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Cover: Life and death in one night - wolf hunting the hare. Mixed media—gouache, acrylics, pen & colour pencils. © Dupati Poojitha.



Additions of two genera of liverworts (Marchantiophyta) to the bryoflora of Nagaland, India

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Abstract: *Pseudolepicolea trollii* (Herzog) Grolle & Ando and *Schiffneriolejeunea tumida* (Nees) Gradst. were recorded for the first time in the bryoflora of Nagaland. This also constitutes the first report of the two genera from the state. Photomicrographic details of the plants have been provided for easy identification.

Keywords: Bryophytes, extended distribution, Marchantiophyta, Nagaland, new record, Photomicrographic, *Pseudolepicolea*, *Schiffneriolejeunea*.

The state of Nagaland is situated in the extreme northeastern part of India having a geographical area of about 16,578 km². The state lies between the geographical coordinates of 25.324–27.020 °N and 93.193–95.113 °E. The state shares an international border with Myanmar (Burma) in the eastern side, while the Indian states of Assam, Arunachal Pradesh, and Manipur are situated to its western, northern, and southern sides, respectively. Nagaland's diverse topography, ranging from hills and valleys to forests and grasslands, coupled with its humid subtropical and temperate climate, creates a rich mosaic of microhabitats. These conditions are ideal for bryophytes like liverworts, mosses, and hornworts, which thrive in moist and shaded environments. The interplay of high rainfall, varying temperatures, and rich

organic matter supports the lush growth of these plants. The rich biodiversity of Nagaland supports a wide range of bryophytic species, contributing to a vibrant and ecologically significant flora.

Few bryologists have worked on the bryoflora of Nagaland. Contributions to the moss flora of Nagaland were made by Bansal et al. (2010, 2011), Chaturvedi et al. (2011a,b), Sale (2012), Sale & Yanthan (2020, 2021a,b), and Sahu et al. 2022. Whereas, Udar & Asthana (1985), Chaturvedi & Chaturvedi (2008), Nath et al. (2010), Chaturvedi et al. (2011c), Chaturvedi & Eshuo (2012), Eshuo (2013, 2014), Eshuo & Chaturvedi (2011a,b,c, 2014), Eshuo et al. (2013a,b), and Ali et al. (2024) contributed towards the knowledge of liverworts and hornworts of the state.

During the bryological exploration in Nagaland, some interesting liverwort specimens were collected from the Kohima and Mokokchung districts. On critical examination of the collected specimens, two specimens were identified as *Pseudolepicolea trollii* (Herzog) Grolle & Ando (Pseudolepicoleaceae) and *Schiffneriolejeunea tumida* (Nees) Gradst. (Lejeuneaceae), which are hitherto unknown to the bryoflora of Nagaland.

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MATERIALS AND METHODS

The collected specimens were air-dried and preserved in a standard packet (size 4 × 6 in) of a brown paper sheet. The dried specimens were soaked in water for 2–5 min to stretch out the plant body fully and morphological characters were observed under a stereo zoom Leica S6D microscope and macro-photographs were taken by using a Leica DFC420 camera attached to the microscope. The cut sections of the specimens were mounted in 30% glycerine and observed under the Leica microscope and photomicrographs were taken using the Leica DFC40 camera mounted on the Leica DM1000 microscope. The preserved specimens have been deposited at the Herbarium, Department of Botany, D.M. College of Science, Manipur (DMH) for future reference.

Taxonomic treatment

Pseudolepicolea trollii (Herzog)

Grolle & Ando, Hikobia 3: 177. 1963. *Blepharostoma trollii* Herzog, Ann. Bryol. 12: 80. 1939. *Lophochaete trollii* (Herzog) R.M.Schust., J. Hattori Bot. Lab. 23: 199. 1960. (Image 1)

Plant small, light green to brownish green, branched, branching *Frullania*-type, intercalary, rarely terminal, 10–17 mm long, 0.9–1.2 mm wide including leaves. Rhizoids are scarce and mostly present at the basal part of the stem. Stem orbicular in outline in transverse section, 9–11 cells across, 126–133.5 × 97.5–99.5 µm in diameter, differentiated; cortical cells 2-layered, sub-quadrate to polygonal, 9.8–15.4 × 5.1–11.9 µm; medullary cells quadrate to sub-quadrate or polygonal, 9.3–17.6 × 8.9–14.3 µm, thin-walled. Leaves imbricate, obliquely spreading, 0.58–0.75 mm long, 0.15–0.2 mm wide, bis bifid, lobes lanceolate, 4-lobed, lobes erect, linear, median lobes subparallel, lateral lobes spreading, lobes 12–17 cells long, 3–5 cells wide at the base, 3–4 cells uniseriate towards the apex, sinus narrow; leaf lamina 4–7 cells long, 11–15 cells wide at middle, margin crenulated; apical cells elongate, 39.2–59.8 × 9.6–12 µm, thick-walled; sub-apical cells rectangular to sub-quadrate, 47–66 × 7.5–13.0 µm, thick-walled; median cells quadrate to sub-quadrate, 19–43 × 8–20 µm, thick-walled; basal cells quadrate to polygonal, 22.5–45 × 8.5–19 µm; oil-bodies not seen. Under leaves imbricate, similar to leaves, bis bifid, 4-lobed, lobes 8–13 cells long, 3–4 cells wide at the base, 2–4 cells uniseriate at apex, sinus narrow. Androecium not seen. Perianth cylindrical, apex toothed, bracts larger than normal leaf, 1.19–1.4 mm long, 0.4–0.52 mm wide, 4-lobed, lobe ¼ of the bract length. Spores brownish green, globose, 12.8–14.4

µm in diameter. Elaters 75–105.6 µm long, 9–11.5 µm wide with bi-spiral thickening bands.

Ecology: The plants grow on moist soil and rocks in association with mosses, and the species of *Jungermannia*, *Scapania*, *Cephalozia*, and *Bazzania*.

Range: India, Bhutan, China, Indonesia, Japan, Malaysia, Nepal, and Taiwan.

Distribution in India: Arunachal Pradesh, Nagaland (present study), Sikkim, and West Bengal.

Specimen Examined: India: Nagaland, Kohima District, Khonoma, 25.371°N 94.114°E, 1700–2300 m, KE10424.

Notes: In India, the genus *Pseudolepicolea* is represented by two species, viz., *Pseudolepicolea fryei* (Perss.) Grolle & Ando and *P. trollii*. *P. fryei* has been reported from Uttarakhand in western Himalaya, whereas *P. trollii* was so far known from Arunachal Pradesh, Sikkim, Uttarakhand, and West Bengal (Singh et al. 2014; Singh & Singh 2023). Therefore, the occurrence of this taxon in Nagaland bryoflora is a new generic addition to the state with an extended distributional range.

Schiffneriolejeunea tumida (Nees)

Gradst., J. Hattori Bot. Lab. 38: 335. 1974. *Ptychanthus tumidus* Nees, Naturgesch. Eur. Leberm. 3: 213. 1838. (Image 2)

Plant light green to brownish-green, 30–60 mm long, 2.0–3.5 mm wide including leaves, irregularly branched. Stem orbicular in outline in transverse section, 0.2 × 0.25 mm in diameter, 9–11 cells across, differentiated; cortical cells 1–2-layered, quadrate to sub-quadrate, 14.5–25.0 × 7.2–21.0 µm, thick-walled; medullary cells quadrate, polygonal, 20–31 × 12–20 µm. Leaves closely imbricate, incurved, margin entire, ovate-oblong, 0.9–1.5 × 1.0–1.6 mm, apex rounded, cells quadrate to penta-hexagonal, apical cells 16–25 × 13–20 µm, median cells 23–30 × 17–22 µm, basal cells 25–44 × 15–22 µm, with nodular trigones; oil-bodies 2–5(6) per cell, 8.6–12.5 µm long, 2.1–4.0 µm wide, elongate-elliptical, or circular, roughly segmented; leaf lobule rectangular, 1/3 of the leaf length, with 2 teeth, first tooth 2 cells long, 1–2 cells wide, second tooth 5 cells long, 3 cells wide at base, 2 cells uniseriate at apex. Under leaves imbricate to contiguous, 0.3–0.5 mm long, 0.5–0.7 mm wide, wider than long, margin entire, apex oblong to obtuse. Autoicous. Androecia on short lateral branches toward the apical region, male bracts in 5–13 pairs, strongly inflated, smaller than vegetative leaves, antheridia not seen. Gynoecium with bracts in 3 pairs, bracteoles lanceolate, 1.5–2.0 mm long, 0.9–1.5 mm wide, bifid

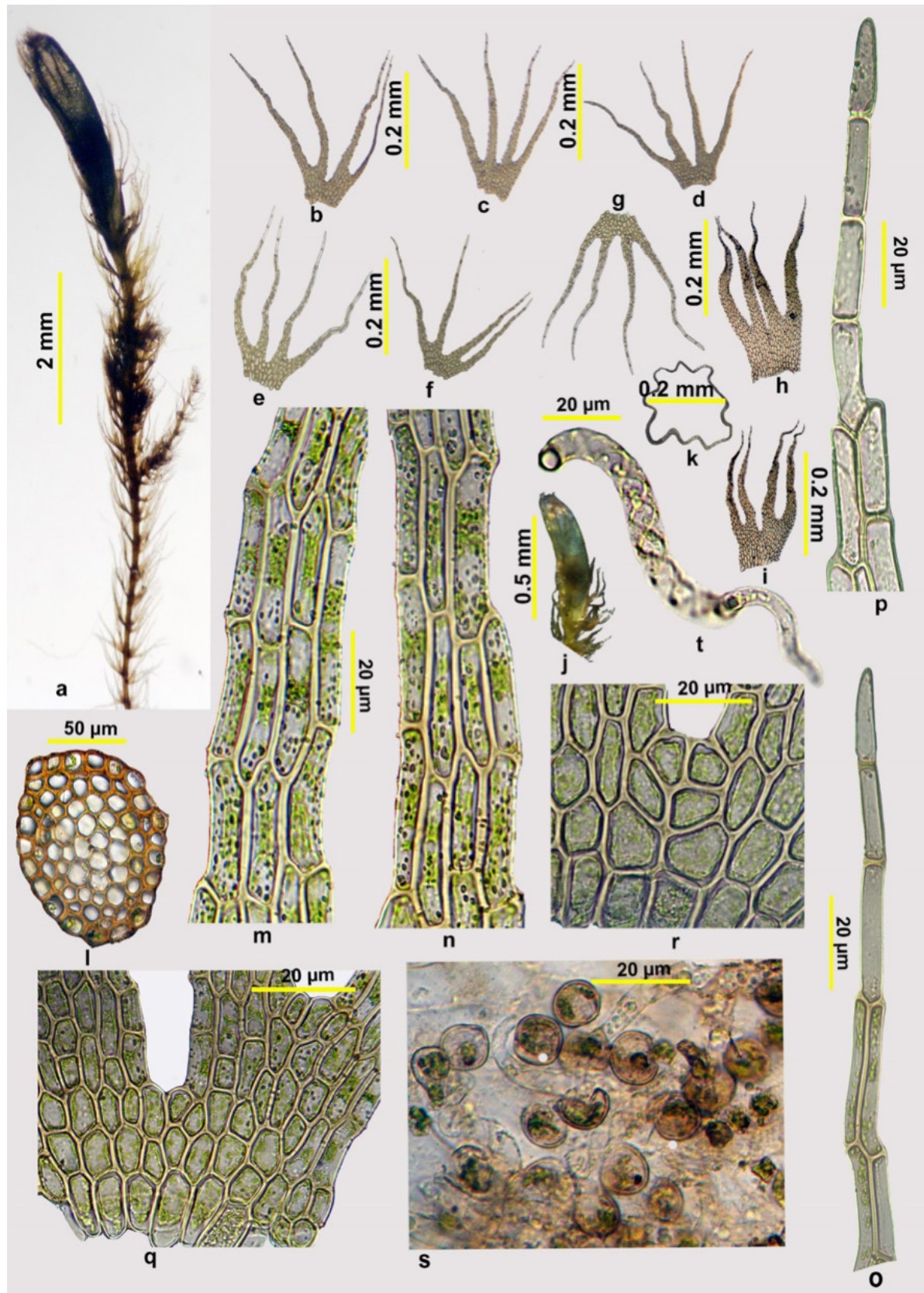


Image 1. *Pseudolepicolea trollii* (Herzog) Grolle & Ando: a—A portion of the female plant in ventral view | b–d—Leaves | e–g—Underleaves | h–l—Female bracts | j—Perianth | k—T.S. of the perianth | l—T.S. of Stem | m–n—Leaf Median cells | o—Leaf apical cells | p—Apical cells of female bract | q–r—Leaf basal cells | s—Spores | t—Elater. © Kazuhrii Eshuo.

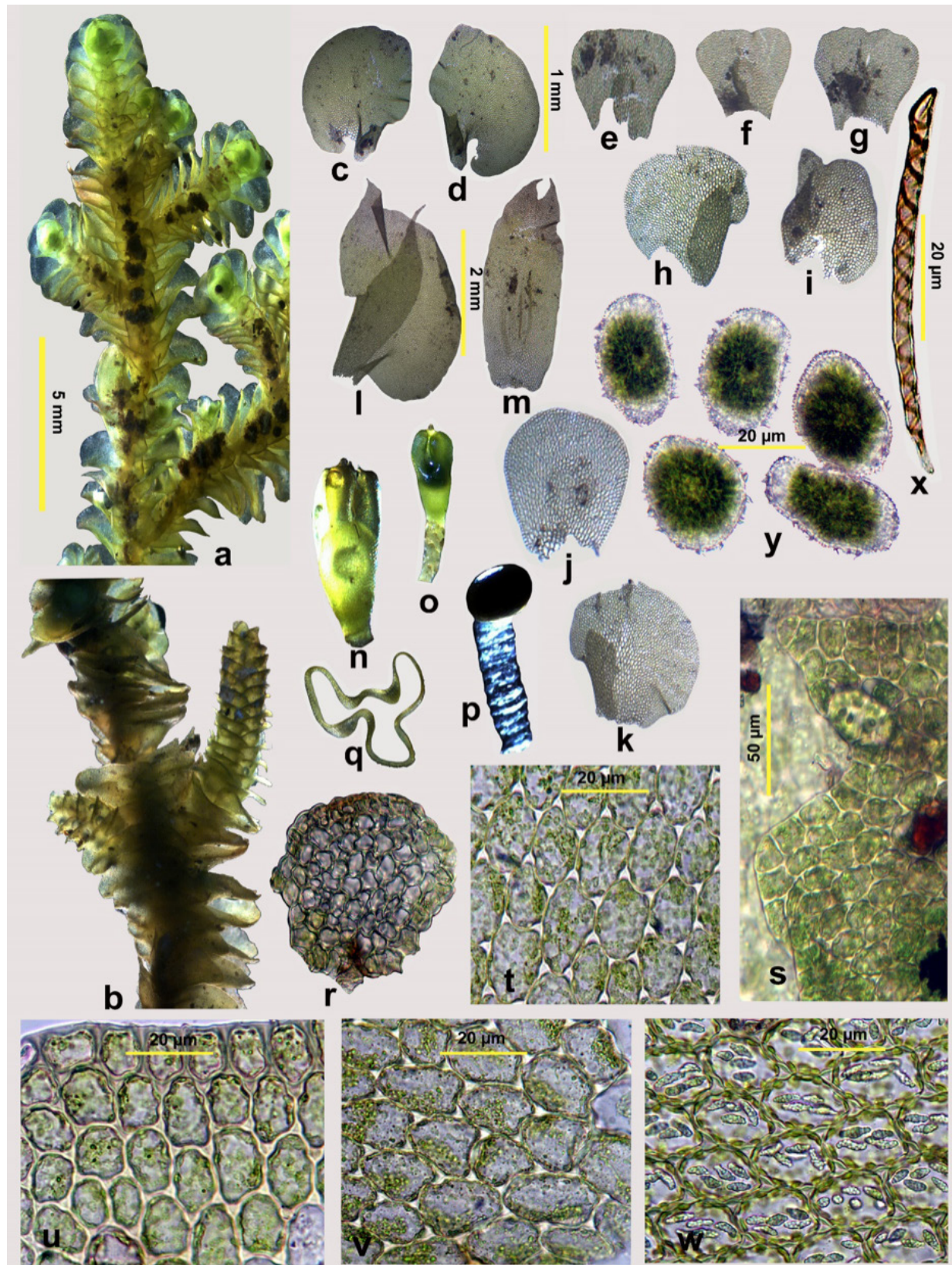


Image 2. *Schiffneriolejuenea tumida* (Nees) Gradst.: a—A portion of a plant in ventral view | b—A portion of Male plant | c—d—Leaves | e—g—Underleaves | h—k—Male bracts and bracteoles | l—Female bract | m—Female bracteole | n—o—Perianths | p—Capsule and seta | q—T.S. of perianth | r—T.S. of the stem | s—Leaf lobule | t—Leaf median cells | u—Leaf marginal cells | v—leaf basal cells | w—oil-bodies | x—Elater | y—Spores. © Kazuhrii Eshuo.

with acute apex; perianth obovate-obpyriform, with 3–5 inflated keel in the distal half and a short beak. Spores oblong to globose – sub-globose, whitish-green, 31–41 x 46–74 µm in diameter, spinose. Elaters 292.5–535 µm long, 14.5–20 µm wide with bi-spiral thickening bands.

Ecology: Epiphytic, growing in association with *Frullania*, *Acrolejeunea*, and mosses.

Range: India, Africa, Australia, China, Fiji, Indonesia, Malaysia, New Caledonia, Papua New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, and Thailand.

Distribution in India: Andaman & Nicobar Islands, Nagaland (present study), and Tripura.

Specimen Examined: India: Nagaland, Mokokchung district, Mopunchuket, 26.235°N 94.313°E, 1,000–1,200 m, KE10517.

Notes: The genus *Schiffneriolejeunea* is represented by four species in India, viz., *S. cumingiana*, *S. polycarpa*, *S. pulopenangensis*, and *S. tumida* (Udar & Awasthi 1982; Dandotiya et al. 2011). The taxa are mainly distributed in southern India and Andaman & Nicobar Islands with only *S. tumida* recently reported from Tripura in northeastern India (Singh & Kumar 2016). Therefore, the occurrence of this taxon in Nagaland bryoflora is a new generic addition to the state with an extended distributional range.

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