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Wiesnerella denudata (Mitt.) Steph. (Marchantiales; Marchantiophyta) a rare species in the Western Ghats of India

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Wiesnerella denudata (Mitt.) Steph., a complex thalloid liverwort in the family Wiesnerellaceae (Marchantiales), is reported as a new species to Peninsular India from the Anamudi Shola National park in the Western Ghats of Kerala. This species is easily confused with another thalloid liverwort, *Dumortiera hirsuta* (Sw.) Nees, due to similar morphological characters, especially size of thallus, colour and habit. *Wiesnerella denudata* is characterised by the presence of elevated air pores which can be seen with the help of a hand lens or even with naked eye, subsessile rotund male receptacle, raised female receptacle with deeply dissected carpocephalum and absence of pseudoperianth. A detailed account of the species along with photographs and SEM images of spores is provided here.

Keywords: distribution, liverwort, monotypic, thallus

Wiesnerellaceae Inoue, is a monotypic family within the order Marchantiales with a single species *Wiesnerella denudata* (Mitt.) Steph. (Iwatsuki and Mizutani 1972, Crandall-Stotler et al. 2009). This genus was first described by Schiffner (1896) with a single species *W. javanica* Schiffn. in the family *Marchantiaceae.* He described it as showing similarity with the thallus of *Lunularia cruciata* (L.) Dumort. ex Lindb. A difference between the two genera is the absence of crescent shaped gemmae cups in *Wiesnerella* Schiffn. However, Mitten (1861) had already described *Dumortiera denudata* Mitt. from east Himalaya (Borovichev and Bakalin 2014), which later became transferred to the genus *Wiesnerella* by Stephani (1899) as *Wiesnerella denudata* (Mitt.) Steph. Subsequently, *Wiesnerella javanica* (Mitt.) Steph. was synonymised with *W. denudata* (Inoue and Shimamura 1981). Campbell (1918) reported the occurrence of this species from the Indo-Malayan region and pointed out its similarity with *Dumortiera velutina* Schiffn. by shared characters such as the occurrence of dorsal air chambers with papillate photosynthetic cells, simple air pores and a symmetrically stellate carpocephalum. While unravelling the evolutionary history of Marchantiophyta by comparison of chloroplast (*rbc*L, *rps*4 and *psb*A) nuclear (ribosomal LSU) and mitochondrial (*nad*5) genes, Forrest et al. (2006) demonstrated that *Wiesnerella* phylogenetically has a sister relationship with *Targionia* L. Gao et al. (1981) described a second species of this genus *Wiesnerella fasciaria* C.Gao & G.C. Zhang, with a narrow thallus. Borovichev and Bakalin (2014) considered this species to be a synonym of *Wiesnerella denudata* and commented that the morphological features described by Gao et al. (1981) are habitat-induced variations.

Kashyap (1929) reported the occurrence of *Wiesnerella denudata* in Dalhousie of Himachal Pradesh in India, collected from a moist rock under water along the Khajiar road. *Wiesnerella denudata* is here reported as new to Peninsular India. During our surveys in Western Ghats for the past 15 years we have not located this species anywhere else than the present locality, the Anamudi Shola National Park in Western Ghats of Idukki district, where we collected it in few patches, so it appears to be rare.

Wiesnerella denudata (Mitt.) Steph., Sp. Hepat. 1: 154. 1899; Kashyap, Liverw. W. Himalayas 1: 40. 1929. *Dumortiera denudata* Mitt., J. Proc. Linn. Soc. 5: 125. 1861. *Wiesnerella javanica* Schiffn., Öst. Bot. Zeit. 46: 87. 1896. *W. fasciaria* C. Gao and K. C. Chang, Act. Bot. Yunnan. 3: 390. 1981.

Monoecious, thallus light greenish, profusely branched and growing on wet rock along with *Dumortiera hirsuta* (Sw.) Nees. *Fissidens taxifolius* Hedw. and *Thuidium* sp. Thallus 2–3 × 0.8–1 cm, 1–many times dichotomously branched, margin undulate, light coloured, areolae very distinct on the dorsal surface of thallus which delimits the inside air chambers; each air chamber opens out through an

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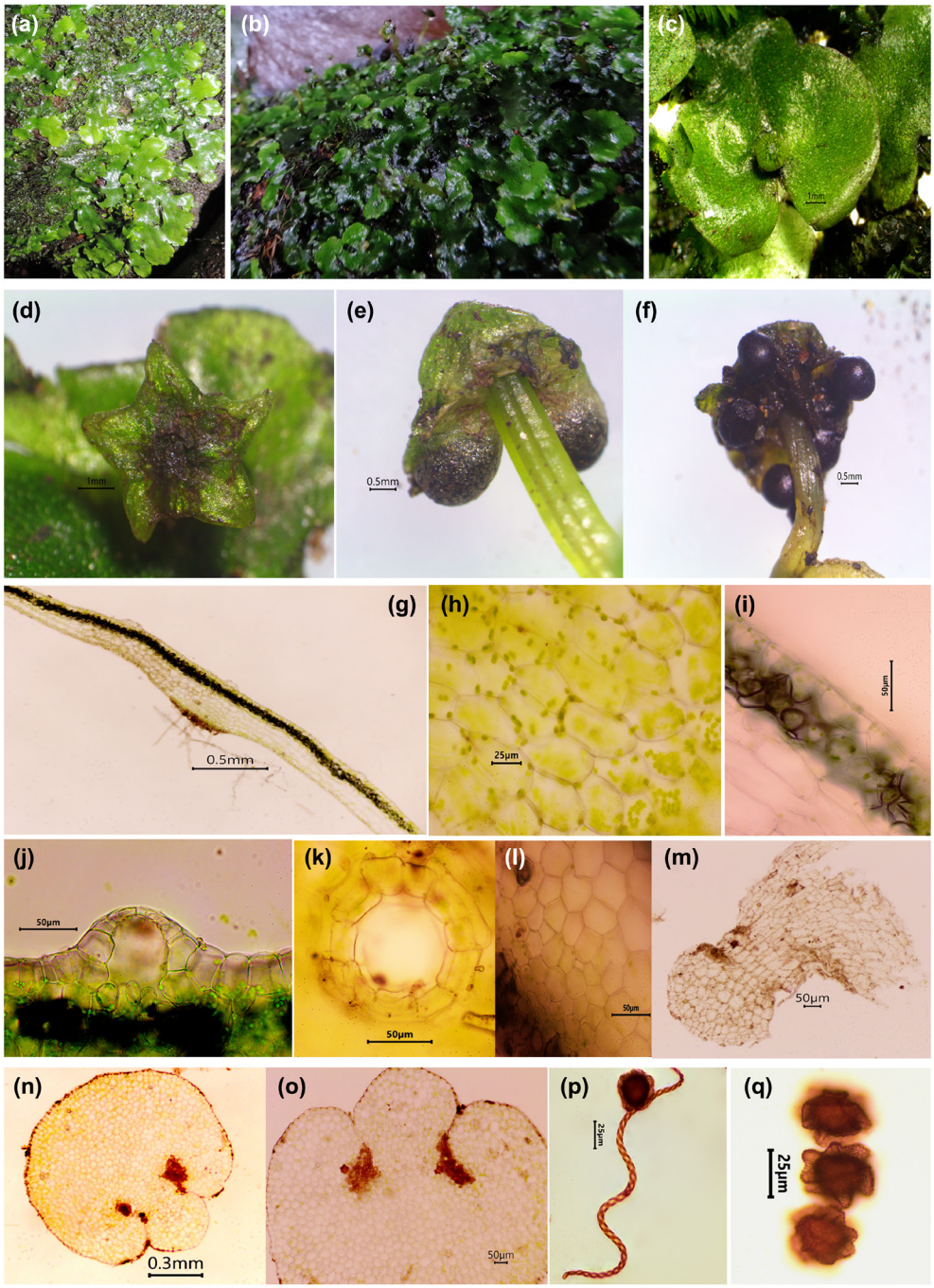


Figure 1. *Wiesnerella denudata*. (a) Plant habit. (b) Habit with sporophyte. (c) Thallus with female receptacle. (d) Female receptacle. (e) Receptacle with sporophyte side view. (f) Receptacle with sporophyte ventral view. (g) T.S. of thallus. (h) Epidermal cells. (i) Assimilatory region. (j) Air pore. (k) Air pore. (l) Storage region. (m) Scale. (n and o) Peduncle C.S. (p) Elater and spore. (q) Spores.

air pore, air pore simple and raised above the surface of the thallus at the centre of an areola, 33–38 µm wide, each pore surrounded by 4–5 rings of cells, with 8–10 cells per ring; dorsal epidermis unistratose, thin walled polygonal, subisodiametric parenchyma cells with 6–10 granulate oil bodies, 54–78 × 25–35 µm, trigones absent; anatomically divided in to upper narrow photosynthetic region and lower broad storage region, photosynthetic region with unistratose photosynthetic chambers which contain rudimentary photosynthetic filaments one or two cells high, photosynthetic cells 19–21 × 13–16 µm; storage region broad, parenchymatous, occupying 4/5 part of the thallus along midrib and 2/3 part along the margin; rhizoids of both tuberculate and smooth walled types, aggregated along the midrib; ventral scales hyaline, in one row on either side of the midrib, delicate with a single appendage, scale appendage semicircular, hyaline in young thallus and purplish in older ones, mucilaginous papillae present along the margin of the scales, margin irregular; male receptacle subsessile, cushion-like and covered by hyaline scales, formed at the tip of thallus or from behind the

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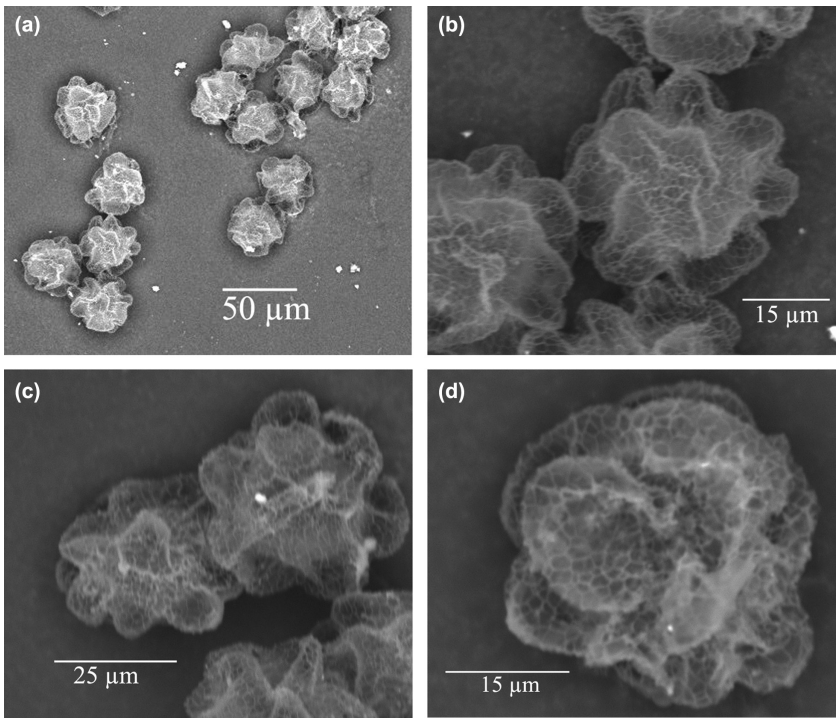


Figure 2. (a–d) SEM photos of spores of *Wiesnerella denudata*.

stalk of female receptacle; female receptacle terminal, raised, arising from a notch at apex of thallus; peduncle hyaline, 2–3 cm long, 1 mm diameter with two rhizoidal furrows; carpocephalum greenish, convex, deeply lobed with 4–6 lobes, each lobe contain a single sporophyte, pseudoperianth absent; capsule blackish, dehiscing through longitudinal valves; spores dark brownish, spherical, winged, wavy with large waves at distal end, exine is reticulate throughout the spore, 27.5–30.4 µm in diameter (without wing), wing 6.5–8 µm wide; elaters golden brown, bispiralled, 320 (± 20) µm long (Fig. 1, 2).

Habitat

In montane wet temperate forest locally known as shola forest, growing as a dense carpet on wet rock along stream side together with *Dumortiera hirsuta* (Sw.) Nees, *Thuidium* sp. and *Fissidens taxifolius* Hedw.

Distribution

Japan (Schiffner 1899), Indonesia: Tjibodason Mt. Gedeh (Campbell 1918), Papua New Guinea (Piippo 1990), China: Hunan, Yunnan, Xizang, Zhejiang, Sichuan (Koponen et al. 2000), Taiwan (Huang et al. 2012); Russia: Iturup and Shikotan Islands of South Kurils; Japan: Honshu; Korea (Borovichev and Bakalin 2014); Nepal (Pradhan and Joshi 2009); Bhutan (Long 2006); Hawaii (Campbell 1927); Afghanistan (Frey 1974); India- Himachal Pradesh: Dalhousie-Khajjiar road (Kashyap 1929, Bir and Chopra 1972.); Jammu and Kashmir (Sharma and Bhagath 2017); Sikkim (Inoue and Shimamura 1981). A map of the world distribution was given by Bischler (1998).

Specimens examined

Kerala (Idukki District) Mannavan shola, Anamudi shola NP, *Mufeed 7205 (1900 m),* 14.07.2017; *Mufeed 7450 (1850 m) 09.11.2017* (*ZGC*).

Discussion

This species is of rare occurrence in Western Ghats. We could collect the plant from only one locality but with profuse growth. The plants flourish during June–July and sporophytes are produced during October–November. The SEM studies on spores shows similarity with Taiwanese plant, the spore size is almost identical and the exine is reticulate throughout the entire spore. Sharma and Bhagat (2017) in their studies on the reproductive biology of *Wiesnerella denudata* commented that the species does not undergo propagation by any vegetative or asexual means and that thalli with only female receptacles were recorded in the populations. They also found that the thalli were monoecious or dioecious and noted that the sexuality in some thalloid liverworts may change according to the habitat. Huang et al. (2012) and Chang and Wu (2006) have reported the genus to be dioecious. In the present locality we collected monoecious specimens, with antheridia and sporophytes on the same thallus. According to Laaka-Lindberg (2000), a higher proportion of dioecious species as compared to monoecious ones fail to produce sporophytes and commented that low spore production may be a possible cause of rarity for dioecious hepatics. Sharma and Bhagat (2017) commented that they observed numerous sporophytes. In the present collection also we could see a number of sporophyte.

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