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# *Caudalejeunea tridentata*, a remarkable new species of Lejeuneaceae (Marchantiophyta) from China

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**ABSTRACT.** A new species, *Caudalejeunea tridentata* (Lejeuneaceae) from Southwestern China, is described and illustrated. It differs from other *Caudalejeunea* species mainly in its bulging trigones and compound oil bodies. A key to Asian species of *Caudalejeunea* is provided.

**KEYWORDS.** Asia, epiphyllous liverworts, Guangxi, Hepaticae.



*Caudalejeunea*, a pantropical genus of Ptychanthoideae (Lejeuneaceae), was established by Schiffner (1893). At present it contains 12 species in the world, nine of which are known only from tropical Africa (Wigginton 2009). In Asia numerous species of the genus were described, but only three species: *C. cristiloba* (Steph.) Gradst., *C. recurvistipula* (Gottsche) Schiffn. and *C. reniloba* (Gottsche) Steph., were accepted by Mizutani (1988). Zhu and So (2001) treated *C. reniloba* and *C. recurvistipula* as conspecific (as in Verdoorn 1934). Recently Dey and Singh (2009) reported the occurrence of the Afro-American *C. lehmanniana* (Gottsche) A.Evans, the type species of *Caudalejeunea*, in India. Therefore, *Caudalejeunea* is represented by three species in Asia. This genus is traditionally recognized by frequently epiphyllous habitats, *Lejeunea*-type branching, stem epidermis cells larger than medullary cells, homogeneous oil bodies, cordate trigones, underleaves often with retuse apex, absence of innovations, perianth with 3–5 sharp keels, and discoid gemmae produced on the apex of specialized branches or also on dorsal leaf surfaces of ordinary

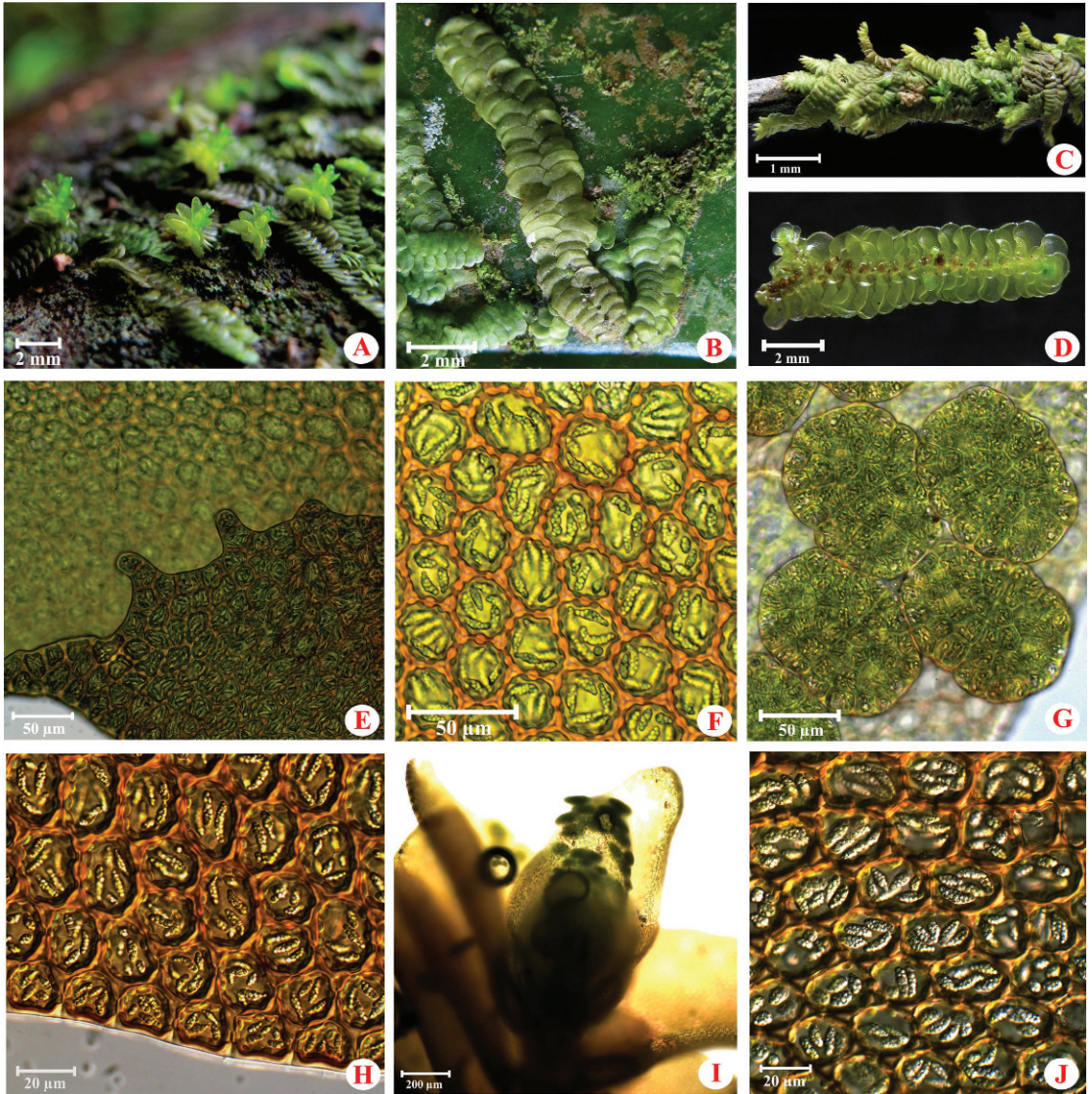
leafy shoots (Gradstein 1994; Thiers & Gradstein 1989; Zhu & So 2001). The unique feature of the genus, by which it differs from all other genera of Ptychanthoideae, is the capacity of most species to reproduce asexually by means of discoid gemmae (Gradstein 1994). During the course of studies on the Asian liverworts, we came across a very interesting species of *Caudalejeunea* from Southwestern China with rather robust stems having ventral merophytes 5–8 cells wide, three teeth at apical margin of the leaf lobule, leaf cells with bulging (not cordate) trigones and segmented oil bodies, and erect, gemmiparous branches. This remarkable plant differs from all hitherto known species of *Caudalejeunea* in having compound oil bodies and bulging trigones. It is here described and illustrated as a species new to science.

***Caudalejeunea tridentata*** R.L.Zhu, Y.M.Wei & Q.He, *sp. nov.* **Figs. 1–2**

*Caudalejeunea lehmanniana* (Gottsche) A.Evans *similis*, *sed differt* 1) *trigonis protuberantibus (non cordatis)*, 2) *corporibus oleosis segmentatis (non homogeneis)* et 3) *foliis apice rotundatis (non obtusis)*.

TYPE. CHINA. GUANGXI: Shangsi Co., Shiwandashan National Forest Park, between Sanchahe and Zhujiangyuan, 21°53'695" N, 107°54'459" E, on

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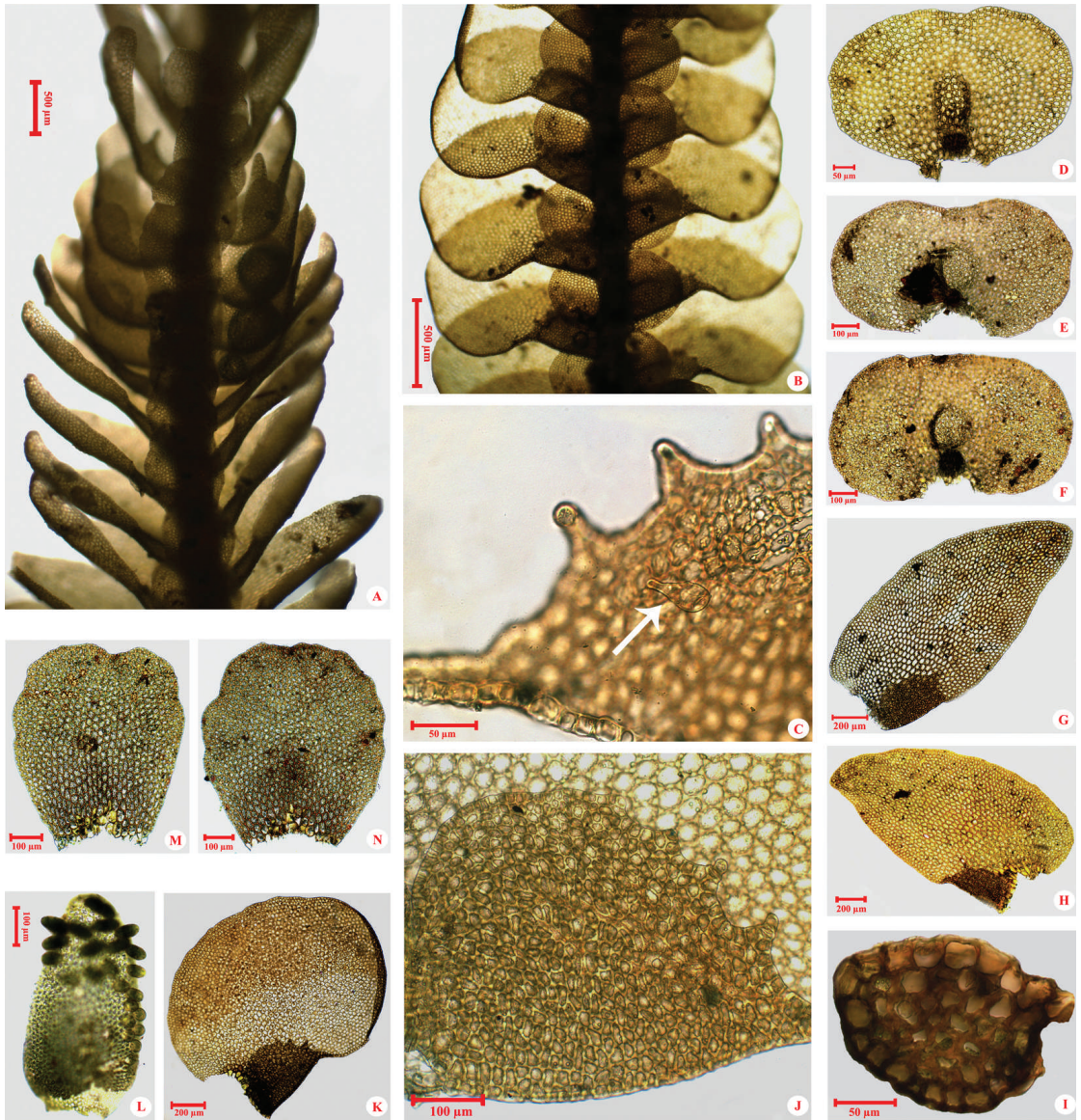


**Figure 1.** *Caudalejeunea tridentata*. A. Plants on tree base, showing erect, gemmiparous branches (in the type locality). B. Plants on living leaves. C. Plants on tree branches, showing erect, somewhat circinate, gemmiparous branches. D. Portion of plant, ventral view. E. Lobular apex showing three teeth. F. Median cells of leaf lobe, showing segmented oil bodies and bulging trigones. G. Discoid gemmae on dorsal surface of leaf lobe. H. Marginal cells of leaf lobe. I. Apex of gemmiparous branches, dorsal view. J. Basal cells of leaf lobe showing oil bodies and trigones. A, E–J from R.-L. Zhu et al. 20100822-3A (holotype), B and D from R.-L. Zhu et al. 20100822-41B, C from R.-L. Zhu et al. 20100822-52B.

tree base of *Mytilaria laosensis* Lec., 350 m, 22 August 2010, Rui-Liang Zhu, Yu-Mei Wei & Qiong He 20100822-3A (holotype: HSN!).

**Description.** Dioicous? (female plants not seen). Plants green to yellowish green, becoming pale yellowish when dry, with dimorphic branches, the branches either plane or erect, somewhat circinate and gemmiparous;

flagelliform branches absent. Plane shoots up to 35 mm long, (1.5–) 1.6–2.4 (–2.5) mm wide, irregularly branched, branching of the *Lejeunea*-type. Stems 140–190 μm in diameter, transverse section consisting of 17–22 cortical cells (21–36 × 11–17 μm) and 17–30 medullary cells (24–30 × 11–16 μm), ventral merophytes 5–8 cells wide. Rhizoids numerous, fasciculate, hyaline to slightly brown, at base of the underleaf, rhizoid-initial



**Figure 2.** *Caudalejeunea tridentata*. A. Portion of male plant, ventral view. B. Portion of sterile plant, ventral view. C. Apex of leaf lobule, showing a hyaline papilla (arrow), inner surface. D–F. Underleaves on plane branch. G, H. Leaves on gemmiparous branch, ventral view. I. Transverse section of stem. J. Leaf lobule showing four teeth. K. Leaf on plane branches, ventral view. L. Gemmiparous leaf showing discoid gemmae, dorsal view. M, N. Underleaves on gemmiparous branches. H–J from Y.-M. Wei 20100211-31A; the others from R.L. Zhu et al. 20100822-3A (holotype).

discs usually present when epiphyllous. Leaves imbricate, spreading from stem at an angle of  $45\text{--}80^\circ$ . Leaf lobe ovate,  $\pm$  falcate, 0.9–1.4 mm long, 0.8–1.3 mm wide, margin entire, apical margin usually strongly incurved, dorsal margin usually plane, arched, apex rounded. Lobe cells thin to moderately thick-walled, trigones large, usually bulging (non cordate), intermediate thickenings pronounced, nodulose, usually 1 per cell wall, marginal

cells quadrate to rectangular,  $15\text{--}25 \times 11\text{--}15 \mu\text{m}$ , median cells usually hexagonal, and slightly longer than wide,  $26\text{--}35 \times 20\text{--}28 \mu\text{m}$ , basal cells slightly larger than median cells,  $26\text{--}46 \times 25\text{--}29 \mu\text{m}$ . Cuticle smooth. Oil bodies 3–10 per median cell of leaf lobe, of the compound type, fusiform, ovoid, spherical or narrowly oblong, grayish, very coarsely segmented, knobably on surface,  $7.1\text{--}18.2 \times 3.0\text{--}5.5 \mu\text{m}$ , granules  $1.5\text{--}3.8 \mu\text{m}$  in

diameter. Ocelli and vitta absent. Leaf lobule ovate, slightly inflated, ca. 1/3 as long as the lobe, keel nearly straight to slightly arched, smooth, free margin plane, with (2-)3(-4) teeth, first tooth (distal tooth) 2-3 cells long, (1-)2-3 cells wide at base, second tooth 1-2 cells long and 1-2 cells wide at base, other teeth (if present) unicellular, hyaline papilla large, long pyriform, 46-50 × 18-22 μm, on the inner surface of proximal side of first tooth base. Underleaves imbricate, sinuately inserted to stem, almost orbicular to transversely oblong, sometimes reniform, 0.40-0.52 mm long, 0.65-0.88 mm wide, 3.5-5 times as wide as stem, apex rounded, truncate or retuse, apical margin plane or recurved. Erect, gemmiparous branches short, 2-4 mm long, 1.8-3.0 mm wide with leaves, more or less circinate. Leaves of gemmiparous branches imbricate, spreading from stem at an angle of 30-45°. Leaf lobe ligulate, strongly cucullate, 1.4-1.6 mm long, 0.7-0.8 mm wide, margin entire, ventral and apical margin mostly strongly incurved, dorsal margin usually plane, apex rounded-obtuse. Leaf lobule oblong to oblong-ovate, ca. 1/4 as long as leaf lobe, apex truncate to oblique, usually with 1-2 teeth, first tooth 1-2(-3) cells long, 1-2 (-3) cells wide at base, second tooth unicellular, usually obsolete. Underleaves of gemmiparous branches imbricate, oblong, ca. 3-4 times as wide as stem, 0.63-0.85 mm long, 0.50-0.75 mm wide, usually longer than wide, apex irregularly waved. Gemmae discoid, 28-46-celled, 5-8(-9) cells or (50-) 70-160 μm in diameter, on dorsal surface or basal dorsal margin of the leaf lobe near the apex of erect, gemmiparous shoots, adhesive cells not seen. Androecia on short branches, intercalary, with an apical gemmiparous branch, bracts in 3-4 pairs, imbricate, hypostatic, obliquely or erectly spreading, shallowly bilobed, bract lobe 0.7-0.9 mm long, 0.35-0.45 mm wide, bract lobule ovate, 1/2-3/4 as long as the bract lobe, and narrower than the bract lobe, apex obtuse, keel strongly arched, bracteoles 3-4, similar to underleaves in shape and size, borne throughout the male shoot. Gynoecia not seen.

**Ecology and distribution.** *Caudalejeunea tridentata* grows on tree trunks, tree bases and tree branches, sometimes on living leaves in relatively open forests at low altitudes (290-380 m), usually in association with *Cheilolejeunea trapezia* (Nees) Kachroo & R.M.Schust., *Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn., *Radula* sp.,

*Spruceanthus semirepandus* (Nees) Verd., and *Tuyamaella molischii* (Schiffn.) S.Hatt. It is a rare species, and known only from Shiwandashan National Forest Park, Guangxi, China.

**Additional specimens examined (all in HSNU).**

CHINA. GUANGXI: Shiwandashan National Forest Park, 21°53'689" N, 107°54'384" E, R.-L. Zhu, Y.-M. Wei & Q. He 20100822-41B; 21°53'695" N, 107°54'463" E, Y.-M. Wei 20100211-35A; 21°53'695" N, 107°54'459" E, Y.-M. Wei 20100211-31A; 21°53'779" N, 107°54'318" E, R.-L. Zhu, Y.-M. Wei & Q. He 20100822-52B; 21°53'747" N, 107°54'359" E, Y.-M. Wei 20110214-25.

**Taxonomic notes and key.** Although the fertile plants of the present new species are not known, the presence of erect, somewhat circinate, gemmiparous branches strongly supports its position in *Caudalejeunea* (Figs. 1A, C). In appearance *Caudalejeunea tridentata* is similar to *Spruceanthus* spp. (e.g., *S. polymorphus* (Sande Lac.) Verd. and *S. semirepandus*) widely distributed in tropical Asia, but the latter are immediately distinguished by the homogeneous oil bodies, absence of discoid gemmae, and usual presence of flagelliform branches. *Caudalejeunea tridentata* is the only species of *Caudalejeunea*, which bears segmented oil bodies and bulging trigones (Figs. 1F, J). In the plane free margin of the leaf lobule, presence of discoid gemmae on leaves near the apex of gemmiparous branches, entire leaf lobes, and orbicular to transversely oblong underleaves with a rounded, truncate or retuse apex, *C. tridentata* appears to be most similar to *C. lehmanniana*. The latter, however, is separated by the obtuse apex of the leaf, cordate trigones, homogeneous oil bodies, leaf lobule with only two teeth, and ventral merophyte only 4 cells wide (5-8 cells wide in *C. tridentata*) (Gradstein 1994).

Although we searched for female plants during different seasons in the type locality and adjacent areas, unfortunately only a few plants with androecia were seen. The lack of gynoecia and rare occurrence of male plants may imply that this species reproduces mainly vegetatively by means of vegetative gemmae. The androecia seen are all on gemmiparous branches (Fig. 2A). This character rarely occurs in other species of *Caudalejeunea*.

There are currently four known species of *Caudalejeunea* in Asia. They can be keyed out below.

**Key to species of *Caudalejeunea* in Asia**

1. Free margin of leaf lobule nearly plane ..... 2
  2. Apex of leaf on non-gemmiparous branches rounded, leaf lobule with 3 teeth, oil bodies compound, trigones bulging; known only from China ..... *C. tridentata*
  2. Apex of leaf on non-gemmiparous branches obtuse or rarely rounded-obtuse, leaf lobule usually with 2 teeth, oil bodies homogeneous, trigones cordate; known from India (Arunachal Pradesh), tropical Africa and America ..... *C. lehmanniana*
1. Free margin of leaf lobule strongly involute ..... 3
  3. Leaf lobule with over 10 teeth and with (1–)2 sacs; known from tropical Asia and Oceania ... *C. cristiloba*
  3. Leaf lobule with 2–4(–5) teeth, without sacs; known from tropical Africa and Asia, Australasia and Oceania ..... *C. reniloba* (older name than *C. recurvistipula*)

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