

A NOTE ON THE STATUS OF *METZGERIA MACROSPORA* (METZGERIACEAE, MARCHANTIOPHYTA)

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ABSTRACT

Metzgeria macrospora is found taxonomically distinct from *M. consanguinea* Schiffn. A detailed description and illustration including SEM study of spores has been provided and its taxonomic status is discussed.

Keywords: *Metzgeria macrospora*, Metzgeriaceae, Rediscovery, Taxonomic status

INTRODUCTION

Metzgeria macrospora Kuwah. was established by Kuwahara (1969) based on collections made by M. Togashi from Migothang-Nayathang and by Hara and others from Dzongri and Nayathang-Phalut in West district of Sikkim in 1960. The species is characterized by dioicous plants with the thalli having both tapered and blunt apices; small, more or less papillose, mucilaginous gemmae present along the tapered apical portion of the thallus; large antheridial branches; club-shaped calyptra; nodulose thickenings in the cells of outer layer and semiannular thickenings in those of the inner layer of capsule wall and large, spinose spores, 31.0 - 36.0µm in diameter (Kuwahara, 1969). In a revision of Indian Metzgeriaceae, Srivastava and Udar (1975) treated this species as doubtful because of non availability of specimens. Recently, in her treatise on the Asiatic species of the genus *Metzgeria* Raddi, So (2003) treated this species as a synonym under *M. consanguinea* Schiffn. based exclusively on vegetative features, like tapered and obtuse thallus apices; marginal and apical gemmae; width of thallus lamina and the number of ventral and dorsal costal cells.

Observations on our recent collections of fruiting specimens, referable to *M. macrospora*, from Zaluk-Lungthung and Lungthung in East district of Sikkim, and the paratypes obtained from NICH, however, have revealed a number of morphological character, including size of male branch, shape of calyptra and the capsule, nature of thickenings in the cells of the capsule wall and the size and sporoderm ornamentation of spores, which provide vital taxonomic parameters for distinguishing it from *M. consanguinea*. While gametophytic features in bryophytes show considerable variation under the influence of the growing conditions, the sporophytic features are considered more conservative and stable, hence more reliable and useful for taxonomic delimitation of the taxa.

We have examined materials of *M. macrospora* from five different locations in East and the West districts of Sikkim and found that range of variations in the key characters are consistent across the populations and hence of considerable taxonomic significance. As the two species are remarkably distinct from each other in their gametoecial and sporophytic details, an elaborate description of *M. macrospora*, including scanning electron microscopic details of spores, is provided to remove any doubts about its taxonomic distinctiveness.

DESCRIPTION

Metzgeria macrospora Kuwah. in J. Hattori Bot. Lab. 32: 17. 1969; S.Hatt. in Hara, The Flora of Eastern Himalaya 2: 240. 1971. *M. consanguinea* auct. non Schiffn.: M.L. So in J. Hattori Bot. Lab. 94: 160. 2003.

(Figs. 1, 2)

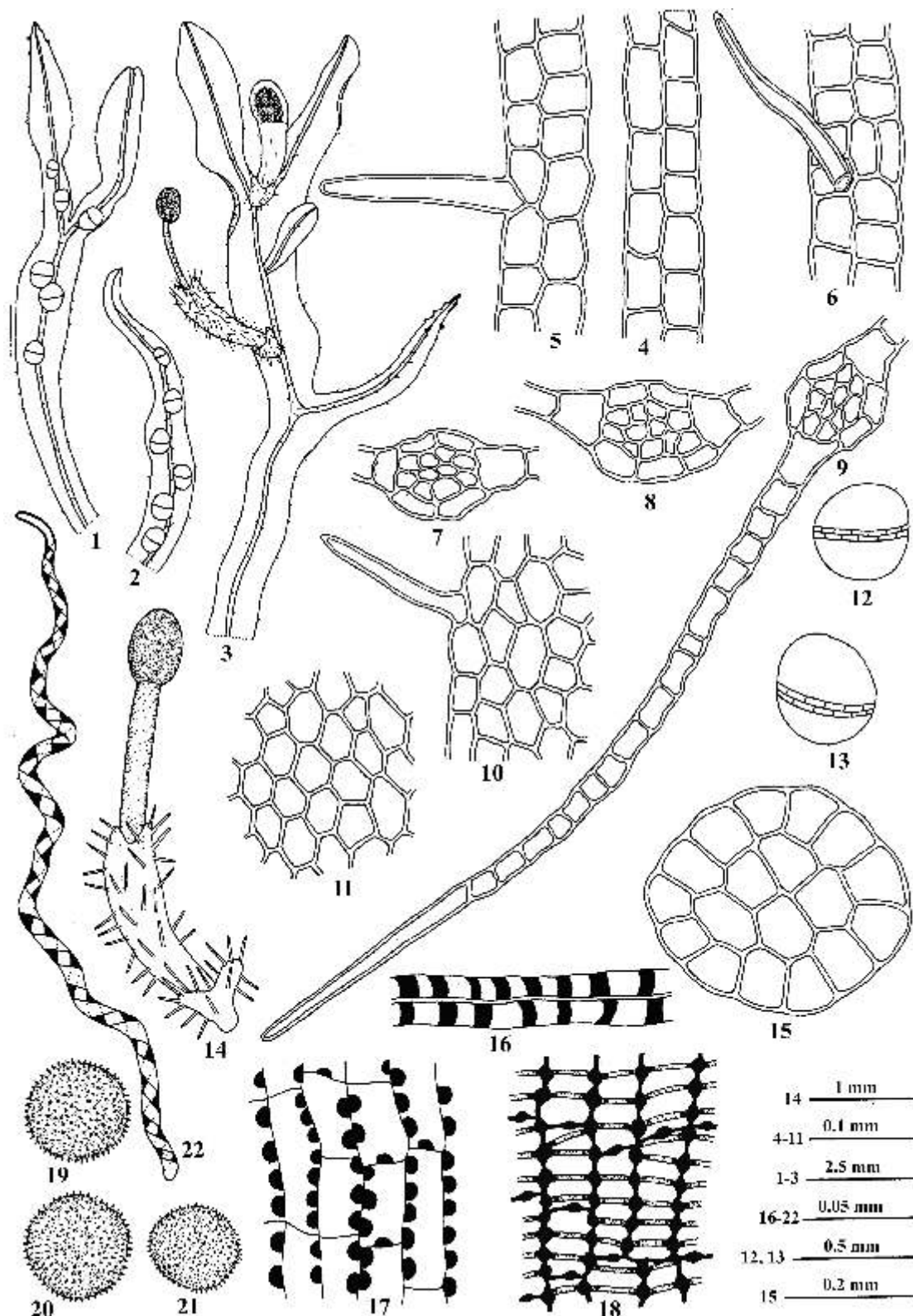


Fig. 1. : *Metzgeria macrospora* Kuwah.: 1, 2. A portion of male thallus in ventral view bearing antheridial branches; 3. A portion of female thallus in ventral view bearing archegonial branches; 4. Dorsal epidermal cells of midrib; 5, 6. Ventral epidermal cells of midrib; 7 – 9. Transverse sections of thallus; 10. Marginal cells of thallus; 11. Median cells of thallus; 12, 13. Antheridial branches; 14. A gynoecial branch with calyptra and sporophyte; 15. Transverse section of seta; 16. Transverse section of capsule wall; 17. Outer layer of capsule wall; 18. Inner layer of capsule wall; 19 – 21. Spores; 22. An elater (Figure 1 drawn from D.K. Singh & D. Singh 39981; 8, 11 from M. Togashi 201677 (NICH) and 13, 19 drawn from H. Hara et al. 201208 (NICH); others from D.K. Singh & D. Singh 39967).

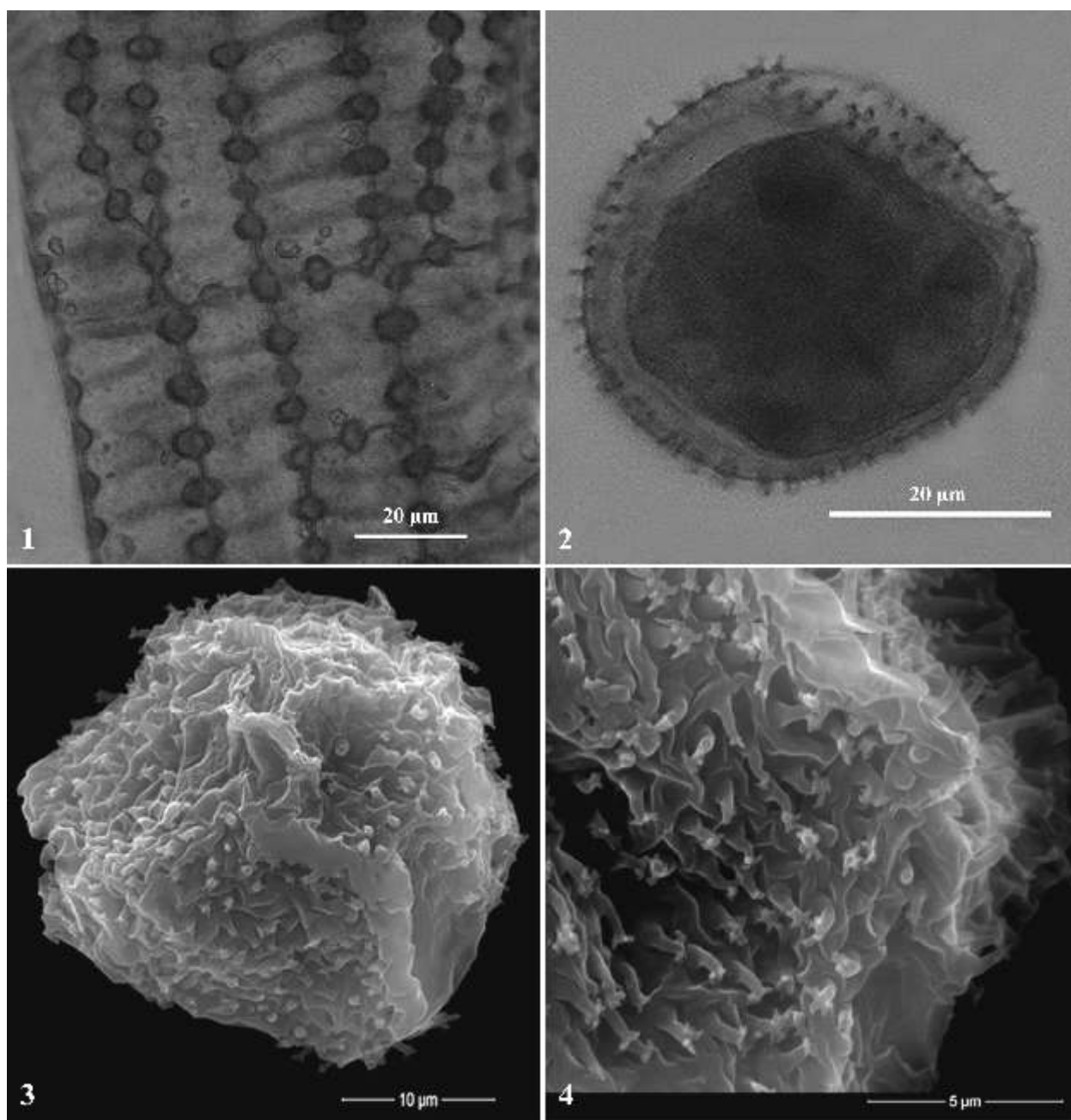


Fig. 2. : *Metzgeria macrospora* Kuwah.: **1.** Inner layer of capsule wall under LM; **2.** A spore in equatorial view under LM; **3.** A spore under SEM; **4.** A portion of the same enlarged (All microphotographs from D.K. Singh & D. Singh 39967).

Plants bright green-light yellowish green when fresh, pale yellow in herbarium, 8.0 - 18.0mm long, 0.7 - 1.2mm wide, dichotomously branched; apices acute-obtuse or slightly retuse; ventral adventitious shoots present. Midrib distinct, 55 - 75µm wide dorsally, 55 - 80µm ventrally; dorsal epidermal cells in 2 rows, subquadrate-rectangulate, 25.0 - 75.0 × 22.5 - 35.0µm; ventral epidermal cells in 2-3 rows, except near the main point of branching, subquadrate-rectangulate, 25 - 70 × 25 - 40µm, inner cells 10 - 11 in number, 4 cells wide, 3 cells high, thin-walled; wing 16 - 24 cells wide on either side of midrib; marginal cells of thallus rectangulate-polygonal, 30.0 - 65.0 × 17.5 - 40.0µm; median cells polygonal, 27.5 - 62.5 × 20.0 - 45.0µm, cells thin-walled with minute-indistinct trigones, intermediate thickenings absent; hairs poorly developed, short-long, straight, 45.0 - 112.5µm long, 10.0 - 12.5µm wide, sparsely disposed singly along the margins of thallus, also scattered on ventral surface of midrib. Rhizoids not seen. Gemmae marginal, usually on tapered portion, papillose, mucilaginous.

Dioicous. Male plants smaller than female plants, 6 - 14mm long, 0.4 - 0.6mm wide, wing 10 - 19 cells wide on either side of midrib; male branches globose-subglobose, 252.5 - 454.5µm in diameter, midrib cells in two rows, hairs absent over the surface. Female branches broadly obovate-more or less cordate, covered with hairs; calyptra club-shaped, often curved, 1.7 - 2.0mm long, covered with hairs, hairs slightly broader and larger than marginal or ventral epidermal hairs, 151 - 252µm long, 12.5 - 17.5µm wide. Seta 252.5 - 303.0µm in diameter, 4-5 cells across; capsule clavate, blackish, 0.3 - 0.6 × 0.2 - 0.35mm, valves light brown, 0.6 - 0.8mm long, 0.3 - 0.4mm wide, each bearing a tuft of fixed elaters at the apex; wall bistratose, thick-walled longitudinal median line absent; cells of the outer layer of capsule wall rectangulate, 30.0 - 80.0 × 12.5 - 30.0µm, with thickenings on the radial as well as transverse walls, with the thickenings sometimes confined to one side of radial wall only, thickenings not extending over tangential wall, thus appearing nodulose in surface view; those of the inner layer rectangulate, 27.5 - 77.5 × 12.5 - 35.0µm, with thickenings on radial walls extending on the inner tangential walls, thus forming semiannular bands. Spores light brown, globose, 32.5 - 45.0µm in diameter, spinose, spines with bulbous base and often branched apices. Elaters 200.0-550.0µm long, 7.5 - 10.5µm wide, unispiral.

SEM study on spores revealed a double sculptured sporoderm which appears to be basically lamellate, with the lamellae anastomosing to give it a more or less reticuloid pattern. The lamellate surface is interspersed with variously oriented, long spines which have a slightly bulbous base and obliquely truncate-furcated apices often appearing 'star-like' in surface view.

Habitat : Corticolous, growing on the bark of *Viburnum* sp. and *Rhododendron* sp. in association with mosses.

Specimens examined : India: Eastern Himalaya, Sikkim, East district, 5km from Zaluk towards Lungthung, ca 2986m, 09.06.2006, D.K Singh & D. Singh 39966, 39967; Lungthung, ca 3671m, 09.06.2006, D.K Singh & D. Singh 39981. West district, Dzongri 'Jongri', 4000m, 21.05.1960, H. Hara & al., 201208 (Paratype: NICH!); Migothang-Nayathang, 3300m, 01.06.1960, M. Togashi 201677 (Paratype: NICH!); Nayathang-Phalut, 3300-3500m, 02.06.1960, H. Hara & al., 200043 (Paratype: NICH!).

Metzgeria consanguinea Schiffn. India: Western Himalaya, Himachal Pradesh, Great Himalayan National Park, Sainj valley, Majhan, 17.09.2003, S. K. Singh 104307 (CAL); Eastern Himalaya, Sikkim, East district, Pangthang, ca 1988m, 05.03.2005, D. Singh 36488, 37511 (CAL); 25.10.2005, D. Singh 36624B (CAL); 25.02.2006, D. Singh 36961 (CAL); Bitu, ca 1650m, 27.10.2005, D. Singh 36675B (CAL); 21.02.2006, D. Singh 36873B, 36875C (CAL); Rate Chhu, ca 1788m, 21.02.2006, D. Singh 36893 36897, 36899A (CAL); 1km from Zaluk towards Lungthung, ca 2844m, 08.06.2006, D.K Singh & D. Singh 39907 (CAL); Eastern Ghats, Tamil Nadu (Kodaikanal), Coakers wall, ca 2000m, 04.01.1966, R. Udar & S. C. Srivastava 53M/1966 (LWU).

Distribution : India [Eastern Himalaya (Sikkim, West Bengal)], Nepal (Kuwahara, 1969, 1975; Hattori, 1971; Pradhan & Joshi, 2009).

Note : During the studies on the liverworts of Indian part of the eastern Himalaya, authors examined 10 taxa of the genus *Metzgeria* recorded from India and noted that the features like nature of thallus apex, number of epidermal and inner cells of midrib, position (dorsal or ventral surface) and number (single or paired along the margins) of hairs, position and nature of gemmae, sexuality, size and surface of antheridial branches, shape of calyptras and capsule, thickening pattern in the cells of different layers of capsule wall and size and surface ornamentation of spores, when used in combination, provide vital taxonomic parameters for taxonomic delimitation of species. These morphological features have been found fairly consistent in different taxa even when not growing under similar ecological conditions. Even in vegetative condition the plants of *M. macrospora* and *M. consanguinea*, growing in the same environ, can be easily differentiated from each other in their considerably distinct costal anatomy with the former having only 10 - 11, thin-walled inner cells as compared to usually 16-18, thick-walled cells in the latter.

Using the morphological characters derived from both vegetative as well as the fertile materials (Table 1), *M. consanguinea* and *M. macrospora* can be easily keyed out. As *M. consanguinea* is represented in Indian herbaria by sterile plants only, the characters of male and female plants in this species have been adopted from Kuwahara (1966, 1984) and Srivastava and Udar (1975).

Table 1 : A comparative morphological analysis of *M. consanguinea* and *M. macrospora*

Taxonomic characters	<i>M. consanguinea</i>	<i>M. macrospora</i>
Plant size	♀ 6 - 20 × 0.5 - 1.3mm ♂ Not smaller than female	♀ 8 - 18 × 0.7 - 1.5mm ♂ smaller than female, 6 - 14 × 0.4 - 0.6mm
Epidermal cells of midrib	in 2 - 3 rows both on dorsal and ventral surface	in 2 rows on dorsal surface; 2 - 3 rows on ventral surface
Inner cells of midrib	(10-) 16 - 18 cells in number, thick-walled	10 - 11 cells in number, thin-walled
Wing	8 - 30 (-40) cells wide	12 - 32 cells wide
Male branch	up to 250µm in diameter (Kuwahara, 1966, f. 21a)	210 - 454.5µm in diameter
Calyptra	pyriform, 1.0 - 1.3mm long	club-shaped, 1.6 - 2.0mm long
Capsule	spherical	clavate
Capsule wall	cells of outer layer with radial wall thickenings extending over tangential wall, thus forming semiannular bands; those of inner layer with thickenings confined to radial walls, thus appearing nodulose in surface view	cells of outer layer with thickenings confined to radial and transverse walls, thus appearing nodulose in surface view; those of inner layer with radial wall thickenings extending across tangential wall, thus forming semiannular bands
Spores	granulose, 18 - 26µm	spinose, 31 - 45µm
Elaters	unispiral, (106-) 160 - 200µm long, 6 - 8 µm wide	unispiral, 230 - 480µm long, 7 - 8µm wide
References	Kuwahara, 1966, 1984; Srivastava & Udar, 1975; Zhu & So, 2001; Singh & al., 2007; Singh & Singh, 2009	See also Kuwahara, 1969

- 1a. Inner cells of midrib 10-11 in number, thin-walled; male plants smaller than female plants; male branch 210 - 454.5µm in diameter; calyptra club-shaped, 1.6 - 2.0mm long; capsule clavate; cells of outer layer of capsule wall with thickenings confined to radial and transverse walls, thus appearing nodulose in surface view; those of inner layer with radial wall thickenings extending across tangential wall, thus forming semiannular bands; spores spinose, 31 - 45µm in diameter.....*M. macrospora*
- 1b. Inner cells of midrib (10-) 16 - 18 in number, thick-walled; male plants not smaller than female plants; male branch up to 250µm in diameter; calyptra pyriform, 1.0 - 1.3mm long; capsule spherical; cells of outer layer of capsule wall with radial wall thickenings extending over tangential wall, thus forming semiannular bands; those of inner layer with thickenings confined to radial walls, thus appearing nodulose in surface view; spores granulose, 18 - 26µm in diameter.....*M. consanguinea*

The *Metzgeria macrospora* has been collected for the first time from Sikkim since its type collection in 1960. The species has a very narrow range of distribution confined to just two districts of the tiny Himalayan State of Sikkim, Sandakphu in nearby West Bengal and Nepal with very limited extent of occurrence and the area of occupancy.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Botanical Survey of India for facilities, the Chief Wildlife Warden, Sikkim Forest Department for facilitating the exploration work in Sikkim, the Curator, Hattori Botanical Laboratory, Japan (NICH) for facilitating the study of type specimens and to the Ministry of Environment and

Forests, New Delhi for financial assistance under the All India Coordinated Project on Taxonomy (AICOPTAX).

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मेट्जीरिया मैक्रोस्पोरा (मेट्जीरिएसी, मार्केशियोफाइटा) की स्थिति पर टिप्पणी

देवेन्द्र सिंह एवं डी. के. सिंह

सारांश

मेट्जीरिया मैक्रोस्पोरा, जो मेट्जीरिया कॉन्संगीनिया से वर्गीकी रूप में पूर्णतया भिन्न है, मूल संग्रह के बाद सिक्किम से संग्रहित की गयी है। इसका, बीजाणुओं के स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोपिक अध्ययन सहित, विस्तृत सचित्र विवरण प्रस्तुत किया गया है तथा इसकी वर्गीकी स्थिति पर चर्चा की गयी है।