



Aristolochia geantha (Aristolochiaceae), a new species from Yunnan, China

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(Manuscript received 21 October 2024; Accepted 24 March 2025; Online published 7 April 2025)

ABSTRACT: A new species of Aristolochiaceae, *Aristolochia geantha* Z.R. Guo & Y.Fan Wang, from Southwest China, is described herein. Detailed scientific illustrations, color figures, and a key are provided. The species is morphologically proximate to *A. petelotii*, but can be readily distinguished by its flat, cupuliform calyx limb, which adaxially covered with golden or rusty villous hairs, a velvety pink upper tube, unusually elongated peduncle, which extends from the basal lignified stems, and distinctive stripe patterns radiating from the throat to the calyx limb margin. Comparative assessments with other congeners are provided to establish its unique taxonomic status within the genus.

KEY WORDS: *Aristolochia austroyunnanensis*, *Aristolochia petelotii*, cauliflorous, liana, morphology, *Siphisia* (*Isotrema*).

INTRODUCTION

Aristolochia Linnaeus, in the family Aristolochiaceae, is a large and complex genus comprising about 600 species distributed throughout tropical, subtropical and temperate regions worldwide (Huber, 1993; Neinhuis *et al.*, 2005; Wanke *et al.*, 2006). The taxonomic boundaries within *Aristolochia* sensu lato have long been a subject of debate, with ongoing discussions and revisions still preventing a universal consensus (Buchwalder *et al.*, 2014; Ohi-Toma and Murata, 2016; Zhu *et al.*, 2019a). However, one widely accepted point is that *Aristolochia* sensu lato consists of three monophyletic clades corresponding to subgenera, each distinguishable by morphological synapomorphies, and strongly supported by molecular evidence, including both intra- and intergeneric phylogenetic analyses (González, 1999a,b; Neinhuis *et al.*, 2005; Ohi-Toma *et al.*, 2006; Wanke *et al.*, 2006; Zhu *et al.*, 2019a; Bai *et al.*, 2023). Despite this agreement on infrageneric monophyly, there are currently two parallel taxonomic frameworks that coexist within the scientific community. Majority of the researchers treat all three clades under the broad concept of *Aristolochia*, leading to the description of numerous new species in recent years following this traditional treatment (Do *et al.*, 2014, 2021a,b, 2023; Cai *et al.*, 2020b; Luo *et al.*, 2020; Ohi-Toma *et al.*, 2021; Phan *et al.*, 2021; Watanabe-Toma *et al.*, 2021; Kashung *et al.*, 2022; Le and Do, 2022; Bai *et al.*, 2023; Pham *et al.*, 2023; Yu *et al.*, 2023; Jost and Wanke, 2024; Yang *et al.*, 2024). However, some scholars have advocated for the reinstatement of one clade to the genus level as *Isotrema* Rafinesque—a clade that, under the sensu lato framework, corresponds to subgenus *Siphisia* (Duchartre) Schmidt. (Zhu *et al.*, 2019a,c). This latter treatment has gained some recognition, with newly described species being published under such framework (Li *et al.*, 2019; Zhou *et al.*,

2019; Zhu *et al.*, 2019b,c; Cai *et al.*, 2020a; Wang *et al.*, 2020a,b, 2021; Liao *et al.*, 2021a,b; Luu *et al.*, 2021; Huang *et al.*, 2022; Lu *et al.*, 2022; Nguyen *et al.*, 2022; Zhu and Ma, 2022; Ma *et al.*, 2023; Xu *et al.*, 2023; Mo *et al.*, 2025). Regardless of the nomenclature rank of subgenus or genus, this clade is characterized by a syndrome of morphological traits, including a strongly curved perianth, a three-lobed gynostemium, and anthers paired on the outer surface of each gynostemium segment (González, 1999b; González and Stevenson, 2000a,b; Wanke *et al.*, 2006). This study follows the *Aristolochia* s.l. framework, which remains widely accepted by the broader botanical community, maintaining continuity with established academic tradition and taxonomic consistency.

The subgenus *Siphisia* currently comprises over 120 accepted taxa, with the majority of species primarily distributed across the Indomalayan and Palearctic Realm, while a small portion extends into the Nearctic and Neotropical Realms (Pfeifer, 1966; González, 1999a; Hwang *et al.*, 2003; Ohi-Toma *et al.*, 2006; Wanke *et al.*, 2006; González *et al.*, 2014). The region spanning the Indochina Peninsula, Southwest China, the Hengduan Mountains, and the southern Himalayas represents the center of diversification for this group, with a remarkable surge in newly described species in recent years (Zhu *et al.*, 2019c; Zhu and Ma, 2022). With exciting increase in species discoveries, these recent findings also highlight certain characteristic traits of the clade, such as high endemism, with species often restricted to extremely localized habitats (Luo *et al.*, 2020; Huang *et al.*, 2022; Xu *et al.*, 2023), and cryptic floral traits that make vegetative individuals difficult to detect (Phan *et al.*, 2021). Additionally, some species exhibit cauliflory, producing flowers only on lignified, mature stems (Peng *et al.*, 2019); thus, individuals must reach sufficient age before flowering, further complicating identification. The understudied growth and reproductive processes,



combined with the frequent occurrence of sympatric species, have historically contributed to challenges in accurate identification and precise classification. Given these complexities, taxonomic work on *Siphisia* requires serious consideration of both historical resources, such as literature, voucher specimens, and living collections from verified institutions, as well as thorough analysis and comparison of newly collected materials to address these challenges in future research endeavors.

Aristolochia petelotii O. C. Schmidt was first described and published in 1933. Native to northern Vietnam and southwestern China, this species is characterized by its large, ornamental flowers, with dark purple venation and a chartreuse base color on the adaxial surface of its fused calyx (Hwang *et al.*, 2003; Pham *et al.*, 2023; Zhu *et al.*, 2017). Due to its striking appearance and unique floral traits, *A. petelotii* is highly valued in horticulture and has been collected and cultivated in botanical gardens for research and educational purposes.

In 2021, during observations at the Vine Garden of the Xishuangbanna Tropical Botanical Garden (XTBG), Chinese Academy of Sciences (CAS), an individual labeled *Aristolochia petelotii* (CHINA, Yunnan: Wenshan Zhuang and Miao Autonomous Prefecture, Xichou County, Pingzhai National Forest, 12 September 2019, T. P. Huang *et al.*, Coll. No. 00,2019,1069; cultivated at Xishuangbanna Tropical Botanical Garden) in the public display area exhibited floral characteristics that loosely corresponded with the protologue of *A. petelotii*. However, upon closer examination, subtle yet significant deviations in floral morphology were noted. These discrepancies prompted further investigation, but with only a single living individual and no additional comparative material, a conclusive identification was not possible. Consequently, a formal taxonomic assessment was postponed until more definitive evidence could be obtained.

In the fall of 2022, we received reports from locals of a population in Malipo County, Wenshan Zhuang and Miao Autonomous Prefecture, Yunnan, displaying floral traits consistent with those of the cultivated plant in XTBG. Although photographs were provided, no voucher specimens were collected at the time. Recognizing the need for material collection and verification of key morphological traits, we conducted a field visit in October 2022. The population was successfully located, but the flowering season had ended, and no reproductive material, such as flowers or fruit capsules, was available. We collected vegetative specimens and living materials for transplantation and ex situ conservation.

In September 2023, we revisited the site and successfully collected floral material from over 15 individuals. Notably, the flowers consistently appeared either fully opened on or near the ground, nestled within the leaf litter with the throat facing upward, or as unopened buds positioned at the tips of elongated

peduncles, seemingly oriented to bring the flower closer to the ground. Detailed morphological analysis revealed several traits that clearly distinguish this population from *Aristolochia petelotii*. The new species features a shallow, cupuliform limb, with its concave surface extending outward. A distinctive trait, rarely observed within the genus, is the presence of long, dense, golden villous hairs covering the adaxial surface of the limb. The base color of the adaxial limb ranges from yellow to beige, accented by vinaceous, sinuate-margined stripes radiating from the throat to the limb's edge. This contrasts sharply with the subcampanulate to hemispherical limb of *A. petelotii*, which is waxy to velvety in texture, glabrous, and exhibits a compact reticulate venation and dark plum coloration. Additionally, the perianth throat of the new species varies from light pinkish beige to pink, adorned with a crescent-shaped, amaranthine coloration on its upper part, and has a velvety texture. In contrast, *A. petelotii* consistently displays a predominantly dark purple throat, with the basal portion being white or pale yellow, glabrous, and waxier in texture.

Subsequent fieldwork across southern Yunnan identified five distinct populations of this new species—four in Malipo County and one in Xichou County—all exhibiting consistent morphological traits and confined to karst habitats. While *Aristolochia petelotii* displayed a broader distribution, spanning from western Guangxi to northern Vietnam and southeastern Yunnan (Do *et al.*, 2014; Hwang *et al.*, 2003; Zhu *et al.*, 2017), the new species showed a more restricted, endemic range. While the new species occurs sympatrically with *A. petelotii*—as mature individuals of *A. petelotii* were observed at all these sites—their floral morphology remains distinct and consistent, despite overlapping vegetative characteristics. Regarding flowering phenology, *A. petelotii* blooms from late April to mid-June, whereas the new species flowers in September and October, further reinforcing its taxonomic distinction.

With the addition of new material and records, along with previous studies, literature, and cases of misidentification, we conclude that this species warrants formal description to confirm its distinction as a new taxon and clarify its identity among closely related congeners. Here, we provide its formal description and illustration.

MATERIALS AND METHODS

All general morphological data were obtained through fieldwork and specimen observations at the CSFI, DR, GXMI, HITBC, IBK, IBSC, KUN, PEM, VAFS, VNMN, XYTC herbaria. Terminology follows *Flora of China* and the morphology framework set forth by González and Wanke (González, 1999b; Hwang *et al.*, 2003; Wanke *et al.*, 2006). Voucher specimens are deposited in the South China Botanical Garden Herbarium (IBSC).

**Table 1.** Morphological Comparison of *Aristolochia geantha* with Close Species.

Characters	<i>A. geantha</i>	<i>A. petelotii</i> *	<i>A. austroyunnanensis</i> *
Leaf blade	16–22 × 8–14 cm; broadly ovate or ovate-elliptic, cordate at base, apex acuminate; leathery to membranous; heavily rusty villous on both sides.	10–22.5 × 5–13 cm; ovate or ovate-lanceolate, cordate at base, apex acuminate; leathery to membranous; heavily rusty villous on both sides.	12–20 × 5–8 cm; narrowly ovate, ovate-lanceolate, or ovate-elliptic; shallowly cordate at base, apex acuminate; leathery, with short indumentum.
Inflorescence	Peduncle 18–24 cm long, arising from lignified stem base, cauliflorous, 1–4 flowers per cyme, flowers opening on the ground.	Peduncle 5–12 cm long, arising from lignified stems or axillary on herbaceous stems; cauliflorous, 1–3 flowers per cyme, hanging from the stem.	Peduncle 4–12 cm long, on lignified stems, or axillary on herbaceous stem cauliflorous, 1–2 per cyme hang on stem.
Calyx tube adaxial side	Basal tube: dark purple at the base, pale yellow with sparse purple stripes, white indumentum; Upper tube: Cylindrical with middle slightly constricted, fully pink, waxy.	Basal tube: dark purple at the base, pale yellow with sparse purple stripes, white indumentum; Upper tube: light yellow from geniculation toward the throat, turning dark purple near the throat, waxy or velvety.	Basal tube: dark purple at the base, pale yellow with purple stripes or entirely dark purple, white indumentum; Upper tube: fully bright yellow, near the throat with possible varied brown dot patterns, waxy or velvety.
Calyx limb adaxial side	8–14 × 8–10 cm, flat, shallow, cupuliform; base color beige to pale yellow with vinaceous, sinuate-margined stripes radiating from the throat to the limb's edge; heavily rusty villous.	6–13 × 6–12 cm, subcampanulate; base color chartreuse with reticulate venation and dark plum coloration. waxy or velvety in texture, glabrous.	5–8 × 4–7 cm, flat or slightly reflexed; dark purple with bright yellow radial stripes or reticulate patterns; velvety in texture, glabrous.
Calyx throat	Pink, with the rim transitioning to pinkish-beige or pale yellow, featuring a crescent-shaped amaranthine coloration on the upper part.	Dark purple predominant, with the basal region transitioning to white or pale yellow; surface glabrous, with a texture ranging from velvety to waxy.	Bright yellow, glabrous, velvety to waxy.

* Morphological data are derived from the new material in this study, as well as from the results of Hwang (1981), Pham *et al.* (2023), and Zhu *et al.* (2017).

TAXONOMIC TREATMENT

Aristolochia geantha Z.R. Guo & Y.Fan Wang, *sp. nov.*

Figs. 1–2

Type: CHINA. Yunnan: Malipo County, Mali Township, Maocaoping Village, elevation 1338.5 m, growing within the dense forests on the slopes of karst limestone mountains, 9 September 2023, stem, leaves and flowers, Z.R. Guo GZR2309001 (holotype: IBSC1041413!; isotypes: IBSC1041414!, IBSC1041415!).

Diagnosis: *Aristolochia geantha* is similar to *A. petelotii* O.C.Schmidt (1933: 95) and *A. austroyunnanensis* S.M. Hwang (1981: 228) in having ovate to lanceolate leaf blades with acuminate apices, cordate bases, and rusty villous hairs on both surfaces, as well as a perianth with a concave, fused calyx limb of similar coloration. However, *A. geantha* can be readily distinguished by its flat cupuliform calyx limb, radiating stripes from the throat to the limb margin, densely long rusty or golden villous hairs on the adaxial surface of the calyx limb, a pinkish beige to pink throat, and a pink upper tube. Notably, this species exhibits a unique floral positioning behavior, characterized by an elongated peduncle emerging from the basal stem, placing the flower prostrate on the ground with the throat facing upward—a trait not observed in any other species within subgenus *Siphisia*. See Figs. 1–2, S1–2 and Table 1 for detailed comparisons.

Description: Perennial twining liana. Young stems terete, densely rusty villous; older stems terete to

cylindrical, lignified, with fissured cork (phellem). Roots fusiform tuberous, 0.3–1.8 m long, 5–15 cm in diameter, with radiating xylem, yellow. Petiole 4–6 cm long, villous. Lamina broadly ovate, ovate-lanceolate, or ovate-elliptic, 16–22 × 8–14 cm, leathery to membranous; adaxially rusty or golden villous along the veins, with the non-vein surface sparsely villous; abaxially densely rusty villous; base shallowly cordate, apex acuminate, venation pinnate. Inflorescence in cymes, basally borne on old lignified woody stems, with 1–4 flowers per cyme. Flowers prostrate on the ground, supported by a 12–24 cm long elongated peduncle, terete, yellow-brown, villous; bractlet absent. Perianth geniculately curved, abaxially rusty villous along the veins, with the non-vein areas sparsely villous. Perianth adaxial surface heterogeneous; utricle indistinct from the tube, white tomentose; base dark purple, 3.5–4.5 cm long, 3.5–4.5 mm in diameter. Basal portion of the tube (from utricle to geniculation, utricle excluded) cylindrical, 3.5–4.5 cm long, 3.5–4.5 mm in diameter, pale yellow to beige with vertical purple stripes, tomentose. Upper portion of the calyx tube cylindrical, slightly hourglass-shaped, with a slight constriction in the middle and wider ends, ca. 2 cm long, pink, velvety-textured, glabrous. Throat 2–3 cm in diameter, semicircular, pink, with rim being pinkish-beige or pale yellow, with crescent-shaped, amaranthine coloration on the upper part. Calyx limb laterally flat, cupuliform, 1.2–2 mm thick; in frontal view, suborbicular, 8–14 × 8–10 cm, adaxial surface pale yellow or beige, accented by vinaceous, sinuate-margined stripes radiating

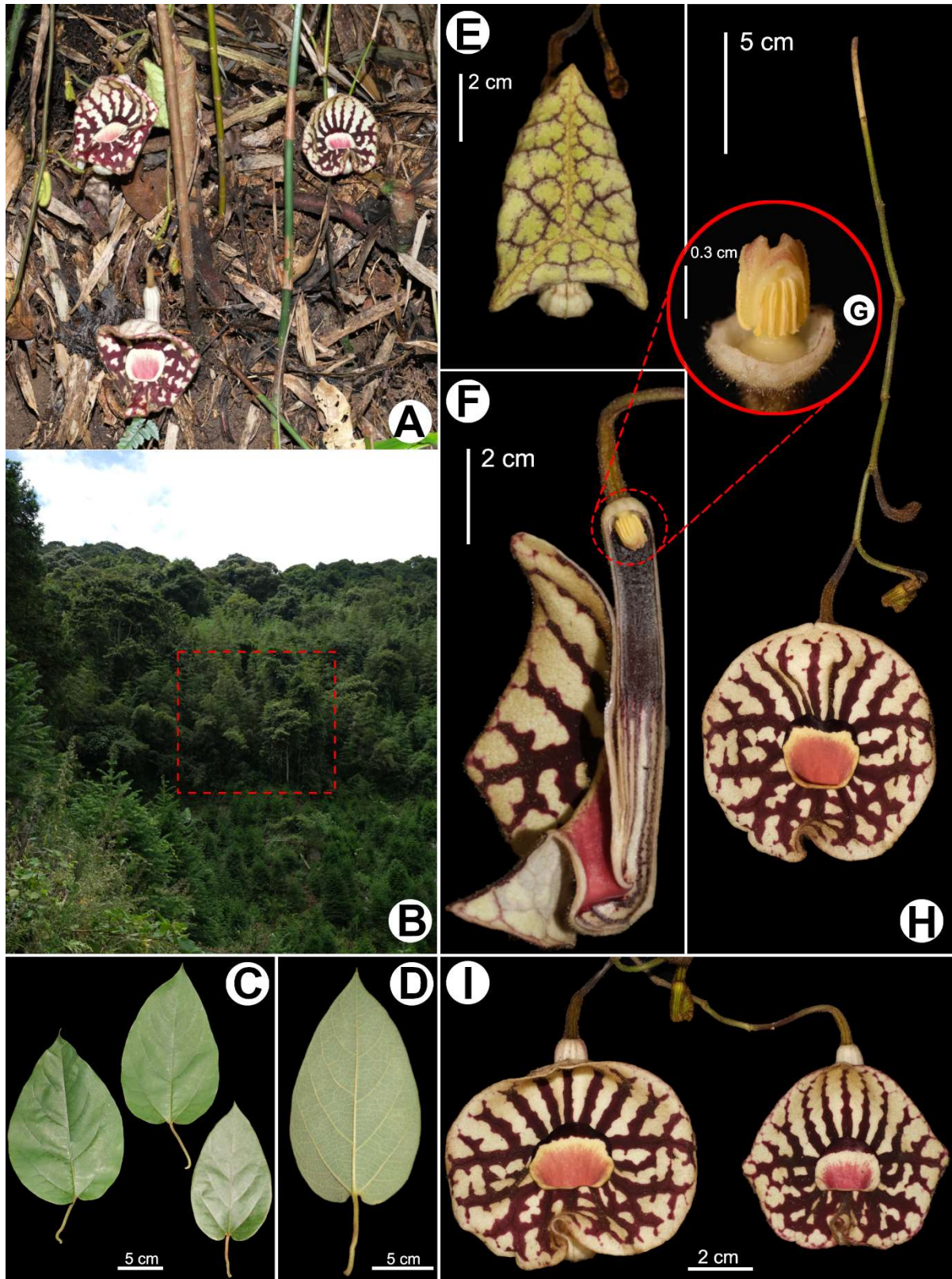


Fig. 1. Illustration of *Aristolochia geantha*. **A.** Plant in situ, with flowers prostrate on the ground, throat facing upward, **B.** Habitat in situ, **C.** Adaxial view of the leaves, **D.** Abaxial view of the leaf, **E.** Bud, frontal view, **F.** Longitudinal section of the flower, **G.** Close-up of the gynostemium, **H.** Inflorescence showing elongated peduncle, **I.** Cyme bearing two flowers. Scale bars are provided in each panel accordingly.

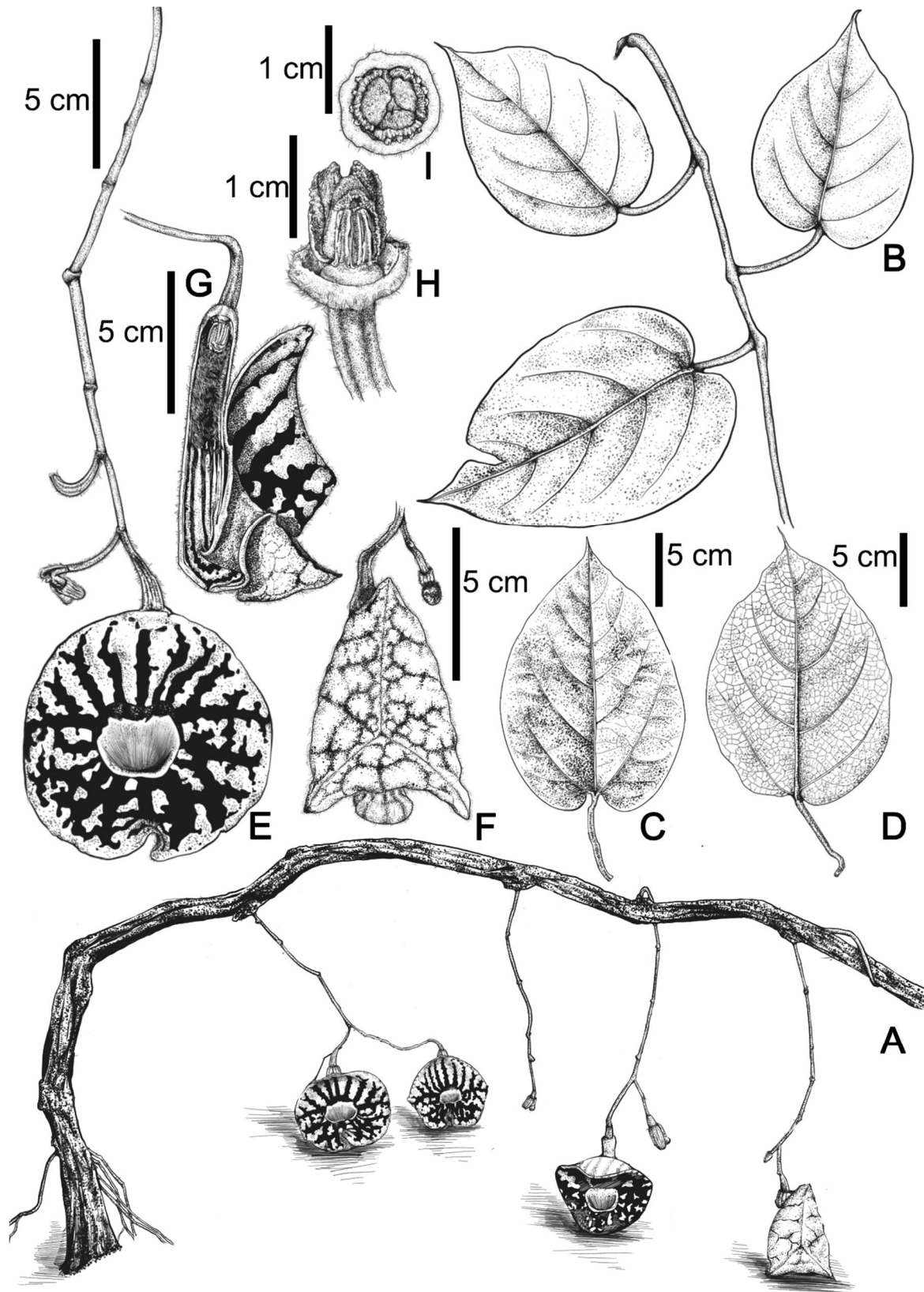


Fig. 2. Line drawing of *Aristolochia geantha* by Ms. Yushan Cai. **A.** Habit, illustrating flowers on the ground, **B.** Young stem with leaves, **C–D.** Adaxial and abaxial views of the leaf, **E.** Inflorescence, **F.** Floral bud, **G.** Interior structure of the perianth, **H–I.** Gynostemium. Scale bars are provided in each panel accordingly.



from the throat to the limb's edge, entirely rusty villous. Calyx area beneath the throat wrinkled, forming an irregular ridge or platform. Anthers 6, oblong, arranged in 3 pairs adnate to the base of the gynostemium, opposite the lobes. Gynostemium 8–12 mm long, 3-lobed, with obtuse lobes at the apex, connected to the ovary by a hemispherical, pedestal-like structure. Ovary terete, 2.5–4.5 cm long, inferior, covered with rusty villous indumentum.

Distribution and habitat: The new species is currently known to Malipo County and Xichou County, Yunnan, China, at elevations between 1300 m and 1500 m. It is locally rare and grows in the forests situated on slope in Karst limestone mountains together with *Alnus nepalensis* D. Don, *Rhododendron delavayi* A. R. Franchet, *Polygala karensium* W. S. Kurz and *Crawfordia maculaticaulis* C. Y. Wu ex C. J. Wu.

Phenology: Flowering period was observed from August to early October, in both wild and cultivated individuals. Fruits or seeds were not observed.

Etymology: The epithet “*geantha*” conveys the species' distinctive inflorescence arrangement, based on extensive field observations and cultivated living collections. The flowers are borne on an unusually elongated peduncle, which extends from the basal lignified stems and positions the flowers directly upon the ground, demonstrating a cauliflorous habit. This arrangement, where the flowers rest on the substrate, is not documented in any other taxa within the subg. *Siphisia*, and the epithet is intended to highlight this unique growth habit.

Vernacular name: During our fieldwork, we learned that *Aristolochia gantha*, along with the sympatric species *A. petelotii*, has long been used as a folk medicine and is occasionally traded in markets under the vernacular name “xuě shàng cǎo” (雪上草), which translates to “growing above the snow.” However, this vernacular term lacks clarity in reflecting the biological properties or traits of the plants and functions as an umbrella name that may refer to multiple *Aristolochia* subg. *Siphisia* taxa, including *A. petelotii*. Based on the distinct characteristics of *A. gantha*, we propose the Chinese name “dì huā guān mù tōng” (地花关木通) to accurately reflect its growth habit and ensure alignment with its scientific identity.

Conservation status: We have discovered five subpopulations of *Aristolochia gantha*, all located in the border region on the China side, geographically congruent with Vietnam. Although we have not yet conducted fieldwork across the border, we speculate potential distribution in Vietnam or Laos due to the close proximity and shared climatic conditions. However, during our fieldwork in China, the plant was rarely observed in the wild, indicating that the population density is naturally low. The subpopulations we identified are neither in natural reserves nor on private property, and signs of encroachment from agricultural activities, such

as *Amomum tsao-ko* A. Crevost & J. F. Lemarié and *Panax notoginseng* (I. H. Burkill) F. H. Chen cultivation, are already evident. Additionally, this species, along with the easily confused *A. petelotii*, has been traditionally used in local medicine, which puts considerable pressure on the sustainability of their populations. With fewer than 50 mature individuals identified and significant ongoing threats, *A. gantha* qualifies as Critically Endangered (CR) under IUCN Criterion C2a(i) (IUCN, 2012, 2024), where the risk of extinction is elevated by the species' small and declining population and the concentration of individuals in a few subpopulations. We advocate for the immediate conservation action on this species, given its already sparse population, awkward distribution across international and jurisdictional boundaries—posing challenges for in situ conservation and habitat monitoring—and the considerable demand from the folk medicine market.

Discussion: While examining all related specimens, we identified a vegetative voucher IBSC0894098 (CHINA. Guangdong: Xinyi City, Dawuling Mountain, 24 November 2002, H. G. Ye *et al.*, Coll. No. 7813) that matches all the morphological traits of the new species we are describing, except that it was collected in western Guangdong Province. Despite several intensive field expeditions in this region, we have not yet to rediscover any *Aristolochia* individuals with traits corresponding to the voucher. During our expeditions, we also surveyed local residents, showing them colored images of the flower and leaf. Local accounts confirmed that the plant has occasionally been seen in the region. However, such oral reports can only be treated as anecdotal evidence. Thus, we cannot conclusively identify this vegetative voucher, especially considering the locality's remoteness and isolation from the type area, until further evidence is obtained.

Additional specimen examined (paratype): CHINA. Yunnan: Malipo County, Mali Township, Maocaoqing Village, elevation 1351 m, growing within the dense forests on the slopes of karst limestone mountains, 15 October 2022, stem & leaves, Z.R. Guo GZR2210001 (IBSC1041416!).

Specimens of *Aristolochia petelotii* examined: CHINA. Yunnan: Lüchun county, 07 June 1974, *Lüchun Exped. 1604* (IBK!), 27 October 1995, S.K. Wu *et al.* 2510 (KUN!); Malipo county, 7 August 2015, X.X. Zhu & S. Liao ZH112 (CSH!), 30 March 2017, X.X. Zhu ZXX17016 (CSH!, XYTC!), 8 May 2017, L. Wu & Z.J. Wen 5840 (CSFI!). Jinggu county, Jinggu township, 17 June 1969, *FoC. Exped. 3998* (HITBC!); Mengla county, Mengyuan township, 5 November 1974, *FoC. Exped. 34581* (HITBC!). VIETNAM. Hanoi: 4 March 2014, J.S. Ma & M. Deng DM6763 (CSH!). Tonkin: September 1932, *A. Pételot 4418* (P!).

Specimens of *Aristolochia austroyunnanensis* examined: CHINA. Guangxi: Napo county, 23 February 1976, D. Fang & D.Y. Liu 22129 (GXMI!). Yunnan: Pingbian county, Waga, alt. 1800 m, 14 June 1956, *Sino-Russ. Exped. 2075* (PEM!, IBSC!), 5 May 1954, P.Y. Mao 04144 (PEM!), 25 May 2014, J. Cai *et al.* 14CS9201 (KUN!); Yuanyang county, 7 June 1974, *Lüchun Exped. 1604* (KUN!). VIETNAM. Cao Bang: Nguyen Binh district, Phia Oac-Phia Den National Park, V.T. Do DVT 65 (VNMN!, DR!); N.B. Trinh & V.T. Pham TB 238 (VAFS!). Lao Cai: Bat Xat district, Y Ty commune, Bat Xat Nature Reserve, V.T. Do DVT 243 (VNMN!).



Key to Similar Species of *Aristolochia geantha*

- 1a. Lamina elliptic or ovate, apex obtuse to rounded, base truncate, papery or leathery, short tomentum on both sides; calyx limb subtund-peltate, dark purple with white stripes, throat porcelain white *A. fangchi*
- 1b. Lamina ovate, ovate-elliptic to lanceolate, apex acuminate, base cordate; rusty or golden villous on both sides 2
- 2a. Lamina leathery; perianth with bright yellow waxy throat and bright yellow adaxial surface of the upper calyx tube; limb flat or slightly reflexed, glabrous. *A. austroyunnanensis*
- 2b. Lamina herbaceous or membranous, extremely rusty villous; Adaxial side of Calyx limb base color pale yellow to chartreuse, with vinaceous to dark purple radiated or venate stripes 3
- 3a. Flowers from basal stem or axillary; limb deep subcampanulate to hemispherical, adaxial side waxy to velvety, glabrous; throat dark purple predominant, basal portion white or pale yellow, waxy, glabrous; upper calyx tube adaxially pale yellow at base, suddenly turning dark purple near the throat *A. petlotii*
- 3b. Inflorescence cauliflorous on old, lignified stem and flowers prostrate on the ground; limb flat cupuliform, adaxially heavily rusty villous, pale yellow or beige with vinaceous, sinuate-margined stripes radiating from the throat to the limb's edge; throat pink, upper calyx tube adaxially fully pink, velvety *A. geantha*

ACKNOWLEDGMENTS

We extend our sincere gratitude to the local community, Mr. Mingfeng Long for his vernacular knowledge, and Mr. Fuguan Deng, Ms. Xianhui Zhang, and Mr. Xianlin Zhang for their invaluable assistance in fieldwork. We also appreciate Ms. Yushan Cai for her precise scientific illustrations and Ms. Ying Yang and Ms. Tianping Huang at XTBG for facilitating access to garden materials. Special thanks go to Dr. Shuai Liao from the South China Botanical Garden for his invaluable support in fieldwork, species identification, and voucher deposition. Finally, we are deeply grateful to all the members of Onyenedum Lab at New York University for their exceptional botanical guidance and insightful discussions throughout this research.

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