

Morphology of *Metzgeria conjugata* Lindb. (Metzgeriales, Hepaticopsida)

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Abstract. Scanning electron microscopy and light microscopy were used to elucidate the morphology of *Metzgeria conjugata* Lindb. and confirm the presence of 2 rows of epidermal cells on the dorsal surface, (21-3) rows on the ventral surface, midrib with cells in (3-51-6) tiers; hirsute, short hairs, straight on the thallus-margin and on the ventral surface of midrib; marginal hairs paired, single or in groups of three; male branches globose or subglobose; female involucre obovate and hirsute at the margin, calyptra fleshy, pyriform to club-shaped, hirsute on the outer surface, hairs long and straight.

Introduction

The morphology of the family Metzgeriaceae has been described and illustrated by many authors in floristic papers to characterize the species belonging to this family. This paper deals with the morphology of *Metzgeria conjugata* Lindb.; it was studied for the first time with a scanning electron microscope (SEM) and the results were compared to those obtained with a light microscope (LM), as a contribution to the taxonomy of the family in Brazil; the Metzgeriaceae is represented there only by the genus *Metzgeria*, with 28 species and 7 varieties. *Metzgeria conjugata* was chosen because it is widespread, but in Brazil it is restricted to the southern and southeastern regions. It belongs to the section with the largest number of species. This study tested the usual technics of scanning electron microscopy in the Metzgeriaceae.

Metzgeria conjugata Lindb., Acta Soc. Sci. Fenn. 10: 495. 1875.

Type-locality: Europe.

Gametophyte thallose, median-sized to robust, pale green to green-yellowish, prostrate, 20-30 mm long and 1-2 mm wide. Thallus plane to slightly convex, dichotomously branched, apex broad and obtuse, margin recurved. Unistratose lamina in transverse section with (10-) 12-20 (-22) hexagonal cells, 22-65 x 16-45 μm , midrib weakly convex on the ventral side, with 2 rows of epidermal cells on the dorsal surface (cells 22-70 x 26-53 μm) and 2(-3) rows of cells on the ventral surface (cells 18-50 x 16-47 μm), medulla consisting of 17-20 cells, distinct from epidermal cells, 10-33 x 7-21 μm , in 3-5(-6) tiers, cells walls thickened, with small trigones.

Thallus hirsute, hairs short, erect, at the thallus-margin and on the ventral surface of midrib (40-120 μm long), not branched; marginal hairs usually geminate, sometimes single, occasionally in clusters of 3. Gemmae at the margin. Monoicous. Male branches globose or subglobose, without hairs. Calyptra pyriform to club-shaped, hirsute, hairs straight, 1.2 x 0.5 mm. Capsule globose or subglobose, opening by 4 valves, the outer layer of capsule wall with semi-circular thickenings, the inner layer with nodulose thickenings. Elaters 120-600 μm long, 5-9(-14) μm wide at midlength, with one spiral thickening. Spores small, 23 x 25 μm , heteropolar, trilete, brown-red and surface verrucate.

Usually found on wet rocks, shaded, rarely on tree trunks.

In Brazil, restricted to the south and southeast regions.

Material and Method

The specimen examined belongs to the bryophyte collection of Rio de Janeiro Botanical Garden herbarium (RB). For SEM examination the material was fixed to an aluminum stub by a double-faced adhesive tape and covered by a gold layer in a Balsers Sputtering apparatus (Postek *et al.* 1980). Observations were made with a SEM JEOL 25-S.II of the Laboratory Hertha Meyer, Institute of Biophysics Carlos Chagas Filho, Federal University of Rio de Janeiro, and with a light microscope Olympus PM-10AD of the Laboratory of Structural Botany of the Rio de Janeiro Botanical Garden.

Transverse sections were made by hand under a stereoscopic microscope, and mounted in water and glycerine. For photomicrographs, sections were stained with Astra Blau 2% and a yellow filter was used.

Results and discussion

The laminal cells are distinct from the midrib cells; the former are hexagonal while the latter

are rectangular (fig. 1). The hairs are located at the thallus-margin and on the ventral surface of midrib (figs. 2-3). At the margin they are short and straight, geminate in some cells, single or in a cluster of three (fig. 4-5). In transverse section the thallus shows 2 rows of epidermal cells on the dorsal surface and 2(-3) on the ventral surface; the lamina is unistratose with (10-)12-20(-22) cells from the midrib to the thallus margin; medulla with 17-20 cells in 3-5(-6) tiers, with wall thickenings (fig. 6-7). The gemmae are lamellar at the thallus margin (figs. 8-9). The male branches are globose or subglobose, without hairs, on the ventral surface of the midrib (figs. 10-11). Female involucre obovate with long straight hairs at the margin (fig. 12). The calyptra is pyriform to club-shaped, with hairs long and straight on the outer surface (fig. 13). Elaters wide in the middle and with one spiral thickening. Spores small, heteropolar, triletes, brown-reddish, surface verrucate (figs. 14-16).

These observations agree with those of Frye and Clark (1937), Kuwahara (1958, 1966, 1976a, 1976b, 1986) and Srivastava and Udar (1975); in our material, marginal gemmae were observed (figs. 8-9) as cited by Frye and Clark.

The marginal hairs, the gemmae, the female involucre, the calyptra, the spores and the elaters were observed under the SEM for the first time showing that the usual SEM technics are possible for the Metzgeriaceae.

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Literature Cited

- Frye, T.C. & Clark, L. 1937. Hepaticae of North America. Univ. Wash. Publ. Bryol. 6(1): 130-140.
Kuwahara, Y. 1958. A revision of the Japanese species of the

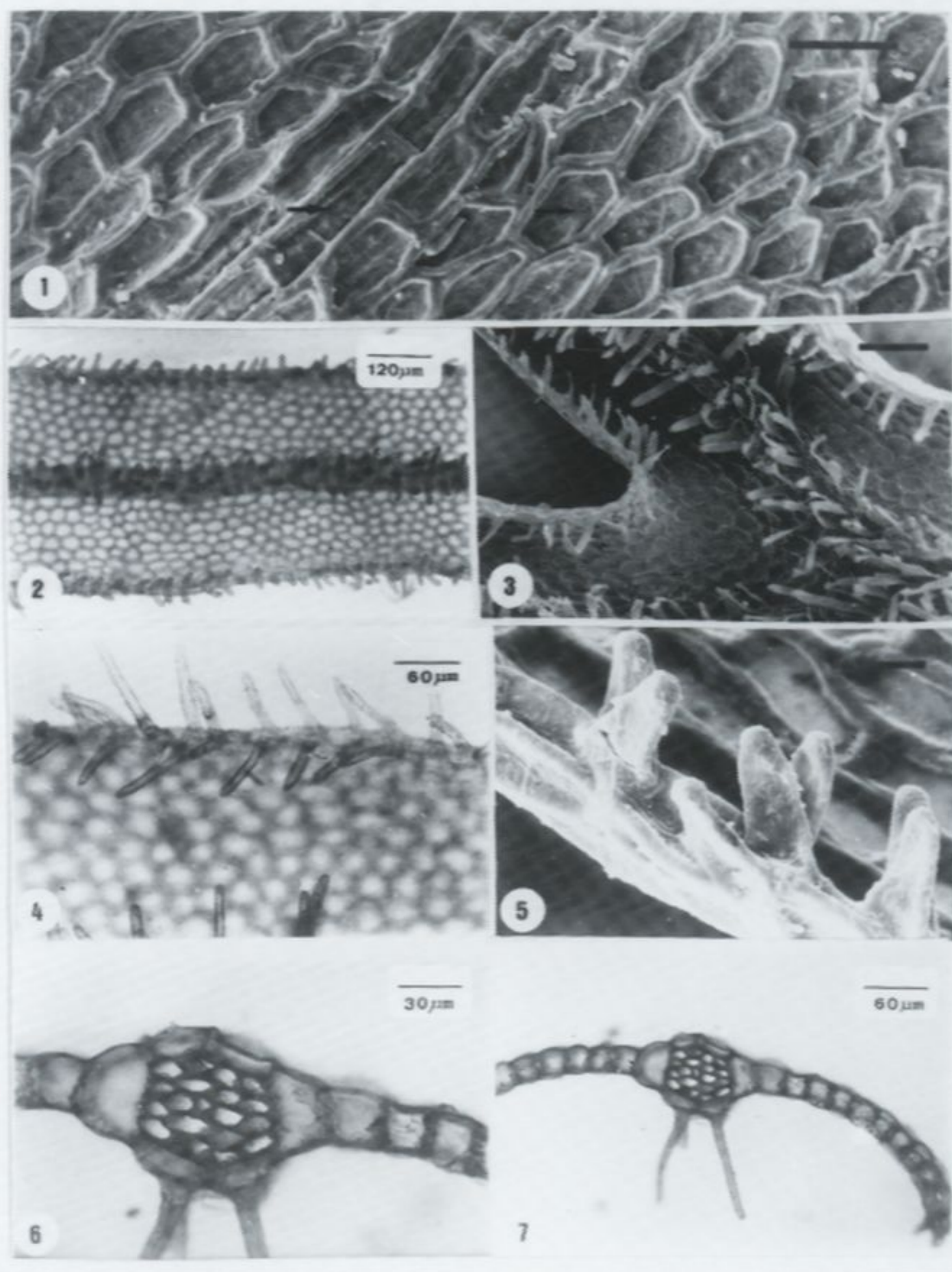


Fig. 1-7. *Metzgeria conjugata* Lindb. 1. Dorsal surface of thallus showing midrib cells and the laminal cells. (SEM-300x, Bar = 40 μm). 2. Ventral surface of thallus (L.M.). 3. Ventral surface of thallus. (SEM-150x, Bar = 100 μm). 4. Marginal hairs (L.M.). 5. Marginal hairs (SEM-1000x, Bar = 10 μm). 6. Transverse sections of thallus (L.M.). 7. Transverse section of midrib (L.M.).

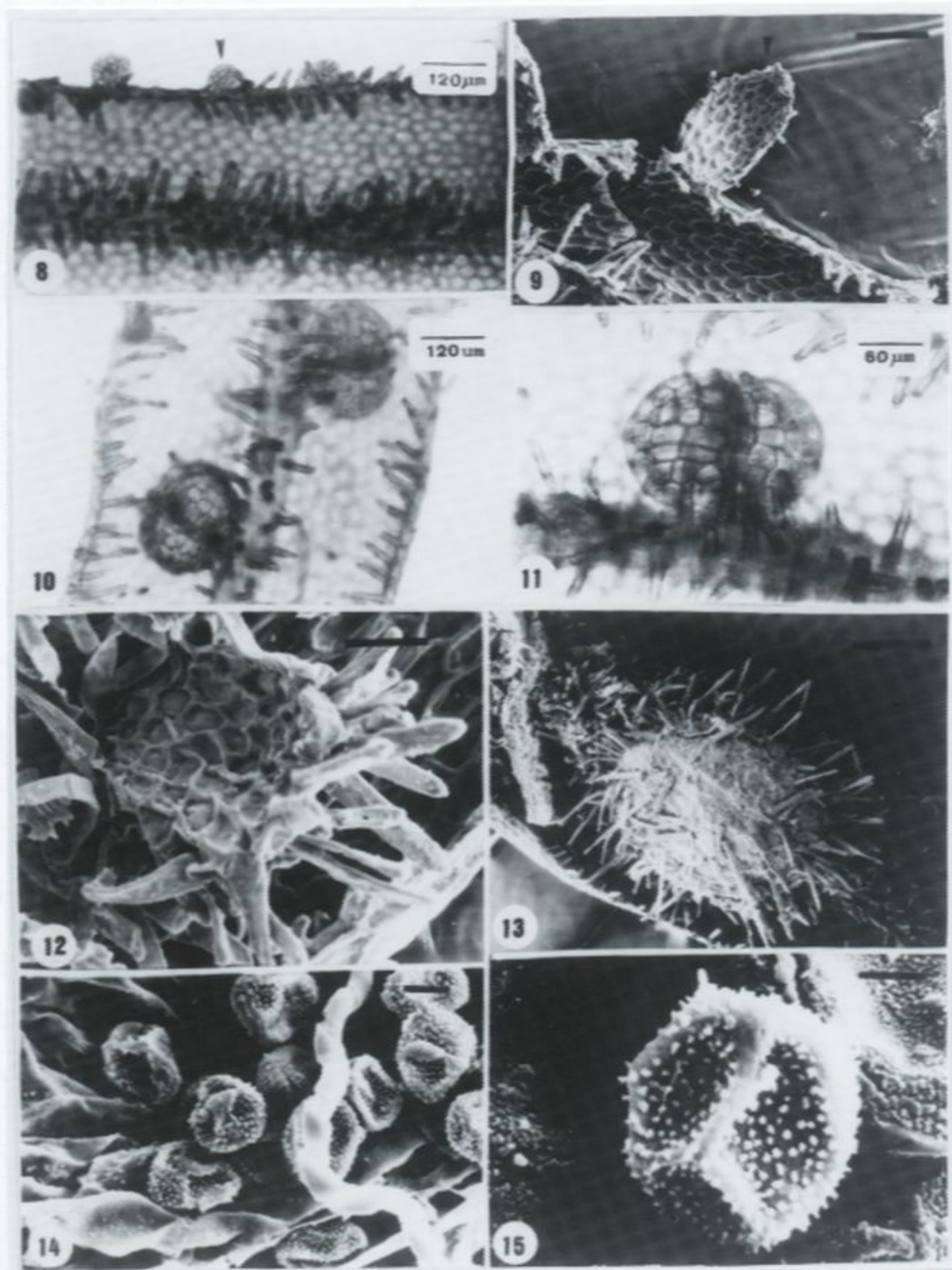


Fig. 8-15. *Metzgeria conjugata* Lindb. 8. Gemmae at the thallus margin (L.M.). 9. Gemmae at the thallus margin (SEM-150x, Bar = 100 μ m). 10. Part of male thallus, with male branches subglobose (L.M.). 11. Male branch subglobose (L.M.). 12. Female involucre (SEM-450x, Bar = 40 μ m). 13. Calyptra (SEM-69x, Bar = 250 μ m). 14. Spores and elaters (SEM-1000x, Bar = 10 μ m). 15. Spore polar view (proximal face up) with trilete aperture and verrucate surface (SEM-3000x, Bar = 5 μ m).

genus *Metzgeria*. Jour. Hattori Bot. Lab. 20: 124-141.

Kuwahara, Y. 1966. The family Metzgeriaceae in North and South East Asia, Pacific Oceania, Australia and New Zealand. Rev. Bryol. Lichénol. 34: 191-239.

Kuwahara, Y. 1976a. Studies of the genus *Metzgeria* of Colombia collected by Mme. Hélien Bischler, 1956-59. Jour. Hattori Bot. Lab. 40: 259-290.

Kuwahara, Y. 1976b. Variation in the capsule-wall structure in three common species of *Metzgeria* (Hepaticae), with special reference to the gametophytic features. Jour. Hattori Bot. Lab. 40: 247-258.

Kuwahara, Y. 1986 The Metzgeriaceae of the Neotropics. Bryophyt. Bibl. 28: 1-254.

Postek, M.T., K.S. Howard, A.H. Johnson & K.L. Michael. 1980. Scanning Electron Microscopy. Ed. Ladd. Research Industries.

Srivastava, S.C. & R. Udar. 1975. Taxonomy of the Indian Metzgeriaceae. A monography study. New Bot. 2(1): 1-57.