

A new species of the genus *Metzgeria* Raddi (Metzgeriaceae, Marchantiophyta) from India

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Abstract – A new species of *Metzgeria* Raddi, *M. mizoramensis* sp. nov. is described from Mizoram (Mamit district), India. The species is distinguished by its monoicous sexuality, 2-3 rows of epidermal cells of midrib in ventral view, hairs usually disposed singly along the margin and also scattered on ventral surface of thallus and presence of marginal gemmae.

Metzgeria mizoramensis / Metzgeriaceae / Mizoram / India

INTRODUCTION

Metzgeria Raddi is worldwide one of the largest genera of the order Metzgeriales with approx. 240 species listed in Index Hepaticarum (Geissler & Bischler, 1985). The species are mostly epiphytic, but many are terrestrial and epiphyllous, found in different kind of forests and ranging from tropical to subalpine. A worldwide monograph on this genus is lacking. Costa (2008) reviewed the genus for tropical America and recognized 57 species. According to Grolle & Long (2000) six species of *Metzgeria* are present in Europe, Schuster (1992) recognized seven species in North America, 17 species are accepted for Australasia and the Pacific by So (2002), eight species for Africa (So, 2004; Phephu & van Rooy, 2013) and 36 species for Asia by Kuwahara (1986), but So (2003) accepted only 10 species in Asia. According to the recently published world checklist of hornworts and liverworts, *Metzgeria* is represented by about 108 taxa worldwide (Söderström *et al.*, 2016).

To date, 21 taxa of the genus are recognized from India with the higher number of species in Eastern Himalaya (14 taxa) followed by Western Ghats (10 taxa) and the Western Himalaya (6 species) (see Srivastava & Udar, 1975; Srivastava & Srivastava, 2004; Singh *et al.*, 2016 and literature therein). The Eastern Ghats and Deccan Plateau is represented by two species viz. *Metzgeria himalayensis* Kashyap and *M. pandei* S.C. Srivast. & Udar, while in Punjab and West Rajasthan only *M. himalayensis* is present (Singh *et al.*, 2016).

In the framework of the liverwort and hornwort flora of Mizoram project, one of author (SKS) collected an interesting corticolous *Metzgeria* population. After a careful examination of the morphological and anatomical characters of this taxon and study of literature (Kuwahara, 1958, 1960, 1965, 1966, 1975, 1984, 1986; Srivastava & Udar, 1975; Schuster, 1992; Paton, 1999; So, 2002, 2003, 2004; Srivastava & Rawat, 2003; Srivastava & Srivastava, 2004; Singh *et al.*, 2007; Singh

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& Singh, 2008; Costa, 2008) it has been found that this belongs to an undescribed species. The new species is described here, illustrations and photographs are presented and differences to the morphologically similar *M. conjugata* Lindb. and *M. furcata* (L.) Corda are discussed.

DESCRIPTION AND DISCUSSION

Metzgeria mizoramensis Sushil K. Singh & D. Singh, *sp. nov.*

Figs 1-42

Type: INDIA: Mizoram, Mamit, Dampa Tiger Reserve, Phuldungsei Range, 23°30'0.7" N, 92°25'0.2" E, 932 m, 27.11.2011, S.K. Singh *et al.* 124090 (holo: CAL; Iso: ASSAM)

Plants light green when fresh, pale green in herbarium; thalli 10-20 mm long, 0.8-1.6 mm wide, dichotomously branched; apices obtuse to slightly retuse; ventral adventitious shoots present. Midrib distinct, 62-80 µm wide dorsally, 65-100 µm ventrally; dorsal epidermal cells in 2 rows, cells subquadrate to subhexagonal, 30-75 × 30-40 µm; ventral epidermal cells in 2-3 rows, except near the dichotomous branching, cells subquadrate to subhexagonal, 37-65 × 25-50 µm; 12-17 inner cells, 4 cells wide, 4-7 cells high; wing 14-20 cells wide on either side of midrib; marginal cells subquadrate to polygonal, 30-45 × 20-35 µm; median wing cells polygonal, 32-55 × 20-37 µm, cells thin-walled with minute-indistinct trigones; hairs short, straight, 35-100 µm long, 10-12 µm wide, usually single, very rarely in pairs, more dense on ventral surface of midrib, 45-150 µm long, 10-15 µm wide, hairs also distributed on ventral surface of thallus, 35-65 µm long, 8-12 µm wide. Gemmae marginal, ovoid – linear-elliptical.

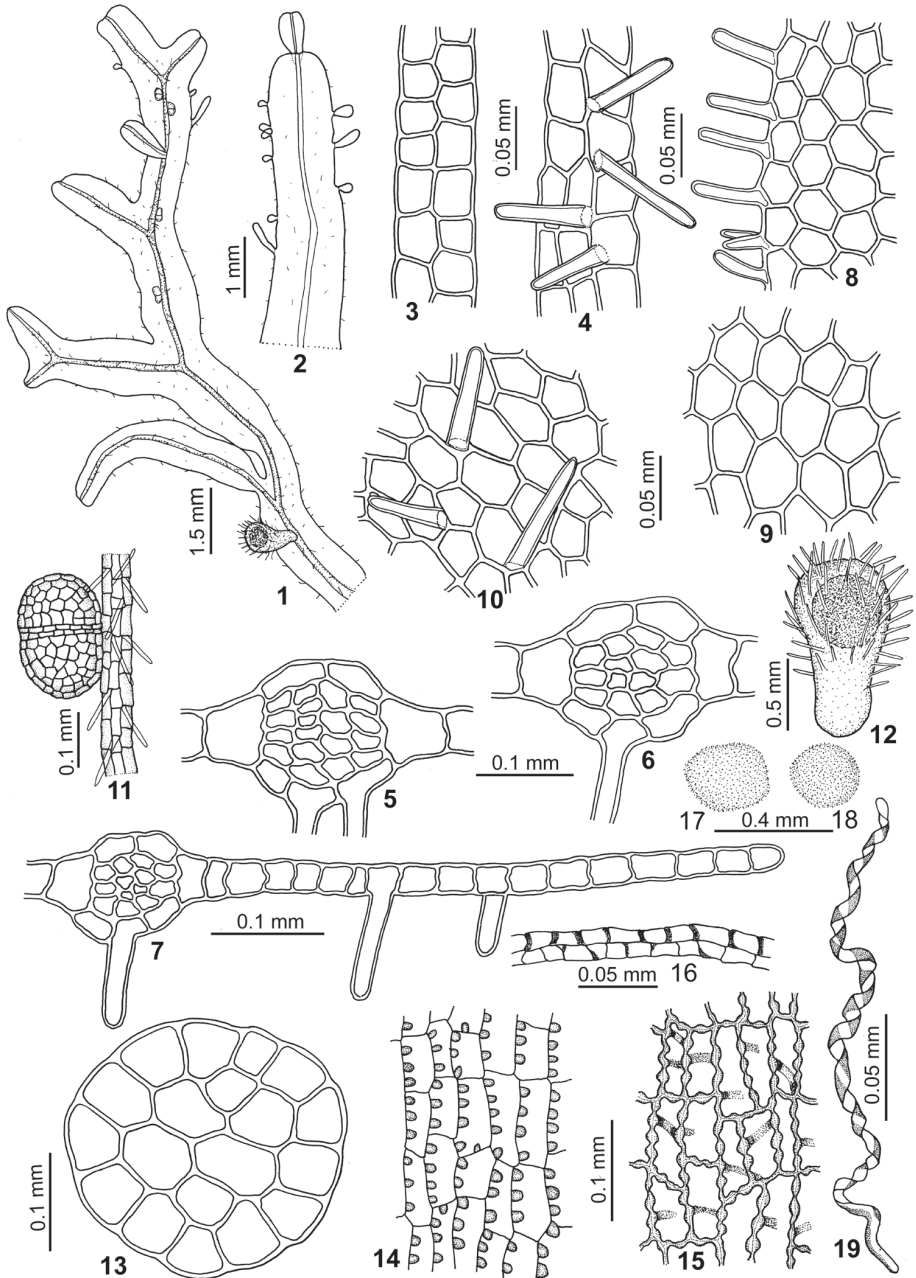
Monoicous. Male branches globose-subglobose, 180-260 × 140-200 µm, hairs absent over the surface and midrib of male branches, midrib cells in two rows. Female branches pyriform, covered with bristly hairs; calyptra clavate, 0.9-1.2 mm long, covered with straight, pointed hairs; hairs 45-65 µm long, 10-15 µm wide. Seta circular in outline in transverse section, 162-180 µm in diameter, 4-5 cells across; capsule subspherical, blackish brown, 480-520 × 420-440 µm, valves 0.4-0.5 mm long, 0.2-0.3 mm wide, each bearing a tuft of fixed elaters at the apex; wall bistratose; cells of the outer layer subquadrate-rectangular, 30-75 × 15-30 µm with thickenings on the radial wall and occasional on transverse walls, with the thickenings confined to one side of radial wall only and not extending over tangential wall, thus appearing nodulose in surface view; those of the inner layer subquadrate-rectangular, 20-62 × 12-25 µm, wall sinuate-subnodulose thickenings on the radial walls with ill-defined, complete or incomplete, weakly pigmented transverse bands and it appears semmiannular in surface view. Spores yellowish red, globose-subglobose, 20-25 µm in diameter, surface tuberculated. Elaters 100-250 µm long, 4-8 µm broad with unispiral thickening band.

SEM study of spores revealed a double sculptured sporoderm pattern, with the surface of exine having distinct verrucae interspersed with conspicuous tubercles. The tubercles are somewhat with bulbous base and occasionally obliquely truncate-furcate apices.

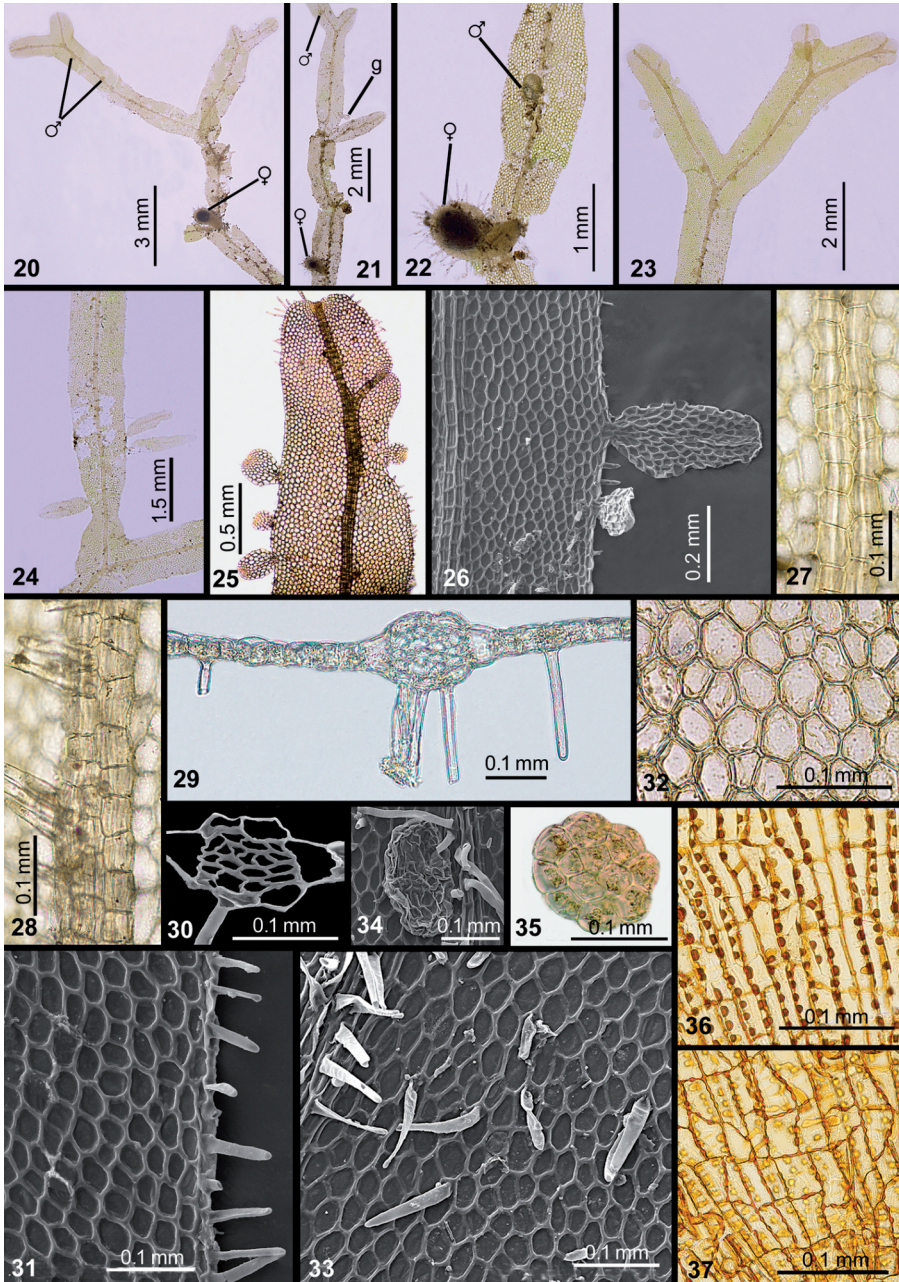
Habitat: Corticolous, growing in moist and shady environment on the bark of tree.

Distribution: India (Mizoram), probably endemic.

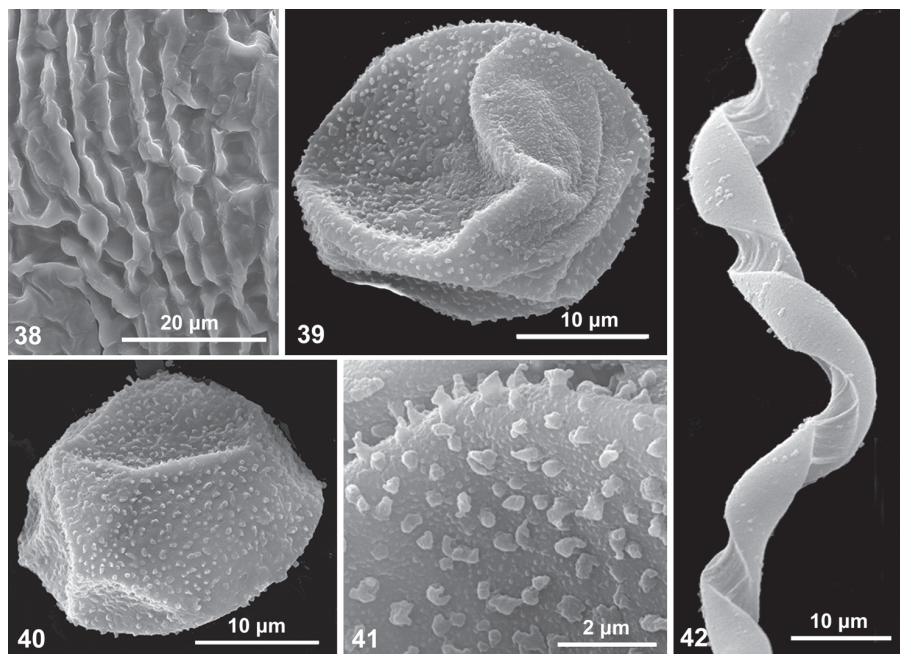
Etymology: The species has been named after its type locality.



Figs 1-19. *Metzgeria mizoramensis* Sushil K. Singh & D. Singh. 1. Thallus in ventral view bearing male and female branches; 2. A portion of thallus showing marginal gemmae in ventral view; 3. Dorsal epidermal cells of midrib; 4. Ventral epidermal cells of midrib; 5-7. Portions of cross section of thalli; 8. Marginal cells of thallus; 9. Median cells of thallus in dorsal view; 10. Median cells of thallus in ventral view; 11. An antheridial branch; 12. Young archegonial branch bearing sporophyte; 13. Cross section of seta; 14. Cells of outer layer of capsule wall; 15. Cells of inner layer of capsule wall; 16. Cross section of capsule wall; 17, 18. Spores; 19. An elater. [All figures drawn from the holotype].



Figs 20-37. *Metzgeria mizoramensis* Sushil K. Singh & D. Singh. 20-22. Portions of thalli in ventral view bearing antheridial and archegonial branches; 23-26. Portions of thalli showing marginal gemmae; 27. Dorsal epidermal cells of midrib; 28. Ventral epidermal cells of midrib; 29, 30. Cross section of thalli; 31. Marginal cells of thallus; 32. Median cells of thallus in dorsal view; 33. Median cells of thallus in ventral view; 34. An antheridial branch; 35. Cross section of seta; 36. Cells of outer layer of capsule wall; 37. Cells of inner layer of capsule wall. [All micrographs from the holotype; g = gemmae; Figs 26, 30, 31, 33, 34 micrographed under SEM, others under light microscope].



Figs 38-42. *Metzgeria mizoramensis* Sushil K. Singh & D. Singh. **38.** A portion of capsule wall, inner view; **39, 40.** Spores; **41.** Detail of spore; **42.** Part of an elater [All micrographs from the holotype].

Metzgeria mizoramensis resembles *M. conjugata* Lindb. in general appearance, monoicy, wing cells and presence of hairs on the ventral surface of the thallus. However, *M. conjugata* differs from *M. mizoramensis* in the absence of marginal gemmae, the marginal hairs are usually paired (occasionally single), the presence of hairs over the surface and midrib of the male branches and by the pyriform calyptra (Schuster, 1992; Singh & Singh, 2008). *Metzgeria mizoramensis* also resembles *M. furcata* (L.) Corda var. *furcata* in having a similar number of wing cells, marginal gemmae and presence of the hairs on the ventral surface of thallus. However, *M. furcata* var. *furcata* differs from *M. mizoramensis* in having dioicous sexuality and invariably disposed single marginal hairs (Kuwahara, 1958; Schuster, 1992).

The closely related and compared species, *M. conjugata* is a complex taxon (Söderström *et al.*, 2016) which includes two clearly separated lineages, i) northern North American lineage (*Metzgeria conjugata* s.str.) and ii) southern North American and European lineage (*Metzgeria simplex*) as demonstrated by Fuselier *et al.* (2009) based on molecular studies. However, in their publication (Fuselier *et al.*, 2009), the authors did not provide any remarkable morphological differences which can differentiate both the lineages morphologically. Following Schuster (1992), our plant is comparable with southern North American and European lineage (*Metzgeria simplex*).

It is also interesting to note that majority of the *Metzgeria* species (< 95 species) are dioicous, and only a very few species namely: *Metzgeria chilensis* Steph., *Metzgeria conjugata* Lindb., *Metzgeria lindbergii* Schiffn. *Metzgeria monoica*

Kuwah. & J.J.Engel, *Metzgeria saxbyi* Pearson and *Metzgeria sikkimensis* S.C.Srivast. & K.K.Rawat bears monoicous sexuality. A key to monoicous species of the genus known from Indian regions is presented.

Key to Monoicous species of *Metzgeria* in India

- 1a. Hairs present on the ventral surface of the wing.....2
- 1b. Hairs absent on the ventral surface of the wing.....3
 - 2a. Marginal gemmae present; marginal hairs usually single (occasionally paired); hairs absent over the surface and midrib of the male branches; calyptra clavate.....*M. mizoramensis*
 - 2b. Marginal gemmae absent; marginal hairs usually paired (occasionally single); hairs present over the surface and midrib of the male branches; calyptra pyriform.....*M. conjugata*
- 3a. Dorsal midrib of the thallus in 2 rows and ventral midrib in 2-3 (-4) rows; marginal gemmae present.....*M. raoii*
- 3b. Dorsal midrib of the thallus in 2 rows and ventral midrib in 2 (-3) rows; marginal gemmae absent.....4
 - 4a. Marginal hairs disposed singly or in pairs.....*M. lindbergii*
 - 4b. Marginal hairs always disposed singly.....5
- 5a. Plants 10-15 mm long; wing 12-18 cells wide on either side of midrib; inner cells of the midrib 9-11 cells in number.....*M. himalayensis*
- 5b. Plants 12-24 mm long; wing 18-27 cells wide on either side of midrib; inner cells of the midrib 17-20 cells in number.....*M. sikkimensis*

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