

long and slender caudal peduncle, and short anal and caudal fins compared to the new species. It is further distinguished by the presence of fully scaled abdomen. *P. amplicephalus* seems to be closely related to *P. balitora* in the morphometric characters but differs from it in having more simple pectoral rays with bigger head, stumpy body with greater body depth and mandible length greater than gape (mouth) width. Morphometric and meristic data⁸ for the two species, *P. homaloptera* and *P. microphthalmus* were used for comparison, as these specimens were not available for examination. It differs from both the species in many morphometric variables and meristic counts (Table 1).

The new species was collected from Balishwar river, with more water current and sandy bottom. Like most other species of the genus, this species also prefers sandy substrate with horizontally placed pectoral fins suited to withstand the flow. Food particles that settle down on the

sandy bottom are consumed by the species, as it is adapted with a ventral mouth for such type of feeding.

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ACKNOWLEDGEMENTS. We are grateful for the financial assistance from NATP under

the Mission Mode Programme of 'Germplasm Inventory, Evaluation and Gene Banking of Freshwater Fishes'. We thank Dr D. Kapoor and Dr S. P. Singh, National Bureau of Fish Genetic Resources, Lucknow for their lead role in this programme. We also thank Dr D. W. Nelson, UMMZ for lending registered specimens and Dr Remadevi, Zoological Survey of India, SRS, Chennai for valuable suggestions.

Received 23 February 2006; revised accepted 11 December 2006

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Rediscovery of *Cyathodium acrotrichum* Schiffn. (Hepaticae: Cyathodiaceae) – A long-lost liverwort often treated as doubtful taxon

Cyathodium acrotrichum Schiffn. was described by Schiffner¹ based on specimens collected by R  verend Decoly and Schaul from Kurseong, Darjeeling District, West Bengal in October 1899. As the species could never be collected again since its original collection, either from its type locality or elsewhere, coupled with the unavailability of its type/authentic specimens, it came to be regarded as a doubtful species in subsequent treatments of the genus^{2,3}. Recently, during the course of our studies on the Hepaticae and Anthocerotae of Sikkim, extensive collections have been made from the state, especially the East District. This has resulted in locating some distinct populations of the genus *Cyathodium* Kunze with hairy plants, which are undoubtedly referable to *C. acrotrichum*. The study of the protologue¹ of the latter confirmed the identity of these plants. The most defining taxonomic feature of *C. acrotrichum* is the presence of forwardly directed hairs towards the anterior portion of the thallus, which easily distinguishes it from hitherto all the known species of the genus.

The present communication constitutes the rediscovery of this interesting endemic and rare Indian liverwort after a lapse of over a century from Sikkim.

As the species is poorly known, a detailed illustrated taxonomic account of the same has been provided to facilitate its easy identification. However, like those of Decoly and Schaul, the present collections also do not have male plants of the species.

Cyathodium acrotrichum Schiffn. in *Ann. Bryol.*, 1939, **12**, 126 (Figures 1 and 2). Plants light-bright green, once or twice dichotomously branched, densely overlapping forming loose tufts; thallus 7–12 mm long, 2–4 mm wide with frequent ventral, apical and marginal innovations, both main thallus as well as adventitious branches densely covered with forwardly directed hairs towards anterior part; dorsal pores large, usually confined to posterior part of thallus below dichotomy, antero posteriorly oval, 132–231 × 66–198 µm, consisting of 3–4 concentric rings of 5–6 cells each; dorsal

epidermal cells sub quadrate, 32.8–106.6 × 16.4–24.6 µm, thin-walled, chlorophyllous, inner walls slightly projecting into air-chambers; ventral epidermal cells more or less quadrate-sub quadrate, 36.9–57.4 × 32.8–61.0 µm, thin-walled; midrib absent; air chambers in single row, without filaments, partitions 2–3 cells high, uniseriate. Thallus hairs straight-falcate, 231–858 µm long, 8.2–14.35 µm wide, densely distributed on the dorsal surface, less on the ventral surface. Rhizoids numerous on ventral surface of thallus and sexual receptacles, hyaline, both thin as well as thick-walled. Ventral scales simple, conspicuous, usually confined to the growing region of the thallus and surface of sexual receptacles, uniseriate, 2–6 cells high. Dioicous (?). Male plants not seen. Involucres large, ovoid, with more or less rounded mouth, 1–3 per thallus, never projecting beyond the thallus margin, outer surface covered with numerous long hairs, rhizoids and ventral scales. Sporophytes, one in each involucre; capsule deep brown to blackish, ovoid-globose,

0.5–0.7 mm in diameter, usually dehiscing by four valves after separation of apical disc; wall single-layered with two tiered apical disc or operculum, outer tier with 5–7 thick-walled, light brown cells, with or without thickening bands on their outer walls; inner tier of 14–21, thin-walled, light brown cells devoid of thickenings; cells of the dehiscent part of the capsule wall reddish-brown, sub quadrate–elongated rectangular, $32.8\text{--}61.0 \times 24.6\text{--}45.1\text{ }\mu\text{m}$, with semi annular thickening bands extending over outer tangential and radial walls, appearing like bands in outer view and nodulose in inner view; cells of the non dehiscent part of the capsule wall larger, hyaline, polygonal, $41.0\text{--}73.8 \times 28.7\text{--}49.2\text{ }\mu\text{m}$, thin-walled, devoid of thickenings. Spores dark brown to blackish-brown, globose–sub globose to oval, $41.0\text{--}53.3\text{ }\mu\text{m}$, double-sculptured, with the sporoderm densely muricate, interspersed with large, $2.05\text{--}6.15$ high baculae or sometimes spines. Elaters 21–24 per capsule, reddish-brown, $495\text{--}742\text{ }\mu\text{m}$ long, $12.3\text{--}16.4\text{ }\mu\text{m}$ wide, with tri-spiral thickening bands except towards extremities, where it is bi-spiral.

The sporoderm architecture, as revealed under SEM, is double-sculptured with distinctly reticulate general surface having conspicuously large granules interspersed with baculae and occasional spines. Distally the baculae are usually blunt with smooth or uneven margins (Figure 2 c).

Plants of *C. acrotrichum* were collected during October–November 2005 and again in February 2006, growing terrestrially on thin soil under shady conditions and slowly dripping water, in association with *Dumortiera hirsuta* (Sw.) Nees and *Heteroscyphus hyalinus* (Steph.) A. Srivast. & S.C. Srivast.

Specimens examined: Sikkim: East District, Boudha, ca. 1800 m, 31 October 2005, D. Singh 36756 (CAL); Nimachen (Tolekhola), ca. 2000 m, 2 November 2005, D. Singh 36784A (CAL); Busuk, ca. 1600 m, 22 February 2006, D. Singh 36923 (CAL).

Distribution: India: West Bengal (Kurseong: Schiffner, 1939), Sikkim (nov.). Endemic.

C. acrotrichum is characterized by dioicous plants with frequent ventral and lateral innovations; thallus covered with hairs towards apical portion (Figure 1 a, b, f–i; Figure 2 a, b); presence of well-defined dorsal pores (Figure 1 c, d); absence of midrib; one cell layer thick lower epidermis (Figure 1 e); hairy invo-

luces (Figure 1 b); with outer tier of the operculum or the apical disc of capsule 5–7-celled (Figure 1 o) and inner tier 14–21-celled (Figure 1 p); globose to sub globose spores, $41\text{--}53.3\text{ }\mu\text{m}$ in diameter, with baculate–spinose sporoderm (Figure 1 s–u; Figure 2 c, d), and $495\text{--}742 \times 12.3\text{--}16.4\text{ }\mu\text{m}$, three (two)-spiraled elaters (Figure 1 v, w). Compared with the plants described by Schiffner¹ from

Kurseong, the present specimens are slightly atypical in invariably having a single-layered lower epidermis and uniseriate ventral scales. However, the two fully conform to each other in all other vital taxonomic parameters.

Schiffner¹ compared the present species with *C. aureonitens* (Griff.) Mitt. (= *C. griffithii* Schiffn.), thus suggesting a close affinity between the two. The latter,

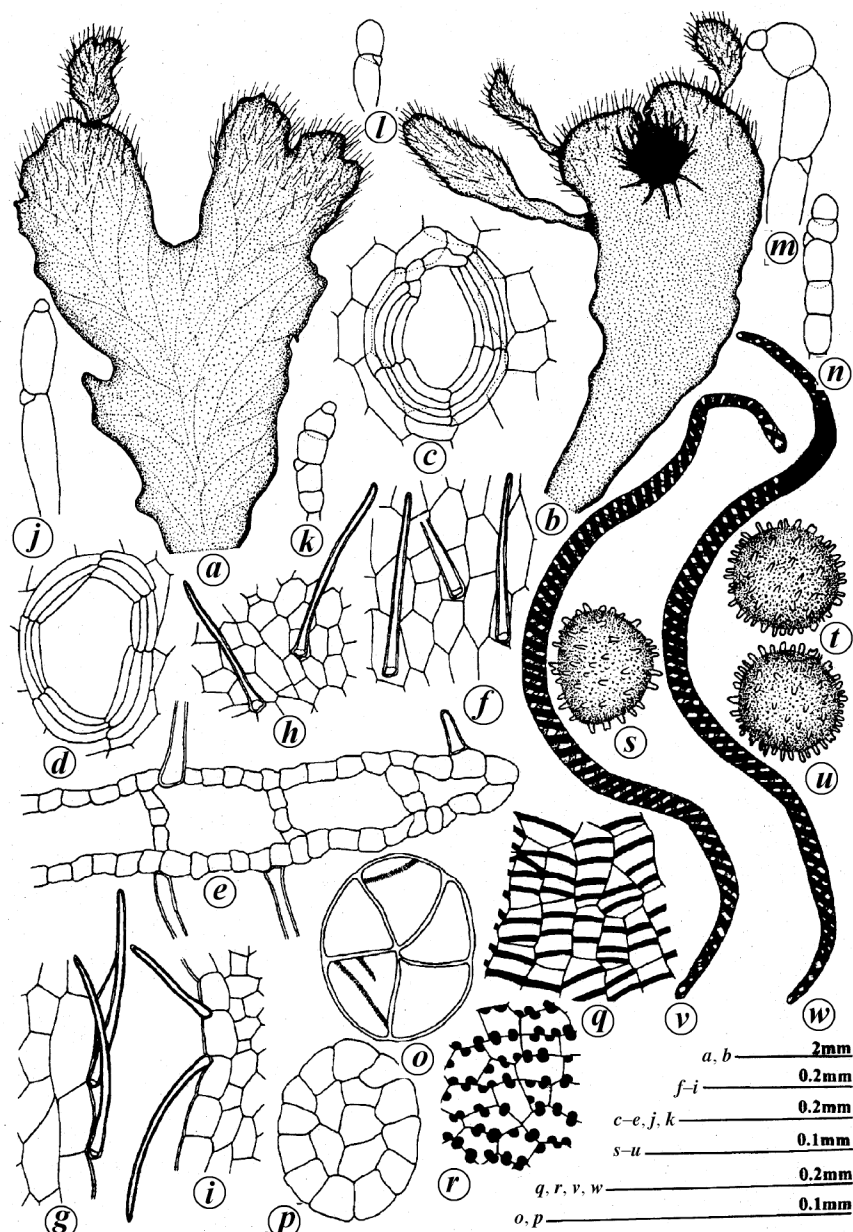


Figure 1. *Cyathodium acrotrichum* Schiffn. a, Portion of vegetative thallus with apical innovation, in dorsal view. b, Portion of female thallus with apical and lateral innovations and mature sporophytes, in ventral view. c, d, Dorsal pores. e, T. S. of thallus. f, Mid dorsal cells of thallus with hairs. g, i, Marginal cells with hairs from margin in dorsal view. h, Mid ventral cells of thallus with hairs. j–n, Ventral scales. o, Outer tier of operculum. p, Inner tier of operculum. q, Capsule wall in outer view, showing transverse bands. r, Same in inner view, showing nodular thickenings. s–u, Spores. v, w, Elaters.

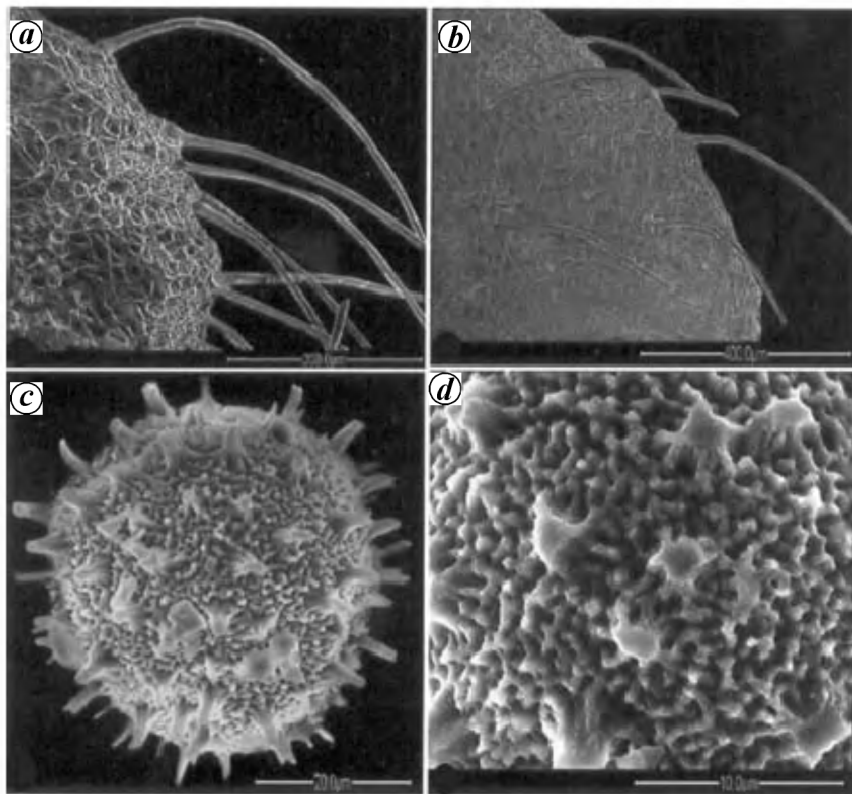


Figure 2. SEM of *C. acrotrichum* Schiffn. **a**, Marginal hairs towards apex. **b**, Surface and marginal hairs. **c**, Spore in surface view. **d**, Portion of the same, magnified.

however, differs from the former in having much larger plants up to 26 mm broad with 5–18 involucre per thallus, absence of surface hairs on the thallus, presence of tubers, operculum of the capsules with four outer and 12–14 inner cells and spores having spines with more or less bulbous base (Srivastava and Dixit³; figure XVII: 1, 2). In its sporo-

derm ornamentation, *C. acrotrichum* closely resembles *C. mehranum* D. K. Singh. However, it is easily distinguishable from the latter⁴, which has smaller, 5–8 mm long and 1–3 mm wide female plants devoid of adventitious branches and surface hairs; dorsal pores with 0–3 concentric rings; tubers on both sterile as well as fertile plants; involucre mouth

lined by thick-walled cells with purple pigmentation, and much larger elaters measuring $640\text{--}900 \times 20\text{--}24 \mu\text{m}$. Any doubt about the taxonomic status of *C. acrotrichum*, therefore, is unfounded.

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ACKNOWLEDGEMENTS. We are grateful to the Director, Botanical Survey of India, Kolkata for facilities and encouragement; the Indian Botanical Liaison Officer, Royal Botanic Gardens, Kew (UK) for relevant literature, and the Ministry of Environment and Forests, New Delhi for financial support under the All India Co-ordinated Project on Taxonomy.

Received 25 May 2006; revised accepted 22 January 2007

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Occurrence and prevalence of *Cyllamyces* genus – A putative anaerobic gut fungus in Indian cattle and buffaloes

Anaerobic fungi are an unusual group of zoospore fungi occupying a unique niche in the digestive tract of wild and domesticated ruminants and large monogastric herbivores¹. They were first isolated from the rumen of sheep². Until this discovery, the microbial population in the rumen was believed to be made up of bacteria and protozoa only. Among the rumen microbes, anaerobic fungi are important as they produce highly active enzymes for degradation of lignocellulose^{3,4} and

have the unique ability to break and penetrate the fibrous feed particles through fungal mycelium, providing more surface area for the action of other microbes.

All the anaerobic fungi studied so far are cellulolytic and are able to degrade structural carbohydrates of plant cell walls playing a vital role in the digestion of high-fibre poor-quality forages. Thus in tropical regions where forages are generally fibrous and of poor quality, development of methods to manipulate superior

strains of fungi, naturally selected or genetically engineered, in the rumen would afford a means of improving the digestion of poor-quality fodder by large ruminants, particularly lactating cows and buffaloes.

The isolation procedure involves ten-fold serial dilution of rumen liquor or freshly voided faeces in a complex medium under strictly anaerobic conditions. Colonies picked from roll tubes were grown at 39°C and transferred after three