–)3–4.5 as long as wide. Marginal cells distally ca. 12–14 × 14–17 μm, thin- to slightly thick-walled. Median cells of ventral lobe ca. 14–17(–20) × 16–20(–23) μm, thin-walled, with moderate to large, slightly to strongly bulging subconfluent angulate trigones. Basal cells of ventral lobe not differentiated in area of lax tissue, ca. 17 × 28–35 μm, thin-walled, with rather large bulging trigones. Oil bodies unknown. Cuticle smooth distally to rather coarsely papillose, with small to large flattened papillae, in basal and occasionally median leaf sectors. Gemmae unknown. Dioicous. Androecia of about 4–5 pairs of probably polyandrous bracts (antheridia decayed), slightly differing from sterile shoot sectors due to stronger convex dorsal lobes of bracts; paraphyses numerous, rather small, lobulate spinose-dentate and ciliate. Female plants unknown.

ETYMOLOGY: The species is named after Dr. David G. Long of Edinburgh, Scotland, who collected the specimen.

RANGE: **India**. Sikkim, West District 27°29´–31´N,

88°10´–12´E, *Long 22647, 22864* (paratypes LE, E, H). **China**. Xizang, 50 km from Bhutan, Cona, 28°N 92°E, *Xizang ecol. group M7440a* (paratypes LE, PE as *Scapania karl-muelleri*). **East Nepal**. 27°04´–37´N, 87°08´–57´E, *Long 16980, 21008* (paratypes LE, E, TNS).

HABITATS: Under *Rhododendron* shrubs; in wet mossy scree; open rocky slope, amongst boulders; huge calcareous boulders on river bank, on mossy rock ledges; 4040–4500 m.

Infrageneric position and differentiation

The species is placed in the sectio *Planifoliae* (Müll. Frib.) Potemkin of the subgenus *Scapania.* Among the species of *Planifoliae* it may be confused with the rather common and widespread *S. ornithopoides* and rare *S. rotundifolia* Nicholson.

Scapania davidii differs from *S. ornithopoides* in the almost subaequally bilobed leaves with broader, hemispherically convex and strongly recurved lobes; subrotund dorsal leaf lobes; constantly brown marginal teeth of leaves; ventral lobes turned backward so strongly that lobes of opposite leaves are situated one over the other and ± perpendicular to the stem and virtually forming one ventral row.

Scapania davidii is distinct from the habitually similar *S. rotundifolia* in the leaf lobes of sterile leaves being ± hemispherically (vs. moderately) convex and subequal in area (dorsal lobe mostly 0.85–0.95 vs. 0.35–0.5(–0.75) the ventral); leaf margins regularly (vs. remotely) spinose dentate, with teeth and often marginal cells fuscous when the leaves are more or less yellowish brown (vs. not differentiated in color); longer leaf teeth, with terminal cells × (2–)3–4.5 (vs. 1.5–2.5) as long as wide; dorsal lobe rather long (vs. ± short) decurrent; ventral lobes ovate to broadly ellipsoid (vs. subrotund to ovate), × (0.85–)0.95–1.0 (vs. 1.0–1.2) as wide as long; and in the larger plants, 1.5–1.8 mm wide vs. 0.75–1.0(–1.5) mm wide.

Scapania davidii may also be confused with *S. karl-muelleri* Grolle because of the strongly convex and recurved leaf lobes somewhat similar in shape. However, the former differs from sterile *S. karl-muelleri* in the shorter and more remote, brown pigmented marginal teeth (vs. dense, bleached marginal cilia) with shorter terminal cells (terminal cells × 2–4 vs. (3–)4–7 as long as wide); smaller size of plants (1.5–1.8 vs. 2.3–2.6 mm wide); thicker-walled outer cortical cells with smaller cavities; as well as the almost smooth (vs. irregularly coarsely papillose) cuticle in distal portions of leaves.

Scapania sinikkae Potemkin, *sp. nova* (Fig. 2; Potemkin 1999: fig. 4F–I)

Scapania sinikkae differt a Scapania ciliatospinosa Horik. praesentia fasciculi centralis caulis et lobisque dorsalibus foliorum longe decurrentibus. Differt a Scapania ferruginea (Lehm. & Lindenb.) Gottsche, Lindenb. & Nees praesentia fasciculi centralis evidenti et longe lateque decurrentibus lobis ventralibus foliorum.

TYPE: China. Yunnan, Diqing Prefecture: Zhongdian Co., forested ridge above Na Pa Hai, N of Zhongdian, 27°55´N, 99°34´E. Steep mossy *Abies/Rhododendron* forest; on log, 3905 m, 12.VI.1993 *Long 24242* (holotype LE, isotypes E, F, H).

Plants 2.5–4 mm wide × 20–50 mm long, green to brown, with sporadic ventral intercalary branches. Cortex 3–4-stratose of moderately thick-walled cells; cortical layer often interrupted ventrally by several tiers of rather thin-walled cells; outer cortical cells with thin to slightly thickened walls and larger cavities in comparison with more thick-walled intracortical cells, ± regularly flattened tangentially; central strand of thick-walled and ± brown cells constantly present except sometimes absent in apical and prostrate basal stem sectors; mycorrhizal infection often abundant in internal cortical cells, sporadic in outer cortical cells and diffuse in medullary cells (Fig. 2K). Leaves spinose dentate everywhere except in decurrent strips of dorsal lobes. Dorsal lobe 0.25–0.5 (larger on male bracts) of the ventral, strongly to rarely slightly divergent from it, divergent with stem at an angle of ca. 10–20(–45)°, cordate-reniform to ovate, usually with a spinose tip, slightly to moderately extending beyond the further edge of stem or not extending, × 1–1.5 as wide as long, ± arcuately inserted and narrowly long decurrent (about as long as ventral lobe). Ventral lobe divergent from stem at an angle ca. 50–90°, ovate to ellipsoid and lingulate, broadly

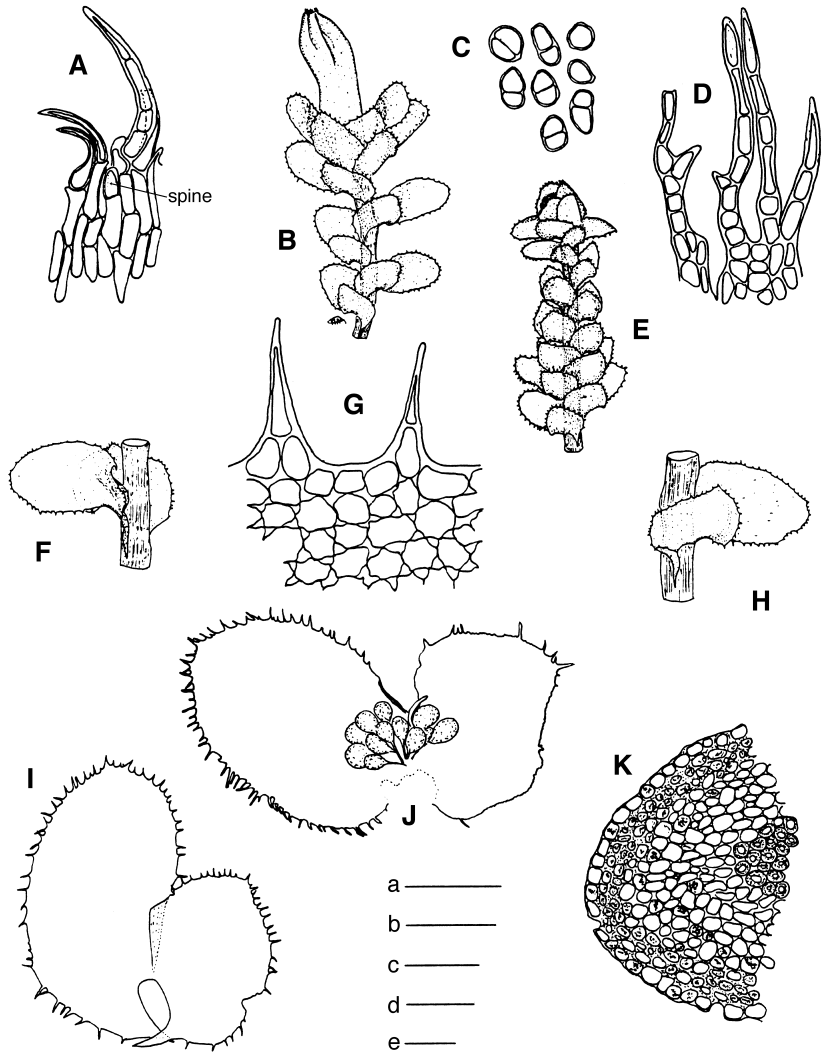

Fig. 2. — **A**: *Scapania ciliatospinosa* Horik. (from *Long 8038*, LE. — **B**–**K**: *S. sinikkae* Potemkin (from the holotype). — **A** and **D**: Sectors of perianth mouths. — **B**: Sector of shoot with perianth. — **C**: Gemmae. — **E**: Sector of male gemmiparous shoot. — **F**: Leaf on stem, postical aspect. — **G**: Sector of postical margin of ventral lobe. — **H**: Leaf on stem, antical aspect. — **I**: Leaf. — **J**: Male bract with antheridia and paraphyses (dorsal lobe modified from gemma formation). — **K**: Lateral sector of stem cross section. Scale bars: a = 0.6 mm (**I**, **J**); b = 2 mm (**B**, **E**); c = 1 mm (**F**, **H**); d = 40 μm (**C**, **G**); e = 50 μm (**A**, **D**, **K**).

rounded to blunt, × (0.53–)0.6–1.05 as wide as long, broadly long-decurrent below keel insertion; decurrent strips of both lobes usually bleached but their cells not differentiated in wall thickness. Keel acute from its base to sinus, 0.12–0.22 (on male bracts to 0.5) of ventral lobe length, slightly to moderately arched; wing unknown. Marginal teeth ± thick-walled and spinose, ± bleached, 1–2 cells at base, 1(–2) cells long, with 1–2-celled uniseriate ends and terminal cells mostly × 2–4 as long as wide, (22–)34–60(–80) μm long and (14–)16–23(–25) μm at base. Marginal cells distally ca. (8–)11–19 × 13–25 μm, thin- to moderately thick-walled. Median cells of ventral lobe ca. 14–19(–22) × 16–25(–27) μm, thin-walled, with small to rather large ± bulging trigones. Basal cells of ventral lobe not forming a definite area of lax tissue, ca. 20–25 × 30–45 μm, thin-walled, with trigones similar to those in median cells. Oil bodies unknown. Cuticle smooth or with tiny papillae on surface of marginal teeth. Gemmae sporadic, (1–)2-celled, reddish brown, few almost not pigmented or yellowish brown, thin-walled, broadly to narrowly ovoid, few somewhat angulate, ca. 13–17(–19) × 20–25(–37) μm, × 1.2–1.6(–2.7) as long as wide; intensive gemma formation resulting in local erosion of marginal teeth (Fig. 2J). Dioicous. Androecia several per shoot, of 3–4 pairs of ± smaller bracts with many (up to 12) antheridia in axils, with larger convex dorsal lobes (to 0.85 ventral) and longer

(to 0.5 ventral lobes) keels (Fig. 2E); paraphyses ± numerous, fimbriate-ciliate and narrowly laciniate. Female bracts similar to sterile leaves, with ± larger dorsal lobes and longer keels. Perianth subcylindrical, multistatose at least in proximal half, with several (about 8) plicae in the upper half; mouth lobulate and densely ciliate, smooth, with cells below teeth largely subisodiametric and cilia 3–12 cells long, sporadically with short accessory teeth at base, with terminal cells 35–75 × 14–17(–19) µm, × 2–4.6 as long as wide (Fig. 2D). Sporophyte unknown.

ETYMOLOGY: This species is named after Prof. Sinikka Piippo of Helsinki, Finland, to whom I am most grateful for help in my studies on *Scapania*.

RANGE: **China.** Yunnan, Diqing Pref.: 27°55´–40´46´´N, 99°34´–46´08´´E, *Long 19031, 24242, 24254, 24418* (LE, E, H); Yunnan, *Wang Qi-wu 7259, Xie Huifang 2065* (LE, PE as *S. ciliatospinosa* and *S. ferruginea*); Xizang: NW of Sikkim, Diggye, 28°30´N, 87°30´E, *Xizang group 7583* (LE, PE as *S. ciliatospinosa*).

HABITATS: On rotten wood in *Abies/Rhododendron* and *Abies* forests, at 3100–3975 m.

Infrageneric position and differentiation

Scapania sinikkae is a species of *Plicaticalyx* Müll. Frib. It is related to *S. ferruginea* and, more distantly, to *S. ciliatospinosa,* with which it was confused by Potemkin (1999). *Scapania ciliatospinosa* occasionally has dorsal lobes of leaves inserted subparallel to stem. They are, however, never broadly long-decurrent like in *S. sinikkae* and *S. ferruginea* (cf. Fig. 2H and Potemkin 1999: fig. 4D). The central strand of *S. sinikkae* appears to have a supporting function, important when cortical cells are rather weakly developed. It may occasionally be absent in apical shoot sectors and in prostrate basal sectors. I have observed a vestigial central strand in some specimens of *S. ferruginea* (*Long 22492, 24503,* LE, E). Such forms of *S. ferruginea* can be distinguished from *S. sinikkae* by the ventral lobe broadly decurrent approximately to the level of keel insertion only. Also, the central strand of *S. ferruginea* consists of weakly thick-walled cells with large cavities and it is defined mostly by a brownish pigmentation. *Scapania sinikkae* is assumed to be closer to *S. ferruginea* rather than to *S. ciliatospinosa* because its perianth mouth has a similar structure as in *S. ferruginea*, having a smooth (vs. spinose in *S. ciliatospinosa*) surface of subisodiametric cells below the cilia (vs. of mostly regularly elongated cells) and variable terminal tooth cells × 2–4.6 as long as wide (vs. × 6–7 as long as wide).

Scapania schljakovii Potemkin, *sp. nova* (Fig. 3)

Scapania schljakovii differt a Scapania ornithopoidi lobis foliorum non decurrentibus, saepe media basi decoloratus; lobis dorsalibus foliorum multo majoribus, 0.6–0.8 plo ventralium; perianthio multistratoso subcylindrico cum ore lobulato-dentato-ciliato cum spinifer pagina. Differt a S. himalayica foliis ad basim regulariter dentatis fusceque marginatis, incrassione arietum cellularium medii folii deminuta.

TYPE: India. Sikkim, North District: glacial valley above Yakche, N of Lachung 27°43´09´´N, 88°44´47´´E; steep rocky valley; on dripping acid cliff, ca. 3 180 m alt., 15.VII.1996 *Long 26450* (holotype LE, isotypes E, F, H).

Plants 2–2.75 mm wide × 15–50 mm long, olive brown to fuscous, with sporadic short ventral intercalary branches. Cortex 1–3-stratose of strongly to moderately thick-walled, mostly fuscous black cells with sporadically discernible deeper pigmented middle lamellae in inner strata; cortical layer often interrupted ventrally by several tiers of rather thin-walled cells; outer cortical cells with smaller cavities than internal cells, flattened tangentially; mycorrhizal infection unknown. Leaves spinose-dentate everywhere, with more remote and often shorter teeth to lobe bases and around dorsal lobes; teeth and one row of marginal cells forming a fuscous border at least in upper leaves. Dorsal lobe 0.6–0.8 of the ventral, moderately divergent with it, divergent from stem at an angle of ca. 10–30(–50)°, cordate to ovate, slightly convex, triangularly narrowed to apex, exceptionally rounded with an acute to blunt tip, extending beyond the further edge of stem, insertion arcuate. Rather sharply defined sequences of leaves distinct on many shoots, where leaves more remote and with narrower dorsal lobes, × 0.89–1.0 as wide as long, altered with leaves more densely placed,

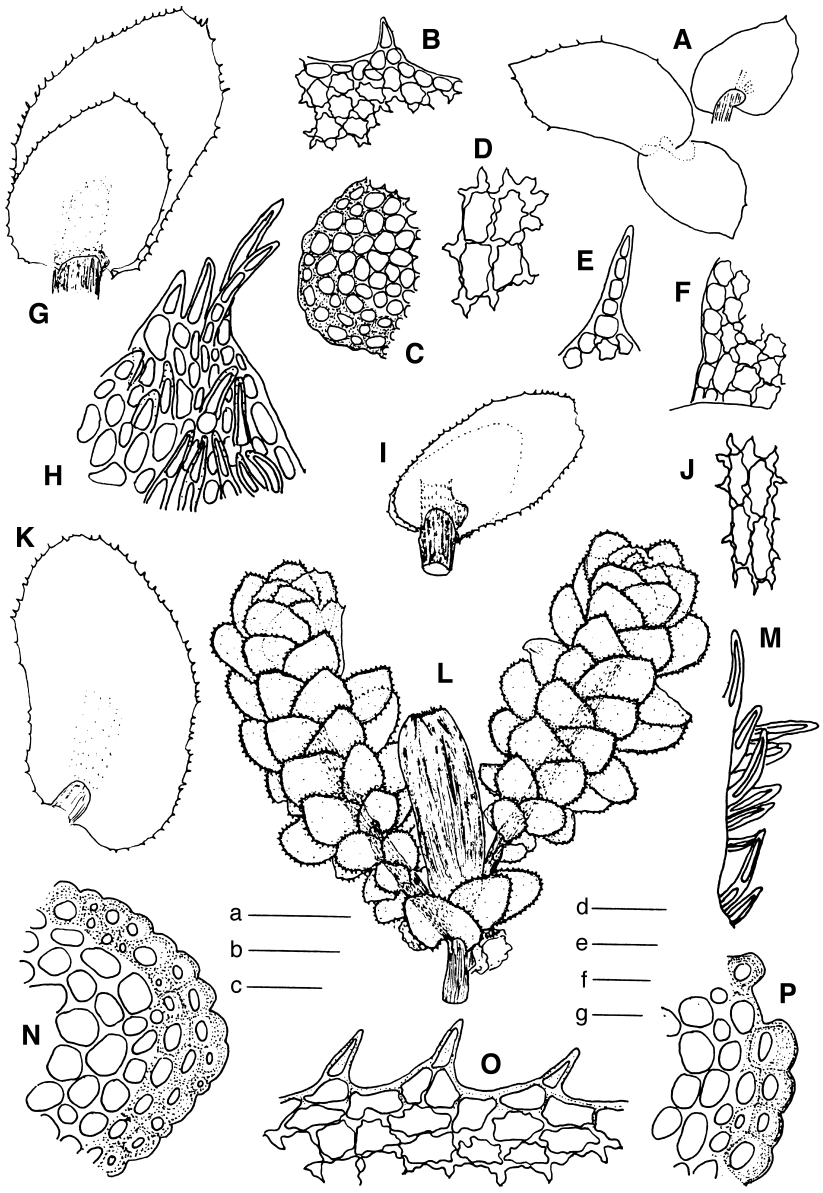

Fig. 3. — **A**–**F**: *Scapania himalayica* Müll. Frib. (from *Poelt H156*, JE). — **G**–**P**: *S. schljakovii* Potemkin (from the holotype). — **A**: Ventral leaf lobe and two dorsal leaf lobes (upper dorsal lobe with sector of stem and an area of lax tissue). — **B**: Median sector of postical margin of ventral lobe. — **C**: Lateral sector of stem cross section. — **D** and **J**: Basal median cells of ventral lobe. — **E**: Cuspidate apex of dorsal lobe. — **F**: Antical margin of dorsal lobe at place of insertion. — **G**: Leaf on stem, antical aspect. — **H**: Sector of perianth mouth with numerous spines on its surface. — **I**: Leaf on stem, postical aspect. — **K**: Ventral lobe with stem sector and (dotted) area of lax tissue. — **L**: Shoot sector with perianth. — **M**: Sector of perianth near mouth, lateral aspect (upper spine of mouth and lower spines on perianth surface). — **N** and **P**: Lateral sectors of stem cross sections in median part of stem and near shoot apex respectively. — **O**: Medial sector of postical margin of ventral lobe. Scale bars: a = 40 μm (**N**–**P**); b = 0.5 mm (**G** and **K**); c = 50 μm (**B**–**F**); d = 0.5 mm (**A**); e = 1 mm (**L**); f = 50 μm (**H**, **J**, **M**); g = 0.5 mm (**I**).

probably modified from gemma formation, with non-bordered and hardly dentate, broader dorsal lobes, × 1.2–1.33 as wide as long. Ventral lobe divergent from stem at an angle of ca. 45–70°, ligulate to broadly ellipsoid, acute to broadly rounded at apex, × 0.59–0.7(–0.79) as wide as long, not hyaline and similarly pigmented near base margin, but often bleached and hyaline in ventral as well as dorsal lobe middle, insertion arcuate. Keel acute, vestigial, distinct on juvenile leaves, lobes connected apparently largely by stem projections (Fig. 3I). Marginal teeth deep brown, 1(–2) cells at base, 1–2 cells long with 1–2-celled uniseriate ends and terminal tooth cells occasionally bleached, spinose, 20–30 µm long, 10–14 µm wide at base, × 1.5–2.3 as long as wide. Marginal cells distally ca. 14–20 × (14–)17–28 µm, somewhat evenly thick-walled (clearly more thick-walled than intramarginal and median cells). Median cells of ventral lobe ca. (15–)20–25(–27) × (20–)23–28 µm, thin-walled, rarely with intermediate thickenings on longer cell walls, with medium-sized, distinctly bulging, trigones narrowed in median sectors. Basal cells of ventral lobe ca. 14–20(–23) × 42–86 µm, forming sharply defined large to rather small areas of lax tissue, thin-walled, with intermediate thickenings, trigones bulging, smaller and strongly elongated along walls (Fig. 3J). Oil bodies unknown. Cuticle ± smooth. Gemmae unknown. Dioicous. Androecia unknown. Female bracts similar to sterile leaves but larger. Perianth subcylinderic, somewhat compressed, deep blackish to greenish fuscous, multistratose from base to mouth, slightly plicate with rather densely spinose surface near mouth (Fig. 3H and M); mouth lobulate, dentate-ciliate, not bleached, with 1-celled spinose teeth and cilia to 3 cells long of strongly elongated cells and terminal cells × 4–5 as long as wide. Sporophyte unknown.

ETYMOLOGY: This species is named after Roman Nikolaevich Schljakov, an outstanding Russian bryologist.

RANGE: **India**. Northern Sikkim. Known from the holotype and a paratype (*Long 26451*) collected in the same place (LE, E).

HABITAT: Steep rocky glacial valley; on dripping acid cliff, 3180 m altitude.

Infrageneric position and differentiation

Scapania schljakovii represents the most advanced member of the genus and, together with the poorly known *S. himalayica* (described by Herzog 1939), belongs in an as yet undescribed section of *Scapania*.

When sterile, *Scapania schljakovii* has a similar habit as *S. ornithopoides*. However, it differs from *S. ornithopoides* in several characters. The leaf lobes are non-decurrent, often bleached at median parts of bases. The dorsal lobes are larger, 0.6–0.8 of the ventral lobes. The leaf trigones are peculiar, ± concave medially and ± bulging in distal portions (Fig. 3J and O). *Scapania schljakovii* differs from *S. himalayica* in the leaf margins, which are regularly dentate to their base and with a fuscous border; the median leaf cells have less thickened walls and the marginal cells of distal leaf sectors have somewhat thickened walls (vs. thin-walled).

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