



<http://dx.doi.org/10.11646/phytotaxa.288.1.1>

Clarification of the confusing identity of *Cremanthodium atrocapitatum* (Asteraceae, Senecioneae), with a new combination and a new species in the genus

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Abstract

Cremanthodium atrocapitatum (Asteraceae, Senecioneae) has been previously largely misunderstood, resulting in considerable taxonomic confusion involving several taxa. Based on observations of both herbarium specimens (including type material) and living plants, here we clarify the taxonomic identity of this species. The Xizang (Tibet) plants previously referred to *C. atrocapitatum* are described as a new species, i.e. *C. bomiense*. *Cremanthodium campanulatum* var. *brachytrichum* is found to be very close to *C. atrocapitatum* rather than *C. campanulatum*, and is thus treated as *C. atrocapitatum* var. *brachytrichum*.

Key words: Compositae, misidentification, taxonomy, Xizang, Yunnan

Introduction

In the course of preparing an account of the genus *Cremanthodium* Bentham (1873: 37) for the *Flora of Pan-Himalaya* (<www.flph.prg/index>), we found that *C. atrocapitatum* Good (1929: 282) has been overlooked or largely misunderstood by later authors since its description, and even its author, Good himself, did not know this species well. This resulted in considerable taxonomic confusion involving this species and another five taxa, including *C. calcicola* Smith (1920: 201; “*calcicolum*”), *C. campanulatum* var. *brachytrichum* Ling & Liu in Liu (1982: 52), *C. pulchrum* Good (1929: 274), *Ligularia microcephala* (Handel-Mazzetti 1920: 174) Handel-Mazzetti (1925: 13), and a hitherto undescribed *Cremanthodium* species from southeastern Xizang (Tibet), China. In this paper we attempt to clear up the confusion, and we propose a new combination and describe a new species in *Cremanthodium*.

Material and methods

For morphological comparisons, we critically checked herbarium specimens or high-resolution images of specimens in A, CDBI, E, GH, IBSC, KUN, P, PE, SYSU, W and WU, and made field observations in southwestern Sichuan, southeastern Xizang and northwestern Yunnan, China.

Results and discussion

Cremanthodium atrocapitatum was described by Good (1929) on the basis of a single collection, *Farrer* 1877 (E; Fig. 1), from the Chawchi pass in Gongshan, northwestern Yunnan, China (not in northeastern Myanmar as stated in the protologue; see Chen & Xu (2016) for the localization of the Chawchi pass). He contrasted the species with *C. microcephalum* Handel-Mazzetti (1920: 174) (= *Ligularia microcephala* as generally recognized; Figs. 2, 3), very probably due to their resemblance in the absence of the ray florets, the colour of the capitula, and the leaf shape.

Although none of the four plants mounted on the holotype sheet were well pressed, with the leaves being more or less folded, it can still be seen that the leaves are petiolate, orbicular-reniform, margin coarsely mucronate-dentate and obviously emarginate at the apex.



FIGURE 1. Holotype sheet of *Cremanthodium atrocapitatum*.

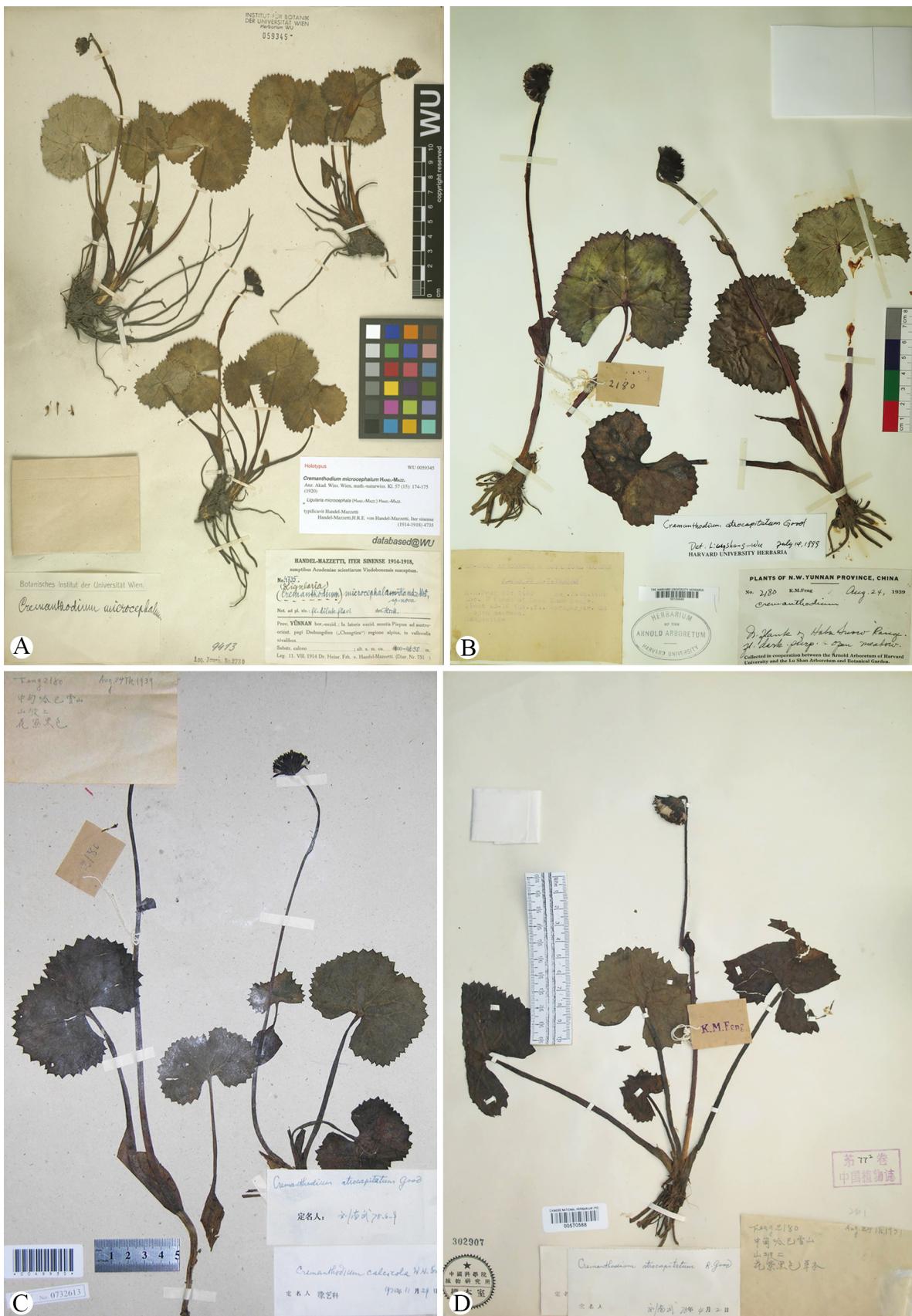


FIGURE 2. Specimens of *Ligularia microcephala*. **A.** China, Yunnan, Zhongdian, H. Handel-Mazzetti 4735 (WU, syntype). **B.** China, Yunnan, Zhongdian, K.M. Feng 2180 (A). **C.** Same locality, K.M. Feng 2180 (KUN). **D.** Same locality, K.M. Feng 2180 (PE). Note that all the three sheets of K.M. Feng 2180 have been previously misidentified as *Cremanthodium atrocapitatum*.



FIGURE 3. *Ligularia microcephala* in the wild, showing the habit (A, C) and capitula (B, D). A, B. China, Yunnan, Dêqên. C, D. China, Sichuan, Muli.

Koyama (1968) did not see the type material of *Cremanthodium atrocapitatum* and just mentioned in passing the name in his preliminary systematic grouping of the genus (he divided the then known species into three informal groups). Hu (1966) did not even include this species in her enumeration of the Chinese *Cremanthodium*, nor did Chen & Li (1994) in their synopsis of the genus from the Hengduan Mountains region of China. In other relevant floristic works including the *Index Florae Yunnanensis* (Wu 1984), *Flora Reipublicae Popularis Sinicae* (Liu 1989), *Flora Yunnanica* (Min 2004), *Flora of China* (Liu & Illarionova 2011), and *Higher Plants of China in Colour* (Chen 2016), *C. atrocapitatum* was treated but its concept was largely misunderstood. This is first indicated by the wrong, often

conflicting accounts of the geographical distribution of this species in China. In the *Flora Reipublicae Popularis Sinicae* and *Flora of China*, the species was recorded to occur in northwestern Yunnan's Zhongdian, but not in Gongshan in that region, the type locality of the species. In the *Index Florae Yunnanensis* and *Flora Yunnanica*, the species was recorded to occur in northwestern Yunnan's Zhongdian and Weixi, also not in Gongshan. Moreover, one collection from Zhongdian, *K. M. Feng 2180* (A, KUN, PE; Fig. 2B–D), was cited under *C. atrocapitatum* in the *Index Florae Yunnanensis*, and all the four sheets of this collection (only three are shown here) were identified on the determination slips as this species by S. W. Liu, the author of *Cremanthodium* in the *Flora Reipublicae Popularis Sinicae* and the first co-author of the genus in the *Flora of China*. A careful examination of this collection, however, has convinced us that it should be referred to *L. microcephala* (the number of the capitula in this species ranges from 1 to 9; the capitula in the collection *K. M. Feng 2180* are singular, thus making it easily confused with *C. atrocapitatum*). The descriptions of *C. atrocapitatum* given in the *Flora Reipublicae Popularis Sinicae*, *Flora Yunnanica* and *Flora of China* should all have been based on this collection. The line illustration of *C. atrocapitatum* in the *Flora Yunnanica* also should have been executed from the two KUN sheets of the collection. Furthermore, none of the three photographs annotated as *C. atrocapitatum* in the *Higher Plants in China in Colour*, one showing the habit and the other two showing the capitula, belong to the species. All these three photographs were actually taken from the Galongla Shan in Bomi, southeastern Xizang, China (see <http://www.cfh.ac.cn/spdb/TaxonNodeTree.aspx?spid=40857#>), although in the accompanying bilingual (Chinese and English) descriptions *C. atrocapitatum* was stated to occur only in northwestern Yunnan and northeastern Myanmar. We will deal with the identity of the Xizang plants presently.

Cremanthodium campanulatum var. *brachytrichum* Ling & Liu in Liu (1982: 52) was described on the basis of a single specimen, *J. F. Rock 22717* (KUN; Fig. 4A), from Fuchuan range, Weixi (not Fugong as stated in the protologue; the authors had evidently confused Fuchuan with Fugong), northwestern Yunnan, China. Ling & Liu stated that their new taxon was distinguished from the type variety, *C. campanulatum* var. *campanulatum*, by having abaxially shortly hirsute leaves, dorsally shortly black pilose phyllaries, and the brown pappus which is much shorter than the tubular corolla. This variety has been recognized by all later authors, including Liu (1989), Min (2004), Liu & Illarionova (2011), and Xu *et al.* (2014).

The holotype sheet of *C. campanulatum* var. *brachytrichum* at KUN is rather depauperate with incomplete leaves. Fortunately, there are two much better prepared isotypes (E, GH) and another two *Rock* collections exactly from the type locality, *18343* (A, E) and *23280* (E, GH). Moreover, *McLaren's Collector 156* (E), a collection also from Weixi, and *G. Forrest 30450* (E, PE), a Yunnan collection but without any further locality information, undoubtedly also belong to the variety because they have very short pappus. Three of these specimens are shown in Fig. 4B–D. During our botanical trip to northwestern Yunnan in September 2016, we successfully discovered a population of *C. campanulatum* var. *brachytrichum* from its type locality. We have also observed ample herbarium material and several wild populations of *C. campanulatum* Diels (1912: 190) during our fieldwork in recent years. The results of our observations clearly demonstrate that *C. campanulatum* var. *brachytrichum* (Figs. 4, 5) is certainly not close to *C. campanulatum* (Figs. 6, 7), a most easily recognizable species by, among other characters, having petaloid, membranous phyllaries.

Our survey of specimens of *Cremanthodium* deposited at E, KUN, P and PE resulted in the discovery of several collections which most closely resemble those of *C. campanulatum* var. *brachytrichum*, differing only in the longer pappus (4–7 mm long, nearly as long as the tubular corolla). These include *Q. Lin 792020* (KUN) from Fugong, *PE Hengduan Shan Exped. 01507* (PE) from Weixi, and *G. Forrest 25874* (E, P) from the Salwin-Kiu Chiang divide in Gongshan. Four sheets of these collections are shown in Fig. 8. The collection localities are all situated in northwestern Yunnan and they are closely contiguous to each other. Among these collections, the *Forrest* gathering, wrongly cited by Good (1929) under his *C. pulchrum* Good (1929: 274), a species very well characterized by the large capitula with glabrous purple-black phyllaries and pure white ray florets and currently known only from northeastern Myanmar, was actually made from the neighborhood of the type locality of *C. atrocapitatum*. In July 2016, we ourselves also discovered a population near the Dulongjiang (= Kiu Chiang) pass in Gongshan, and the plants, although not yet in full bloom (Fig. 9), match well the three collections mentioned above. From these results we came to the conclusion that all these three collections and the population at the Dulongjiang pass should belong to the true *C. atrocapitatum*. Meanwhile, it can be seen that the only point of essential difference between *C. campanulatum* var. *brachytrichum* (Figs. 4, 5) and *C. atrocapitatum* (Figs. 1, 8, 9) is in the length of the pappus. We therefore consider it justifiable to treat the former as a variety of the latter.



FIGURE 4. Specimens of *Cremanthodium campanulatum* var. *brachytrichum* (= *C. atrocapitatum* var. *brachytrichum*). **A.** China, Yunnan, Weixi, Fuchuan range, J.F. Rock 22717 (KUN, holotype). **B.** Same locality, J.F. Rock 22717 (GH, isotype). **C.** Same locality, J.F. Rock 23280 (GH). **D.** China, Yunnan, Weixi, McLaren's Collector 156 (E).

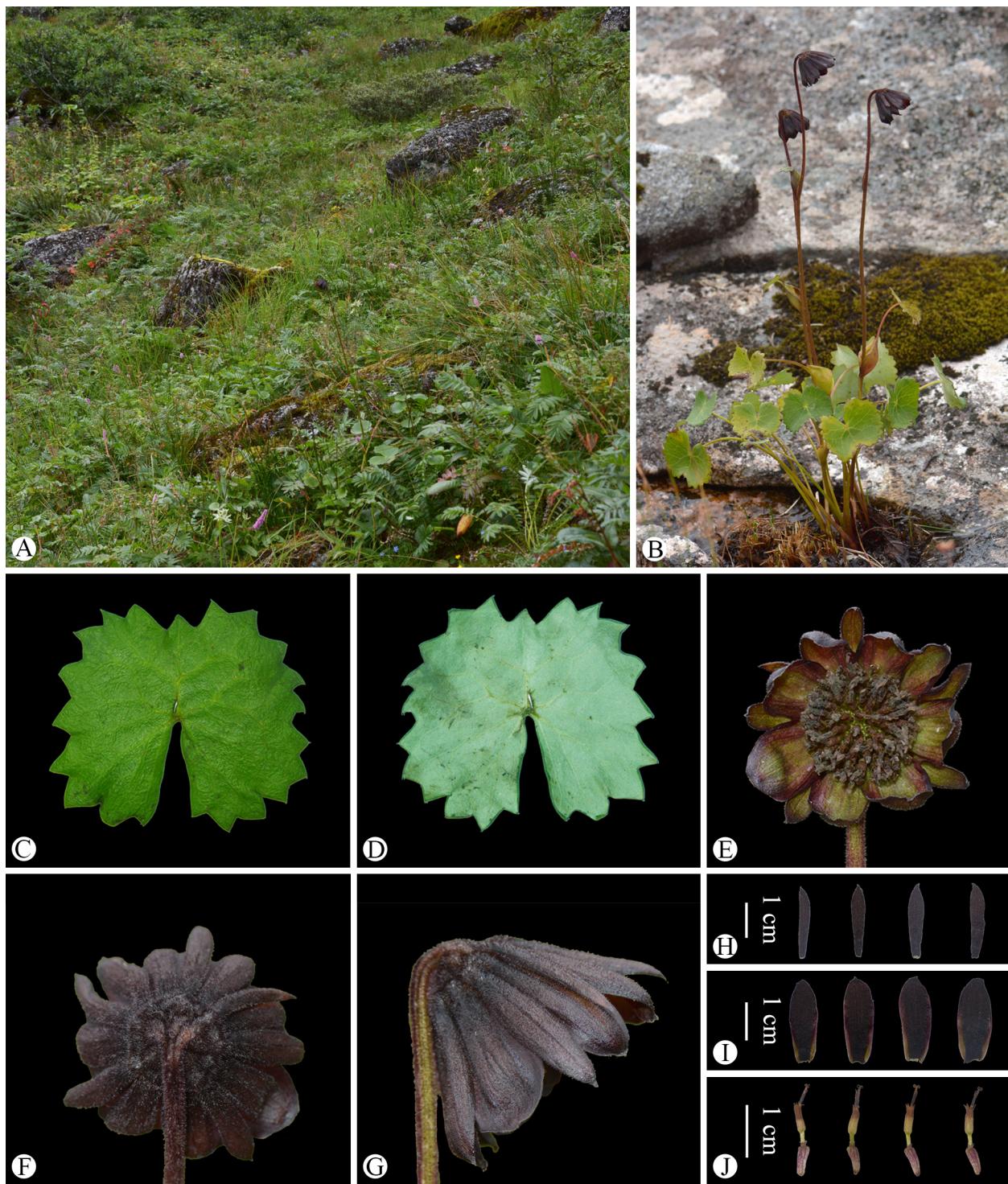


FIGURE 5. *Cremanthodium atrocapitatum* var. *brachytrichum* in the wild (China, Yunnan, Weixi). **A.** Habitat. **B.** Habit. **C.** Leaf blade (adaxial surface). **D.** Leaf blade (abaxial surface). **E.** Capitulum (top view). **F.** Capitulum (back view). **G.** Capitulum (side view). **H.** Outer phyllaries (abaxial surface). **I.** Inner phyllaries (abaxial surface). **J.** Tubular florets.

As shown in Figs. 10, 11, the aforementioned Xizang plants are distinguished from *Cremanthodium atrocapitatum* by having densely purple pubescent (vs. brown pubescent) stem, crenate (vs. mucronate-dentate) leaf blades with a rounded (vs. obviously emarginate) apex, and larger involucres (1.7–2.2 vs. 1.2–1.6 cm high, 2.4–4.0 vs. 1.2–2.8 cm in diam.). All herbarium specimens of such plants, including Y.S. Chen & Z.H. Wang 9341 (IBSC, KUN, PE), C.C. Ni *et al.* 1436 (PE), and J.Y. Xiang 09-366 (IBSC, KUN), all from Bomu or the closely adjacent Mêdog, have not been identified on the determination slips as *C. atrocapitatum*, but instead as *C. calcicola* (Fig. 12), a species otherwise known to occur only in Zhongdian in northwestern Yunnan. From *C. calcicola* the Xizang plants are different in the

densely purple pubescent (vs. densely yellowish brown pubescent and white arachnoid) stem, reniform-ovate (vs. suborbicular) leaf blades with a broader, divergent (vs. very narrow, not divergent) sinus, and more or less black pubescent (vs. glabrous or subglabrous), 14–18 (vs. 18–25) phyllaries. We therefore determine that the Xizang plants in question represent a hitherto undescribed species, which we describe below.



FIGURE 6. Specimens of *Cremanthodium campanulatum*. **A.** China, Yunnan, Lijiang, J.M. Delavay 2192 (P, syntype). **B.** China, Yunnan, Dêkênn, J.F. Rock 9966 (E). **C.** China, Sichuan, Muli, J.F. Rock 18036 (E). **D.** China, Xizang, Zayü, Qinghai-Xizang Exped. 10209 (PE).



FIGURE 7. *Cremanthodium campanulatum* in the wild (China, Yunnan, Weixi). **A.** Habit. **B.** Portion of stem. **C.** Lead blade (adaxial surface). **D.** Leaf blade (abaxial surface). **E.** Capitulum (top view). **F.** Capitulum (back view). **G.** Capitulum (side view, with two phyllaries removed). **H.** Outer phyllaries (abaxial surface). **I.** Inner phyllaries (abaxial surface). **J.** Tubular florets.

Taxonomic treatment

Cremanthodium atrocapitatum Good (1929: 282). Figs. 1, 8, 9

Type:—CHINA. Yunnan, Gongshan, Chawchi Pass, 12,800 feet (= 3901 m), marshes of the alpine lawns, 30 August 1920, *Farrer* 1877 (holotype E!). Fig. 1.

—*Cremanthodium pulchrum* Good (1929: 274), p.p., quoad *G. Forrest* 25874; Wu (1984: 1363), p.p., quoad *G. Forrest* 25874. Fig. 8D.

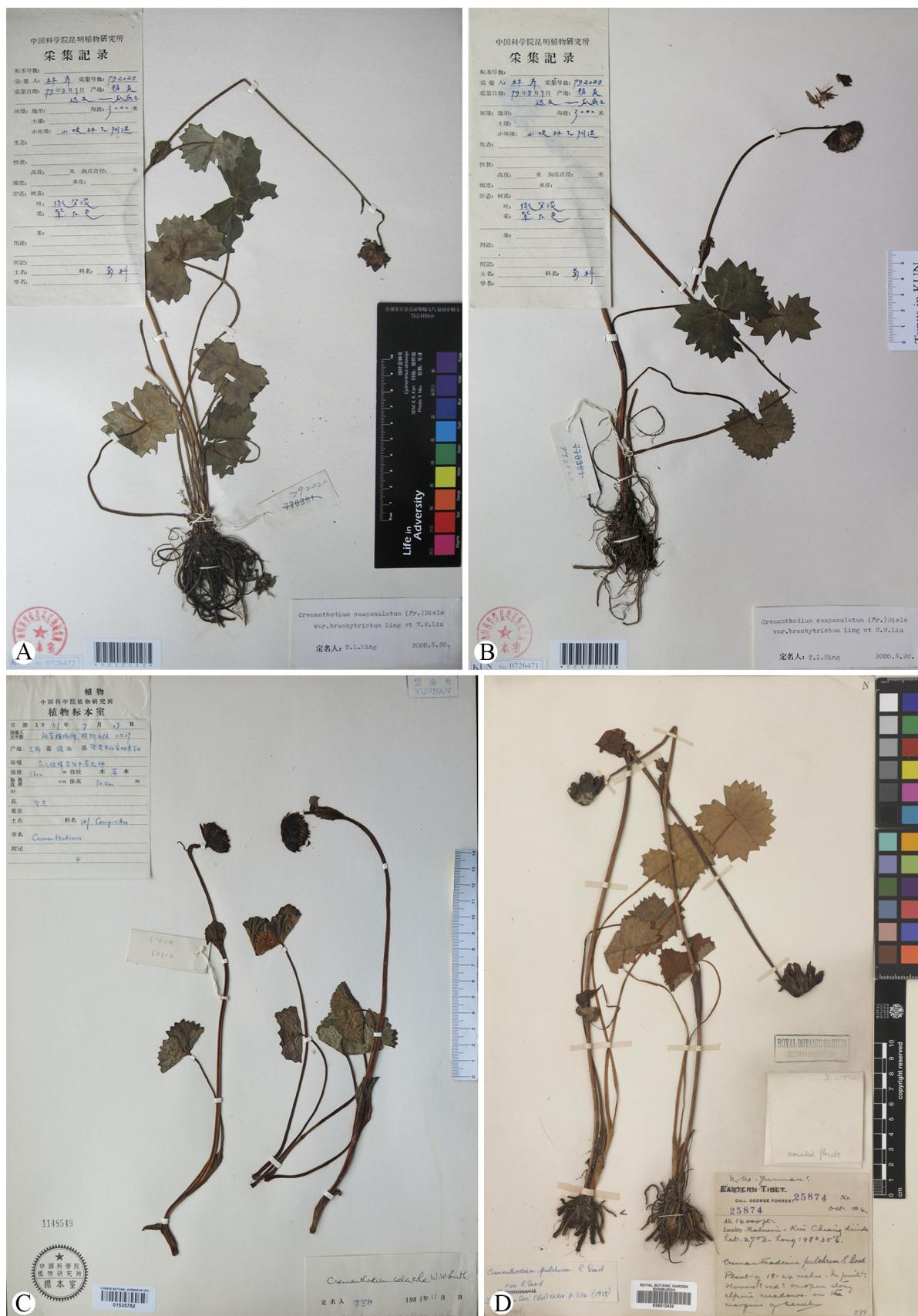


FIGURE 8. Specimens of *Cremanthodium atrocapitatum* var. *atrocapitatum*. **A, B.** China, Yunnan, Fugong, Q. Lin 792020 (KUN). **C.** China, Yunnan, Weixi, PE Hengduan Shan Exped. 01507 (PE). **D.** China, Yunnan, Salwin-Kiu Chiang divide, G. Forrest 25874 (E). Note that G. Forrest 25874 has been previously misidentified as *C. pulchrum*.

Stems solitary or fasciculate, erect, to 30 cm tall, 3–4 mm in diam. at base, proximally sparsely brown or purple pubescent, distally densely brown or purple pubescent. Basal leaves 1–7, petiolate; petiole to 25 cm long, glabrous; leaf blade orbicular-reniform, 4–7 cm long, 3–9 cm wide, adaxially bright green, abaxially pale green, base cordate, glabrous on both surfaces or initially yellow pubescent along veins, margin coarsely mucronate-dentate, apex obviously emarginated; palmate veins slightly sunken adaxially, prominent abaxially. Middle stem leaves 1–2, smaller than basal leaves, orbicular-reniform, base sheathed. Distal stem leaf absent or 1, lanceolate, linear or obovate-rhombic. Capitula solitary, nodding. Involucre hemispheric, 1.2–2.2 cm high, 1.2–4.8 cm in diam., outside brown or purple pubescent; phyllaries 12–15, in 2 rows, dorsally dark purple, ventrally dark purple on upper part, bright green on lower part, outer ones lanceolate, 2–5 mm wide, apex acute, inner ones narrowly oblong, 4–8 mm wide, apex acute or obtuse. Ray florets absent. Tubular florets numerous, yellow, limb 4–6 mm long, tube 1–3 mm long. Achenes 3–7 mm long. Pappus brown, 0.5–7 mm long, as long as or much shorter than tubular corolla.

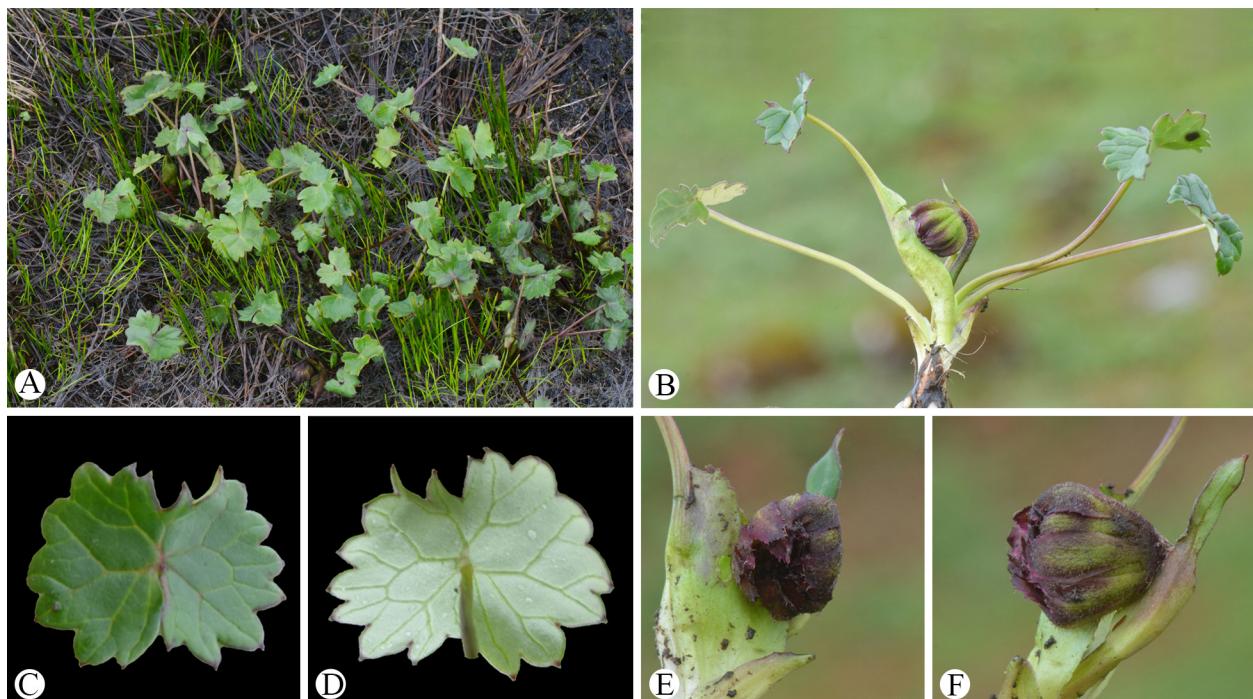


FIGURE 9. *Cremanthodium atrocapitatum* var. *atrocapitatum* in the wild (China, Yunnan, Gongshan). **A.** Habitat. **B.** Habit. **C.** Lead blade (adaxial surface). **D.** Leaf blade (abaxial surface). **E.** Capitulum (top view). **F.** Capitulum (side view).

Distribution and Habitat:—*Cremanthodium atrocapitatum* is distributed in northwestern Yunnan (Fugong, Gongshan, Weixi), China. It grows in alpine meadows, in woods or on gravelly slopes at elevations of 3000–4460 m above sea level. Since its description this species has always been recorded to occur in northeastern Myanmar (e.g., Wu 1984, Liu 1989, Min 2004, Liu & Illarionova 2011, Kress *et al.* 2003), but all the records resulted from the wrong localization of the type locality.

Note:—In the protologue of *Cremanthodium atrocapitatum*, Good (1929) mentioned two collections, *G. Forrest* 25023 (E, PE) and 27272 (E, P) (Fig. 13) from northeastern Myanmar, and pointed out that they seemed to be atypical forms of it and might have a hybrid origin. In our opinion, both of them are almost identical to *Ligularia microcephala*, differing only in the stramineous-blackish (vs. black) phyllaries. A further study is needed to determine their identity with certainty.

Cremanthodium atrocapitatum var. *atrocapitatum*

Involucre 1.2–1.6 cm high, 1.2–2.8 cm in diam.; outer phyllaries 2–3 mm wide, inner phyllaries 4–5 mm wide; pappus 4–7 mm long, as long as tubular corolla.

Distribution and Habitat:—*Cremanthodium atrocapitatum* var. *atrocapitatum* occurs in Fugong, Gongshan and Weixi, northwestern Yunnan, China. It grows in alpine meadows or in woods at elevations of 3000–4267 m above sea level.

Phenology:—Flowering July to August; fruiting September.



FIGURE 10. Holotype sheet of *Cremanthodium bomiense*.

Additional specimens examined:—CHINA. Yunnan, Fugong, moist places in woods, 3000 m, 1 August 1979, Q. Lin 792020 (KUN); Gongshan, Salwin-Kiu Chiang divide, 27° N, 98°35' E, on open stony alpine meadows on the margins of scrub, 14000 feet (= 4267 m), October 1924, G. Forrest 25874 (E, P); Gongshan, Dulongjiang pass, 27°47'54.17"N, 98°28'10.86"E, alpine meadows, 3922 m, 27 July 2016, L. Wang & Y.P. Zeng 878 (IBSC); Weixi, Biluo Xue Shan, Anqielai pass, alpine meadows, 3600 m, 13 July 1951, PE Hengduan Shan Exped. 01507 (PE).

Cremanthodium atrocapitatum var. *brachytrichum* (Ling & Liu in Liu 1982: 52) L. Wang, C. Ren & Q. E. Yang, comb. nov. *Cremanthodium campanulatum* var. *brachytrichum* Ling & Liu in Liu (1982: 52). Figs. 4, 5

Type:—CHINA. Yunnan, Weixi, Fuchuan range, on gravelly slopes, 13,000 feet (= 3962 m), May–June 1932, *J. F. Rock* 22717 (holotype KUN!; isotypes E!, GH!). Fig. 4A, B.

Involucre 1.8–2.2 cm high, 2.5–4.8 cm in diam.; outer phyllaries 3–4 mm wide, inner phyllaries 7–8 mm wide; pappus 0.5–2 mm long, much shorter than tubular corolla.

Distribution and Habitat:—*Cremanthodium atrocapitatum* var. *brachytrichum* is currently known only from Weixi, northwestern Yunnan, China. It grows in alpine meadows or on gravelly slopes at elevations of 3765–4460 m above sea level.

Phenology:—Flowering late July; fruiting middle September. The collection date of the type gathering, May–June 1932, as given on the field label, could be wrong.

Additional specimens examined:—CHINA. Yunnan, Weixi, Ma Kia Ho, collection date unknown, *McLaren's Collector 156* (E); Weixi, Mount Fu-Chuan, 4460 m, September–October 1929, *J.F. Rock* 18343 (A, E); Weixi, Fuchuan range, gravelly slopes, 13000 feet (= 3962 m), August–September 1932, *J.F. Rock* 23280 (E, GH); Weixi, Weideng, 29°44'28.10"N, 95°41'10.61"E, gravelly slopes, 3765 m, 20 July 2016, L. Wang & Y.P. Zeng 867 (IBSC); Same locality, 3765–3850 m, 15 September 2016, L. Wang 1400 (IBSC); Precise locality unknown, collection date unknown, G. Forrest 30450 (E, PE).

Note:—The name *Cremanthodium petaloideum* S.W. Liu & T.N. He (better known as T.N. Ho), appearing in the *Index Florae Yunnanensis* (Wu 1984), has never been validly published and was obviously based on *J. F. Rock* 22717 (KUN; Fig. 4A), not 22712 as wrongly cited there.

***Cremanthodium bomiense* L. Wang, C. Ren & Q. E. Yang, sp. nov.** Figs. 10, 11

Type:—CHINA. Xizang, Bomi, Galongla Shan, 29°44'28.10"N, 95°41'10.61"E, on grassy slopes, 3700–4200 m, 13 August 2016, L. Wang et al. 993 (holotype IBSC; isotypes KUN, PE). Fig. 10.

—*Cremanthodium atrocapitatum* auct.: Chen (2016: 476).

Stems solitary or fasciculate, erect, to 35 cm tall, 3–4 mm in diam. at base, proximally sparsely purple pubescent or glabrescent, distally densely purple pubescent. Basal leaves 2–5, petiolate; petiole to 20 cm long, initially densely purple pubescent on upper part, more or less glabrescent later, base sheathed; leaf blade reniform-cordate, 4–9 cm long, 4.5–10 cm wide, adaxially bright green, glabrous, abaxially pale green, brown pubescent along veins, base deeply cordate, sinus divergent, margin crenate, apex rounded; palmate veins slightly sunken adaxially, prominent abaxially. Middle stem leaves single or 2, smaller than basal leaves, triangular-cordate or reniform, base enlarged sheathed. Distal stem leaf absent or 1, lanceolate or ovate-lanceolate, margin entire. Capitula solitary, nodding. Involucre broadly campanulate or hemispheric, 1.7–2.2 cm high, 2.4–4.0 cm in diam., outside more or less black pubescent; phyllaries 14–18, in 2 rows, dorsally dark purple, ventrally bright purplish red, outer ones lanceolate, 3–5 mm wide, apex acute or acuminate, shortly purple ciliate in the upper part, inner ones narrowly oblong, 6–9 mm wide, margin membranous, apex obtuse or mucronulate. Ray florets absent. Tubular florets numerous, purple; limb ca. 5–6 mm long, tube 2–3 mm long, style branches purple. Achenes cylindrical, 4–5 mm long; pappus brown, 7–8 mm long, as long as tubular corolla.

Distribution and Habitat:—*Cremanthodium bomiense* is currently only known from the type locality, i.e. Galongla Shan between Bomi in the north and Mêdog in the south, southeastern Xizang, China. It grows on grassy slopes, in alpine scrub or alpine meadows at elevations of 3500–4150 m above sea level.

Phenology:—Flowering July to August; fruiting September.

Etymology:—The specific epithet is derived from Bomi, southeastern Xizang, China, the type locality of the species.

Additional specimens examined:—CHINA. Xizang, Bomi, Galongla Shan, roadside, grassy slope, 3900–4100 m, 8 August 2009, Y.S. Chen & Z.H. Wang 9341 (IBSC, KUN, PE); Bomi, northern slope of Galongla Shan, alpine scrub or alpine meadows, 4000–4100 m, 15 August 1982, S.Z. Cheng & B.S. Li 00164 (PE); Bomi, on the way from Bomi to Mêdog, alpine meadows, 3500 m, 7 August 2009, J.Y. Xiang 09-366 (IBSC, KUN); Mêdog, southern slope of Galongla Shan, alpine scrub, 4150 m, 14 August 1982, S.Z. Cheng & B.S. Li 00022 (PE); Mêdog, southern slope of Galongla Shan, grassy slope, 4100 m, 6 September 1980, C.C. Ni et al. 1436 (PE).

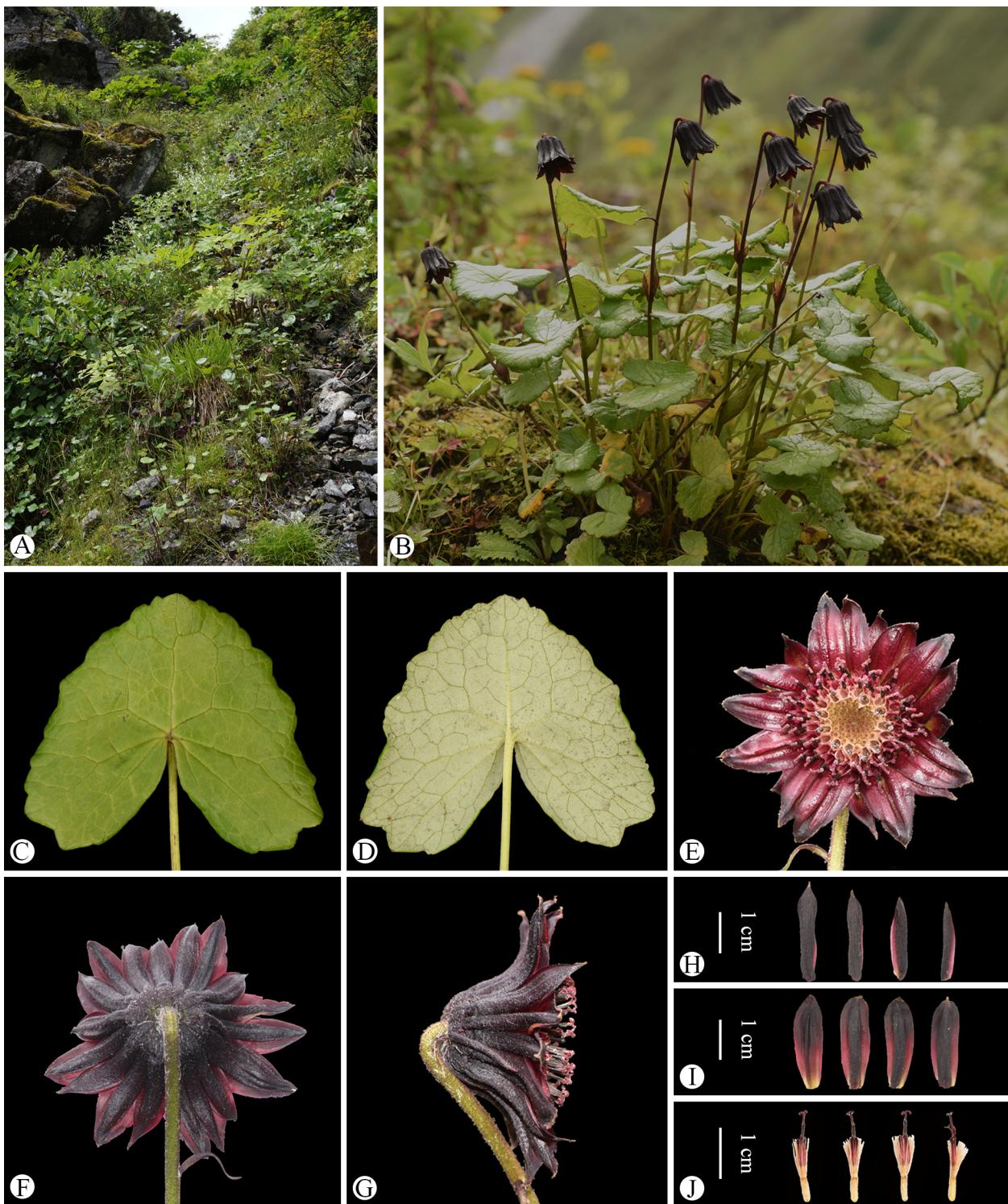


FIGURE 11. *Cremanthodium bomiense* in the wild (China, Xizang, Bomi). **A.** Habitat. **B.** Habit. **C.** Leaf blade (adaxial surface). **D.** Leaf blade (abaxial surface). **E.** Capitulum (top view). **F.** Capitulum (back view). **G.** Capitulum (side view). **H.** Outer phyllaries (abaxial surface). **I.** Inner phyllaries (abaxial surface). **J.** Tubular florets.

Note:—According to the infrageneric classification of *Cremanthodium* by Liu (1982, 1989), *C. bomiense* can be readily referred to *C. ser. Calcicola* Ling & Liu in Liu (1982: 51) under *C. sect. Cremanthodium*. This series is well characterized by the discoid capitula with leaflike, herbaceous, oblong or oblanceolate, and apically obtuse phyllaries. With the description of this new species the series includes five taxa now, namely *C. atrocapitatum* var. *atrocapitatum*, *C. atrocapitatum* var. *brachytrichum*, *C. calcicola*, *C. cucullatum* Ling & Liu in Liu (1982: 53), and *C. bomiense*. All these taxa are restrictedly distributed in northwestern Yunnan and southeastern Xizang, China (Fig. 14), with *C. atrocapitatum* var. *atrocapitatum* occurring in northwestern Yunnan's Fugong, Gongshan and Weixi, *C. atrocapitatum*

var. *brachytrichum* in northwestern Yunnan's Weixi, *C. calcicola* in northwestern Yunnan's Zhongdian, *C. bomiense* in southeastern Xizang's Galongla Shan between Bomi and Mêdog, and *C. cucullatum* in northwestern Yunnan's Lanping. They can be keyed out as follows:



FIGURE 12. Specimens of *Cremanthodium calcicola*. **A.** China, Yunnan, Zhongdian, G. Forrest 12711 (E, syntype). **B.** Same locality, G. Forrest 12711 (KUN, syntype). **C.** Same locality, K.M. Feng 1762 (PE). **D.** Same locality, T.T. Yu 11749 (PE).



FIGURE 13. Specimens almost identical to *Ligularia microcephala*, but somewhat different in having stramineous-blackish (vs. black) phyllaries. **A, B.** Myanmar, N'maikha-Salwin divide, G. Forrest 25023 (E, PE). **C, D.** Same locality, G. Forrest 27272 (E, P).

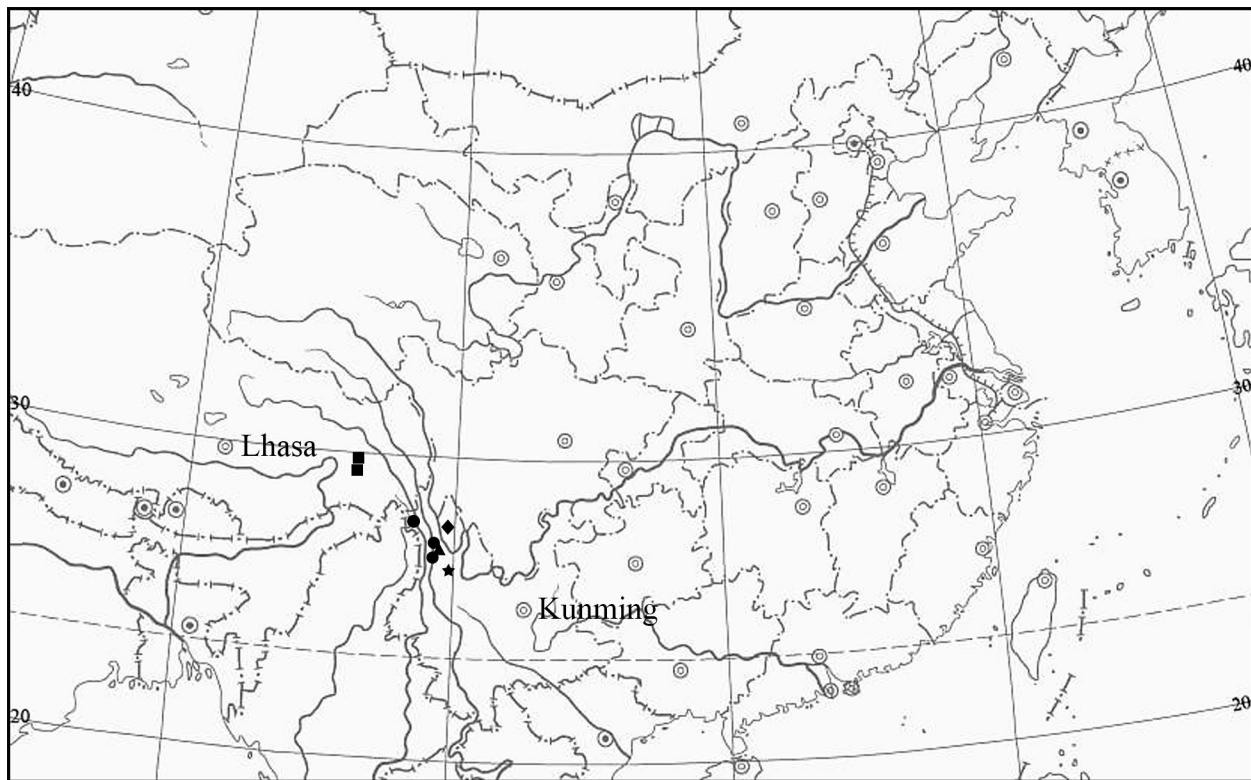


FIGURE 14. Distribution of *Cremanthodium atrocapitatum* var. *atrocapitatum* (●), *C. atrocapitatum* var. *brachytrichum* (▲), *C. bomiense* (■), *C. calcicola* (□), and *C. cucullatum* (◆).

Key to the species of *Cremanthodium* sect. *Cremanthodium* ser. *Calcicola*

1. Basal leaves orbicular-reniform, margin coarsely mucronate-dentate, apex obviously emarginate 2
- Basal leaves reniform, reniform-cordate or suborbicular, margin crenate or shallowly dentate, apex rounded or obtuse 3
2. Involucre 1.2–1.6 cm high; inner phyllaries 4–5 mm wide; pappus 4–7 mm long, as long as tubular corolla *C. atrocapitatum* var. *atrocapitatum*
- Involucre 1.8–2.2 cm high; inner phyllaries 7–8 mm wide; pappus 0.5–2 mm long, much shorter than tubular corolla *C. atrocapitatum* var. *brachytrichum*
3. Basal leaves smaller, 1–1.5 cm long, 1.5–3.1 cm wide, densely white arachnoid abaxially *C. cucullatum*
- Basal leaves larger, 4–7.5 cm long, 4–10 cm wide, slightly purple pubescent along veins or glabrous abaxially 4
4. Stem densely yellowish brown pubescent and white arachnoid distally; leaves suborbicular, sinus very narrow, not divergent; phyllaries 18–25, glabrous or subglabrous; pappus ca. 4 mm long *C. calcicola*
- Stem densely purple pubescent distally; leaves reniform-ovate, sinus divergent; phyllaries 14–18, more or less black pubescent; pappus 7–8 mm long *C. bomiense*

Acknowledgements

We are grateful to an anonymous reviewer and Dr. Alexander Sennikov, subject editor of *Phytotaxa*, for their valuable comments on the manuscript. We thank the curators of A, CDBI, E, GH, IBSC, KUN, P, PE, SYSU, W and WU for allowing us to examine specimens or use their images of specimens. This work was supported by the National Natural Science Foundation of China (grant no. 31370232, 31670195).

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