


Materia Revisionis Arisaemarum: III. taxonomic notes and five new taxa of the genus *Arisaema* (Araceae) from South China

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Abstract

In the course of systematic studies and fieldwork on the genus *Arisaema* in China between 2017 to 2024, five new species are being proposed and are herein described in detail, accompanied by photographs, diagnosed against allied species, and briefly analyzed the morphological variation patterns between related taxa. These newly proposed species are *A. cordigerum*, *A. hui*, *A. mengii*, *A. pulchellum*, and *A. sceptrum*. *Arisaema thunbergii* subsp. *autumnale*, native to Taiwan Island, is elevated to species status, while *A. melanostomum* has been synonymized to *A. brevistipitatum*, a previously overlooked name. Additionally, based on Engler's unranked subgeneric division, *Arisaema* sect. *Auriculata* is proposed based on combined evidence. Furthermore, the identities of *A. sinii* and *A. xuanweiense* are re-examined, drawing on inspections of original materials. Lastly, the patterns of distribution observed and their biogeographical inferences are discussed for these newly discovered species and their closely related counterparts, emphasizing the rich diversity of *Arisaema* species in the subtropical South Chinese flora.

Key words: *Arisaema* sect. *Auriculata*, Aroid, Flora of China, Linnean Taxonomy, Plant Systematics

Introduction

Arisaema Martius (1831: 459) is a large genus comprising approximately 200 species (Ma & Chen 2024), primarily distributed across East Asia, West Malesia, Peninsular India, southern Arabian Peninsula, and tropical East Africa in the Old World, and also disjunctively in the humid regions of the Eastern North America, and Southern Mexico in the New World (Li 1980, Mayo *et al.* 1997 p. 270). The Himalayas-Hengduan Mountains is noted as the primary center of diversity for the genus (Li 1980). As one of the most morphologically diverse genera among Araceae in the northern temperate zone, *Arisaema* is recognized by a combination of morphological traits: subterranean stem rhizomatous or tuberous with simple laticifers, leaf blades compound that vary from simple, trifoliolate to pedate or radiate. The leaf venation is reticulate, with submarginal collective veins. The spathe is highly specialized, composed of a closed tube, mouth, and limb, with the male tube typically possessing an opening for pollinators at base. The free, paradioecious spadix is terminated with a highly differentiated apical appendix, which may be covered by neuters. The genus exhibits basal placentation with commonly several ovules (rarely up to 17 or more, see Murata 1986 and Ma & Yue 2025), and its synandria are 2–6-androus, with various dehiscence patterns (Mayo *et al.* 1997).

The taxonomic complexity of *Arisaema* has long motivated botanists to develop a comprehensive sectional classification (summarized in Murata *et al.* 2013). Early efforts began with Schott (1859), who divided the genus into four highly heterogeneous *greges*: Trisecta, Pedatisecta, Radiatisecta and Peltatisecta (all invalidly published without description) based on arrangements of leaflets. Later, in the light of the Darwinian tradition (Mayo & Bogner 2013 p. 252), in his magnificent *Das Pflanzenreich*, Engler (1920 pp. 150–151) made a major revision of the genus *Arisaema* by introducing 15 unranked subgeneric divisions supported by evidence of inflorescence characters, primarily the form of the basal part of spadix-appendix, and also the form of spathe, spadix, appendix apex, and synandrium. After WWII, a renaissance in the interest of *Arisaema* emerged from the late 1960s to 1980s, especially with the exploration of the eastern Himalayan flora, Hara (1971) played a key role in refining the classification by incorporating traits of the spadix, leaf lobation and, most importantly, pattern of anther dehiscence into the revised sectional framework.

In the last two decades, Gusman & Gusman (2002, 2006), Murata (2011) and Murata *et al.* (2013) significantly advanced the sectional classifications by emphasizing vegetative morphology, including shoot architecture and leaf veneration (Murata 1987), while the recent advances that resulted from molecular phylogenetics offer a more robust understanding of the evolutionary relationships within the genus, which led to the recognition of 15 sections in the genus (Renner *et al.* 2004, Murata *et al.* 2013, Ohi-Toma *et al.* 2016). In China, *Flora of China* provides the most recent comprehensive treatment, documenting 78 species of *Arisaema* (Li *et al.* 2010), covering all major groups except *A. sect. Fimbriata* (Engler 1920: 151) H.Li (1979a: 123) *sensu stricto*. (sensu Murata *et al.* 2013, Ohi-Toma *et al.* 2016).

This paper reports the discovery of five new *Arisaema* species from fieldwork conducted in southern China between 2017 and 2024. These species are analyzed using both morphological and geographic evidence to assess their systematic placement and relationships with their close allies. The recognition of the recent progress and the taxonomic treatments in the current study contributes to an updated total of 93 *Arisaema* species in China (Gusman 2006, An *et al.* 2011, Zhu *et al.* 2011, Hu *et al.* 2012a, Bruggeman 2016, Nangkar *et al.* 2017, Bruggeman 2018, Ma 2018, Ma & Huang 2018, Ma *et al.* 2019, Ma & Chen 2024). Notably, this study also supports the formal recognition of *A. sect. Auriculata* (Engler 1920: 163) Z.X.Ma *stat. nov.* as a distinct section, based on a thorough re-examination of the systematic position of *A. auriculatum* Buchet (1911: 123) and *A. meleagris* Buchet (1911: 122) and their relationship with *A. sect. Nepenthoidea* Gusman & L.Gusman ex J.Murata (2011: 63).

Materials and methods

All holotype material for this study were collected during fieldwork in South China from 2017 to 2024. Herbarium specimens were air-dried overnight using hot-air-dryer, and spirit specimens fixed and preserved in 75% alcohol at BAZI. Key features were measured and photographed from fresh specimens in the field using a Nikon D5300 camera. Associated herbarium studies were conducted at A, BAZI, CAS, HITBC, KUN, MICH, MO, NY, PE, PH, UC, US, and WIS (herbarium code follows *Index Herbariorum*, Thiers 2008+), with physical visits taken between 2019 and 2024.

Taxonomy

1. *Arisaema sect. Attenuata* (Engler 1920: 155) H.Li (1979a: 127). Lectotype [designated by Hara (1971: 324)]: *A. laminatum* Blume (1836: 99)

1.1. *Arisaema cordigerum* Z.X.Ma, *sp. nov.* (Figs. 1–3)

Arisaema cordigerum is allied with *A. pachystachyum* Hetterscheid & Gusman (2003: 37) but differs in having a strongly cordate white patch at the back of spathe, a spadix axis not distinctly swollen to the base, and a shortly recurving spadix-appendix, 3.5–5.6 cm long.

Type:—CHINA. Yunnan Province: Pu'er, Menglian County, along road G219, near Gongxincun, from Menglian to Jingxin, 12 June 2024, Y.E.Wang 784 (holotype BAZI!, isotype PE!).

Perennial geophyte, seasonally dormant, paradioecious. Subterranean stem tuberous, pale white, subglobose, to 4.5 cm in diam., bearing tubercles. Eophyll unknown. Cataphylls 3, membranous, free. Foliage leaves 1–2; petiole dull purplish green, mottled with dark purple, to 40.4 cm long, proximally sheathing into a upright pseudostem, petiolar sheath free; leaf blade trifoliolate, dull green, waxy, thickly membranous; laminae venation forming a smooth and clear brochidodromous collective venation close to the leaf margin, lateral veins raised at abaxial surface, strongly impressed at adaxial surface; lateral leaflets oblique oblong, 13.7–26.5 × 9.7–12.6 cm, base rounded, subsessile, apex acuminate and caudate, with a short tail 0.3–0.8 cm long; central leaflet elliptic to oblong, 15.7–30.7 × 11.1–17.1 cm, with petiolule 0.9–3.5 cm long. Inflorescence solitary, always below leaves; peduncle concolorous with petiole. Spathe tube green and mottled with dark dots on the abaxial surface, glossily pale green on the adaxial surface, cylindric, 5.2–5.5 cm long, 1.0–1.3 cm in diam, with a long cordate white patch in the middle, ca. 1.9–3.5 × 1.6–2.3 cm; spathe mouth green, obliquely truncate, not auriculate; limb green, triangular–ovate, 1.7–2.0 cm wide (at base), long acuminate to the apex, with a short filiform tail. Spadix dioecious, 5.8–7.9 cm long; female zone subcylindric,



FIGURE 1. Habit of *Arisaema cordigerum*. All photos are vouched by the holotype, Y.E. Wang 784 (BAZI!).



FIGURE 2. Leaf blade of *Arisaema cordigerum*. A. Abaxial surface with raised foliar venation; B. adaxial surface. All photos are vouched by the holotype, Y.E. Wang 784 (BAZI!).

1.5–2.3 cm long, 0.4–0.7 cm in diam.; gynoecia densely arranged; ovary glossily green, obovoid; placentation basal; style short but obvious; stigma white, pubescent; male zone subcylindric, 1.3–1.5 cm long; androecia lax; synandrium consisting 2 bithecal anthers, cofiliment short; thecae dark purple, globose, dehiscing by a short slit resulting in an apical pore; connective inconspicuous; appendix purplish green, slender, 3.5–5.6 cm long, sessile at base, attenuate and curving forward at apex; neuters purplish green, subulate, curved, to 0.3 cm long, covering on proximal portion of female spadix; Infructescence and seed unknown. Anthesis form May to June.

Distribution:—Endemic to SW China (SW Yunnan, Pu'er), likely in E Myanmar.

Eponymy:—The Latin epithet “*cordigerum*” comes from “*cordis*” and “*gerere*”, meaning “bearing a heart” or “heart-bearing”, describing the diagnostic heart-shaped white patch on the back of the spathe.

Additional specimens examined (paratypes):—CHINA. Yunnan Province: Pu'er, Gongxin, Gongxincun, Xinzhai, Qiuyushan Hill, in forest valley, elev. ca. 1300 m, 11 May 2010, *S.S.Zhou* 7320 (HITBC [mounted on two sheets, sheet numbers: 138322, 138323]!); Jingxin, Jingxin Cun, on limestone hills along Nanlei River, elev. ca. 950 m, 20 May 2010, *S.S.Zhou* 7611 (HITBC [sheet number: 138617]!); Jingxin, Langdao, under the forest, elev. 1250 m, 5 June 2012, *H.Dong, L.Chen & Q.Zhao* 175 (KUN [barcode: KUN1227439]!); Simao, in forest west of Lake Heilongtang, 11 June 2024, *Y.E.Wang* 751 (BAZI!, PE!).



FIGURE 3. Inflorescence of *Arisaema cordigerum*. A, B. Inflorescences in a bunch showing the pattern of variation, note the heart-shaped white patch at the back of the spathe; C. the heart-shaped white patch viewed from the adaxial spathe surface; D–F. inflorescence in different views; G. male spadix; H. female spadix; I. details on neuters of female spadix. All photos are vouched by the holotype, *Y.E.Wang* 784 (BAZI!).

2. *Arisaema* sect. *Auriculata* (Engl.) Z.X.Ma, stat. nov. Basionym:—*Arisaema* [infragen. unranked] *Auriculata* Engler (1920: 163, as “§ 4”). Type:—*A. auriculatum* Buchet (1911: 123) (Art. 10.8, Turland *et al.* 2018)

Small geophyte, paradioecious. Subterranean stem tuberous, globose, small, to 1.2 cm in diam. Phyllotaxy quincuncial. Cataphyll and petiolar sheath closed proximally; pseudostem subterranean, subtended completely by cataphyll. Foliage leaf pedate, leaflets entire or variously erose; leaf rachis present, rarely obscure. Spathe green or pale brown, densely flushed with dark purple or dark brown spots, auriculate at mouth. Spadix unisexual; androecia initiation subcentrifugal (not genuinely acropetal); synandrium consisting 2 bithecal anthers, cofilament short, thecae globose, dehiscing by a short slit resulting in an apical pore; appendix terete or flagellate, swollen proximally and gradually narrowed to the base, often sessile, apex obtuse or filiform.

Species included:—*Arisaema auriculatum* Buchet [= *A. lushuiense* G.W.Hu & H.Li in Hu *et al.* (2012b: 684)] and *A. meleagris* Buchet (1911: 122) [= *A. shimienense* H.Li in Li *et al.* (1977: 108)].

Distribution:—Alpine regions in Central-Southwest China (Chongqing, Hubei, NW Hunan, S Shaanxi, Sichuan, NW Yunnan), elev. 1400–3100 m.

Notes:—The newly recognized *Arisaema* sect. *Auriculata* emerges from a revised classification of the species *A. auriculatum* Buchet and *A. meleagris* Buchet that previously being assigned to the *A. sect. Nepenthoidea* (Gusman & Gusman 2002 pp. 221, 2006 p. 265, Li *et al.* 2010 p. 55, Murata 2011 p. 63). The section *A. sect. Nepenthoidea* was first proposed by Gusman & Gusman (2002 p. 221), based on the unranked infrageneric division of Engler (1920 p. 208). However, due to the lack of proper citation of basionym, this section was not validly published until Murata (2011 pp. 63). *Arisaema nepenthoides*, which automatically became the type, was the only species cited when the unranked group was established (Engler 1920 p. 208), while *A. wattii* Hooker f. (1893: 498) was recognized as part of *A. sect. Pistillata* in the same publication (Engler 1920 p. 199). The two species, *A. nepenthoides* and *A. wattii*, form a small coherent group, *A. sect. Nepenthoidea sensu stricto*, while phylogenetic analysis indicated (Arunkumar *et al.* 2019), though holding a different interpretation here, a necessity of adopting a broader concept of the species *A. nepenthoides* to synonymize most of its satellite species, resulting a monotypic section.

Recently, well-sampled phylogenetic studies have shown *A. sect. Nepenthoidea sensu lato* being paraphyletic (Ohi-Toma *et al.* 2016, Tran *et al.* 2022). Together with *A. auriculatum*-*A. meleagris* (*A. sect. Auriculata*) and *A. sect. Decipientia* (Engler 1920: 195) H.Li (each a monophyletic group), *A. sect. Nepenthoidea s.l.* represents a paraphyletic group at the base of the Clade IX, and it is appropriate to accept *A. sect. Auriculata* as a separate section to maintain the monophyly of *A. sect. Nepenthoidea s.l.*

Additionally, the patterns of geographical distribution of *A. sect. Auriculata* and *A. sect. Nepenthoidea s.s.* highlights their distinct floristic associations. The distribution of *A. sect. Nepenthoidea s.s.* is largely eastern Himalayan, which begins from Nepal and extends through the entire eastern Himalayas (Hara 1971, Li 1979a p. 177), northeastward to the northern end of the Gaoligong Mountains (Li *et al.* 2000 pp. 1057, 1060–1062), and southward along the margin of Yunnan-Guizhou Plateau to the subalpine regions of southeastern Yunnan [Li 1979b p. 821, as *A. biauriculatum* Smith ex Handel-Mazzetti (1936: 1365)], southwestern Guangxi (Qin & Fang 2003 p. 141), and northern Vietnam (Luu *et al.* 2022, as *A. vietnamense* Luu, Q.B.Nguyen, H.C.Nguyen, & T.Q.T.Nguyen), adjacent to the Gulf of Tonkin. In contrast, *A. sect. Auriculata* is endemic to the alpine regions of Central China-Hengduan Mountains (Li *et al.* 2010 pp. 56, 60), where it consists of two species with nearly sympatric distribution that extends from the Wuling Mountains in central China across the Sichuan Basin to the Qinling Mountains in the north and high-altitude areas of the Hengduan Mountains in the west. The only known area where the distributions for these two sections overlap is Yunling-Gaoligong Mountains in northwestern Yunnan (Li *et al.* 2000 pp. 1057, 1060–1062, Li 2003 pp. 613, 616), perhaps also in the alpine regions of the Kachin Mountains in Myanmar, which has yet been reported.

Consequently, based on their distinct distribution patterns and probable different geographical origins, I propose that *A. sect. Auriculata* and *A. sect. Nepenthoidea s.s.* represent different floristic associations: specifically *A. sect. Nepenthoidea s.s.* likely originated in the eastern Himalayas, with patchy distribution in the southeastern extension toward the Gulf of Tonkin possibly being a glacial relic, and, in contrast, *A. sect. Auriculata* likely originated in the Central China and East Hengduan Mountains, where it has continued to thrive.

3. *Arisaema* sect. *Clavata* (Engler 1920: 171) H. Ohashi & J. Murata (1980: 283) Type:—*A. clavatum* Buchet (1911: 121)

3.1. *Arisaema hui* Z.X.Ma, Zi Rui Guo & R.K.Li, *sp. nov.* (Figs. 4, 5)

Arisaema hui differs from *A. silvestrii* in having an often non-reflected tuber; a caulescent pseudostem to 42 cm long, leaflets 13–15, all parts of inflorescence mottled with black dots, and a broadly auriculate spathe mouth with auricles to 0.8 cm wide.

Type:—CHINA. Chongqing Municipality: Qianjiang District, mountain valley west of road S209, near Houziyan, beside a stone path in deciduous forest, 8 March 2024, Y.E.Wang 162 (holotype BAZI!, isotypes BAZI!, E!, PE!).



FIGURE 4. Habit of *Arisaema hui*. A, B. Individuals from S Chongqing (type gathering), Y.E. Wang 162 (BAZI!); C, D. population from N Guizhou, Y.E. Wang 129 (BAZI!).

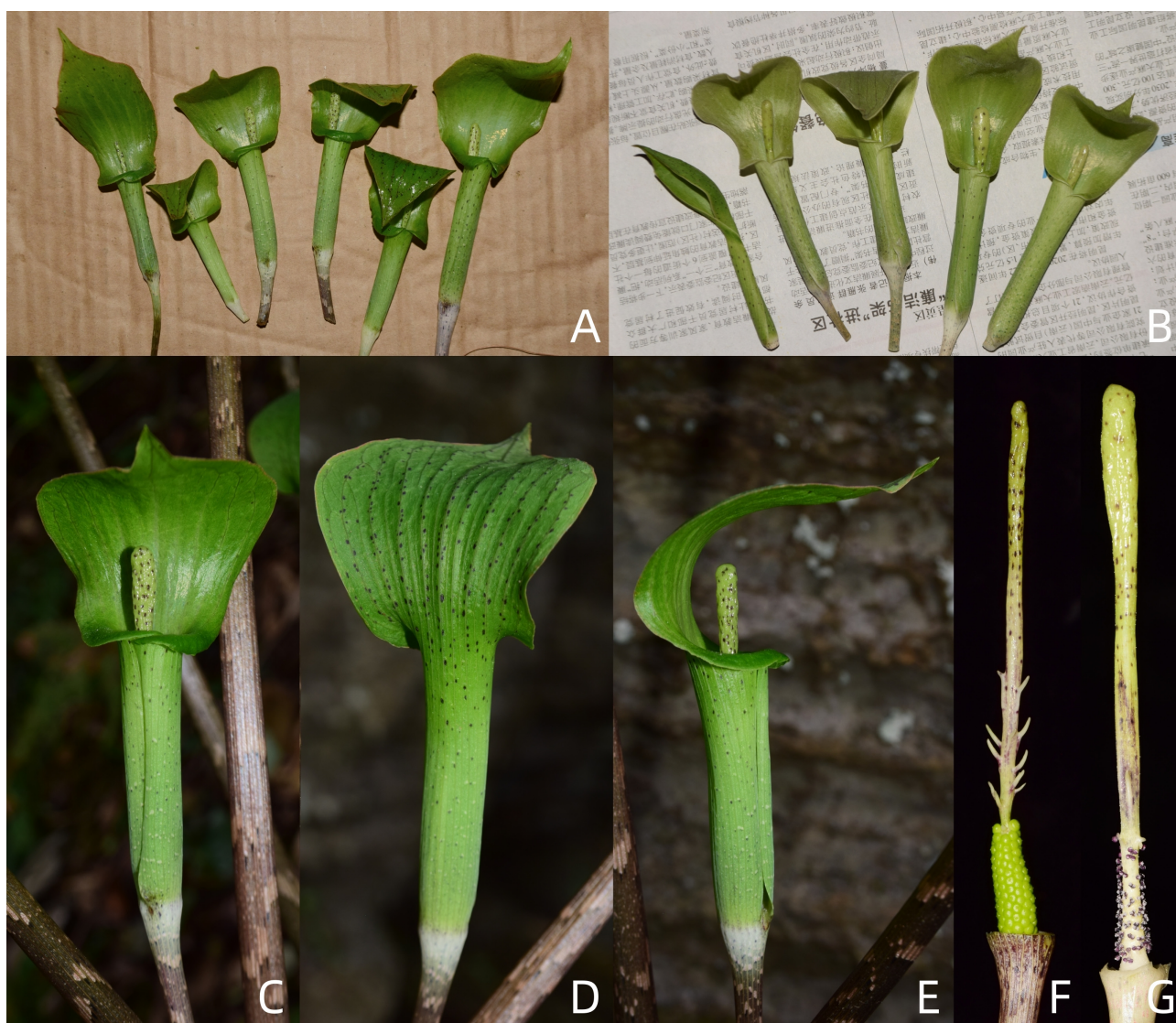


FIGURE 5. Inflorescence of *Arisaema hui*. A, B. Inflorescences in bunches showing the pattern of variation; C–E. inflorescence in different views, note the broadly auriculate spathe-mouth; F. female spadix; G. male spadix. A, C–G are individuals from the type gathering in S Chongqing, Y.E. Wang 162 (BAZI!), while B represents a population from N Guizhou, Y.E. Wang 129 (BAZI!).

Perennial geophyte, to ca. 80 cm tall, seasonally dormant, paradioecious. Subterranean stem tuberous, subglobose, erect, often not deflecting, to ca. 3.4 cm in diam., rarely bearing tubercles; accessory buds white with purple mottled, 2–4 grouped. Cataphylls 3, free. Foliage leaves 1–2; petiole and pseudostem glossily green mottled purplish brown, 22.3–67.5 long, petiolar sheath free, proximal ca. $\frac{1}{2}$ sheathing into a caulescent and upright pseudostem; leaf blade pedate; leaflets 13–15, green, waxy, thickly membranous, oblanceolate, base sessile, broadly cuneate, apex acuminate; primary veins and lateral veins raised abaxially, concolor with petiole, laminae venation brochidodromous, forming a smooth collective vein near leaf edge; central leaflet 6.4–8.3 \times 1.9–3.2 cm, largest or shorter than the adjacent leaflets; outermost leaflets often minute; rachis 12.4–25.6 cm long between central and outermost leaflets. Inflorescence solitary, below leaves when female, above when male, without obvious odor. Peduncle mottled purplish brown, glossy, always proportionally longer in male than female. Spathe tube abaxial surface green with very obscure dark green striation, with dark purple dots aligning vertically, white at base, slightly glaucous, adaxial surface nearly glossily green, cylindric to long funnelform, 4.3–9.5 cm long, 0.9–2.7 cm in diam. at the narrowest point; spathe mouth greenish, broadly auriculate, auricle 0.5–0.8 cm wide, sometimes recurving; spathe limb abaxially green, with black dots vertically aligning, adaxially glossily green, lanceolate to acuminate-ovate, bending forward and flat, 6.2–8.5 cm long. Spadix unisexual, 7.5–12.3 cm long; female zone cylindric, somehow pyramidoid, to 2.7–3.0 cm long, 0.4–1.2 cm in diam.; gynoecium densely arranged; ovary glossy green, obovoid, 1-locular; placentation basal; style very short; stigma white, puberulent; male zone cylindric, 1.4–1.7 cm long; androecium lax; synandrium consisting 2 bithecal

anthers, cofilament short; thecae dark purple, globose, dehiscing by a short slit resulting in an apical pore; appendix greenish yellow, with black dots, erect, slender claviform, to 4.1–9.3 cm long, 0.2–0.8 cm in diam., somewhat clavate to the apex, proximal part sessile, subulate neuters present in female, absent in male. Mature infructescence unknown. Anthesis from March to Early April.

Distribution:—S Chongqing (Qianjiang) and N Guizhou (Jiangkou), endemic to Central China.

Eponymy:—The species epithet “*hui*” honors Zheng-Kun Hu of the Administrative Bureau of Fanjingshan National Nature Reserve for his extensive exploration of the local flora and fauna of Mt. Fanjingshan. He was the first to encounter this new species in 2022.

Additional specimens examined (paratypes):—CHINA. Chongqing: Qianjiang, valley at west of road S209, near Houziyan, beside stone path, 8 March 2024, *Y.E.Wang 154* (BAZI!, PE!); *loc. ibid.*, 14 May 2024, *R.K.Li s.n.* (BAZI!). Guizhou: Jiangkou, Mt. Fanjingshan, at the entrance of Fanjing Mountain Scenic Area, in Bamboo forests behind the farmhouse, next to the boundary monument of the reserve, 10 March 2023, *Zheng-Kun Hu s.n.* (BAZI!); *loc. ibid.*, 2 March 2024, *Y.E.Wang 129* (BAZI!, PE!); *loc. ibid.*, Mt. Fanjingshan, Yamugou Scenic Area, trailside next to the monkey statues, under the deciduous forest by the stream, 2 March 2024, *Y.E.Wang 131* (BAZI!, PE!).

3.2. *Arisaema sceptrum* Z.X.Ma, *sp. nov.* (Figs. 6, 7)

Arisaema sceptrum is similar to *A. clavatum* and *A. silvestrii*, but differs in having a tall, caulescent pseudostem, to 1.2 m long, a pedate leaf blade with 11–17 leaflets, a strongly bicolorous spathe, dull green abaxially and dark purple adaxially, a claviform appendix, not abruptly capitate nor exerted from spathe, apex with dark purple, raised, anastomosed venations. This species is also similar to *A. heterocephalum* subsp. *okinawaense* H. Ohashi & J. Murata (1980: 293), but differs in having more leaflets, 11–17, an uncapitate spadix-appendix, with dark purple anastomosed venations at apex, and an endemic distribution to the Karst regions in S Guizhou, mainland Asia.

Type:—CHINA. Guizhou Province: Libo County, along road Y006, Maolan, Shishangsenlin, in limestone crevices, 21 March 2024, *Y.E.Wang 334* (holotype BAZI!, isotypes BAZI!, E!, PE!).

Perennial geophyte, to 1.2 m tall, seasonally dormant, paradioecious. Subterranean stem tuberous, creamy white, erect to slightly deflective, subglobose to depressed globose, to ca. 7 cm in diam., rarely bearing tubercles; axillary bud scale-like and 4–6 in a group. Eophyll unknown. Cataphylls ca. 3, membranous, free. Foliage leaves 2; petiole glossily dark green, mottled with purple and brown, cylindric, to 1 m long, the proximal ½ part sheathing into pseudostem, petiolar sheath free; leaf blade pedate; leaflets 11–17, pale green, thick membranous, entire, oblong or oblanceolate, base cuneate, subsessile to shortly petiolulate, apex long-acuminate and attenuate; laminae venation brochidodromous, forming a smooth collective vein near leaf edge; central leaflet 16.5–32.6 × 3.3–9.7 cm, usually the largest or sometimes slightly shorter than the adjacent leaflets, shortly petiolulate at base; outermost leaflet 1.5–8.5 × 0.5–2.7 cm, sometimes minute; rachis 13.5–28.4 cm long. Inflorescence solitary, always borne on the pseudostem, positioned below leaves when female, above when male. Spathe tube abaxially green and thickly glaucous, adaxially glossily pale green with thick longitudinal purple striation, fading distally, cylindrical to narrowly funnelliform, 6.9–9.8 cm long, 1.1–1.9 cm in diam.; spathe mouth purple, rounded; spathe limb dull green abaxially, dark purple adaxially, broad lanceolate, 6.5–12.9 × 2.9–5.4 cm, acuminate to the apex. Spadix dioecious, 6.9–12.4 cm long; female zone short subpyramidal, 2.5–2.7 cm long; gynoeceium densely arranged; ovary greenish, obovoid; ovules 3–4; placentation basal; style obscure; stigma subglobose, whitish pubescent; male zone subpyramidal, 1.9–2.4 cm long; androeceium lax; synandrium consisting of 2 bithecal anthers, cofilament short; thecae pale purple, globose, dehiscing by a short slit resulting in an apical pore; appendix whitish, often molted with purple, claviform, swollen, 5.4–9.7 cm long, 0.5–0.9 cm in diam, base attenuate and loosely covering curved and subulate neuters, apex obtuse, with dark purple, raised, anastomosed venations. Infructescence and seeds unknown. Anthesis from February to March.

Distribution:—Karst region in S Guizhou, possibly in N Guangxi.

Eponymy: The epithet “*sceptrum*”, a latinized form of the Greek word “σκήπτρον”, refers to a rod or staff, a symbol of sovereign authority, which is often highly ornamented, and here it is metaphorically used to describe the spadix-appendix, featuring the complex dark purple anastomosed venations on the apex.

Additional specimens examined (paratypes):—CHINA. Guizhou Province: Libo County, along road Y006, Maolan, Shishangsenlin, in limestone crevices, 19 March 2024, *Y.E.Wang 300* (BAZI!, PE!); *loc. ibid.*, along road Y002, Daodonghua, in limestone crevices of ravine forest understory, 22 March 2024, *Y.E.Wang 348* (BAZI!, PE!).

Notes:—*Arisaema* sect. *Clavata* is a coherent group, distinguished by a unique combination of characteristics: (1) quincuncial phyllotaxy, (2) multiple accessory buds accompanying auxiliary bud on the subterranean stem, (3) pedate

leaf blades, and (4) a sessile, claviform to flagellate spadix-appendix with short, acute neuters present at the base (Li *et al.* 2010 p. 49; Murata 2011 p. 26, Ohi-Toma *et al.* 2016).



FIGURE 6. Habit of *Arisaema sceptrum*. A. Female individual; B. male individual. All photos are vouched by Y.E.Wang 348 (BAZI!).

Recently, three new species from this section were described in China: *A. hui* (in this publication), *A. jiufushanense* Ma & Chen (2024: 287), and *A. sceptrum* (in this publication). Based on my personal observations of the species of this section, I have noted remarkable morphological consistency, especially in the number of leaflets, pseudostem height, and spathe characters (e.g. shape and coloration of the tube and mouth). The form of the spadix-appendix is also diagnostic at the species level. Among the species with a cylindrical spadix-appendix, *A. clavatum* shows a diverse pattern of morphological variation in its spadix-appendix, yet its apical ornamentation—consistently capitate and ranging from rugose to echinate—remains relatively stable. Nonetheless, for a more comprehensive understanding of this group, future cladistic and cytogeographic studies on population level are required.

The geographic distribution of *A. sect. Clavata* is also noteworthy. Endemic to the subtropical Sino-Japanese flora, this section includes nine species that display a disjunct distribution extending from continental East Asia to the southern Japanese Archipelago (Murata 2011 pp. 62, 70). Of these, six species are restricted to continental East Asia: *A. hui*, *A. clavatum*, *A. hunanense*, *A. jiufushanense*, *A. sceptrum*, and *A. silvestrii*. The remaining species are found on Pacific islands, with *A. ilanense* Wang (1996: 71) on Taiwan Island, *A. heterocephalum* Koidzumi (1928: 12) in the Ryukyu Islands (Murata 1985), and *A. negishii* Makino (1918: 41) in the Izu Islands.

The disproportionate concentration of species ($\frac{2}{3}$) in continental East Asia, particularly in the Wuling Mountains and its north-south extensions through southwestern Hubei, southeastern Chongqing, eastern Guizhou, western Hunan, and northern Guangxi, suggests that this region is the center of distribution (and even center of origin) for *A. sect. Clavata*, though currently still poorly understood and having been overlooked by the previous studies.



FIGURE 7. Inflorescence of *Arisaema sceptrum*. A. Inflorescences showing range of variation; B, C. inflorescence in different views; D. adaxial spathe surface with a dark purple coloration; E. female spadix; F. male spadix; G. apex of spadix-appendix, note the finely raised dark purple reticulate venation. All photos are vouched by Y.E.Wang 348 (BAZI!).

4. *Arisaema* sect. *Flagellarisaema* (Nakai 1950: 6) H.Hara (1971: 326). Type:—*Arisaema thunbergii* Blume (1836: 105)

4.1. *Arisaema autumnale* (J.C.Wang, J.Murata & H.Ohashi) Z.X.Ma, *stat. nov.* Basionym:—*Arisaema thunbergii* Blume subsp. *autumnale* J.C.Wang, J.Murata & H.Ohashi in Wang (1996: 75). Type:—CHINA. Taiwan: Taipei Hsien, Sanhsia, Hsiung-kung to Man-yue-yuan, on the floor of broadleaf forest, Wang, Sang & Chen 9460 (holotype TNU!, isotypes HAST!, TNU!)

Notes:—*Arisaema autumnale*, endemic to the Taiwan Island, is found in the central montane region of the island. In his systematic treatment of Taiwanese *Arisaema* species, Wang (1996) initially classified *A. autumnale* as a subspecies of *A. thunbergii*, and identified a few distinct morphological differences between it and *A. thunbergii* subsp. *urashima*. Notably, the spathe of *A. autumnale* is diagnostic of a less expanded limb and prominent longitudinal striations on both surfaces (Wang 1996, Omori *et al.* 2004). Furthermore, the flowering season of *A. autumnale* is highly differentiated, occurring exclusively in the autumn months of October to November, in stark contrast to the springtime bloom of all other subspecies of *A. thunbergii* (April to May, as reported in Murata 2011 p. 100). Wang (1996) attributed this unique phenology to an adaptation to a warm subtropical climate of *A. autumnale*'s habitat.

More recently, molecular phylogenetic evidence presented by Ohi-Toma *et al.* (2016) and Tran *et al.* (2022) has challenged our understanding of the taxonomic relationships within *A. thunbergii* *s.l.* by revealing the paraphyletic nature of *A. thunbergii*. This also challenged our understanding of the pattern of morphological variation in this species, especially emphasizing the special role that anthesis differentiation may play in speciation. Consequently, given the combined evidence, it is reasonable to propose upgrading *A. autumnale* to species status.

4.2. *Arisaema brevistipitatum* Merrill (1934: 19). Type:—CHINA. Kwangtung [Guangdong]: Tseng-shing District [Zengcheng Qu], Naam Kwan Shan [Mt. Nankun Shan], Apr. 7, 1932, in a dry bamboo garden, *W.T.Tsang 20149* (holotype NY [barcode: NY00133839]!, isotypes¹ A [barcode: A00025760]!, PE [barcode: PE00032460]!, SYS [barcodes: SYS00022361, SYS00022362, SYS00095397]!, US [barcode: US00088066]!). = *Arisaema melanostomum* Z.X.Ma, X.Yun Wang & W.Y.Du (2019: 266), **syn. nov.** Type:—CHINA. Guangdong Province: Shenzhen City, Yantian District, Yantian Sub-district, Sanzhoutian, ca. 450 m, 14 April 2018, *Z.X.Ma 0021* (holotype: PE [barcode: PE02333685]!, isotypes HK, PE [barcode: PE02333689]!)

Notes:—It has come to my attention that *A. brevistipitatum* is an earlier name that was inadvertently overlooked. Upon the publication of *A. melanostomum*, a thorough examination of the type of *A. brevistipitatum* was not conducted, resulting in a misunderstanding that they represented distinct entities. However, upon further review of the holotype, it is evident that both names refer to the same species. Therefore, I hereby merge the later-published *A. melanostomum* with *A. brevistipitatum* to reflect this understanding.

5. *Arisaema* sect. *Franchetiana* (Engler 1920: 184) H.Hara (1971: 326). Type:—*A. franchetianum* Engler (1881: 487)

5.1. *Arisaema mengii* Z.X.Ma, *sp. nov.* (Figs. 8–9)

Arisaema mengii is similar to *A. calcareum* H.Li in Li *et al.* (1977: 106) but differs from the latter in having abaxially glaucous leaf blades, chartaceous when dry, a uniformly green spathe, without a white patch at back, broad lanceolate limb acute and uncaudate to the apex, widely auriculate spathe mouth, strongly reflexing on the back of limb, a thick claviform appendix, truncated stipitate at base. *A. mengii* is also reminiscent of *A. sinii* K.Krause (1930: 1047) but differs from the latter in having chartaceous leaf blades when dry, an acute spathe limb, a broad auriculate spathe mouth strongly reflexing on the back of limb, a monoecious or male spadix with thick claviform appendix, truncated stipitate at base, without neuter attachment. *A. mengii* is also possibly related to *A. xuanweense* H.Li (2000: 419), but differs in having a broadly and strongly reflexing auriculate spathe mouth, uniformly green spathe, and a robust, claviform spadix-appendix.

Type:—CHINA. Hunan Province: Yongzhou, Lanshan, Citangxu, Zhaitou, 24 April 2024, *Z.X.Ma s.n.* (holotype BAZI!, isotypes BAZI!, E!, PE!).

Perennial geophyte, seasonally dormant, paradioecious. Subterranean stem tuberous, greenish white, glabrous, subglobose, to ca. 4 cm in diam., rarely bearing tubercles, petiolar sheath breaking into persistent fibers during dormancy; accessory bud solitary, scattered. Eophyll unknown. Cataphylls 3, membranous, free at distal region (3.4–4.1 cm), connate proximally. Foliage leaves 1–2 together; petiole pale green, proximally sheathing into an upright pseudostem, petiolar sheath connate proximally, free at apex, free part of petiole 17.6–31.6 cm long; leaf blade trifoliolate, green, abaxially paler, glaucous, thick membranous when fresh, chartaceous when dry; laminae venation broadly brochidodromous, strongly raised abaxially, slightly impressed adaxially, lateral veins forms brochidodromous collective venation near leaf edge; lateral leaflets subrhombic and somewhat oblique, 11.9–17.5 × 8.6–11.4 cm; central leaflet subrhombic, 7.8–16.5 × 11.1–11.3 cm, base sessile, broadly cuneate, apex acute. Inflorescence solitary, always

¹ The isotype at K [barcode: K000499304] refers to a different species, *A. consanguineum* Schott (1859: 27), and, as a heterogeneous entity, it must be excluded from the type gathering.

bearing on the pseudostem, below or equal with leaves in male, below than leaves in female. Peduncle pale green, glaucous, always proportionally longer in male than female. Spathe tube green, glossy, funnelform, attenuate to base, 4.8–5.6 cm long, 1.1–1.6 cm in diam. in the narrowest point; mouth green, broadly auriculate, to ca. 1.6 cm wide, strongly reflexing on the back of limb; limb green, glossy, bending forward and flat, long triangular to acute-ovate, 4.5–4.9 cm long, without a tail apically. Spadix male or monoecious when mature (female spadix not observed); monoecious spadix, pyramidoid, to 6.8 cm long; female zone, 1.0–1.3 cm long, 0.6–0.7 cm in diam.; gynoecia densely arranged; ovary glossy green, obovoid, shaped, 1-locular; placentation basal; style very short; stigma white, puberulent; male zone with up to 14 synandria together; male spadix cylindric, to 6.4 cm long; androecia spirally arranged; synandrium consisting 2 bithecal anthers, cofilament distinct; thecae dark purple, globose, dehiscing by a short slit resulting in an apical pore; *appendix* claviform, 5.4–5.8 cm long, base truncated stipitate, apex obtuse and swollen, to 1.1 cm in diam. Infructescence and seeds unknown. Anthesis from March to April.



FIGURE 8. Habit of *Arisaema mengii*, note the strongly backward extending auricle in C. All photos are vouched by the holotype, Z.X.Ma s.n. (BAZI!).

Distribution:—NE Guangxi (Guilin, pers. comm. with D.C.Meng) to SW Hunan (Yongzhou), endemic to SW China.

Eponymy:—The species epithet “*mengii*” is in honor of De-Chang Meng (born 1996, South China Botanical Garden, Chinese Academy of Sciences), a passionate botanist, who provided the type material of this species.

Additional specimens examined (paratype):—CHINA. Yunnan: Mengzi, prepared from cultivated plants at Bazi Botanical Garden (originated from Yongzhou, Hunan), 19 June 2024, Y.E.Wang 637 (BAZI!); *loc. ibid.*, 14 March 2025, Y.E.Wang 1729 (BAZI!).

Notes:—The systematic position of *Arisaema mengii* remains a topic for imminent discussion. While its subglobose tuber, fully connate cataphyll and petiolar sheath, trifoliate leaf blades (Fig. 8 A, B), green spathe, and claviform and basally truncated stipitate spadix-appendix make it superficially reminiscent of *A. sinii* and *A. calcareum*, pro parte sensu typus (Fig. 9 A–F), it is clearly distinct from both (see diagnosis).

When diagnosing against *A. mengii* above, the exact identity of *Arisaema sinii* is worth circumscription. *A. sinii* was first described by Krause (1930) based on type specimens of two duplicates collected by Shu Szi Sin (辛树帜, Ph.D. student of Berlin Botanical Garden during 1924–1927) in the Yaoshan Mountain Range of Northern Guangxi (Fig. 10 A, B). Based on the types and protologue, the diagnostic characteristics of this species includes a green spathe with a slightly auriculate mouth, an acuminate and caudate limb apex, and a dioecious spadix with a cylindrical, sessile spadix-appendix bearing a few neuters or neuter residuals at the base (Krause 1930, Fig. 11 A–G).

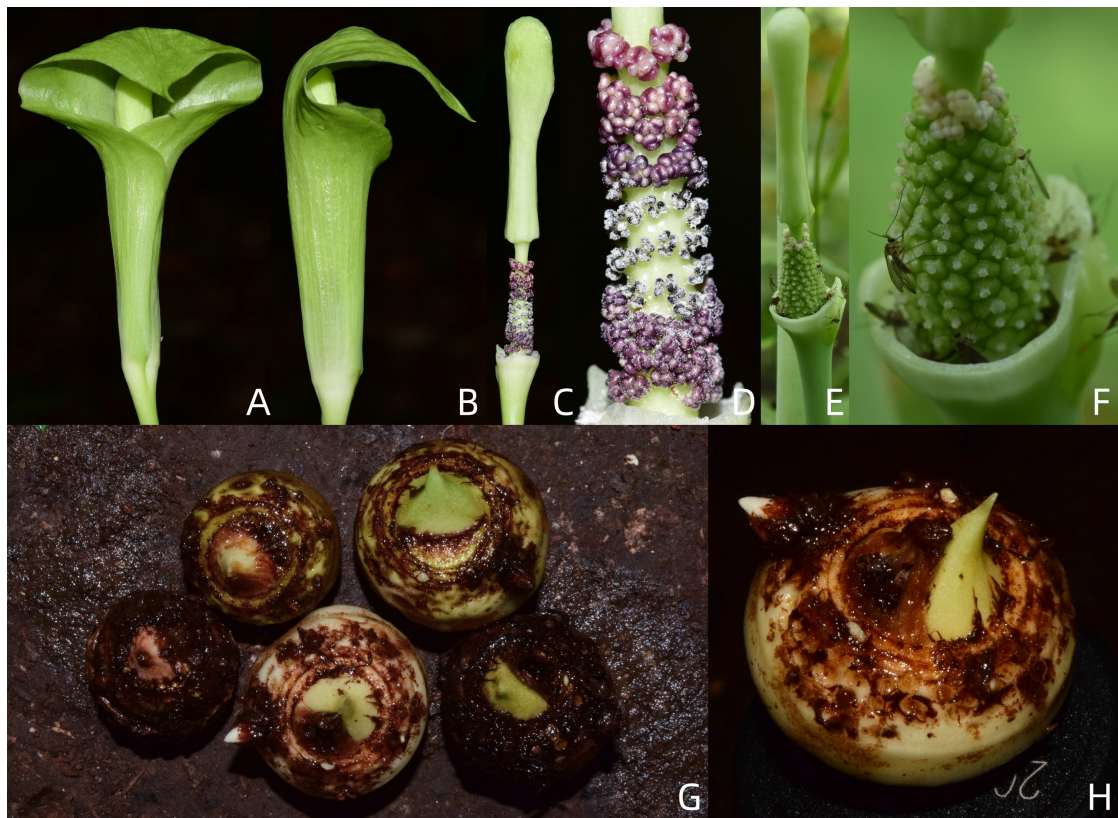


FIGURE 9. Inflorescence and tuber of *Arisaema mengii*. A, B. Inflorescences in different views; B. male spadix, note the distinctive stipitate spadix-appendix; C. androecia; E, F. monoecious spadix; G, H. tubers, note the. All photos are vouched by the holotype, Z.X.Ma s.n. (BAZI!).



FIGURE 10. Type duplicates of *Arisaema sinii* (S.S.Sin 9052, B!). Images © Herbarium, Botanic Garden and Botanical Museum Berlin-Dahlem.



FIGURE 11. Habit and inflorescence of *Arisaema sinii*, a population from the vicinity of Kunming, Yunnan. A. Habit; B–D. Inflorescence in different views; E, F. female spadix with variable neuters; G. male spadix. All photos are vouched by Y.E.Wang 731 (BAZI!).

Furthermore, another enigmatic species, *A. xuanweiense*, possibly allied with *A. mengii*, also remains undetermined due to insufficient knowledge regarding its identity. *A. xuanweiense* was described based on a sole specimen and a line drawing from plant collected from Xuanwei, northeastern Yunnan, which was subsequently brought into cultivation in Li Heng's nursery of the Kunming Botanical Garden (pers. comm. with Li Heng). Unfortunately, there is no known photographic record of the species, despite Li's long-standing practice of photographing living materials.

According to the type specimen (Fig. 12 A), *A. xuanweiense* is characterized by a tuber that likely being stoloniferous (though differently interpreted as rhizomatous in the protologue), trifoliate leaf blade, an obliquely truncate spathe mouth without auricles, and a claviform spadix-appendix with a stipitate base (Li 2000). However, some features described in the original publication, such as a rhizome and details about the spathe form, seem inconsistent or misinterpreted based on the type specimen.



FIGURE 12. Holotype and illustration of *Arisaema xuanweiense*. A. Holotype (X.Z.Liu 93023, KUN!); B. draft of illustration as part of the original material, prepared by Shiao-Lien Tseng, 6 May 1993.

Making things more difficult, the line drawing accompanying the description of *A. xuanweiense* contains obvious mistakes, particularly the depiction of two protrusions on the underground stem which were originally labeled as new shoots (handwritten manuscript associated with the type specimen), but misinterpreted as an inflorescence in the final format (Fig. 12 B), which is very uncommon in the *Arisaema*. In a recent interview, the artist revealed that he had never seen a living plant of *A. xuanweiense* during his preparation of the work, and the drawing was solely based on the holotype and Li's description, where artistic interpretations may have not been accurate (pers. comm. with S.L. Tseng). Thus, unfortunately, given the lack of additional material and field observations from the type locality, the true identity of *A. xuanweiense* and its relationship with *A. mengii* remain unclear, though *A. xuanweiense* lacks an auriculate spathe and probably bears a stoloniferous tuber and is distinct from the new species *A. mengii*.

6. *Arisaema* sect. *Lobata* Gusman & L.Gusman (2006: 260). Type:—*A. lobatum* Engler (1881: 487)

6.1. *Arisaema pulchellum* Z.X.Ma, sp. nov. (Figs. 13, 14)

Arisaema pulchellum differs from *A. lobatum* in having a small, creamy white tuber; membranous and somewhat bullate leaf blades, a proportionally larger and slightly galeate spathe limb (limb-tube length ratio = 1: 1.25–1.30, vs. 1: (2.2–)3.5–4.3 in *A. lobatum*), with brochidodromous white striation abaxially, and an appendix gradually narrowed and stipitate, but never crisped at base.

Type:—CHINA. Guizhou Province: Qiannan, Libo County, along road Y006, Maolan, Shishangsenlin, elev. 783 m, 19 March 2024, Y.E.Wang 299 (holotype BAZI!, isotypes BAZI!, E!, PE!).



FIGURE 13. Habit of *Arisaema pulchellum* in its type locality, note the color is darkened in the wilted inflorescence in B. A & C are vouched by the holotype, *Y.E. Wang 299* (BAZI!), B is vouched by *Y.E. Wang 336* (BAZI!).



FIGURE 14. Inflorescence and tuber of *Arisaema pulchellum*. A. Adaxial spathe surface showing longitudinal purple striation on spathe tube and white anastomosed venation extended to the spathe limb; B–D. inflorescence in different views, note the large spathe-limb with broadly auriculate mouth; E. male spadix; F. androecia connected to a stipitate spadix appendix with a rounded base; G. tubers in dormancy; H, I. tuber in the growing season, note the persistent whitish color. All images are vouched by the holotype, *Y.E.Wang 299* (BAZI!).

Perennial lithophyte, seasonally dormant, paradioecious. Subterranean stem tuberous, creamy white, subglobose, to 2.1 cm in diam., strongly deflected during growing season, bearing multiple tubercles. Eophyll unknown. Cataphylls 3–5, membranous, free at distal region (2.1–4.1 cm), connate proximally. Foliage leaf solitary, rarely in pairs; petiole glossy, green and mottled with purple, the proximal 5.4–17.6 cm sheathing into pseudostem, petiolar sheath fully connate; leaf blade trifoliolate, membranous, slightly bullate adaxially; laminae venation broadly brochidodromous, slightly raised abaxially, impressed adaxially; lateral leaflet, oblique, 9.9–16.5 × 4.7–8.4 cm, base subsessile; central leaflet oblong to elliptic, 9.8–11.4 × 4.4–9.4 cm, base narrowly attenuate or obtuse, petiolule 0.8–1.2 cm long, apex attenuate and acuminate. Inflorescence solitary, always held below leaves. Spathe tube pale green abaxially, pale green with purplish longitudinal striation, funnellform, 3.2–4.4 cm long, 0.9–1.6 cm in diam; spathe mouth broadly auriculate, 0.5–0.8 cm wide; spathe limb pale green with obscure brochidodromous white striation abaxially, dark purple with distinct pale green brochidodromous white striation abaxially, suberect, broadly lanceolate, 6.7–9.5 × 3.1–4.1 cm, long acuminate and attenuate to apex, slightly galeate at back; limb-tube length ratio=1: 1.25–1.3 (excluding the apical tail). Spadix dioecious, 4.3–5.4 cm long; female zone unknown; male zone cylindric to subpyramidal, 1.3–2.1 cm long; androecium lax; synandrium consisting 2 bithecal anthers, the cofilament distinct; thecae dark purple, globose, dehiscing by a short slit resulting in an apical pore; connective inconspicuous; appendix pale green and molted with purple, cylindric, 2.4–3.4 cm long, base gradually narrowed and stipitate, never crispate, apex obtuse. Infructescence and seeds unknown. Anthesis in March.

Distribution:—Karst regions from S Guizhou (Qiannan) to SW Guangxi (Baise and Chongzuo, pers. comm. with B.M.Wang and W.B.Xu), endemic to China, likely in N Vietnam. Possibly a southern relative of *A. lobatum*.

Eponymy:—The specific epithet “*pulchellum*” stems from the Latin “*pulchellus*”, meaning “beautiful”, in reference to the adorable inflorescence of this species.

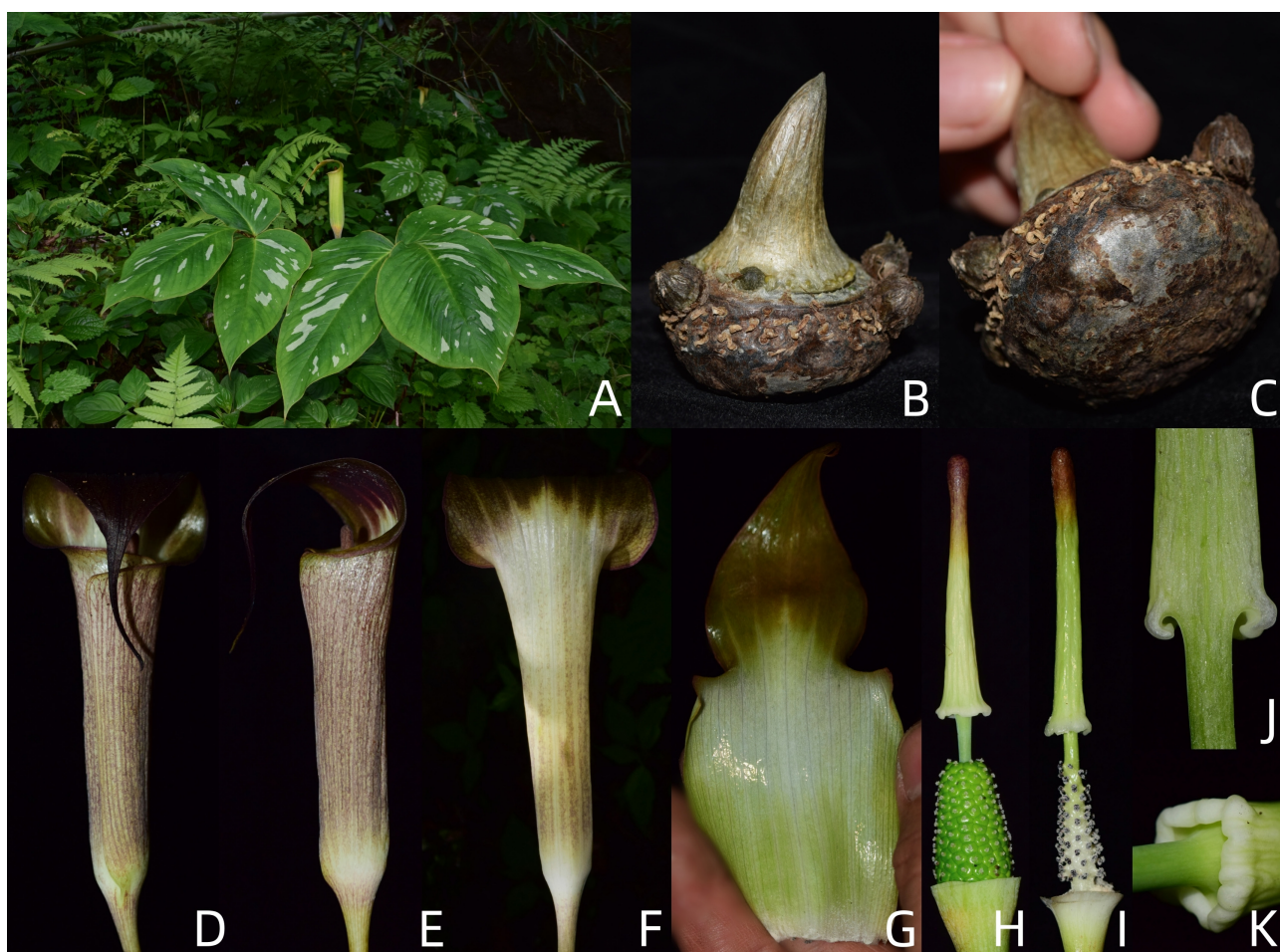


FIGURE 15. *Arisaema lobatum* from W Hubei, China. A. Habit of an individual with muculate variation; B, C. tuber, note the bluish green coloration; D–F. inflorescence in different views; G. adaxial spathe surface; H. female spadix; I. male spadix; J, K. the distinctive cristate base of the spadix-appendix. All photos are vouched by Y.E.Wang 700 (BAZI!).

Additional specimens examined (paratype):—CHINA. Guizhou Province: Qiannan, Libo, Yongkang, Liangshuijiang, elev. ca. 720, 08 March 2022, Y.F.Deng 31082 (PE[sheet numbers: 2658577, 2658580]!; *loc. ibid.*, Libo, along road Y006, Maolan, Shishangsenlin, elev. 742 m, 21 March 2024, Y.E.Wang 336 (BAZI!, PE!); *loc. ibid.*).

Notes:—*Arisaema pulchellum* is presumably related to *A. lobatum*, sharing purplish-mottled petioles, oblique leaflets, unisexual spadices, and a stipitate appendix in common. *A. lobatum*, a species with relatively limited variation, has been extensively discussed by Gusman (1997). A notable distinction is that *A. pulchellum* consistently has a small milky-white tuber (Fig. 14 G–I), while *A. lobatum* features a bluish-green one (Fig. 15 B, C). Observationally, *A. pulchellum* tends to have thinner and somewhat bullate leaves (Fig. 13 A–C), whereas *A. lobatum* has thicker, smoother leaves (Fig. 15 A). Their spathe form and color also differ: *A. pulchellum* displays distinct longitudinal striations, with a spathe limb, slightly galeate, and adorned with striking white anastomosed markings and a limb-to-tube length ratio of 1:1.25–1.3 (Fig. 14 A–D). In contrast, *A. lobatum* has a grayish-orange to pale purple spathe, with a larger limb-to-tube length ratio of 1:(2.2–)3.5–4.3 (Fig. 15 A, D–G). Additionally, the appendix base of *A. lobatum* is typically crisate in both male and female inflorescences (Fig. 15 H–K), while in *A. pulchellum* it is attenuate and never crisate (Fig. 14 E, F). It is worth noting that the female plants of *A. pulchellum* are poorly described, and larger individuals may exhibit more variation in appendix morphology.

Geographically, *A. pulchellum* and *A. lobatum* show a clear pattern of substitution. *A. lobatum* is a widespread species in continental Asia, endemic to subalpine regions from the Hengduan Mountains to eastern China, at elevations of (600–)2000–3300(–4500) meters (Gusman 1997, Li *et al.* 2010). It is predominantly a geophyte, rarely found in limestone areas. In contrast, *A. pulchellum* is an obligate lithophyte, restricted to the Karst regions in Guizhou and western Guangxi, where it prefers habitats of well-drained limestone crevices. Its elevation range decreases from about 780 meters in Guizhou (the type locality) to lower altitudes further south in Guangxi. This clear substitution in both distribution and ecological niche strongly supports the recognition of *A. pulchellum* as a distinct species.

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