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## Two New Species of *Aristolochia* (Aristolochiaceae) from Hainan Island, China

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**ABSTRACT.** Two new species of *Aristolochia* (Aristolochiaceae), *A. ledongensis* Han Xu, Y. D. Li & H. J. Yang and *A. jianfenglingensis* Han Xu, Y. D. Li & H. Q. Chen, are described and illustrated from Hainan Island, China. *Aristolochia ledongensis* differs from the similar *A. championii* Merr. & Chun and *A. bambusifolia* C. F. Liang ex H. Q. Wen by having the exterior of the calyx yellow (vs. yellowish green), a smaller basal portion of the calyx tube ( $15\text{--}16 \times 4.5\text{--}5$  mm vs.  $30\text{--}70 \times 7\text{--}10$  mm), a narrower calyx limb ( $0.5\text{--}0.7$  cm vs.  $1.5\text{--}6$  cm wide), and a shorter peduncle ( $0.7\text{--}1$  cm vs.  $1.8\text{--}5$  cm). *Aristolochia jianfenglingensis* differs from the similar *A. championii* and *A. bambusifolia* by having the stems glabrous (vs. densely villous), the exterior of the calyx light red-brown (vs. yellowish green), a smaller basal portion of the calyx tube ( $23\text{--}26 \times 5\text{--}6$  mm vs.  $30\text{--}70 \times 7\text{--}10$  mm), and a narrower calyx limb ( $0.8\text{--}0.9$  cm vs.  $1.5\text{--}6$  cm wide). *Aristolochia championii* and *A. bambusifolia* have densely villous stems; the exterior of the calyx is yellowish green, with a larger basal portion of the calyx tube ( $> 30 \times \text{ca. } 10$  mm); the calyx limb is discoid and more than 15 mm wide; and the peduncle is longer than 18 mm. Both new taxa are assessed as Vulnerable (VU D2) according to IUCN Red List criteria.

**Key words:** *Aristolochia*, Aristolochiaceae, China, Hainan, IUCN Red List.

Aristolochiaceae has about eight genera and an estimated 450 to 600 species that grow primarily in tropical and subtropical regions. A total of four genera (one endemic) and 86 species (69 endemic) are recorded from China. *Aristolochia* L. is the largest genus in the family, with about 400 species widely distributed in tropical, subtropical, and temperate regions of the Old World, including Australia. There are 45 species (33 endemic) in China, and five

species of *Aristolochia* are known from Hainan Island. The two new species described here bring the species total from Hainan Island to seven. *Aristolochia* species are mainly twining climbers with woody or herbaceous stems, rarely erect shrubs or herbs, and the roots are often tuberous (Huang, 1987; Cheng et al., 1988; Huang et al., 2003).

**I. *Aristolochia ledongensis*** Han Xu, Y. D. Li & H. J. Yang, sp. nov. TYPE: China. Hainan: Jianfengling Natl. Nature Reserve, Ledong,  $18^{\circ}45'N$ ,  $108^{\circ}58'E$ , 310 m, 20 Aug. 2008, Han Xu & H. Q. Chen JFL00972 (holotype, CANT). Figure 1.

Species *Aristolochiae championii* Merr. & Chun et *A. bambusifoliae* C. F. Liang ex H. Q. Wen similis, sed ab eis calyce flavo tubo basali  $15\text{--}16 \times 4.5\text{--}5$  mm, limbo perianthii  $0.5\text{--}0.7$  cm lato et pedunculo pendulo  $0.7\text{--}1$  cm longo differt.

Lianas; stems woody, terete, densely yellow-brown villous. Leaves with the petioles  $0.5\text{--}1.1$  cm, densely yellow-brown villous; leaf blades lanceolate or elliptic-lanceolate,  $6.5\text{--}11 \times 1.7\text{--}3.9$  cm, leathery, abaxially densely yellow-brown villous, especially on midrib, adaxially with mixed tomentum of yellow-brown villous and white pubescence, veins pinnate, in 7 to 10 pairs, shortly yellow-brown villous; blade base shallowly cordate, sinus  $< 2\text{--}3$  mm deep, apex acute. Flowers solitary; peduncles pendulous,  $0.7\text{--}1$  cm, yellow-brown villous; bracteoles ovate, ca.  $0.6 \times 1.3$  mm, inserted at peduncle bases, inconspicuous. Calyx externally yellow,  $3.1\text{--}3.7$  cm; throat yellow with dark red-brown spots; calyx tube geniculate, externally densely yellow villous; basal portion of tube  $15\text{--}16 \times 4.5\text{--}5$  mm; calyx limb yellow,  $5\text{--}7$  mm wide, margin not revolute, the lower lobe protuberant, adaxially densely papillate; stamens 6 in 1 series of 3

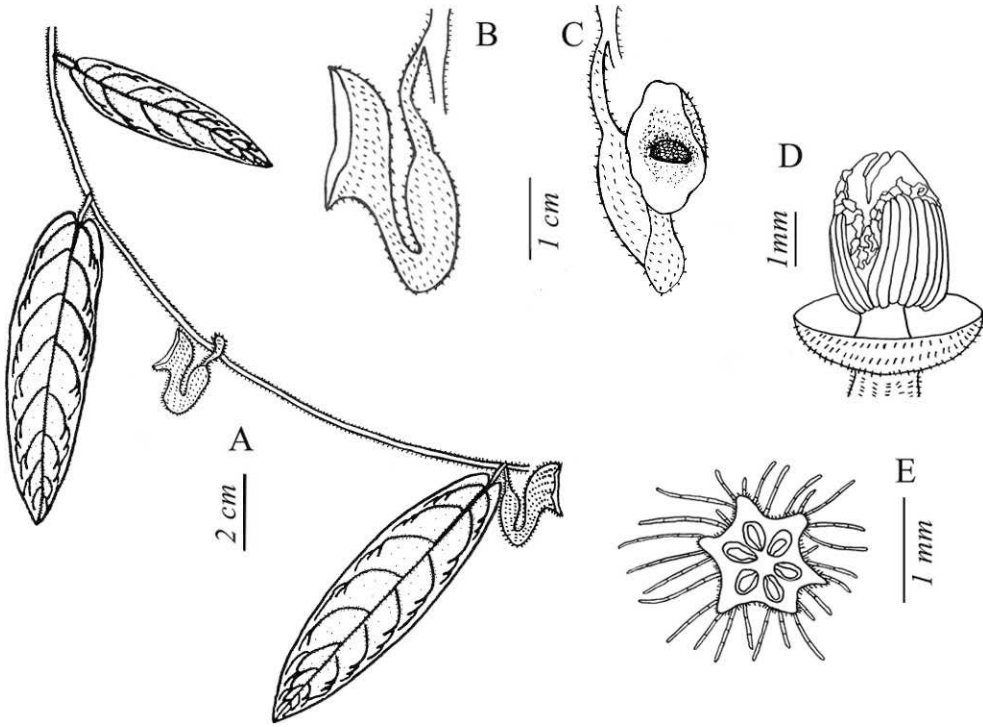


Figure 1. *Aristolochia ledongensis* Han Xu, Y. D. Li & H. J. Yang. —A. Flowering branch. —B. Lateral view of open flower. —C. Face view of open flower. —D. Gynostemium. —E. Transverse section of ovary. Drawn by S. L. Lu from the holotype Han Xu & H. Q. Chen JFL00972 (CANT).

pairs; anthers oblong, ca. 2.1 mm, 2-loculed, dehiscence longitudinal; ovary 6-loculed, with long yellow-brown villous hairs; ovules numerous, usually in 1 series; placentation axile; gynostemium free, column 3-lobed, without protuberant apex. Capsule not seen.

**Distribution and habitat.** *Aristolochia ledongensis* is known from two populations found within the Jianfengling National Nature Reserve on Hainan Island. The type population was found under the canopy of tropical rainforest dominated by plant families including Dipterocarpaceae, Theaceae, Euphorbiaceae, and Myrtaceae at an altitude of 310 m, and the climate is tropical monsoon.

**IUCN Red List category.** Jianfengling is located in the southwest of Hainan Island. To date, 2817 plant species belonging to 1213 genera and 239 families have been reported from this 472-km<sup>2</sup> area (Zeng et al., 1995). Logging has been prohibited in this area since 1993, and the habitats are now protected. An area of 202 km<sup>2</sup> is designated as Jianfengling National Nature Reserve. Within this area, *Aristolochia ledongensis* is known from only two populations, with fewer than five individuals seen at

each site. Therefore, the new species is assigned a preliminary status of Vulnerable (VU D2) according to IUCN Red List criteria (IUCN, 2001), indicating a population with a very restricted area of occupancy (typically less than 20 km<sup>2</sup>) or number of locations (typically five or fewer).

**Phenology.** Flowering specimens of the new species were collected in August.

**Etymology.** The specific epithet is derived from the Chinese Pinyin name of the collection locality of the holotype, Ledong, referring to the name of the city.

**Relationships.** *Aristolochia ledongensis* is most similar to *A. championii* Merr. & Chun (distributed in Guangdong, Guangxi, Guizhou, and Sichuan provinces, China) and *A. bambusifolia* C. F. Liang ex H. Q. Wen (distributed in Guangxi Province, China). The new species differs by having the exterior of the calyx yellow (vs. yellowish green), the basal portion of the calyx tube smaller (15–16 × 4.5–5 mm vs. 30–70 × 7–10 mm), a narrower calyx limb (0.5–0.7 cm vs. 1.5–6 cm wide), and a shorter peduncle (0.7–1 cm vs. 1.8–5 cm). *Aristolochia ledongensis* is also similar to *A. fangchi* Y. C. Wu ex L. D. Chow &

S. M. Hwang and *A. petelotii* O. C. Schmidt, but differs by having a narrower leaf blade (1.7–3.9 cm vs. 3.5–8 cm wide), solitary flowers (vs. two to four and racemose), and a narrower calyx limb (0.5–0.7 cm vs. 4–7 cm wide).

Infragenera in *Aristolochia* include subgenus *Pararistolochia* (Hutch. & Dalziel) O. C. Schmidt, subgenus *Siphisia* (Raf.) Duch., and subgenus *Aristolochia* L.; recent treatments to sectional levels include Ma (1989) and González and Stevenson (2002). Only subgenus *Siphisia* and subgenus *Aristolochia* are distributed in China. Subgenus *Siphisia* is characterized by having more than three lobes of the gynostemium, a solitary anther on the outer surface of each gynostemium lobe, and a perianth with one to three lobes. Subgenus *Aristolochia* is characterized by having three lobes of the gynostemium, anthers paired on the outer surface of each gynostemium segment, and a perianth with three lobes. Based on these characters, the new species is placed in subgenus *Siphisia*.

*Paratype.* CHINA. Hainan: Jianfengling Natl. Nature Reserve, under tropical rainforest, 18°45'N, 108°58'E, 310 m, 20 Aug. 2008, Han Xu & H. Q. Chen JFL00973 (IBSC).

**2. *Aristolochia jianfenglingensis*** Han Xu, Y. D. Li & H. Q. Chen, sp. nov. TYPE: China. Hainan: Jianfengling Natl. Nature Reserve, 18°51'N, 108°51'E, 980 m, 4 Sep. 2008, Han Xu & H. Q. Chen JFL00876 (holotype, CANT). Figure 2.

Species *Aristolochiae championii* Merr. & W. Y. Chun et *A. bambusifoliae* C. F. Liang ex H. Q. Wen similis, sed ab eis caulibus glabris, calyce rufo tubo basali 23–26 × 5–6 mm et limbo perianthii 8–9 mm lato differt.

Lianas; stems woody, terete, glabrous. Leaves with the petioles 1.5–2.3 cm, densely yellow-brown villous; leaf blades lanceolate or elliptic-lanceolate, entire, 13–17.3 × 2.1–2.7 cm, leathery, abaxially mixed tomentum of yellow-brown villous and white pubescence, adaxially sparsely yellow-brown villous and white pubescence, veins pinnate, in 16 to 18 pairs, sparsely yellow-brown villous; base shallowly cordate, sinus < ca. 2 mm deep, apex acuminate. Flowers solitary; peduncles pendulous, 2.7–3.5 cm, densely yellow-brown villous; bracteoles lanceolate-ovate, ca. 0.4 × 1.1 mm, inserted at the peduncle bases, inconspicuous. Calyx externally light red-brown, 4.9–6.1 cm; throat pink with red-brown spots; calyx tube geniculate, externally densely yellow-brown villous; basal portion of tube 23–26 × 5–6 mm; calyx limb pink, 8–9 mm wide, margin revolute, unequally 3-lobed, the lower lobe with a short apex, adaxially densely papillate and white pubescent;

stamens 6 in 1 series of 3 pairs; anthers oblong, ca. 2.4 mm, paired, 2-loculed, dehiscence longitudinal; ovary inferior, 6-loculed, mixed with long yellow-brown villous hairs and white pubescence; ovules numerous, usually in 1 series; placentation axile; gynostemium free, column 3-lobed, with a short, curved apex. Capsule not seen.

*Distribution and habitat.* Like *Aristolochia ledongensis*, *A. jianfenglingensis* is also only known from a single population found within the Jianfengling National Nature Reserve on Hainan Island, China. The type population was found at an altitude of just below 1000 m, rather higher than the altitude at which *A. ledongensis* was collected, under the canopy of tropical rainforest dominated by the families Lauraceae, Rubiaceae, Fagaceae, Palmae, and Myrtaceae.

*IUCN Red List category.* Within the Jianfengling National Nature Reserve, *Aristolochia jianfenglingensis* is known from only a single population, with fewer than five individuals seen. It is therefore assigned a preliminary status of Vulnerable (VU D2) according to IUCN Red List criteria (IUCN, 2001), indicating a population with a very restricted area of occupancy (typically less than 20 km<sup>2</sup>) or number of locations (typically five or fewer). Although the sites that these two new species grew were disturbed about 15 years ago, there has not been further deforestation since then (Jian & Lu, 1991). More populations of these two species could remain to be found in similar habitats in these areas. However, an extensive field survey is needed, because the plants are inconspicuous and difficult to find in the field.

*Phenology.* Flowering specimens of the new species were collected in September and are known to bloom from July to September based on field observation.

*Etymology.* The specific epithet is derived from the Chinese Pinyin name of the collection locality of the holotype, Jian feng ling, with Ling referring to mountain.

*Relationships.* *Aristolochia jianfenglingensis* is most similar to *A. championii* and *A. bambusifolia*. The new species differs by having the stems glabrous (vs. densely villous), the exterior of the calyx light red-brown (vs. yellowish green), the basal portion of the calyx tube smaller (23–26 × 5–6 mm vs. 30–70 × 7–10 mm), and a narrower calyx limb (0.8–0.9 cm vs. 1.5–6 cm wide). Three other species of *Aristolochia* have been described in adjacent areas but differ significantly from *A. jianfenglingensis*. *Aristolochia jianfenglingensis* differs from *A. cathcartii* Hook. f.

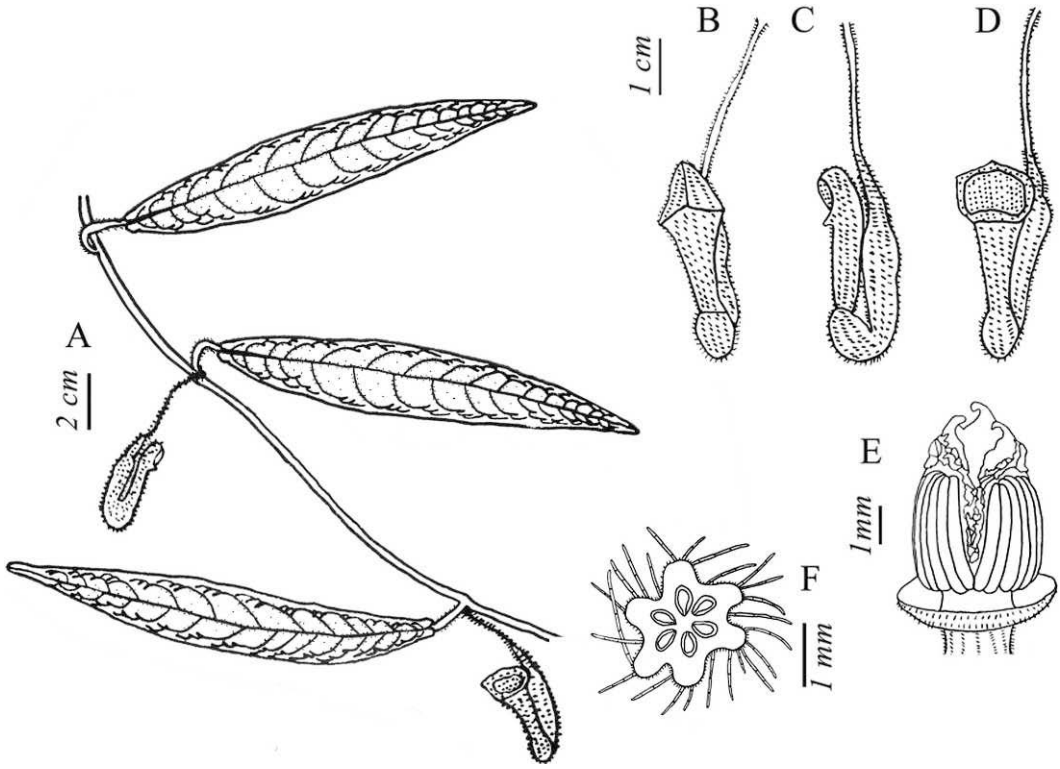


Figure 2. *Aristolochia jianfenglingensis* Han Xu, Y. D. Li & H. Q. Chen. —A. Flowering branch. —B. Closed flower. —C. Lateral view of open flower. —D. Face view of open flower. —E. Gynostemium. —F. Transverse section of ovary. Drawn by S. L. Lu from the holotype Han Xu & H. Q. Chen JFL00876 (CANT).

(distributed from the eastern Himalayas to southern China) (Upson & Brett, 2006) and *A. saccata* Wall. (distributed in Bhutan, northeastern India, Myanmar [Burma], Nepal, and Sikkim) by having a smaller leaf blade ( $13\text{--}17.3 \times 2.1\text{--}2.7$  cm vs.  $17\text{--}35 \times 10\text{--}26$  cm and  $20\text{--}35 \times 15\text{--}30$  cm, respectively); it differs from *A. balansae* Franch. (distributed in Vietnam) by having densely yellow-brown villous leaves (vs. the leaves glabrous).

Like *Aristolochia ledongensis*, *A. jianfenglingensis* is also placed in subgenus *Siphisia*.

*Paratype*. CHINA. **Hainan**: Jianfengling Natl. Nature Reserve, under tropical rainforest,  $18^{\circ}51'N$ ,  $108^{\circ}51'E$ , 980 m, 4 Sep. 2008, Han Xu & H. Q. Chen JFL00877 (IBSC).

The two new species are morphologically similar in their lanceolate or elliptic-lanceolate leaf blades, solitary flowers, 2-loculed anthers, and 3-lobed gynostemium column. *Aristolochia ledongensis* differs from *A. jianfenglingensis* by the densely yellow-brown villous stems (vs. glabrous), the calyx externally yellow (vs. light red-brown), the calyx limb margin not revolute (vs. revolute), and the smaller basal portion of the calyx tube ( $15\text{--}16 \times 4.5\text{--}5$  mm vs.  $23\text{--}26 \times 5\text{--}6$  mm).

The following key to 11 species of *Aristolochia* includes the two new species and their two most closely related species, as well as seven species found in Hainan Island and adjacent districts.

#### KEY TO ELEVEN SIMILAR SPECIES OF *ARISTOLOCHIA* IN HAINAN AND CHINA

- 1a. Calyx tube rectilinear or slightly curved; limb ligulate; gynostemium 6-lobed; anthers elliptic, opposite to lobes of gynostemium.
  - 2a. Leaf blades polymorphic, ovate or ovate-deltate to sagittate, 2.5–5.5 cm long ..... *A. polymorpha* S. M. Hwang
  - 2a. Leaf blades triangular-lanceolate to sagittate, 7–14 cm long ..... *A. austrochinensis* C. Y. Cheng & J. S. Ma
- 1b. Calyx tube horseshoe-shaped or geniculately curved at middle; limb often 2- or 3-lobed; gynostemium 3-lobed; anthers oblong, adnate in pairs opposite the gynostemium lobes.
  - 3a. Calyx limb expanded above, obliquely trumpet-shaped; orifice larger than tube ..... *A. hainanensis* Merr.
  - 3b. Calyx limb expanded above, discoid; orifice distinctly smaller than tube.

- 4a. Leaf blades polymorphic, margin deeply or shallowly lobed, rarely entire ..... *A. howii* Merr. & Chun  
4b. Leaf blades uniform, margin entire.  
5a. Leaf blades ovate-elliptic to oblong-elliptic, 7–12 cm wide ..... *A. fulvicoma* Merr. & Chun  
5b. Leaf blades lanceolate or elliptic-lanceolate, usually < 7 cm wide.  
6a. Basal portion of calyx tube > 7 mm wide.  
7a. Calyx limb adaxially papillate; veins in 4 to 6 pairs.  
8a. Calyx limb discoid, 4–6 cm diam., margin not revolute .... *A. championii* Merr. & Chun  
8b. Calyx limb discoid, 1.5–2 cm diam., margin revolute  
..... *A. bambusifolia* C. F. Liang ex H. Q. Wen  
7b. Calyx limb adaxially smooth; veins in 6 to 16 pairs.  
9a. Calyx purple with yellow blotches ... *A. fangchi* Y. C. Wu ex L. D. Chow & S. M. Hwang  
9b. Calyx yellow with purple-brown blotches ..... *A. petelotii* O. C. Schmidt  
6b. Basal portion of calyx tube < 7 mm wide.  
10a. Stems densely yellow-brown villous; calyx limb margin not revolute; calyx exterior  
yellow; basal portion of calyx tube 15–16 × 4.5–5 mm.....  
..... *A. ledongensis* Han Xu, Y. D. Li & H. J. Yang  
10b. Stems glabrous; calyx limb margin revolute; calyx exterior light red-brown; basal portion  
of calyx tube 23–26 × 5–6 mm ..... *A. jianfenglingensis* Han Xu, Y. D. Li & H. Q. Chen

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