cryptogamie
Bryologie
2020 • 41 • 10

A synopsis of *Colura* (Dumort.) Dumort. (Marchantiophyta: Lejeuneaceae) in India

Sushil Kumar SINGH, Tamás PÓCS, Devendra SINGH & Shashi KUMAR

art. 41 (10) — Published on 24 July 2020
www.cryptogamie.com/bryologie

PUBLICATIONS SCIENTIFIQUES
MUSÉUM NAL HIST NATURELLE

Couverture / *Cover*:
Extraits d'éléments de la Figure 8 / Extracts of the Figure 8

Cryptogamie, Bryologie est indexé dans / Cryptogamie, Bryologie *is indexed in:*
– Biological Abstracts
– Current Contents
– Science Citation Index
– Publications bibliographiques du CNRS (Pascal).

Cryptogamie, Bryologie est distribué en version électronique par / Cryptogamie, Bryologie *is distributed electronically by:*
– BioOne® (http://www.bioone.org)

Cryptogamie, Bryologie est une revue en flux continu publiée par les Publications scientifiques du Muséum, Paris
Cryptogamie, Bryologie *is a fast track journal published by the Museum Science Press, Paris*

Les Publications scientifiques du Muséum publient aussi/ *The Museum Science Press also publish:* ***Adansonia, Geodiversitas, Zoosystema, Anthropozoologica, European Journal of Taxonomy, Naturae, Comptes Rendus Palevol,*** **Cryptogamie sous-sections** ***Algologie, Mycologie.***

Diffusion – Publications scientifiques Muséum national d'Histoire naturelle
CP 41 – 57 rue Cuvier F-75231 Paris cedex 05 (France)
Tél.: 33 (0)1 40 79 48 05 / Fax: 33 (0)1 40 79 38 40
diff.pub@mnhn.fr / http://sciencepress.mnhn.fr

ISSN (imprimé / *print*): 1290-0796 / ISSN (électronique / *electronic*): 1776-0992

A synopsis of *Colura* (Dumort.) Dumort. (Marchantiophyta: Lejeuneaceae) in India

Sushil Kumar SINGH
Botanical Survey of India, Northern Regional Centre
192, Kaulagarh Road, Dehradun-248195 (India)
sksbsinc@rediffmail.com (corresponding author)

Tamás PÓCS
Botany Department, Institute of Biology,
Eszterházy University, Eger, PB. 43, H-3301 (Hungary)

Devendra SINGH
Botanical Survey of India, Central National Herbarium, Howrah, 711103 (India)

Shashi KUMAR
Botanical Survey of India, Eastern Regional Centre, Shillong, 793003 (India)

Submitted on 18 August 2018 | Accepted on 1 July 2020 | Published on 24 July 2020

Singh S. K., Pócs T., Singh D. & Kumar S. 2020. — A synopsis of *Colura* (Dumort.) Dumort. (Marchantiophyta: Lejeuneaceae) in India. *Cryptogamie, Bryologie* 41 (10): 111-129. https://doi.org/10.5252/cryptogamie-bryologie2020v41a10. http://cryptogamie.com/bryologie/41/10

ABSTRACT
The genus *Colura* (Dumort.) Dumort. is morpho-taxonomically investigated in India and eight species have been recognized mainly distributed in three different bryo-geographical regions of the country. *Colura corynophora* (Nees, Lindenb. & Gottsche) Trevis. is reported here for the first time from India, *C. leratii* (Steph.) Steph. is added to the East Himalayan bryogeographical territory, *C. acroloba* (Prantl) Jovet-Ast, *C. ari* (Steph.) Steph. and *C. conica* (Sande Lac.) K.I. Goebel are new additions to Mizoram, while *C. tenuicornis* (A. Evans) Steph. is a new report to the state of Meghalaya.

KEYWORDS
Colura,
India,
Harmophyllum,
Glotta.

RÉSUMÉ
Un synopsis du genre Colura *(Dumort.) Dumort. (Marchantiophyta: Lejeuneaceae) en Inde.*
L'investigation morphologique et taxonomique du genre *Colura* (Dumort.) Dumort. en Inde permet de reconnaître la présence de huit espèces distribuées dans trois différentes régions bryo-géographiques. *Colura corynophora* (Nees, Lindenb. & Gottsche) Trevis. est rapporté pour la première fois en Inde, *C. leratii* (Steph.) Steph. est à ajouter au territoire bryo-géographique de l'Himalaya Est, *C. acroloba* (Prantl) Jovet-Ast, *C. ari* (Steph.) Steph. et *C. conica* sont nouveaux pour le Mizoram, tandis que *C. tenuicornis* (A. Evans) Steph. est nouveau pour l'état de Meghalaya.

MOTS CLÉS
Colura,
Inde,
Harmophyllum,
Glotta.

INTRODUCTION

Lejeuneaceae is the largest family of Marchantiophyta with 74 genera currently accepted (Zhu *et al.* 2017, 2019). The genus *Colura* (Dumort.) Dumort. is one of large genera of the family with 83 species and two varieties (incl. two species *incertae sedis*) in the world belonging to two subgenera and six sections (Pócs & Eggers 2007; Söderström *et al.* 2016; Sangrattanaprasert *et al.* 2018). The species are abundant in tropical and subtropical regions, especially in Malesia which is considered as a hotspot (Pócs 1996; Zhu & So 2001; Sangrattanaprasert *et al.* 2017). Members of this genus are mostly foliicolous, but also grow on bark, and are characterized by the presence of tubular to cylindrical leaf lobules terminating into a sac with a valve and pore. Jovet-Ast in her revisionary work on *Colura* (Jovet-Ast 1953, 1954) recognized over 50 species in the genus. Since then, more than 30 new species are described from different parts of the world (Jovet-Ast 1957, 1958, 1961, 1968a, b, 1976, 1980, 1983; Jovet-Ast & Tixier 1958; Grolle 1965, 1969; Vanden Berghen 1972; Miller 1981; Gradstein 1986; Thiers 1987; Schuster 1992; Pócs 1993, 1995, 1997, 2011, 2013, 2015; Jones & Pócs 1987; Pócs & Eggers 2007; Müller & Pócs 2007). Also range extensions of several species have been reported in scattered publications including regional checklists (Mizutani 1961; Kitagawa 1969; Engel 1978; Onraedt 1979; Pócs 1991, 2010, 2012; Grolle 1995; Dauphin *et al.* 1998; Fischer 1999; Zhu & So 2001; Grolle & Zhu 2002; Chuah-Petiot & Pócs 2003; Chuah-Petiot 2011; Pócs & Ninh 2005, 2012; Pócs & Streimann 2006; Lai *et al.* 2008; Söderström *et al.* 2010, 2011; Hylander *et al.* 2010; Wang *et al.* 2011; Pócs *et al.* 2011, 2013; Ah-Peng *et al.* 2012; Gradstein & Benitez 2014; Long & Rubasinghe 2014; Sangrattanaprasert *et al.* 2017). But, an updated worldwide monograph of *Colura* is still lacking.

In India, the genus was first recorded by Lal (1977), who reported *Colura tenuicornis* (A.Evans) Steph. from Darjeeling in Eastern Himalaya. Since then seven species namely, *C. acroloba* (Prantl) Jovet-Ast, *C. ari* (Steph.) Steph., *C. calyptrifolia* (Hook.) Dumort., *C. conica* (Sande Lac.) K.I.Goebel, *C. leratii* (Steph.) Steph., *C. tenuicornis* (A. Evans) Steph. and *C. pluridentata* Jovet-Ast, have been reported from the country (Lal 1980, 2003; Udar & Awasthi 1985; Singh 1996; Asthana & Shukla 2010; Dey & Singh 2016; Singh & Kumar 2016; Mufeed *et al.* 2018). Earlier to the present report, majority of the species were recorded from very restricted pockets of the country, viz. *C. pluridentata* to Great Nicobar Island, *C. conica* and *C. tenuicornis* to Eastern Himalaya, *C. calyptrifolia* and *C. leratii* to Western Ghats, while *C. acroloba* and *C. ari* are distributed in Andaman and Nicobar Island (South Andaman Island) and East Himalayan bryo-geographical territories (Singh *et al.* 2016; Singh & Kumar 2016; Mufeed *et al.* 2018) and except *C. tenuicornis*, specimens are poorly represented in Indian herbaria.

In recent years, while conducting bryo-floristic surveys in North east India, especially Mizoram, one of the authors (SKS) collected several populations of the genus. The detailed morpho-taxonomic study on these specimens revealed the presence of six species in the region. Of these, *C. corynophora* is an addition to the bryoflora of India, *C. leratii* is new to the East Himalayan bryogeographical territory, *C. acroloba, C. ari* and *C. conica* are new addition to the state of Mizoram, while *C. tenuicornis* is new to the state of Meghalaya. In the present study we have also attempted to study and catalogue all the materials of the genus available in Indian herbaria. Unless otherwise mentioned, the distributional data of each species have been adopted from Singh *et al.* (2016).

Conspectus of the genus *Colura* in India

Subgenus A. Colura
Sect. I. *Colura*
C. calyptrifolia (Hook.) Dumort.
C. *tenuicornis* (A. Evans) Steph.
Sect. II. *Harmophyllum* Grolle
C. ari (Steph.) Steph.
C. conica (Sande Lac.) K.I. Goebel
C. pluridentata Jovet-Ast
Subgenus B. Glotta Grolle & R.-L. Zhu
Sect. I. *Heterophyllum* Jovet-Ast
C. acroloba (Prantl) Jovet-Ast
C. leratii (Steph.) Steph.
C. corynophora (Nees, Lindenb. & Gottsche) Trevis.

TAXONOMIC DESCRIPTION

Family Lejeuneaceae
Colura (Dumort.) Dumort.

Colura acroloba (Prantl) Jovet-Ast
(Figs 1A-P; 8A)

Revue Bryologique et Lichénologique 22: 297 (1953).

Specimens examined. — **India**. Arunachal Pradesh, Tirap district Khonsa, II.1982, *K.P Singh s.n.* (ASSAM); Mizoram, Lawngtlai, Ngengpui WLS, 22°29'49.7"N, 92°46'33.1"E, 138 m, 01.XII.2012, *S. K. Singh & Party 127584M*; Ngengpui Wildlife Sanctuary, 22°29'52.2"N, 92°45'49.1"E, 134 m, 02.XII.2012, *S. K. Singh & Party 127670A* (ASSAM); Ngengpui Wildlife Sanctuary, 22°29'50.4"N, 92°45'34.6"E, 146 m, 02.XII.2012, *S. K. Singh & Party 127680A* (ASSAM); Ngengpui WLS, 22°29'29.9"N, 92°45'22.5"E, 170 m, 02.XII.2012, *S. K. Singh & Party 127692C* (ASSAM); Tripura, Jampui Hills, Longai river side, 23°50'48.9"N, 91°57'44.7"E, 470 m, 26.X.2015, *S. Kumar TSLI-1315B, 1327C* (ASSAM).

Habitat. — Foliicolous, growing in association with *Caudalejeunea lehmanniana, Cheilolejeunea trapezia, Cololejeunea floccosa, C. subfloccsa, Drepanolejeunea devendrae, D. foliicola, Lejeunea exilis, Leptolejeunea balansae, L. latifolia, L. maculata, L. epiphylla, Microlejeunea punctiformis*, in relatively less moist places at elevation of 100-200 m a.s.l.

Distribution. — India [Andaman & Nicobar Islands, Mizoram-present study, Arunachal Pradesh-present study, Tripura (Singh *et al*. 2016)], Cambodia, China, Fiji, Indonesia, Malaysia, New Caledonia, Papua New Guinea, Philippines, Samoa, Sri Lanka, Taiwan, Thailand, Vietnam, Australia (Tixier 1979, 1980; Grolle & Piippo 1984; Tan & Engel 1986; Piippo 1990; Zhu & So 2001; McCarthy 2006; Lai *et al.* 2008; Söderström *et al.* 2010; Söderström *et al.* 2011; Chuah-Petiot 2011; Thouvenot *et al.* 2011; Wang *et al.* 2011; Long & Rubasinghe 2014; Bakalin & Van Sinh 2016).

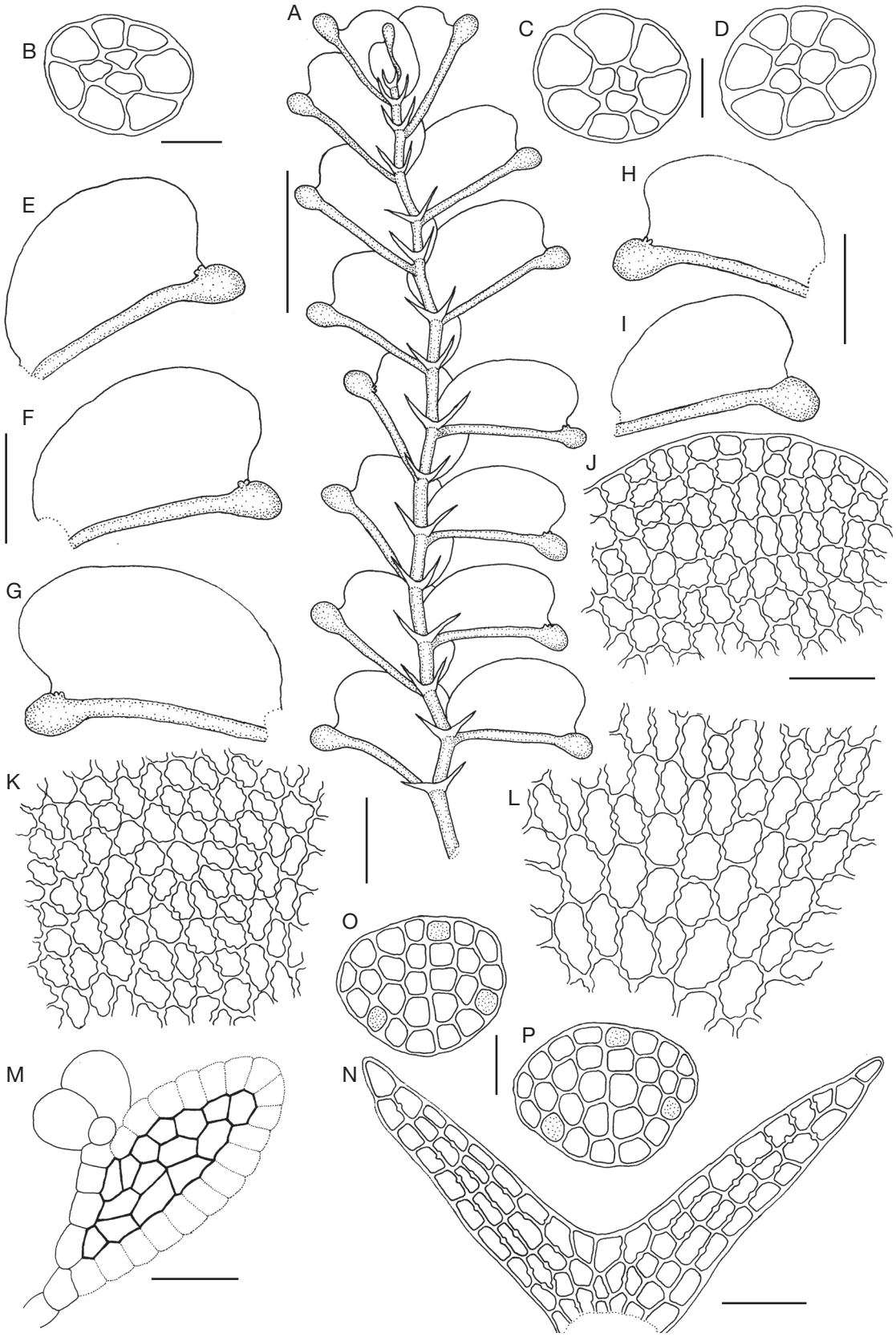

FIG. 1. — *Colura acroloba* (Prantl) Jovet-Ast: **A**, portion of plant in ventral view; **B**-**D**, cross sections of stem; **E**-**I**, leaves; **J**, marginal leaf cells towards apex; **K**, median leaf cells; **L**, basal leaf cells; **M**, a valve; **N**, an underleaf; **O**, **P**, gemmae. Scale bars: A, 1 mm; B-D, M, O, P, 0.03 mm; E-I, 0.5 mm; J-L, N, 0.6 mm.

Description

Plants

Light green when fresh, pale yellowish in herbarium; shoots 5-9 mm long, 1.7-2.2 mm wide including leaves, irregularly branched.

Stem

In cross section suborbicular in outline, 62.5-85.0 µm, 4 cells across the diameter; cortical cells 7, subquadrangular, 17.5-27.5 × 12.5-25.0 µm; medullary cells 3, rectangular-polygonal, 12.5-20.0 × 10.0-15.0 µm; ventral merophyte 1-2 cells wide. Rhizoids numerous, fasciculate at base of underleaves.

Leaves

Contiguous-distant, obliquely-widely spreading; leaf lobes oblong-obovate, 0.8-1.1 mm long, 0.48-0.68 mm wide, dorsal margin arched, ventral margin straight except near apex, margin entire; marginal leaf cells towards apex subquadrate-rectangular, 15.0-32.5 × 12.5-20.0 µm; median leaf cells hexagonal-polygonal, 20.0-35.0 × 15.0-25.0 µm; basal leaf cells slightly elongated, hexagonal-polygonal, 30.0-55.0 × 15.0-35.0 µm; cells with cordate-nodulose trigones, intermediate thickenings 1-2 per cell wall; cuticle smooth; leaf lobules tubular, as long as lobe, slightly wider toward sac, lateral margin usually incurved, sac small inflated at middle, rounded at apex, margin entire, surface smooth, valve elliptical-ligulate, 110.0-127.5 × 75.0-82.5 µm, with 11-15 median cells surrounded by a ring of 20-25 hyaline cells.

Underleaves

Distant, 3-4 times as wide as stem, 0.21-0.26 mm long, 0.21-0.36 mm wide, deeply bilobed, sinus wide, lobes subulate, 7-10 cells long, 3-4 cells wide at base, margin entire.

Gemmae

Present on the leaf lobe, discoid, 72.5-82.5 × 85.0-95.0 µm with 3 adhesive cells.

Androecia and gynoecia

Not seen.

Note

Colura acroloba can be easily recognized by its entire dorsal margin of leaf lobe, leaf lobule as long as leaf lobe, sac small rounded at apex and sometimes absent, inflated and with rounded apex, and underleaf lobes 2-4 cells wide at base (Udar & Awasthi 1985).

Colura ari (Steph.) Steph.

(Figs 2A-T; 8B)

Species Hepaticarum 5: 936. (1916).

Specimens examined. — **India**. Andaman & Nicobar Islands, Port Blair, near ICAR experimental farm, 200 m, 09.XII.1978, *J. Lal. s.n.* (CAL); Assam, Lakhimpur, Dulung Reserve Forest., 16.IX.2011, *N. Odyuo 124472A; 124475E 124476A, 124477A, 124480E* (ASSAM); Dulung Reserve Forest, 17.IX.2011, *N. Odyuo 124479E, 124492E* (ASSAM); Dulung Reserve Forest, 18.IX.2011, *N. Odyuo 124339F, 124340C, 124341A* (ASSAM); Mizoram, Mamit, Dampa Tiger Reserve, Teirei range, Bamboo hut area, 23°40'51.9"N, 92°22'42.9"E, 288 m, 23.XI.2011, *S. K. Singh & Party 123916A, 123917A* (ASSAM); Lawngtlai, Ngengpui WLS, 22°29'49.7"N, 92°46'33.1"E, 138 m, 01.XII.2012, *S. K. Singh & Party 127592B, 127597C, 127601A, 127604A* (ASSAM).

Habitat. — Foliicolous, growing in association with *Caudalejeunea lehmaniana, Cololejeunea appressa, C. gottschei, C. latilobula, C. mizutaniana, C. subfloccosa, Drepanolejeunea foliicola, Leptolejeunea balansae, L. epiphylla, L. foliicola, L. maculata, Radula acuminata, R. tjibodensis,* in relatively less moist places at elevation of 100-300 m a.s.l.

Distribution. — India [Andaman & Nicobar, Assam, Mizoram-present study (Singh *et al.* 2016)], Bangladesh, Cambodia, China, Fiji, Indonesia, Malaysia, New Caledonia, Pakistan, Papua New Guinea, Philippines, Samoa, Sri Lanka, Vietnam, Australia (Pócs *et al.* 1967; Grolle & Schultze-Motel 1972; Tixier 1979; Grolle & Piippo 1984; Tan & Engel 1986; Piippo 1990; Banu-Fattah 2001; McCarthy 2006; Söderström *et al.* 2010; Söderström *et al.* 2011; Chuah-Petiot 2011; Thouvenot *et al.* 2011; Long & Rubasinghe 2014; Bakalin & Van Sinh 2016).

Description

Plants

Pale green-yellowish green; shoots 8-18 mm long, 1.8-2.6 mm wide including leaves, irregularly branched.

Stem

In cross section suborbicular in outline, 85.0-125.0 µm, 4 cells across the diameter; cortical cells 7, subquadrate-polygonal, 25.0-50.0 × 20.0-30.0 µm; medullary cells 3, subquadratepolygonal, 20.0-37.5 × 17.5-27.5 µm; ventral merophyte 2 cells wide.

Rhizoids

Numerous, fasciculate, hyaline, at base of underleaf, rhizoidal disc absent.

Leaves

Imbricate-contiguous, obliquely - widely spreading; lobes obovate, 0.75-1.20 mm long, 0.48-0.66 mm wide, dorsal margin plane towards base, serrate towards apex, denticulations 1-2 cells long, 1-2 cells wide at base, ventral margin nearly straight, smooth; marginal leaf cells towards apex subquadrate-polygonal, 25.0-37.5 × 12.5-27.5 µm; median leaf cells hexagonal-polygonal, 37.5-50.0 × 15.0-30.0 µm; basal leaf cells hexagonal-polygonal, slightly elongated, 37.5-52.5 × 17.5-25.0 µm; cells with cordate-nodulose trigones, intermediate thickenings frequent, 1-3 per cell wall; cuticle smooth; leaf lobules narrowly tubular, as long as leaf lobes, slightly flaring toward sac, lateral margin usually slightly incurved, sac inflated, very small, less than ⅙ as wide as the leaf lobe, acute to rounded at apex, denticulate owing to projecting cells at margin; valve oval-subglobose, 75.0-87.5 × 75.0-85.0 µm, composed of 12-16 median cells surrounded by a ring of 14-15 hyaline cells.

Underleaves

Distant, 2.5-3.5 times as wide as stem, nearly transversely inserted to the stem, 0.19-0.72 mm long, 0.10-0.33 mm

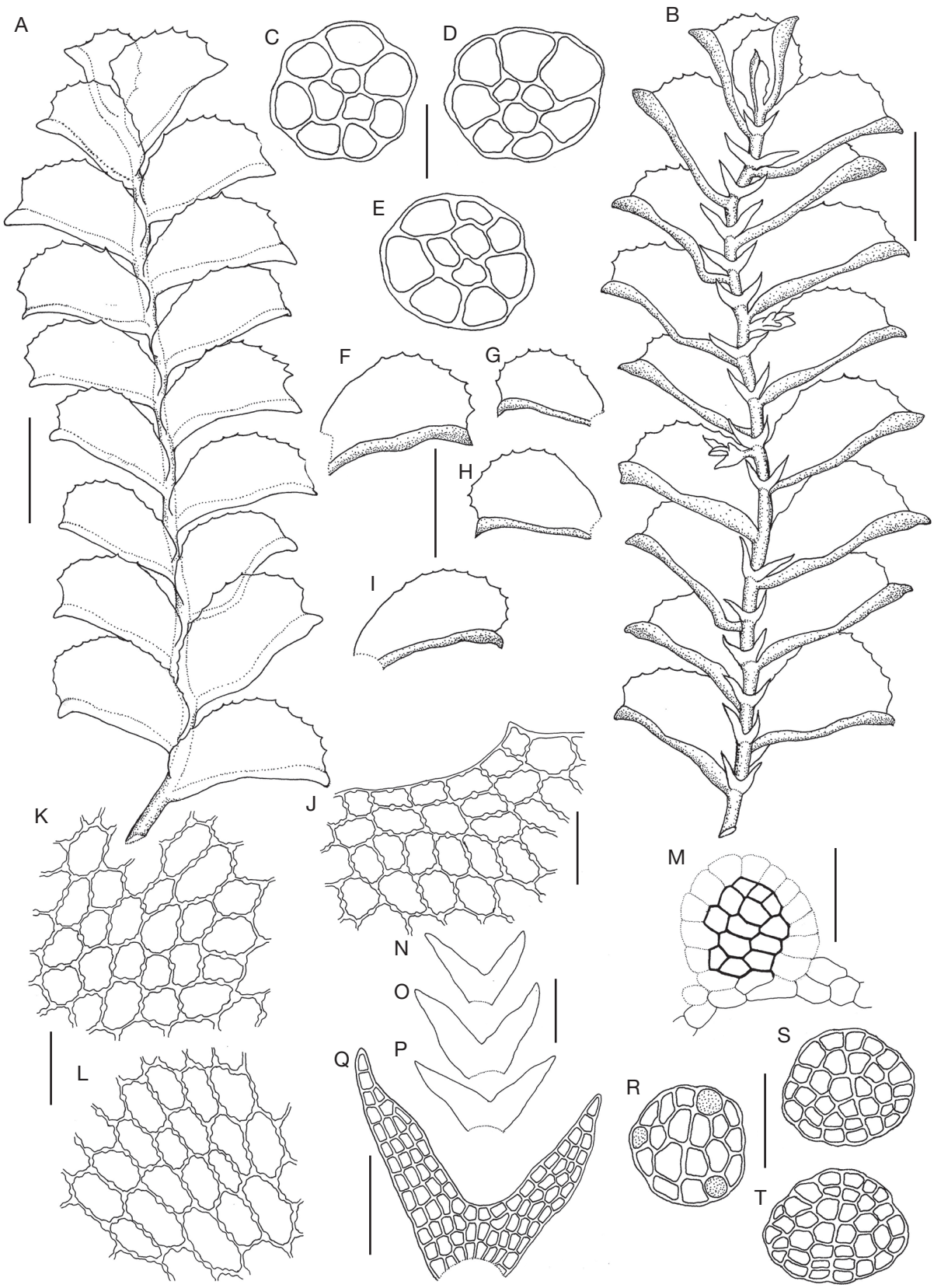

Fig. 2. — *Colura ari* (Steph.) Steph.: **A**, portion of plant in dorsal view; **B**, the same in ventral view; **C**-**E**, cross sections of stem; **F**-**I**, leaves; **J**, marginal leaf cells towards apex; **K**, median leaf cells; **L**, basal leaf cells; **M**, a valve; **N**-**P**, underleaves; **Q**, an underleaf cellular; **R**-**T**, gemmae. Scale bars: A, B, F-I, 1 mm; C-E, J-M, R-T, 0.05 mm; N-P, 0.5 mm; Q, 0.2 mm.

wide, deeply bilobed, sinus wide, lobes lanceolate, 8-11 cells long, 4-5 cells wide at base, margin entire.

Gemmae
Frequent, spherical-subspherical, 70.0-77.5 × 62.5-67.5 µm with 3 adhesive cells or sometimes without adhesive cells.

Androecia and gynoecia
Not seen.

NOTE
The species is easily recognized by its serrate dorsal margin of leaf lobe, and the very narrow leaf lobule with its sac slightly turning laterally. It shows similarity with *Colura conica*, but the latter differs in having larger, well developed, straight apiculate sacs (Zhu & So 2001).

Colura calyptrifolia (Hook.) Dumort.
(Fig. 8C)

Recueil d'Observations sur les Jungermanniacées fasc. 1: 12 (1835).

SPECIMENS EXAMINED. — **India**. Kerala, Idukki district, Anamuishola National Park, 2300 m, 08.XI.2017, *Mufeed 7462* (ZGC!).

HABITAT. — Corticolous, growing in association with *Cheilolejeunea xanthocarpa, Frullania sp., Parmelia* genus of lichens, in moist shady areas of montane wet temperate forest at elevation *c.* 2300 m a.s.l.

DISTRIBUTION. — India [Kerala (Mufeed *et al.* 2018)], Nepal, Sri Lanka, Taiwan, Chile, Africa, Europe (Söderström *et al.* 2002; Gradstein & da Costa 2003; Zhu & Long 2003; Ros *et al.* 2007; Wigginton 2009; Long & Rubasinghe 2014).

DESCRIPTION
Colura calyptrifolia is characterized by 5-6 mm long and 1.2-1.3 mm wide plants; stem 87-100 µm in diameter, consisting of seven cortical and three medullary cells; leaves, 1.1-1.2 mm long, 0.18-0.25 mm wide, leaf cells thin-walled without trigones and intermediate thickenings; leaf lobules 0.90-1.2 mm long strongly inflated, forming a fusiform sac with a narrow beak towards apex, lobular beak shorter, ¼-⅓ as long as the whole leaf, free margin involute, strongly valve at the mouth of the sac, ovate to short-ligulate with hyaline border cells; underleaves deeply bilobed, lobes divergent, 3-4 cells wide at base; and by presence of discoid, 20-22 celled gemmae.

NOTE
The occurrence of *C. calyptrifolia* in Arunachal Pradesh and West Bengal is dubious as there is no trace of specimens at CAL or ASSAM that can substantiate the report and also the detailed description and illustration of the species based on above area materials are lacking.

Colura conica (Sande Lac.) K.I.Goebel
(Figs 3A-S; 8D)

Annales du Jardin Botanique de Buitenzorg 39: 3 (1928).

SPECIMENS EXAMINED. — **India**. Arunachal Pradesh, Tirap, Namdapha National Park, II.1982, *K. P. Singh s.n.* (ASSAM); Mizoram, Lawngtlai, Ngengpui Wildlife Sanctuary, 22°29'49.7"N, 92°46'33.1"E, 138 m, 01.II.2012, *S. K. Singh & Party 127633G, 127643A, 127644F* (ASSAM); Tripura, North district, Jampui Hills, Longai river side, 23°50'48.9"N, 91°57'44.7"E, 470 m, 26.X.2015, *S. Kumar TSLI-1315A* (ASSAM).

HABITAT. — Foliicolous, growing in association with *Cheilolejeunea ghatensis, Cololejeunea subfloccosa, Drepanolejeunea foliicola, Lejeunea anisophylla, L. exilis, Leptolejeunea balansae, L. epiphylla, Radula tjibodensis,* in relatively less moist places at elevation up to 500 m a.s.l.

DISTRIBUTION. — India [Arunachal Pradesh, Mizoram-present study, Tripura (Singh *et al.* 2016)], Bangladesh, Cambodia, China, Fiji, Indonesia, Laos, Vietnam, Malaysia, New Caledonia, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam, Australia (Pócs *et al.* 1967; Tixier 1970, 1979; Grolle & Piippo 1984; Tan & Engel 1986; Zhu & So 2001; Banu-Fattah 2001 as *Colura acutifolia*; McCarthy 2006; Lai *et al.* 2008; Söderström *et al.* 2010; Söderström *et al.* 2011; Chuah-Petiot 2011, also as *Colura acutifolia*; Thouvenot *et al.* 2011; Long & Rubasinghe 2014; Bakalin & Van Sinh 2016).

DESCRIPTION
Plants
Pale green-yellowish green; shoots 5-11 mm long, 1.6-2.2 mm wide including leaves, irregularly branched.

Stem
In cross section suborbicular in outline, 75-107 µm, 4 cells across diameter; cortical cells 7, subquadrangular, (10.0-) 20-45.0 × (5.0-) 10.0- 37.0 µm; medullary cells 3, subquadrangular-polygonal, 15.0-25.0 × 7.5-17.5 µm; ventral merophyte 1-2 cells wide.

Rhizoids
Numerous, fasciculate, hyaline, at base of underleaf, rhizoidal disc absent.

Leaves
Imbricate-contiguous, obliquely-widely spreading; lobes obovate 0.60-1.05 mm long, 0.36-0.60 mm wide, dorsal margin strongly arched, serrate-serrulate, denticulations 1 cell long and wide at base, ventral margin nearly straight; marginal leaf cells quadrate-subquadrate, 17.5-37.5 × 12.5-27.5 µm; median leaf cells hexagonal-polygonal, 30.0-50.0 × 15.0-22.5 µm; basal leaf cells slightly larger than median cells, hexagonal-polygonal, 32.5-57.5 × 10.0-25.0 µm; cells with cordate-nodulose trigones, intermediate thickenings frequent, 1-3 per cell wall; cuticle smooth; leaf lobules narrowly cylindrical, as long as leaf lobes, slightly flaring toward sac, free lateral margin usually strongly incurved, sac strongly inflated, large, ⅓ to almost as wide as leaf lobes, usually acute-acuminate or sometimes rounded to subacute at apex, entire or often denticulate owing to projecting cells at margin; valve ovate

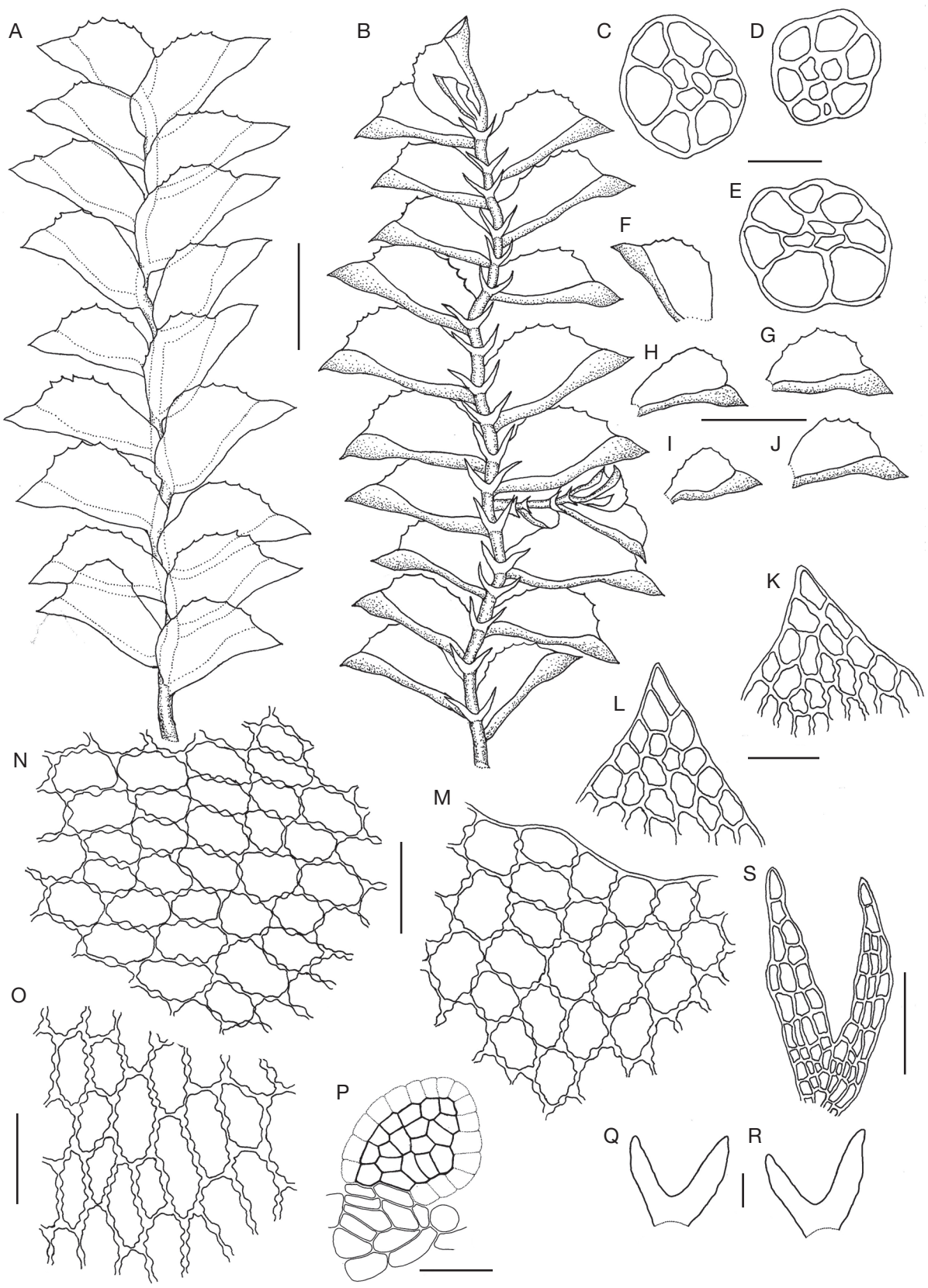

Fig. 3. — *Colura conica* (Sande Lac.) K.I.Goebel: **A**, portion of plant in dorsal view; **B**, the same in ventral view; **C**-**E**, cross sections of stem; **F**-**J**, leaves; **K**, **L**, leaf apices; **M**, marginal leaf cells towards apex; **N**, median leaf cells; **O**, basal leaf cells; **P**, a valve; **Q**, **R**, underleaves; **S**, an underleaf cellular. Scale bars: A, B, G-J, 1 mm; C-F, K-P, 0,05 mm; Q-S, 0,1 mm.

to short-ligulate, 85.0-105.0 × 80.0-87.5 µm, composed of 14-18 median cells surrounded by a ring of 16 hyaline cells.

Underleaves
Distant, transversely inserted to the stem, 0.19-0.26 mm long, 0.08-0.18 mm wide, 3-4 times as wide as stem, deeply bilobed, sinus U-V-shaped, lobes lanceolate, 7-8 cells long, 3-4 cells wide at base, margin entire.

Gemmae
Absent.

Androecia and gynoecia
Not seen.

NOTE
Colura conica readily distinguishable among the Indian species of the genus by its conical sac which is about ⅓ as wide as leaf lobes.

Colura corynophora (Nees, Lindenb. & Gottsche) Trevis.
(Figs 4A-Z; 8E)

Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali 4: 402 (1877).

SPECIMENS EXAMINED. — **India**. Mizoram, Lunglei, Thorang WLS, 23°14'55.6"N, 92°33'48.3"E, 629 m, 30.XI.2011, *S. K. Singh & Party 124232* (ASSAM); Lawngtlai, Ngengpui WLS, 22°29'49.7"N, 92°46'33.1"E, 138 m, 01.XII.2012, *S. K. Singh & Party 127605A* (ASSAM).

HABITAT. — Foliicolous, growing in isolated population or in association with *Caudalejeunea lehmanniana, Cololejeunea appressa, C. lanciloba, Leptolejeunea balansae, L. maculata,* in relatively less moist places at elevation of 100-650 m a.s.l.

DISTRIBUTION. — India [Mizoram-present study], Cambodia, China, Fiji, Indonesia, Malaysia, Mariana Is. New Guinea, New Caledonia, Philippines, Sri Lanka, Thailand, Vietnam (Zhu & So 2001; Pócs 2013; Bakalin & Van Sinh 2016).

DESCRIPTION
Plants
Pale yellowish in herbarium; shoots 8-17 mm long, 1.2-1.8 mm wide including leaves, irregularly branched.

Stem
In cross section suborbicular in outline, 55-80 µm, 4 cells across diameter; cortical cells 7, subquadrangular, 17.5-35.0 × 12.5-25.0 µm; medullary cells 3, subquadrangular or sometimes slightly triangular, 12.5-22.5 × 7.5-12.5 µm; ventral merophyte 1 (-2) cells wide.

Rhizoids
Numerous, fasciculate at base of underleaf.

Leaves
Imbricate-contiguous, rarely remote, obliquely-widely spreading; lobes obovate, 0.66-1.02 mm long, 0.39-0.62 mm wide, margin entire, dorsal margin slightly arched, ventral margin nearly straight; marginal leaf cells towards apex quadrate-subquadrate, 17.5-30.0 × 10.0-20.0 µm; median leaf cells hexagonal-polygonal, 25.0-40.0 × 15.0-25.0 µm; basal leaf cells hexagonal-polygonal, 22.5-37.5 × 10.0-25.0 µm; cells with cordate-nodulose trigones, intermediate thickenings frequent, 1-3 per cell wall; cuticle smooth; leaf lobules usually ⅗-¾ as long as leaf lobe or sometimes equally long, wide at middle, in most cases reduced, tubular, slightly flaring toward sac, lateral margin usually slightly incurved, sac strongly inflated, occasionally reduced, always rounded at apex, entire at margin; valve elliptical-ligulate, 80.0-100.0 × 42.5-55.0 µm, composed of 12-18 median cells surrounded by a ring of 17-20 hyaline cells.

Underleaves
Distant, nearly transversely inserted to the stem, 0.20-0.24 mm long, 0.18-0.26 mm, deeply bilobed, sinus wide; 2-3 times as wide as stem, lobes linear-lanceolate, 7-8 cells long, 4 cells wide at base, margin entire.

Gemmae
Absent.

Monoicous

Androecia
Terminal on long or very short lateral branches; bracts in 3-5 pairs; bracteoles similar to underleaves but smaller.

Gynoecia
On long branches, terminal; bract lobe oblong, 0.28-0.34 mm long, 0.14-0.25 mm wide, rounded at apex, margin entire; bract lobule linear-oblong, ⅗ as long as the bract lobe, truncate at apex, free margin plane, entire; bracteole similar to underleaf in the size and shape or sometimes highly reduced; perianth obovate, 0.6-0.8 mm long, 0.35-0.40 mm wide, with 3 wing-shaped keels, keels entire at margin, smooth on surface, beak very short, 1 cell long.

Seta
Orbicular in cross section, 62.5-150 µm in diameter with 4 inner and 11 outer cells.

Capsule
Globose, wall bistratose; cells of the outer layer 15.0-27.5 × 7.5-20.0 µm, with sinuate-nodular thickenings; those of the inner layer comparatively smaller, 10.0-22.5 × 7.5-20.0 µm, without or with minute sinuate thickenings.

Spores
25-65 × 10-20 µm, exine finely papillate with usually 1-2 elliptical to ovoid rosettes on its surface.

Elaters
160-210 µm long, 12.5-20.0 µm wide, walls slightly thickened.

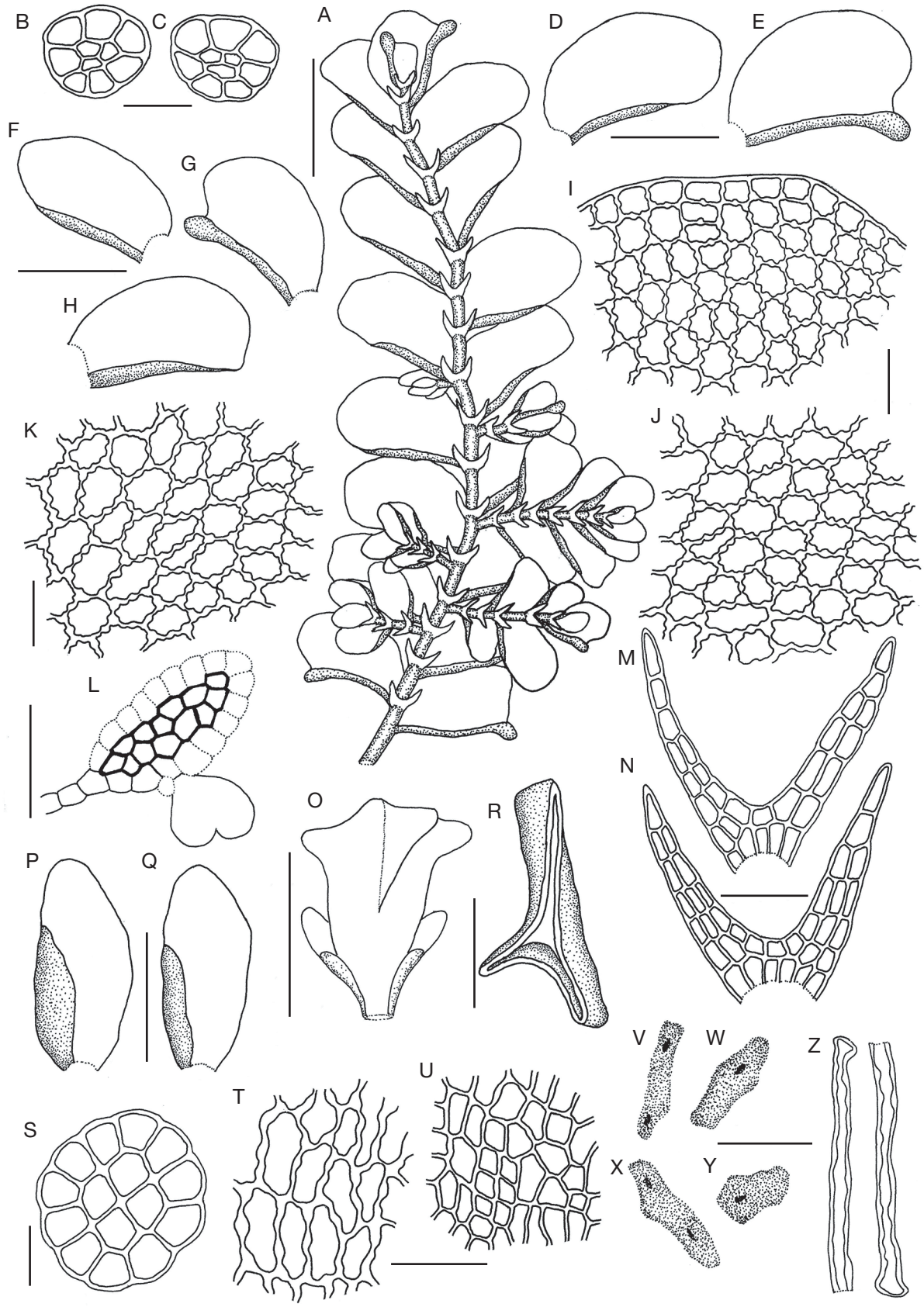

Fig. 4. — *Colura corynophora* (Nees, Lindenb. & Gottsche) Trevis.: **A**, portion of plant in ventral view; **B**, **C**, cross sections of stem; **D**-**H**, leaves; **I**, marginal leaf cells towards apex; **J**, median leaf cells; **K**, basal leaf cells; **L**, a valve; **M**, **N**, underleaves; **O**, a perianth with bracts; **P**, **Q**, female bracts; **R**, cross section of perianth; **S**, cross section of seta; **T**, cells of outer layer of capsule wall; **U**, cells of inner layer of capsule wall; **V**-**Y**, spores; **Z**, two elaters. Scale bars: A, 1 mm; B, C, I-K, S-Z, 0.05 mm; D-H, O, 0.5 mm; M, N, 0.06 mm; P-R, 0.2 mm.

NOTE
Colura corynophora is characterized by its entire dorsal margin of leaf lobe, leaf lobules usually ⅗ - ¾ as long as leaf or sometimes equal to it, the usual absence of a sac, and the underleaf lobes 4 cells wide at base. This species is closely allied to *C. acroloba* in having almost similar leaf lobe margin, leaf cells, valves and underleaves. However, *C. corynophora* can be easily differentiated in the presence of smaller leaf lobules which are usually ⅗-¾ as long as leaf lobe and predominantly without terminal sac. The studied plants of Mizoram slightly differ from those from China in plant and underleaf size, but resemble them in all vital taxonomic characters (see Zhu & So 2001). The present report constitutes the first record of *Colura corynophora* from India.

Colura leratii (Steph.) Steph.
(Figs 5A-R, 8F)

Species Hepaticarum 5: 939 (1916).

SPECIMEN EXAMINED. — **India.** Mizoram, Lawngtlai, Ngengpui Wildlife Sanctuary, 22°29'49.7"N, 92°46'33.1"E, 138 m, 01.XII.2012, *S. K. Singh & Party 127619E* (ASSAM).

OTHER SPECIMEN EXAMINED. — *Colura ornata* K.I. Goebel, Indonesia, Java Occ., Res. Batavia, G. Salak, in silvis primigeniis ad decl., *c.* 1000 m, XII.1893, V. Schiffner 151 (CAL).

HABITAT. — Foliicolous, growing in association with *Cololejeunea nilgiriensis, Leptolejeunea elliptica, L. epiphylla, L. udarii, Radula acuminata,* in relatively less moist places at elevation of about 150 -700 m a.s.l.

DISTRIBUTION. — India [Karnataka, Mizoram-present study (Singh *et al.* 2016)], Fiji, Indonesia, Malaysia, New Caledonia, Australia (Pócs & Streimann 2006; Söderström *et al.* 2010; Chuah-Petiot 2011; Söderström *et al.* 2011; Thouvenot *et al.* 2011).

DESCRIPTION
Plants
Light green when fresh, pale yellowish in herbarium; shoots 6-9 mm long, 1.8-2.2 mm wide including leaves, irregularly branched.

Stem
In cross section orbicular in outline, 75-102 µm, 4 cells across diameter; cortical cells 7, subquadrate, 17.5-45.0 × 12.5-37.5 µm; medullary cells 3, subquadrate-polygonal, 15.0-22.5 × 10.0-17.5 µm; ventral merophyte 1-2 cells wide.

Rhizoids
Numerous at the base of underleaves.

Leaves
Imbricate-contiguous, occasionally distant, widely spreading; leaf lobes obovate, 0.52-1.27 mm long, 0.10-0.32 mm wide, margin irregularly dentate-spinose, dorsal margin arched, ventral margin straight, sometime constricted at middle, apex rounded; marginal leaf cells towards apex subquadrate-polygonal, 15.0-35.0× 10.0-22.5 µm; median leaf cells subquadrate to hexagonal-polygonal, 30.0 57.5 × 17.5-27.5 µm; basal leaf cells hexagonal-polygonal, 27.5-60.0 × 15.0-30.0 µm, cells with cordate-nodulose, intermediate nodular thickenings 1-3 per cell wall; cuticle smooth; leaf lobules narrowly tubular, ⅔ as long as leaf lobe or slightly longer or sometimes reduced, somewhat flaring toward prolonged conical sac, lateral margin usually slightly incurved, apex acute; valve elliptical, 130.0-145.0 × 112.5-117.5 µm, with 18-21 median cells surrounded by a ring of 22-24 hyaline cells.

Underleaves
Distant, 3-4 times as wide as the stem, 0.23-0.28 mm long, 0.22-0.35 mm wide, deeply bilobed, sinus wide, lobes linear-lanceolate, 7-10 cells long, 3-8 cells uniseriate towards apex, 2-3 cells wide at base, margin entire.

Gemmae
Absent.

Androecia and gynoecia
Not seen.

NOTE
Colura leratii was reported in India by Asthana and Shukla (2010) from Karnataka, Western Ghats. It is closely allied to *Colura ornata* K.I. Goebel – an Indo-malesian species known from Sri Lanka, Indonesia, Malaysia, Philippines, New Guinea and Indochina (Pócs & Ninh 2012). But, *C. ornata* differs from the *C. leratii* by its lobule which is exceeding the lobe and sac, usually ending into by 4-teethed crest and perianth with three short erect horns (Jovet-Ast 1953). The present species is recorded for the first time from the East Himalayan bryogeographical region of the country.

Colura pluridentata Jovet-Ast
(Figs 6A-V; 8G)

Revue bryologique et lichénologique 22: 265 (1953).

SPECIMEN EXAMINED. — **India**. Andaman and Nicobar Islands, Great Nicobar Biosphere Reserve, East-West Road, 12 km from Campbell Bay, *c.* 176 m, 06°59'53"N, 93°52'56"E, 06.IV.2013, *C. Murugan 61507E* (CAL).

HABITAT. — Foliicolous, growing in association with *Caudalejeunea recurvistipula, Cheilolejeunea serpentina, C. trapezia, Lejeunea tuberculosa, Leptolejeunea epiphylla, L. maculata, Lopholejeunea subfusca Microlejeunea punctiformis,* in moist and shady condition at elevation *c.* 200 m a.s.l.

DISTRIBUTION. — India [Andaman and Nicobar Islands (Singh *et al.* 2016)], Fiji, Indonesia, Papua New Guinea, Africa (Seychelles) (Jovet-Ast 1953; Pócs & Eggers 2007; Wigginton 2009; Pócs 2013).

DESCRIPTION
Plants
Light green when fresh, yellowish brown in herbarium; shoot 6-10 mm long, 2.5-3.5 mm wide including leaves; sparsely branched, branching irregular.

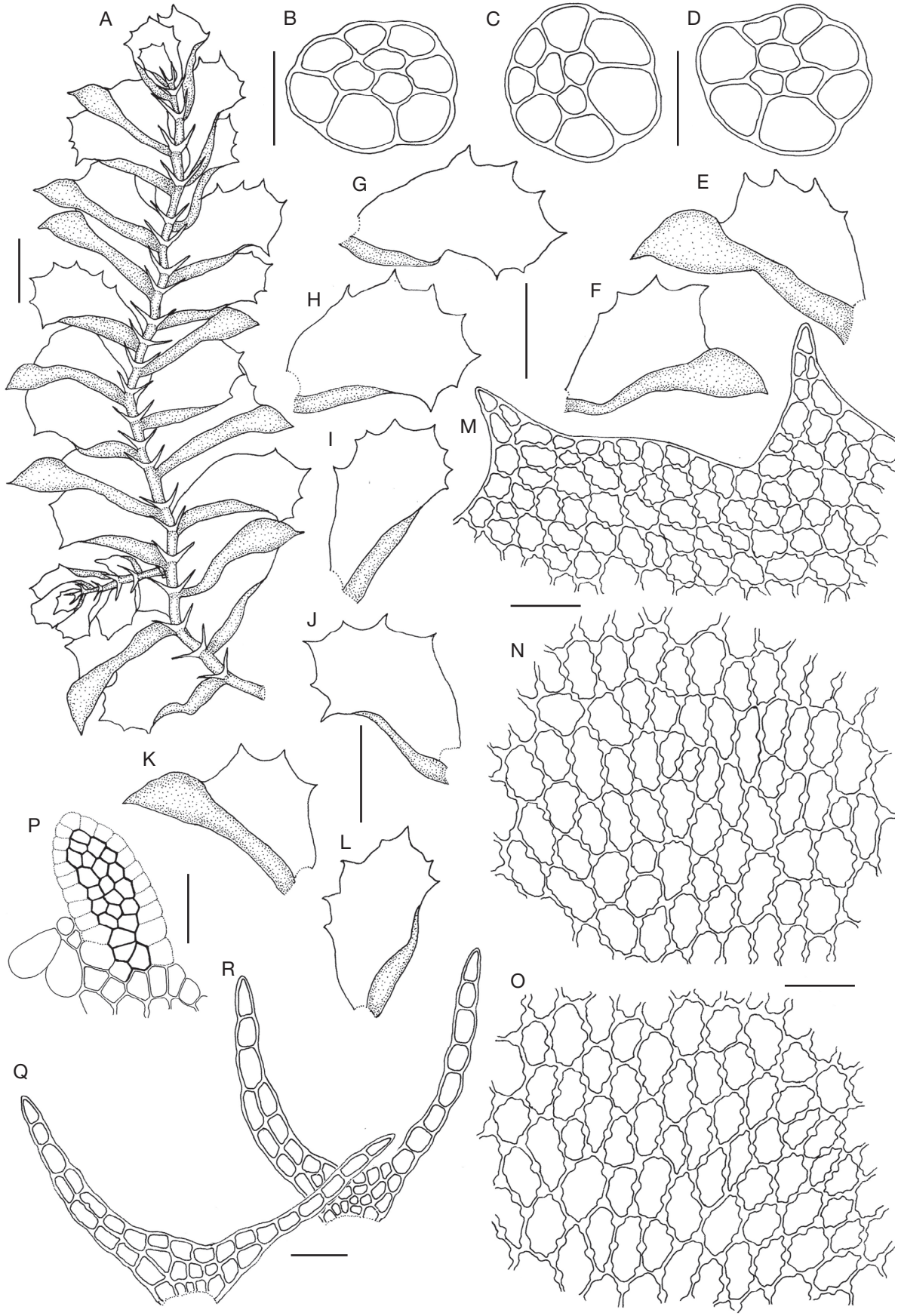

FIG. 5. — *Colura leratii* (Steph.) Steph.: **A**, portion of plant in ventral view; **B**-**D**, cross sections of stem; **E**-**L**, leaves; **M**, marginal leaf cells; **N**, median leaf cells; **O**, basal leaf cells; **P**, a valve; **Q**, **R**, underleaves. Scales bars: A, E-L, 0.5 mm; B-D, M-R, 0.05 mm.

Key to the species

1. Valve rounded-ovate, connected to the lobule along a hinge, hence detachable 2
— Valve more elongated, not detachable, fused directly to the lobule, not detachable 6

2. Lobule sac prolonged into in a narrow cylindrical beak; lobe almost as wide as lobule; valve with 2 triangular basal cells, hinge composed of 2 cells 3
— Lobule broadens towards apex; lobe much broader than the lobule; valve with 1 or 2 rectangular basal cells, hinge composed of 3 cells 4

3. Leaves remotely arranged, lobular beak ½ of leaf length ..... 8. *C. tenuicornis* (A. Evans) Steph.
— Leaves closely arranged, lobular beak ⅓-¼ of leaf length ..... 3. *C. calyptrifolia* (Hook.) Dumort.

4. Lobule sac apex is obtuse or truncate; underleaf lobes usually 8-10 cells wide at their base ..... 7. *C. pluridentata* Jovet-Ast
— Lobule sac apex acute or apiculate; underleaf lobes usually 2-5 cells wide at their base 5

5. Lobule sac small, less than ⅙ as wide as the leaf lobe, apex slightly turned outwards and tipped by a triangular point consisting of 1-2 cells ..... 2. *C. ari* (Steph.) Steph.
— Lobule sac larger, up to ⅓ as wide as the leaf lobe, apex tipped by a triangular point consisting of 3-8 cells ... . 4. *C. conica* (Sande Lac.) K.I. Goebel

6. Lobe with irregular teeth on the margin; lobule often tipped by a bidentate cret ..... 6. *C. leratii* (Steph.) Steph.
— Lobe with entire margin; lobule not tipped by a bidentate crest 7

7. Leaves usually with equally well developed, club-shaped lobules ending in an inflated sac ..... 1. *C. acroloba* Jovet-Ast
— Leaves usually with reduced lobule, ending well below the rounded leaf lobe apex or sometimes a few lobules with club-shaped lobules ending into an inflated sac ..... 5. *C. corynophora*

Stem
Orbicular in outline in cross section, 105-130 µm, 4 cells across diameter; cortical cells 7, rectangular-polygonal, 22.5-45.0 × 200-37.5 µm, thin-walled; medullary cells 3, polygonal, 20.5-32.5 × 20.0-30.0 µm, thin-walled; ventral merophyte 2 cells wide.

Rhizoids
Numerous, fasciculate at base of underleaves.

Leaves
Loosely imbricate, obliquely spreading, leaf lobe ovate-lanceolate, 1.4-2.1 mm long, 0.62-0.95 mm wide, dorsal margin arched, proximal ⅓ entire, distal ⅔ dentate; teeth (1-) 2-3 (-4) cells long, 1-2 (-3) cells wide at base; ventral margin slightly arched; marginal leaf cells towards apex rectangular-polygonal, 17.5-30.0 × 15.0-30.0 µm; median leaf cells hexagonal-polygonal, 37.5-55.0 × 17.5-27.5 µm; basal leaf cells slightly elongated, polygonal, 50.0-70.0 × 20.0-27.5 µm; cells thin-walled with large, cordate-nodulose trigones, intermediate thickenings subnodulose, 1-2 per cell wall; cuticle smooth; leaf lobule inflated, 1.6-2.0 mm long, 0.24-0.30 mm wide, cylindrical at base, widest at middle, terminating into a strongly inflated, cylindrical to lanceolate sac; sac 0.62-0.75 mm long, widest at base, narrowing towards apex, apex rounded to obtuse, margin entire; valve ovoid, 105-175 × 90-130 µm with 18-20 median cells and 2 median basal cells surrounded by a ring of 14-18 hyaline cells.

Underleaves
Distant, 3-4 times as wide as stem, 0.42-0.80 × 0.48-0.90 mm, deeply bilobed, sinus wide, lobes divergent, lanceolate, 12-15 long, 8-10 cells wide at base, 1-2 cells uniseriate at apex, margin entire.

Gemmae
Clustered at the apex of leaf lobule, discoid, 17-24-celled, 40-80 µm in diameter.

Androecia and gynoecia
Not seen.

Note
Colura pluridentata is readily distinguishable among the Indian species of the genus in having underleaf lobes 8-10 cells wide at base. In having denticulate to dentate leaf lobe margins, it is somewhat similar to *C. ari* and *C. conica*. But, both the species are distinct from *C. pluridentata* in having leaf lobule sacs ending into acute-apiculate apices (see also Jovet-Ast 1953; Lal 1980, 2003; Pócs & Eggers 2007; Dey & Singh 2016).

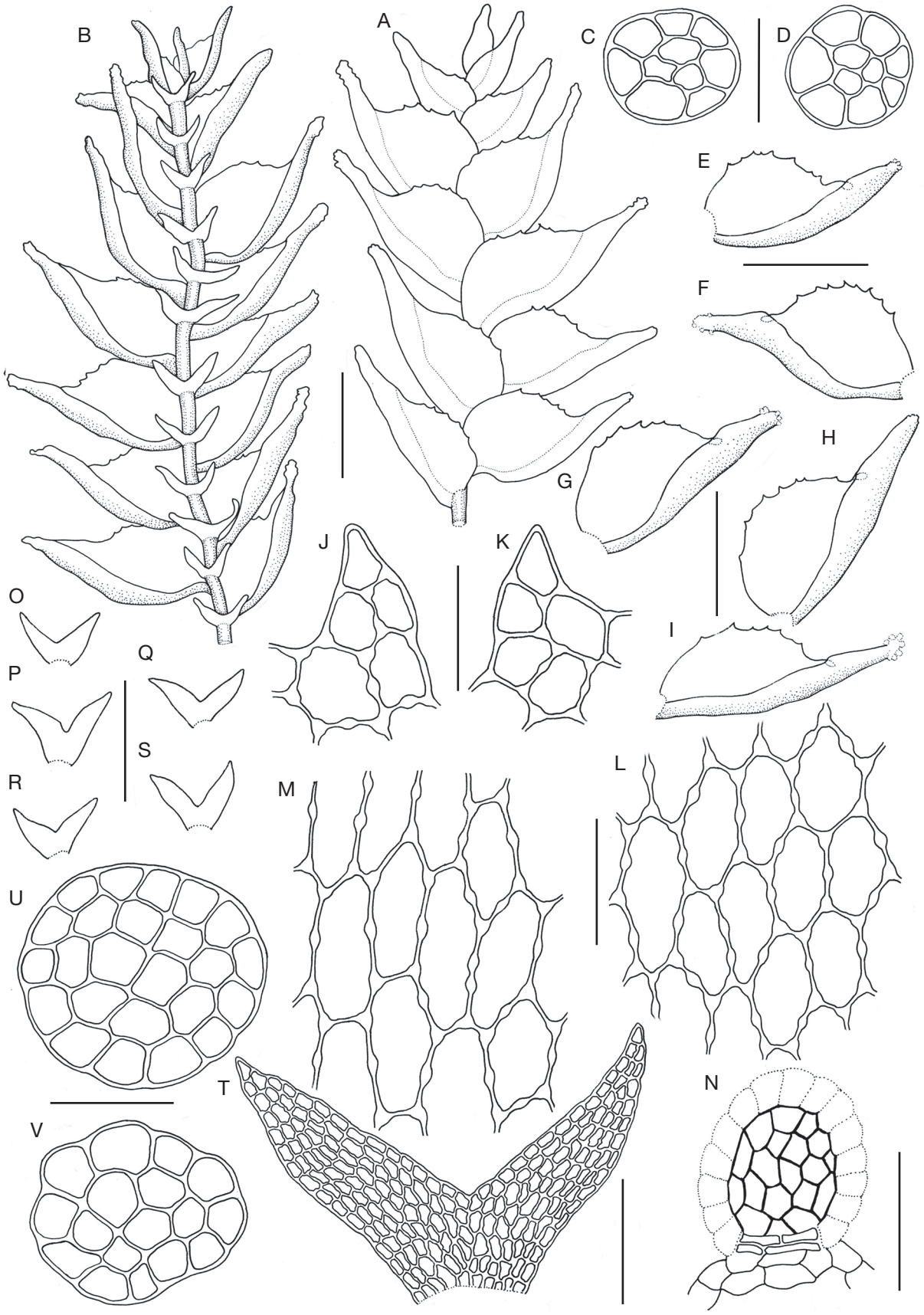

Fig. 6. — *Colura pluridentata* Jovet-Ast: **A**, portion of plant in dorsal view; **B**, the same in ventral view; **C**, **D**, cross sections of stem; **E**-**I**, leaves; **J**, **K**, marginal leaf cells; **L**, median leaf cells; **M**, basal leaf cells; **N**, a valve; **O**-**S**, underleaves; **T**, an underleaf cellular; **U**, **V**, gemmae. Scale bars: A, B, E-I, O-S, 1 mm; C, D, N, 0.1 mm; J-M, U, V, 0.05 mm; T, 0.2 mm.

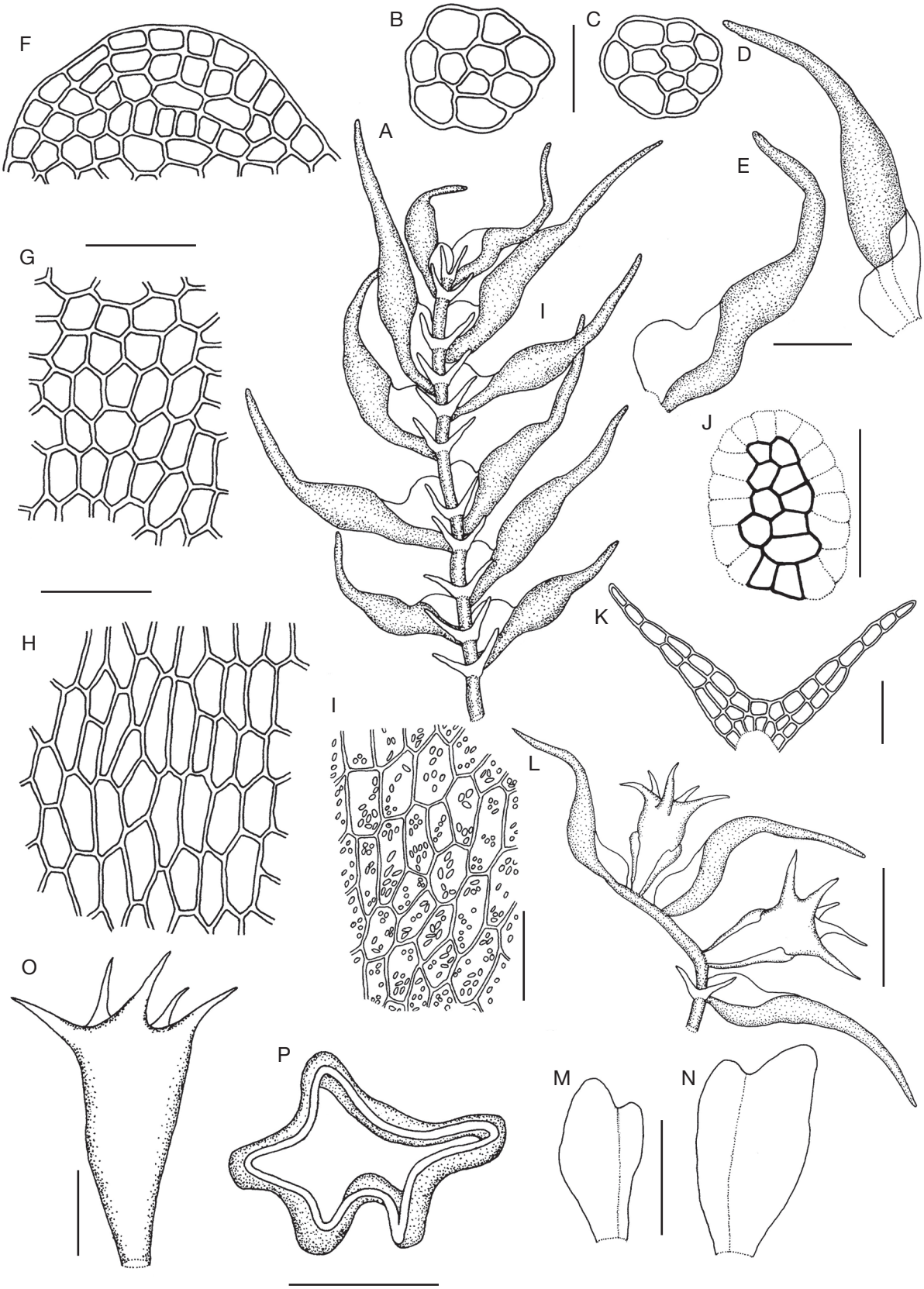

Fig. 7. — *Colura tenuicornis* (A.Evans) Steph.: **A**, portion of plant in ventral view; **B**, **C**, cross sections of stem; **D**, **E**, leaves; **F**, marginal leaf cells; **G**, median leaf cells; **H**, basal leaf cells; **I**, mid basal cells showing oil-bodies; **J**, a valve; **K**, an underleaf cellular; **L**, a portion of plant with gynoecial branches in ventral view; **M**, **N**, female bracts; **O**, a perianth; **P**, cross section of perianth. Scale bars: A, D-H, M-O, 0.2 mm; B, C, J-L, 0.05 mm; I, 0.03 mm.

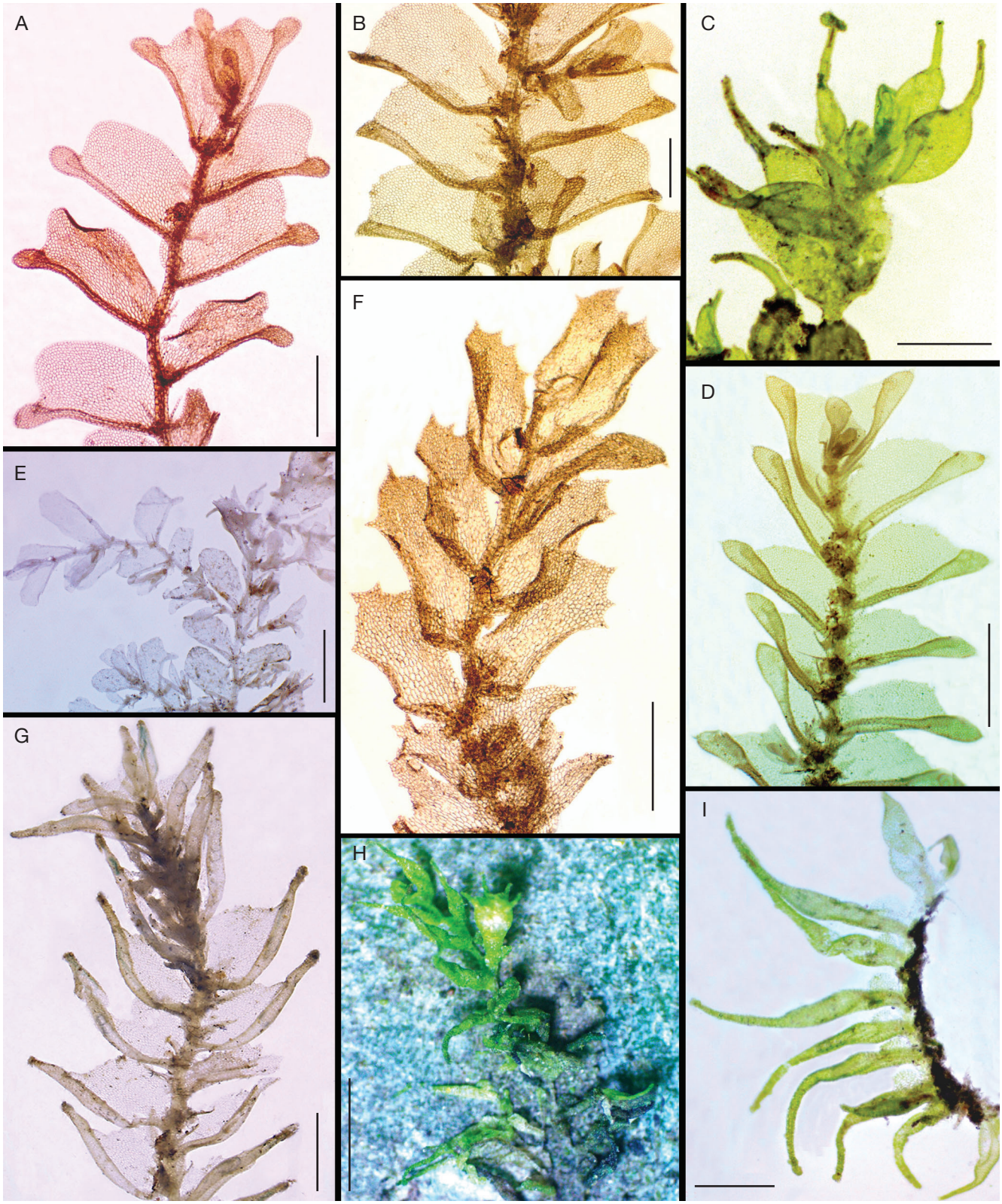

FIG. 8. — **A**, *Colura acroloba* (Mont. ex Steph.) Jovet-Ast; **B**, *Colura ari* (Steph.) Steph.; **C**, *Colura calyptrifolia* (Hook.) Dumort.; **D**, *Colura conica* (Sande Lac.) K.I.Goebel; **E**, *Colura corynophora* (Nees, Lindenb. & Gottsche) Trevis.; **F**, *Colura leratii* (Steph.) Steph.; **G**, *Colura pluridentata* Jovet-Ast; **H**, **I**, *Colura tenuicornis* (A.Evans) Steph. Scale bars: A, B, F, G, I, 0.5 mm; C, 0.6 mm; D, E, H; 1 mm.

Colura tenuicornis (A. Evans) Steph.
(Figs 7A-P; 8H, I)

Species Hepaticarum 5: 942 (1916).

Specimens examined. — **India**. Arunachal Pradesh, Dibang Valley district, on way to Dessali from Hunli, *c*. 1150 m, 15.01.1984, *D. K. Singh 675C/1984* (ASSAM); Lower Dibang Valley district, Chekhopani, *c*. 2000 m, 17.XI.2000, *D.K. Singh 98169B* (BSD); Meghalaya, East Khasi Hills, Elephant falls, 25°32'12.8"N, 91°49'21.03"E, 1769 m, 02.V.2016, *Shasi Kumar TSLI - 2105* & 23.VII.2016, *TSLI - 2193, 2194* (ASSAM); near Mawkajem, 25°25'23"N, 91°51'47"E, 1715 m, 25.XI.2017, *S. K. Singh & Party TSLI - 3796* (ASSAM); Sikkim, North district, Thulung, 27°38'13.3"N, 88°26'29"E, *c*. 2449 m, 03.IV.2013, *D. Singh 60598B* (CAL); East district, Pangthang, *c*. 1988 m, 18.IX.2007, *D. Singh 40967* (CAL); ½ km before Bojogari falls on way from Burtak to Pangthang, *c*. 1850 m, 28.VII.2008, *B. S. Kholia 41103C* (CAL); West district, between Hilley and Barsey, *c*. 2784 m, 26.V.2008, *K. Das 41091B* (CAL); Hilley, *c*. 2766 m, 28.V.2008, *K. Das 41096C* (CAL), 08.III.2010, *D. Singh & S. Majumdar 47562A* (CAL); 12th mile from Hilley towards Okhrey, *c*. 2700 m, 12.III.2010, *D. Singh & S. Majumdar 47740B, 47746C* (CAL); South district, Maenam Wildlife Sanctuary, 27°18'42.5"N, 088°21'54.5"E, *c*. 2192 m, 01.VI.2011, *D. Singh 51720A, 51745B*; West Bengal, Darjeeling district, Takdah, *c*. 1650 m, 17.I.2005, *D. Singh & M. Dey 36218* (CAL).

Habitat. — Foliicolous, growing in association with *Cololejeunea latilobula, C. longifolia, C. pseudofloccosa, C. truncatifolia, Drepanolejeunea erecta, D. fleischeri, D. longii, Lejeunea anisophylla, L. discreta, L. flava, L. wallichiana, Leptolejeunea balansae, L. elliptica, Microlejeunea punctiformis,* in moist and shady places at elevation of 1200-2800 m a.s.l.

Distribution. — India [Arunachal Pradesh, Meghalaya-present study, Sikkim, West Bengal (Singh *et al.* 2016)], Bhutan, Cambodia, China, Comoro Archipelago, Fiji, Galapagos, Hawaii, Indonesia, Japan, Malaysia, Nepal, Papua New Guinea, Sri Lanka, Taiwan, Vietnam, Africa, South America (Tixier 1979; Yano 1984; Grolle & Piippo 1984; Piippo 1990; Pócs 1993; Zhu & Long 2003; Staples & Imada 2006; Yamada & Iwatsuki 2006; Pradhan & Joshi 2009; Wigginton 2009; Söderström *et al.* 2010; Söderström *et al.* 2011; Gradstein & Ziemmeck 2011; Chuah-Petiot 2011; Wang *et al.* 2011; Long & Rubasinghe 2014; Bakalin & Van Sinh 2016).

Description

Plants

Green when fresh, pale yellowish green in herbarium; shoots 2-6 mm long, (1.0-) 1.8-2.4 mm wide including leaves; branching irregular.

Stem

In cross section suborbicular in outline, 52.5-82.5 × 52.5-75.0 µm, 4 cells across diameter; cortical cells 7, subquadrate-rectangular or polygonal, 17.5-32.5 × 10.0-22.5 µm, thin-walled; medullary cells 3, polygonal, 15.0-25.0 × 10.0-17.5 µm, cells thin-walled. Ventral merophytes 1-2 cells wide.

Leaves

Contiguous-remote, obliquely-widely spreading, leaf lobes lanceolate, 0.25-0.45 mm long, 0.12-0.20 mm wide, margin entire, dorsal margin slightly arched, ventral margin nearly straight-slightly arched; marginal leaf cells towards apex rectangular-polygonal or subquadrate, 12.5-20.0 × 7.5-12.5 µm; median leaf cells pentagonal-hexagonal, 15.0-27.5 × 10.0-17.5 µm; basal leaf cells elongated pentagonal - hexagonal or rectangular, 25.0-45.0 × 10.0-17.5 µm; cells thin-walled without trigones and intermediate thickenings; cuticle smooth; oil-bodies 6-14 per leaf cell, spherical, 2.0-3.5 µm in diameter, or elliptical, 5.0-7.2 × 2.5-4.0 µm ; leaf lobules inflated, 2-3 times as long as the lobe, widest at middle, 0.75-1.25 mm long, 0.13-0.17 mm wide, sac cylindrical-lanceolate forming a long tubular beak towards apex, beak *c*. ½ as long as leaf lobule, margin entire; valve elliptical-ovoid, 87.5-92.5 × 65.0-72.5 µm, composed of 11-14 median cells surrounded by a ring of 15-16 hyaline cells, hinge distinct.

Underleaves

Remote, (2.5-) 3-4 times as wide as the stem, 0.16-0.19 mm long, 0.13-0.25 mm wide, deeply bilobed, sinus wide, lobes divergent, linear-lanceolate, 6-8 cells long, 2-3 cells wide at base, apex subacute, margin entire. According to Jovet-Ast (1953) monoicous. Androecial branches on Indian plants not seen.

Androecia and gynoecia

Androecial branches on Indian plants not seen; gynoecia on short or long branches, with one subfloral innovation; bract lobe narrowly oblong, (0.25-) 0.37-0.51 mm long, 0.10-0.16 mm wide; bract lobule, (0.2-) 0.31-0.45 mm long, (0.04-) 0.07-0.10 mm wide; bracteoles not seen. Perianth obovate, 0.62-0.81 mm long, 0.22-0.27 mm wide, mouth with five large horn-like keels (two lateral, two ventral and one dorsal); keels ⅓ as long as the perianth, subcylindrical, apices sharply acute, margin entire, surface smooth. According to Jovet-Ast (1953) monoicous.

Mature sporophytes

Not seen.

Note

C. tenuicornis is characterized by its contiguous-remote leaves with lanceolate leaf lobe; thin-walled leaf cells devoid of trigones and intermediate thickenings; cylindrical-lanceolate lobule sac forming a long tubular beak towards apex, *c*. ½ as long as the whole leaf, and perianth with five large horn-like keels (Zhu & So 2001; Dey & Singh 2012). The species is closely allied to *C. calyptrifolia,* but the latter differs by its shorter lobular beak (¼-⅓ as long as the whole leaf) and perianth with five short spreading horns (Porley 1997; Yang *et al.* 2013; Mufeed *et al.* 2018).

Acknowledgements

We thank the Director, Botanical Survey of India, Kolkata for encouragement; Dr D. K. Singh, Scientist G (Rtd.), BSI Kolkata and two anonymous reviewers for their valuable suggestions towards improvement of the manuscript; forest officials of Mizoram, Meghalaya, Sikkim and Andaman & Nicobar Islands for rendering help during field work. We are also thankful to Dr Manju C. Nair, Asstt. Prof., The zamorin Guruvayurappan College, Kerala for provid-

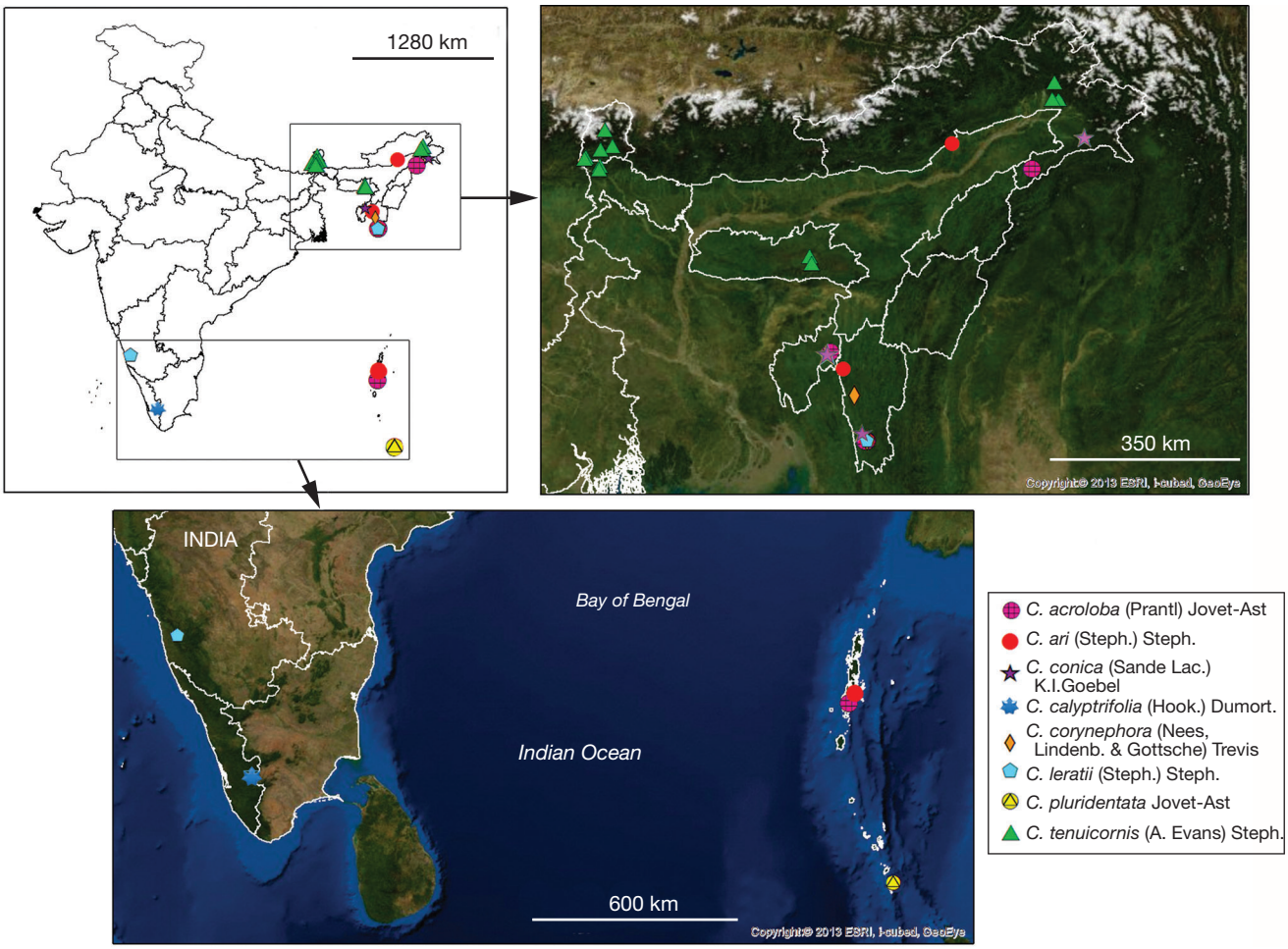

FIG. 9. — Distribution of the species of genus *Colura* (Dumort.) Dumort. in India.

ing the specimens of *Colura calyptrifolia* for study and its photographs; Ms. Natasha Shrivastava, BSI, Howrah for the help with distribution map. Shashi Kumar (SPF) is also grateful to director, BSI, for financial assistance under 'Flora of India' project.

REFERENCES

AH-PENG C., BARDAT J., PÓCS T., SÖDERSTRÖM L., STAMÉNOFF P. & STRASBERG D. 2012. — Red List of liverworts and hornworts for Réunion (Mascarene archipelago). *Phytotaxa* 68: 1-23. https://doi.org/10.11646/phytotaxa.68.1.1

ASTHANA G. & SHUKLA A. 2010. — *Colura leratii* (Steph.) Steph. new to India. *Tropical Bryology* 32: 100-102.

BAKALIN V. & VAN SINH N. 2016. — The checklist of liverworts (hepaticae) and hornworts (anthocerotae) of Vietnam updated based on literature survey. *Tap Chi Sinh Hoc* 38 (4): 480-491. https://doi.org/10.15625/0866-7160/v38n4.8771

BANU-FATTAH K. 2001. — A comprehensive checklist of bryophytes of Bangladesh. *Bangladesh Journal of Plant Taxonomy* 8: 7-18.

CHUAH-PETIOT M. S. 2011. — A checklist of Hepaticae and Anthocerotae of Malaysia. *Polish Botanical Journal* 56 (1): 1-44.

CHUAH-PETIOT M. S. & PÓCS T. 2003. — East African Bryophytes XIX. A contribution to the Bryoflora of Kenya. *Acta Botanica Hungarica* 45 (1-2): 53-64.

DAUPHIN G., GRADSTEIN S. R., BERNECKER-LÜCKING A. & MORALES M. I. 1998. — Additions to the hepatic flora of Costa Rica II. *Lindbergia* 23: 74-80.

DEY M. & SINGH D. K. 2012. — *Epiphyllous Liverworts of Eastern Himalaya*. Botanical Survey of India, Thiruvananthapuram, 415 p.

DEY M. & SINGH D. K. 2016. — Three foliicolous taxa of Lejeuneaceae (Marchantiophyta) new to India from Great Nicobar Biosphere Reserve, Andaman and Nicobar Islands. *Acta Botanica Hungarica* 58 (1-2): 49-68.

DUMORTIER B. C. 1835. — *Recueil d'observations sur les Jungermanniacées*. Fascicle I, Tournay: 3-27.

ENGEL J. J. 1978. — A taxonomic and phytogeographic study of Brunswick Peninsula (Strait of Magellan) Hepaticeae and Anthocerotae. *Fieldiana Botany* 41: 247-248.

FISCHER E. 1999. — A new species of *Colura* (Lejeuneaceae) from the Aberdare Mountains/ Kenya. *Tropical Bryology* 16: 205-208.

GOEBEL K. I. 1928. — Morphologische und biologische Studien. XII. Malesische Lebermoose. *Annales du Jardin Botanique de Buitenzorg* 39: 1-116.

GRADSTEIN S. R. 1986. — The genus *Colura* in the Galapagos Islands. *Hikobia* 9: 353-356.

GRADSTEIN S. R. & BENITEZ A. 2014. — A second locality for the critically endangered *Colura irrorata* (Lejeuneaceae) in the Ecuadorian Andes. *Journal of Bryology* 36: 151-155. https://doi.org/10.1179/1743282013Y.0000000088

GRADSTEIN S. R. & DA COSTA D. P. 2003. — The hepaticae and Anthocerotae of Brazil. *Memoirs of the New York Botanical Gar-*

den 87: 1-318.
Gradstein S. R. & Ziemmeck F. 2011. — CDF Checklist of Galapagos Horn- & Liverworts, *in* Bungartz F., Herrera H., Jaramillo P., Tirado N., Jímenez Uzcategui G., Ruiz D., Guézou A. & Ziemmeck F. (eds), *Charles Darwin Foundation Galapagos Species Checklist.* Charles Darwin Foundation, Puerto Ayora, Galapagos: https://www.darwinfoundation.org/en/datazone/checklist Last updated 13 Apr. 2011.
Grolle R. 1965. — Lebermoose aus Neuguinea. I. *Journal of the Hattori Botanical Laboratory* 28: 43-54.
Grolle R. 1969. — Novae Guineae Hepaticae Schusteranae. *Journal of the Hattori Botanical Laboratory* 32: 140-144.
Grolle R. 1995. — The Hepaticae and Anthocerotae of the East African Islands An Annotated Catalogue. *Bryophytorum Bibliotheca* 48: 1-178.
Grolle R. & Piippo S. 1984. — Annotated catalogue of Western Melanesian bryophytes. I. *Acta Botanica Fennica* 125: 1-86.
Grolle R. & Schultze Motel W. 1972. — Vorläufiges Verzeichnis der Lebermoose von Samoa. *Journal of the Hattori Botanical Laboratory* 36: 75-89.
Grolle R. & Zhu R.-L. 2002. — On *Macrocolura* and the subdivision of *Colura* (Lejeuneaceae, Hepaticae). *Journal of the Hattori Botanical Laboratory* 92: 181-190.
Hylander K., Pócs T. & Nemomissa S. 2010. — Liveworts of southwest Ethiopian montane forests: ecological and biogeographical notes. *Journal of Bryology* 32: 92-100. https://doi.org/10.1179/037366810X12578498135995
Jones E. W. & Pócs T. 1987. — African Hepatics. XXXVI. Three new species of *Colura. Journal of Bryology* 14 (3): 495-501. https://doi.org/10.1179/jbr.1987.14.3.495
Jovet-Ast S. 1953. — Legenre *Colura*: Hépatiques, Lejeuneaceae, Diplasieae. *Revue bryologique et lichénologique* 22: 206-312.
Jovet-Ast S. 1954. — Le genre *Colura:* Hépatiques, Lejeuneaceae, Diplasieae (supplément). *Revue bryologique et lichénologique* 23: 1-22.
Jovet-Ast S. 1957. — Deux *Colura* nouveaux de Madagascar. *Revue bryologique et lichénologique* 25: 272-276.
Jovet-Ast S. 1958. — Localités nouvelles de diverses espèces du genre *Colura. Revue bryologique et lichénologique* 27: 24-30.
Jovet-Ast S. 1961. — *Colura* de Sud-Vietnam (Récoltes de Pierre Tixier). *Revue bryologique et lichénologique* 30: 5-12.
Jovet-Ast S. 1968a. — *Colura* récoltes du Pakistan aux Philippines par Pierre Tixier. *Revue bryologique et lichénologique* 35: 138-142.
Jovet-Ast S. 1968b. — Compléments à l'étude des *Colura:* Localités nouvelles; description d'une espèce nouvelle de Bornéo. *Revue bryologique et lichénologique* 35: 143-148.
Jovet-Ast S. 1976. — Compléments à la connaissance des *Colura*: espèce et localités nouvelles. *Revue bryologique et lichénologique* 42: 909-922.
Jovet-Ast S. 1980. — La section *Oidocorys* S. J.-A. Du genre *Colura* Dum. Est-elle agée de plus de 100 millions d'années? *Cryptogamie, Bryologie-Lichénologie* 1 (3): 277-287.
Jovet-Ast S. 1983. — *Colura* nouveaux d'origines diverses (Hépatiques, Lejeunéacées). *Cryptogamie, Bryologie-Lichénologie* 4: 205-216.
Jovet-Ast S. & Tixier P. 1958. — Hépatiques, du Viet-Nam. – I. *Revue bryologique et lichénologique* 27: 201-210.
Kitagawa N. 1969. — A small collection of Hepaticae from Penang, Malaysia. *Bulletin of the Nara University Education, B.* 18 (2): 27-43.
Lai M. J., Zhu R.-L. & Chantanaorrapint S. 2008. — Liverworts and horworts of Thailand: An updated checklist and bryofloristic accounts. *Annales Botanici Fennici* 45: 321-341. https://doi.org/10.5735/085.045.0501
Lal J. 1977. — *Colura* Dum. (Hepaticae) – A genus new to Indian flora. *Current Science* 46: 618.
Lal J. 1980. — *Colura ari* Steph. (Hepaticae) from Andamans, a new record for India. *Bulletin of the Botanical Survey of India* 22: 207-209.
Lal J. 2003. — *Colura acutifolia* Ast (Hepaticae), new to Indian bryoflora. *Bulletin of the Botanical Survey of India* 45: 227-228.
Long D. G. & Rubasinghe S. C. K. 2014. — Liverworts and Hornworts of Sri Lanka: a revised checklist. *Ceylon Journal of Science (Biological Sciences)* 43 (1): 1-36. https://doi.org/10.4038/cjsbs.v43i1.7280
Mccarthy P. M. 2006 — Checklist of Australian Liverworts and Hornworts. Australian Biological Resources Study, Canberra. Version 6 April 2006. http:// www.anbg.gov.au/abrs/liverwortlist/liverworts_intro.html
Miller H. A. 1981. — Notulae hepaticarum polynesiae. *Phytologia* 47: 319-324. https://doi.org/10.5962/bhl.part.4461
Mizutani M. 1961 — A revision of Japanese Lejeuneaceae. *Journal of the Hattori Botanical Laboratory* 24: 235-237.
Mufeed B., Chandini V. K., Manju C. N. & Rajesh K. P. 2018. — *Colura calyptrifolia* (Lejeuneaceae: Marchantiophyta) a rare leafy liverwort from the Western Ghats of India. *Nelumbo* 60 (2): 148-153. https://doi.org/10.20324/nelumbo/v60/2018/127615
Müller F. & Pócs T. 2007. — A contribution to the knowledge of epiphyllous bryophytes of Bioko Island (Equatorial Guinea), including additional remarks on non-epiphyllous species. *Journal of Bryology* 29: 81-94. https://doi.org/10.1179/174328207X186803
Onraedt M. 1979. — Bryophytes de Sri Lanka (Ceylan) IV. Le genre *Colura. Revue bryologique et lichénologique* 45 (4): 443-452.
Piippo S. 1990. — Annotated catalogue of Chinese Hepaticae and Anthocerotae. *Journal of the Hattori Botanical Laboratory* 68: 1-192.
Pócs T. 1991. — The genus *Colura* in East Africa. *Bulletin of the British Bryological Society* 57: 33-39.
Pócs T. 1993. — New or little known epiphyllous liverworts, IV. Two new Cololejeuneoideae from the Comoro Archipelago. *Journal of the Hattori Botanical Laboratory* 74: 45-57.
Pócs T. 1995. — East African bryophytes, XIV. Hepaticae from the Indian Ocean islands. *Fragmenta Floristica Geobotanica* 40: 251-277.
Pócs T. 1996. — Epiphyllous liverwort diversity at worldwide level and its threat and conservation. *Anales del Instituto de Biología de la Universidad Nacional Autónoma de México Botany* 67: 109-127.
Pócs T. 1997. — New or little known epiphyllous liverworts, VII. Two new Lejeuneaceae species from the Mascarene Islands. *Cryptogamie Bryologie-Lichénologie* 18: 195-205.
Pócs T. 2010. — East African bryophytes, XXVI. New records from Mayotte (Maore) Island (French Comoro). *Acta Bryolichenologica Asiatica* 3: 105-114.
Pócs T. 2011. — New or little known epiphyllous liverworts XIV. The genus *Colura* (Lejeuneaceae) in Sao Tome Island, with the description of *Colura thomeensis* sp. nov. *The Bryologist* 114 (2): 362-366. https://doi.org/10.1639/0007-2745-114.2.362
Pócs T. 2012. — New or little known epiphyllous liverworts, XVI. A small collection from Laos. *Acta Biologica Plantarum Agriensis* 2: 5-10.
Pócs T. 2013. — The genus *Colura* (Lejeuneaceae) in New Guinea and in the neighboring areas. *Chenia* 11: 12-38.
Pócs T. 2015. — Contribution to the bryoflora of Australia, V. *Colura streimannii* sp. nov. from Queensland. *Polish Botanical Journal* 60 (1): 7-11. https://doi.org/10.1515/pbj-2015-0006
Pócs T. & Eggers J. 2007. — Bryophytes from the Fiji Islands, II. An account of the genus *Colura*, with a description of *C. vitiensis* sp. nov. *Polish Botanical Journal* 52 (2): 81-92.
Pócs T. & Ninh T. 2005. — Contribution to the Bryoflora of Vietnam, VI. On the liverwort flora of Vu Quang Nature Reserve. *Acta Botanica Hungarica* 47 (1-2): 151-171.
Pócs T. & Ninh T. 2012. — New or little known epiphyllous liverworts, XVII. Records from the Cát Tiên National Park, southern Vietnam. *Acta biologica plantarum Agriensis* 2: 11-19.
Pócs T. & Streimann H. 2006 — Contributios to the Bryoflora of Australia, I. *Tropical bryology* 27: 19-24.
Pócs T., Luong T. T. & Ho B. C. 2013. — New of little known

epiphyllous liverworts, XVIII. records from the Bidoup-Núi Bà National Park, Vietnam, with the description of *Drepanolejeunea bidoupensis*, sp. nov. *Cryptogamie, Bryologie* 34 (3): 287-298. https://doi.org/10.7872/cryb.v34.iss3.2013.287

Pócs T., Sass-Gyarmati A., Naikatini A., Tuiwawa M., Braggins J., Pócs T. & Von Konrat M. 2011. — New liverwort (Marchantiophyta) records for the Fiji Islands. *Telopea* 13 (3): 455-494. https://doi.org/10.7751/telopea20116031

Pócs T., Tixier P. & Jovetast S. 1967. — Adatok ÉszakVietnam mohaflórájához. II. *Botanikai közlemenyek* 54: 27-38.

Porley R. D. 1997. — British Bryological Society Expedition to Mulanje Mountain, Malawi. 8. Lejeuneaceae: Colura (Hepaticae). *Journal of Bryology* 19: 799-803. https://doi.org/10.1179/jbr.1997.19.4.799

Pradhan N. & Joshi S. D. 2009. — Liverworts and hornworts of Nepal: a synopsis. *Botanica Orientalis – Journal of Plant Science* 6: 69-75.

Ros R. M., Mazimpaka V., Abousalama U., Aleffi M., Blockeel T. L., Brugués M., Cano M. J., Cros R. M., Dia M. G., Dirkse G. M., Saadawi W. E., Erdağ A., Ganeva A., Gonzálezmancebo J. M., Herrnstadt I., Khalil K., Kürschner H., Lanfranco E., Losadalima A., Refai M. S., Rodríguezñuñez S., Sabovljevic M., Sérgio C., Shabbara H., Simsim M. & Söderström L. 2007. — Hepatics and Anthocerotes of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie* 28: 351-437.

Sangrattanaprasert J., Chantanaorrapint S. & Zhu R.-L. 2017. — Notes on *Colura crenulata* (Lejeuneaceae, Marchantiophyta), a new record for Thailand, with a sporophyte description. *Polish Botanical Journal* 62 (2): 197-202. https://doi.org/10.1515/pbj-2017-0014

Sangrattanaprasert J., Chantanaorrapint S. & Zhu R.-L. 2018. — The genus *Colura* section *Gamolepis* (Lejeuneaceae, Marchantiophyta) in Malesian region, with the description of *Colura sigmoidea. Phytotaxa* 387 (1): 40-54. https://doi.org/10.11646/phytotaxa.387.1.3

Schuster R. M. 1992. — The oil-bodies of the Hepaticae. II. Lejeuneaceae (part 2). *Journal of the Hattori Botanical Laboratory* 72: 163-359.

Singh D. K. 1996. — Hepaticae (Bryophyta), *in* Hajra P. K. (ed.), *A contribution to the flora of Namdapha Arunachal Pradesh*. BSI, Calcutta, 46-67 p.

Singh D. K., Singh S. K. & Singh D. 2016. — *Liverworts and Hornworts of India: an Annotated Checklist.* Botanical Survey of India, Kolkata, 439 p.

Singh S. K. & Kumar S. 2016. — A preliminary study on liverworts and hornworts of Tripura, North-East India. *Nelumbo* 58: 130-151. https://doi.org/10.20324/nelumbo/v58/2016/106363

Söderström L., Gradstein S. R. & Hagborg A. 2010. — Checklist of the hornworts and liverworts of Java. *Phytotaxa* 9: 53-149. https://doi.org/10.11646/phytotaxa.9.1.7

Söderström L., Hagborg A., Konrat M. V., Began S. B., Bell D., Briscoe L., Brown E., Cargill D. C., Costa D. P., Stotler B. J. C., Cooper E. D., Dauphin G., Engel J. J., Feldberg K., Glenny D., Gradstein S. R., He X., Heinrichs J., Hentschel J., Borges A. L. I., Katagiri T., Konstantinova N. A., Larraín J., Long D. G., Nebel M., Pócs T., Puche F., Drehwald E. R., Renner M. A. M., Gyarmati A. S., Verwimp A. S., Moragues J. G. S., Stotler R. E., Sukkharak P., Thiers B. M., Uribe J., Váňa J., Villarreal J. C., Wigginton M., Zhang L. & Zhu R. L. 2016 — World checklist of hornworts and liverworts. *Phytokeys* 59: 1-828. https://doi.org/10.3897/phytokeys.59.6261

Söderström L., Hagborg A., Pócs T., Sass-Gyarmati A., Brown E., Von Konrat M. & Renner M. 2011. — Checklist of hornworts and liverworts of Fiji. *Telopea* 13 (3): 405-454. https://doi.org/10.7751/telopea20116030

Söderström L., Urmi E. & Váňa J. 2002. — Distribution of Hepaticae and Anthocerotae in Europe and Macaronesia. *Lindbergia* 27: 3-47.

Staples G. W. & Imada C. T. 2006. — Checklist of Hawaiian Anthocerotes and Hepatics. *Tropical Bryology* 28: 15-47.

Stephani F. 1912-1917. — *Species Hepaticarum V*. Georg et Cie, Lyon, même Maison, Genève & Bale, 1044 p.

Tan B. C. & Engel J. J. 1986. — An annotated checklist of Philippine Hepaticae. *Journal of the Hattori Botanical Laboratory* 60: 283-355.

Thiers B. M. 1987. — A preliminary account of *Colura* (Hepaticae, Lejeuneaceae) in Australia. *Brittonia* 39 (2): 175-179. https://doi.org/10.2307/2807369

Tixier P. 1979. — Biogeographie du Mont Bokor (Cambodge) Bryophyta Indosinica XXIV. *Bryophytorum Bibliotheca* 18: 1-121.

Tixier P. 1980. — Bryophyta Indosinica –XXIV. Cambodian bryoflora, collections from Phnom Kulen. *Nova Hedwigia* 32: 377-392.

Thouvenot L., Gradstein S. R., Hagborg A., Söderström L. & Bardat J. 2011. — Checklist of the liverworts and hornworts of New Caledonia. *Cryptogamie, Bryologie* 32: 287-390. https://doi.org/10.7872/cryb.v32.iss4.2011.287

Trevisan V. 1877. — Schema di una nuova classificazione delle Epatiche. *Memorie del Reale Istituto Lombardo di Scienze e Lettere, Serie 3, Classe di Scienze Matematiche e Naturali* 4: 383-451.

Udar R. & Awasthi U. S. 1985. — *Colura acroloba* (Mont.) Jovetast. – new to Indian Bryoflora. *Journal of the Indian Botanical Society* 64: 284-286.

Vanden Berghen C. 1972. — Hépatiques épiphylles récoltées au Burundi par J. Lewalle. *Bulletin du Jardin botanique national de Belgique* 42: 431-494. https://doi.org/10.2307/3667667

Wang J., Lai M.-J. & Zhu R.-L. 2011. — Liverworts and hornworts of Taiwan: an updated checklist and floristic accounts. *Annales Botanici Fennici* 48: 369-395. https://doi.org/10.5735/085.048.0501

Wigginton M. J. 2009. — Checklist and distribution of the liverworts and hornworts of subSaharan Africa, including the East African Islands. *Tropical Bryology Research Report* 8: 1-116.

Yamada K. & Iwatsuki Z. 2006. — Catalog of the hepatics of Japan. *Journal of the Hattori Botanical Laboratory* 99: 1-106.

Yang J.-D., Yao K.-Y. & Lin S.-H. 2013. — Two species of *Colura* (Family: Lejeuneaceae) newly recorded to Taiwan. *Taiwan Journal of Biodiversity* 15 (4): 331-341.

Yano O. 1984. — Checklist of Brazilian Liverworts and Hornworts. *Journal of Hattori Botanical Laboratory* 56: 481-548.

Zhu R. L. & Long D. G. 2003. — Lejeuneaceae (Hepaticae) from several recent collections from the Himalaya. *Journal of the Hattori Botanical Laboratory* 93: 101-115.

Zhu R.-L. & So M.-L. 2001. — Epiphyllous liverworts of China. *Nova Hedwigia Beihefte* 121: 1-418.

Zhu R.-L., Shu L. & Bi X.-F. 2019. — *Mohamedia,* a new genus of Lejeuneaceae: Marchantiophyta) from Oceania and tropical Asia. *The Bryologist* 122: 84-97. https://doi.org/10.1639/0007-2745-122.1.084

Zhu R.-L., Shu L., Mustapeng A. M. & Suleiman M. 2017. — *Thiersianthus* (Marchantiophyta: Lejeuneaceae), a new genus from lowland rainforests in Borneo. *The Bryologist* 120: 51-520. https://doi.org/10.1639/0007-2745-120.4.511

Submitted on 18 August 2018;
accepted on 1 July 2020;
published on 24 July 2020.