PRESENT STATUS OF *COLOLEJEUNEA* SUBGENUS *COLOLEJEUNEA* IN INDIA

GEETA SRIVASTAVA & S. C. SRIVASTAVA

Department of Botany, University of Lucknow, Lucknow 226 007, India

Abstract

The genus *Cololejeunea* subgenus *Cololejeunea* was earlier known to the Indian Bryoflora by two older names : *C. hispidissima* (Steph.) Herzog (now *C. baskarliana*) (Gott.) Benedix) and *C. indica* Pande & Misra (now *C. spinosa* (Horik) Hatt.). Two more taxa, *C. mizutaniana* Udar & Srivastava from south India and *C. pseudoplagiophylla* Wu & Lou from eastern Himalaya have been added making a total of four species in India. Both the latter taxa are foliicolous, characterized by widely spreading leaves, backwardly directed lobules and the papillosity on the leaf-lobe cells. *C. pseudoplagiophylla*, a species earlier known from Tibet, is described as a new record from India and the taxonomic details of all the four taxa have been provided.

Introduction

The genus *Cololejeunea*, a member of subfamily Cololejeuneoideae, (Lejeuneaceae) was introduced by Spruce (1884-85) for a most delicate hepatic having a reduced type of axial anatomy (five cortical and one medullary cells in cross-section) and devoid of underleaves. For many years this genus was variously treated by different workers (Spruce, 1884-85; Schiffner, 189 -95; Evans, 1911; Stephani, 1912-17; Goebel, 1928; Zwickel, 193 ; Jones, 195 , 1953a, 1954).

Benedix (1953), first time recognized only one genus *Cololejeunea* and placed various equivalent genera of other workers under it at subgeneric level. He described following ten subgenera for Indomalayan *Cololejeunea*: *Aphanolejeunea* (Evans) Benedix, *Chalorolejeunea* Benedix, *Chlorolejeunea* Benedix, *Chondriolejeunea* Benedix. *Cryptolejeunea* Benedix, *Lasiolejeunea* Benedix, *Metalejeunea* Benedix, *Pedinolejeunea* Benedix, *Rhadinolejeunea* Benedix, and *Taeniolejeunea* (Zwickel) Benedix. Similarly Mizutani (1961) also recognized a single genus *Cololejeunea* and included the Japanese taxa under the following five subgenera : *Aphanolejeunea*, *Cololejeunea*, *Leptocolea*, *Pedinolejeunea* and *Taeniolejeunea*.

In recent years, it has been observed that *Cololejeunea* is abundantly distributed all over India occupying a wide range of habitat conditions and representing predominantly corticolous and foliicolous populations. The rupicolous and terricolous conditions are however, rare. The Indian taxa of this genus have been recognized under the following six subgenera : *Aphanolejeunea*, *Chlorolejeunea*, *Cololejeunea*, *Leptocolea*, *Pedinolejeunea* and *Taeniolejeunea* for the first time.

The genera *Cololejeunea* and *Leptocolea* were segregated on the basis of inflated and compressed perianth, respectively, but this character was not sufficient to segregate them as many species of *Leptocolea* have inflated perianth with distinct dorsal plica and many species of *Cololejeunea* have more or less compressed perianth failing the Spruce's and Schiffner's basis of segregation of these two genera (Jones, 1954). The subgenus *Cololejeunea* (following Mizutani, 1961) is now characterized by well-developed dorsal papillosity on the leaf-cells. Their shape and height may vary from taxon to taxon in being conical, papillose or spinose. Benedix (1953) described these types of plants under the subgenus *Lasiolejeunea* which was latter synonimised under the subgenus *Cololejeunea*

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by Mizutani (1961). The present paper provides the morpho-taxonomic details of the Indian species of subgenus *Cololejeunea*

Key to the subgenera of the genus *Cololejeunea* occurring in India.

1. Plants small, leaves distant..... *Aphanolejeunea.*

1. Plants large, leaves imbricate .....2.
   2. Leaf-lobe margin entire or bordered by specialized hyaline or linear-flexuose cells, dorsal bulge or ocelli always absent, lobule (usually) ligulate, hyaline papilla at the apex of the first tooth..... 3.
      3. Axis with massive stem anatomy (17 cortical and 6-8 medullary cells in cross-section)..... *Chlorolejeunea.*
      3. Axis with reduced stem anatomy 5-(11) cortical and 1-(2) medullary cells in cross-section) *Pedinolejeunea.*
   2. Leaf-lobe margin crenate, dentate or spinate, never bordered by specialized hyaline or linear-flexuose cells, dorsal bulge or ocelli often present, lobule never ligulate, hyaline papilla at the base of the first tooth..... ....4.
      4. Dorsal bulge rarely present, restricted to the margins of the leaf-lobes or to younger leaves only.... .....*Leptocolea.*
      4. Dorsal bulge always present, not restricted, present on all the leaves .....5.
         5. Cells thin walled, not trabaculate, ocelli absent, dorsal protrusions of the cells large, spinose or papillose.. *Cololejeunea.*
         5. Cells thick walled, trabaculate, ocelli usually present, dorsal bulge of the cells small, papillose .... *Taeniolejeunea.*

Systematic description

Subgenus *Cololejeunea* Spruce, *Trans. Proc. Bot. Soc. Edinburg*, **15** : 292, 1884).

Cololejeunea subgenus *Physocolea* (Spruce) Schiffn., in Engler & Prantl, *Nat Pfl. Fam.* **1, 3** : 122, 1895.

Physocolea (Spruce) Steph., *Spec. Hepat.* **5** : 863, 1916.

Cololejeunea subgenus *Pasiolejeunea* Benedix, *Feddes Repert.* **134** : 36, 1953.

Plants light green, appressed to the substratum. Stem pinnately branched; cross-section of the stem with 5-(9) cortical cells and 1-(2) medullary cells. Rhizoids grouped, hyaline. Leaves imbricate, widely-obliquely spreading; leaf-lobe ovate-oblong (triangular); margin entire, crenate or spinate due to the projecting cells: apex rounded or acute; leaf-cells thin walled, trigones present or absent; dorsal protrusions of the cells large, papillose-spinose and always present, hyaline cells and ocelli absent; leaf-lobule inflated, first tooth usually 2-celled, second tooth small, often indistinct, hyaline papilla at proximal base of the first tooth or at the base of tooth on inner surface. Gemmae may be present or absent, when present, discoid, with three mamillose cells. Usually monoecious, rarely dioecious. Male inflorescence terminal or intercalary; bracts inflated or similar to the vegetative leaves. Female inflorescence with one subfloral inovation. Perianth obovate, inflated, dorsally flat, lateral two plicae sharp, two ventral plicae united to form one rounded plica.

Type—*Lejeunea calcarea* Libert (=*Cololejeunea calcarea* (Libert) Schiffn.).

Key to the Indian species of the subgenus *Cololejeunea.*

1. Leaf-lobe margin spinate to crenate...2.
   2. Leaf-lobe triangular, not covering the stem, first tooth one celled, gemmae present.....*C. haskarliana.*
   2. Leaf-lobe ovate- oblong, covering the stem, first tooth 2-celled, gemmae absent.....*C. spinosa.*

1. Leaf-lobe margin entire ..... .3.
   3. Leaf-lobule completely attached to the postical leaf-lobe margin by its keel, papilosity present on all the cells of the leaf-lobe ...*C mizutaniana*
   3. Leaf-lobule not completely attached to the postical leaf-lobe margin by its keel, papillosity present on the median cells of the leaf-lobe only, absent on marginal cells of the leaf-

lobe .....*C. pseudoplagiophylla.*

1. *Cololejeunea haskarliana* (Gott.) Benedix (Text-fig. 1 : 1-12).

Cololejeunea haskarliana (Gott.) Benedix, *Feddes Repert.* **134** : 57, 1953.
Lejeunea haskarliana Gott., *Syn. Hep.* 346, 1844.
Lejeunea venusta Sde-Lac., *Syn. Hep. Jao.* 64, 1856.
Cololejeunea baueriana Schiffn. *Nam. Sol. Hep. Mass. Jav. Hedw.* 199, 1900.
Cololejeunea venusta (Sde-Lac.) Schiffn., *Nat. Pfl Fam.* 1/3, **I**, 122, 1895.
Physocolea venusta (Sde-Lac.) St., *Spec. Hep.* **V** : 907, 1916.
Leptocolea hispidissima St., *Spec. Hep.* **VI** : 423, 1923.
Physocolea hispidissima (St.) Herz., *Ann. Bryol.* **IV** : 94, 1931.

Plants light green, appressed to the substratum. Stem usually 1.8-1.9 mm long, 0.81 mm wide with leaves, branching rare, 0.04--0.05 mm across diameter with 5 cortical cells, 12×8-20×13 μm and one medullary cell, 15×10 μm. Rhizoids grouped, hyaline. Leaves loosely imbricate, widely-obliquely spreading; leaf-lobe ovate-triangular, 0.36-0.54 mm long, 0.23-0.40 mm wide; antical margin arched towards base, not crossing the stem, postical margin nearly straight; apex rounded, margin spinate due to projecting cells; marginal cells small, rectangular papillose, 8-16×8-12 μm; median cells polygonal, 20-28×16-21 μm, basal cells elongated, 32-49×12-16 μm; trigones present, intermediate nodular thickenings absent; dorsal protrusions of the cells papillose, 4-8 μm in diameter; leaf-lobule inflated, 0.16-0.21×0.10-0.12 mm, first and second both the teeth unicellular, hyaline papilla not distinct; keel broad and crenate; stylus absent. Gemmae discoid, 61×49 μm, 22-celled, with three mamillose cells. Dioecious. Male inflorescence terminal on main axis; bracts in 2-3 pairs, similar to vegetative leaves, with one antheridium per bract. Female inflorescence terminal on main axis with one subfloral innovation which is again floriferous; the lobe of female bract similar to leaf-lobe, 0.39-0.54 ×0.18-0.32 mm, margin crenate due to projecting cells; lobule of female bract 0.24-0.29×0.09-0.14 mm. Perianth not seen.

Type locality—Java; *Habitat* : Foliicolous; *Range*—Malacca, Sumatra, Java, Borneo, Celebes, Lingga Archipelago, Philippines, India (Karnataka, Tamil Nadu).

Specimen examined—LWU 6250/82, Locality : Agumbe (Karnataka) alt. ca. 791 m, Habitat : Foliicolous, Leg. : R. Udar & Party, September 28, 1982.

Cololejeunea haskarliana was earlier reported from Kudremukh as *C. hispidissima* by Pande and Misra (1943) on the basis of sterile plants. Now the fertile plants at younger stages also have been collected from Agumbe. The taxon is mainly characterised by triangular leaves with rounded apex, not covering the axis (Text-fig. 1 : 1, 2), spinate margin due to papillosity on leaf-lobe cells (Text-fig. 1 : 4-6), inflated lobules with unicellular first and second teeth (Text-fig. 1 : 9-11). Gemmae are discoid with three mamillose cells, frequently occuring on leaf-lobes as well as male and female bract-lobes (Text-fig. 1 : 1,2,12). The plants are dioecious. The male inflorescence is terminal. The male bracts are similar to vegetative leaves having single antheridium per bract (Text-fig. 1 : 2). The female plant is repeatedly floriferous having six pairs of bracts on same plant (Text-fig. 1 : 1). Perianth is lacking.

Regarding the status of *C. hispidissima* (treated here also as synonym of *C. haskarliana*), there is a controversy among diffetent workers as Benedix (1953) has transferred it under *C. haskarliana*. Mizutani (1961, p. 262) also recognized *C. haskarliana* as a genuine species with unicellular first and second teeth but on the other hand Tixier (1972) gave separate status to both the taxa; *C. hispidissima* with 2-celled first tooth and *C. haskarliana* with unicellular first and second teeth. He described two new varieties under *C. haskarliana*, *C. haskarliana* var. *luzonensis* and var. *thermarum*. However, the Indian plants described by

Text-figure 1. 1-12—*Cololejeunea haskarliana* (Gott.) Benedix **1.** A female plant; **2.** A male plant; **3.** Cross-section of axis; **4,5.** Leaves; **6.** Marginal leaf-cells; **7.** Median leaf-cells; **8.** Basal leaf-cells; **9-11.** Leaf-lobules showing teeth; **12.** A gemma.

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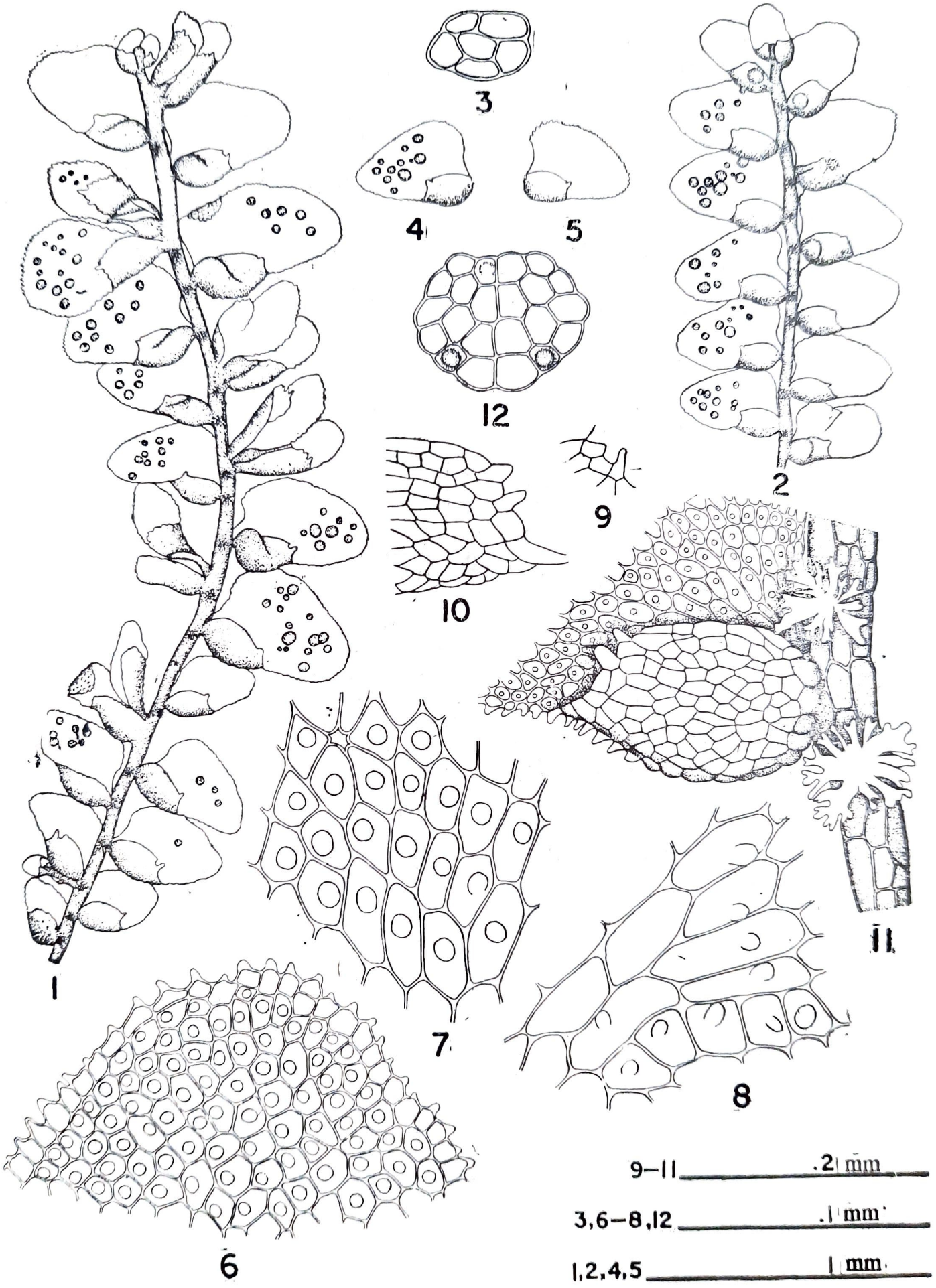

Text-figure 1

Pande and Misra (1943) as *C. hispidissima* from Kudremukh and Gersoppa Falls (Jog Falls) and those freshly collected and studied by the authors from Agumbe are totally assignable to *C. haskarliana*.

2. *Cololejeunea spinosa* (Horik.) Hatt. (Text-fig. 2 : 1-17).

Cololejeunea spinosa (Horik.) *Hatt.*, *Bull. Tokyo Sci. Mus.* **11** : 102, 1944.
Cololejeunea venusta auct. non (Sde-Lac.) Schiffn. : Evans, *Proc. Wash. Acad. Sci.* **8** : 146, 1906.
Physocolea spinosa Horik. *Jour. Sci. Hiroshima Univ. Ser.* b div. 2, **1** : 70,1931.
Cololejeunea indica Pande *et* Misra, *J. Indian bot. Soc.* **22** : 164, 1943.
C. haskarliana (Gott.) Benedix var. *spinosa* (Hoik.) Kodama, *J. Hattori Bot. Lab.* **17** : 66, 1956.

Plants whitish-yellowish green, appressed to the substratum. Stem usually 2-4 mm long, 0.5-1.0 mm wide with leaves, branching irregularly pinnate, 0.03-0.07 mm across diameter with 5-cortical cells, 11 × 14-25 × 21 μm and one medullary cell, 15 × 11 μm. Rhizoids grouped, hyaline. Leaves imbricate, widely spreading; leaf-lobe ovate, 0.27-0.54 mm long, 0.14-0.36 mm wide; antical margin arched towards the base and far beyond the farther edge of the stem, postical margin slightly arched; apex pointed; margin spinate-crenate due to the projecting cells; marginal cells small, 12-16 × 8-16 μm, median cells 16-29 × 16-21 μm; basal cells large, elongated 32-49 × 12-25 μm; trigones small, intermediate nodular thickenings absent; dorsal protrusions of the cells spinose-papillose, 8-21 μm in height; leaf-lobule inflated 0.08-0.16 × 0.04-0.10 mm, first tooth (1)-2-celled, hyaline papilla at proximal base of the tooth, second tooth small, single celled, often indistinct; keel broad, spinate to crenate; stylus (5-celled, uniseriate) rarely present. Gemmae not seen.

Type locality—Kogoshima (Japan). *Habitat*—Foliicolous *Range*—Japan, Ryu-kyu, India (Arunachal Pradesh, West Bengal).

Specimen examined—LWU 2511. *Locality*—Mungpoo; Darjeeling (West Bengal), alt. ca. 2000 m. Habitat : Foliicolous, Leg. : S. N. Das Gupta, LWU 6806/81, LWU 6817/81, Locality : E. Siang (Arunachal Pradesh), Habitat : Foliicolous, Leg. : D. K. Singh, January-February, 1981.

Mizutani (1961) treated *Cololejeunea indica* Pande & Misra (1943) described from Mungpoo, eastern Himalaya, India as a synonym of *C. spinosa*. This taxon has been recently collected from Arunachal Pradesh also. The population from Mungpoo is variable showing different types of growth patterns: (1) having less branched plants with somewhat elongated leaves, spinose dorsal protrusions and spinate keel (Text-fig. 2: 1-7), (2) having profusely branched plants with comparatively wider leaves, papillose dorsal protrusions and crenate keel(Text-fig. 2: 8-14). The plants collected from Arunachal Pradesh show the intermediate condition between two morphoforms of Mungpoo (Text-fig. 2: 15-17). These populations clearly indicate the graded morphological variations present in this taxon. It is mainly characterised by ovate-triangular leaves with acute apex and spinate margins. Lobule is inflated with 2-celled first tooth and crenate-spinate keel. Gemmae are not recorded in this taxon.

C. spinosa was earlier described as a variety of *C. haskarliana*, *C. haskarliana* var. *spinosa* by Kodama (1956) which was later raised to a specific rank (Mizutani, 1961) as *C. haskarliana* possesses unicellular first and second teeth and frequent gemmae, whereas *C. spinosa* has 2-celled first tooth and the gemmae are rather rare. The Indian plants of *C. haskarliana* and *C. spinosa* also exhibit similar differences.

3. *Cololejeunea mizutaniana* Udar *et* Srivastava (Text-fig. 3: 1-19).

Cololejeunea mizutaniana Udar *et* Srivastava, *Misc. Bryol. Lichenol.* **9**(7) : 137, 1983.

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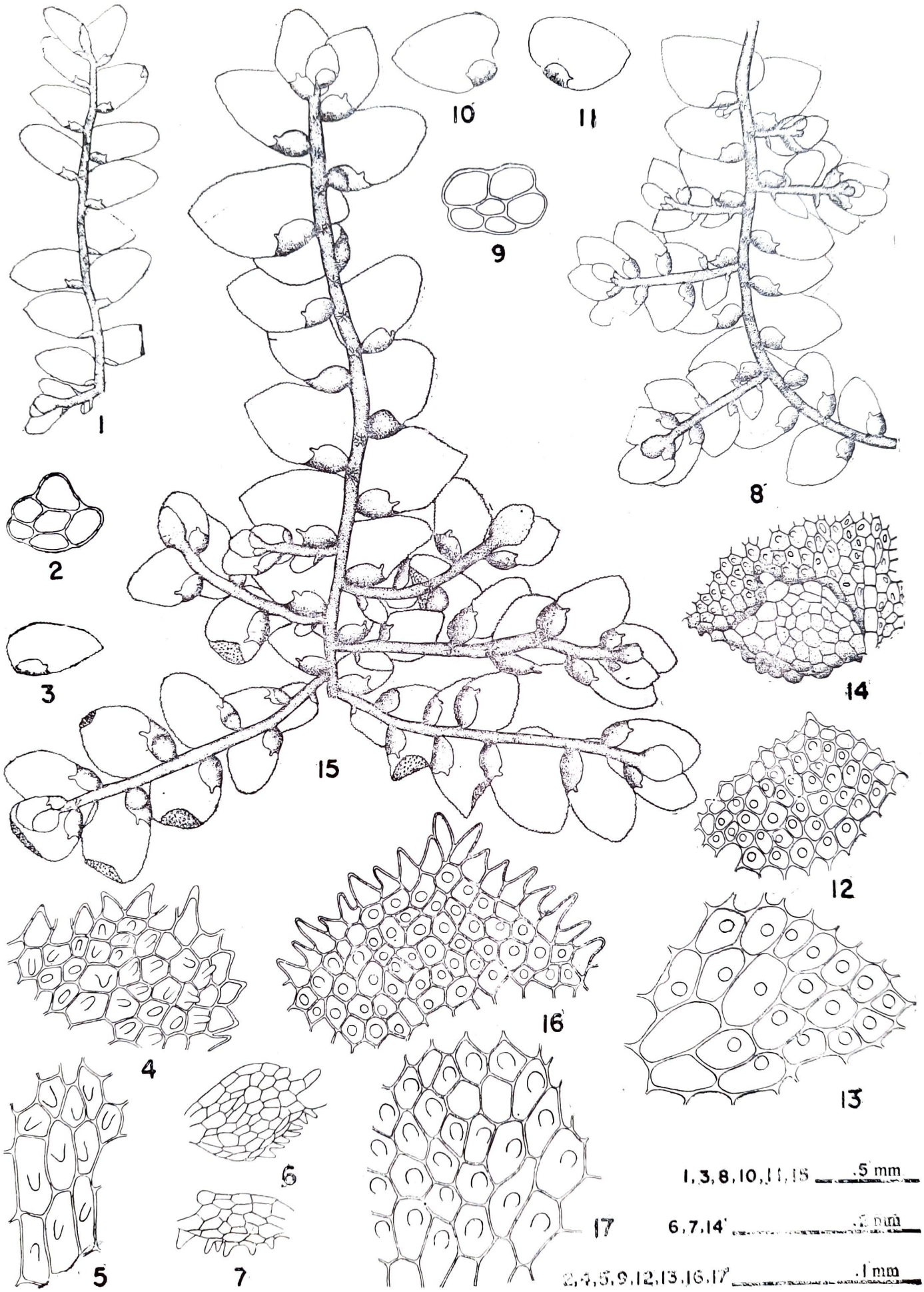
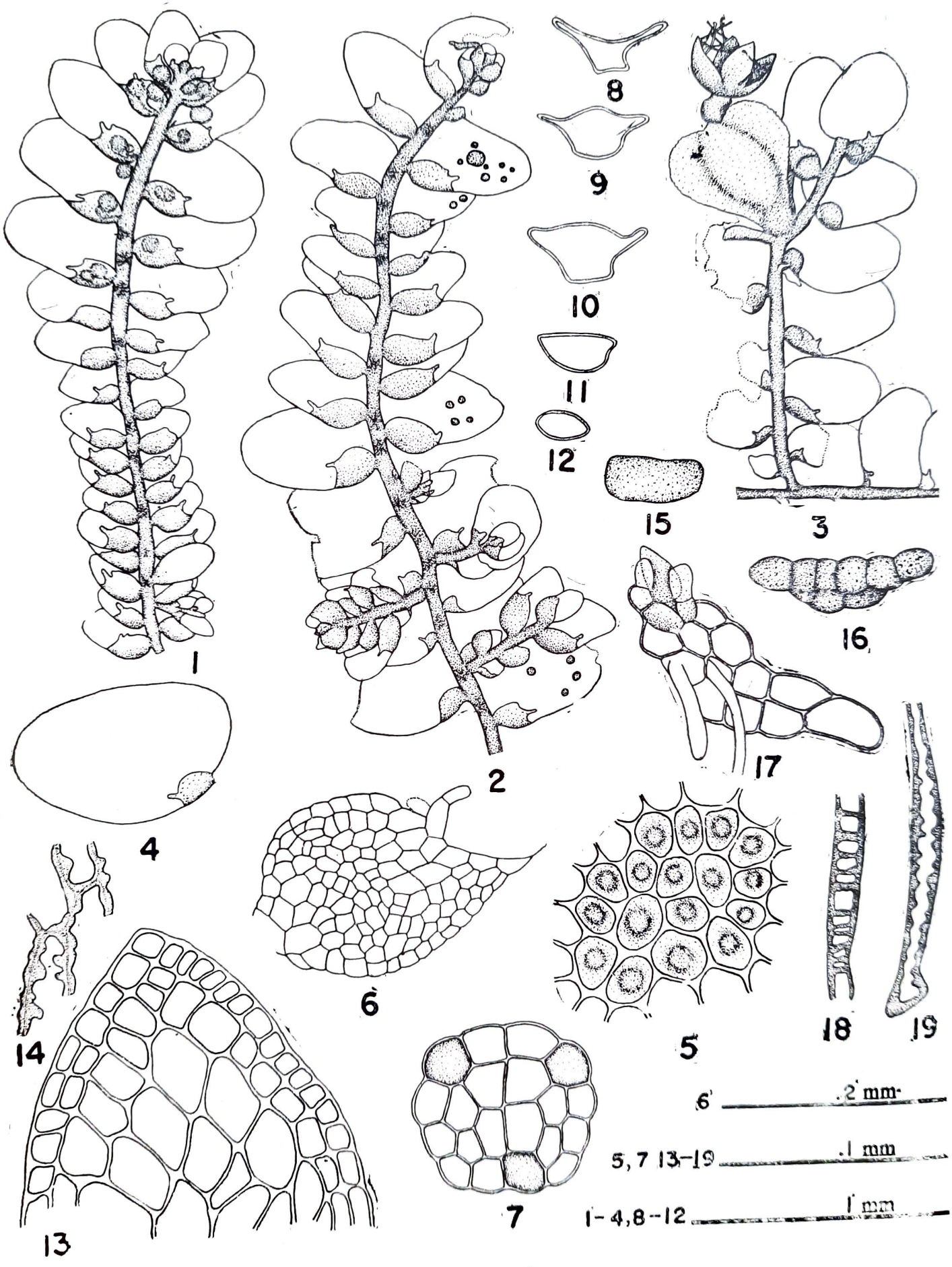
Text-figure 2 : 1-17—*Cololejeunea spinosa* (Horik.) Hatt. **1-14.** Plants from Mungpoo; **15-17.** Plants from Arunachal Pradesh. **1,8,15.** Plants from different populations; **2,9.** Cross-sections of axis; **3,10, 11.** Leaves; **4,12,16.** Marginal leaf-cells; **5,13,17.** Basal leaf-cells; **6,7,14.** Leaf-lobules.



Text-figure 2



Text-figure 3

Plants yellowish green, appressed to the substratum. Stem usually 2-9 mm long, 0.9-1.5 mm wide with leaves, branching pinnate, 0.05-0.07 mm across diameter with 5-6 cortical cells, 12×16-16×35 μm and 1-2 medullary cells, 12×16 μm; ventral cells of the cortex smaller than other cortical cells. Rhizoids grouped, hyaline. Leaves imbricate, widely-backwardly spreading; leaf-lobe ovate-oblong, 0.3-0.9 mm long, 0.2-0.5 mm wide; both antical and postical margin convex; apex rounded; margin entire; marginal cells small, squarish-rectangular, 6-14×6-10 μm; median cells ovate-polygonal, 17-29×17-20 μm; basal cells large, elongated 37-48×17-27 μm; trigones present, intermediate nodular thickening absent; dorsal protrusions of the cells spherical, 4-8 μm in diameter; oil-bodies 6-12 per cell, ovate-elongated 2-7×2-4 μm, finely segmented; leaf-lobule small, inflated, 0.12-0.21×0.09-0.16 mm, first tooth 2-celled, hyaline papilla at the proximal base of the tooth, second tooth small, single celled, often indistinct; keel broad and smooth; stylus absent. Gemmae discoid, 69×61-82×65 μm, 20-celled with three mamillose cells. Dioecious. Male inflorescence either on lateral branch or all allong the main axis; bracts in 4-17 pairs; similar to vegetative leaves or smaller, lobule large and much inflated, 1-2 antheridia per bract. Female inflorescence terminal with one subfloral innovation; the lobe of female bract smaller than leaf-lobe, 0.35×0.18 mm, margin entire, lobule of female bract 0.27×0.10 mm. Perianth obovate, inflated, 0.41-0.50×0.36-0.43 mm, margin crenate, dorsal plica indistinct, two lateral plicae sharp, two ventral plicae indistinct and united to form a broad rounded plica. Capsule spherical, dehiscing into four distinct valves; capsule wall hyaline two layered; cells of the outer layer 16×8-49×28 μm, cells of the inner layer 28×16 μm, thickening irregular. Spores irregularly elongated in shape, 28×16 μm; germinated spore 102×20 μm, with minute spines. Elaters few, hyaline, 143×12 μm, without or with faint annular and sinuate thickening.

Type locality—Jog Falls (India): *Habitat* : Foliicolous, *Range* : Recorded only from India.

Specimens examined—LWU 3775/40 (Holotype), Locality: Jog Falls (Karnataka) alt. ca. 600 m., Habitat: Foliicolous, Leg. : S. K. Pande, January 5, 1940, Det. : R. Udar & G. Srivastava. LWU 3761/40, LWU 3778/40, LWU 3782/40, Locality : Jog Falls (Karnataka) alt. ca. 600 m., Habitat : Folliicolous, Leg. : S. K. Pande, January 5, 1940, LWU 3877/50, LWU 3880/50, Locality: Agumbe (Karnataka) alt. ca. 791 m, Habitat: Foliicolous, Leg. : S. K. Pande, October 15, 1950, LWU 4787/81 Locality : Agumbe (Karnataka) alt. ca. 791 m., Habitat : Foliicolous, Leg. : D. Kumar, A. Kumar & U. S. Awasthi, May 4, 1981, LWU 6233/82, LWU 6241/82, LWU6245/82, LWU6246/82, LWU6247/82, LWU 6248/82, LWU 6249/82, LWU 6250/82, LWU 6251/82, LWU 6252/82, LWU6285/82, LWU6299/82, LWU6301/82, LWU 6302/82, LWU 6304/82, LWU 6521/82, LWU 6523/82, LWU 6529/82, LWU 6534/82, LWU 6535/82, Locality : Agumbe (Karnataka) alt. ca. 791 m. Habitat : Foliicolous, Leg. : R. Udar & Party, September 28, 1982.

Cololejeunea mizutaniana is recorded from India and was described through their sterile specimens mainly characterized by oblong leaves with backwardly directed lobules, two celled first tooth with basal hyaline papilla and papillosity on the leaf-lobe cells (Udar & Srivastava, 1983). Recently, fertile plants of the taxon have been collected from its known locality and complete details have been provided here. The taxon is dioecious. Male inflorescence either occur on short lateral branch with small bracts (Text-fig. 3 : 2), or it may present all along the axis with compactly arranged bracts which may be either smaller or identical to the vegetative leaves (Text-fig. 3 : 1). Antheridia are present in younger bracts which ensure their identity. Female inflorescence is present on lateral branch with one subfloral innovation. The perianth shows mature and dehisced sporophyte. Sporo-

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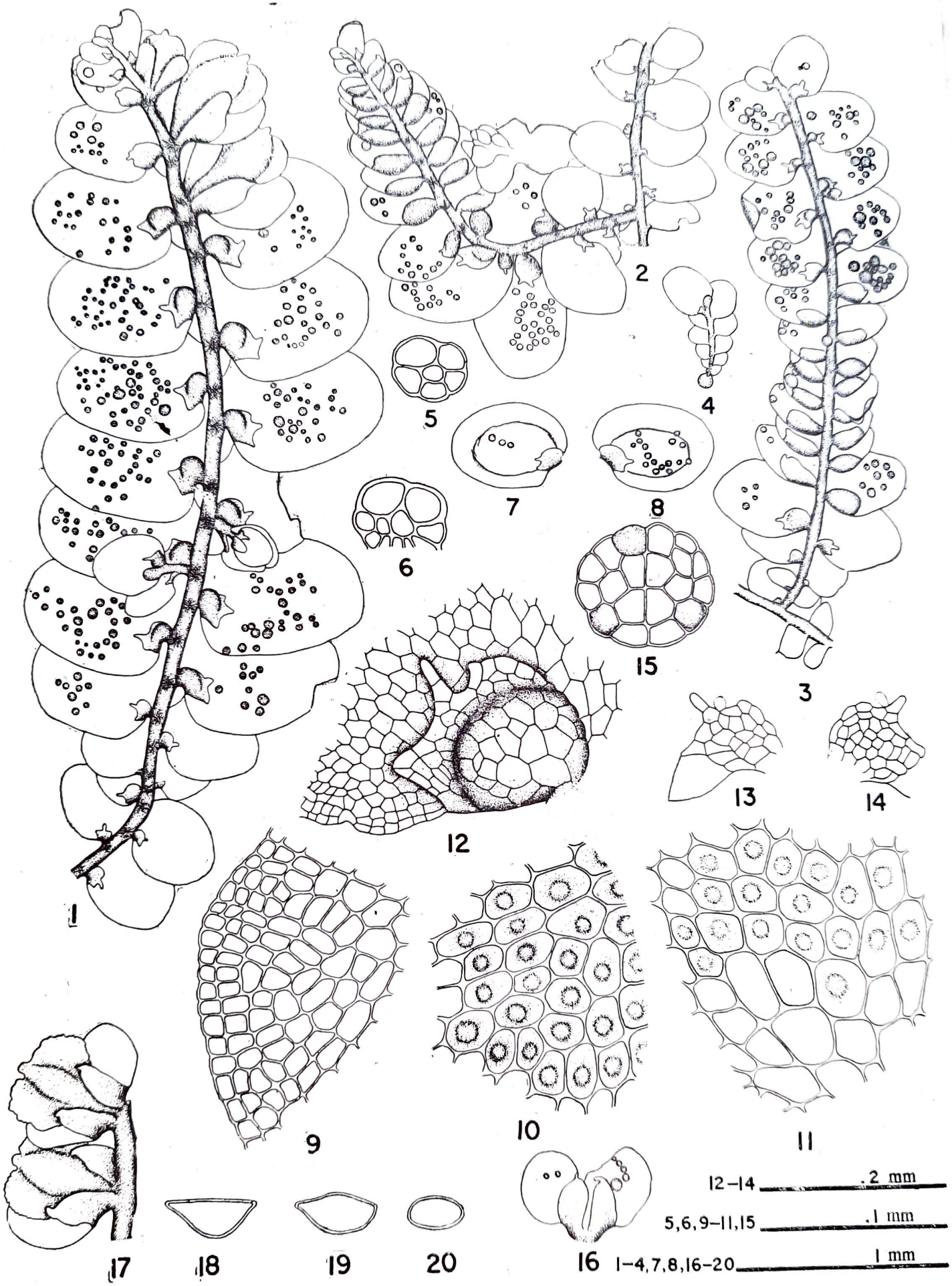
Text-figure 3 : 1-19—*Cololejeunea mizutaniana* Udar & Srivastava. **1,2.** Male plants; **3.** Female plant with dehisced capsule; **4.** A leaf; **5.** Leaf-cells; **6.** Leaf-lobule; **7.** A gemma; **8-12.** Cross-sections of perianth; **13.** Outer layer of capsule wall; **14.** Inner layer of capsule wall; **15.** Spore; **16,17.** Germinated spores; **18,19.** Elaters.



Text-figure 4

phytic details are typical *Cololejeunea* type. The capsule dehisces into four distinct valves and the capsule wall is two layered. Spore are irregularly elongated having a tendency of *in situ* germination. Elaters are few and attached to the capsule wall.

4. *Cololejeunea pseudoplagiophylla* Wu *et* Lou (Text-fig. 4: 1-20).

Cololejeunea pseudoplagiophylla Wu *et* Lou, *Acta Phyto. Tax. Sin.* **16:** 102-112, 1978.

Plants yellowish-green, appressed to the substratum. Stem usually 6 mm long, 1.6 mm wide with leaves, branching rare, 0.08 mm across diameter with 5-9 cortical cells, 8×7-25×18 μm and 1-2 medullary cells, 8×6-14×11 μm; ventral cells of the cortex smaller than other cortical cells. Rhizoids grouped, hyaline. Leaves imbricate, widely spreading; leaf-lobe oblong 0.75--0.81 mm long, 0.59-0.63 mm wide; both antical and postical margin arched; apex rounded; margin entire ;marginal cells small 8-16 × 8-12μm; median cells rectangular-polygonal, 16-24× 16-21 μm, basal cells elongated, 32-61 ×28-32 μm; trigones present, intermediate nodular thickenings absent; dorsal protrusions of the cells spherical, 4-8 μm in diameter; leaf-lobule inflated, 0.18-0.21 × 0.14-0.16 mm, first tooth 2-celled, hyaline papilla at the proximal base of tooth, second tooth small 1-(2) celled, often indistinct; keel short, distal portion of the lobule not attached to the postical margin of lobe, stylus absent. Gemmae discoid, 65 ×61 μm, 19-20 celled, with three mamillose cells, germinated gemmae also present. Monoecious. Male inflorescence on long lateral branch, terminal or intercalary, bracts 7-8 pairs, bracts similar to vegetative, leaves smaller with much inflated lobules, antheridia not seen. Female inflorescence terminal with one subfloral innovation which is again floriferous; the lobe of female bract smaller than leaf-lobe, 0.32-0.43 ×0.22-0.27 mm; lobule of female bract 0.24-0.35 ×0.10-0.14 mm. Perianth obovate, inflated, 0.45-0.49 ×0.39-0.40 mm, margin crenate, dorsal plica absent two lateral plicae sharp and winged, two ventral plicae united to form a broad rounded plica. Mature sporophyte not seen.

Type Locality—Tibet; *Habitat :* Foliicolous; *Rang :* Tibet, India (Arunachal Pradesh).

Specimens examined—LWU 6798/83, LWU 6799/83, LWU 6800/83, LWU 6801/83, LWU 6802/83, Locality : Shimar Forest (Yingkiyong), E. Siang (Arunachal Pradesh) alt. ca. 750 m., Habitat: Foliicolous, Leg. : D. K. Singh, January 7, 1983

Cololejeunea pseudoplagiophylla Wu *et* Lou was earlier known from Tibet (Wu & Lou, 1978) and is being reported here as a new record for India. This taxon grows as foliicolous population in Arunachal Pradesh. In overall appearance it shows similarity with *C. mizutaniana* but differs in leaf morphology and sexuality. *C. pseudoplagiophylla* has comparatively broader leaf-lobe and the papillosity is absent on marginal leaf-lobe cells. The distal portion of lobule is also not completely attached to the postical lobe margin (Text-figs. 4 : 12-14). The leaves frequently possess discoid gemmae with three mamillose cells and eventually young plant-lets produced from the germinated gemmae (Text-fig. 4 : 4) are of common occurrence.

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Text-figure 4 : 1-20—*Cololejeunea pseudoplagiophylla* Wu & Lou. **1.** A plant showing female inflorescence; **2,3.** Plants showing male inflorescence (terminal and intercalary); **4.** A young plantlet; **5,6.** Cross-sections of axis; **7,8.** Leaves; **9.** Marginal leaf-cells; **10.** Median leaf-cells; **11.** Basal leaf-cells; **12-14.** Leaf-lobules; **15.** A gemma; **16.** Female bracts; **17.** Perianths; **18-20.** Cross-sections of perianth.

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