STUDIES IN EAST HIMALAYAN HEPATICAE—II : THE GENUS *CHANDONANTHUS* MITTEN*

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ABSTRACT

Taxonomic details of two species of the genus *Chandonanthus* Mitt. viz., *C. birmensis* St. and *C. hirtellus* (Web.) Mitt., occurring in India are described. In the country the genus is represented by three species—the above two species belonging to the subgenus *Chandonanthus* which is distributed in tropical—antipodal regions and *C. filiformis* St. of the subgenus *Tetralophozia* which is distributed in arctic and alpine regions. In India all these species are so far known only in the eastern Himalayas.

INTRODUCTION

The genus *Chandonanthus* Mitt. (MITTEN, 1867) is a rather primitive taxon of family Lophoziaceae (see KITAGAWA, 1965; SCHUSTER, 1969). It is diagnosed by small to robust, dark-green to yellowish or yellowish-brown to deep-brown plants. The stem is rigid and erect or procumbent (specially in epiphytic plants) with small, thick-walled cells in cortex and larger thin to thick-walled cells in medulla. The branches are intercalary, arising from the axil of leaves or underleaves, but sometimes may be terminal. The leaves are transversely to obliquely inserted, succubous and deeply 2-3-4-lobed. The sinus descends up to the base of leaves and the lobes are canaliculate, equal or strongly unequal (with large dorsal lobe) more or less adaxially convex with reflexed margins having teeth or laciniae. The oil-bodies are 2-6 per cell, botryoidal to faintly granular. The underleaves are up to 1/2 of the leaf size arising from the broad ventral merophyte and deeply bilobed with marginal teeth or cilia. The rhizoids are few and scattered on the stem. The asexual reproduction is absent. The plants are dioecious. The androecia are intercalary with less deeply bilobed bracts which are ventricose at base and enclose 2-3 antheridia. The gynoecia are usually with single subfloral innovation. The bracts and bracteoles are almost similar to leaves and underleaves but less deeply bilobed and basally never connate with each other. The perianth is large, largely emergent, ovoid to cylindrical, strongly and deeply pluriplicate to the base with slightly contracted and highly ciliate mouth.

In the genus *Chandonanthus*, SCHUSTER (1960) recognises two subgenera, viz., *Chandonanthus* Mitt. and *Tetralophozia* Schust. The former is tropical antipodal in distribution while the latter is arctic and alpine (see also SCHUSTER, 1969).

In India the genus is represented by three species, viz., *C. birmensis* St. and *C. hirtellus* (Web.) Mitt., both of which belong to the subgenus *Chandonanthus* and *C. filiformis* St. belonging to the subgenus *Tetralophozia*. The report of *C. setiformis* (Ehrh.) Lindb. in Indian bryoflora, a member of the subgenus *Tetralophozia*, has not been accepted by

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*Contribution from the Department of Botany, University of Lucknow, Lucknow, India. New Series (Bryophyta) No. 135. The first paper of the series, "Studies in east Himalayan Hepaticae I. The genus *Trichocolea* Dumort.", in *Geophytology*, **7**(1) : 65-72, 1977.

SCHUSTER (1969). The details of *C. birmensis* and *C. hirtellus* have been described in the present paper. It has not been possible to either collect or examine the specimens of *C. filiformis* which is known only from eastern Himalayas and China (KITAGAWA, 1973).

MATERIAL AND METHOD

The specimens of *C. birmensis* were collected from Llyod Botanical Garden (Darjeeling, 27.03 N : 88.18E) and *C. hirtellus* from Elephant Fall (Shillong 25.34N : 91.56E) and Nathula Pass (Sikkim, 27.30N : 88.30E). The slides of these species prepared from specimens collected by Rev. P. Decoly and Schaul in 1897-1898 from Kurseong and available in the Department, have also been examined. The description of the female plants of the latter species is based on the specimens collected by Prof. Pande in 1939 from Pedros Peak (Ceylon). The herbarium plants were stretched in water for about 24 hours. The oil-bodies of the latter species were drawn from the fresh collection made from Nathula Pass.

KEY TO THE SPECIES

1. Leaves usually 2-3 lobed 2
   2. Medullary cells thin-walled, hyaline. Leaf 2-3 lobed ; lobes ± entire. Underleaves with 1-2 teeth .. .. *C. birmensis*
   2. Medullary cells thick-walled, yellowish. Leaf 3 lobed ; lobes with numerous large teeth. Underleaves with several teeth throughout .. .. .. *C. hirtellus*
1. Leaves usually 4 lobed .. .. *C. filiformis*

TAXONOMIC DESCRIPTION

1. Chandonanthus birmensis St. Species Hepaticarum 3 : 643, (1909). Text-figs. 1-20.

Syn. *Temnoma birmense* (St.) Horik. Hikobia, 1 : 90, (1951) ; Hattori *in* J. Hattori bot. Lab. **7** : 46, (1952).

Plants in pure dense mats, rather rigid, procumbent, yellowish brown. Branches few, lateral intercalary. Stem 170-236 μm in diam.; cortex 1-2(-3) layered thick, brown, thick-walled, 5-17 X 5-16 μm.; medullary cells hyaline, thin-walled, 13-23 × 16-34 μm. Leaves obliquely inserted, contiguous to imbricate (at apex), yelllowish brown, 0.7-1.1 mm long, 1-2 mm wide, (2)-3-lobed, sinus descending up to the base; lobes ovate to oblong with acute to acuminate apex: dorsal lobe convex adaxially, larger in size, 0.7-1.1 mm long, 0.5-0.8 mm wide : intermediate lobe of middle size, 0.6-0.9 mm long, 0.3-0.6 mm wide forming a prominent ventral fold on stem with dorsal lobe : ventral lobe often present, smaller in size. 0.2-0.6 mm long, 0.1-0.2 mm wide, occasionally with few, small, 35-80 μm long, 15-30 μm wide teeth at base, marginal cells 5-13 × 5-13 μm; middle cells 5-16 ×5-14 μm, basal cells 13-31 ×10-16 μm; walls thin to slightly thick, with or without trigones. Underleaves bifid, sinus descending up to base; lobes, oblong to lanceolate with acute to acuminate apex, margins with 1-?, small, 10-35 μm long, 10-26 μm wide basal teeth.

Specimens examined—LWU 3279/77, Date : December 12, 1977, Loc. Llyod Botanical Garden (Darjeeling), ca 1220 m, Coll. : S. C. Srivastava and A. Kumar, Det., : R. Udar and A. Kumar.

Habitat—The plants grow in pure population on logs in moist and shady places or in association with *Spruceanthus semirepandus* (Nees) Verd.

Range– India (Darjeeling, Kurseong); Indo-Malaya; Japan; Madagascar.

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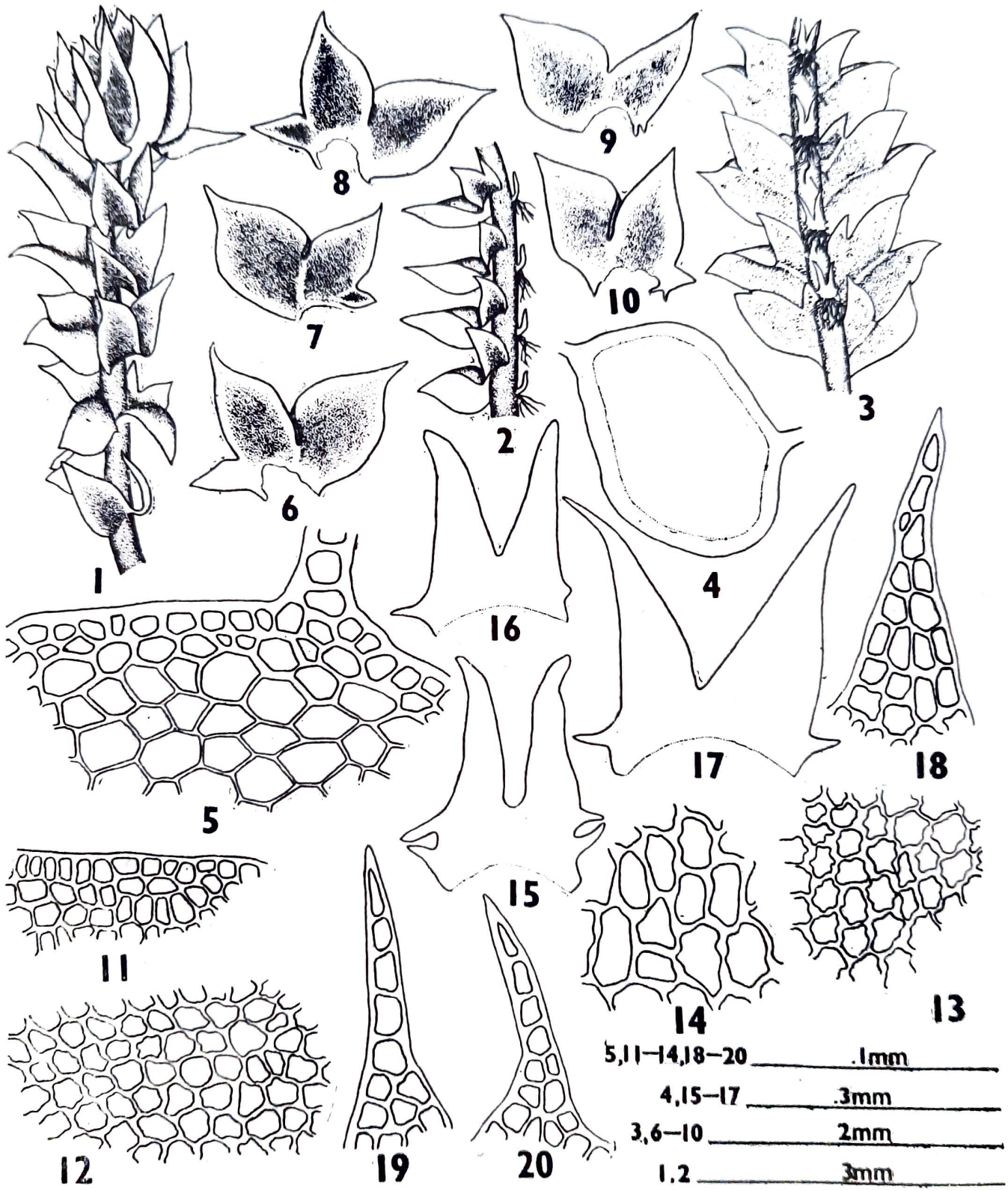
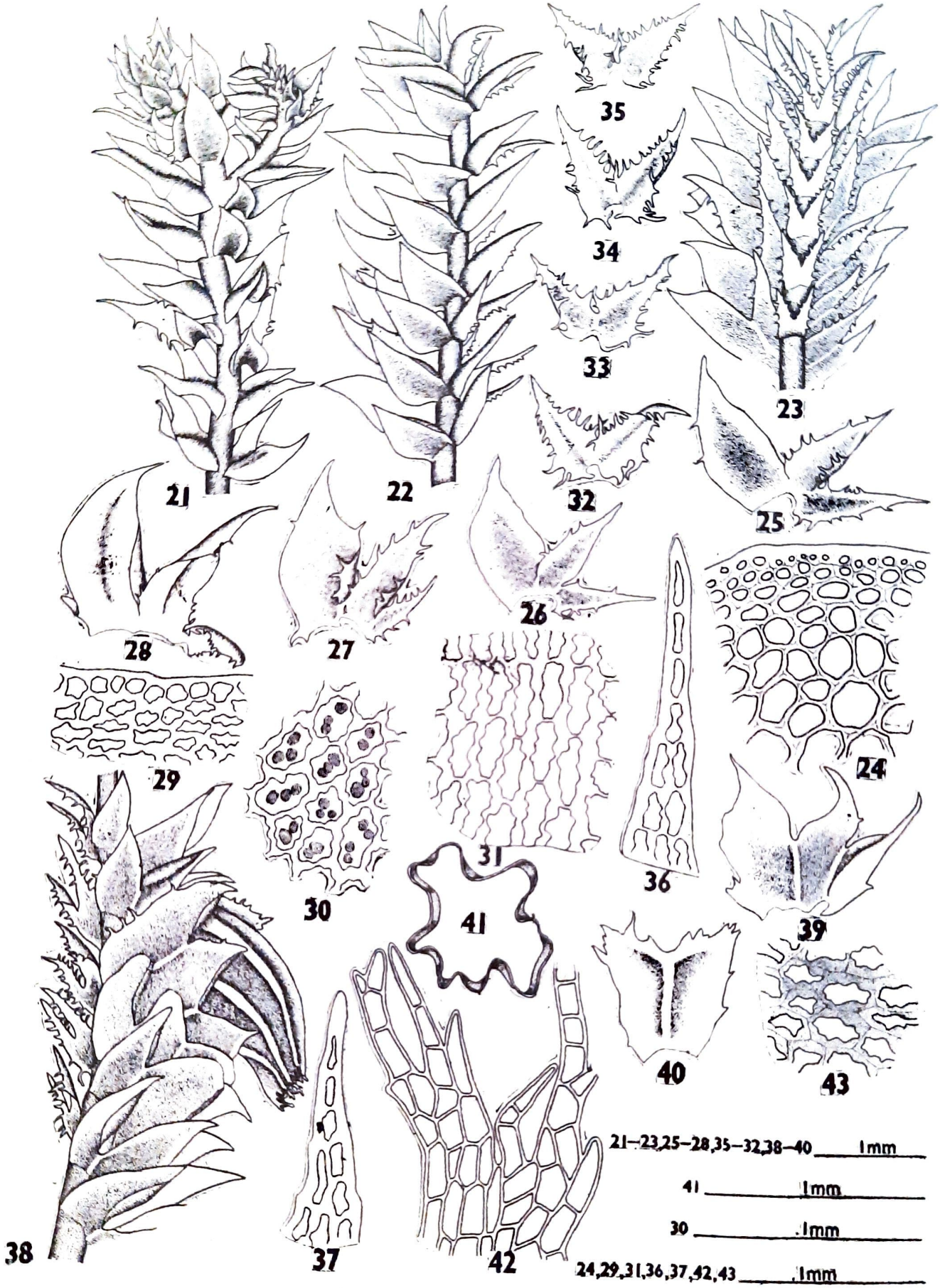
Range– India (Darjeeling, Kurseong); Indo-Malaya; Japan; Madagascar.

The species is distinctive in stem anatomy, in number of leaf lobe and in degree of development of teeth at the margin of leaf lobe and underleaf. The stem has 1-2 (-3) layered thick-walled, brown cortical cells and thin-walled, hyaline, medullary cells (Text-fig. 5). The leaves are 2-3 lobed (Text-figs. 6-10) with the ventral lobe having few teeth (Text-fig. 10) and underleaves also have only 1-2 basal teeth at their basal margins (Text-



Text-figs. 1-20. *Chandonanthus birmensis* St. 1. Plant in dorsal view, 2. A portion of plant in lateral view, 3. Plant in ventral view, 4, 5. T. S. of stem (4. semidiagrammatic), 6-10. Leaves, 11. Marginal cells of the leaf, 12, 13. Median cells of the leaf, 14. Basal cells of the leaf, 15-17. Underleaves, 18-20. Teeth of underleaf.



Text-figs. 21-43. *Chandonanthus hirtellus* (Web.) Mitt. 21. Plant in dorsal view, 22. Plant in lateral view, 23. Plant in ventral view, 24. T. S. of stem, 25-28. Leaves, 29. Marginal cells of the leaf, 30. Median cells of the leaf showing oil-bodies, 31. Basal cells of the leaf, 32-35. Underleaves, 36-37. Teeth of the leaf, 38. Female plant in lateral view (semidiagrammatic), 39. Female bract, 40. Female bracteole, 41. T. S. of the perianth, 42. Perianth cells at mouth, 43. Perianth cells at middle.

figs. 15-17). This species is, however, of particular interest in showing variations in size and colour of plants, presence and absence of ventral leaf lobe, marginal teeth of leaf and underleaf and development of trigones in the cells. All these types of variations are possibly ecologically influenced as evidenced in specimens collected from Llyod Botanical Garden which were growing under very moist condition and from Kurseong representing growth conditions under exposed situations. The plants of moist and shady places are smaller in size and lesser pigmented than those growing in slightly dry condition. The number of teeth, although they are few in this species, and the development of trigones in the cells are not to scarcely defined in the plants growing in moist condition—whereas these features including the development of ventral lobes are considerably pronounced in the plants of exposed condition.

2. Chandonanthus hirtellus (Web.) Mitt. Hook., Handb. New Zealand Fl. 2 : 750, (1857). Text-figs. 21-43.

Syn. *Jungermannia hirtella* Web., Prodron. 50, No. 43, (1818). *Timnoma hirtellum* (Web.), Horik., Hikobia 1. 90, (1951) ; Hattori *in* J. Hattori bot. Lab. 7 ; 47, (1952), *Mastigophora spinosa* Horik., Sci. Rep. Tohoku Imp. Univ., Ser. 4, 5 : 634, (1930).

Plants usually scattered among other bryophyte or in pure population, rigid, procumbent, deep-brown, up to 35 mm long. Branches lateral intercalary. Stem 200-350 μm in diam. ; cortex 2-4 layered thick, deep-brown, highly thick-walled with very reduced lumen, 10-21 × 8-18 μm ; medullary cells light yellow, moderately thick-walled, trigonous, comparatively with larger lumen, 20-34 × 13-29 μm. Leaves obliquely inserted, contiguous to imbricate (at apex), brown, 1.6-1.9 mm long, 1.5-1.9 mm wide, 3-lobed, sinus descending up to the base ; lobes ovate to oblong with usually acuminate apex: dorsal lobe convex adaxially, larger in size, 1.6-1.9 mm long, 0.8-1.2 mm wide : intermediate lobe incurved, medium or more or less of same size, 1.5-1.8 mm long, 0.6-0.9 mm wide, forming a prominent ventral fold on stem with dorsal lobe : ventral lobe always present, incurved, smaller in size, 0.7-1.5 mm long, 0.4-0.7 mm wide, having more teeth than median and dorsal lobes; teeth up to 40-170 μm long, 50-80 μm wide; marginal cells 8-13 × 6-13 μm; middle cells 13-26 × 8-16 μm ; basal cells 16-39 × 13-17 μm; cell walls thick with large confluent trigones. Oil bodies 2-4 in each cell, more or less spherical to elliptical, 2-3.5 μm, faintly granulose. Underleaves bifid, sinus descending up to base; lobes ovate to oblong with usually acuminate apex, margins recurved with numerous, large, 26-250 μm long, 25-95 μm wide teeth throughout. Gynoecia terminal with single (rarely two) subfloral innovations. Female bracts like leaves but slightly larger, less deeply 3-lobed, apex acute to acuminate, margin less dentate. Female bracteole less deeply bilobed, with few teeth at margins, apex acute. Perianth oblong, emergent, 0.7-1.4 mm long , 0.3-0.7 mm wide, 8 or more plicate, contracted at mouth, mouth with numerous cilia, cilia 1-8 cells long with hyaline cells ; mouth cells thin-walled, light yellowish, 13-26 (—35) × 8-15 μm; middle cells thick-walled, brown.

Specimens examined—LWU 104/76, Date : April 1976, Loc. : Elephant Fall (Shillong), ca 1600 m, Coll. : D. K. Singh. LWU 3086/77, Date : December 28, 1977, Loc. : Nathula Pass (Sikkim), ca 2000 m, Coll. : S. C. Srivastava and A. Kumar. LWU 617/39, Date : December , 1939, Loc. : Pedro's Peak (Ceylon), Coll. : S. K. Pande, Det. : R. Udar and A. Kumar.

Habitat—The plants grow either in pure population or in association of *Herberta* and mosses on slopy rocks/soil in moist and shady places.

Range--India (Shillong, Sikkim, Kurseong), Ceylon, Taiwan, Japan, Africa and Australia.

Although *C. hirtellus* shows variations in size and colour of plants and in development of teeth on leaves and underleaves but it exhibits some interesting features which are distinctive for this species. The stem has thick-walled, yellow, trigonous cells in medulla (Text-fig. 24). The leaves are trilobed with numerous large teeth on margins (Text-figs. 25-28). The underleaves also show numerous large teeth throughout margin from base to apex (Text-figs. 32-35).

KITAGAWA (1965), in a discussion of the variations of both these taxa, suggested that *C. birmensis* should be treated as a variety of *C. hirtellus*. However, the distinguishing features between them are sufficiently stable and both the taxa deserve independent status.

ACKNOWLEDGEMENT

The authors are thankful to the University Grants Commission for financing the project entitled "Monographic studies on the liverworts of eastern India" during the tenure of which the present work has been completed.

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