Saccogyna darjeelingensis (Saccogynaceae: Marchantiophyta) – a new species from Eastern Himalaya, India with a new generic record for Indian Bryoflora

Söderström *et al.*[1] have listed three species of the genus *Saccogyna* Dumort., belonging to the monogeneric family Saccogynaceae, viz. *Saccogyna ligulata* Steph., *Saccogyna subacuta* Steph. and *Saccogyna viticulosa* (L.) Dumort. However, Grolle[2] and later Blackstock[3] recognized only one species (*S. viticulosa*) under the genus *Saccogyna.* Grolle[2] considered *S. ligulata* as a synonym of *Saccogynidium caldense* (Ångstr.) Grolle and kept *S. subacuta* under doubtful taxon as the type specimens of *S. subacuta* examined and present in Stephani's herbarium (G) did not belong to *Saccogyna* but a member of Southbyaceae. Grolle's[2] concept of only one taxon is followed here.

Stephani[4] described *Saccogyna subalternifolia* Steph. from Kudremukh, India, while Chopra[5] also reported it from Darjeeling, India. However, *S. subalternifolia* is a synonym of *Notoscyphus paroicus* Schiffn[2,6]. Thus, the genus *Saccogyna* is presently not known from India (see also Singh *et al.*[7]).

The genus *Saccogynidium* Grolle of Acrobolbaceae can be easily confused with genus *Saccogyna*, both of which were previously assigned to the family Geocalycaceae due to the presence of papillose cuticle. However, *Saccogynidium* can be distinguished by the presence of rounded papillae on the leaf surface, except for terminal 1–2 (–4) cells where the cuticle is smooth (leaf cuticle with line-shaped papillae present throughout the leaf surface, including the terminal leaf cell in *Saccogyna*); 8–20 oil-bodies per cell [2–3 (–4) oil-bodies per cell in *Saccogyna*]; flat to convex underleaves with wide lobes, sometimes toothed at the base (slightly concave underleaves in *Saccogyna*); marsupium with short calyptras (marsupium with large calyptras in *Saccogyna*); capsule wall consisting of 4–5 layers of cells (capsule wall with two layers of cells in *Saccogyna*) and spores two times the elater diameter (spores hardly thicker than the elater in *Saccogyna*) (see also Grolle[2] and Singh and Singh[8]).

During recent studies on the liverworts of Darjeeling district, West Bengal, India, the present authors recognized an interesting population not belonging to any of the genera known from the country. Subsequent morphotaxonomic and scanning electron microscopic studies revealed it as a hitherto undescribed species of the genus *Saccogyna*. The same has been described and illustrated here as *Saccogyna darjeelingensis.*

Taxonomic description: *Saccogyna darjeelingensis* M. Dey & S. Majumdar sp. nov.

Plants delicate, 6.0–16.0 mm long, 0.55–0.75 mm wide; leaves subquadrate–rectangulate with bidentate apices; leaf cuticle densely papillose, papillae elongated with a blunt apex, usually fused with each other; underleaves deeply bilobed, lobes divergent without a lateral tooth, underleaf base not covering the entire stem width; rhizoids

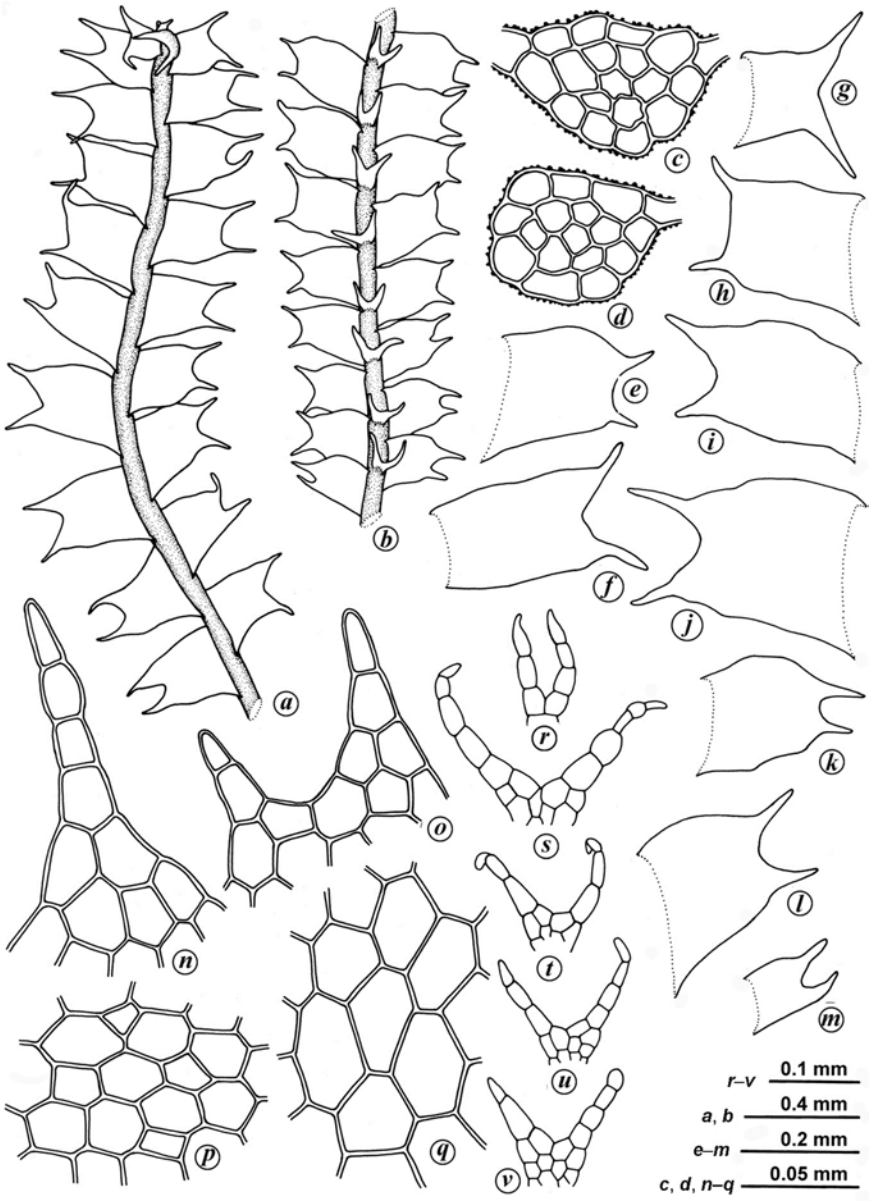

Figure 1. *Saccogyna darjeelingensis* M. Dey & S. Majumdar. ***a***, A portion of the plant in dorsal view. ***b***, The same in ventral view (rhizoids not drawn). ***c***, ***d***, T.S. of the stem showing papillae. ***e–m***, Leaves. ***n***, ***o***, Apical leaf cells. ***p***, Median leaf cells. ***q***, Basal leaf cells. ***r–v***, Underleaves (cellular). (All figures drawn from holotype, M. Dey 81492A CAL.)

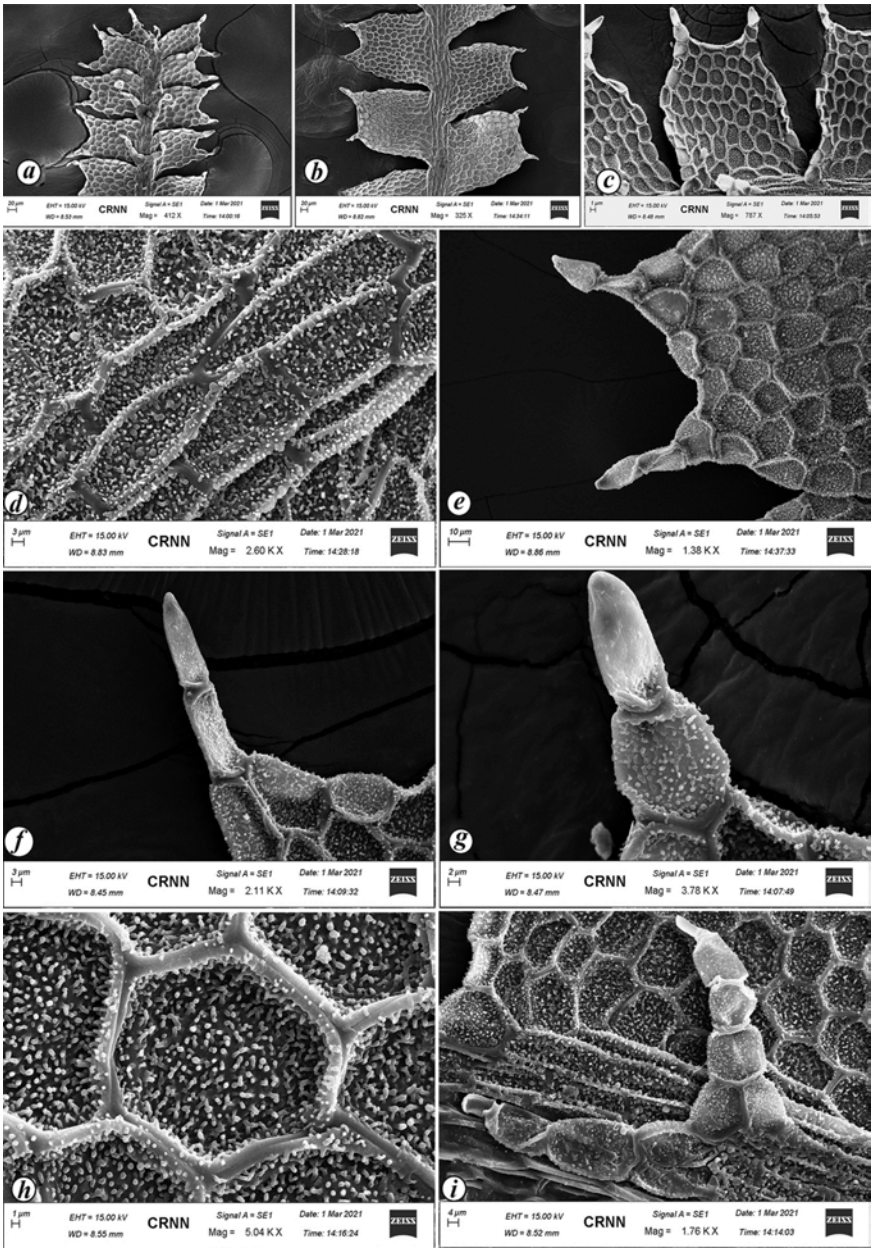

Figure 2. *S. darjeelingensis* M. Dey & S. Majumdar. ***a***, A portion of the plant in ventral view. ***b***, The same in dorsal view. ***c***, Leaves (showing ventral leaf attachment). ***d***, Stem surface showing papillae. ***e***–***g***, Apical leaf cells showing papillae. ***h***, Median leaf cells showing papillae. ***i***, Underleaf originating from the stem. (All SEM images from holotype, M. Dey 81492A CAL.)

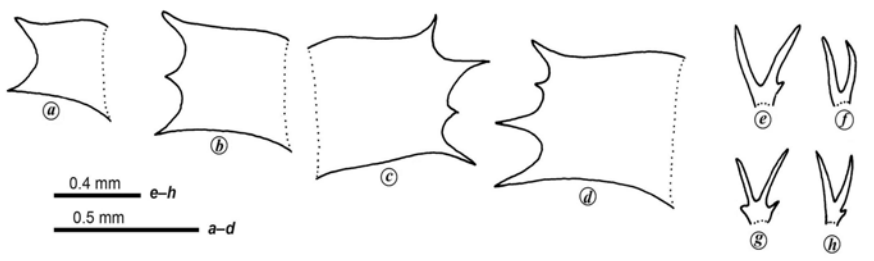

Figure 3. *Saccogynidium irregularospinum* C.H. Gao, T. Cao & M.J. Lai. ***a***–***d***, Leaves. ***e***–***h***, Underleaves. (All figures drawn from M. Dey 81492B CAL.)

hyaline, confined to the base of underleaves.

Type: India, Eastern Himalaya, West Bengal, Darjeeling district, 2 km from Jogighat towards Ahaldara, 26°56′05.59″N, 88°22′18.33″E, 726 m, 08 March 2019, M. Dey 81492A (Holotype & Isotype: CAL!).

Plants olive-green when fresh, yellowish-green in herbarium; shoots 6.0–16.0 mm long, 0.55–0.75 mm wide (including leaves). Stem oval–elliptical in outline in transverse section, 75.0–89.0 × 52.0–65.0 μm, 5–6 cells across the diameter; cortical cells subquadrate–rectangulate or polygonal, 12.0–24.0 × 8.0–16.2 μm, thin-walled; medullary cells subquadrate–polygonal, 9.0–22.0 × 7.0–15.0 μm, thin-walled; surface densely papillose, papillae usually fused with each other. Leaves loosely imbricate–contiguous or distant, widely–obliquely spreading; leaf lamina subquadrate–rectangulate, 0.16–0.40 mm long, 0.09–0.25 mm wide, margin entire to slightly wavy, apex mostly bidentate very rarely with a single tooth; teeth (1–) 2–5 (–7) cells long, 2–4 (–5) cells wide at the base, 1–4 cells uniseriate towards apex; terminal teeth cells slightly elongated, rectangulate, 18.0–30.0 × 13.0–25.0 μm; marginal leaf cells rectangulate–polygonal, 24.0–32.0 × 15.0–30.0 μm; median leaf cells rectangulate–polygonal, 14.0–24.0 × 10.0–20.0 μm; basal leaf cells polygonal, (27.0–) 33.0–55.0 × (18.0–) 28.0–35.0 μm; cells thin-walled, with indistinct trigones, intermediate thickenings absent; oil bodies not seen; cuticle densely papillose, papillae elongated with a blunt apex, usually fused with each other, papillae on terminal cells of apical teeth sometimes less dense or restricted to the basal portion of the cell. Underleaves distant, slightly concave, 0.07–0.16 mm long, 0.05–0.06 mm wide near sinus, base not covering the entire stem width, deeply bilobed, without a lateral tooth, sinus 2/3–3/4 of underleaf length; lobes divergent, 3–7 cells long, 1–2 cells wide at the base, 2–5 cells uniseriate towards apex; lamina (1–) 2–3 cells long, 2–4 cells wide; cells thin-walled, with indistinct trigones, without intermediate thickenings; cuticle papillose, papillae on the terminal cells of lobes sometimes less dense or restricted to the basal portion of the cell. Rhizoids hyaline, confined to the base of underleaves. Fertile plants not seen.

Etymology: The species has been named after the district of its occurrence, i.e. Darjeeling.

Habitat: Terrestrial, growing in moist and shady environments in association

with *Saccogynidium irregularospinum* C.H. Gao, T. Cao & M.J. Lai.

Distribution: India [Eastern Himalaya (West Bengal)], probably endemic.

Saccogyna darjeelingensis differs from *S. viticulosa* in having delicate plants, 6.0–16.0 mm long, 0.55–0.75 mm wide (Figures 1 *a*, *b* and 2 *a–c*) [1–5 (–8) cm long, (1.0–) 2.0–4.3 mm wide in *S. viticulosa*]; subquadrate–rectangulate leaves with bidentate apices (Figures 1 *a*, *b*, *e–m*, *o* and 2 *a–c*, *e*) (ovate–oblong leaves devoid of apical teeth in *S. viticulosa*); deeply bilobed underleaves with divergent lobes, lateral margins devoid of teeth, base not connate with lateral leaves (Figures 1 *b*, *r–v* and 2 *a*, *i*) (underleaves with closely parallel or partly connate lobes, lateral margins dentate–laciniate, base connate with one or both lateral leaves in *S. viticulosa*)[2,9–11].

The new species described here has been assigned to the genus *Saccogyna* of the monogeneric family Saccogynaceae because of the presence of elongated papillae present throughout the leaf surface, including the terminal leaf cell (papillae rounded and absent on 1–2 (–4) cells at the leaf apex in *Saccogynidium*) and slightly concave underleaves (flat to convex in *Saccogynidium*) (see also Grolle[2]).

S. darjeelingensis resembles *S. irregularospinum* C.H. Gao, T. Cao & M.J. Lai along with which it has been found growing in having a densely papillose stem, leaf and underleaf surface; thin-walled leaf cells with indistinct trigones, devoid of intermediate thickenings; and deeply bilobed (sinus 2/3–3/4 of underleaf length), distant, divergent underleaves. However, *S. irregularospinum* differs in having wider plants (1.5–2.0 mm); leaves with 2–4 (–5) unequal dentitions at apex (Figure 3 *a–d*); surface papillae absent in the terminal 1–2 cells of apical teeth of leaves and terminal 1–2 cells of underleaf lobes; underleaves usually with single tooth on either side, sometimes with two teeth at any side of the lateral margin (Figure 3 *e–h*) (Singh and Singh[8] and Gao *et al.*[12]).

Saccogynidium irregularospinum is also being recorded for the first time from the state of West Bengal in the present communication.

The genus *Saccogyna* has so far been represented by a single species, i.e. *Saccogyna viticulosa* (L.) Dumort., distributed in Macaronesia (Azores, Canary Islands and Madeira)[3,13]; Portugal[13,14]; Faeroe Isles, Norway, Corsica, Italy and Lebanon[3,15,16]; Europe[3,17] and oceanic southern-temperate zone[3,18]. The discovery of the new species increases the range of extension of this genus to the Indian subcontinent.

S. darjeelingensis is presently known from a single location only from Darjeeling district, West Bengal. The plants are vulnerable to anthropogenic disturbances as the site of occurrence is just 2 km away from human habitation (Jogighat village) and near the road connecting two tourist spots (Jogighat and Ahaldara).

Conflict of interest: The authors have no conflict of interest.

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