

Additions of Lejeuneaceae taxa to the hepatic flora of Yunnan, China

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The present study reports 31 species new to Yunnan, including ten new to China: *Acrolejeunea recurvata* Gradst., *Cheilolejeunea ventricosa* (Schiffn.) X.-L. He, *C. vittata* (G. Hoffm.) R. M. Schust. & Kachroo, *Cololejeunea serrulata* Steph., *C. yakusimensis* (S. Hatt.) Mizut., *Lejeunea alata* Gottsche, *L. infestans* (Steph.) Mizut., *L. neelgherriana* Gottsche, *L. obscura* Mitt., and *L. stevensiana* (Steph.) Mizut. Male plants and perianths of *L. subacuta* Mitt. are reported and illustrated for the first time. *Lejeunea cocoes* Mitt. and *Lejeunea tuberculosa* Steph. are newly reported for Papua New Guinea and Indonesia, respectively.

Key words: *Acrolejeunea*, *Cheilolejeunea*, China, *Cololejeunea*, epiphyllous liverworts, Hepaticae, *Lejeunea*, new records, Lejeuneaceae, Yunnan

INTRODUCTION

Yunnan, covering an area of 394 000 km², is situated in southwestern China (21°08'–29°15'N, 97°31'–106°12'E). Owing to its very complex, diverse topography, peculiar geographic position, and a very broad altitudinal range between Meiliushan (6 740 m) and Hekou (76.4 m), the province is reputed as a plant paradise where about 50% of Chinese seed plants occur (Yunnan Institute of Botany 1977). Since the French missionary P. J. M. Delavay collected bryophytes in Yun-

nan in 1882, the rich flora has attracted a number of bryologists to visit the province. Piippo (1990, 1992) listed 47 species of Lejeuneaceae for Yunnan. Zhu and Hu (1993) added 12 more species to the province. Recently, Piippo *et al.* (1998) studied the collections of hepatics from the joint Finnish-Chinese and Chinese-American expeditions to Yunnan, and provided an updated checklist of hepatics of the province, giving 67 species of Lejeuneaceae. Zhu and So (1998a, 1999a, 1999b, 1999c) further added 5 more species of Lejeuneaceae to the province. The present authors exam-

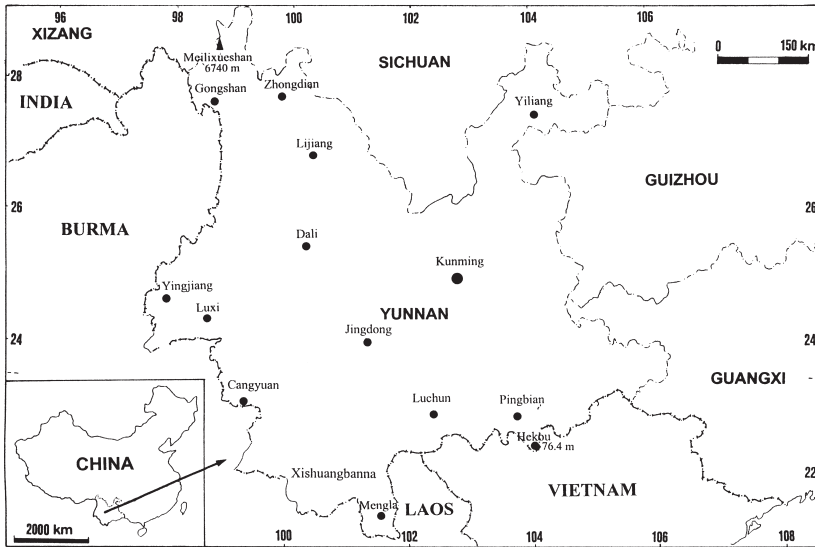


Fig. 1. Map of Yunnan showing the counties mentioned in this paper.

ined the partial collections of the family from Yunnan made by Q. Gao, D.-K. Li, X.-J. Li, Y.-G. Su, L.-S. Wang, M. Zang, S.-Y. Zheng, and R.-L. Zhu during the last 25 years. Our studies reveal that another 32 species and 2 genera can be added to the records from Yunnan, ten of which are new to China. This paper reports these additions, and provides taxonomic notes on several taxa.

ENUMERATION OF TAXA NEW TO YUNNAN

The taxa are arranged alphabetically by genus and species. For each species, representative specimens with the following data are included as far as possible: locality, habitat, altitude, date of collection, collector, and collection number. For localities and names of counties in the province, see Fig. 1.

Acrolejeunea recurvata Gradst.

Bryoph. Biblioth. 4: 79. 1975.

Illustrations: Gradstein 1975: pl. II (fig. 1); pl. XI.

This species was originally described by Gradstein (1975), based on material from Indo-China. Although the Yunnan material is sterile, it is readily recognized by its upright, usually barren flagellae.

Representative specimen examined. — **China.** Yunnan, Cangyuan Co., Xiaban, Laolongtoushan, 1982 S.-Y. Zheng 80-1934 (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: India, Laos, and Thailand (Gradstein 1975).

Aphanolejeunea grossepapillosa Horik.

J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 1: 92. 1932.

Illustration: Horikawa 1932: 92 (fig. 16).

Specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang (Du Long River), epiphyllous, 1 500 m, 1982 M. Zang 1621 (HSNU, KUN).

Range. As 2: China (Taiwan (Horikawa 1932), Yunnan); As 4: Papua New Guinea (Pócs *et al.* 1994).

Archilejeunea polymorpha (Sande Lac.) B. Thiers & Gradst.

Mem. New York Bot. Gard. 52: 10. 1989.

Illustrations (selected): Mizutani 1961: 166 (figs. 1–14 as *Spruceanthus polymorphus* (Sande Lac.) Verd.); Thiers & Gradstein 1989: 11 (fig. 2).

Representative specimen examined. — **China.** Yunnan, Hekou Co., Fengwuzhai, on tree trunk, 1974 M. Zang 4119 (HSNU ex IFP).

Additional specimens examined. — **China.** Guangxi, Shangsi Co., Hongqilinchang, 1974 Q. Gao 2121 (HSNU ex IFP); Hainan, Changjiang Co., Bawangling Nature Reserve, 1 070 m, on twigs, 1989 R.-L. Zhu 89461 (HSNU); Hong Kong, Pat Sin Leng, on tree trunk, 250 m, 1996 M. L.

So & M. C. Lee 96112A1 (HSNU).

Range. As 2: China (Hainan, Taiwan (Piippo 1990), new to Guangxi, Hong Kong, and Yunnan), and Japan (Furuki & Mizutani 1994); As 3: India (Mizutani 1961 as *Spruceanthus polymorphus*); As 4: Borneo, Java, Papua New Guinea, Philippines, Sumatra, and West Irian (Mizutani 1961 as *S. polymorphus*, Grolle & Piippo 1984); Oc: Hawaii, New Caledonia, Samoa, "Solomons", and Tahiti, (Mizutani 1961 as *S. polymorphus*, Grolle & Piippo 1984). Austral 1: Lord Howe Is., Norfolk Is., and northern Queensland (Thiers & Gradstein 1989).

Cheilolejeunea intertexta (Lindenb.) Steph.

Bull. Herb. Boiss. 5: 79. 1897.

Illustration (selected): Mizutani 1982: 171 (fig. 9).

Yunnan plants of *Cheilolejeunea intertexta* differ slightly from typical ones. Paroicous plants are very common, but autoicous plants can also be seen. The gynoecial innovation is rare (always pycnolejeuneoid if present). *Cheilolejeunea intertexta* is easily confused with *C. serpentina* (Mitt.) Mizut., however, the latter differs in having lejeuneoid gynoecial innovations. Yunnan plants of *Cheilolejeunea intertexta* are extremely similar to those of *C. paroica* Mizut., known from Borneo and Sulawesi (Mizutani 1979a). *Cheilolejeunea paroica*, however, usually bears large trigones, it rarely produces gynoecial innovations, if present, always lejeuneoid.

Representative specimen examined. — **China.** Yunnan, Pingbian Co., on tree trunk, associated with *Cheilolejeunea ventricosa* (Schiffn.) X.-L. He, 1974 *M. Zang 4352* (HSNU ex IFP, KUN-4149).

Range. Afr 2 (Wigginton & Grolle 1996); Afr 3 (Grolle 1995); As 2: China (Taiwan (Piippo 1990), Yunnan), Japan (Mizutani 1982); As 3: India (Asthana *et al.* 1995), Sri Lanka (Grolle 1979); As 4: Ambonia, Papua New Guinea, Philippines, and Sumatra (Grolle 1979); Oc: Marshall Is., Samoa, and Tahiti (Grolle 1979).

Cheilolejeunea trifaria (Reinw. *et al.*) Mizut.

J. Hattori Bot. Lab. 27: 132. 1964.

Illustrations (selected): Horikawa 1934: 270 (fig. 56 as *Euosmolejeunea latifolia* Horik.); Mizutani 1982: 169 (fig. 8).

Representative specimen examined. — **China.** Yunnan, Xishuangbanna, Shangyong, on tree bark, 1974 *X.-J. Li 2933* (HSNU ex IFP).

Range. Pantropical. In China this species has been known from Hainan and Hong Kong (So & Zhu 1996a, 1996b, Zhu & So 1996).

Cheilolejeunea ventricosa (Schiffn.) X.-L. He

Acta Bot. Fenn. 163: 60. 1999.

Illustrations: Mizutani 1967: 178 (fig. 5 as *Pycnolejeunea fitzgeraldii* Steph.); He 1995: 254 (fig. 2 as *Cheilolejeunea fitzgeraldii* (Steph) X.-L. He).

Hitherto the oil bodies of *Cheilolejeunea ventricosa* have not been known. They are 2–5 per leaf cell, spherical, elliptical or long oblong, coarsely segmented (*Calypogeia*-type, cf. Gradstein 1994), 6–20 × 2.2–5 mm in Hong Kong material

Representative specimens examined. — **China.** Yunnan, Pingbian Co, on tree trunk, 1974 *M. Zang 4352* (HSNU, IFP, KUN); Pingbian Co., Daweishan Nature Reserve, on tree trunk, 1 800 m, 1988 *R.-L. Zhu 88003a* (HSNU).

Additional specimens examined. — **China.** Hong Kong, Tai Po Kau Nature Reserve, on tree trunk, associated with *Cheilolejeunea ryukyuensis* Mizut., 1996 *M. L. So & R.-L. Zhu 96312L2* (HSNU, HKBU).

Range. As 2: China (Yunnan). As 4: Indonesia, Malaysia, Papua New Guinea, Singapore (He 1995 as *Cheilolejeunea fitzgeraldii*; He 1999).

Cheilolejeunea vittata (G. Hoffm.) R. M. Schust. & Kachroo

J. Linn. Soc., Bot. 56: 509. 1961.

Illustration (selected): Mizutani 1980: 322 (fig. 2).

Specimen examined. — **China.** Yunnan, Xishuangbanna, on twigs, 1974 *X.-J. Li 3624* (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: Sri Lanka (Onraedt 1981); As 4: Borneo, Java, Papua New Guinea, Philippines, Seram, and West Irian (Grolle & Piippo 1984, Mizutani 1980, 1986); Austr 1 (Thiers 1992, 1997).

Cololejeunea desciscens Steph.

Hedwigia 34: 248. 1895.

Illustrations (selected): Mizutani 1965: 110 (fig. 2: 6–10); Tixier 1985: 122 (fig. 61).

Cololejeunea desciscens is well characterized and readily recognized by the sigmoid marginal cells of leaf, 34–58-celled gemmae, and linear leaf lobule which is only one cell wide.

Representative specimen examined. — **China.** Yunnan, Hekou Co., epiphyllous, 1974 *M. Zang 4543* (KUN).

Range. As 2: China (Guangdong (Tixier (1968), Hainan (Tixier 1985), Yunnan); As 3: Bangladesh (Tixier 1973), Kampuchea, Sri Lanka, Thailand, and Vietnam (Onraedt 1981, Tixier 1985); As 4: Papua New Guinea, West Irian (Mizutani 1965, Grolle & Piippo 1984).

***Cololejeunea dozyana* (Sande Lac.) Schiffn.**

Consp. Hep. Archip. Indici: 242. 1898.

Illustrations: Benedix 1953: T. 13; Zhu & So 1998b: 126 (fig. 1).

Specimen examined. — **China.** Yunnan, Gongshan Co., 2 200 m, 1982 *M. Zang 1455* (HSNU, KUN).

Range. As 2: China (Taiwan (Zhu & So 1998b), Yunnan); As 4: Borneo, Java, Philippines, Seram, Sumatra, and West Irian (Benedix 1953, Grolle & Piippo 1984, Tixier 1985, Mizutani 1986).

***Cololejeunea hainanensis* R. L. Zhu**

J. Hattori Bot. Lab. 78: 87. 1995.

Illustration: Zhu 1995: 88 (fig. 4).

Specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, on tree bark, 2 200 m, 1982 *M. Zang 1501* (HSNU ex IFP).

Range. As 2: China (Hainan (Zhu 1995), Yunnan).

***Cololejeunea pluridentata* P. C. Wu & J. S. Lou**

Acta Phytotax. Sin. 16: 105. 1978.

Illustration: Wu & Lou 1978: 105 (fig. 3).

Cololejeunea pluridentata is common in southeastern Xizang and northwestern Yunnan. It is characterized by the stellate dorsal papillae of leaf cells, the serrate margin of leaf lobe, and asymmetrical-ovate leaves.

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, Maku, epiphyllous, 2 200 m, 1982 *M. Zang 1586* (HSNU ex IFP).

Range. As 2: China (Xizang (Wu & Lou 1978), Yunnan).

***Cololejeunea pseudoschmidtii* Tixier**

Garden Bull. Singapore XXVI: 145. 1972.

Illustrations: Tixier 1972 (fig. III); Tixier 1985: 231

(fig. 23); Zhu 1995: 97 (fig. 9).

Specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, Qinlangdang, 1 350 m, epiphyllous, 1982 *M. Zang 2003* (HSNU ex IFP).

Range. As 2: China (Guizhou, Hainan (Zhu 1995), Yunnan); As 3: Vietnam (Tixier 1985); As 4: Malaysia, and Philippines (Tixier 1972, 1985).

***Cololejeunea serrulata* Steph.**

Hedwigia 34: 252. 1895.

Cololejeunea serrulata was originally described by Stephani (1895), based on the material from Tonkin, Vietnam. It is a little known species which is characterized by ovate-oblong leaves, leaf lobule with two cells long first tooth, smooth leaf cells, 4-keeled perianths, and unicellular stylus. This species is closely related to *Cololejeunea goebelii* (Schiffn.) Schiffn., a common *Cololejeunea* species in Yunnan. However, *C. serrulata* differs in its unicellular stylus. *Cololejeunea serrulata* also resembles to *C. obliqua* (Nees & Mont.) Schiffn., however, the latter usually bears dorsal papillae on its leaf cells.

Representative specimens examined. — **China.** Yunnan, Hekou Co., epiphyllous, 1974 *M. Zang 4041* (HSNU ex IFP); Xishuangbanna, epiphyllous, 1974 *X.-J. Li 3698* (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: Vietnam (Stephani 1895).

***Cololejeunea yakusimensis* (S. Hatt.) Mizut.**

J. Hattori Bot. Lab. 57: 430. 1984.

Illustration (selected): Mizutani 1984: 431 (fig. 2).

Cololejeunea yakusimensis is readily confused with *C. latilobula* (Herzog) Tixier, which is common in Yunnan. However, the former differs in its synoicous sexuality.

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, Qinlangdang, 1 500 m, epiphyllous, 1982 *M. Zang 1600* (HSNU, IFP, KUN-5838).

Additional specimen examined. — **China.** Sichuan, Erlangshan, Xingou, 1980 *Q. Gao et al. 17588* (HSNU ex IFP).

Range. As 2: China (Yunnan), Japan (Mizutani 1984).

***Colura corynephora* (Nees et al.) Trevis.**

Mem. Institut. Lombardo, Sci. Lett., Ser. 3, 4: 402. 1877.

Illustration (selected): Jovet-Ast 1954: 301 (fig. 62).

Representative specimen examined. — **China.** Yunnan, Xishuangbanna, epiphyllous, 1974 *X.-J. Li* 3622 (HSNU).

Range. As 2: China (Hainan (Wu & Lin 1978), Yunnan); As 3: Kampuchea, Sri Lanka, Thailand, and Vietnam (Jovet-Ast 1961, Tixier 1970a, Onraedt 1979); As 4: Borneo, Java, Malay Pen., New Guinea, Philippines, and Sumatra (Jovet-Ast 1954); Oc: Mariana Is. and New Caledonia (Jovet-Ast 1954).

Drepanolejeunea pentadactyla (Mont.) Steph.

Spec. Hep. 5: 357. 1913.

Illustrations (selected): Horikawa 1934: pl. 21 (fig. 1–12 as *Drepanolejeunea tenuioides* Horik.).

Specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, Qinlangdang, epiphyllous, 1 240 m, 1982 *M. Zang* 2272 (HSNU ex IFP).

Range. Afr 3: Madagascar (Mizutani 1975 as *Drepanolejeunea micholitzii* Steph.); As 2: China (Taiwan (Piippo 1990), Yunnan); As 3: Thailand (Tixier 1970a as *D. micholitzii*), and Vietnam (Jovet-Ast & Tixier 1962 as *D. micholitzii* var. *micholitzii*); As 4: Borneo (Herzog 1934 as *Drepanolejeunea micholitzii* var. *dactylophoroides* Herzog, Mizutani 1966 as *D. micholitzii*), Java (Mizutani 1975 as *D. micholitzii*), Philippines (Grolle 1980), and West Irian (Grolle & Piippo 1984); Oc: Hawaii, Samoa, and Tahiti (Grolle 1980).

Drepanolejeunea vesiculosa (Mitt.) Steph.

Spec. Hep. 5: 356. 1913.

Illustrations (selected): Udar & Awasthi 1982: 435 (fig. 6).

Specimen examined. — **China.** Yunnan, Xishuangbanna, epiphyllous, 1974 *X.-J. Li* 3613 (HSNU ex IFP).

Range. Afr 2 (Wigginton & Grolle 1996); As. 2: China (Hainan and Taiwan (Piippo 1990), Yunnan); Japan (Mizutani 1978b); As 3: Sri Lanka (Onraedt 1981), India (Udar & Awasthi 1982), Vietnam (Jovet-Ast & Tixier 1962); As 4: Borneo, Java, Papua New Guinea, Philippines, and Singapore (Mizutani 1966, 1970, 1978a, 1978b, Grolle & Piippo 1984); Austr 1: Norfolk Is (Mizutani 1978b); Oc: Samoa, Savaii, and Tahiti (Mizutani 1978b, Grolle 1980).

Lejeunea alata Gottsche

in Gottsche *et al.*, Syn. Hep. 406. 1845.

Illustrations (selected): Mizutani 1970: 244 (fig. XIII as *Lejeunea mitracalyx* (Eifrig) Mizut.).

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, 1 240 m, 1982 *M. Zang* 2286

(HSNU ex IFP).

Range. Afr 2 (Wigginton & Grolle 1996); Af 3 (Grolle 1995); As 2: China (Yunnan); As 3: Vietnam (Jovet-Ast & Tixier 1962 as *Taxilejeunea mitracalyx*); As 4: Borneo, Java, Papua New Guinea, and Sumatra (Mizutani 1970 as *Lejeunea mitracalyx*, Grolle 1977, 1995, Pócs *et al.* 1994); Oc: Polynesia (Miller *et al.* 1983), and Samoa (Grolle 1977).

Lejeunea cocoes Mitt.

J. Proc. Linn. Soc., Bot. 5: 114. 1861 “1860”

Illustrations: Mizutani 1963: 177 (fig. 10–18); So & Zhu 1998: 138 (fig. 1).

Representative specimen examined. — **China.** Yunnan, Luchun Co., Yuanyang, 1973 *M. Zang* 288 (HSNU ex IFP).

Additional specimens examined. — **Papua New Guinea.** Purdy Island, 1894 *Kärbach* (BM, G-21903 all labeled as *Micolejejeunea catanduana* Steph.); Stephansort, Nyman *s.n.* & *s.d.* (G-026507 labeled as *Micolejejeunea catanduana*).

Range. As 2: China (Guangxi, Hainan, Hong Kong, Taiwan, and Zhejiang (So & Zhu 1998), Yunnan); As 3: Sri Lanka (So & Zhu 1998); As 4: Java, Papua New Guinea (new), and Sarawak (Mizutani 1963).

Lejeunea compacta (Steph.) Steph.

Spec. Hep. 5: 771. 1915.

Illustrations (selected): Mizutani 1961: 198 (figs. 16–24).

Representative specimen examined. — **China.** Yunnan, Yiliang Co., Chaotianmalin, on rock, 1972 *X.-J. Li* 4377 (HSNU).

Additional specimens examined. — **China.** Anhui, Jiuhuashan, on soil, 1 230 m, 1983 *R.-L. Hu* & *Y.-F. Wang* 110 (HSNU); Fujian, Chongcan Co., Wuyishan, Wanggangshan, 2 000 m, *Z.-L. Liu* 36274-a (HSNU ex SHM); Hainan, Ledong Co., Jianfengling, north slope, on tree trunk, 1962 *P.-J. Chen* (*P.-C. Chen*) *et al.* 664f (HSNU ex IBSC-04903); Jiangxi, Sanqingshan, between Qianbumen and Fengmen, on rock, 1 320 m, 1987 *X.-M. Shao* 387 (HSNU); Sichuan, Emeishan, between Hongchunping to Yuxiansi, on tree trunk, 1 200–1 750 m, 1980 *Q. Gao* *et al.* 19584 (HSNU ex IFP); Taiwan, Tainan, Mt. Arisan, Shinboku-Numanodaira, 1932 *Horikawa* 9049 (HIRO); Zhejiang, Qingyuan Co., Baishanzu Nature Reserve, on soil (associated with mosses), 1 240 m, 1990 *R.-L. Zhu* 90070 (HSNU).

Range. As 2: China (Taiwan (Piippo 1990), Zhejiang (Zhu *et al.* 1998), new to Anhui, Fujian, Hainan, Jiangxi, and Sichuan), Japan (Mizutani 1961), and Korea (Hong 1997, Yamada & Choe 1997).

Lejeunea discreta Lindenb.

in Gottsche *et al.*, Syn. Hep.: 361. 1845.

Illustrations (selected): Eifrig 1937: 87 (Abb. IV: 2 as *Hygrolejeunea discreta* (Lindenb. & Schiffn.) Steph.; Mizutani 1961: 204 (figs. 14–27).

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, 1 740 m, 1982 *M. Zang* 2378 (HSNU ex IFP).

Range. As 2: China (Taiwan (Piippo 1990), Zhejiang (Zhu *et al.* 1998), Yunnan), Japan (Furuki & Mizutani 1994), and Korea (Hong 1997, Yamada & Choe 1997); As 3: Bhutan (Long & Grolle 1990), India, Kampuchea, Nepal, and Sri Lanka (Mizutani 1971, Tixier 1979); As 4: Borneo, Java, Moluccas, New Guinea, Papua New Guinea, Philippines, and Sumatra (Mizutani 1971, 1975, Grolle & Piippo 1984); Austr 1: Norfolk Is. (Grolle 1981); Oc: New Caledonia (Mizutani 1971).

Lejeunea infestans (Steph.) Mizut.

J. Hattori Bot. Lab. 27: 143. 1964.

Illustration: Mizutani 1964: 144 (fig. III: 1–10).

The important features of this species include autoicous sexuality, small, deeply bilobed underleaves, thin stem and the usual presence of regenerants from leaf margins.

Representative specimen examined. — **China.** Yunnan, Pingbian Co., on tree trunk, 1974 *M. Zang* 4403 (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: Vietnam (Mizutani 1964); As 4: Borneo (Mizutani 1966).

Lejeunea magohukui Mizut.

Misc. Bryol. Lichenol. 7: 133. 1977.

Illustrations: Mizutani 1977: 133 (fig. 1).

Specimen examined. — **China.** Yunnan, Hekou Co., on tree trunk, 1974 *M. Zang* 4093 (HSNU ex IFP).

Range. As 2: China (Fujian, and Hong Kong (So & Zhu 1998), Yunnan), Japan (Mizutani 1977).

Lejeunea neelgherriana Gottsche

in Gottsche *et al.*, Syn. Hep.: 354. 1845.

Representative specimen examined. — **China.** Yunnan, Pingbian Co., Daweishan, epiphyllous, 1 800 m, 1988 *R.-L. Zhu* 88163 (HSNU).

Additional specimen examined. — **China.** Xizang, Motuo Co., Hanmi, on tree trunk, 2 520 m, 1983 *Y.-G. Su* 4908 (HSNU, KUN-4125).

Range. As 2: China (Yunnan); As 3: Bhutan, India, Nepal, Sikkim, and Sri Lanka (Long & Grolle 1990).

Lejeunea obscura Mitt.

J. Proc. Linn. Soc., Bot. 5: 112. 1861 (“1860”).

Illustrations: Eifrig 1937: 91 (Abb. VI: 3a–d).

Representative specimen examined. — **China.** Yunnan, Xishuangbanna, Mengla Co., epiphyllous, 1974 *X.-J. Li* 3654 (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: Nepal, Sikkim (Mitten 1861), and Sri Lanka (Onraedt 1981); As 4: Java (Eifrig 1937).

Lejeunea stevensiana (Steph.) Mizut.

J. Hattori Bot. Lab. 34: 452. 1971.

Illustration: Mizutani 1971: 453 (fig. IV).

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, 1 500 m, 1982 *M. Zang* 1650 (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: Bhutan (Long & Grolle 1990), India, Nepal, and Sikkim (Mizutani 1971, 1972).

Lejeunea subacuta Mitt. (Fig. 2)

J. Proc. Linn. Soc., Bot. 5: 113. 1861 “1860”. — Type: India “Sikkim Himalaya”, 7 000 ft., *J. D. Hooker & T. Thomson* 1466 (syntypes: BM!, NY!).

Illustrations: Mizutani 1963: 172 (figs. 9–17); Mizutani 1971: 450 (fig. II).

Lejeunea subacuta was originally described by Mitten (1861), based on material from Sikkim, India. This species was somewhat poorly understood owing to the lack of fertile plants in type material. Mizutani (1963) provided a description and illustrations, based on the original sterile material. Later Mizutani (1971) gave more detailed illustrations, adding several young gynoecia, based on the Indian material. Fortunately, male plants are rather common in the Yunnan material cited above, and few mature perianths are also found. The following description is based on the type and Yunnan material.

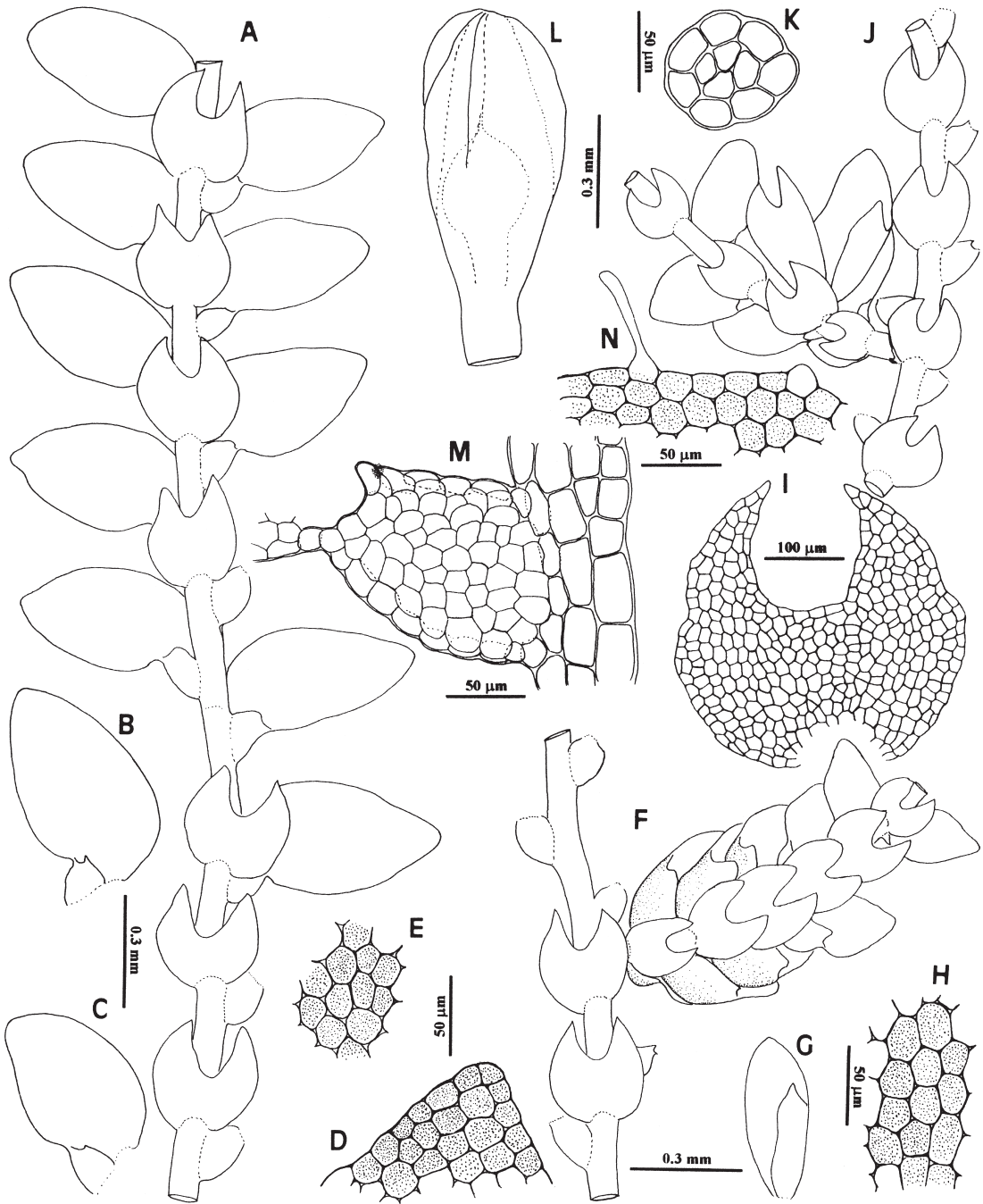


Fig. 2. *Lejeunea subacuta* Mitt. (from X.-J. Li 4483, HSNU ex IFP). — A: Portion of plant, ventral view. — B and C: Leaves, ventral view. — D: Apex of leaf lobe. — E: Median cells of leaf lobe. — F: Portion of male plant, ventral view. — G: Female bract, ventral view. — H: Basal cells of leaf lobe. — I: Underleaf. — J: Portion of female plant, ventral view. — K: Transverse section of stem. — L: Perianth. — M: Leaf lobule and portion of stem, ventral view. — N: Marginal cells of leaf lobe showing one rhizoid at the margin of leaf lobe.

Dioicous. Plants pale yellow to pale green in dried condition. Stems 6–20 mm long, 64–85 mm

in diameter, 0.8–1.1 mm wide with leaves, irregularly branched, branching of *Lejeunea* type, trans-

verse section of stem 7 cortical cells and 3–7 medullary cells, cortical cells \pm rectangular, 24–32 \times 18–30 μ m, medullary cells \pm isodiametric, 16–28 \times 14–18 μ m. Ventral merophytes of stem 2 cells wide. Rhizoids at base of underleaves, few, tufted, usually hyaline, occasionally at leaf margins, rhizoid disc always absent. Leaves strongly caducous, usually remote, sometimes slightly imbricate, diverging from stem at an angle of 45–75°. Leaf lobes oblong, usually falcate, 0.40–0.57 mm long, 0.20–0.35 mm wide, apex obtuse, rarely subacute or rounded-obtuse, \pm incurved, margin entire, rarely with short or long, unicellular rhizoids. Leaf lobules small, triangular-ovate, inflated, ca. 1/4 (–1/3) length of leaf lobe, lateral free margin usually incurved, bordered by 4 rectangular to subquadrate marginal cells, apex obliquely truncate, with a unicellular apical tooth, keel straight to slightly arched, hyaline papilla situated at the proximal side of apical tooth. Leaf cells thin-walled to slightly thickened, trigones small to large, intermediate thickenings usually absent, marginal cells of leaf lobe quadrate to rectangular, 12–25 \times 11–20 μ m, median cells \pm isodiametric, 18–34 \times 13–25 μ m, basal cells isodiametric to rectangular, 24–36 \times 13–25 μ m, dorsal cuticle usually strongly punctate. Vitta and ocelli absent. Oil bodies unknown. Underleaves remote, suborbicular in outline, longer than wide, 0.21–0.37 mm long, 0.20–0.36 mm wide, 2.5–3.5 times as wide as stem, bilobed to 1/3–1/2 underleaf length, sinus U- or V-shaped, lobes triangular, acute to obtuse at apex, margin entire, insertion deeply sinuate to subtransverse. Androecia usually on very short lateral branches, sometimes on main shoots, usually with an apical vegetative continuation, bracts 2–4 pairs, 0.20–0.28 mm long, 0.16–0.20 mm wide, apex obtuse to rounded-obtuse, rarely subacute, bract lobule lightly shorter than bract lobe, antheridia not seen, bracteoles 2–4, borne throughout the androecium. Gynoecia usually on long branches, with one lejeuneoid innovation, bracts oblong to elliptical, ca. 0.40 mm long, 0.16 mm wide, entire at margin, rounded-obtuse or obtuse at apex, bract lobules ligulate to oblong, ca. 2/3 as long as long as bract lobes, apex truncate, acute or obtuse, margin entire, keels ca. 2/3 length of bract lobule, bracteole oblong, ca. 0.32 mm long, 0.16 mm wide, bilobed to 1/3–1/

3.5 its length at apex, entire at margin. Perianth emergent, obovate, ca. 0.90 mm long, 0.37 mm wide, inflated, with 5 smooth keels, beak indistinct. Sporophytes not seen. Asexual reproduction by caducous leaves.

Lejeunea subacuta is well characterized and easily separated from other members of *Lejeunea* by the strongly caducous, falcate, oblong leaves with usually obtuse apices, the presence of male bracteoles throughout the androecium, and the occasional presence of rhizoids at the margin of the leaf lobe. It seems to be related to *Lejeunea stevensiana* (Steph.) Mizut., however, the latter differs in having triangular-ovate leaves with acuminate apices.

Lin *et al.* (1992) and Piippo (1990) reported *L. subacuta* for China. Our studies reveal that their reports are erroneous, because the voucher specimens (*P.-C. Chen et al.* 444e, *P.-C. Chen et al.* 511c, HSNU ex IBSC) have ovate, non-caducous leaves with rounded apices. They do not belong to the true *L. subacuta*. The report from Guangdong and Taiwan of China (He 1997) might be erroneous, because it was not cited in the literature.

Representative specimens examined. — **China.** Yunnan, Jingdong Co., Ailaoshan, on tree trunk, 2 400 m, 1982 *J.-K. Zhang* 575 (HSNU ex IFP); Luchun Co., Huanglianshan, on tree trunk, 1973 *M. Zang* 669 (HSNU ex IFP); Yingjiang Co., Tongbiguan, on tree trunk, associated with *Lejeunea bidentula* Herzog, 1983 *L.-S. Wang* 83176 (HSNU ex IFP), Yiliang Co., 2 060 m, 1972 *X.-J. Li* 4483 (HSNU ex IFP).

Range. As 2: China (Yunnan); As 3: India, Nepal, Sikkim, and Sri Lanka (Mizutani 1971, 1979b).

Lejeunea tuberculosa Steph.

Spec. Hep. 5: 790. 1915.

Illustration: Mizutani 1971: 451 (fig. III).

Specimen examined. — **China.** Yunnan, Kunming, Xishan, 2 100 m, 1988 *D.-C. Zhang* 0013 (HSNU ex IFP).

Additional specimen examined. — **Indonesia.** Java, no detailed collection data, *V. Schiffner s.n.* (NY).

Range. As 2: China (Hainan and Hong Kong (So & Zhu 1998), Yunnan); As 3: Bhutan (Long & Grolle 1990), India, Nepal, and Sikkim (Mizutani 1971, Mizutani *et al.* 1995); As 4: Java (new), Philippines (Mizutani 1978a). According to Pócs (1992), *Lejeunea tuberculosa* is widespread in Africa.

Lejeunea wightii Lindenb.

in Gottsche *et al.*, Syn. Hep.: 379. 1845.

Illustration: Mizutani 1964: 147 (fig. IV: 7–11).

Representative specimen examined. — **China.** Yunnan, Luxi Co., 1977 X.-J. Li 24 (HSNU ex IFP).

Range. As 2: China (Taiwan (Herzog & Noguchi 1955), Yunnan); As 3: India, Nepal (Mizutani 1964, Mizutani *et al.* 1995), Sikkim (Mitten 1861), Sri Lanka (Hattori 1968), and Thailand (Hattori & Mizutani 1969); As 4: Borneo (Mizutani 1966), and Philippines (Tan & Engel 1986).

Leptolejeunea epiphylla (Mitt.) Steph.

Spec. Hep. 5: 380. 1913.

Illustration (selected): Herzog 1942: 413 (Abb. 19).

Specimen examined. — **China.** Yunnan, Hekou Co., epiphyllous, 1974 M. Zang 4506 (HSNU ex IFP).

Range. Afr 2 (Wigginton & Grolle 1996); Afr 3 (Grolle 1995); As 2: China (Taiwan (Herzog & Noguchi 1955), new to Yunnan), and Japan (Mizutani 1978b); As 3: Kam-puchea, Laos (Tixier 1970b, 1980), Sri Lanka, (Herzog 1942), and Thailand (Tixier 1973); As 4: Borneo, Java, Malacca, Nicobar Is., Papua New Guinea, Philippines, and Sumatra (Mizutani 1975, 1978b, Grolle & Piippo 1984); Oc: New Caledonia, Solomon Islands, and Tahiti (Herzog 1942, Grolle 1968).

Rhaphidolejeunea tibetana P. C. Wu & J. S. Lou

Acta Phytotax. Sin. 16: 102. 1978.

Illustration: Wu & Lou: 103 (fig. 1).

Rhaphidolejeunea tibetana is a common epiphyllous liverwort in northwestern Yunnan and southeastern Xizang. It is easily separated from other members of *Rhaphidolejeunea* by the small leaf cells, the robust underleaf lobes (3–5 cells wide at base), and the five wing-like entire keels of perianth.

Representative specimen examined. — **China.** Yunnan, Gongshan Co., Dulongjiang, epiphyllous, 1982 M. Zang 2308 (HSNU, KUN).

Range. As 2: China (Xizang (Wu & Lou 1978, Yunnan).

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