

MORPHO-TAXONOMIC STUDY ON SOME CORTICOLOUS MOSSES OF LONGKHUM RESERVE FOREST, MOKOKCHUNG DIS- TRICT, NAGALAND

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ABSTRACT

Morpho-taxonomic characters of five species of moss taxa, viz., *Dicranum lorifolium* Mitt., *Ptychomitrium indicum* (Schrad.) Jaeg., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch., *Cyathophorella adiantum* (Griff.) Fleisch., collected from Longkhum Reserve Forest, Mokokchung District, Nagaland have been described for the first time. *Ptychomitrium indicum* (Schrad.) Jaeg., is a new record for North-east India, whereas, the other four taxa, viz., *Dicranum lorifolium* Mitt., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch., *Cyathophorella adiantum* (Griff.) Fleisch., are new records for the Nagaland State.

Keywords: Morpho-taxonomy, Mosses, Longkhum reserve forest, Mokokchung, Nagaland.

Introduction

Nagaland is a vibrant hill state located in the extreme North Eastern region of India 25°6'N - 27°4'N Latitude, and 93°20'E - 95°15'E Longitude, bounded by Myanmar in the East; Assam in the West; Arunachal Pradesh and a part of Assam in the North with Manipur in the south. Mokokchung District is situated in the North-west of Nagaland at an altitude of 4347 feet above sea level. Mokokchung has a pleasant and moderate climate - not too cold in winters and pleasant summers. December and January are the coldest months with frost. However, occasional snowfall may also be experienced at higher altitudes during December and January. During the peaks of summers, from July-August, temperature ranges from 28.6°C to 33°C. Heavy rainfall occurs during summer. An average annual rainfall ranges

from 1788.4 cm to 2518.3 cm. Mokokchung is located at 26°22'N - 26°83'N Latitude, and 94°29'E - 94°76'E Longitude. Longkhum is one of the many villages under Mokokchung District. Longkhum is a place known for its rich reserve forest. Longkhum Reserve Forest is situated at an altitude of 6056 feet above sea level in the South of Mokokchung District. In India, comprehensive studies on mosses have been done by Chopra (1975) who published a monograph on the systematic position of Indian mosses entitled "Taxonomy of Indian Mosses". He described morpho-taxonomic details of 2000 species of mosses belonging to 329 genera under 56 families. Gangulee (1969 - 72, 1974 - 77, 1978 - 80) described morpho-taxonomic characters of 990 species in his elaborated work entitled "Mosses of Eastern India and Adjacent Regions". Lal (2005) published a "Checklist of Indian Mosses" where he

mentioned the occurrence of 1693 species of mosses belonging to 342 genera and 57 families in Indian sub-continent. But so far no extensive work has been carried out on the morphotaxonomy of mosses of Nagaland. However, there are scanty reports on the occurrence and diversity of moss taxa from the state of Nagaland. Gangulee (1969 - 80) has reported occurrence of some of the moss taxa to be found in Naga Hills but no precise localities for the occurrence of these taxa have been mentioned, and Lal *et al* (2003) have reported *Fabronia assamica* Dix. (Fabroniaceae) from Nagaland. Recently Bansal *et al* (2010) have reported diversity of genus *Brachymenium* Schwaegr. from Mokokchung District of Nagaland. Therefore, the present paper deals with the first hand studies of morphotaxonomic characteristics of five moss taxa, viz., *Dicranum lorifolium* Mitt., *Ptychomitrium indicum* (Schrad.) Jaeg., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch., *Cyathophorella adiantum* (Griff.) Fleisch., collected from Longkhum reserve forest of Mokokchung District of Nagaland State in North-East India. The present studies have been carried out with an aim to record the diversity of moss taxa in the state of Nagaland.

Materials and Methods

The specimens have been collected from Longkhum reserve forest of Mokokchung District, Nagaland during the month of August 2009. Longkhum is situated at an altitude of 6056 feet above sea level (See Map - 1). The specimens were found growing on the tree bark (Corticolous). Observations were made under light microscope. Field photographs have been taken with the help of Fuji Film camera, model Fine Pix S9500. Photomicrographs and Photomicrographs of the external and internal details of investigated taxa have taken with the help of

Leica Stereo Zoom (Leica S6D) and Leica digital Light Microscope (Leica DM1000) respectively. The specimens have been deposited in the Nagaland University Herbarium (N.U.H.), Department of Botany, Nagaland University, Lumami.

Taxonomic Observation

Dicranum lorifolium Mitt., J. Linn. Soc. Bot. Suppl. 1. 15. 1859.

Plate - 1 : Figs. A-F

Family - Dicranaceae Schimp., Coroll. Bryol. Eur. 11. 1855-1856. T: *Dicranum* Hedw.

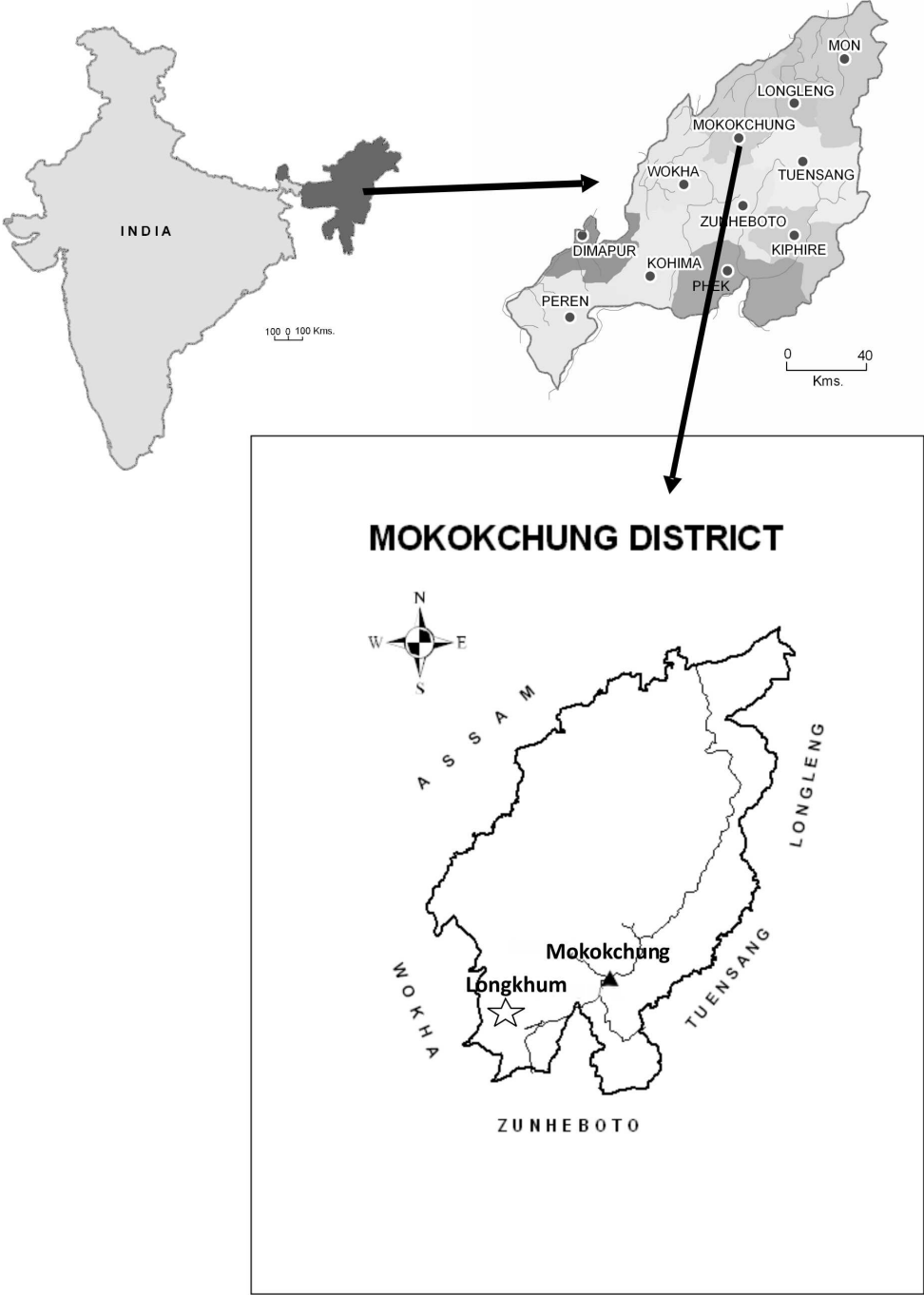
Corticolous. Stem dichotomously branched, \pm 4.5 cm long, reddish brown in colour, covered with falcato-second patent leaves. Leaves long, linear, slowly narrowing down from a broad base, \pm 1 cm long and \pm 1 mm wide at the base, canaliculate leaf apex. Leaf margin sharply and heavily serrulated at the upper region of the leaf. Costa ends slightly below tip, brown in colour, serrulated at the back. Alar bulging out large, deep reddish brown cells at the periphery and hyaline cells at the interior. Leaf cells in the upper lamina rectangular with porose walls, \pm 82 μ long and \pm 10 μ wide, basal lamina cells similar with the upper lamina cells but larger, \pm 91 μ long and \pm 16 μ wide.

Distribution and Ecology: Nagaland, Mokokchung, Longkhum, 159 Vap Mkg, November 2007, at an altitude of about 6056 feet above sea level, habitat - found growing on the tree bark.

Range: East Nepal, Darjeeling, Sikkim, Bhutan, Khasia Hills and Naga Hills.

Collected by: Vaphuno Sale.

Examined by: Vaphuno Sale.



☆ Showing the locality of study site.)

▲ District Headquarter.

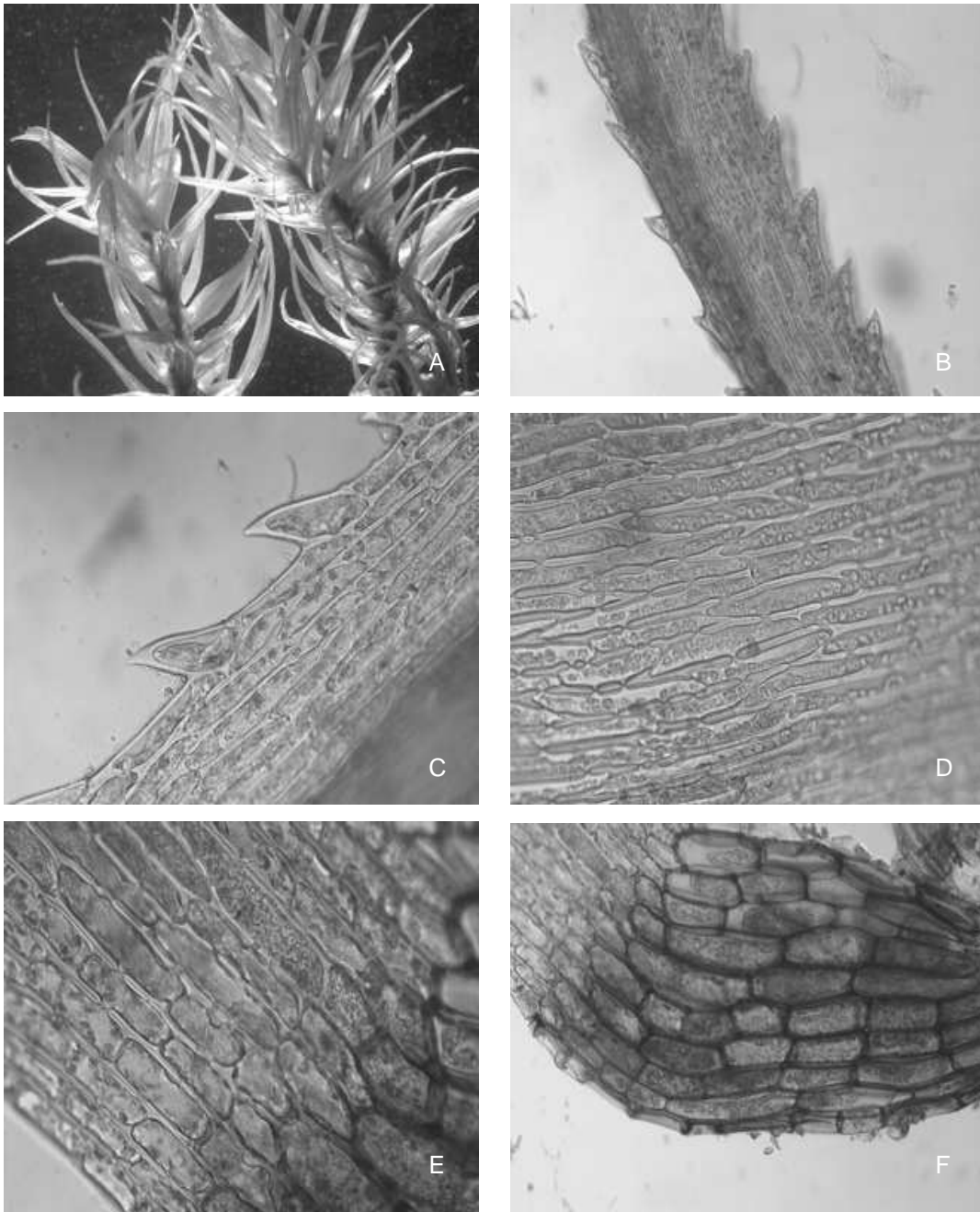


Plate - 1; Figs, A - F *Dicranum lorifolium* Mitt.

A. Plant body, **B.** Leaf apex showing sharp serrulation at the leaf margins and on the back of the costa, **C.** Apical region of leaf showing apical cells and sharply serrulated leaf margin, **D.** Porose lamina cells at the mid-leaf region, **E.** Rectangular porose basal cells, **F.** Alar bulging out and showing deep reddish brown coloured cells.

Ptychomitrium indicum (Schrad.) Jaeg., Ber. S. Gall. Naturw. Ges. 1872-73: 104. 1874.

Plate - 2 : Figs. A-F

Family - Ptychomitriaceae Schimp., Syn. Musc. Eur. 241. 1860. T: *Ptychomitrium* Furrn.

Corticolous. Plants yellowish green in colour, sometimes dichotomously branched, up to 3.5 cm high. Leaves erecto-spreading but curled when dry, lanceolate from a rectangular semi-sheathing base, ± 3 mm long and ± 0.5 mm wide at the base, margin entire, leaf apex acute carinate. Leaf cells in upper lamina round-ovate, ± 10 μ wide, thick-walled with irregular thickenings on inner walls of the cells, on top of rectangular base ± 35 μ long and ± 8 μ broad, with more or less sinuose walls, inner cells in lower rectangular base somewhat thick-walled, smooth, rectangular, ± 45 μ long and ± 11 μ broad, with several layers of quadrate cells on the leaf border, distinct alars of orange-brown cells at the leaf base corners with two patches of long transparent rectangular cells on both sides of the costa.

Distribution and Ecology: Nagaland, Mokokchung, Longkhum, 160 Vap Mkg, November 2007, at an altitude of about 6056 feet above sea level, habitat - found growing on the tree bark.

Range: Darjeeling.

Collected by: Vaphuno Sale.

Examined by: Vaphuno Sale.

Trachypodopsis serrulata (P. Beauv.) Fleisch., Hedwigia 45: 67. 1906.

Plate - 3 : Figs. A-F

Family - Trachypodaceae Fleisch., Hedwigia 45: 63. 1906. T: *Trachypus* Reinw. et Hornsch.

Corticolous. Plants robust to semi-robust, in dense mats, Secondary branches ascending or hanging, up to ± 5.5 cm long, pinnately branched. Leaves not so dense, erect spreading, plicate, lanceolate, ± 2 mm long and ± 0.5 mm broad at the base, acuminate, margin serrulated almost to the base, leaf base auricled. Costa ending below the apex. Leaf cells at the upper part of the leaf are thick-walled, smooth, rhomboid, ± 30 μ long and ± 5 μ broad, leaf cells at the lower part of the leaf are rhomboid with a single papilla at the lumen centre, ± 25 μ long and ± 5 μ broad. At the leaf base, the juxtacostal cells are broader rectangular with porose walls, ± 30 μ long and ± 5 μ broad, outer cells are narrower. A group of quadrate-rhomboid cells with highly thickened walls are present in the alar region.

Distribution and Ecology: Nagaland, Mokokchung, Longkhum, 162 Vap Mkg, November 2007, at an altitude of about 6056 feet above sea level, habitat - found growing on the tree bark.

Range: East Nepal, Darjeeling, Sikkim, Bhutan, Arunachal, Naga Hills, Khasia Hills, Manipur and Andaman Island.

Collected by: Vaphuno Sale.

Examined by: Vaphuno Sale.

Homaliodendron montagneanum (C. Muell.) Fleisch., Hedwigia 45: 74. 1906.

Plate - 4 : Figs. A-F

Family - Neckeraceae Schimp., Coroll. Bryol. Eur. 99. 1855-1856. T: *Neckera* Hedw.

Corticolous. Plants yellow-green in colour, sparsely branched or frondose, secondary branches erect or inclined, ± 7 cm long. Leaves spreading horizontally, longitudinally

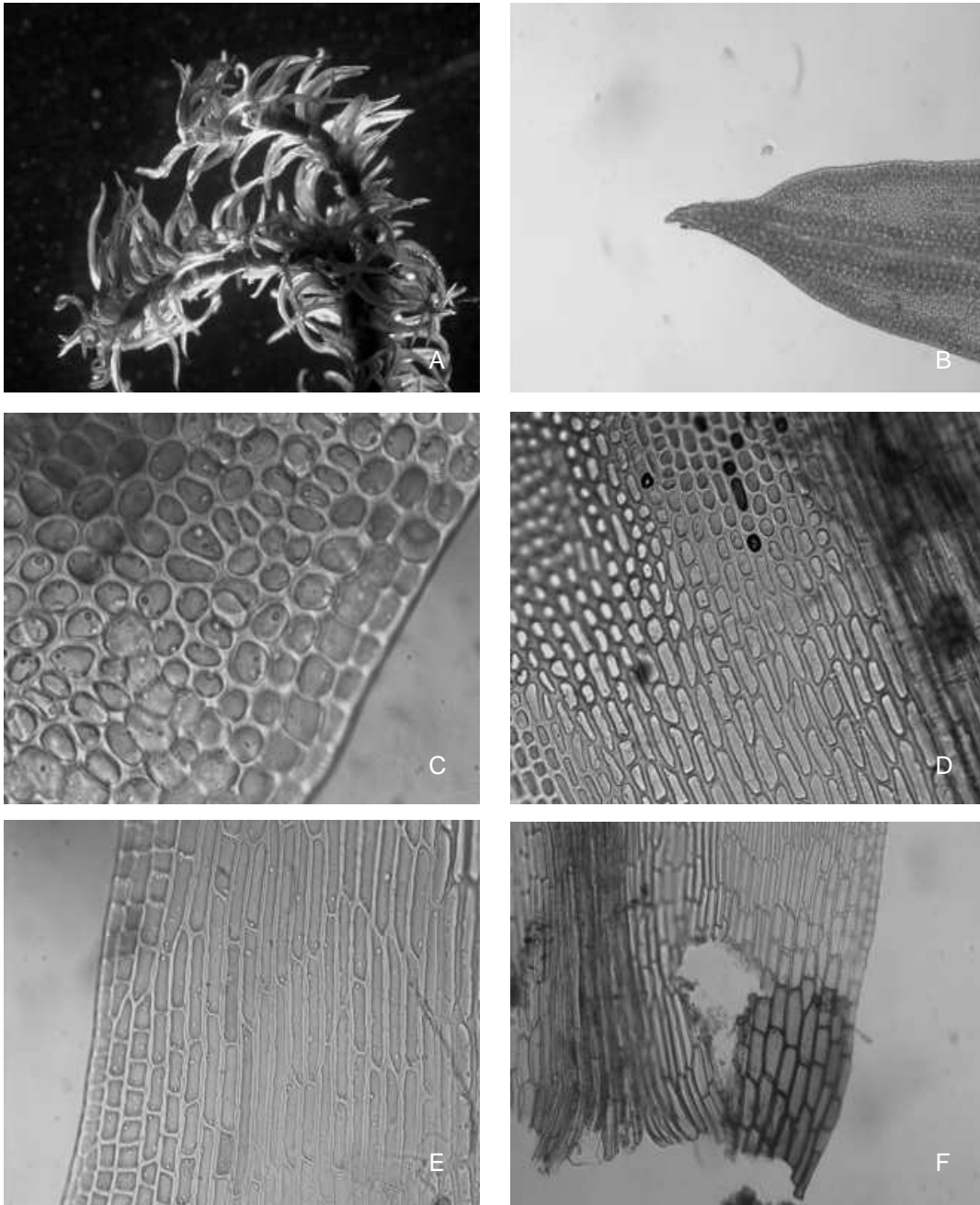


Plate - 2; Figs, A - F *Ptychomitrium indicum* (Schrad.) Jaeg.

A. Plant body, **B.** Leaf apex, **C.** Apical cells which are rounded, **D.** Transitional zone of cells showing rounded cells becoming more elongated towards the lower part of the leaf, **E.** Elongated basal cells with some quadrate cells towards the leaf border, **F.** Distinct alars of orange-brown cells at the leaf base corners with two patches of long transparent rectangular cells on both sides of the costa.

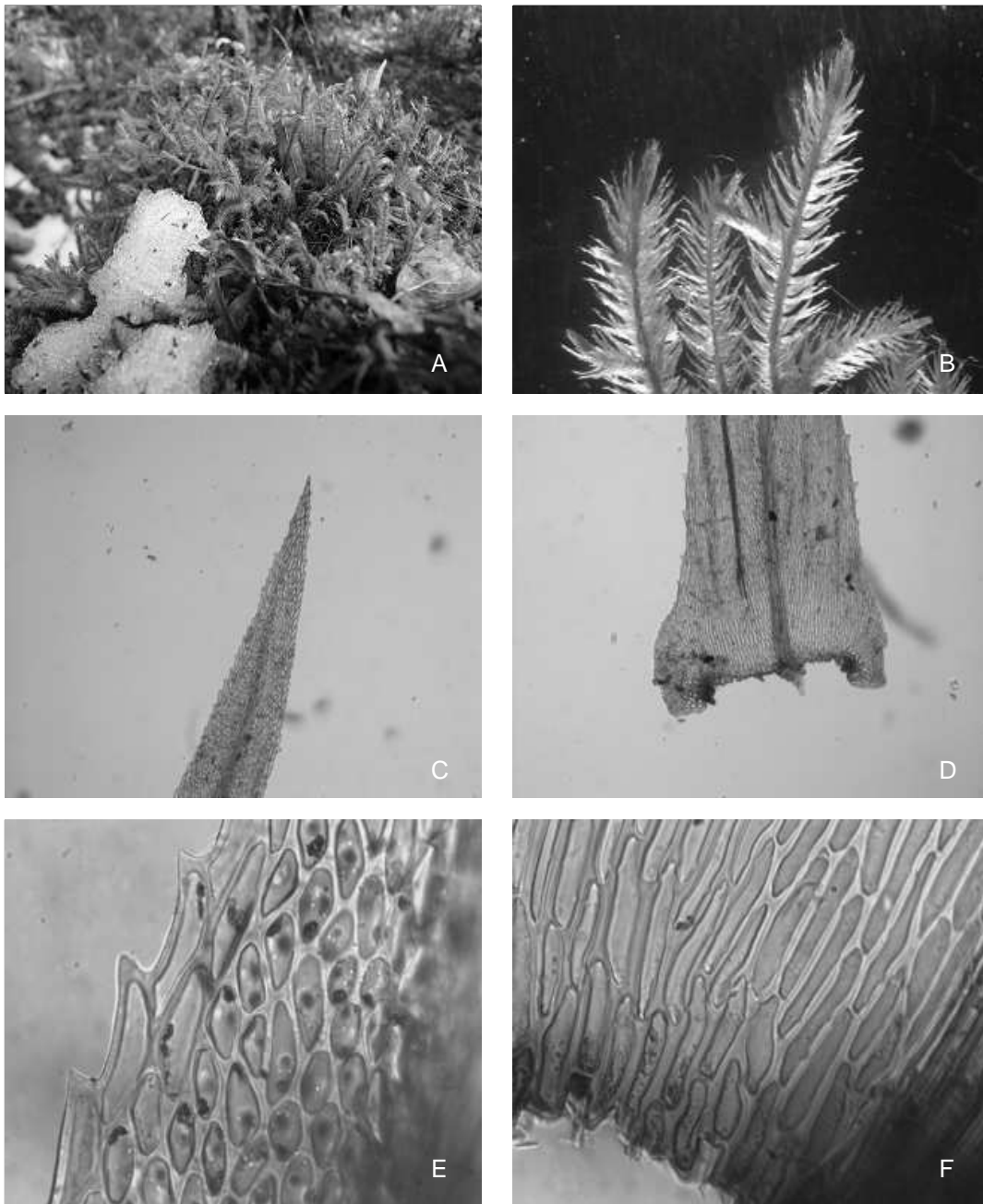


Plate - 3; Figs. A - F *Trachypodopsis serrulata* (P. Beauv.) Fleisch.

A. Plant growing in the natural habitat, **B.** Plant body, **C.** Acuminate leaf apex, **D.** Auricled leaf base, **E.** Leaf margin serration which is almost to the leaf base and laminal cells showing one papilla in the lumen centre, **F.** Basal cells which are highly porous.

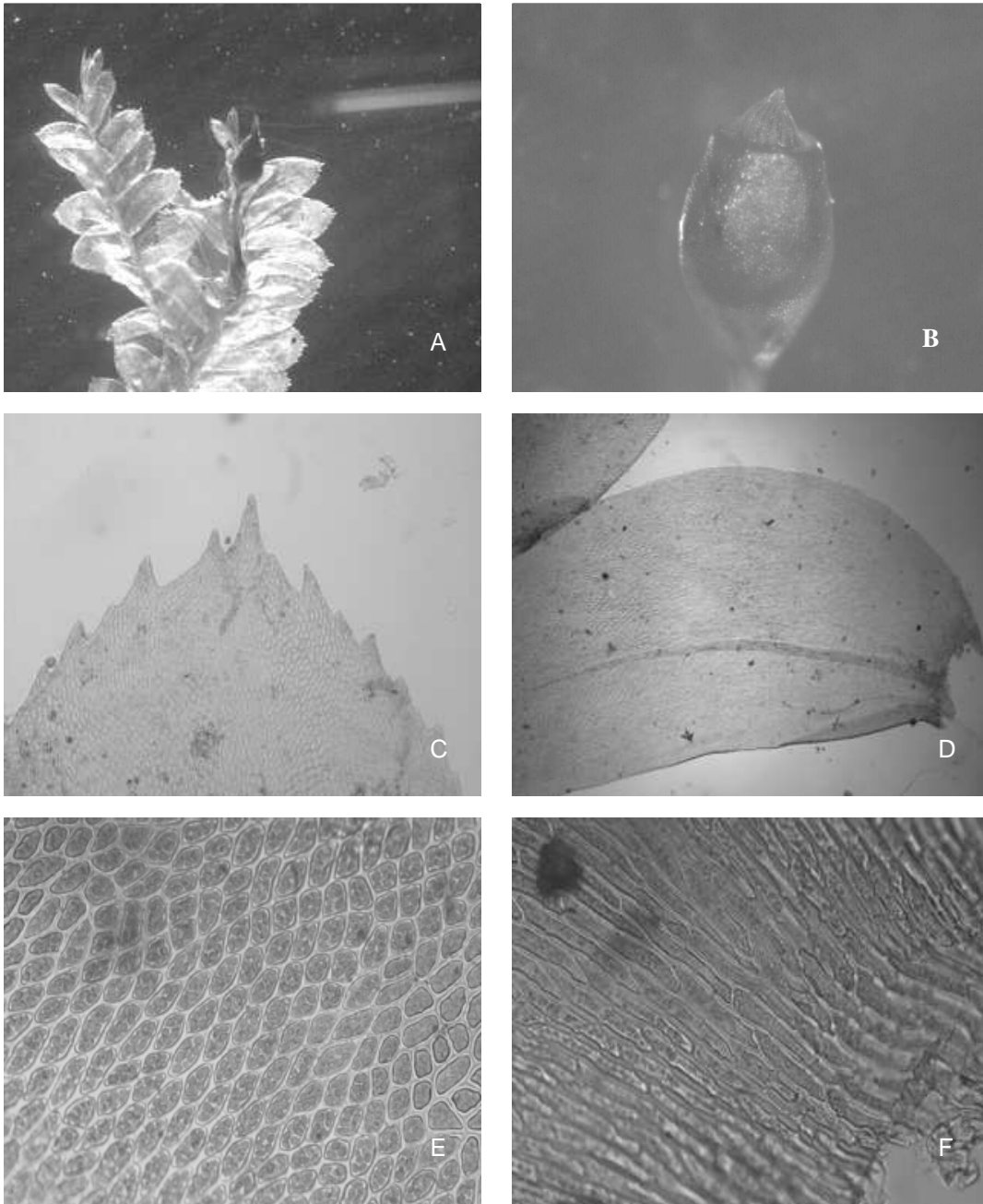


Plate - 4; Figs, A - F *Homaliodendron montagneanum* (C. Muell.) Fleisch.

A. Plant body showing the capsule born laterally and the conic-rostrate operculum which is bent to one side, **B.** Capsule showing the peristomes, **C.** Leaf apex showing heavy serrulation, **D.** Leaf base showing the leaf inflexed on one side and the costa reaching two-third of the leaf length, **E.** Apical cells which are rhomboidal to quadrate and smooth, **F.** Basal cells which are elongated and porous.

plicate when dry, asymmetrically ovate-lingulate, ± 3 mm long and ± 1 mm broad, leaf apex rounded, strongly serrulated, margin smooth below, inflexed on one side at the base. Costa single and covering two-thirds of the leaf. Leaf cells smooth, rhomboidal to quadrate at the upper part of the leaf with a marginal row of smaller cells, gradually more elongated and porose at the basal part of the leaf, $\pm 23 \mu$ long and $\pm 1 \mu$ broad at the upper part of the leaf, $\pm 60 \mu$ long and $\pm 10 \mu$ broad at the basal part of the leaf, few shorter cells on the leaf attachment region. Sporophyte on short lateral shoots. Seta erect, ± 2.5 mm. long. Capsule fully exerted, ovoid, ± 2 mm long and ± 1 mm wide. Operculum small, conic-rostrate, tip bent to one side.

Distribution and Ecology: Nagaland, Mokokchung, Longkhum, 157 Vap Mkg and 161 Vap Mkg, November 2007, at an altitude of about 6056 feet above sea level, habitat - found growing on the tree bark.

Range: East Nepal, Sikkim, Darjeeling, Bhutan, Assam, Nilgiri, Khasia Hills, Naga Hills and Manipur.

Collected by: Vaphuno Sale.

Examined by: Vaphuno Sale.

Cyathophorella adiantum (Griff.) Fleisch., Musci Fl. Buitenzorg 3: 1094. 1908.

Plate - 5 : Figs. A-F

Family - Hypopterygiaceae Mitt., Jour. Proc. Linn. Soc. Suppl. Bot. 1: 147. 1859. T: *Hypopterygium* Brid.

Corticolous. Plants usually branched, main stem rhizomatous, tomentose, creeping, secondary branches erect, often caudate at tip, ± 2.5 cm high and ± 8 mm wide, clusters of orange-red gemmae may be present

near top. Leaves dimorphous, lateral rows complanate, lax and widely spreading but curled yet spreading when dry, asymmetrical, oblong-ovate, acuminate, ± 5 mm long and ± 2 mm broad, margin serrate-spinous, the spinous cells form a border of elongated pallid cells at the base where spines are absent. Amphigastrial leaves in one row, symmetrical, ovate-acuminate, ± 2 mm long and ± 0.9 mm broad. Costa forked and short. Indistinct short double costa in amphigastrial leaf. Upper lamina cells rhomboid, $\pm 70 \mu$ long and $\pm 14 \mu$ broad, basal lamina cells irregularly rhomboid becoming narrower towards border, $\pm 105 \mu$ long and $\pm 21 \mu$ broad, spine cells at the upper part of the leaf $\pm 112 \mu$ long.

Distribution and Ecology: Nagaland, Mokokchung, Longkhum, 50 Vap Mkg, 53 Vap Mkg, 156 Vap Mkg and 158 Vap Mkg, November 2007 and August 2008, at an altitude of about 6056 feet above sea level, habitat - found growing on the tree bark;

Range: East Nepal, Sikkim, Darjeeling, Bhutan, Khasia Hills, Lusai Hills and South India.

Collected by: Vaphuno Sale.

Examined by: Vaphuno Sale.

Conclusion

Morphotaxonomical studies of five moss taxa collected from Longkhum reserve forest of Mokokchung district, Nagaland State of North-East, India, reveals that all the five moss taxa viz., *Dicranum lorifolium* Mitt., *Ptychomitrium indicum* (Schrad.) Jaeg., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch., *Cyathophorella adiantum* (Griff.) Fleisch., are corticolous (grows on tree bark). In *Dicranum lorifolium* Mitt., *Ptychomitrium*

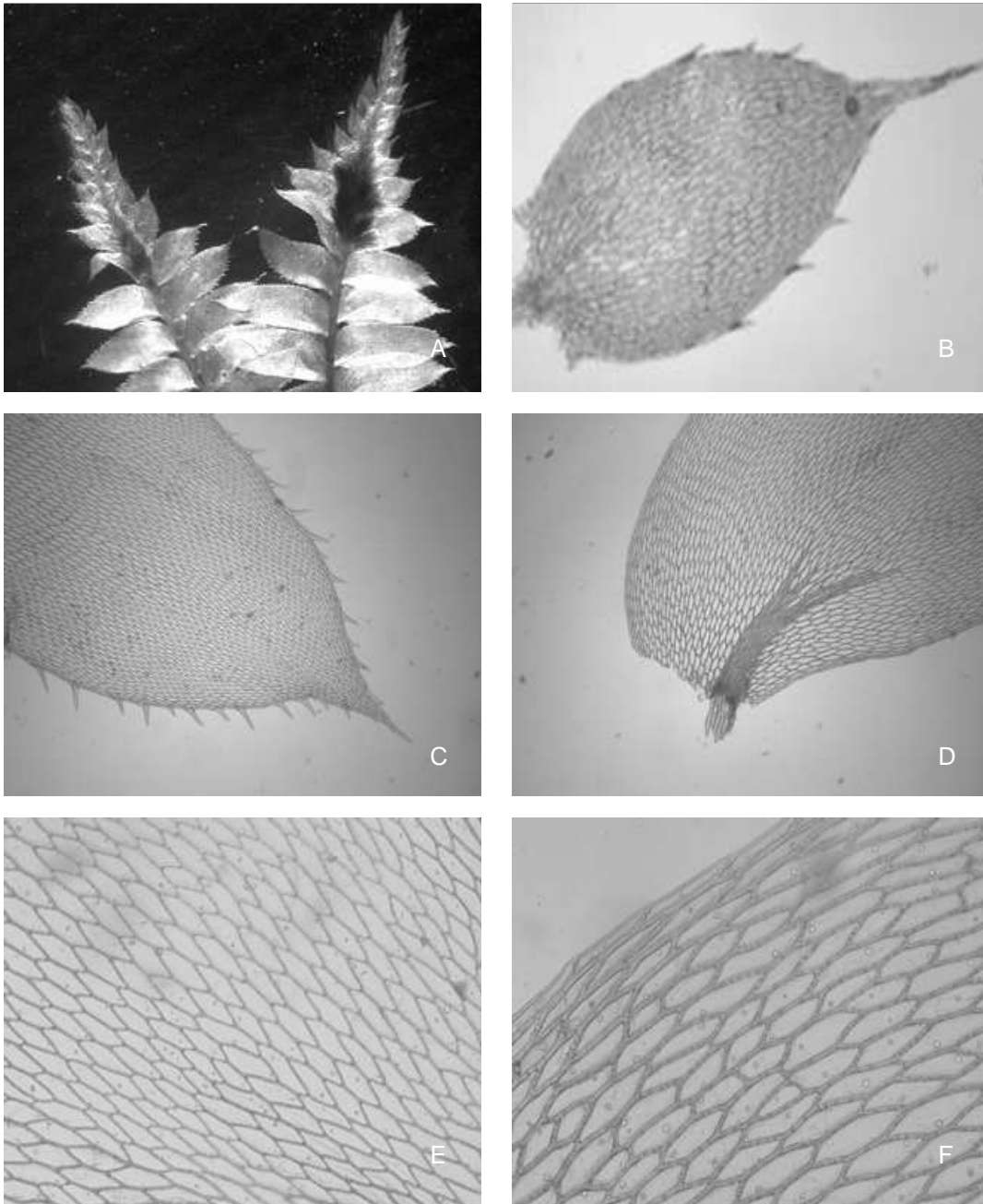


Plate - 5; Figs, A - F *Cyathophorella adiantum* (Griff.) Fleisch.

A. Plant body showing the caudate tip and cluster of orange-red gemmae, **B.** Amphigastral leaf showing indistinct short double costa, **C.** Upper part of the leaf showing serrate-spinous leaf margin, **D.** Leaf base showing forked costa, **E.** Apical cells which are rhomboid, **F.** Basal cells rhomboid and becoming narrower towards the margin.

indicum (Schrad.) Jaeg. and *Trachypodopsis serrulata* (P. Beauv.) Fleisch., the shape of the leaf is lanceolate, whereas, in *Homaliodendron montagneanum* (C. Muell.) Fleisch. and *Cyathophorella adiantum* (Griff.) Fleisch., the shape of the leaf has been found to be ovate-lingulate and oblong-ovate. In *Dicranum lorifolium* Mitt. and *Ptychomitrium indicum* (Schrad.) Jaeg., the alars were distinct and coloured whereas in the other three taxa viz., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch. and *Cyathophorella adiantum* (Griff.) Fleisch., the alars were absent. *Trachypodopsis serrulata* (P. Beauv.) Fleisch., differs from the other four taxa viz., *Dicranum lorifolium* Mitt., *Ptychomitrium indicum* (Schrad.) Jaeg., *Homaliodendron montagneanum* (C. Muell.) Fleisch. and *Cyathophorella adiantum* (Griff.) Fleisch., in having auricled leaf base. *Cyathophorella adiantum* (Griff.) Fleisch., can be differentiated from the other four taxa, viz., *Dicranum lorifolium* Mitt., *Ptychomitrium indicum* (Schrad.) Jaeg., *Trachypodopsis serrulata* (P. Beauv.) Fleisch. and *Homaliodendron montagneanum* (C. Muell.) Fleisch., in having erect caudate secondary branches, clusters of orange-red gemmae on the top of the secondary branches, forked costa, dimorphic leaves and spinous-serration of leaf margin. *Dicranum lorifolium* Mitt., differs from the other four taxa, viz., *Ptychomitrium indicum* (Schrad.) Jaeg., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch. and *Cyathophorella adiantum* (Griff.) Fleisch., in having rectangular porose lamina cells, sharp serrations on the

apical margins of the leaf as well as on the back of costa,. *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch. and *Cyathophorella adiantum* (Griff.) Fleisch., have rhomboidal lamina cells where as in *Ptychomitrium indicum* (Schrad.) Jaeg., the cells at the apical region of lamina are rounded to ovate and the cells at the basal region of lamina are rectangular. After a thorough survey of literature on the distribution of Indian moss taxa, it is concluded that *Ptychomitrium indicum* (Schrad.) Jaeg., is a new record for North-east India, whereas, the other four taxa viz., *Dicranum lorifolium* Mitt., *Trachypodopsis serrulata* (P. Beauv.) Fleisch., *Homaliodendron montagneanum* (C. Muell.) Fleisch., *Cyathophorella adiantum* (Griff.) Fleisch., are new records for Mokokchung District as well as Nagaland State.

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