

FURTHER NOTE ON SOLENOSTOMA MARCESCENS (MITT.) BAKALIN (HEPATICAE)  
ЕЩЁ РАЗ О SOLENOSTOMA MARCESCENS (MITT.) BAKALIN (HEPATICAE)

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Abstract

*Solenostoma sanguinolentum* (Griff.) Steph. and related species are discussed based on study of type and other available materials. The species status of *S. marcescens* (Mitt.) Bakalin is confirmed and *S. longii* Bakalin sp. nov. is described. The new species is characterized by pink coloration, prostrate to ascending growth and not or barely decurrent leaves. The photographs made from type materials are provided.

Резюме

*Solenostoma sanguinolentum* (Griff.) Steph. и близкие таксоны обсуждены на основе изучения типовых и прочих доступных материалов. Подтвержден видовой статус *S. marcescens* (Mitt.) Bakalin. Описана *S. longii* Bakalin sp. nov. Новый вид характеризуется розовой пигментацией, стелющимся до восходящего ростом и не сбегаящими или слегка сбегаящими листьями. Приводятся фотографии, сделанные с типовых материалов.

KEYWORDS: hepatics, taxonomy, Himalayas, typification

INTRODUCTION

A Himalayan species, *Jungermannia marcescens* Mitt. (= *Solenostoma marcescens* (Mitt.) Bakalin), was described shortly after another species from about the same region, *Jungermannia sanguinolenta* Griff. (= *Solenostoma sanguinolentum* (Griff.) Steph.). They were accepted as a good species, including a revision of Amakawa (1967), until Váňa (1972) synonymized the former name with the latter one. However Bakalin (2013) found these two species distinct enough, resurrecting the species status for *J. marcescens*, transferring it to the genus *Solenostoma*. The acceptance of *S. marcescens* as a separate species was criticized by Váňa *et al.* (2013) in the discussion on sexual conditions in the genus *Solenostoma*. According to these authors, *S. marcescens* and *S. sanguinolentum* are connected by transitional forms in such features as inflorescence type, perianth wall structure, size, color and leaf cells features. Unfortunately Váňa *et al.* (2013) in the most cases did not provide the references to the specimens examined and listed only herbaria where *S. sanguinolentum* and *S. marcescens* was studied. I was able to find specimens named both as *S. sanguinolentum* or *S. marcescens* in NICH, BM, G, NY, TNS and MO. Certainly I was able to check only a part of materials that apparently was studied by Váňa *et al.* (2013). However my opposite conclusion retained, thus the additional evidence seems worthy be presented and discussed in the present paper.

MATERIAL AND METHODS

The original base for the present work was the study of type materials for *Solenostoma marcescens* and *S. san-*

*guinolentum*. The morphological descriptions and photographs of lectotypes of both taxa were done in BM (Figs. 1, 2). In addition I studies isolectotypes in NICH, G and NY (noticeable that the latter is the house for the majority of Mitten's types and it is not understandable why the lectotype for *S. marcescens* was selected from BM, cf. Váňa, 1972, despite an especially big specimen is kept in NY). Along with study of type materials I re-studied specimens named as *Solenostoma sanguinolentum* from TNS (two barcodes cited below), three specimens so named by Váňa in MO (all belonging to the different taxa as showed below), several specimens of *Solenostoma* sp. (one of them belong to the superficially related *S. longii*, that is described). In total about 15 specimens of the both taxa were studied. Along with morphological study I made the photographs for lectotypes of the both *S. marcescens* and *S. sanguinolentum* those are published for the first time and thus let to avoid artifacts that may appear in line drawings.

OBSERVATIONS

The main statement of Váňa *et al.* (2013) is that the difference in sexuality is not stable in "*Solenostoma sanguinolentum* s.l.", thus dioicous *S. sanguinolentum* and paroicous *S. marcescens* can be considered to be conspecific. However, such conclusion can be achieved if the studied material is heterogeneous and belongs to more than one taxon as well. Of course, the morphological differences, even very distinct ones, between isolectotypes of *S. marcescens* and *S. sanguinolentum* discussed earlier (Bakalin, 2013) are not necessarily sufficient for their interpretation as a distinction between species. The com-

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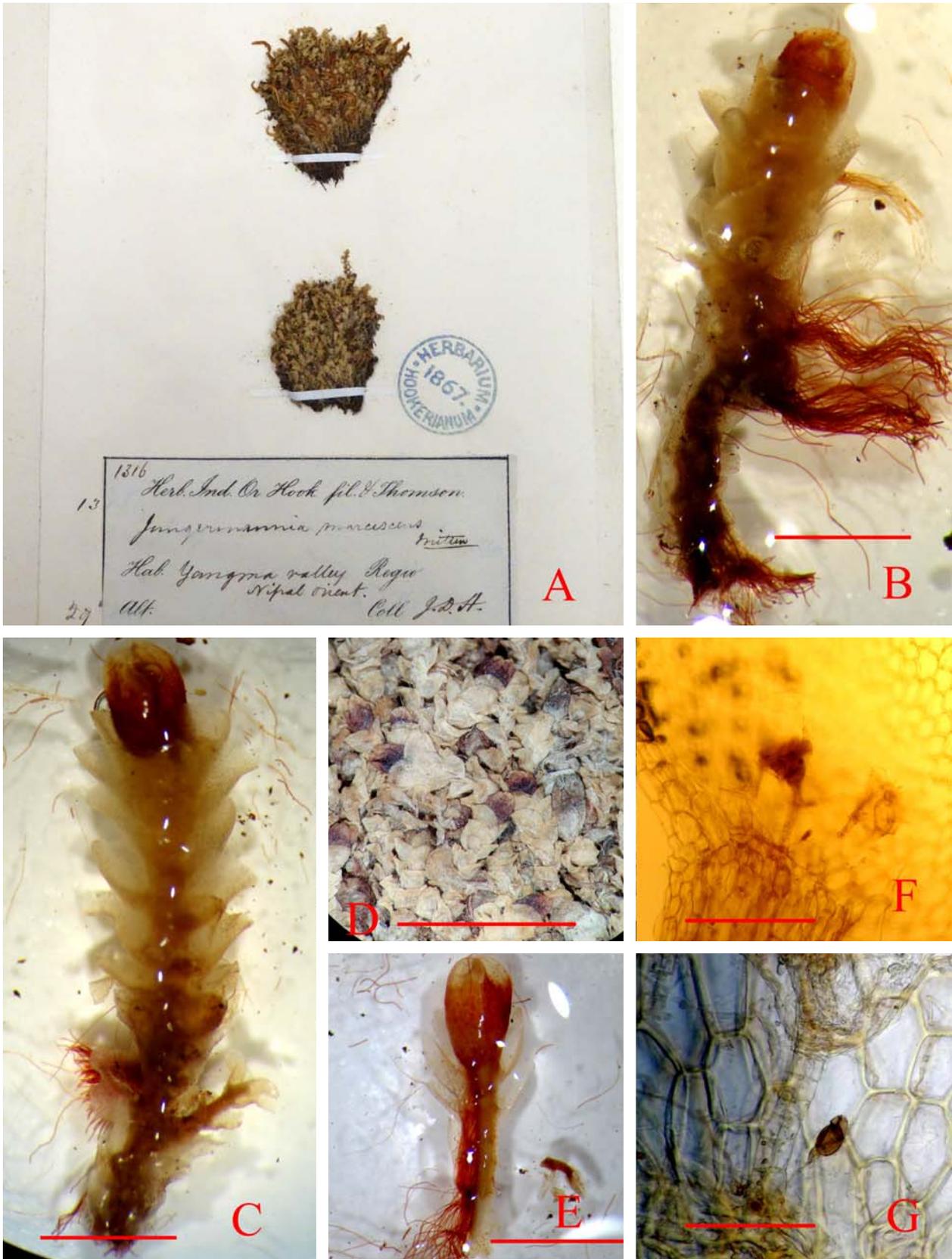


Fig. 1. *Solenostoma marcescens* (Mitt.) Bakalin A – lectotype label; B – habit, lateral view; C – habit, dorsal view; D – habit, dry plants in the herbarium; E – rhizoids, some leaves are detached; F, G – antheridia remnants. All from lectotype, BM. Scales: B, C, E – 1 mm; D – 5 mm; F – 20  $\mu$ m, G – 50  $\mu$ m



Fig. 2. *Solenostoma sanguinolentum* (Griff.) Steph. A – lectotype label; B – habit, dry plants from herbarium; C – cells along leaf margin; D – cells in the leaf middle; E – syntype labels (Khasia Mts); F – habit, male and female plant; G – habit, perianthous plants. A–D – from lectotype; E–G – from syntype (Khasia Mts., BM). Scales: B – 5 mm, C, D – 50 µm; F, G – 3 mm.

ments on additionally studies specimens are as follow:

Male plants were found in lectotype of *S. sanguinolentum* in BM (Fig. 2), despite Váňa *et al.* (2013: 34) wrote that androecia “were never found in the type specimens of *Solenostoma sanguinolentum*”. These androecial plants are highly distinctive from female due to considerable smaller width of branches. Although Váňa *et al.* (2013) mentioned a supposedly pure male branch in the lectotype of *S. marcescens*, I inclined to treat it as an undeveloped paroicous branches. In any case the characteristic of these “pure androecial shoots” are strikingly different from those in the lectotype of *S. sanguinolentum*.

The MO herbarium possesses three specimens named as *Solenostoma sanguinolentum* by Váňa. Two of them (MO6231188, MO6231190) belong to the species described below as *S. longii* and the third one (MO 6231814) is *S. suborbiculatum*.

Specimens TNS #32092 and TNS 200894, labelled by J. Váňa as *S. sanguinolentum*, belong either to *S. marcescens* or the third taxon, which evaluation is difficult due to poor preservation of the material. Both specimens contain brownish plants, without any traces of red or purplish pigmentation. Although no antheridia below perianth were found in these specimens, the protoandry of *S. marcescens* may explain their absence as

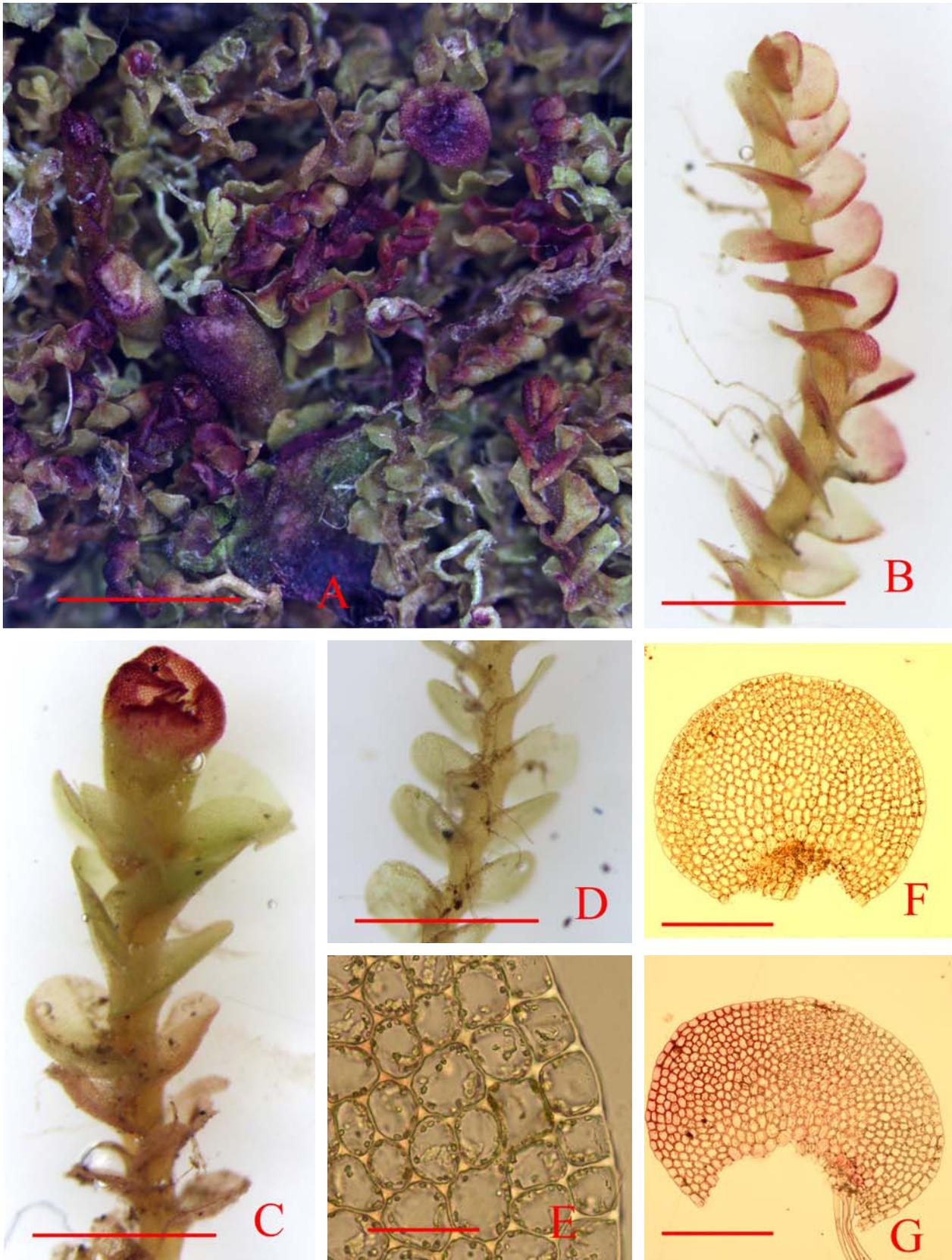


Fig. 3. *Solenostoma longii* Bakalin. A – habit, dry plants in the herbarium; B – habit, sterile plant; C – habit, perianthous plant; D – ventral view, fragment; E – cells along leaf margin; F, G – leaves. All from holotype, MO6231188. Scales A-D – 1 mm; E – 50  $\mu$ m; F, G – 200  $\mu$ m.

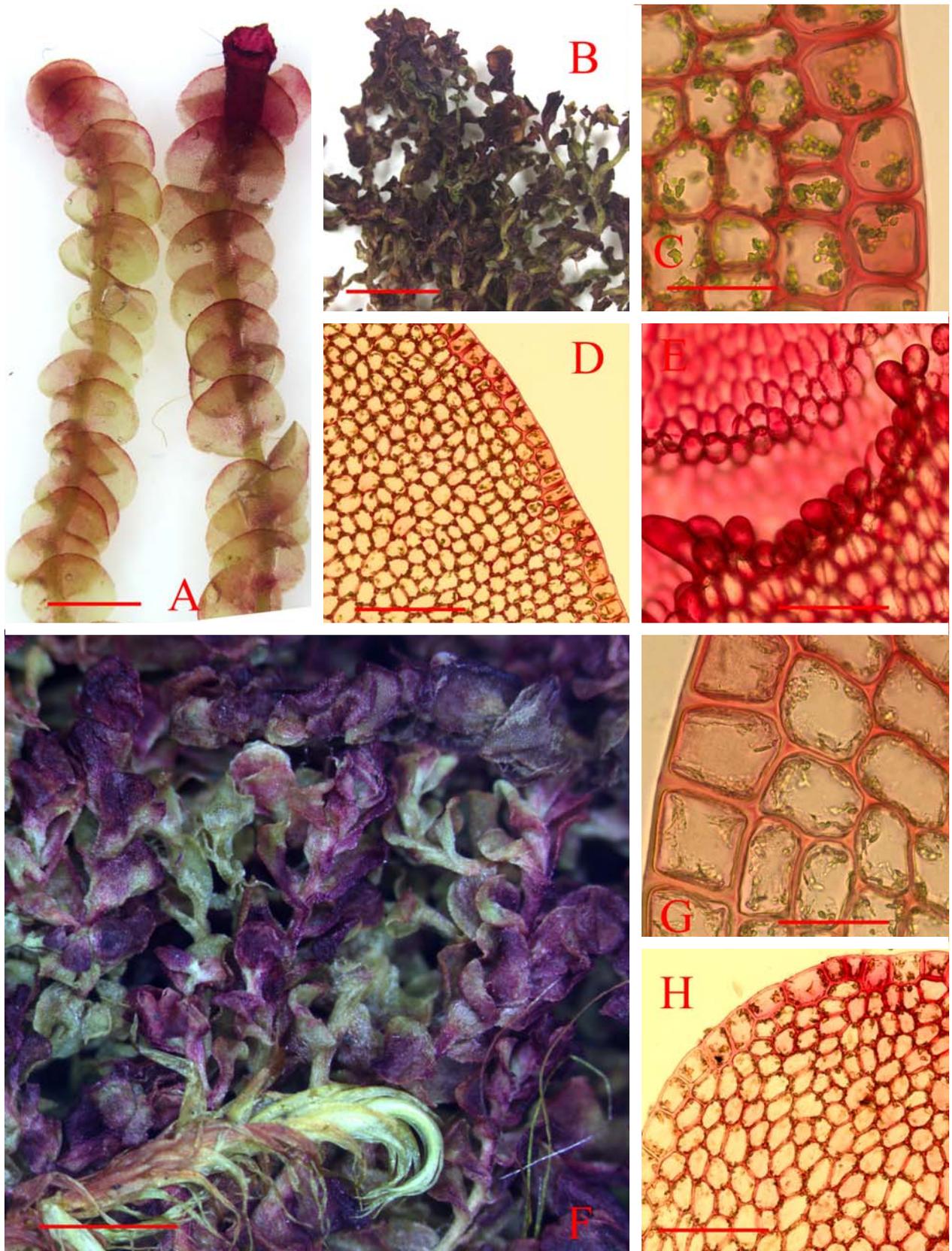


Fig. 4. *Solenostoma suborbiculatum* (Amak.) Váňa. A – plant habit; B – habit, dry plants in the herbarium; C, D – cells along leaf margin; E – overgrowth mamillae in the perianth surface; F – habit, dry plants in the herbarium; G, H – cells along leaf margin. A-E – from MO6231814; F, G – from MO6099904; H – from MO6096951. Scales: A – 2 mm; B – 5 mm; C, G – 50 µm; D, E, H – 200 µm; F – 2 mm.

well. Two other specimens (virtually from the same place) were found in TNS in more recent collections that are cited below.

The differences between *Solenostoma marcescens* and *S. sanguinolentum* are as follow: 1) strongly laterally compressed shoots in *S. sanguinolentum* versus somewhat dorsiventrally (sometimes vermiculate) shoots in *S. marcescens*, 2) (related to 1) plants of *S. sanguinolentum* lying on lateral side in the drop of water in the microscope slide versus plants of *S. marcescens* lying on dorsal or ventral side in the same conditions, 3) coloration of *S. sanguinolentum* varying from greenish to deep pink, but never can be brownish or brown, versus coloration of *S. marcescens* varying from greenish yellowish to brownish and rusty-brown with the deepest coloration in basal part of the perianth (in *S. sanguinolentum* this part is not different or having lower intensity coloration than apical part of the perianth), 4) dioicous inflorescence in *S. sanguinolentum* with highly distinctive appearance of androecial shoot, versus paroicous highly protoandrical inflorescence in *S. marcescens*, 5) rigid and deeply colored rhizoids in *S. marcescens* versus pale colored and very soft rhizoids in *S. sanguinolentum*, 6) long decurrent leaves in *S. sanguinolentum* versus only shortly decurrent in *S. marcescens*.

#### TAXONOMY

To avoid confusions, the following descriptions are made from lectotypes only, as Váňa *et al.* (2013) pointed that my previous studies (Bakalin, 2013) described isolectotypes, but not lectotypes.

***Solenostoma marcescens*** (Mitt.) Bakalin, Polish Bot. J. 58(1): 139. 2013. (Basionym: *Jungermannia marcescens* Mitt. J. Proc. Linn. Soc., Bot. 5: 91. 1861. “Jangma<sup>1</sup> Valley, Nepal Orientalis” Leg. J.D. Hooker, n. 1316, lectotype in BM!, selected by Váňa, 1972, isolectotypes in NY!, G14835/00115162!, NICH225129!)

**Description.** Plants erect, brownish to yellowish, rusty brown in some parts (especially in basal part of the perianth), rarely pale brownish golden, 1.0–1.3 mm wide, 5–8 mm long, sparsely laterally branched. Stem elliptic in cross section, ca 0.15–0.20 × 0.28–0.35 mm. Rhizoids very dense, rigid, mostly brown to golden brown and rusty-brown, erect from the stem in dense mat, or decurrent down (in upper part of shoot) and forming more or less clear fascicle. Leaves contiguous to imbricate, sheathing the stem at the base, when flattened transversely elliptic to reniform, rarely retuse at apex; transversely inserted and oriented, 0.7–1.2 × 1.2–1.8 mm, shortly (less than 1/5 of stem width) or barely decurrent in dorsal side, not decurrent on ventral side; margin entire and flat, rarer undulate and loosely crispate. Midleaf cells mostly oblong hexagonal, 33–50 × 22–35 μm, thin-walled, with small concave trigones, walls yellowish (probably due to age); cells along margin 14–28 μm, mostly thin-walled,

sometimes with thickened external wall, trigones moderate, triangle; cells near base 42–73 × 25–36 μm, oblong hexagonal, thin-walled, with small concave trigones. Perianth terminal, without subfloral innovations, red-brown in color, tubular to subclavate, loosely or evidently 3(–5)-plicate in upper 1/4, gradually narrowed to indistinctly beaked mouth, 1.2–1.5 × 0.9–1.0 mm, exerted for 2/5–1/2 of its length, bistratose in lower 1/2–3/5 of its length; rhizogenous in lower half. Bracts sheathing the perianth, similar in size with larger leaves. Perigynium vestigial. Androecia intercalary, divided from perianth by 2–4 pairs of sterile leaves, with 2–3(–5) pairs of bracts, 1–3-androus, stalk biseriate (the basal layer may be uniseriate), 75–100 μm long, body nearly spherical, ca 130–140 μm in diameter, with reddish tint, bracts similar to larger leaves but inflated at base (Fig. 1)

**Comments.** The description above is almost identical to that based on isolectotype (Bakalin, 2013). Additionally I made two other observations. It is not easy to find antheridia or their remnants in the plants because androecia divided from female bracts by 2–4 (sometimes probably more) pairs of sterile leaves, therefore plants are protoandrical and antheridial body may be very easily washed away. Another observation was made on branching. The new branches originated in the sinuses of androecial bracts (not in sterile leaves) and this fact, therefore, promotes disappearance of antheridia and their stalks.

The basic characteristic of the species are 1) rigid, deeply colored rhizoids, 2) transversely inserted and not or barely decurrent concave to cupped leaves, 3) mostly pale colored plants, with deeply colored basal (but not apical!) part of the perianth. In the practice, when plant detached from the mat and placed to the drop of water it lies on ventral side, if rhizoids not prevent such position.

**Specimens examined** (besides the types): NEPAL. Between Ghopte and Gosa, 3700 m alt., Iwaskuki Z. 13.VI.1972 (TNS 32092); Numbur, 3420 m alt., Yoda K. V.1963 (TNS 200894); Dhunche, 2000 m alt., 15787, 15789, Higuchi M. 13.IX.1988 (TNS 110043, 110044).

***Solenostoma sanguinolentum*** (Griff.) Steph., Species Hepaticarum 2: 51. 1901. (Basionym: *Jungermannia sanguinolenta* Griff. Not. Pl. Asiat. 302. 1849. Lectotype BM!, isolectotype NY-00967448!: Assam “Khasia Mts.” Leg. Griffith, lectotypes selected by Váňa, 1972; syntypes BM!: Upper Assam Leg. Griffith).

**Description.** Plants soft [, probably erect], brownish deep pink to purplish, with more intensively (to purple) marked upper half of perianth and adjacent leaves, as well as lower (!) third of leaves situated below, 2.2–3.8 mm wide and 15–20 mm long. Stem very rarely laterally branched, reddish brownish, 260–310 μm in diameter. Rhizoids common to numerous, colorless to grayish, very soft, mostly obliquely spreading, not forming the fascicle

<sup>1</sup> – Váňa (1972) wrote “Jangrea Valley”, although in the label it is written “Jangma” (that is the really existing geographic locality).

decurent down the stem or in very unclear such kind of fascicle. Leaves contiguous to subimbricate, subtransversely inserted, widely, for 1–2 stem widths, decurrent dorsally and for 1/2–3/2 of stem width decurrent ventrally, mostly laterally appressed to the stem and then very slightly concave, subtransversely oriented, in weaker plants sometimes obliquely spreading and concave–canaliculate and subtransversely oriented, when flattened in the slide nearly orbicular to widely ovate, 1.25–1.9 × 1.25–2.5 mm. Midleaf cells 32.5–67.5 × 25.0–40.0 µm, thin-walled, subisodiametric to shortly oblong, trigones small to moderate in size, mostly concave, cuticle smooth, cell walls commonly pink colored; cells along margin 20–40 µm, nearly thin-walled, external wall slightly thickened, trigones moderate, concave, cuticle smooth. Dioicous. Perianth without subfloral innovations, exerted for 2/3–3/4 of the length, loosely clavate, bistratose in lower 2/3, composed by shortly oblong cells, suddenly contracted to the not beaked crenulate mouth. Male branches distinctively smaller than female branches, androecia with 8–10 pairs of bracts, with bracts inflated to cupped with canaliculate upper 1/3–1/4. Androecia seems to be terminal, at least I did not found branches continuing the development after androecia. (Fig. 2)

**Comments.** There are three specimens of the species those may be referred to types. One of them is lectotype cited above, another one is most probably the lectotype duplicate (labels and contained plants are identical) and third one (also mentioned by Váňa, 1972) is from Upper Assam.

The main diagnostic features of this species (that is dissimilar to *S. marcescens*) are: 1) very soft, not fasciculate, nearly colorless to grayish rhizoids, 2) purplish to deep pink color of plants, 3) laterally appressed nearly plane or only slightly concave leaves that are distinctly and long decurrent in the both sides. In practice, when plant detached from the mat and put into drop of water it is lying on lateral side, but not on ventral side as in *S. marcescens*.

The species is closely related to *Solenostoma suborbiculatum*, from which it differs in thin-walled and nearly the same size with inward cells along leaf margin, versus thick-walled and larger than inner marginal cells, and smooth perianth surface, versus having overgrowth mamillae (= “dispersed papilla-like protuberances” of Amakawa, 1967: 188). Another difference may be in more lax texture of *S. suborbiculatum*, at least specimens in MO and holotype in NICH commonly have strongly plicate-undulate leaves when dry, that is in contrast with the type of *S. sanguinolentum* having more or less plane leaves. The difference in size is probably not so valuable since some specimens of *S. suborbiculatum* from Yunnan have larger size, as up to 2.74 mm wide (MO 6231814, 6096951, 6099904). The mentioned specimens from Yunnan may represent another variety of the species, but this question needs further studies.

***Solenostoma longii* Bakalin sp. nov.**

**Holotype:** China, Yunnan Prov., Fugong County (27°12'11"N 98°41'38"E), 3665 m alt., leg. Long D.G. and J. Shevock 37336 (MO6231188, sub *S. sanguinolentum*).

**Paratypes:** China, Yunnan Prov., Fugong County (27°46'11"N 98°26'49"E), 3270 m alt., leg. Long D.G. 35773 (MO6160012). China, Yunnan Prov., Fugong County (27°12'11"N 98°41'38"E), 3665 m alt., leg. Long D.G. and J. Shevock 37328 (MO6231190, sub *S. sanguinolentum*).

**Etymology:** named in honor of Dr. D.G. Long who first collected this species.

**Description.** Plants prostrate to ascending, more or less rigid, yellowish pinkish to brownish pinkish in color, forming dense patches with other hepatics, 0.63–1.25 mm wide (up 1.75 mm in perianthous plants). Rhizoids sparse, originated mostly near ventral leaf base, obliquely to erect spreading, rarely decurrent, but not forming fascicle, colorless to brownish. Stem yellowish, sparsely laterally branched, 150–300 µm in diameter. Leaves subtransversely inserted, ventrally insertion line arcuate and leaves not or barely decurrent, dorsally barely or up to 1/3 of stem width decurrent, suberect spreading and subtransversely to obliquely oriented, concave to nearly plane, transversely elliptic to nearly reniform, 500–700 × 750–1100 µm. Midleaf cells very thin-walled, subisodiametric, 25–45 × 25–45 µm, trigones small, concave to moderate in size and triangle, cuticle smooth; cells along leaf margin 22–38 µm, thin-walled (external wall slightly thickened), trigones moderate in size to small, concave, cuticle smooth. Dioicous. Perianth terminal, without subfloral innovations, exerted for 2/3 of its length, nearly cylindrical to obovate, 1.2–1.5 × 0.85–1.0 mm, suddenly contracted into not or loosely beaked mouth, with mouth commonly ‘bulged-in’ into the perianth tube that the perianth apex looks as transversely succise; perigynium virtually absent, bracts in one pair, similar to leaves. Androecia intercalary, with 3–5 pairs of bracts, different generation divided by 10 or more pairs of sterile leaves, bracts inflate in lower half (but not colored in inflated area), the same or nearly the same size with sterile leaves, 2–3-androus. (Fig. 3)

**Comments.** Sterile plants of the new species are somewhat similar to *Solenostoma (Eucalyx) hyalinum* (Lyell) Mitt. in growth form and texture, being different in very peculiar pink pigmentation. Moreover, perianth of the species free of perigynium and composed by subisodiametric cells in its upper half, that confirm position of the species within *Solenostoma* in its narrow sense (subg. *Solenostoma*). The most closely related species I was able to find is *S. suborbiculatum* (Amak.) Váňa (Fig. 4). Both taxa are different in characteristics of leaf margin cells (larger than inner, swollen and thick-walled in *S. suborbiculatum*, versus thin-walled and not different in size in *S. longii*), leaf insertion (sinuate and long decurrent in

the both sides in *S. suborbiculatum* versus subtransversely inserted, not or barely decurrent ventrally and shortly decurrent dorsally in *S. longii*) and growth form (nearly erect in *S. suborbiculatum* and prostrate to ascending in *S. longii*).

#### DISCUSSION

Váňa *et al.* (2013) regarded features separating *S. marcescens* and *S. sanguinolentum* used by Bakalin (2013) as environmentally induced or depending on development stage of an individual. I agree with this partly, concerning the number of cell strata in the perianth (plants in the lectotype indeed have perianths with two-layered wall for longer extent that it was estimated before (Bakalin, 2013). However I disagree for other characters.

Especially it concerns the difference in coloration. Váňa *et al.* (2013) imply the transition of brownish pigmentation in *S. marcescens* and pink in *S. sanguinolentum* basing on supposition (l.c.: 36) that “the purplish colour is the reaction to the occurrence in sunny places (...). The colour of old specimens is mostly pale or yellowish, which probably is caused by the decoloration of green plants after many years”. I have two counterarguments. The first one is that the type of *S. sanguinolentum* is the oldest known specimen in this species pair, but it still deeply colored (Fig. 2). On the other hand, the presence of brown pigmentation versus pink in the well-exposed phases is quite another matter. For instance, the easiest feature that helps to separate *S. sphaerocarpum* (Hook.) Steph. from exceedingly variable *S. confertissimum* (Nees) Schljakov is the deep olive-brown coloration of the former in exposed places (versus purple coloration in the latter). The pale colored phases on those Váňa *et al.* (2013) accent the attention are not arguments to the transition nature of this feature in *S. marcescens*/*S. sanguinolentum*. Moreover, Váňa *et al.* (2013) did not comment the fact that if somebody will admit their approach on supposed inadequacy of coloration to evaluate taxon of species rank once for one species pair, there would be no restrictions to apply the same approach for other spe-

cies pairs within the genus. Then some species appear to need of synonymizing, e.g. *Solenostoma clavellatum* Mitt. ex Steph. – *S. flavorevolutum* (Váňa) Váňa & D.G. Long.

Similarly, the statement that the sexual condition does not help in differentiation of *S. marcescens* and *S. sanguinolentum* is inconsistent with cases where the unisexual and bisexual plants have virtually no (or minor and presumable environmentally induced) other distinctions, e.g. in *Solenostoma paroicum* (Schiffn.) R.M. Schust. / *S. hyalinum* (Lyell) Mitt., prostrate forms of *Jungermannia pumila* With. / *J. borealis* Damsh. & Váňa, *Radula constricta* Steph. / *R. complanata* (L.) Dumort., *Marsupella funckii* (F. Weber & D. Mohr) Dumort. / *M. sprucei* (Limpr.) Bernet, some phases of *Scapania hyperborea* Jørg. / *S. kaurinii* Ryan, some phases of *Cephaloziella divaricata* (Sm.) Schiffn. / *C. varians* (Gottsche) Steph.

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#### LITERATURE CITED

- AMAKAWA, T. 1967. New or little known Asiatic Species of the family Jungermanniaceae III. – *Journal of the Hattori Botanical Laboratory* **30**: 181–198.
- BAKALIN, V.A. 2013. New taxa of *Solenostoma* and *Plectocolea* and other taxonomic novelties based on study of collections in the New York Botanical Garden Herbarium. – *Polish Botanical Journal* **58**(1): 127–142.
- BAKALIN, V.A. The revision of ‘*Jungermannia* s.l.’ in the North Pacific: the genera *Endogemma*, *Jungermannia* s. str., *Metasolenostoma*, *Plectocolea* and *Solenostoma* (Hepaticae). – *Botanica Pacifica* **3**(2): 55–128.
- VÁŇA, J. 1972. Miscellaneous notes on the Asiatic Jungermannioideae II. – *Journal of the Hattori Botanical Laboratory* **36**: 57–74.
- VÁŇA, J., L. SÖDERSTRÖM, A. HABORG & M. VON KONRAT. 2013. Notes on Early Land Plants Today. 44. Comments on sexuality in *Solenostoma* (Solenostomataceae, Marchantiophyta) and on some newly described taxa. – *Phytotaxa* **152**(1): 33–47.