STUDIES IN EAST HIMALAYAN HEPATICAE I. THE GENUS *TRICHOCOLEA* DUMORT.*

RAM UDAR AND DEVENDRA KUMAR SINGH

Department of Botany, University of Lucknow, Lucknow

ABSTRACT

The paper deals with two new species of the genus *Trichocolea* DUMORT., *T. indica* sp. nov. and *T. tenera* sp. nov., revealed during an investigation of the collections of liverworts from Darjeeling (Eastern Himalayas) and its neighbourhood. The former species is characterised by larger plants, irregular bi-tripinnate branching, presence of 21-23 cells across the stem diameter, very rare occurrence of paraphyllia, 8-12 series of antheridial bracts, each subtending 1-3 antheridia, complete absence of paraphyllia from the surface of coelocaule and 60-240 μm long stumpy-elongated bispiral elaters, whereas the latter is characterised by small delicate plants, regular bipinnate branching, presence of rhizoids, presence of 8-12 cells across the stem diameter, 4-8 series of antheridial bracts and presence of one antheridium per bract.

INTRODUCTION

Trichocolea is a primitive plant as exhibited by the presence of more or less isophyllous three ranked leaves which are highly dissected and finally resolved into filamentous outgrowths; presence of rhizoidal discs on the abaxial surface of the lamina of underleaves giving rise to numerous rhizoids; presence of coelocaule, instead of a well developed perianth, which carries unfertilized archegonia towards its apex and 6-8 layered thick capsule wall. The plant has never been adequately studied in Indian Bryology.

The genus *Trichocolea* has been treated variously by different authors. EVANS (1939-40) and CAVERS (1910) placed it under the family Ptilidiaceae, while MÜLLER (1954 in 1951-58, p. 586) proposed the family Trichocoleaceae for it on the basis of the following characters exhibited by the genus : (a) generally asymmetircal, 3-9 lobed, alternate-succubous leaves (never incubous), (b) complete absence of a well developed perianth and presence of a coelocaule formed by the stem tissue, (c) free, uni-tripinnate *Frullania* type branching, and (d) non collenchymatous elongated cells of leaves.

The family Trichocoleaceae includes only two genera (SCHUSTER, 1966), *Trichocolea* DUMORT. with 48 species (STEPHANI, 1909-12, 1924) from various parts of the world and a monotypic genus *Eotrichocolea* Schust. (SCHUSTER, 1963). But MÜLLER (1951-58) includes within the family two more genera, *Chaetocolea* and *Lepicolea*.

In India very little is known about the family Trichocoleaceae. There are simply some records of its occurrence. According to the census of PARIHAR (1961-62) there are two species, *T. tomentella* and an unidentified *Trichocolea* sp., both from the Eastern Himalayas. Recently UDAR AND SRIVASTAVA (1975) have described sterile plants of *T. tomentella* from South India. A detailed study carried on recently collected plants from Eastern Himalayas revealed the presence of two new species of *Trichocolea* in this region. However, we did not come across the species *T. tomentella* during our present investigations.

---

*Paper presented at the First Indian Geophytological Conference, Lucknow, December 21-24, 1975.

MATERIALS AND METHODS

The material for the present investigation was repeatedly collected, in the month of April, 1970 by one of us (R. U.) from Tangloo and neighbouring areas and again in the month of December, 1972 and January, 1973 by Ram Udar and party from Darjeeling and neighbouring areas. The collections made in April, 1970 from Tangloo contained only plants of *T. indica*. Plants of *T. tenera* were found in the collections, from Darjeeling and its neighbourhood, made in the month of December, 1972 and January, 1973. The plants were fixed in 90% alcohol. Selected portions were then dehydrated through ascending alcohol series and embedded in the paraffin wax in the usual manner. The sections were cut 8-15 μm thick and the staining was done in heidenhain's iron-alum haematoxylin.

KEY TO THE INDIAN SPECIES OF *TRICHOCOLEA*

1. Plants densely paraphylliated ..... *T. tomentella*
1. Plants with very rare paraphyllia ..... (2)
   2. Plants large, 6-14 cm long, stem robust, 21-23 cells across diamteter. Leaves asymmetrical, 4-7 lobed, lamina 2-3 cells long. Bracts in 8-12 series, usually 2 antheridia per bract ..... *T. indica*
   2. Plants small, 6-9 cm long, stem delicate, 8-12 cells across diameter. Leaves asymmetrical-subsymmetrical, 4-5 lobed, lamina 1-2 cells long. Bracts in 4-8 series, usually one antheridium per bract ..... *T. tenera*

TAXONOMIC DESCRIPTION

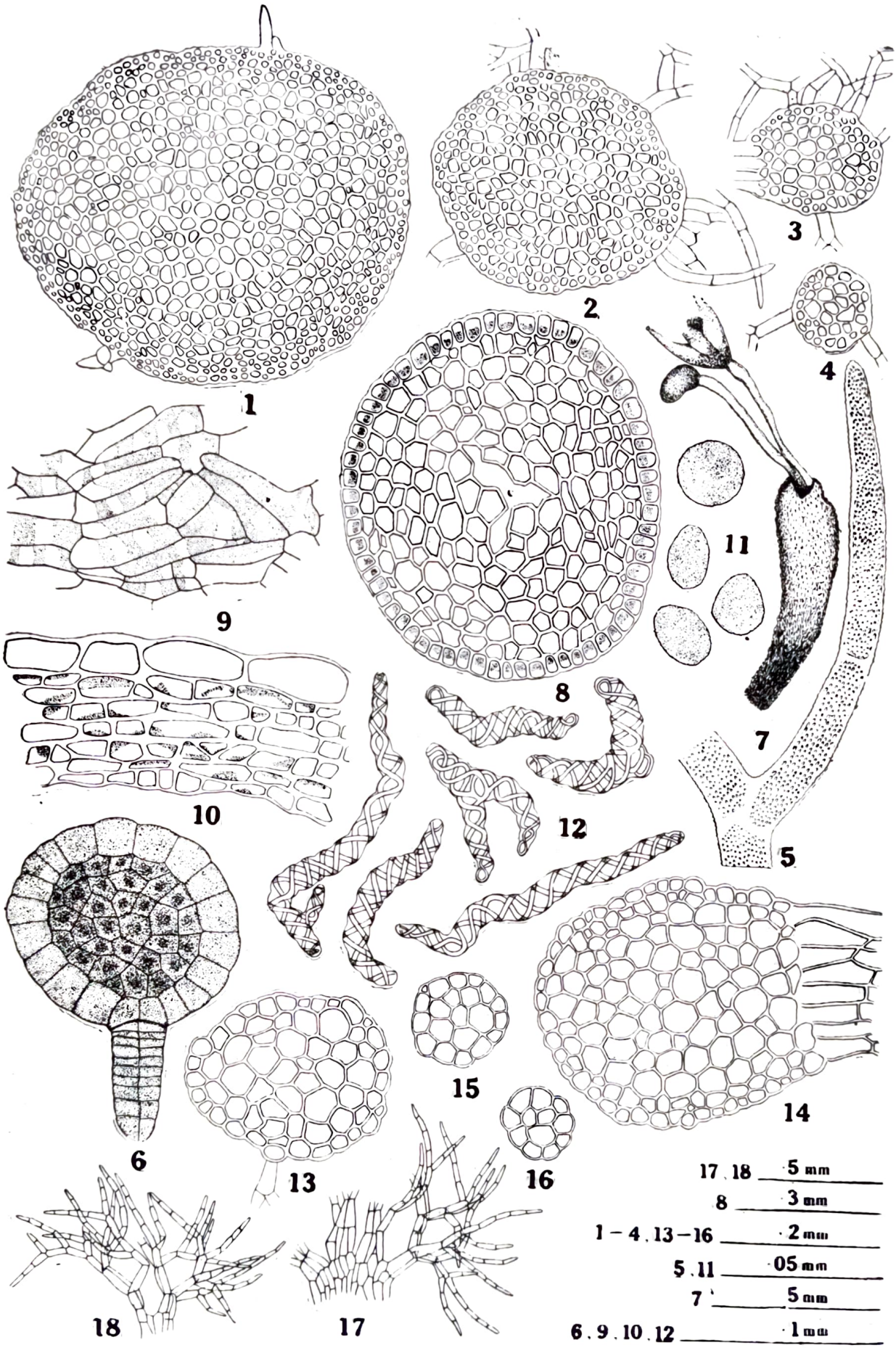
1. Trichocolea indica sp. nov. (Text-figs. 1-12; Pl. 1, Figs. 1-5; Pl. 2, Figs. 6-10).

Diagnosis—Dioica. Plantae flavido-brunneae, prostratae, 6-14 cm longae; caulis robustus, bi-vel tripinnatus, trans diametrum 21-23 cellulatus; cortex 2-3 stratosus, cellulis corticis 4-8 μm, medullosis 8-26.7 μm diam; rhizoidea carentia; folia lateralia asymmetricalia, 4-7 lobata, lamina 465-486 μm lata, 2-3 cellulis longa; folia inferioria subsymmetricalia, 2-4 lobata, 1-3 cellulis longa; rami androeciales cis ramorum vegetiorum semiles, bracteis 8-12 seriatis, antheridiis plerumque 2 per bracteam; sporophytum juvenile intracoelocaulem inclusum; seta ca 25 mm longa, cylindrica, trans diametrum usque 14 cellulata; capsule clavata, rufobrunnea, ca 3 mm longa, 0.8 mm lata, pariete 6-8 stratoso; sporae rufobrunneae, rotundatae, 13-21 μm diam., minute papillosae; elateres rufobrunnei, elongato-obtusi, bisporales.

Typus positus in herbario hepatico, sectionis botanices, Universitatis Lucknow, Lucknow (India). sub numero 12,676 *Trichocolea indica* sp. nov. Leg. R. U. Loc.—Tangloo mense April, 1970, Det. R. U. et D. K. S.

Description—Dioecious. Plants in large tufts, scattered among other bryophytes, palegreen-yellowish brown, prostrate, 6-14 cm long, 1-2 cm wide including branches, irregularly bi-tripinnately branched, the vegetative branches of *Frullania* type (arising from the ventral half of a lateral segment) forming an angle of 75-80°, or as subfloral innovations (arising from the base of female inflorescence making thereby the inflorescence intercalary), antheridia bearing apices thickened. Stem robus; main stem oval-orbicular in cross section,

Text-figs. 1-12. *Trichocolea indica* sp. nov., 1. T. S. main stem, 2. T. S. primary branch, 3. T. S. secondary branch, 4. T. S. tertiary branch, 5. A cilium of leaf, 6. Young antheridium, 7. A coelocaule with two sporophytes, 8. T. S. seta (c: central triradiate cavity), 9. Innermost layer of the capsule wall in surface view, 10. T. S. of the capsule wall, 11. Spores, 12. Elaters. Text-figs. 13-18. *Trichocolea tenera* sp. nov., 13-14. T. S. main stem, 15. T. S. primary branch, 16. T. S. secondary branch, 17. Lateral leaf (only a part drawn), 18. Underleaf.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
17 . 18 — 5 mm
8 — 3 mm
1 – 4 . 13 – 16 — 2 mm
5 . 11 — 05 mm
7 — 5 mm
6 . 9 . 10 . 12 — 1 mm

395×450 μm wide, 21-23 cells across diameter; cortex 2-3 cell layered, cells uniformly thick walled, 4-8 μm in diameter, rectangulate-oval, nontrigonous; medullary cells 8-26.7 μm in diameter, oval-polygonal, nontrigonous; cuticle thick, striolate; paraphyllia very rare; rhizoids absent; primary branch oval-orbicular in cross section, 160-288 μm wide, 16-18 cells across diameter; cortex 2 layered, cells uniformly thick walled, 4-8 μm in diameter, oval-rectangulate, nontrigonous; medullary cells 5.4-21.4 μm in diameter, oval-rectangulate (polygonal), nontrigonous; cuticle thick, striolate; secondary branches delicate, oval in cross section, 133×152 μm wide, 9-11 cells across diameter; cortex 1-2 layered, cells 4-10.8 μm in diameter, rectangular, nontrigonous; medullary cells 5.4-22.4 μm in diameter, rectantular-polygonal, nontrigonous, cuticle thick striolate; tertiary branches delicate, filiform, orbicular in cross section, 93. 4 μm wide, 6-7 cells across diameter, cortex single layered, cells 5.4-13.4 μm in diameter, rectangular (oval), nontrigonous, medullary cells 5.4-22 μm in diameter, rectangular, nontrigonous, cuticle striolate. Leaves in three rows; lateral leaves distant or imbricate, erect-spreading, obtrapezoidal-subreniform, obliquely attached to axis, alternate-succubous, asymmetrical, (3) 4-7 (9) lobed, lobes conspicuous, descending up to 0.6-0.9 of the leaf length, ventral portion of leaf larger, lobes more or less triangular, largely resolved into numerous capillary segments ending in long cilia, armed with opposite-verticillate cilia, lamina wider than long, 465-486 μm wide, 130-160 μm long (2-3 cells long), cells always cylindrical rectangular; cells of lamina 16-80 μm long, 11-32 μm wide; cells of lobes 75.6-107 μm long, 21.4-48 μm wide; cells of cilia 48-68 μm long, ca 13 μm wide, rarely cells are subquadrate-hexagonal, nontrigonous, cuticle thick, densely verrucose; leaves on branches similar to those on main stem, except for smaller size, smaller number of lobes and less extensive branching. Underleaves smaller, usually half the general area of lateral leaves, lamina 224-260 μm wide, 1-3 cells long, transversely attached to the axis, erect-spreading, often connate with the lateral leaves, cells rectangular-subquadrate, lamina 2-4 lobed, subsymmetrical, lobes resolved into narrow capillary segments, armed with cilia, cells of capillary segments cylindrical, rarely oblong-hexagonal, 16-27 μm wide, 40-68 μm long, nontrigonous, cuticle papillose-verruculose. Asexual reproductive structures absent. Male plants, as compared to female plants, light in colour; androecial branches similar to vegetative branches, apices thickened, borne on main stem and primary branches only; bracts in 8-12 series, similar to lateral leaves but larger and less branched than latter; bracteoles similar to underleaves; antheridia large globose, yellowish-brown, body of antheridium 80-114.5 μm in diameter, antheredial wall unistratose, stalk massive, biseriate, 60 μm long, 26.7 μm wide. Sporophyte terminal on main stem or primary branch, sometimes appearing intercalary, when young enclosed within a coelocaule or "shoot calyptra". Coelocaule completely devoid of paraphyllia, 6-7 cell layered thick throughout, cells in the basal region elongated-rectangular, in the apical region orbicular-polygonal, towards the apex unfertilized archegonia present. Sporophyte well differentiated into anchor-shaped foot, sometimes branched at base; seta delicate, elongated cylindrical, ca 25 mm long, 640-715 μm wide, with a central triradiate cavity, cells of outermost layer with starch contents, 30-35 μm in diameter, inner cells 27-60 μm in diameter, nontrigonous; capsule clavate, reddish-brown, ca 3 mm long, 0.8 mm wide, when mature projecting out of the coelocaule by means of long seta, quadrivalved, capsule wall 6-8 stratose, cells of outermost surface layer large, thin walled, hyaline, without thickenings, cells of innermost layer very irregularly arranged with transverse hyaline thickenings, cells of intermediate layers smaller, with irregular thickneings; spores reddish-brown, oval-rounded, sometimes elliptical, 13-21 μm in diameter, finely papillose; elaters red-brown, elongated [160-200 (240) μm long] -stumpy (60-70 μm long), with narrowed or blunt end, bispiral, rarely branched.

Type specimen deposited in the Hepatic Herbarium, Department of Botany, University of Lucknow No. 12,676. *Trichocolea indica* sp. nov. growing epiphytically on barks of angiospermic plants. Coll. R. U. Loc. Tangloo, April, 1970, Det. R. U. and D. K. S.

The plants also grow in Tiger Hill, Teesta valley, Ghoom and Lebong at Darjeeling, Eastern Himalayas, India. They form large tufts, usually epiphytic on the bark of angiospermic plants and sometimes as a cover on associated mosses also. They may also grow on rocks under moist and shady conditions. The major associates are *Thuidium* sp., *Brachythecium* sp., *Anomobryum* sp., *Plagiochila* sp., and *Scapnia* sp. Sometimes some unicellular algal colonies are also found in the association of the plants.

2. Trichocolea tenera sp. nov. (Text-figs. 13-18).

Diagnosis—Dioica ? Plantae albido-virides, prostratae, 6-9 cm longae; caulis tenuis, bipinnatus, transdiametrum 8-12 cellulatus; cortex unistratosus, cellulis corticis 11-27 μm, medullosis 21-37.8 μm diam; rhizoidea praesentia; folia lateralia asymmetricalia vel sub symmetricalia, 4-5 lobata, lamina 370-520 μm lata, 1-2 cellulis longa; folia inferioria sub symmetricalia, 2-4 lobata, lamina 1-2 cellulis longa; rami androeciales cis ramorum vegetiorum similes; bracteis 4-8 seriatis; antheridia plerumque une per bracteam, caulibus 1-2 seriatis. Plantae femineae non visae.

Typus positus in herbario-hepatico, sectionis botanices, Universitatis Lucknow, Lucknow (India), sub numero 12,677. *Trichocolea tenera* sp. nov. Leg. R. U. *et al.* Loc.-Tiger Hill (Darjeeling) mense December, 1972; Det. R. U. *et* D. K. S.

Description—Dioecious ? Plants in tufts, scattered among other bryophytes, whitish green-yellowish green, prostrate, 6-9 cm long, 1-1.5 cm wide including branches, regularly bipinnate, vegetative branches of *Frullania* type, branches never terminating into rhizoidous flagella, antheridia bearing apices thickened. Stem delicate; main stem oval in cross section, 281-346 μm wide, 8-12 cells across diameter, cortex single layered, cells 11-27 μm in diameter, oval-subquadrate, medullary cells 21-37.8 (43.2) μm in diameter, oval-polygonal, nontrigonous, cuticle striolate, paraphyllia very rare, rhizoids present; primary branches filiform, more or less orbicular in cross section, 118-124 μm wide, 5 cells across diameter, cortex and medullary cells not distinctive, cortical cells 11-27 μm in diameter, medullary cells 21.6-43.2 μm in diameter; cuticle striolate, paraphyllia and rhizoids absent; secondary branches very delicate, filiform, oval in cross section, 82×90 μm wide, 4 cells across diameter, cortical cells 16.2-32.5 μm in diameter, medullary cells 21.6-37.8 μm in diameter, cuticle inconspicuous, striolate, paraphyllia and rhizoids absent. Leaves in three rows, lateral leaves distant, rarely imbricated, erect-sprea ing, alternate-succubous, obliquely attached to the axis, obtrapezoidal-subreniform in outline, asymmetircal-subsymmetrical, (3) 4-5 lobed nearly to the base, lobes more or less triangular, resolved into capillary segments, segments armed with opposite cilia, lamina wider than long, 370-520 μm wide, 1-2 cells long, cells of lamina, lobe, and cilia rectangular, cells of lamina 53-93 μm long, 13-24 μm wide, those of lobes 43-86 μm long, 21-32 μm wide and those of cilia 37.3-64 μm long and ca 16 μm wide, cuticle conspicuous, verruculose, leaves on branches usually 3 lobed, smaller; underleaves smaller, about half as wide as lateral leaves, patent-spreading, transversely inserted over the axis, subsymmetrial, 2-4 lobed, lamina 256 μm wide, 1-2 cells long, lobes resolved into capillary segments, cells of lamina 75.6-97.2 μm long, 21.6-27 μm wide, those of lobes 54-86.4 μm long, 32.4 μm wide, and those of cilia 43.2-64.8 μm long, 10.8-21.6 μm wide, cuticle verruculose, lamina of the underleaves on main stem bear rhizoidal disc bearing tufts of rhizoids ending distally into multilobed, well developed holdfast, underleaves on branches usually 2 lobed, patent. Asexual reproductive structures

absent. Androecial branches similar to vegetative branches, terminal on main axis or primary branch, male inflorescence composed of 4-8 series of bracts and bracteoles similar to leaves and underleaves except in their size as the former are larger, 1 rarely 2 antheridia in the axil of each bract, body of the antheridium yellowish-brown, large globose, 89-92 μm wide, antheridial wall unistratose, stalk massive, 43 μm long, biseriate (24 μm wide) very rarely uniseriate (18 μm wide). Female plants not seen.

Type sepcimen deposited in the Hepatic Herbarium, Department of Botany, University of Lucknow, Lucknow No. 12,677. *Trichocolea tenera* sp. nov. gorowng epiphytically on barks of trees. Coll. R. U. and party. Loc. Tiger Hill (Darjeeling) December, 1972. Det. R. U. and D. K. S.

The plants also occur in Teesta valley, and Lebong at Darjeeling, Eastern Himalayas, India.

The plants of *T. tenera* grow in tufts, epiphytic on the bark of angiospermic trees and on the rocks under moist and shady conditions. The associates are *Brachythecium* sp., *Plagiochila* sp., *Scapania* sp., and *Thuidium* sp.

DISCUSSION

Trichocolea indica presents some very interesting features in its reproductive structures. The male inflorescence is composed of 8-12 series of bracts and bracteoles. Each bract generally subtends 2 antheridia in its axil (Pl. 1, Fig. 2) but sometimes 3 or even only one antheridium may be present in tha axil of a bract. Bracteoles are generally not associated with antheridia but in the present species antheridia occur, in few plants, also in the axil of bracteoles, a character quite uncommon in the genus as well as in the family. The surface of the body of the young antheridium is smooth (Text-fig. 6) and yellow-brown in colour but it becomes shrunken and dark brown in colour at maturity (Pl. 1, Fig. 5.).

The sporophytes are terminal on a leading branch (Pl. 2, Fig. 6) or on an abbreviated branch (Pl. 1, Fig. 1) and are completely enclosed within the coelocaule in younger stages (Pl. 1, Fig. 1). The coelocaule is formed by the upgrowth of the apical stem tissue, thus enclosing the developing sporophyte, as evidenced by the presence of unfertilized archegonia towards its apex (Pl. 2, Fig. 8). The coelocaule is 6-7 stratose throughout with elongate-rectangulate cells towards the base and orbicular cells towards the apex (Pl. 2, Figs. 7, 8). At maturity the sporophyte projects out of the coelocaule by means of long, delicate yet stout seta (Pl. 2, Fig. 6). In one plant, out of the total six plants with sporophytes available to us, the coelocaule showed two setae, emerging out of its mouth, bearing capsules at their distal ends. One capsule was already dehisced into 4 valves while the other one was still intact (Text-fig. 7). The presence of double sporophytes could be due to (a) the fertilization of two archegonia present side by side at the apex of gynoecial branch, resulting, thereby, into the development of two sporophytes within the same coelocaule, or (b) occurrence of polyembryony, or (c) occurrence of polysety.

T. indica approaches *T. tomentella* (Ehrh.) Dumort. Corr. Nees and *T. tomentosa* (Sw.) Gottsche. However, it is distinctive and differs considerably from both in having irregular bi-tripinnately bracnhed plants, in stem anatomy and size of the cortical and medullary cells [in *T. tomentella* plants are regularly bipinnate and the stem has the diameter 25-35 cells across and is well differentiated into 3-5 cell layered cortex with cortical cells 19 μm in diameter and medullary cells 42 μm in diameter (HATCHER, 1957; SCHUSTER, 1966) whereas in *T. tomentosa* plants are regularly pinnate with the stem having the diameter 21-26 cells across, cortex 1-2 layered, cortical cells 19 μm in diameter and medullary cells 32 μm in diameter (HATCHER, 1957)]. *T. indica* has paraphyllia rather rare whereas *T.*

tomentella is densely paraphylliated (HATCHER, 1957; SCHUSTER, 1966) and *T. tomentosa* is completely devoid of paraphyllia (HATCHER, 1957). Other differentiating characteristics are seen in the size of leaves, number of leaf lobes, size of cells of the leaf lamina, lobes and cilia [in *T. tomentella* leaves are 6-8 lobed, lamina 2 mm wide (HATCHER, 1957; SCHUSTER, 1966), cells of lamina 50-80 μm long, 16-28 μm wide (SCHUSTER, 1966), 62 μm long, 28 μm wide (HATCHER, 1957), those of cilia 50-85 μm long, 7-25 μm wide (SCHUSTER, 1966), 63 μm long, 19 μm wide (HATCHER, 1957), whereas in *T. tomentosa* leaves are 5-8 lobed, lamina 1.4 mm wide, cells of lamina 31 μm long, 25 μm wide and those of cilia 73 μm long, 12 μm wide (HATCHER, 1957)]. In *T. indica* lamina of the underleaf is only 0.23-0.26 mm wide while in *T. tomentella* it is 1.0 mm wide (HATCHER, 1957; SCHUSTER, 1966) and in *T. tomentosa* (HATCHER, 1957) 0.7 mm wide.

T. indica has androecial branches generally composed of 8-12 series of bracts, each bract having (1) 2(3) antheridia in its axil while in *T. tomentella* there are 12-15 or more series of bracts each having 2 antheridia in its axil (HATCHER, 1957; SCHUSTER, 1966), and in *T. tomentosa* bracts are in 6 series and each bract bears only one antheridium (HATCHER, 1957). But for *T. tomentosa*, the male inflorescence is terminal in *T. tomentella* and *T. indica*. In *T. tomentosa* male inflorescenec is intercalary (HATCHER, 1957).

In *T. indica* coelocaule is devoid of paraphyllia whereas in *T. tomentella* as well as in *T. tomentosa* the external surface of coelocaule is densely paraphylliated (HATCHER, 1959). Coelocaule in *T. indica* is 6-7 stratose throughout while in *T. tomentella* coelocaule is 6-8 stratose towards its base and 3 stratose towards the apex (HATCHER, 1959). *T. indica* differs from *T. tomentella* also in having seta ca 25 mm long, 640-715 μm wide in *T. indica* while ca 30 mm long and 800 μm wide in *T. tomentella* (SCHUSTER, 1966). In *T. indica* elaters are of two types: elongated with narrowed ends, 160-240 μm long and short-stumpy, 60-70 μm long with blunt ends; sometimes elaters are branched also while in *T. tomentella* elaters are elongated and ca 117 μm long (HATCHER, 1957).

T. tenera differs very widely from *T. indica* in having smaller, regularly bipinnate plants, in anatomy of the stem, in the size of cortical and medullary cells, in the presence of rhizoids on the lamina of the underleaves (in *T. indica* rhizoids are absent), in the number of leaf-lobes, in the size of the leaf lamina and also in the size of the cells of leaf lamina, lobe and cilia.

Male inflorescence in *T. tenera* is composed of 4-8 series of bracts and bracteoles as compared to 8-12 series of bracts and bracteoles in *T. indica*. In *T. tenera* usually one rarely 2 antheridia are present per bract while in *T. indica* usually 2, or rarely one or 3 antheridia are present per bract. Antheridia of both the species are similar except in their size (body of the antheridium 89-92 μm wide, stalk 43 μm long, and 18-24 μm wide in *T. tenera* while in *T. indica* body is 80-114.5 μm wide and stalk is 60 μm long, 26.7 μm wide).

T. tenera slightly approaches *T. argentea* Herzog, *T. brevifissa* Steph., *T. elegans* Lehmann, *T. elliottii* Steph., *T. flaccida* (Spruce) Jack & Steph., *T. floccosa* Heorzg & R. Hatcher, *T. robusta* Steph., *T. sprucei* Steph., *T. uleana* Steph. in having almost the equal number of cells across the stem diameter but it distinctly differs from these species in following features: size of the cortical and medullary cells, size of lamina of leaves, size of the plants. All the above mentioned species entirely lack paraphyllia where as in *T. tenera* paraphyllia are rarely present.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. (Miss) Edith K. Cash of New York, U.S.A. for the Latin rendering of the diagnoses and to the University Grants Commission for a Junior

Research Fellowship to one of us (DKS) during the tenure of which the present work has been completed.

REFERENCES

CAVERS, F. (1910). The inter-relationships of the Bryophyta. *New Phytol.* **9**: 93-111.

EVANS, A. W. (1939-40). The classification of Hepaticae. *Bot. Rev.* **5**: 49-96.

HATCHER, R. E. (1957). The genus *Trichocolea* in North, Central and South America—(Hepaticae). *Lloydia.* **20**(3): 139-185.

HATCHER, R. E. (1959). The structure of the female inflorescence and its taxonomic value in the genus *Trichocolea*—(Hepaticae). *Lloydia.* **22**(3): 208-214.

MÜLLER, K. (1951-58). Die Lebermoose Europas. *In Rabenhorsts Kryptogamen Flora.* 3 Ed. Vol. 6 (1 and 2). Leipzig.

PARIHAR, N. S. (1961-62). *An Annotated Revised Census of Indian Hepatics.* Senate House, Allahabad.

SCHUSTER, R. M. (1963). *Boreal Hepaticae, A Manual of the Liverworts of Minnesota and Adjacent Regions.* University of Notre Dame Press, Notre Dame, Indiana.

SCHUSTER, R. M. (1966). *The Hepaticae and Anthocerotae of North America.* Vol. I. Columbia Univ. Press, New York and London.

STEPHANI, F. (1909-12). Species Hepaticarum. IV. Geneve: 51-65.

STEPHANI, F. (1924). *Op. cit. Trichocolea.* VI. Geneve: 372-378.

UDAR, R. & SRIVASTAVA, S. C. (1975). Notes on South Indian Hepaticae. I. *Journ. Bombay Nat. Hist. Soc.* **72**: 401-406.

EXPLANATION OF PLATES

PLATE 1

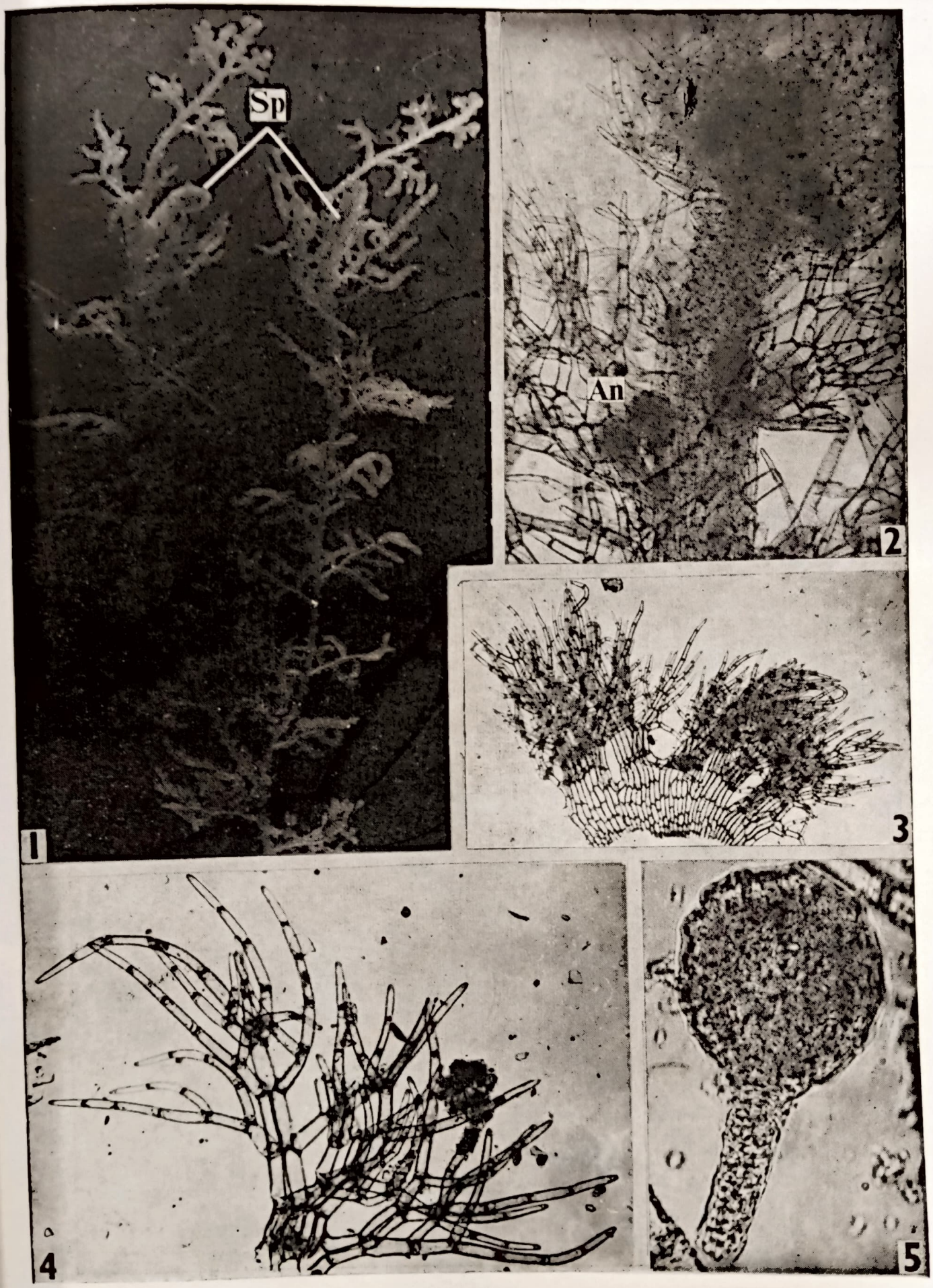
Trichocolea indica sp. nov.

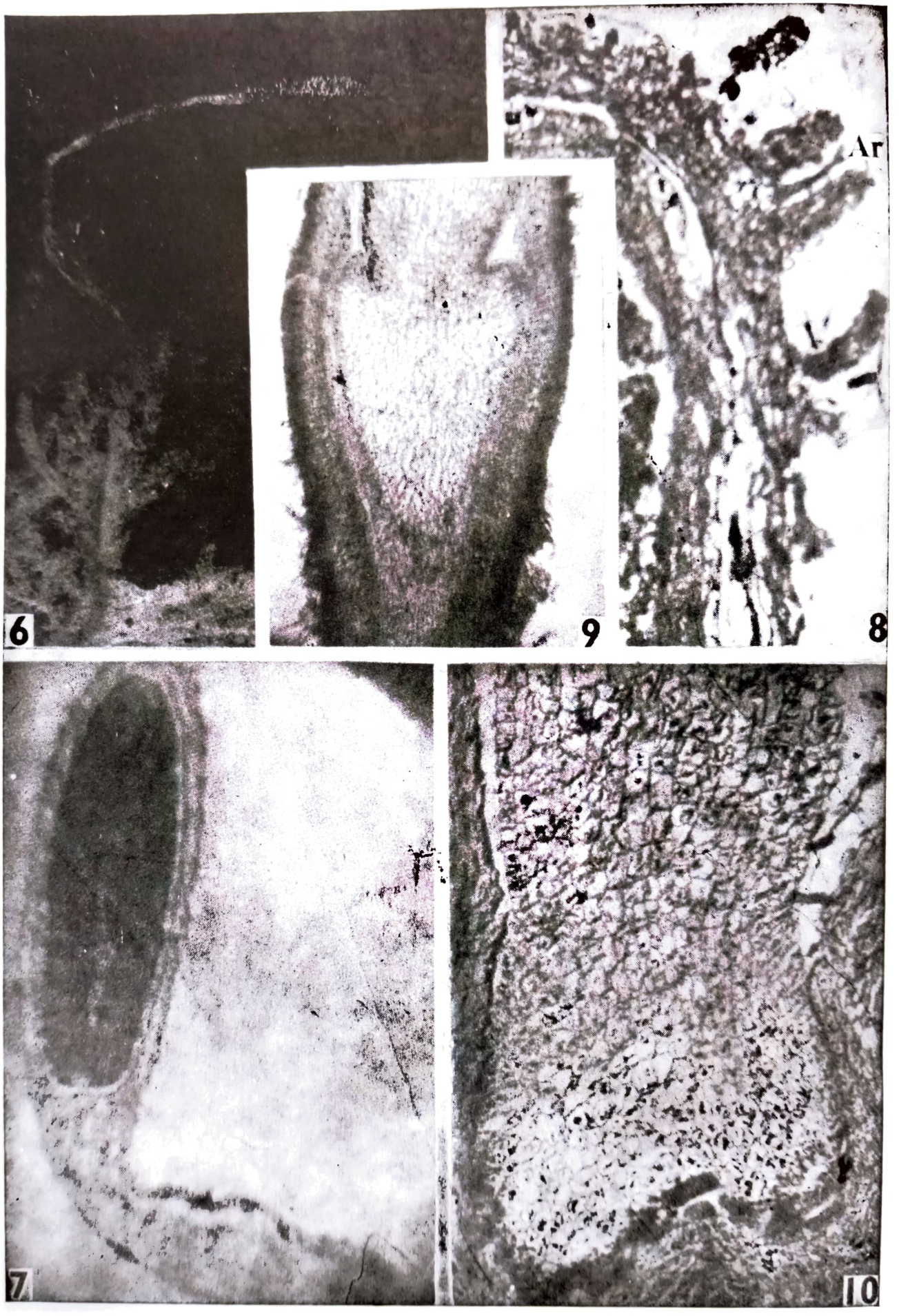
1. Habit of the plant bearing intercalary young sporophytes. ×ca 2.5. (Sp: sporophytes).
2. Dissected male shoot showing antheridia in two rows. ×105. (An: antheridia).
3. Lateral leaf. ×ca 55.
4. Underleaf. ×105.
5. A mature antheridium. ×400.

PLATE 2

Trichocolea indica sp. nov.

6. Terminal coelocaule with seta bearing capsule dehisced into 4 valves. ×ca 5.
7. V. L. S. sporophyte. ×ca 27.
8. V. L. S. young coelocaule bearing unfertilized archegonia towards the apex. ×105. (Ar: archegonia).
9. V. L. S. foot (Anchor-shaped). ×ca 55.
10. V. L. S. foot showing a little branching at the base. ×105.


Sp
An
1
2
3
4
5


Ar
6
9
8
7
10