A new species of *Arisaema* sect. *Attenuata* (Araceae) with an amended key to its species in mainland China

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ABSTRACT

A new aroid species, *Arisaema chenii*, belonging to *A.* sect. *Attenuata* is described, illustrated and compared with its allied species: *A. austroyunnanense*, *A. guangxiense* and *A. penicillatum*. Additionally, an amended key for *A.* sect. *Attenuata* in mainland China is made, to provide clearer distinctions among species.

KEY WORDS

Arisaema chenii, *Arisaema* sect. *Attenuata*, *Arisaema*, Araceae, Guangdong Province, China.

INTRODUCTION

Arisaema sect. *Attenuata* (Engler) H. Li, consisting of 26 species (Ma & Li, 2017), is distributed in tropical Asia, especially in Indochina-Malasia as its distribution center. At the northern border of the distribution of this section, seven species, namely *A. austroyunnanense* H. Li, *A. barbatum* Buchet, *A. calcareum* H. Li, *A. guangxiense* G.W. Hu & H. Li, *A. lackneri* Engl., *A. penicillatum* N. E. Brown, *A. ramulousum* Alderw., have been reported in southern China (Hainan, Hongkong, Guangdong, Guangxi, Guizhou, Taiwan and Yunnan) (Li et al., 1977; Li, 1979; Gusman et al., 2007; Yin & Gusman, 2008; Li & Murata, 2010; Ma & Li, 2017).

Section *Attenuata* of *Arisaema* has a complicated taxonomic history. It was initially established by A. Engler in his famed accomplishment, *Das Pflanzenreich* (Engler, 1920). Unfortunately, the 15 infrageneric taxa in the genus *Arisaema* he created, including the name "*Attenuata*",

were all unranked (Murata, 2013), since the sign "§", frequently meaning the state "section", prefixed to the groups' name, is also used in other part of the same publication, for instance, *Stylochiton* Lepr., *Theriophonum* Blume and *Typhonium* Schott(Murata et al., 2013). H. Hara (1971) lectotypified the section *Attenuata*, designating *A. laminatum* Blume as the type species. Later, in 1979, the section was clearly marked as a section in the genus *Arisaema* (Li, 1979). However, the name *A.* sect. *Attenuata* (Engl.) Gusman & L. Gusman published in 2008 (Gusman, 2008) is superfluous, due to the property of the name *A.* sect. *Attenuata* (Engler) H. Li.

Serendipitously encountered by Mr. Yu-Qiang Chen, a local botany hobbyist, in 2016, a peculiar *Arisaema* population was discovered. Having studied the photos provided, the authors recognized it should belong to a new species whose series of characters, rhombic-elliptic white patch on the spathe, auriculate spathe-mouth and laxly arranged pistils are remarkable. Later, in the March of 2018, one of us (Huang) recollected several specimens in its original habitat, and finally, with close observations during the cultivation and meticulous examinations toward the specimens, the authors reached a consensus on its identity of a new species, and it is published here.

Amended Key to *Arisaema* sect. *Attenuata* in Mainland China

1a. Spadix-appendix claviform, slightly attenuate to the apex.

2a. Epiphyte; leaf usually solitary, emerges later than inflorescence; spathe green entirely; spathe-limb long acuminate and caudate apically, to ca. 60 cm . . . . *A. lackneri*

2b. Geophyte; leaves usually paired, emerge simultaneously with inflorescence; spathe green with longitudinal white lines and a white patch at the middle of the limb; spathe-limb accuminate to apex, but not caudate . . . . . *A. calcareum*

1b. Spadix-appendix slender cylindric, conspicuously attenuate to the apex.

3a. Spathe with a longitudinal white patch at back; spadix-appendix bending at apex with numerous stout-subulate neuters . . . . . *A. penicillatum*

3b. Spathe with a transverse white bend or a rhombic-elliptic white patch at back; spadix-appendix erect distally and often with filiforme or subulate neuters at apex.

4a. The white patch of spathe a rhombic-elliptic area; spathe-mouth auriculate; gynoecium lax . . . . *A. chenii*

4b. The white patch of spathe a transverse bend; spathe-mouth non-auriculate; gynoecium dense.

5a. Plant height short, only to ca. 20 cm; spathe-tube greenish, mottled dark purple longitudinally; spadix-appendix with numerous filiforme neuters distally, 3–6 mm in length . . . . . *A. guangxiense*

5b. Plant height usually higher than 20 cm; spathe-tube entirely greenish; spadix-appendix with sparse neuters distally . . . . . *A. austroyunnanense*

Notes: The reports of *A. barbatum* and *A. ramulousum* in China are confusing since insufficient details were provided and the distributions of the two species, disjunctively between Java Island (Indonesia) and China (and northern Vietnam) (Gusman et al., 2007; Yin & Gusman, 2008), are doubtful. The authors believe the identifications of the two species in China needs the support of more phylogenetic evidence, and therefore, we keep a conventional attitude toward these issues that *A. barbatum* and *A. ramulosum* are not listed above in the amended key.

Figure 1. *Arisaema chenii* Z.X. Ma & Yi Jun Huang. Individual in its habitat. Images © Yi-Jun Huang

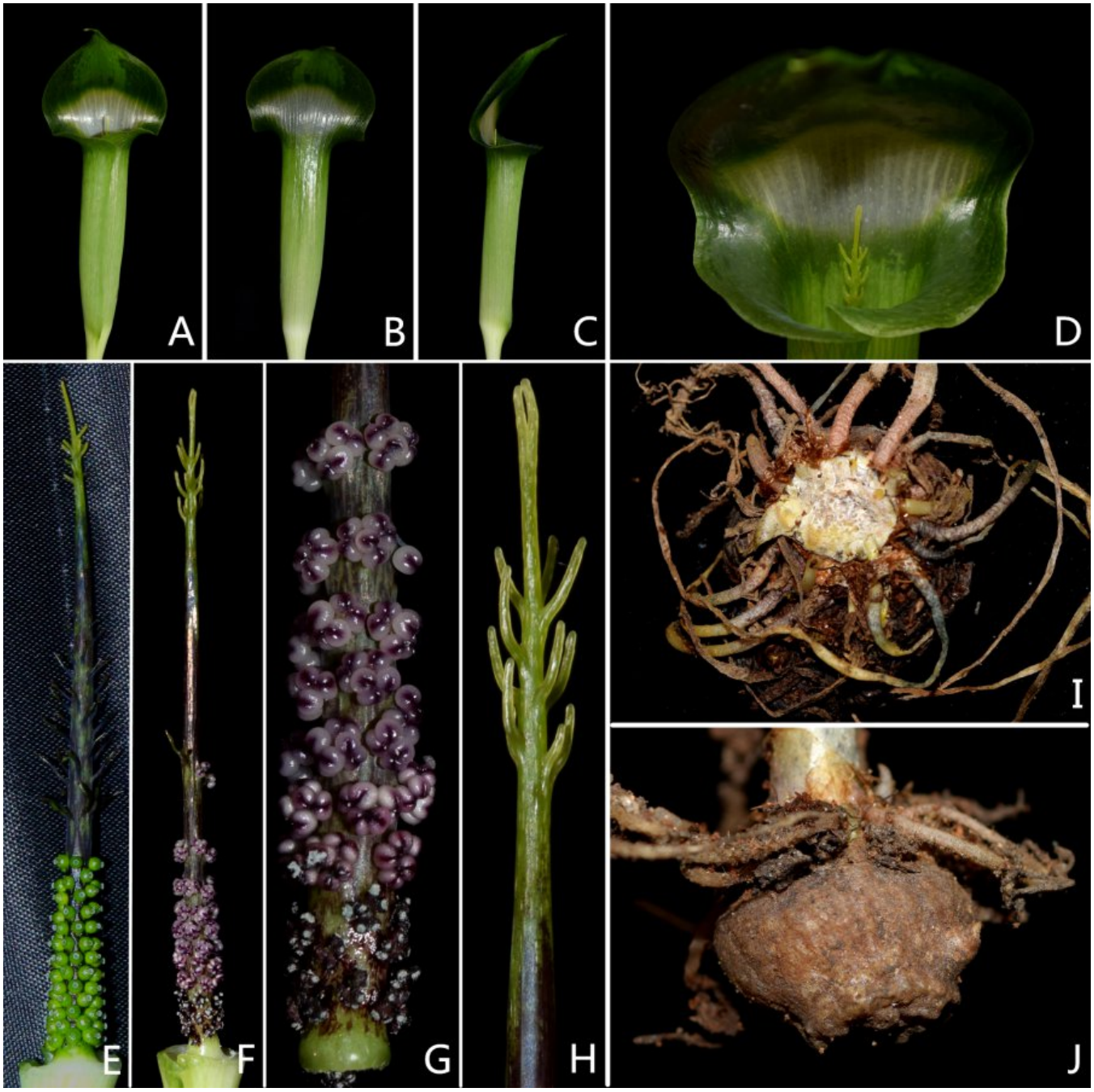

Figure 2 ***Arisaema chenii*** **Z.X. Ma & Yi Jun Huang**. A. Inflorescence (front view). B. Inflorescence (rear view). C. Inflorescence (lateral view). D. Spathe-mouth. E. Female spadix. F. Male spadix. G. Fertile zone of the male spadix. H. Apex of spadix-appendix. I. Tuber (apical view). J. Tuber (lateral view).Images A.-D.& F.-J.© Zheng-Xu Ma; E. © Yi-Jun Huang.

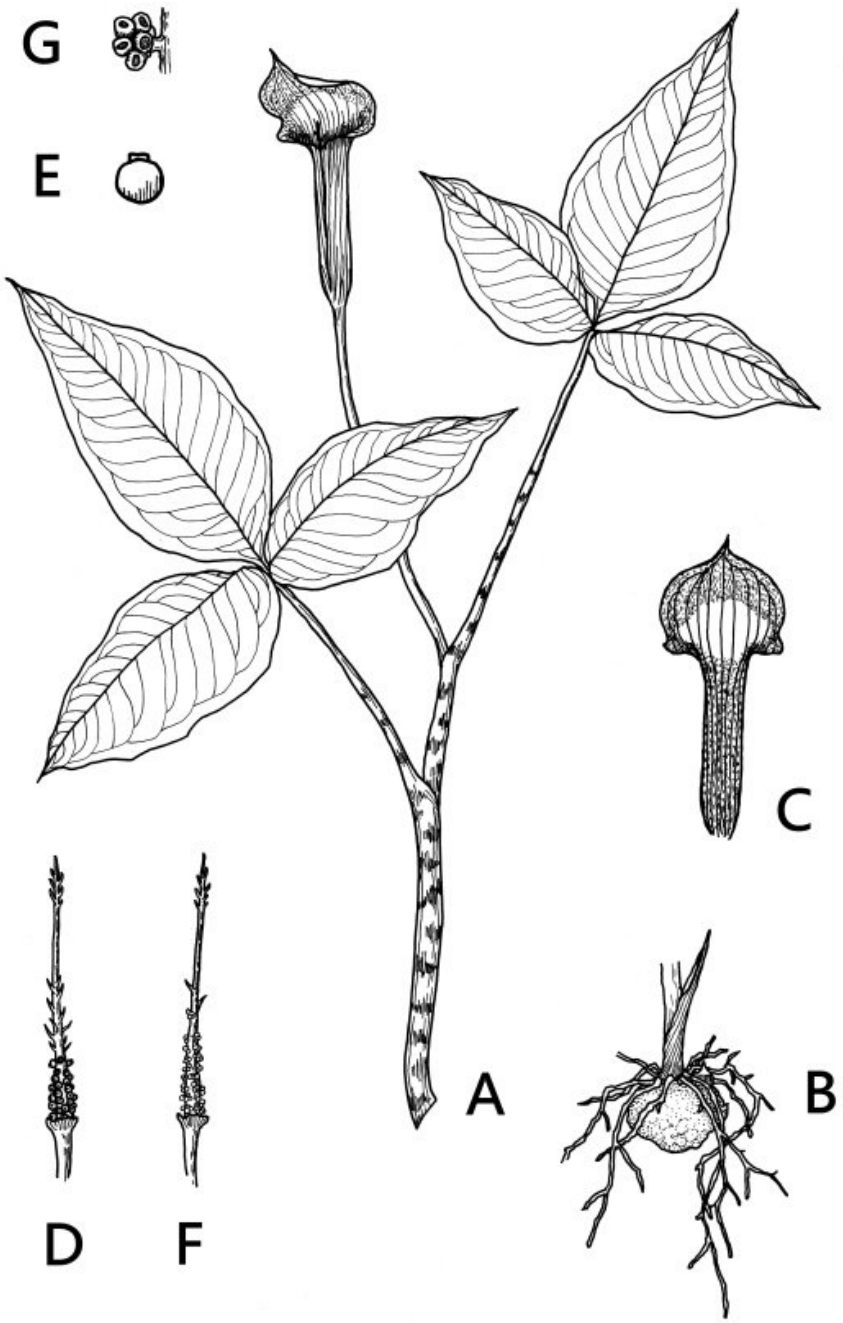

Figure 3. *Arisaema chenii* Z.X. Ma & Yi Jun Huang. A. mature individual, B. subterranean stem, C. rear-view of spathe, D. female spadix, E. pistil, F. male spadix, G. synandria. Drawn by Yi-Fan Li from the holotype.

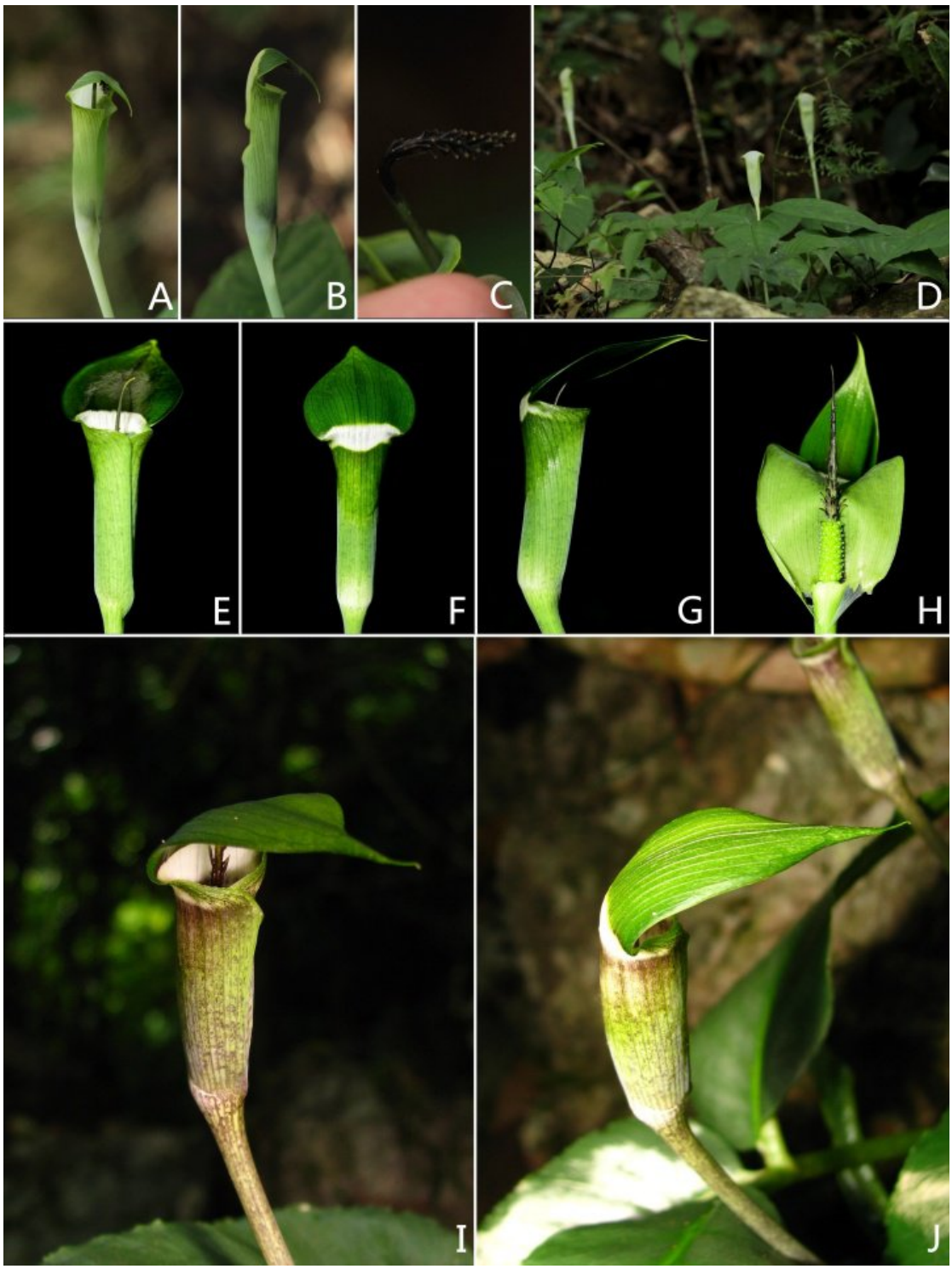

Figure 4. A.-D. *Arisaema penicillatum* N.E. Brown; E.-H. *A. austroyunnanense* H. Li; I. & J. *A. guangxiense* G.W. Hu & H. Li. A. Inflorescence (front view). B. Inflorescence (lateral view). C. Apex of spadix-appendix. D. Individuals in their habitats. E. Inflorescence (front view). F. Inflorescence (rear view). G. Inflorescence (lateral view). H. Female spadix. I. Inflorescence (front view). J. Inflorescence (lateral view). Images A.-D. © Xiao-Yun Wang, E.-H. © Ang Liu, I. & J. © Yan Liu.

The systematic position of *A. calcareum* is controversial, as phylogenetic evidences suggest a high homology between this species and *A.* sect. *Sinarisaema* (Ohi-Toma et al., 2016). However, the authors retain this species in *A.* sect. *Attenuata* here, since its morphological characteristics are nearly inseparable from this section, and we are expecting more revisionary studies, especially in ontogeny and cytology, for resolving this puzzle.

TAXONOMY

Arisaema chenii Z.X. Ma & Yi Jun Huang, ***sp. nov.*** Type: CHINA. Guangdong Province: Jiangmen City, NE of Taishan Town, Mt. Beifengshan, 25 April 2018, *Zhengxu Ma 0022*, prepared from cult., (holotype: PE!). **Figure 1–3**.

This species is allied with *Arisaema penicillatum* but differs from it in having a flat spathe-limb with a rhombic-elliptic white patch at back, an auriculate spathe-mouth, a lax gynoecium and a distally greenish, erect spadix appendix, laxly attached with short conic neuters.

Herbaceous perennial, seasonally dormant, paradioecious. Subterraneous stem tuberous, brown outside, white inside, subglobose to irregular globose, 1.5–2.0 cm in height, 2.0–3.5 cm in diam. Cataphylls 3, reddish brown with whitish mottling, membranous, lanceolate, 4.5–12.0 × 1.1–2.0 cm. Leaves 1–2; petiole grayish brown or dark green with purplish and black mottling, cylindric, 21—29.5 in length, 0.3—0.5 cm in diam., about 1/2 sheathing into pseudostem; leaf blade trifoliolate; central leaflet stipitate, to ca. 1.0 cm, dull green adaxially, light green abaxially, glossy, veins conspicuous, elliptic to oblong-lanceolate, 8.5–10.5 × 4.0—5.5 cm, acuminate to apex; lateral leaflets sub-sessile, deflective oblong-lanceolate, 8.5–11.5 × 3.0–5.0 cm. Inflorescence solitary, odorless, emerges simultaneously with leaves. Peduncle greenish, slightly glaucous, erect, 23.5–30.0 cm in length, 0.2–0.3 cm in diam., about half sheathing into pseudostem, ca. 16 cm. Spathe basically greenish, glossy adaxially and with veination abaxially; tube greenish, with a vaguely white base, long cylindric, 4.0–6.0cm in length, 0.9–1.1 cm in diam., slightly attenuate to the base; both broadly expending, sub-auriculate, to 0.6 cm in width; limb green with a fusiform white patch at base, 1.6–2.2 × 1.3–1.6 cm, flat, sub-erect, sub-triangular, expending at base and acuminate to the apex, 2.5–4.0 × 1.5–3.0 cm. Spadix unisexual, forming a green stipe at base, ca. 1.5 mm. Female spadix cylindric, ca. 1.6 cm in lengh, ca. 0.4 cm in diam.; gynoecium lax; ovary green, ovoid, ca. 1.5 mm; stigma whitish, disciform. Male spadix cylindric, 1.4–1.8 cm in length, ca. 0.2 cm in diam.; androecium lax; synandrium stipitate; anthers 4 together, dehiscing by an apical pore; pollen purplish. Spadix-appendix glossy, bicolor, proximally purple, sometimes mottled with green marks and distally always light green, slender cylindric, ca. 3.0 cm in length, ca. 0.3 cm in diam., sessile at base and attenuate to the apex. Neuter dimorphic; basal neuters

purple, subulate, to 0.4 cm, sometimes slightly twisting, always numerous in female spadix and few in the male; apical neuters greenish (concolors with the upper part, to 1.3 cm, of the spadix-appendix), short conic, to ca. 1.0 mm, uniformly present in both spadices.

Eponymy: The epithet of this new species, *chenii*, is in honor of new species' first discoverer, a local botany hobbyist, Mr. Yu-Qiang Chen (陈裕强). Currently, since sciences are popularized pervasively among China's public, the cooperation between hobbyists and scientists are intensified in areas like botany. The authors do advocate this operation mode, since the hobbyists, indeed, offer plentiful crucial information for researches and can largely advance the industry. What the hobbyists have done is able to save costs significantly and improve the efficiency.

Phenology: Flowering from late March to mid May. Fruiting unknown.

Distribution and Habitat: The new species, *A. chenii*, is only known from a single site with seldom individuals in Beifengshan Forest Park, Guangdong Province. It inhabits subtropical evergreen broad-leaved forest, mainly comprised by *Ampelopsis cantoniensis*, *Antidesma bunius*, *Bauhinia championii*, *Camellia crapnelliana*, *Litsea glutinosa*, *Machilus chinensis*, *Psychotria. sp.*, *Sarcandra glabra*, *Schefflera octophylla*, *Schima superb* and *Symplocos glauca*, along the footpath. However, the habitat of this new species is fragile and is intensively influenced by human activities, especially in facing of the aperiodical weedings by the park administrator, using herbicides.

Additional specimen of *A. chenii* examined (paratype): CHINA. Guangdong Province: Jiangmen City, NE of Taishan Town, Mt. Beifengshan, 31 March 2018, *Yijun Huang s.n. (paratype: HK!).*

Discussion: *Arisaema chenii* is recognized as a new member in *A.* sect. *Attenuata* in having i) a weak connection between tuber and pseudostem, especially in male individuals, ii) a fleshy trifoliolate leaf blade, iii) as well as an erect and sessile spadix-appendix presenting projections. The new species is especially related to *A. austroyunnanense*, *A. guangxiense* and *A. penicillatum* morphologically, the comparisons among *A. chenii* and which are listed below.

Arisaeam chenii is closely allied with *A. austroyunnanense* and *A. guangxiense*. Nevertheless, it is significantly separable in having i) a stable rhombic-elliptic white patch at the back of the spathe-limb, ii) an obvious long-cylindric spathe-tube, 4.0–6.0 cm in length, 0.9–1.1 cm in diam., iii) an auriculate spathe-mouth and iv) a lax gynoecium. Besides, *A. chenii* is also readily distinguishable from *A. penicillatum*, since it has i) an auriculate spathe-mouth, ii) an rhombic-elliptic white patch at the back of the spathe-limb, iii) an all-through flat spathe limb, rather than arcing, iv) and an

spadix-appendix whose distal part is always light-green colored, erect and attenuate, attached with sparse light-green subulate neuters.

The morphology of the white patch in the genus *Arisaema* is believed to be a reliable diagnostic characteristic which sustains a moderate variation range, as the rhombic-elliptic white patch is one of the most significant characteristics of *A. chenii*. We supposed it is its function in the pollination helps sustain a high conservative degree for the morphology of the spathe white patch. Therefore, the morphology of the white patch should be well appreciated, as it is a reliable characteristic for classification in the genus *Arisaema*.

According to our cultivations and field investigations, the coloration of the pseudostem of the new species, including the light-green pattern and the snake-skin colored pattern, is variable and we have discovered different phenotypes in the same population. In addition, the transients between the two phenotypes were also observed, showing the morphological instability of this trait, and thus the coloration of the pseudostem and petiole should not be applied to the species diagnosis. Nevertheless, interestingly, it is also astonishing to find that the color of the peduncle in *A. chenii* is always light-green, with a single phenotype, and its frequency of variation is tremendously lower than the petiole (up to the submission of the manuscript, no more coloration variation has been discovered in its peduncle).

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