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THREE NEW SPECIES OF *SCAPANIA* (HEPATICAE) COLLECTED BY DR. DAVID G. LONG IN NEPAL

ТРИ НОВЫХ ВИДА *SCAPANIA* (HEPATICAE), СОБРАННЫХ Д-РОМ ДЭВИДОМ ЛОНГОМ В НЕПАЛЕ

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Abstract

Scapania pseudocontorta sp. n., *S. spiniloba* sp. n., and *S. zhukovae* sp. n. were present in collections by Dr. David G. Long from East Nepal, Sankhuwasabha District: Pemathang Kharka, S side of Barun Khola. Their descriptions and known ecology are provided. Diagnostic characters of each species are defined and illustrated. *S. pseudocontorta* shares characters with *S. contorta* and *S. hians* but differs in its smooth leaf cuticle; *S. spiniloba* occupies an intermediate position between *S. hians* and *S. orientalis*; and *S. zhukovae* is related to *S. ornithopoides* differing from it primarily in distant rather broad-based marginal teeth and unistratose cortex of extremely thick-walled cells.

Резюме

Scapania pseudocontorta sp. n., *S. spiniloba* sp. n. и *S. zhukovae* sp. n. выявлены в сборах д-ра Дэвида Лонга из Восточного Непала, все три из одного местонахождения. Приводятся описания видов и известные данные об экологии. Их диагностические признаки описаны и проиллюстрированы. *S. pseudocontorta* характеризуется признаками *S. contorta* и *S. hians*, но имеет гладкую кутикулу листьев; *S. spiniloba* занимает промежуточное положение между *S. hians* и *S. orientalis*, а *S. zhukovae* родственна *S. ornithopoides*, от которой отличается прежде всего редкими, относительно широкими в основании зубцами листьев и однослойной чрезвычайно толстостеной корой.

Collections of Dr. David G. Long from East Nepal (Sankhuwasabha District: Pemathang Kharka, S side of Barun Khola, 27°44'N, 87°12' E) include three new species of *Scapania* (Dumort.) Dumort. These well-defined and evolutionary interesting species are significant for understanding the evolution of *Scapania* and will be considered in subsequent publications.

Scapania pseudocontorta Potemkin, species nova (Fig. 1)

Species habitu *Scapaniae contortae* Mitt. similis, a qua differt: (1) cuticula foliorum levi; (2) dentibus marginalibus et cellulis foliorum coloratione a reliquis cellulis folii non differentibus; (3) marginibus posticalibus foliorum ad basim integris; (4) lobis posticalibus foliorum distaliter triangulariter sensim angustati; (5) lobis anticalibus foliorum plerumque ultra caulem non extensis; (6) cellulis foliorum cum lamellis medianis fusce vel purpureo coloratis parietalibusque nodulatis hyalinis valde incrassatis.

Plants 2-3.5 mm wide x 20-35 mm long, fuscous brown (blackish when dry), with upper gemmiparous leaves purplish. Cortex 2-4-stratose, of strongly thick-walled cells with distinct in thin sections deep pigmented middle lamellae, broadly interrupted ventrally by several tiers of nonpigmented thin-walled cells. Outer cortical cells thicker-walled and smaller than internal cells, varying from noncompressed to definitely tangentially compressed in the same stem section, with smooth to faintly papillose (seen in upper shoot sectors) outer surface; mycorrhizal infection unknown. Leaves dentate distally with distribution of marginal teeth or their vestiges at most to the lower sectors of the middle third of postical margin. Dorsal lobe 0.68-0.72 the lenght of ventral, subparallel it, divergent from stem at angle ca. 40-

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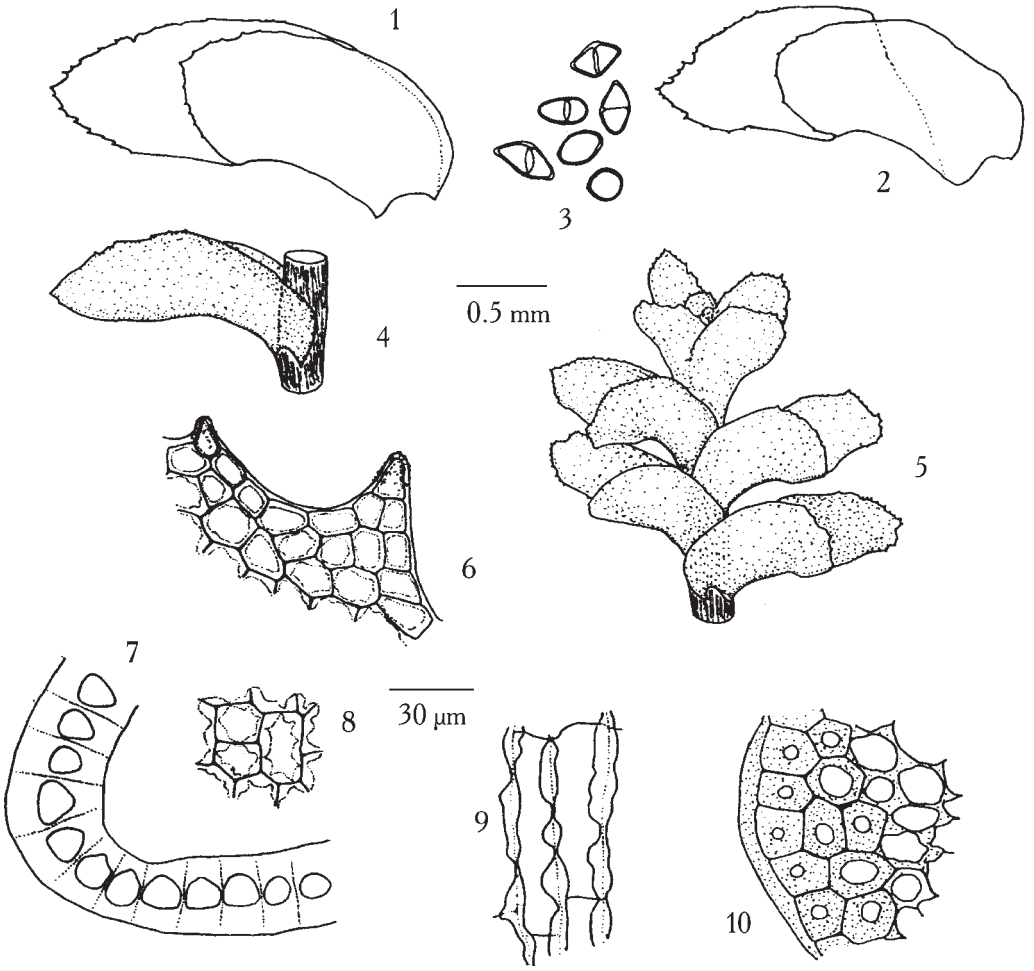

Fig. 1. *Scapania pseudocontorta* Potemkin (from holotype, Long 20761, LE): 1, 2 – leaves; 3 – gemmae; 4 – leaf on stem, postical aspect; 5 – upper sector of gemmiparous shoot; 6 – distal sector of postical margin of ventral lobe; 7 – keel cross section, medially; 8 – median cells of ventral lobe with distinct middle lamellae and hyaline parietal thickenings; 9 – basal cells of ventral lobe from area of lax tissue; 10 – lateral sector of thin stem section with distinct middle lamellae of outer cells and hyaline parietal thickenings. Scale bars: 0.5 mm for 1, 2, 4, 5; 30 μm for 3, 6-10.

55°, obliquely ovate, somewhat falcate, broadest in the lower half of the middle third, convex, triangulary narrowed in ±sharp apiculus, reaching the further edge of stem but mostly not extending beyond it, x 0.57-0.7 as wide as long, inserted arcuately and ±short decurrent, frequently ±turned to the ventral side. Ventral lobe divergent from stem at angle ca. 45-60°, ligulate and somewhat falcate, ±gradually triangularly narrowed in sharp apex, x 0.39-0.44 as wide as long, arcuately inserted and narrowly short to broadly long decurrent below the keel insertion or not decurrent, frequently turned to the ventral side, not hyaline and similarly pigmented near base margin. Keel 1-stratose, ±angulate to narrowly rounded everywhere except proximal leaf portion, where usually rather broadly rounded, about 0.5 ventral lobe length, slightly to rarely moderately arched, stronger near sinus, wing unknown. Marginal teeth mostly not spinose, gradually rounded on tips, never regularly differentiated in color from the adjacent leaf sectors, 1-3 cells at base, 1-3(-4) cells long, with 1(-2)-celled uniseriate ends and terminal cells x (1.0-)1.2-1.8 as long as wide. Marginal cells distally ca. (6-)8-11 x 11-17(-24) μm, slightly evenly thick-walled, without trigones. Median cells of ventral lobe at level of sinus ca. 14-17 x 17-23 μm, thin-walled, with brown or purple middle lamellae and with pel-

Table 1. Distinctive characters of *Scapania pseudocontorta* Potemkin and *S. contorta* Mitt.

Characters	*Scapania pseudocontorta*	*Scapania contorta*
Leaf margins	not differentiated in color	differentiated due to deep brown marginal teeth and cells
Ventral lobe apex	±triangulary narrowed	±rounded
Marginal teeth	not spinose distributed at most to the middle third of postical margin	spinose distributed at most to the base of postical margin
Dorsal lobes	broadest in the middle third, about as wide as ventral lobe, extending to but mostly not beyond the further edge of stem	broadest in the proximal third, broader than ventral lobe, extending normally beyond the further edge of stem
Cuticle	smooth	irregularly coarsely papillose
Median leaf cells	with deep pigmented middle lamellae contrasting with large nodular hyaline parietal and often confluent thickenings indistinguishable when leaf observed with small magnifications	with at most slightly differentiated middle lamellae
Basal leaf cells	form large area of lax tissue in median sector of leaf base	form mostly small area of lax tissue in median sector of leaf base

lucid very coarse elongated and often confluent trigones. Basal cells of ventral lobe form extensive area of lax tissue at leaf base middle, ca. 17-23 x 40-75 μm, thin-walled with strongly longitudinally elongated brown bulging angular thickenings and intermediate thickenings or thick-walled because of confluent thickenings; their middle lamellae often indistinct. Oil bodies not persistent, unknown. Cuticle smooth to sporadically faintly papillose on marginal teeth and along leaf margins. Gemmae common in studied specimen, (1-)2-celled, purplish brown, thin-walled, variable in shape from ovoid to citron-shaped, rhomboid, and subtriangular, 13-14 x 20-23 μm, x 1.4-1.75 as long as wide. Androecia, perianths and sporophytes unknown.

Type. East Nepal, Sankhuwasabha District: Pemathang Kharka, S side of Barun Khola, 27°44'N, 87°12' E, 29.09.1991 D.G. Long 20761 (LE, holotype; E, H, TNS, isotypes)

Range. Known only from the type locality.

Habitat. Ravine in dense *Rhododendron/Betula/Abies* forest; on wet shady cliff, ca. 3500 m alt.

Differentiation and taxonomic status. *Scapania pseudocontorta* resembles *S. contorta* and, at first glance, seems to be an ecological form or variety of the latter. Detailed comparison of both species decriptions shows that *S. pseudocontorta*, being similar in habit to *S. contorta*, possesses a number of characters of *S. hians* Steph. ex Müll. Frib. (= *S. papillosa* Müll. Frib., syn nov.) and is distinct from both species in having a smooth cuticle and very peculiar thickenings of the leaf cells. Distinctive characters of *S. pseudocontorta* and *S. contorta* are opposed in Tab. 1.

Criteria 1-5 and 7 of *Scapania pseudocontorta* are also shawn in *S. hians*, from which it differs in the considerably larger size of plants (2-3.5 vs. 1-1.7 mm wide); invariably thick-walled outer cortical cells; in the absence of mycorrhiza infection (vs. rather common diffuse circular mycorrhiza infection); smooth (vs. regularly coarsely papillose) cuticle; in the more elongated terminal tooth cells (x (1.0-)1.2-1.8 vs. 1.0-1.5 as long as wide) and in the mostly lower tooth distribution along postical leaf margin as well as in peculiar leaf areolation.

The facts above persuade me to distinguish *Scapania pseudocontorta* as a distinct species rather than an infraspecific taxon of *S. contorta*.

Scapania spiniloba Potemkin, species nova (Fig. 2)

Scapania spiniloba differt a *Scapania hiantis* lobis foliorum in apicem spinose acuminatis; cuticula foliorum sublevi; carina foliorum breviore; minoribus cellulisque foliorum et majoribus gemmis. *Scapania spiniloba* differt

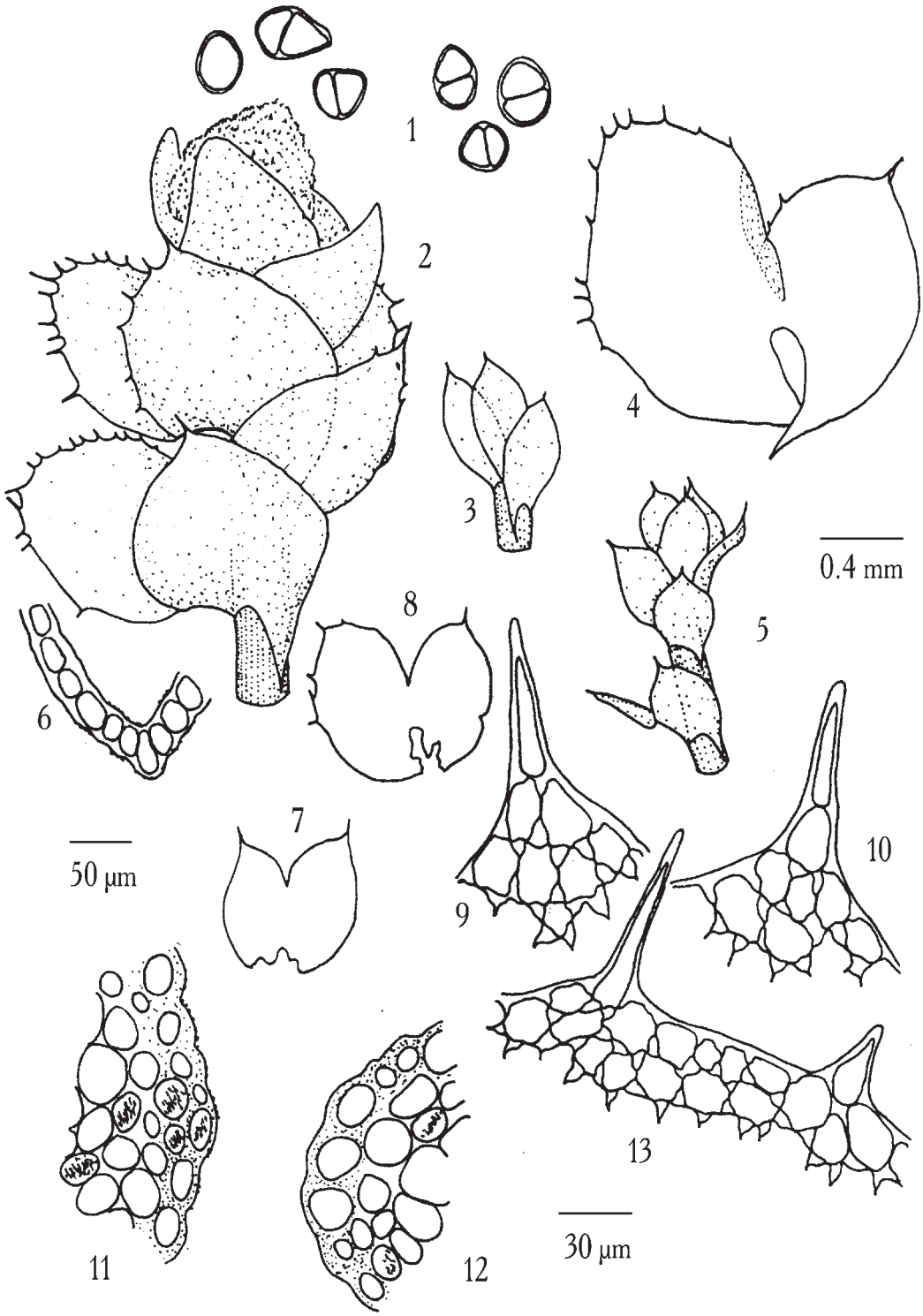

Fig. 2. *Scapania spiniloba* Potemkin (from holotype, Long 20743a, LE). 1 – gemmae; 2 – upper sector of robust gemmiparous shoot, antical aspect; 3 – upper sector of small shoot, mod. *parvifolia-integrifolia*, postical aspect; 4,7,8 – leaves of robust, small and medium-sized plants respectively; 5 – upper sector of small shoot, mod. *parvifolia-integrifolia*, antical aspect; 6 – keel cross section, medially; 9 – apical sector of dorsal lobe of leaf 8; 10 – apical sector of ventral lobe of leaf 8; 11 – lateral sector of stem cross section of robust plant; 12 – lateral sector of stem cross section of small plant; 13 – postical margin of ventral lobe, medially. Scale bars: 0.4 mm for 2-5, 7, 8; 50 μm for 6; 30 μm for 1, 9-13.

Table 2. Principal distinctive features of small phases of *Scapania spiniloba* Potemkin from *S. hians* Steph. ex Müll. Frib.

Character	*Scapania spiniloba* (small)	*Scapania hians*
Leaf lobes	subentire terminated by long bleached spines	dentate to subentire never terminated by long bleached spines
Cuticle	±smooth	±regularly coarsely papillose
Dorsal lobes	obliquely inserted, long decurrent	arcuately inserted, at most short decurrent
Leaf keel	0.2-0.4(-0.5) the ventral lobe length	0.5-0.61(-0.73) the ventral lobe length

a *Scapania orientali* Steph. ex Müll. Frib. minoribus plantis, gemmis cellulisque foliorum; majoribus lobis dorsalibus foliorum; longiore carina foliorum et brevioribus cellulis extremis dentium folii (1.2-5 vs. (2.5-)5.5-7.0 longioribus quam latis).

Plants 0.8-2 mm wide x 4-20 mm long, brownish and purplish to green, simple. Cortex 1-3-stratose, of moderately to rather slightly thick-walled cells, interrupted ventrally by a few tiers of thin-walled not pigmented cells; outer cortical cells slighter thick-walled than internal cells, often bleached, with ±larger cavities, tending to form hyalodermis when cortex (2-)3-stratose, in dorso-lateral sector of stem cross section 11-14 µm wide and 10-12(-14) µm high, tangentially flattened, with ±papillose outer surface; mycorrhizal infection diffuse in the medulla. Leaves entire to remotely spinose dentate particularly along postical margin of ventral lobes, distally or occasionally, on larger plants, dentate to proximal sectors of the middle third of ventral lobes. Dorsal lobe 0.65-0.9 the ventral in area, its length 0.7-0.95 the length of the ventral lobe and the width is less or similar the ventral (width of dorsal lobe at sinus level 0.7-0.95 the ventral), moderately to slightly divergent from it, divergent from stem at angle ca. 15-35°, obliquely ovate and cordate to rounded rectangular and triangular, broadest in the proximal third, plane, slightly convex or incurved, ±spreading out the ventral lobe, ±abruptly spinose tipped on leaves nonmodified from gemma production (spine 1-2 cells at base, 1-4 cells long, with bleached strongly elongated terminal cell ca. 40-70 x 12-16 µm, x 3.3-5 as long as wide), extending to the further edge of stem and in larger plants beyond it, x (0.7-)0.8-1.3 as wide as long (lobe length measured without terminal spine cells), obliquely inserted and long decurrent. Ventral lobe divergent from stem at angle ca. 35-50°, oblong to obovate and ovate, x (0.5-)0.65-0.83 as wide as long, ±abruptly spinose tipped on leaves nonmodified from gemma production (spine 1-2 cells at base, 1-4 cells long, with bleached strongly elongated terminal cells ca. (30-)40-70 x 12-16 µm, x (1.7-)3.3-5 as long as wide), arcuately inserted, moderately to hardly decurrent below or to the keel insertion, not hyaline and similarly pigmented near base margin. Keel acute from

Table 3. Principal distinctive features of large phases of *Scapania spiniloba* Potemkin from *S. orientalis* Steph. ex Müll. Frib.

Characters	*Scapania spiniloba* (large)	*Scapania orientalis*
Marginal cilia	shorter and more slender, with terminal cells to 70 µm long and 12-16 µm wide at base	longer and broader, with terminal cells (50-)100-150 µm long and 17-25 µm wide at base
Dorsal:ventral lobe area	0.65-0.9: 1	0.4-0.6(-0.8): 1
Cortex	weaker defined, 1-3-stratose, with slight differentiation of outer and inner layers	stronger defined, 3-4-stratose, with distinctly differentiated outer and inner layers
Outer cortical cells in cross section	ca.11-14 µm wide and 10-12(-14) µm high	ca. (14-)17-27 µm wide and 19-25 µm high
Leaf keel	ca. 0.2-0.4 the ventral lobe length	ca. 0.15-0.2 the ventral lobe length
Median leaf cells	ca. 13-19 x 16-20 µm	ca. 17-28 x 20-30 µm
Marginal leaf cells	ca. 11-14(-17) µm	ca. 14-23 x 17-25 µm
Gemmae	ca. (14-)17 x 17-28 µm	ca. 17-21 x 20-32 µm

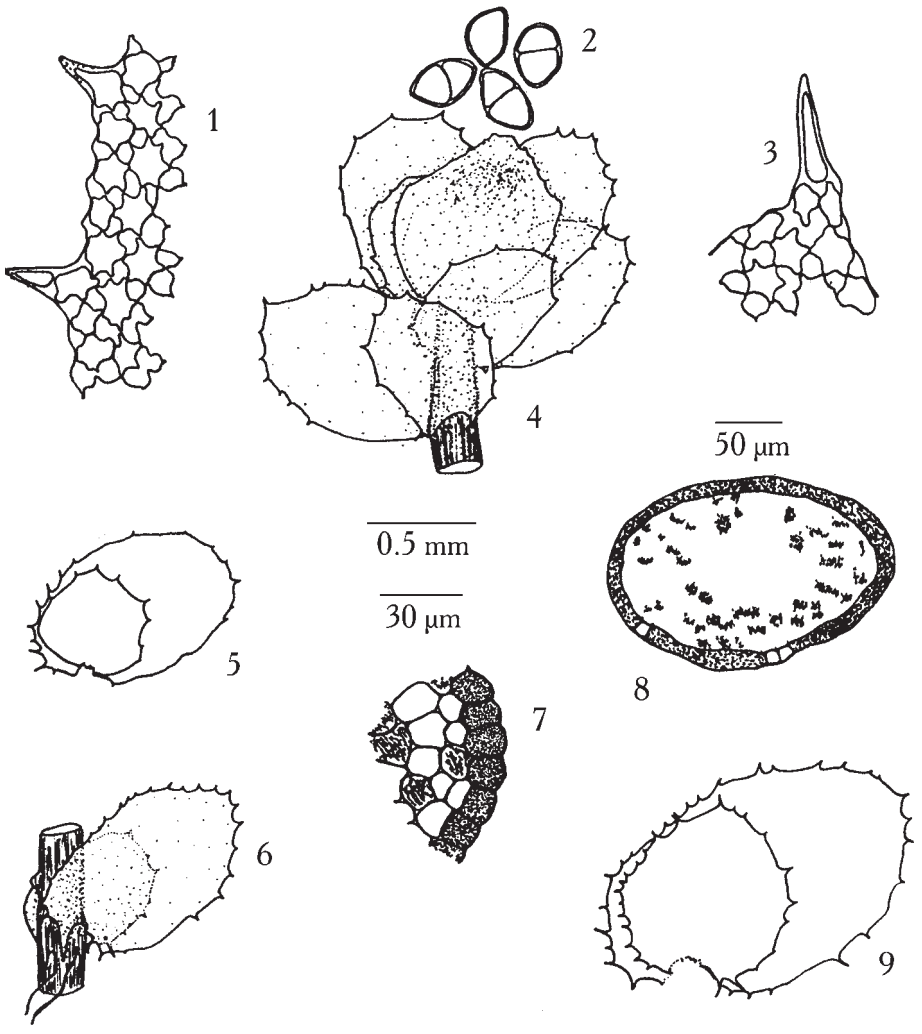

Fig. 3. *Scapania zhukovae* Potemkin (from holotype, Long 20743b, LE): 1 - sector of postical margin of ventral lobe of leaf 9, medially; 2 - gemmae; 3 - apical sector of dorsal lobe of leaf 9; 4 - upper sector of gemmparous shoot, antical aspect; 5, 9 - leaves; 6 - leaf on stem, postical aspect; 7 - lateral sector of stem cross section; 8 - stem cross section, with marked distribution of mycorrhiza. Scale bars: 0.5 mm for 4-6, 9; 50 μm for 8; 30 μm for 1-3, 7.

leaf base to sinus, (0.14-)0.2-0.4(-0.5) the ventral lobe length, straight to moderately arched in larger plants, wing unknown. Marginal teeth few, scattered, mostly shorter than apical spines, 1-2 cells at base, with 1-2-celled terminal ends and terminal tooth cell x 1.2-5 as long as wide, to 70 x 14 μm. Marginal cells distally ca. (11-)14-17 x 14-17(-23) μm, thin-walled. Median cells of ventral lobe ca. 13-19 x 16-20 μm, thin-walled, with moderate bulging trigones. Basal cells of ventral lobe form extensive to small area of lax tissue at lobe base middle, ca. 17-25 x 35-45 μm, thin-walled, with trigones similar to those in median cells. Oil bodies not persistent, unknown. Cuticle smooth to hardly papillose (distinct in leaf sections). Gemmae sporadic, (1-)2-celled, reddish brown, with slightly thickened walls, citron-shaped, ovoid, rounded triangular, subspherical, (14-)17 x 17-28 μm, x (1-)1.15-1.40(-1.65) as long as wide; gemma production leads to reduction of apical teeth. Androecia, perianths and sporophytes unknown.

TYPE. East Nepal, Sankhuwasabha District: Pemathang Kharka, S side of Barun Khola, 27°44'N, 87°12' E. 28.09.1991 D.G. Long 20743 a (LE, holotype; E, isotype)

RANGE. Known only from the type locality.

HABITAT. Cliffs at top of steep ravine; on wet rock slabs, associated with *S. hians, Jungermannia sp., Marsupella sp.*, 3580 m. alt.

Table 4. Distinctions of *Scapania zhukovae* Potemkin and *S. ornithopoides* (With.) Waddell

Characters	*Scapania zhukovae*	*Scapania ornithopoides*
Leaf teeth	remote, at most to 20 on postical and to 15 on antical leaf margin distinctly broadened at base	normally more dense and numerous indistinctly basally broadened
Cortex	1-stratose, of exceedingly thick-walled not flattened cells with ±indistinct lumina	3-5-stratose, of strongly thick-walled cells ±tangentially flattened cells with distinct small lumina
Mycorrhiza	common, circular, in outer cells of medulla	sporadic, diffuse, ventral
Size of plants	1.2-2.3 mm wide, 10-15 mm long	1.5-4.5 mm wide, 30-150 mm long
Marginal leaf cells	smaller, with very thin outer walls and ±projecting thickenings of transverse walls, 11-14 x 14-17 μm	larger, with ±thickened outer walls and usually not or indistinctly projecting thickenings of transverse walls, 14-20 x 14-20 μm

VARIATION AND DIFFERENTIATION. *Scapania spiniloba* shows striking variability within the type specimen. Its small pigmented phases resemble *Scapania hians* whereas larger plants are close to *S. orientalis*. Their distinctive characters are in Tabs. 2 & 3.

Scapania zhukovae[2] Potemkin, species nova (Fig. 3)

Scapania zhukovae differt a *Scapania ornithopoidi* (With.) Waddell minoribus plantis cellulisque foliorum; dispositis dentibus marginalibus foliorum; cortice unistratoso; mycorrhiza in cellularis caulinas medullae externis circulariter sitis.

Plants 1.2-2.3 mm wide x 10-15 mm long, yellowish to reddish brown, simple. Cortex blackish, unistratose from shoot base to the upper sectors, of exceedingly thick-walled, not or slightly flattened cells with deep pigmented middle lamellae, mostly interrupted ventrally by a few unpigmented rather thin-walled cells; mycorrhizal infection circular, diffuse in outer strata of medulla. Leaves remotely dentate from apex to base except often inner margin of ventral lobe, with stronger developed basal teeth and teeth near sinus base. Dorsal lobe 0.4-0.5 the ventral, strongly to moderately divergent from it, divergent from stem at angle ca. 10-30°, narrowly to broadly ovate, plane to slightly convex, triangulary narrowed to rounded in a spinose point, hardly to moderately extending beyond the further edge of stem, x 0.85-1.15(-1.30) as wide as long, mostly ±arcuately inserted, occasionally short decurrent. Ventral lobe divergent from stem at angle ca. 45-90°, narrowly ovate to oblong, plane, broadly rounded to triangulary pointed, x 0.68-0.85 as wide as long, arcuately inserted and decurrent to or a little decurrent below the keel insertion, postical leaf base not differentiated. Keel vestigial, acute, 0-0.06 ventral lobe length, entire but with long leaf teeth on adjacent to keel sector of dorsal and rarely ventral lobes. Marginal teeth distant, up to 20 on postical and to 15 on antical leaf margins, usually notably broadened and 1-2(-3) cells at base, 1-3(-5) cells long, with 1-2(-3)-celled uniseriate ends and mostly bleached spinose terminal cells x 1.5-2.6(-3.6) as long as wide (19-35(-43) μm long and 12-13.5 μm at base). Marginal cells distally ca. 11-14 x 14-17 μm, thin-walled, with very thin smooth outer walls and ±projecting thickenings of transverse walls. Median cells of ventral lobe ca. 13-19 x 14-20(-25) μm, exceedingly thin-walled with moderate to small bulging trigones. Basal cells of ventral lobe form indistinct area of lax tissue, ca. 16-20 x 30-40 μm, thin-walled, with usually larger, longitudinally elongated bulging trigones. Oil bodies unknown. Cuticle irregularly moderately coarsely papillose in proximal leaf portions, similarly but weaker papillose or smooth in distal portions; papillae flat and rather indistinct. Gemmae common in studied specimen, (1-)2-celled, deep purple, ± thin-walled, broadly ovoid to subspherical, 15-19 x (17-)20-27 μm, x (1-)1.4-1.65(-1.7) as long as wide; modification of leaf margin from gemma formation not mentioned. Androecia, perianths and sporophytes unknown.

[2] – After Dr. Anna Leonidovna Zhukova, my first teacher in hepatics, my mother-in-science

TYPE. East Nepal, Sankhuwasabha District: Pemathang Kharka, S side of Barun Khola, 27°44'N, 87°12' E. 28.09.1991 D.G. Long 20743b (LE, holotype; E, isotype).

RANGE. Known only from the type locality

HABITAT. Cliffs at top of steep ravine; on wet rock slabs, associated with *Scapania hians, Cephaloziella sp., Jungermannia sp., Marsupella sp.*, 3580 m. alt.

DIFFERENTIATION. *Scapania zhukovae* might be mistaken for *S. ornithopoides* and even for *S. nimbosa* Tayl. ex Lehm. Its distinctions from the former are shown in Table 4. *S. zhukovae* is distinct from *S. nimbosa* in slightly divergent from stem dorsal lobes; short spinose terminal tooth cells; weaker papillose cuticle; different stem anatomy and some other characters.

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