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A new species and a new combination of the genus *Arisaema* (Araceae) from China

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Abstract

A new species, *Arisaema melanostomum*, and a new combination, *A. yunnanense* subsp. *quinquelobatum*, are proposed, described and illustrated in this article.

Keywords: *Arisaema melanostomum*, *Arisaema* sect. *Flagellarisaema*, *Arisaema* sect. *Odorata*, *Arisaema yunnanense* subsp. *quinquelobatum*

Introduction

The genus *Arisaema* Martius (1831: 459) (Araceae) contains 199 species (Bruggeman, 2016; Ma & Li 2017; Bruggeman, 2018), distributed mostly in temperate to tropical regions of eastern Asia-eastern Africa of the Old World and eastern North America-central Mexico of the New World. In China, the centre of its diversity and distribution is located in the Himalayas-Hengduan Mountains region (Li, 1980), to which 81 species and two varieties have been reported (Ma & Li 2017). According to Murata *et al.* (2013) and Ohi-Toma *et al.* (2016), the genus *Arisaema* is divided into 15 sections, supported by both phylogeny and morphology. In this article, a new combination of *A.* sect. *Odorata* J. Murata in Murata *et al.* (2013: 43) and a new species of *A.* sect. *Flagellarisaema* (Nakai 1950: 6) Hara (1971: 326) are proposed based on morphological evidence.

Arisaema sect. *Flagellarisaema* is a section disjunctively distributed in eastern Asia and eastern North America (Murata, 2011), while the distribution of *A.* sect. *Odorata* is restricted to the Hengduan Mountains in eastern Asia and its vicinity (Murata, 2011; Ma & Li 2017). Currently, the two sections contain 7 and 9 species, respectively (Murata, 2011; Ma, 2018), with 4 and 9 species reported to China. After this study, the number of species in the genus is 200 and the number of species in China is 84 (Ma & Li, 2017). Out of these species ca. 55% are endemic to China.

The population of the new species was first discovered by the local plant hobbyists in Shenzhen, China, around 2010, but was long misidentified as *A. cordatum* N.E.Brown in Hemsley & Forbes (1903: 117). This misidentification was adapted by other authors without examination of the material, e.g. in Ma & Li (2017). Nevertheless, as one of us (Xiao-Yun Wang), a local botany enthusiast, compared the material with typical *A. cordatum* discovered in Shenzhen, the problematic identification was recognised. Subsequently, in April 2018, during our field trip to the habitats of the unusual population and the typical *A. cordatum* in Shenzhen, further observations and comparisons were made. Ultimately, based on close observations of the living material and meticulous examination of herbarium specimens (HK, KUN, PE and SZG), we verified that the population should be classified as a new species allied with *A. cordatum* (distributed in southern mainland China), *A. kiushianum* Makino (1918: 3) (distributed in southern Japan) and *A. thunbergii* Blume (1836: 105) subsp. *autumnale* J.C.Wang, J.Murata & H.Ohashi in Wang (1996: 75) (distributed in Taiwan).

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Materials and Methods

The living materials of *A. cordatum* and *A. melanostomum* sp. nov. were collected from Shenzhen, Guangdong Province, China during our field trips in April 2018. The main conventional taxonomic studies were carried out in HK, KUN, PE and SZG, and the images of specimens (including the types) of the related taxa, *A. cordatum*, *A. kiushianum* and *A. thungberii* subsp. *autumnale* were obtained for examination from JSTOR Global Plants website [http://plants.jstor.org].

Taxonomy

***Arisaema melanostomum* Z.X.Ma, Xiao Yun Wang & Wen Yan Du, *sp. nov.* (Figs. 1–3, 4A)**

The new species is closely related to Arisaema kiushianum *Makino, but differs from it in having a glossily atropurpureus subterranean stem producing glabrous, short cylindric and nodular tuberlets with multiple lateral buds (vs. creamy to whitish yellow subterranean stem covered with fibrous, applanate-globose tuberlets without lateral buds), a stably 5–7-foliolate leaf blade (vs. 7–13(–15)-foliolate leaf blade), a flat spathe-limb with a glossily atropurpureus ring on adaxially (vs. a fornicate-orbiculate spathe-limb with sub-circular atropurpureus lines on adaxially) and a spathe-tube with thick T-shaped white area adaxially, viridescent-colored at middle part (vs. a spathe-tube with thin T-shaped white area adaxially, never viridescent-colored at middle part).*

Type:—CHINA. Guangdong Province: Shenzhen City, Yantian District, Yantian Sub-district, Sanzhoutian, ca. 450 m, 14 April 2018, *Zhengxu Ma 0021* (holotype PE!, isotypes HK!, PE!).

Perennial herb, seasonally dormant, paradioecious. **Subterranean stem** tuberous, glossily atropurpureus to purplish-brown at outside, subglobose to slightly depressed globose, to 4.0 cm in diam., bearing several tubercles at apex. Tubercles concolorous with subterranean stem, short cylindric, nodular and bearing multiple lateral buds. Cataphylls 3, very thinly membranous. **Foliage leaf** solitary; petiole green to purplish-green, glossy; proximally sheathing and forming subterranean pseudostem, leaf blade pedate, forming obscure rachis, 5–7-foliolate; veins abaxially raised, lateral numerous; leaflets olive-green, waxy, thick membranous, sessile, oblong, 17.0–21.0 cm × 5.0–7.0 cm, base broadly cuneate, apex acute to slightly acuminate. **Inflorescence** solitary, adhere to ground. **Peduncle** creamy, glossy, 2.3–2.5 cm in length, nearly subterranean. **Spathe** basically creamy, waxy and very thickly membranaceous; tube cylindric, 4.0–4.5 cm in length, 1.6–2.0 cm in diam., abaxially creamy, obscurely darkenedly mottled, with a white area at base, adaxially glossily atropurpureus, with white longitudinal lines, presenting a thick white "T" shaped area (attenuate to base and abruptly expending at apex forming a semicircle distally, 4.1–5.2 cm in length, 0.9–1.3 cm in width) viridescent at middle; mouth broadly auriculate, auricle horizontal or bending, to 1.3 cm in width, creamy, mottled purplely; limb bending and flat, acuminate-ovate, ca. 4.5 cm × 5.0–5.3 cm, slightly caudate at apex, broadly rounded-auriculate at base, abaxially creamy, sometimes slightly purplish, with the mid rib raised and arcing at base, adaxially creamy, with a thick atropurpureus ring, but never presenting reticulations or anastomosed strips. **Spadix** unisexual. Female zone short cylindric, 1.3–1.4 cm in length; gynoecium dense; ovary green, barrel-shaped, rugose; stigma very short, nearly invisible; style a white spot, puberulent. Male zone cylindric, ca. 1.5 cm in length; androecium lax; synandria pale yellow, stipitate, consistingca. 2 anthers of each; thecae globose, dehiscing by an apical pore. **Spadix-appendix** long-flagelliform, sigmoid, to ca. 49.0 cm in length; proximal part reddish-white with purple mottles, erect, sub-cylindric, 2.0–2.7 cm in length, sessile and attenuate to base, to ca. 0.4 cm in diam. at base; middle part dark reddish-purple, bending down and reaching out of spathe-mouth, obviously swelling, to ca. 7.6 cm in length, to ca. 0.6 cm in diam.; distil part greenish white, upright, flagelliform, to ca. 39 cm in length, ca. 0.1 cm in diam., attenuate to apex. **Infructescence** cylindric, erect, ca. 2.9 cm in diam., ca. 3.5 cm in length. **Fruit** a bacca, densely arranged, orange-red when ripened, ellipsoidal, 0.5–0.7(–1.0) cm in diam., 0.6–1.2 cm in length, rugose to slightly echinate and with obvious irregular ridges on the upper side, apex acute, with a short tip, each comprising 1–2(–3) seeds. **Seed** creamy, globose or semi-globose, 0.5–0.6 cm in diam.

Additional specimen examined (paratype):—CHINA. Guangdong Province: Shenzhen City, Yantian District, Yantian Subdistrict, Sanzhoutian, ca. 450 m, 30 March 2018, *Jun-Rong Xie 1803001* (SZG!).

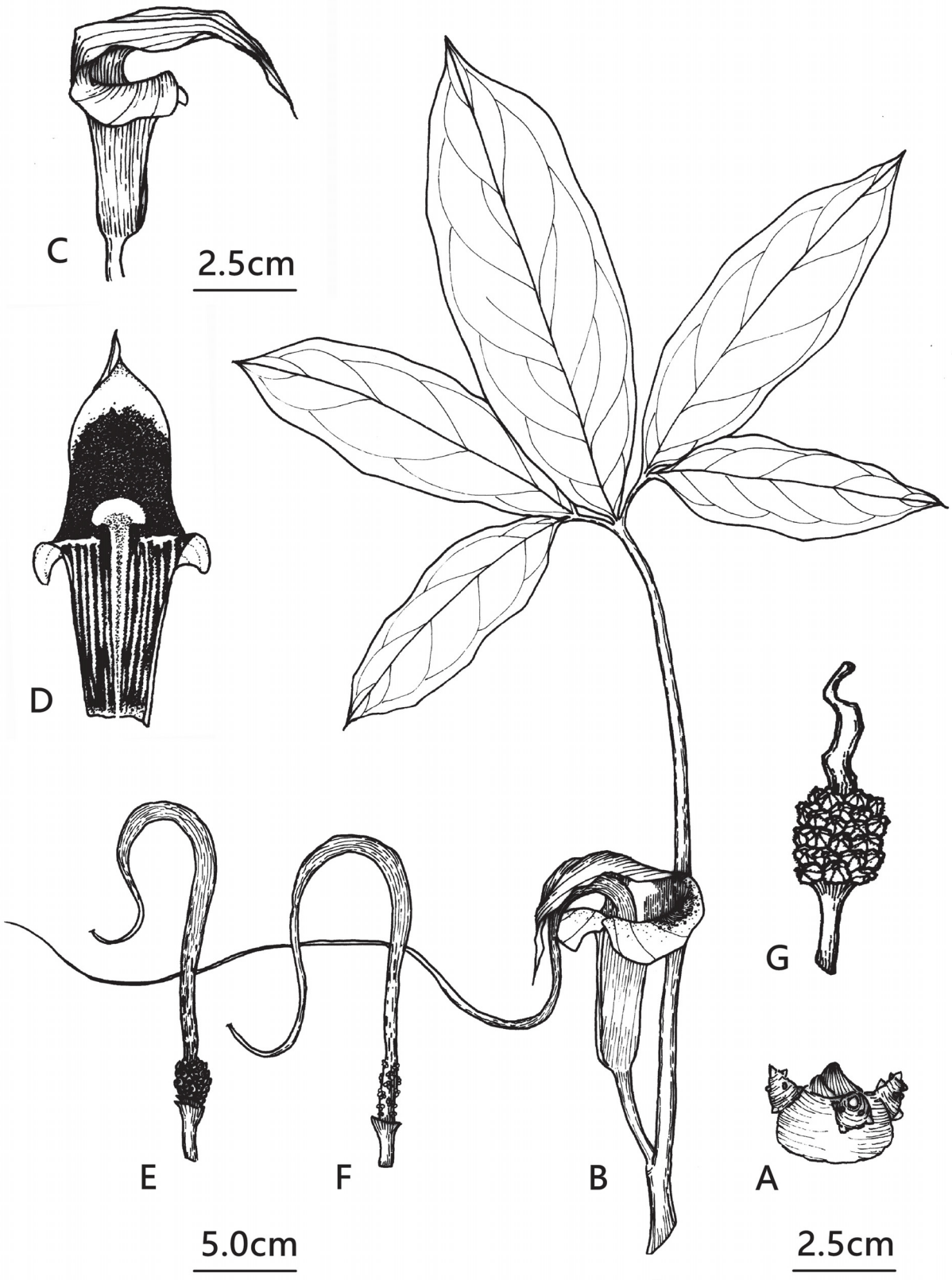

FIGURE 1. *Arisaema melanostomum*. A. subterranean stem; B. mature individual; C. abaxial surface of spathe (side view); D. adaxial surface of spathe; E. female spadix; F. male spadix; G. infrutescence. The painting is drawn by Yi-fan Li.

FIGURE 2. *Arisaema melanostomum*. A. individual in the habitat; B. inflorescence (front view); C. inflorescence (side view); D. adaxial surface of spathe; E. male spadix with in spathe; F. gynoecium; G. subterranean stem. Images A, C & E © Xiao-Yun Wang; B, D, F & G © Zheng-Xu Ma. All plant images were taken from the type population of *A. melanostomum*, and B, F & G are from the holotype.

Phenology:—Flowering from mid-March to mid-April. Fruiting from August to October.

Distribution and habitat:—*Arisaema melanostomum* is only known to a nameless stream valley covering dense subtropical forests in Shenzhen, Guangdong Province, China (Fig. 6).

Conservation Status:—*Arisaema melanostomum* is so far only recorded from a single locality near Shenzhen City, Guangdong Province, China, with fewer than 250 individuals. Potential threats of the species include illegal collecting, illegal land clearing, illegal lumbering, and road construction. The inefficiency of the legislature and frequent nonfeasance of the government and local botanical gardens are also serious problems for the conservation of *A. melanostomum* as well as other rare local species. According to our field surveys and empirical evidence provided by the local hobbyists, the extent of occurrence (EOO) of the species is estimated to be 0.010 km^2, whereas its area of occupancy (AOO) is estimated to be 5 km^2. Consequently, *A. melanostomum* is supposed to be assigned a preliminary conservation status of "Critically Endangered" [CR B1a+2a+C] (IUCN, 2001).

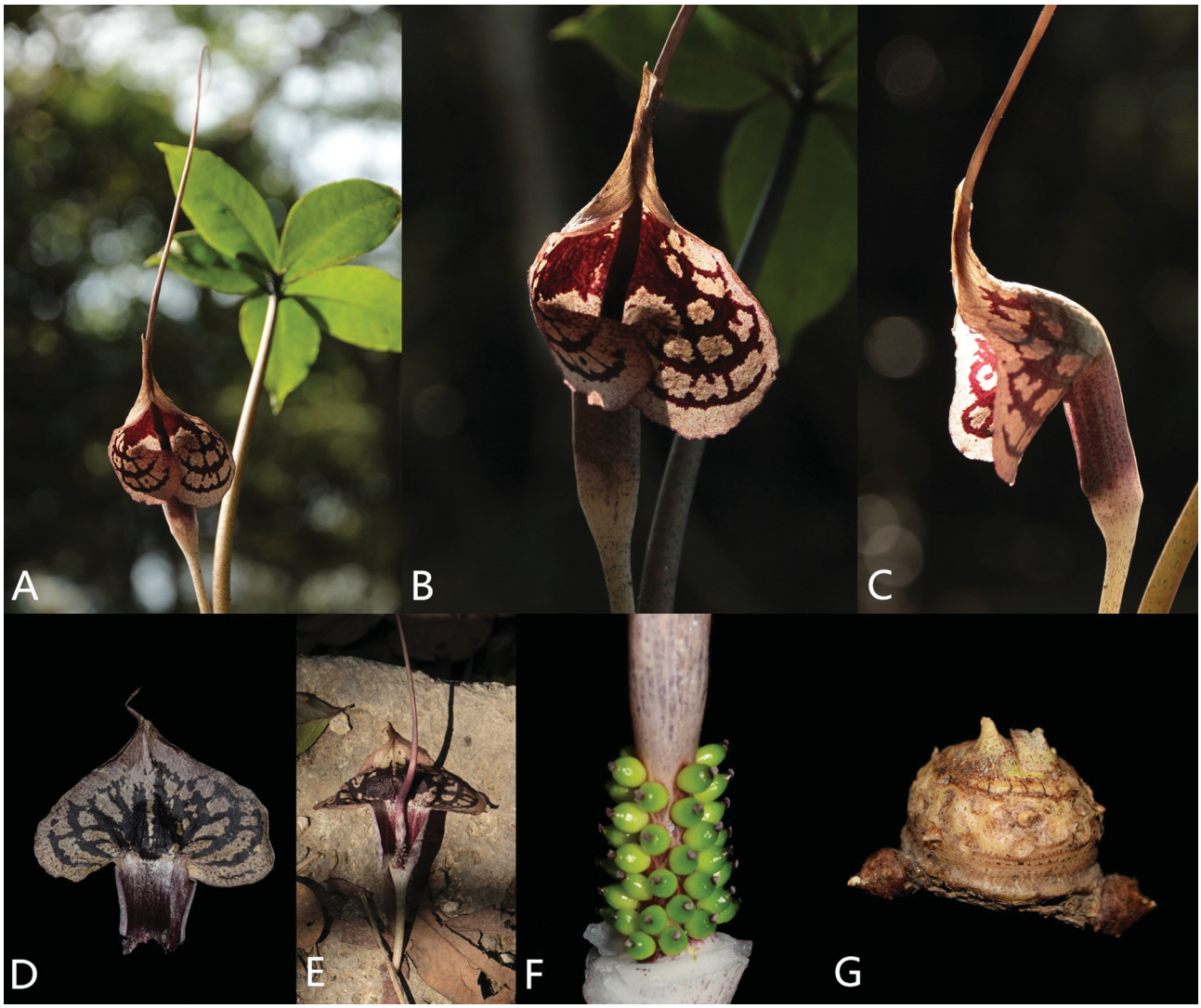

FIGURE 3. *Arisaema cordatum*. A. individual in the habitat; B. inflorescence (front view); C. inflorescence (side view); D. adaxial surface of spathe; E. male spadix with in spathe; F. gynoecium; G. subterranean stem. Images A, C & E © Xiao-Yun Wang; B, D, F & G © Zheng-Xu Ma.

Eponymy:—The epithet of the new species, *melanostomum*, is the combination of two greek morpheme, "melano-" and "-stomum", derived from the words melanos (black, dark colored) and stoma (mouth), respectively, referring the obvious atropurpureus ring at spathe-limb and spathe-mouth. The Chinese name of this new species is recommended as "墨喉南星", a translation of the epithet.

Key to the *Arisaema* sect. *Flagellarisaema* (partly revised from Li *et al.* (2010) and Murata (2011))

1. Spathe basically green; spadix bisexual or unisexual 2
– Spathe multi-colored, usually with purple strips or reticulations; spadix unisexual 4
2. Peduncle longer than petiole; spathe flat, bending. Eastern Asian ..... *A. heterophyllum* Blume (1836: 110)
– Peduncle shorter than petiole; spathe sub-erect. Northern American 3
3. Leaf blade 5–7(–9)-foliolate; spathe-limb widened, expending at base or slightly auriculate, slightly warping spadix-appendix at apex ..... *A. macrospathum* Bentham (1840: 52)
– Leaf blade (5–)7–13(–21)-foliolate; spathe-limb small, slightly involute, margin truncate ..... *A. dracontium* (Linnaeus 1753: 964) Schott (1832: 17)
4. Spathe-limb expanded at base, united with expanded part of spathe-mouth and showing a single cordate appearance ..... *A. cordatum* N.E.Brown
– Spathe-limb not united with auricles at base 5
5. Spathe-tube without a T-shaped area adaxially 6
– Spathe-tube with a T-shaped area adaxially 9
6. Spathe with distinctly longitudinal striation on both surfaces, spathe-limb flat; anthesis at autumn ..... *A. thunbergii* Blume subsp. *autumnale* J.C.Wang, J.Murata & H.Ohashi

– Spathe without distinct longitudinal striation on both surfaces, spathe-limb fornicate; anthesis at spring.....7
7. Spadix-appendix abruptly inflate at and bright yellow, crisped and verrucose at spathe-mouth, obviously attenuate to the base..... ..... *A. thunbergii* Blume subsp. *thunbergii*
– Spadix-appendix inflated dark to light purple proximally, slightly attenuate to the base 8
8. Spadix-appendix smooth entirely .... *A. thunbergii* Blume (1836: 105) subsp. *urashima* (H.Hara 1935: 822) H.Ohashi & J.Murata (1980: 307)
– Spadix-appendix rugose at base .....*A. thungbergii* Blume subsp. *geomundoense* S.C.Ko (2006: 213)
9. Subterranean stem bearing subglobose to depressed-globose tubercles; T-shaped area at spathe-tube pure white; spathe-limb orbiculate-fornicate, with sub-circular atropurpureus lines, never ringed adxially..... *A. kiushianum* Makino
– Subterranean stem bearing nodular tubercles; T-shaped area at spathe-tube viridescent at middle; spathe-limb flat, with a thick atropurpureus ring adaxially.....*A. melanostomum* Z.X.Ma, Xiao Yun Wang & Wen Yan Du

FIGURE 4. Immature infructescences of *Arisaema melanostomum* (A) & *A. cordatum* (B). Images A © Jun-Rong Xie; B © Liu. Image A was taken from the type population of *A. melanostomum*.

Discussion:—The morphological characteristics of the new species *A. melanostomum* well fit in the *A.* sect. *Flagellarisaema*, consisting i) a tuberous subterannean stem; ii) a quincuncial phyllotaxy; iii) an often pedate leaf blade; iv) apically dehiscing thecaes and v) a flagelliform and sigmoid spadix-appendix, sessile at base, without neuter flower and largely elongate at apex. The morphological evidences reveal close relationships among the novelty, *A. thunbergii* subsp. *autumnale*, *A. cordatum* and *A. kiushianum*, while meticulous morphologic comparisons are shown in Table 1 and detailed discussions are presented below.

The novelty, *A. melanostomum*, was previously misrecognized as *A. cordatum* since they share a similar silhouette in general. However, according to our observation of living material as well as examination of the desiccated specimens, the diagnostic characters are readily distinguishable in the two species, and the detailed comparison is present in Table 1. Here we would like to discuss on several details, which are often illegible or neglected in observation.

First, the spathe structure of the 2 species are completely different (Figs. 2–3). The spathe structure of *A. cordatum* is unique in the genus *Arisaema* for its almost united spathe-limb and spathe-mouth showing a single triangular appearance. The spathe-limb of this species is always noticeably sub-erect for its correlation with the spathe-mouth. On the contrary, the one in *A. melanostomum* is much simpler and well differentiated into spathe-limb and spathe-mouth: its spathe-limb is flat and bending, with a mid-rib rising abaxially and its spathe-mouth is simply auriculate and independent.

TABLE 1. Comparison of *A. melanostomum* with three morphologically similar taxa

Trait	*A. cordatum*	*A. kiushianum*	*A. melanostomum*	*A. thunbergii* subsp. *autumnale*
subterranean stem	creamy to whitish yellow at outside, subglobose to applanate-globose	creamy to whitish yellow at outside, subglobose to depressed-globose	atropurpureus to purplish-brown at outside, sub-globose	creamy to whitish yellow at outside, subglobose
tubercles	beared at base, brownish yellow, fiberous, applanate-globose and never bearing lateral buds	beared at apex, brownish yellow, fiberous, applanate-globose and never bearing lateral buds	tubecles beared at apex, glossly atropurpureus, short cylindric, nodular and bearing multiple lateral buds	unknow
number of leaf blades	5–7	7–13(–15)	5–7	11–15
abaxial surface of spathe-tube	redish purple, with a white area at base	purplish red, with longitudinal white lines (sometimes obscure)	creamy, obscurly darkenedly motted, with a white area at base	white or pale yellow with longitudinal purple stripes
adaxial surface of spathe-tube	purplish brown, the white "T" shaped area never presents	atropurpureus, presenting a very narrow white "T" shaped area, never greenish at middle	atropurpureus, with white longitudinal lines, presenting a thick white "T" shaped area, viridescent at middle	bending and flat
spathe-mouth	broadly auriculate; auricle obviously enlarged, creamy, with obvious reddish-purple reticulation, margins broadly expanded to spathe-limb	broadly auriculate; auricle slightly enlarged, greenish white, with sub-circular atropurpureus lines joining sometimes	broadly auriculate; auricle slightly enlarged, creamy, motted purplely	slightly auriculate; auricle concolor with abaxial suface of spathe-tube
silhouette of spathe-limb	erect to suberect, flat, united with spathe-mouth, showing a single cordate appearance	bending and fornicate- to orbiculate-ovate	bending and flat	concolor with abaxial surface of spathe-tube
abaxial surface of spathe-limb	creamy, without a midrib obscure	greenish white, with dotted longitudinal purple lines	creamy, with the mid rib raised and arcing	concolor with abaxial surface of spathe-tube
adaxial surface of spathe-limb	creamy with reddish-purple reticulations never ringed	greenish white, with sub-circular atropurpureus lines, joining sometimes but never ringed	creamy, with a thick atropurpureus ring, reticulations never present	concolor with abaxial surface of spathe-tube
shape of ovary	barrel-shaped	depressed-barrel-shaped	barrel-shaped	barrel-shaped
gynoecium	lax	dense	dense	dense
spadix-appendix	upright and slightly sigmoid, unconspicuously swelling at spathe-mouth, slightly thickened to base	sigmoid, conspicuously swelling proximally and slightly attenuate to base	sigmoid, conspicuously swelling proximally and slightly attenuate to base	sigmoid, conspicuously swelling proximally and slightly attenuate to base
becca	smooth and umbilicated at apex	unknow	verrucose to slightly echinate and with several irregular ridges at apex	unknow

FIGURE 5. Isotype of *Arisaema cordatum* (HK-29670). Image © Zheng-Xu Ma.

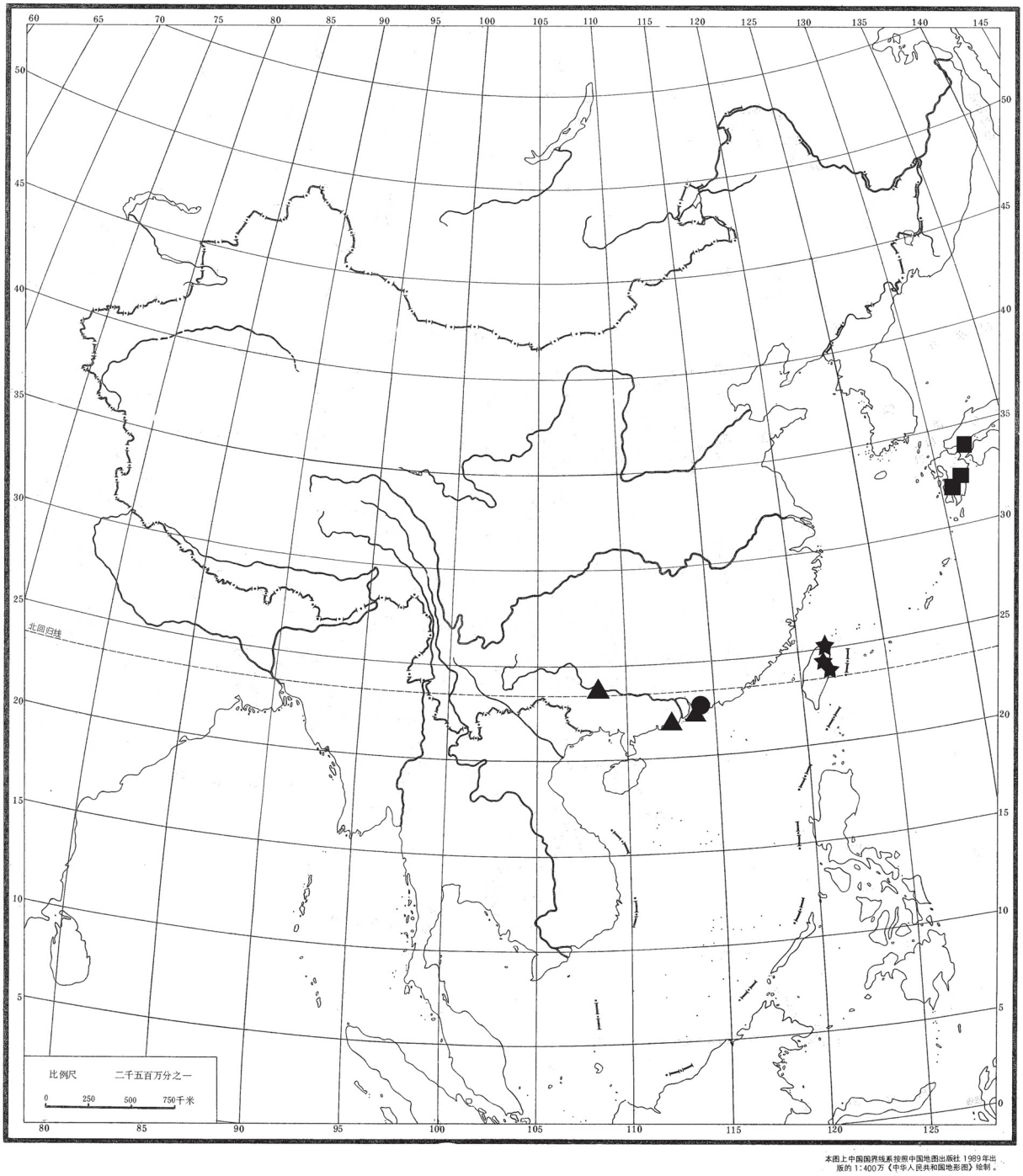

FIGURE 6. Distribution map of *Arisaema cordatum* (triangle), *A. kiushianum* (square). *A. melanostomum* (solid circle) and *A. thunbergii* subsp. *autumnale* (pentagram). Scale 1: 25 000 000. China's border in this map is derived from *Topographic Map of the People's Republic of China (scale 1: 4 000 000)* (1989) published by Sinomaps Press.

Second, the structural discrepancy in gynoecium between the two species is also conspicuous. *Arisaema melanostomum* has a slightly rugose and dense gynoecium, while *A. cordatum* exhibits a smooth and lax one. Furthermore, when the pistil develops into immature fruit, the recognizable differences between the two taxa even increase: berry in the former presents a verrucose to slightly echinate appearance with a little tip at apex (Fig. 4A), but it is completely glossy and slightly concaved in *A. cordatum* (Fig. 4B). However, the morphology of gynoecium and fruit are still seldom studied or often completely neglected in *Arisaema* taxonomy, and we are looking forward to more precise comparative studies on these characters.

In addition, from a geological perspective, though *A. melanostomum* shares a sub-sympatric distribution with *A. cordatum*, the two are never really observed mixed in the same population. Our field works suggested that the former inhabits the understory of the dense sub-tropical forests in a lower elevation at about 200–300 m, whereas the latter is always found in a higher elevation generally above 650 m, in lax forests, sometimes mixing with bamboo, or gravel slops. As a result, though the two species are closely related and even sharing the adjacent distribution, the genetic exchange could be minimal due to geographical isolation.

On the other side, the utility of morphological characters in classification should be examined. In general, the taxonomic significance of subterranean stem morphology and leaflets' number (vegetative organ), as well as coloration of spathe (reproductive organ), are highly debated (Gusman & Gusman 2002, Gusman & Gusman 2006, Li *et al.* 2010, Ma & Li 2017). Therefore, based on our empirical observations and measurements, we hope to give a clear morphological evaluation of *A. melanostomum*.

The morphology of subterranean stem is often regarded as an important character for *Arisaema* taxonomy and it can sometimes exhibit an enormous variation among closely allied species (Gusman & Gusman 2002, Gusman & Gusman 2006, Murata 2011, Ma & Li 2017). *A. melanostomum* has a sub-globose subterranean stem, atropurpureus to purplish-brown at outside, bearing several glossily atropurpureus, short cylindric and nodular tubercles, which is often distributed with many multiple lateral buds at apex. According to our observations of the *ex-situ* collections, structure of the subterranean stem of the novelty is morphologically conservative and it is readily distinguishable from all its supposed relatives, *A. cordatum*, *A. kiushianum* and *A. thunbergii* subsp. *autumnale*. Hitherto, the short cylindric and nodular tuberlet with multiple lateral buds has never been reported to any species in the *A.* sect. *Flagellarisaema* and its discovery in *A. melanostomum* reveals the high morphological diversity of stem structure in the genus *Arisaema*.

Besides, the number of leaflets is also worth of discussing for its controversy. This characteristic is often abandoned in *Arisaema* taxonomy due to its wide range of variation—even in a single population—profoundly affected by the precipitation as well as other environmental factors. However, according to our measurements *A. melanostomum* always has a 5–7-foliolate leaf blade, thus differing from *A. kiushianum* (7–13(–15)-foliolate) and *A. thunbergii* subsp. *autumnale* (11–15-foliolate). Therefore, it is suggested that this character could be diagnostic among the three taxa. Nonetheless, due to our deficiency in the cultivation of the latter two taxa, as well as the controversies in the stability of the leaflets' number, we would still like to hold a cautious attitude toward the utility of this character.

As for the reproductive organ, the coloration of spathe, a part of inflorescence, is sometimes taxonomically confusing as well. The coloration of the spathe-mouth-limb in the 4 allied species is distinctive and detailed comparison of this characteristic among them is given below in Table 1. Especially, the presence of the white area in the spathe-tube (here as the T-shaped area) is believed to be crucial diagnostic characters for certain species in the genus, considering its importance in the pollination, a vital process for genetic flow, with obvious discrepancies potentially influencing the process and possibly even generating reproductive isolation between the populations. Consequently, we presume that because of the significantly distinct spathe morphology the gene flow between *A. melanostomum* and its relatives should be minimal and, thus, it is suggested that the spathe coloration is capable of distinguishing the 4 morphologically allied species.

In conclusion, based on the morphological studies comparing *A. melanostomum* with its relatives, as well as evaluating the characters used in *Arisaema* taxonomy, we consider that *A. melanostomum* should be confirmed as a distinct species based on sufficient evidence.

Arisaema yunnanense **Buchet (1911: 367) subsp. *quinquelobatum* (H.Li & J.Murata) Z.X.Ma, *comb. & stat. nov.***

Arisaema quinquelobatum H.Li & J.Murata in Li *et al.* (2010: 59). *syn. nov.* Type:—CHINA. Yunnan Province: Lijiang City, Yulong County, Hutiaoxia Town, Hutiao Valley, 1860 m, 20 Jun. 1995, *J. Murata, X. Cheng, H. Takahashi, J. Ohno & H. Murata s.n.* (holotype TI!).

Arisaema yunnanense var. *quinquelobatum* (H.Li & J.Murata) Z.X.Ma & H.Li (2017: 75). *syn. nov.*

Distribution and habitat:—Thickets, valley slopes, roadsides, grassy slopes, *Pinus-Quercus* forests. At elevations of 1800–2100 m. Northern to central Yunnan Province, China.

Discussion:—The subspecies *A. yunnanense* subsp. *quinquelobatum* was previously treated as a variety of *A. yunnanense* (Ma & Li, 2017). However, the evidences of chromosome number of the former (2n=24) and the latter (2n=48) (Li *et al.*, 2010) indicate the reproductive isolation between them and the stable presence of the leaf blade number, 5-foliolate in the former and 3-foliolate in the latter, also suggested their obvious morphological distinction. Furthermore, according to our field investigations and examination of herbarium specimens, *A. yunnanense* subsp.

quinquelobatum is always found in the dry-hot river valley and its vicinity in northcentral to northwestern Yunnan Province, whereas *A. yunnanense* subsp. *yunnanense* appears commonly in more various habitats, and is widespread in Guangxi Province, Guizhou Province, Sichuan Province and Yunnan Province. Consequently, considering the concept of variety and subspecies, we propose ranking the taxon as a subspecies instead of a variety.

Key to the *Arisaema* sect. *Odorata*

1. Spadix bisexual or staminate 2
– Spadix unisexual 4
2. Spathe green with a white patch at middle; spadix-appendix recurved ..... *A. lidaense* J.Murata & S.K.Wu (2003: 81)
– Spathe without the white patch at middle; spadix-appendix pendulous 3
3. Spathe pure white, spathe-tube infundibuliform; spadix-appendix long cylindric ..... *A. odoratum* J.Murata & S.K.Wu in Murata *et al*. (1994: 153)
– Spathe greenish with white stripes, spathe-tube cylindric; spadix-appendix filiform ..... *A. prazeri* Hooker (1894: 501)
4. Spathe entirely white ..... *A. mairei* Leìveilleì (1915: 10)
– Spathe green, or with white longitudinal stripes 5
5. Spadix-appendix flagelliform, pendulous or upright 6
– Spadix-appendix recurved 8
6. Leaf blade integrate or 3-foliolate; spadix-appendix linear, often purplish and twisted distally ..... *A. bathycoleum* Handel-Mazzetti (1925: 123)
– Leaf blade pedate, always 5–9-foliolate; spadix-appendix thick cylindric, attenuate to apex 7
7. Leaf blade (1–)3–5-foliolate; ovary fusiform; spadix-appendix linear, pendulous ..... *A. saxatile* Buchet (1911: 124)
– Leaf blade 5–9-foliolate; ovary bottle shaped; spadix-appendix upright or pendulous ..... *A. aridum* H.Li in Li *et al.* (1977:107)
8. Spathe pure olive-green; tube long cylindric; mouth with darkened reticulation, auriculate; gynoecium lax; spadix-appendix slender cylindric ..... *A. longitubum* Z.X.Ma (2018: 295)
– Spathe green with white stripes; tube funnelform; mouth margin obliquely truncate, non-auriculate; gynoecium dense; spadix-appendix thick cylindric 9
9. Leaf blade 5-foliolate; chromosomes 2n=48 ..... *A. yunnanense* Buchet subsp. *yunnanense* (1911: 367)
– Leaf blade 3-foliolate; chromosomes 2n=24 ..... *A. yunnanense* Buchet subsp. *quinquelobatum* (H.Li & J.Murata) Z.X.Ma

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