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CHEILOLEJEUNEA OSUMIENSIS (MARCHANTIOPHYTA: LEJEUNEACEAE) – AN ADDITION TO THE INDIAN BRYOFLOTA FROM EASTERN HIMALAYA

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ABSTRACT

Cheilolejeunea osumiensis (S.Hatt.) Mizut., earlier known from China and Japan, has been described and illustrated for the first time in Indian bryoflora from Anjaw district of Arunachal Pradesh and South district of Sikkim.

Key words: Arunachal Pradesh, *Cheilolejeunea osumiensis*, India, New record, Sikkim

INTRODUCTION

The taxonomy of the genus *Cheilolejeunea* (Spruce) Schiffn. has received considerable attention in Indian bryoflora (Mitten, 1861; Herzog, 1939; Mizutani, 1963, 1964, 1967, 1972, 1980, 1982; Hattori, 1966; Udar & Awasthi, 1983; Asthana & al., 1995; Joshi, 2001; Asthana, 2007; Zhu & al., 2002; Manju & al., 2005; D.K. Singh & al., 2006; A.P. Singh & Nath, 2007; Dey & al., 2009; Daniels, 2010; Daniels & Mabel, 2010; D. Singh & al., 2010; Dey & D.K. Singh, 2012; Manju & al., 2012; D. Singh, 2012; S.K. Singh & Barbhuiya, 2012; Daniels & Kariyappa, 2013; Das & Sharma, 2013; Singh Deo & D.K. Singh, 2013). In the present state of our knowledge it is represented in the country by *C. birmensis* (Steph.) Mizut., *C. eximia* (Ast & Tixier) R.L. Zhu & M.L. So, *C. ghatensis* G. Asthana, S.C. Srivast. & A.K. Asthana, *C. incisa* (Gottsche) R.M. Schust. & Kachroo, *C. intertexta* (Lindenb.) Steph., *C. kitagawae* W. Ye & R.L. Zhu, *C. krakakammae* (Lindenb.) R.M. Schust., *C. laeviuscula* (Mitt.) Steph., *C. lindenberghii* (Gottsche) Mizut., *C. longiloba* (Steph. ex G. Hoffm.) Kachroo & R.M. Schust. ex J.J. Engel & B.C. Tan, *C. mariana* (Gottsche) B. Thiers & Gradst., *C. obtusifolia* (Steph.) S. Hatt., *C. orientalis* (Gottsche) Mizut., *C. pluriplicata* (Pearson) R.M. Schust., *C. serpentina* (Mitt.) Mizut., *C. subopaca* (Mitt.) Mizut., *C. trapezia* (Nees) Kachroo & R.M. Schust. ex Mizut., *C. trapezia* var. *ceylanica* (Gottsche) A.E.D. Daniels & K.C. Kariyappa, *C. trifaria* (Reinw., Blume & Nees) Mizut., *C. turgida* (Mitt.) W. Ye & R.L. Zhu, *C. udarii* G. Asthana, S.C. Srivast. & A.K. Asthana and *C. xanthocarpa* (Lehm. & Lindenb.) Malombe. Of these, *C. ghatensis*, *C. udarii* (Tamil Nadu) and *C. orientalis* (Madhya Pradesh) are endemic to the country; *C. eximia*, *C. incisa*, *C. kitagawae*, *C. lindenberghii*, *C. pluriplicata* and *C. turgida* are confined to Eastern Himalaya and the North-east India in Indian bryoflora; *C. birmensis*, *C. trapezia* var. *ceylanica* to the Western Ghats and *C. obtusifolia* is restricted to Andaman & Nicobar Islands only. Whereas, the rest are common between two or more bryogeographical regions of the country (Singh Deo & D.K. Singh, 2013).

The ongoing studies on the liverworts and hornworts of Arunachal Pradesh and Sikkim, in Eastern Himalaya, India, revealed the presence of *Cheilolejeunea osumiensis* (S.Hatt.) Mizut. – a species so far known only from China and Japan (Mizutani, 1982; So & Zhu, 1996; Zhu & So, 2001; Yamada & Iwatsuki, 2006). The same has been described and illustrated to facilitate its easy identification.

DESCRIPTION

Cheilolejeunea osumiensis (S.Hatt.) Mizut., Misc. Bryol. Lichénol. 8: 148. 1980. *Euosmolejeunea osumiensis* S.Hatt., Bull. Tokyo Sci. Mus. 11: 105. 1944. (Fig. 1, Pl. 1)

Plants yellowish green when fresh, yellowish in herbarium; shoot 5–15 mm long, 0.5–1.2 mm wide, branching irregular. Stem orbicular–suborbicular in outline in transverse section, 80.0–112.5 × 82.5–100.0 µm, 5–6 cells across the diameter; cortical cells in 7 (–8) vertical rows, rectangulate–polygonal, 12.5–22.5 × 17.5–40.0 µm, thick-walled; medullary cells in 8–12 vertical rows, subquadrate–rectangulate or polygonal,

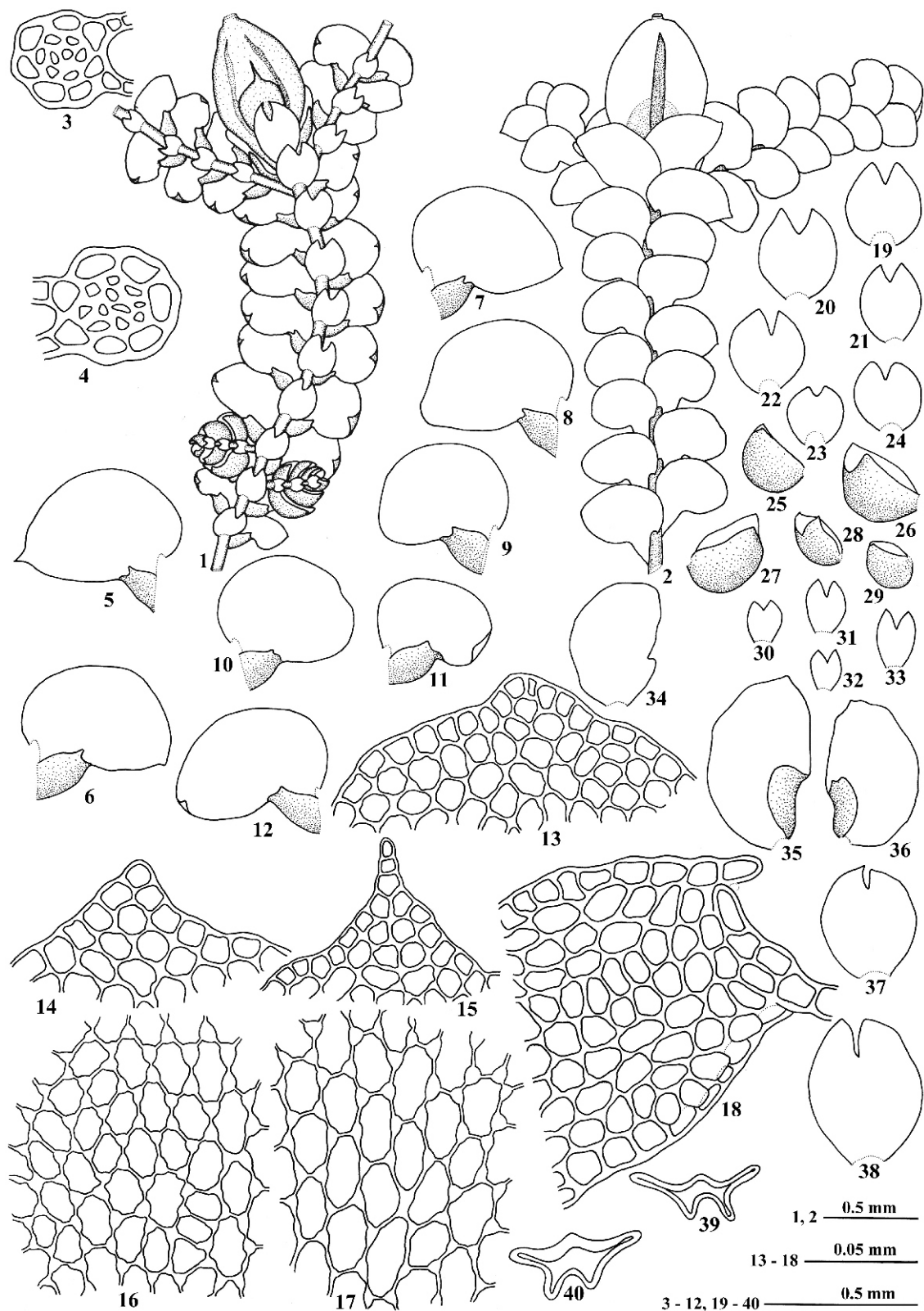


Fig. 1. : *Cheilolejeunea osumiensis* (S.Hatt.) Mizut., 1. A portion of the plant in ventral view showing androecial and gynoecial branches (rhizoids not drawn); 2. The portion of plant in dorsal view showing gynoecial branch; 3, 4. Transverse section of stem; 5-12. Leaves; 13-15. Apical leaf cells; 16. Median leaf cells; 17. Basal leaf cells; 18. A leaf lobule; 19-24. Underleaves; 25-29. Male bracts; 30-33. Male bracteoles; 34-36. Female bracts; 37, 38. Female bracteoles; 39, 40. Transverse sections of perianth (Figure 1 drawn from D. Singh 62449 B; others from D.K.Singh 20/1A).

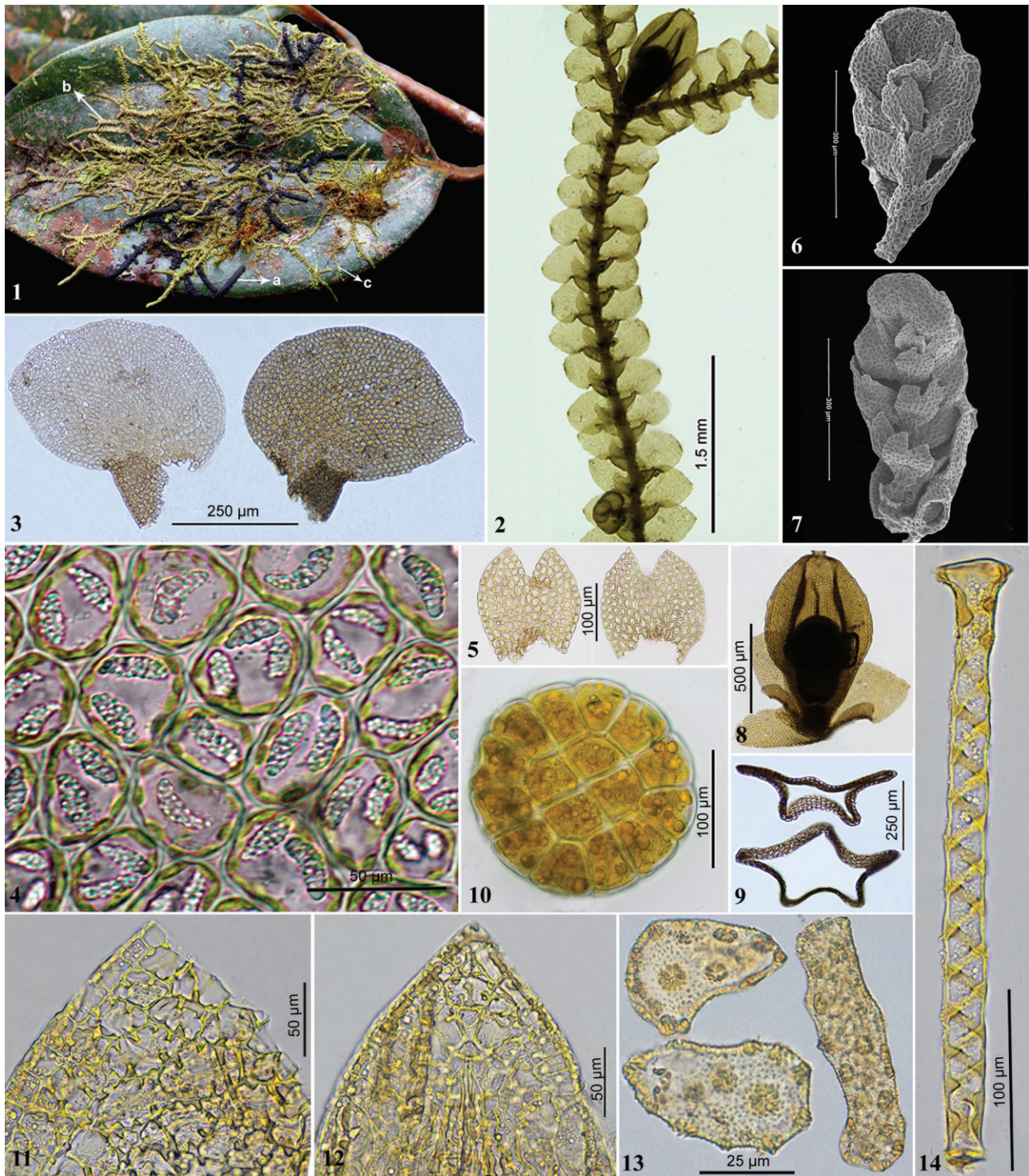


Plate-1. : *Cheilolejeunea osumiensis* (S.Hatt.) Mizut. **1.** Plants growing on *Cinnamomum* leaf (a: *L. nigricans*; b: *C. osumiensis*; c: *M. punctiformis*); **2.** A portion of plant in ventral view showing androecial and gynoecial branches; **3.** Leaves; **4.** Median leaf cells showing oil-bodies; **5.** Underleaves; **6, 7.** Androecial branches; **8.** A gynoecium; **9.** Transverse section of perianth; **10.** Transverse section of seta; **11.** Outer layer of capsule wall; **12.** Inner layer of capsule wall; **13.** Spores; **14.** An elater (micrograph 4 from D. Singh 62446B; 6, 7 from D.K. Singh 20/1A and others from D. Singh 62449B).

5.0–15.0 × 7.5–20.0 µm, thick-walled; ventral merophytes of stem 2 cells wide. Leaves imbricate, widely spreading; leaf lobe oblong-ovate, slightly falcate, 0.38–0.6 mm long, 0.28–0.45 mm wide, apex obtuse, acute–apiculate, mucronate, usually incurved, margin entire, dorsal margin strongly arched, ventral margin almost straight–very slightly arched; apical leaf cells subquadrate–polygonal, (3.0–) 5.0–15.0 × (5.0–) 6.0–17.5 µm; median leaf cells polygonal, 8.0–17.0 × 12.5–25.0 µm; basal leaf cells elongated, polygonal, 20.0–37.5 × 12.5–19.0 µm; cells thin-walled with minute–large, triangular bulging trigones, intermediate thickenings occasional, subnodulose in the basal leaf cells; cuticle smooth; ocelli and vita absent; oil-bodies grayish, 1–2 (–3) per leaf cell, usually oblong–ellipsoidal or sometimes 'cashew'-shaped, 8.5–13.5 × (10–) 15.0–30.0 µm, very coarsely segmented with irregular outline. Leaf lobule inflated, 1/4–1/3 as long as the leaf lobe, rectangulate–oblong-ovate, 0.12–0.18 mm long, 0.09–0.13 mm wide, bidentate; first tooth indistinct, second tooth more or less triangulate, 1 (–2) cells long; 1 (–2) cells wide at base; hyaline papilla present at the distal side of second tooth; keel slightly arched, smooth. Underleaves distant, sinuately inserted, 2–3 times as wide as the stem, suborbicular, 0.19–0.39 mm long, 0.18–0.26 mm wide, bilobed to 1/5–1/3 of their length, margin entire, sinus narrow–wide. Rhizoids numerous, fasciculate at the base of underleaves at the older portion of the shoot. Asexual reproductive bodies not seen.

Monoicous. Androecia terminal on long or short branches; bracts in 2–5 pairs, densely imbricate; bract lobe ovate–oblong-ovate, 0.17–0.32 mm long, 0.12–0.21 mm wide, apex acute–subacute or obtuse, margin entire; bract lobule strongly inflated, almost as long as the bract lobe; bracteoles 2–4, present throughout the androecia except when the bracts are in 5-series, suborbicular, 0.11–0.20 × 0.10–0.14 mm, bilobed to 1/4–1/3 of their length. Gynoecia terminal on long or short branches with 1–2 subfloral innovations, innovation leaf sequence lejeuneoid; bract lobe oblong-ovate, 0.45–0.62 mm long, 0.25–0.37 mm wide, apex subacute–acute or obtuse, margin entire; bract lobule oblong–linear, 1/3–2/3 as long as the bract lobe, apex subacute–obtuse; bracteole oblong-ovate, 0.36–0.45 mm long, 0.18–0.38 mm wide, bilobed to 1/7–1/4 of its length, margin entire. Perianth obovate, 0.73–1.1 mm long, 0.42–0.60 mm wide; keels 4–5 (2 lateral, 2 ventral, 0–1 dorsal), extending from apex to 1/2–2/3 of perianth length, sharp, surface smooth; beak 3–6 cells long. Seta orbicular in outline in transverse section, 180–200 µm in diameter with 12 outer cells surrounding 4 inner cells; capsule subglobose–globose, blackish brown, 0.26–0.32 × 0.22–0.30 mm, dehiscing into 4-valves; valves 0.40–0.44 mm long, 0.18–0.24 mm wide; capsule wall 2-layered, cells of outer layer subquadrate–polygonal, 20–45 × 20–35 µm with yellowish, sinuate nodular thickenings; those of inner layer subquadrate–polygonal 15.0–30.0 × 12.5–25.0 µm with yellowish irregular subnodular thickenings, both the surface of capsule wall with yellowish–hyaline minute papillae. Spores irregular in shape, oblong–ellipsoidal, 40–80 × 20–44 µm, minutely papillose, with 6–14 distinct rosettes; rosette 7.5–10.0 µm in diameter, composed of 6–9 triangular outgrowths, 1.6–2.2 × 1.2–1.6 µm in size. Elaters yellowish, 200–280 µm long, 10–15 µm wide, surface covered with yellowish–hyaline minute papillae, walls strongly sinuately thickened or with a faint spiral thickening band.

Habitat: Corticolous, growing in moist shady places in association with *Cephalozia hamatiloba* Steph. and *Scapania verrucosa* Heeg; epiphyllous, growing on the leaves of *Cinnamomum* sp. in moist and shady places in subtropical mixed forest in association with *Plagiochila sciophila* Nees ex Lindenb., *Radula tjibodensis* K.I.Goebel, *Cololejeunea truncatifolia* (Horik.) Mizut., *Lopholejeunea nigricans* (Lindenb.) Schiffn., *Microlejeunea punctiformis* (Taylor) Steph.

Distribution: INDIA [Eastern Himalaya (Arunachal Pradesh, Sikkim) – present study], CHINA, JAPAN (Mizutani, 1982; So & Zhu, 1996; Zhu & So, 2001; Yamada & Iwatsuki, 2006).

Specimens examined: India: Eastern Himalaya, Arunachal Pradesh, Anjaw district, on the way from Methumna to Metaliang, c. 1650 m, 10.10.1985, D.K. Singh 20/1A (ASSAM); Sikkim, South district, Maenam Wildlife Sanctuary, 27° 18' 42.5" N, 088° 21' 54.5" E, c. 2192 m, 12.12.2013, D. Singh 62446B, 62447B, 62449B (CAL)

DISCUSSION

Cheilolejeunea osumiensis is characterised by monoicous plants with highly variable leaf lobe apex (obtuse, mucronate, acute, apiculate, rounded), leaves slightly recurved ventrally (Figs. 1: 1, 5–12; Plate1: 2, 3); oil-

bodies grayish, 1–2 (-3) per leaf cell, usually oblong–ellipsoidal or sometimes 'cashew'-shaped, very coarsely segmented (Plate 1: 4); leaf lobule oblong-ovate with a small triangulate tooth (Fig. 1: 18); underleaves bilobed to 1/5–1/3 of their length (Figs. 1: 19–24; Plate 1: 5); male bracteoles 2–4, present throughout the androecium, except when the bracts present in 5-series (Fig. 1: 1; Plate 1: 6,7) and perianth with 4–5 sharp keels (Figs. 1: 39, 40; Plate 1: 9). The plants from Arunachal Pradesh were collected from the bark of the trees, whereas those from Sikkim were found growing as epiphylls.

The discovery of *C. osumiensis*, hitherto known only from China and Japan, in Indian bryoflora extends its range of distribution further westwards. The species shows some variation in the leaf surface topography, cell wall thickenings of the leaf lobe, shape and size of apical tooth of the leaf lobule and the number and shape of oil-bodies in the populations across its range of distribution. According to Mizutani (1982), the basal leaf cells in Japanese plants are completely devoid of intermediate thickenings, leaf surface is mammillose and the leaf-lobule has unicellular, more or less triangular, thin as well as thick-walled apical tooth. Earlier, Hattori (1944, 1951) described 1–3, elliptical–oblong and grape-cluster like oil-bodies per cell in this species (= *Euosmolejeunea osumiensis* S.Hatt.) from Japan. Whereas, in Chinese plants basal leaf cells show indistinct intermediate thickenings, the surface of the leaf is smooth or often slightly mammillose, the leaf cells usually have 1 (-3), 'cashew'-shaped, grape-cluster like oil-body and the leaf-lobule has 1(-2)-celled, angular, thin-walled apical tooth (So & Zhu, 1996; Zhu & So, 2001). The Indian plants of *C. osumiensis* having leaf cells with occasional intermediate thickenings and 1–2 (-3), elliptical–oblong to 'cashew'-shaped, grape-cluster like oil-bodies, smooth leaf surface and the leaf lobule with 1(-2) cells long, triangulate, thin-walled apical tooth, combine these features of both the Chinese as well Japanese populations of the species.

Mizutani (1982) reported 2–3-paired male bracts with the bracteoles present throughout the androecium in *C. osumiensis*, whereas So and Zhu (1996) and Zhu and So (2001) reported (2) 4–5 (-9) and 2–9 pairs of male bracts respectively with as many number of bracteoles. The androecia in Indian plants examined by us exhibit only 2–5 pairs of bracts and 2–4 bracteoles. But, the Indian populations of the species are interesting in the sense that, while the androecia with up to four pairs of bracts always have bracteoles present throughout, those with 5-paired bracts have only four bracteoles. As the two different conditions of frequency of male bracteoles are seen on the same plant, our plants are clearly referable to *C. osumiensis* in view of its overall taxonomic parameters.

C. osumiensis closely resembles *C. krakammae* (Lindenb.) R.M.Schust. [= *C. khasiana* (Mitt.) N.Kitag.] in both being autoicous and the shape and size of leaves and underleaves. However, *C. osumiensis* can be easily distinguished from the latter which has stem comprising 15–18 medullary cells (as compared to 8–12 cells in the former); 0–2 male bracteoles present only at the base of androecium (throughout or up to 4 in the former), and the perianth without or with 2–4 obtuse keels (as against 4–5 sharp keels in the former) (see also Mizutani, 1982; So & Zhu, 1996; Zhu & So, 2001).

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काइलोलैज्युनिया ओसुमिएंसिस (मार्कैशियोफाइटा: लिज्युनिएसी)-

पूर्वी हिमालय से भारतीय हरितोद्भिद में नया अभिलेख

डी.के. सिंह, शुभदीप मजूमदार एवं देवेन्द्र सिंह

सार सारांश

अभी तक चीन व जापान से ज्ञात काइलोलैज्युनिया ओसुमिएंसिस (एस.हट्ट.) मिजुत. का प्रथम बार भारतीय हरितोद्भिद में अरुणाचल प्रदेश के अंजाव जनपद तथा सिक्किम के दक्षिणी जनपद से वर्णन एवं चित्रण किया गया है।