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Notes on *Asterella wallichiana* (Lehm. et Lindenb.) Grolle from Chamkati Masjid, Malda district of West Bengal, India

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Abstract

Asterella wallichiana (Lehm. and Lindenb.) Grolle is described for the first time from upper Gangetic Plains (Gour, Malda) of west Bengal. The same has been described along with the ecological notes. A detailed description, distribution and along with ultrastructure study of spores provided for easy identification.

Key Words: *Asterella*, Morpho-taxonomy, Spores, SEM, Malda, West Bengal

Introduction

Family Aytoniaceae is represented by two genera, namely *Asterella* and *Plagiochysma*. *Asterella* P. Beauv. is a cosmopolitan genus and distributed in all the bryo-geographical unit of India (except Andaman and Nicobar Islands). *Asterella* is a thalloid hepatic genus belonging with family Aytoniaceae in the order Marchantiales (Long, 2006). Spore ornamentation patterns appear to be an important character for species determination (Long, 1998). So far about 48 species are found almost world-wide, although some species have rather restricted distributions (Long, 2005, 2006). Chandra (1967) in his unpublished work, studied spores of various taxa of family Aytoniaceae including a total of 22 taxa of *Asterella* Beauv. from India in relation to spore morphology as well as plant morphology and recognized only seven genuine species of *Asterella* viz. *A. wallichiana*, *A. parvipora*, *A. khasiana*, *A. blumeana*, *A. mussuriensis*, *A. teptophylla* and *A. sanguinea* while rest were either treated as synonyms or as doubtful. The genus was intensively studied by D. G Long and co-workers (Long, 1998, 1999,

2005, 2006; Long, Moller and Preston, 2000). Total six species of *Asterella* are reported different part of India (Singh et al., 2016) including four species *A. lectophylla* (Mont.), *A. multiflora* (Steph.), *A. mussuriensis* (Kashyap) and *A. wallichiana* (Lehm & Lindenb.) by (Bapna & Karchroo, 2000b; Long, 2006a, 2006b). During our field visit of Malda district, we observed an interesting population of the genus *Asterella* P. Beauv. After morphological study with consultation of literature (Long, 2006b) it belongs to *A. wallichiana* (Lehm. & Lindenb.), a noteworthy liverwort species reported herewith new range extension of Malda district, West Bengal, India.

Historical place of Malda

Malda district are situated Northern part state of West Bengal and this district are historical place is called the gate way of North Bengal. It was once the capital of Gour-Banga with its 3733 square kilometres (1,441.6 sq.). There are so many Masques in this area; one of the famous Masques is Chamkati masjid was constructed under the support of Sultan Yusuf Shah in the year 1475. It has tremendous historical and architectural significance associated with the 14th and 15th centuries. It is a huge influx of historical fantastic tourists from various regions of the world.

Materials and Methods

This study is based on the extensive survey of liverworts specimen of the Malda district state of West Bengal (Fig.1). The morphological descriptions of the newly distribution species are based on recently collected specimen identification was carried out consultation of literatures (Pande et al., 1954; Long, 2006). Morpho-taxonomic investigations of the specimens were performed under stereo-zoom binocular microscope (Carl Zeiss Stemi-508 and Leica DM-1000). For SEM images of the spores were fixed on the stub and coated with gold palladium. Then the mounted sample was observed and images were taken from scanning electron microscope (ZEISS FESEM SUPRA-40).

Taxonomic Description

Asterella wallichiana (Lem. et Lindenb.) Pande et al. ex Grolle, *Ergebn. Forsch. -Unterne. Nepal Himalaya* 1: 262 (1966).

Plants strongly foetid (smelling like fish), bright or yellowish green, unbranched or sometime branched, unbranched or sometime branched, 5-10 mm length and 2-3 mm width. Dorsal epidermis persistent, cell thick walls; pores simple, surrounded by 2-4 concentric rings of 3-6 cells each; thallus margin delicate. Air chambers usually 1 layer, without photosynthetic

filaments. Storage tissue well developed, usually with scattered oil-cells. Ventral scales obliquely crescentic, usually purplish-black, in one row on each side of midrib. monoicous, male receptacle not seen; female receptacle situated at the apical notch, carphocephalum flattened, 3-5 mm in diameter, strongly papillose above, slightly lobe at margin; stalk with one rhizoidal furrow disc hemispherical to conical, usually 2 lobed, nearly smooth, with slightly air chambers. Involucres membranous, pseudo-perianth formed a lanceolate. Sporophyte differentiated into a short foot, very short seta and globose capsule, 0.5-0.7 mm long. Capsule usually dehiscing at apex as a single, well-defined piece, the basal larger portion left as an urn-shaped remnant with crenulate margins; wall unistratose, deep brown, slightly thickened. Spore dark brown, rounded triangle, anisopolar trilete, $60-110 \times 50-100 \mu\text{m}$ in size. Elaters are yellowish brown, usually monospirately, $60-150 \times 10-30 \mu\text{m}$ in size (Figs. 2 & 3).

Spores under SEM

Dorsal surface of spore convex, lamellate, distinct to faint of variable length and width, wavy, while some spores are irregular lamellae are also visible on later facets. The ventral surface with prominent tri-radiate mark, rays equal to variable length, lateral facets smooth or with few short with indistinct lumini (Fig. 4).

Habitat

Plant growing in concrete walls intermixed with *Barbula indica* etc. at an altitude of 17m, soils substrate showed a P^{H} of 7.6, mV-034, CHK-039, Temperature-26°C and Total Dissolved Solid-139 ppm.

Specimen Examined

India: West Bengal, Malda district, Chamkati masjid, 17m, $24^{\circ}58'59.60'' \text{N}$, $088^{\circ}08'15.13'' \text{E}$, 19.12.2019, 07.02.2020 A. K. Mondal & V. Mondal 0047, 0052 (Vidyasagar University Herbarium).

Distribution

India [Meghalaya (Cherrapunji), Manipal (Imphal), Andhra Pradesh, Arunachal Pradesh, Andhra Pradesh, Goa Gujrat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Punjab, Rajasthan, Sikkim, Uttar Pradesh, Uttarakhand, Tamil Nadu, West Bengal (Darjeeling, Kurseong, Mungpoo), (Singh et al. 2016), Chamkati masjid, Gour, Malda, present study, new to upper Gangetic plains], Bangladesh, Bhutan, China, Indonesia, Japan, Myanmar, Nepal, Pakistan, Papua new Guinea, Philippines, Solomon Island, Taiwan, Thailand, Europe.

Discussion

Asterella wallichiana (Lem. et Lindenb.) very closely resembles *A. Khasyana* (Griff.) in size and shape of thallus, however, the former differs from the latter species in having a very thin and delicate with short branches (long, 2006). Under SEM study of two species *A. wallichiana* shows a wide variation in sporoderm architecture, the upper surface irregular lamellae and some irregular lamellae are also visible on lateral facets, while *A. khasyana* spores complicate areoles, yellow (Boonkerd et al., 2007).

Conclusion

Gour, Malda district is highly historically fascinating as the taxon is reported from a new range of extension Eastern Himalaya to mid Gangetic plains within West Bengal, India. Spores of family Aytoniaceae are very unique taxonomic characters which are useful in study of the status of several taxa and their relationship with others.

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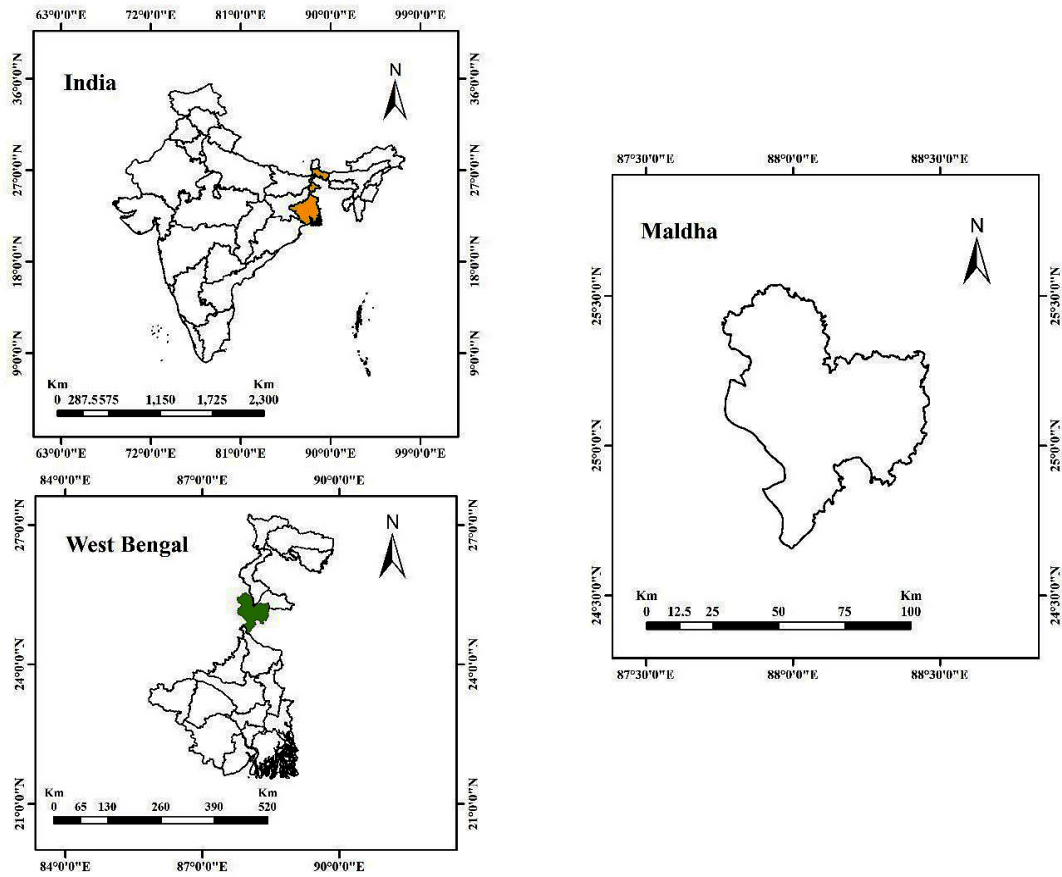


Figure 1. Map of India showing West Bengal in orange color and Malda district in blue color; part of the map in a magnified to show the location of collection site.

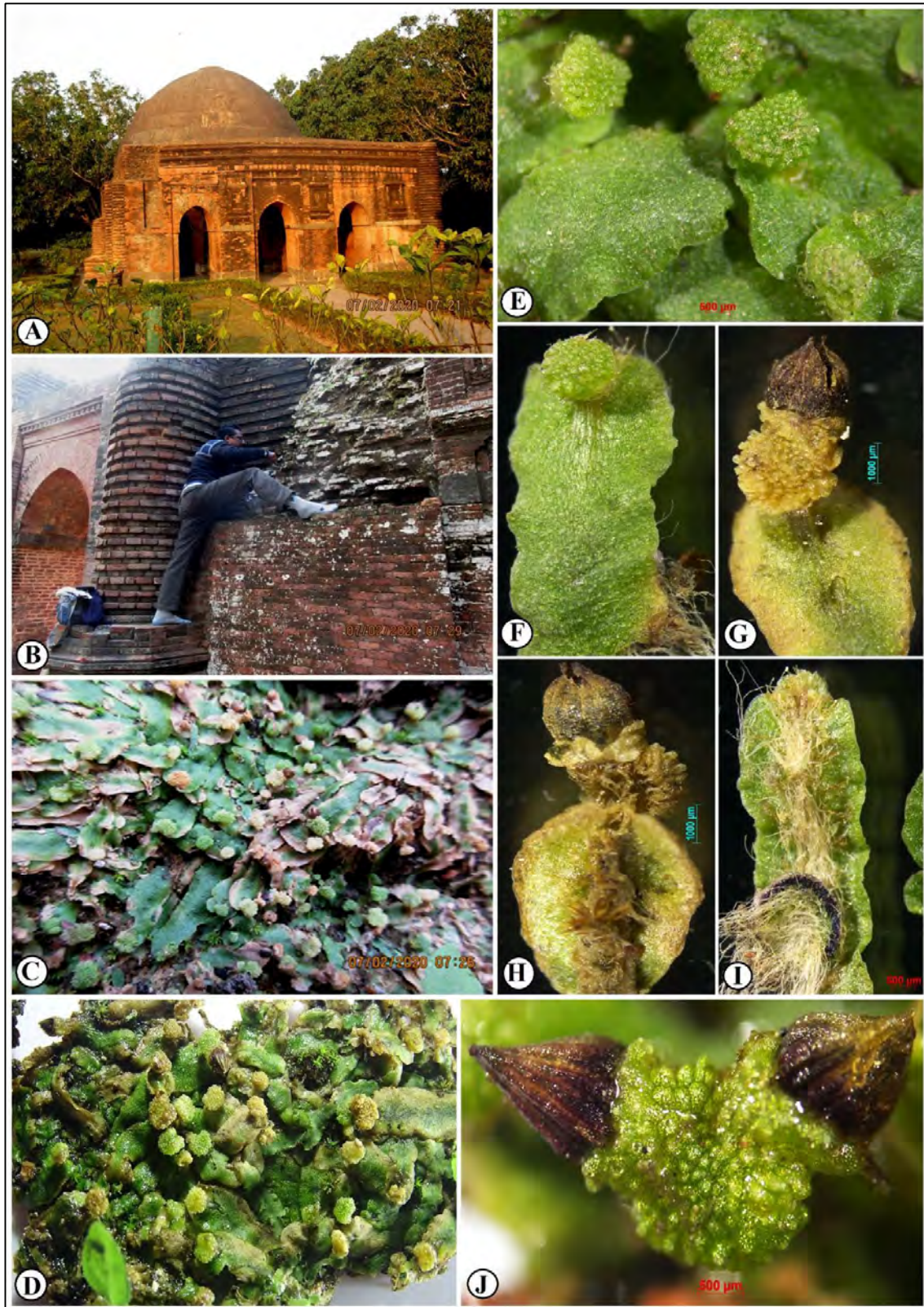


Figure 1. LM of *Asterella wallichiana* (Lehm. et Lindenb.) Grolle. A-B. Plant collection site; C. Habit of plant; D-E. A fertile thallus showing androecium and archegoniophore F-G. Immature and mature dorsal thalli; H-I. Mature and immature ventral thalli; J. Carpocephalum of female receptacle. [Photographs A-J are from A. K. Mondal and V. Modal; 0047, 0052 (Vidyasagar University Herbarium)].

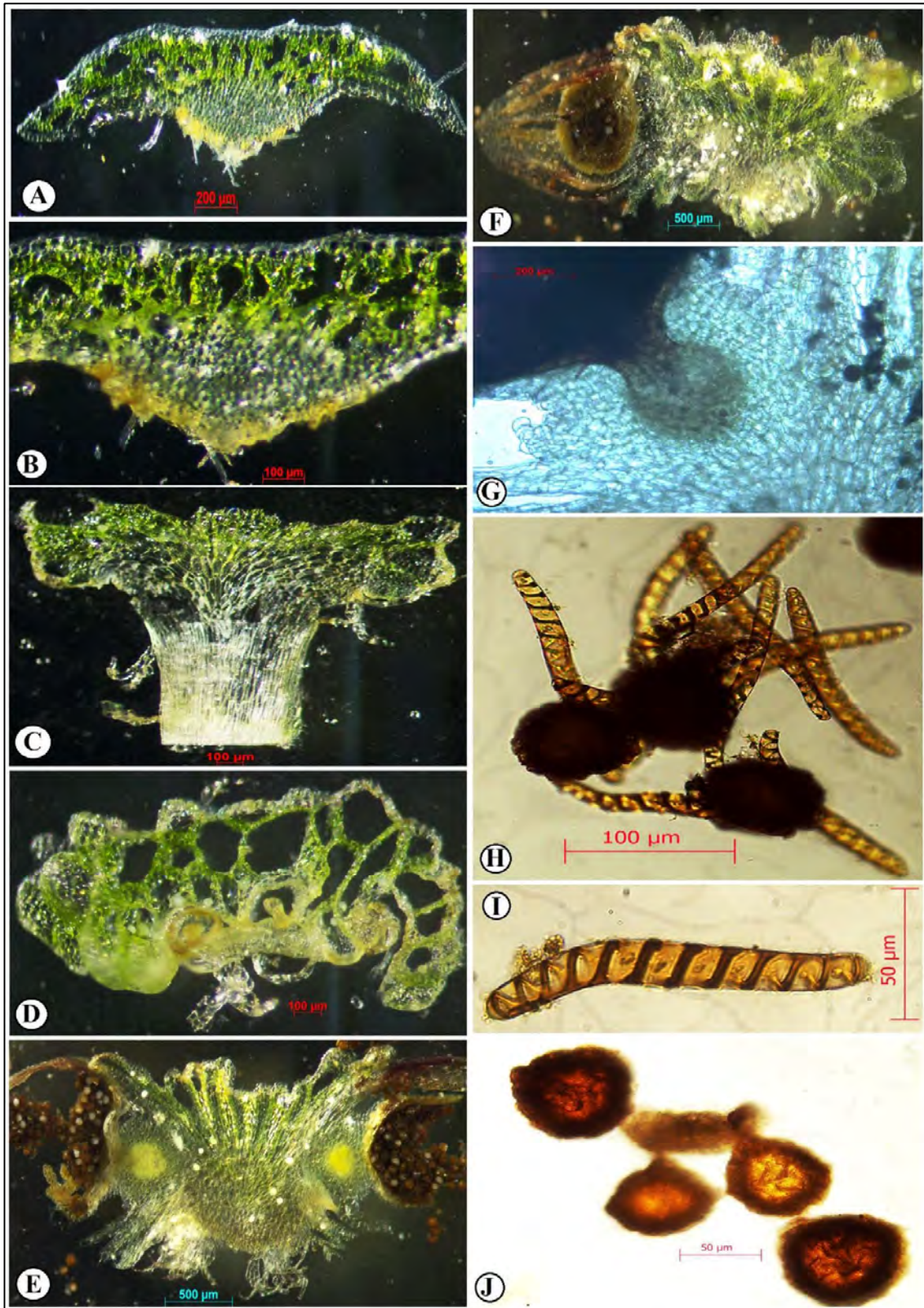


Figure 2. LM of *Asterella wallichiana* (Lehm. et Lindenb.) Grolle. A. Transverse section of thallus; B. Median part of thallus transverse section; C. Transverse section of seta; D. T. S of immature carpocephalium; E-F. T. S of mature carpocephalium; G. enlarge view of developing archegonium; H. Spores and elaters; I. Elater; J. Spores. [Photographs A-J are from A. K. Mondal and V. Modal; 0047, 0052 (Vidyasagar University Herbarium)].

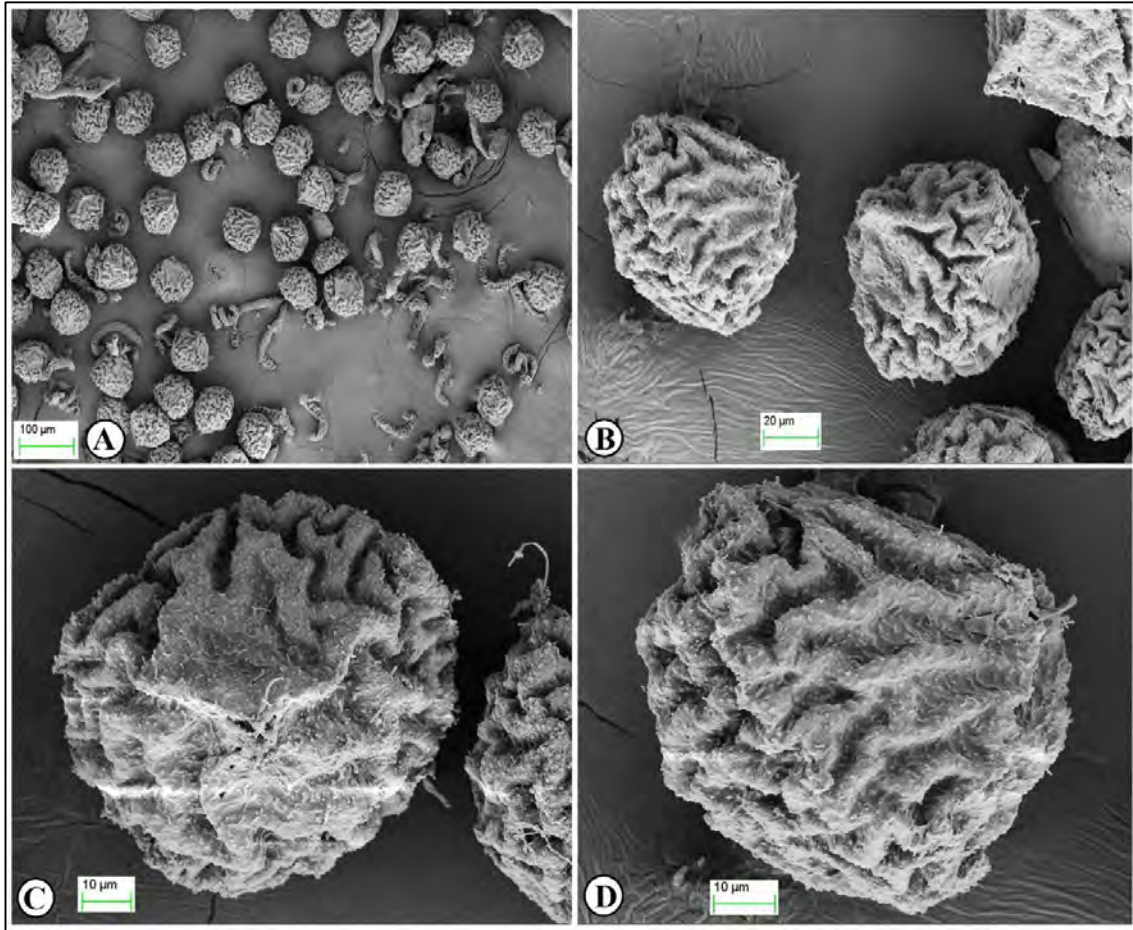


Figure 3. SEM of *Asterella wallichiana* (Lehm. et Lindenb.) Grolle. A. Spores and Elaters; B. Side view of spore; C. Ventral surface showing triradiate mark and smooth lateral facets; D. A portion of the same enlarged. [Photographs A-J are from A. K. Mondal and V. Mondal; 0052 (Vidyasagar University Herbarium)].