

Aristolochia austroyunnanensis S. M. Hwang,
A NEW RECORD FOR THE FLORA OF VIETNAM

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ABSTRACT

Aristolochia austroyunnanensis S. M. Hwang (family Aristolochiaceae), a species endemic to southern China, is newly recorded for the flora of Vietnam. This newly recorded species belong to subgenus *Siphisia* and is most similar to *Aristolochia petelotii* O. C. Schmidt and *Aristolochia fangchi* C. Wu ex L. D. Chow & S. M. Hwang. Detailed morphological descriptions and color illustrations, together with information on distribution, habitat, phenology, and taxonomic notes are given. An identification key to all known *Siphisia* species in Vietnam is also provided.

Keywords: *Aristolochia*, *Aristolochia austroyunnanensis*, new record, *Siphisia*, Vietnam.

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INTRODUCTION

The genus *Aristolochia* Linnaeus (1753) sensu lato is the largest genus of family Aristolochiaceae, and is widely distributed throughout the tropics, subtropics and also extending to temperate regions (Huber, 1993; Hwang et al., 2003). According to traditional taxonomic and recent phylogenetic studies, the genus can be subdivided into three monophyletic subgenera, viz. subgenus *Aristolochia*, subgenus *Siphisia* (Duch.) O. C. Schmidt, and subgenus *Pararistolochia* (Hutch. & Dalziel) O. C. Schmidt (Schmidt, 1935; Ma, 1989; Wanke et al., 2006; Ohi-Toma & Murata, 2016). Although Zhu et al. (2019) recognized *Isotrema* Raf. as including all species of subgenus *Siphisia*, we continue to include them in *Aristolochia*, as has been widely accepted in other studies (Cai et al., 2020; Phan et al., 2021; Do et al., 2021a, 2021b, 2023; Do & Hoang, 2022).

Within the Indo-Chinese floristic region, southern China and Vietnam were considered the most diverse with respect to *Aristolochia* in Asia, especially subgenus *Siphisia* (Do et al., 2015). A total of 20 species of the subgenus *Siphisia* were recorded for the flora of Vietnam (Do et al., 2019, 2021a, 2021b, 2023; Do & Hoang, 2022).

Hwang (1981) originally described *Aristolochia austroyunnanensis* S. M. Hwang, based on collections from Yunnan province, China. The author provided a full description, a line drawing, and a comparison with the most similar species *Aristolochia petelotii* O. C. Schmidt. However, the shape and color of the upper tube and the inner surface of the limb as well as the color of the throat were not fully described and illustrated, which are most important for the delimitation of *Aristolochia* species, but often impossible to observe in dried specimens. By lacking these diagnostic characteristics from living plants of *A. austroyunnanensis* and *A. petelotii*, Ma (1989) thought that there was no essential difference between these two species, so the author synonymized *A. austroyunnanensis* with *A. petelotii*. Based on recent observation of living plants of these two species, Zhu et al.

(2017) distinguished *A. austroyunnanensis* from *A. petelotii* by the difference of morphological characters of the lamina, the inner surface of limb lobes as well as the color of the throat.

During recent botanical surveys addressing diversity of genus *Aristolochia* in Vietnam, we also recorded *A. austroyunnanensis* occurring in Bat Xat Nature Reserve, Lao Cai province and Phia Oac-Phia Den National Park, Cao Bang province, Northern Vietnam, which has not yet been recorded from Vietnam in the previous studies (Hwang, 1981; Ma, 1989; Hwang et al., 2003; Do et al., 2015; Zhu et al., 2017). Therefore, we here report *A. austroyunnanensis* as a new record for the flora of Vietnam. This species has a strongly curved perianth, a 3-lobed limb, and a 3-lobed gynostemium, placing it into the *Aristolochia* subgenus *Siphisia*. Detailed morphological description and color illustrations together with information on distribution, habitat, phenology, and taxonomic notes are given and an identification key to all known *Siphisia* species in Vietnam is also provided.

MATERIALS AND METHODS

The studied specimens were collected in Bat Xat Nature Reserve, Lao Cai province, and Phia Oac-Phia Den National Park, Cao Bang province, Northern Vietnam, and deposited in the herbaria of Vietnam National Museum of Nature (VNMN), Vietnam Academy of Science and Technology and Silviculture Research Institute, Vietnamese Academy of Forest Sciences (VAFS).

The morphological characters (e.g. shape, the color of the perianth) were measured and photographed using Olympus (Japan) digital camera. These characters were compared with descriptions in the protologue, type material and additional specimens of *Aristolochia*, subgenus *Siphisia* species at the following herbaria: DR, HITBC, HN, HNU, IBK, IBSC, KUN, NIMM, P, PE, PEM, VAFS, VNM, and VNMN (herbarium acronyms according to Thiers (2022), continuously updated). Furthermore, relevant literature (Hwang,

1981; Ma, 1989; Hwang et al., 2003; Do et al., 2015; Zhu et al., 2017) were reviewed as well.

The description of the species follows the morphological terminology used by Harris & Harris (2001), Hwang et al. (2003), and Do et al. (2015).

RESULTS

***Aristolochia austroyunnanensis* S. M. Hwang**, *Acta Phytotax. Sin.*, 19: 228. 1981. (Figs. 1, 2)

Synonyms: *Isotrema austroyunnanense* (S. M. Hwang) X. X. Zhu, S. Liao & J. S. Ma in *Phytotaxa* 401(1): 8. 2019.

Type: CHINA. Yunnan: Pingbian County, Waga, alt. 1800 m, 14 June 1956, *Sino-Russ. Exped. 2075* (lectotype: PEM0001663!; isolectotype: IBSC0127607!), designated by Zhu et al., 2017).

Description (Figs. 1, 2): Perennial, woody liana. Stem terete in cross section, young branches densely yellowish-brown villous, older stem shallowly striate bark. Petiole 2.5–3 cm long, pendulous, densely yellow-brown villous. Leaf blade narrowly ovate, elliptic to lanceolate-ovate, 10–16 × 4–6 cm, subcoriaceous, leaf base cordate or shallowly so, leaf apex acute, adaxially slightly villous along veins, abaxially densely villous, basal veins three, palmate, two external veins reaching upwards to one-third of the length of the lamina, secondary veins four to five, pinnate, venation loosely reticulated, clearly prominent on the abaxial surface and flattened on the adaxial surface, margin entire, glabrous. Inflorescence cymose, 1–2-flowered, solitary or clusters of 1–2 cymes, on old woody stems. Inflorescence axis 2–3 cm long, densely brown villous. Bracteole lanceolate to subulate, clasping the axis, conspicuous, 3–5 × ca. 2 mm wide, sessile, both surfaces densely villous. Pedicel 2–3 cm long, dark-purple, pendulous, densely brown villous. Ovary oblong, 1.5–1.7 × 0.5–0.6 cm, densely brown villous. Perianth narrowly U-shaped, outside yellowish-white, densely brown villous, with parallel purple ridges. Utricle indistinct from the tube, inside dark-purple with densely glandular trichomes. Tube strongly curved, basal portion of tube ellipsoid to oblong-cylindrical, 6–6.5 × 0.9–1

cm, inside pale-yellow with purple stripes and densely glandular trichomes; upper portion bent upwards, cylindrical to narrowly funnel-shaped, 3–4 cm long, 0.7–0.8 cm in diam. at the base, 1.1–1.2 cm in diam. at apex, inside yellow, smooth. Limb unequally 3-lobed, the lobes valvate in pre-anthesis, during anthesis margin of all lobes expanded, not revolute, forming a subrotund-peltate limb, 5.5–6 in diam., limb lobes broadly deltoid, obtuse or slightly acute at apex, outside white with prominent dark-purple reticulate veins, sparsely brown villous, inside flattened, exclusively dark-purple with light-yellow to white radiate stripes. Annulus ellipsoid flange, ca. 1.2 cm in diam. Throat yellow, sometimes with a purple band. Gynostemium 3-lobed, cylindrical, smooth, 7–8 × 4–5 mm, yellowish-white, the lobes with obtuse apices. Anthers six, oblong, 5–6 mm long, yellow, adnate in 3 pairs to the base of gynostemium, opposite to the lobes. Capsule narrowly ellipsoidal, 10–12 × 1.8–2 cm, 6-ridged, densely brown villous, dehiscent basipetally. Seeds triangular-ovate, 6–7 × 4–5 mm, convexo-concave, smooth on both surfaces.

Ecology and phenology: In Vietnam, *A. austroyunnanensis* was found mostly in cloudy broad-leaved evergreen forests and edges of limestone forests, at elevation 1,100–1,800 m. Flowering was well observed from April to June, fruiting was recorded from May to July.

Distribution: CHINA (Yunnan and Guangxi), and new to VIETNAM (Lao Cai: Bat Xat and Cao Bang; Nguyen Binh).

Taxonomic notes: *A. austroyunnanensis* is characterized by having a strongly curved perianth, a 3-lobed limb, and a 3-lobed gynostemium, which supports its place into *Aristolochia* subgenus *Siphisia*. Morphologically, *A. austroyunnanensis* is most similar to *A. petelotii*, a *Siphisa* species occurring in southern China and Northern Vietnam, in the shape of leaves and perianth, but it differs from the latter in the upper portion of the tube, the shape and inner surface of limb, and the color of the throat. It is also similar to *Aristolochia fangchi* Y. C.

Wu ex L. D. Chow & S. M. Hwang, another *Siphisa* species also occurring in southern China and Northern Vietnam, in the shape of perianth and limb, but it differs from the latter in the shape of leaf base and the inner surface of tube and limb, and the color of the throat. A detailed morphological comparison of *A. austroyunnanensis* with *A. petelotii* and *A. fangchi* was shown in Table 1 and Figure 2.

Additional specimens of *A. austroyunnanensis* examined: Cao Bang province, Nguyen Binh district, Phia Oac-Phia Den National Park, *Do Van Truong DVT 65* (VNMN, DR); *Trinh Ngoc Bon & Pham Van The TB 238* (VAFS); Lao Cai province, Bat Xat district, Y Ty commune, Bat Xat Nature Reserve, *Do Van Truong DVT 243* (VNMN).

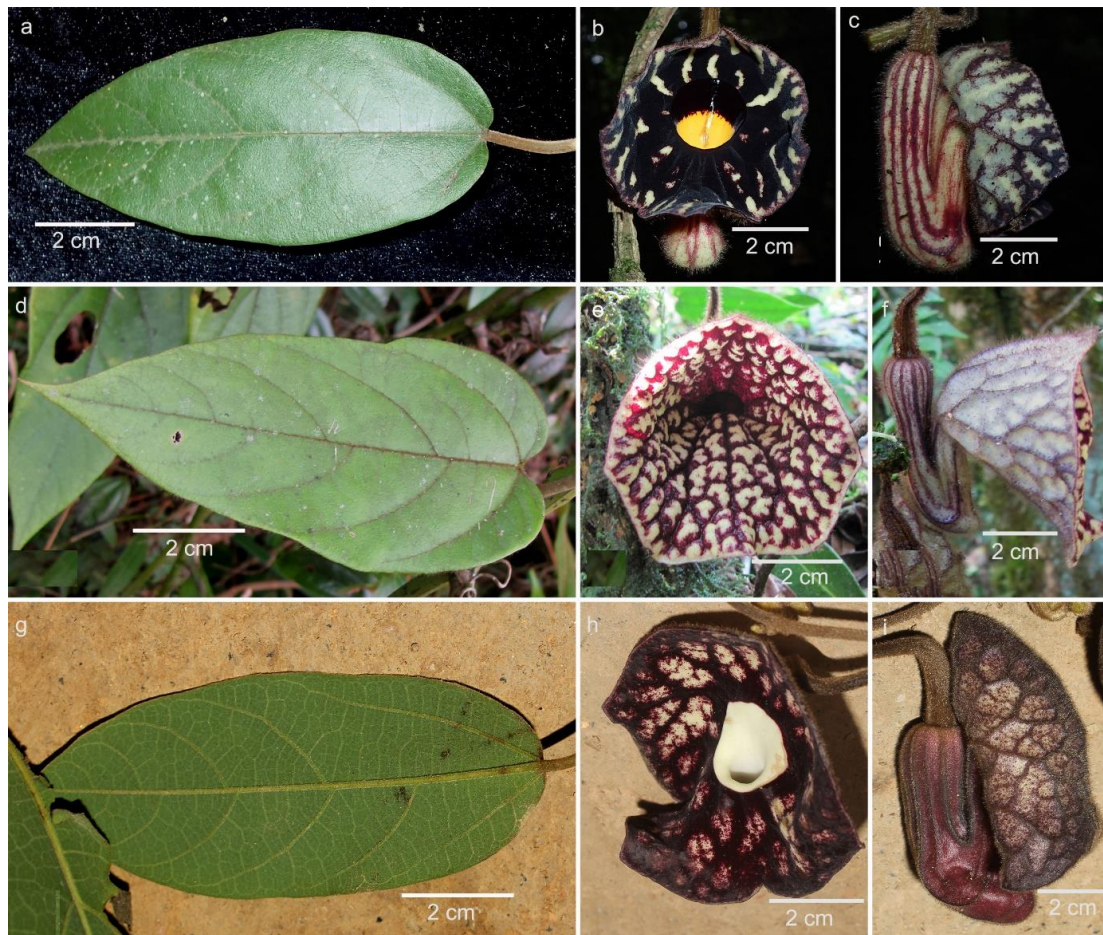


Figure 1. Aristolochia austroyunnanensis S. M. Hwang: a) Cymose inflorescence; b) Adaxial leaf surface; c) Abaxial leaf surface; d) Lateral view of opened flower; e) Frontal view of opened flower; f) Dorsal view of opened flower; g) Longitudinal dissection of opened flower; h) Flower in pre-anthesis; i) Top view of gynostemium; j) Shape of capsule [a–c: photo by Trinh Ngoc Bon, d–f: photo by Do Van Truong, g–i: photo by Nghiem Duc Trong, figure: prepared by Do Van Truong]

In order to facilitate identification, a key to the known species of *Aristolochia* subgenus *Siphisa* in Vietnam is updated based on the

previous results (Do et al., 2019, 2021a, 2021b; Phan et al., 2021; Do & Hoang, 2022; Nguyen et al., 2022).

Key to the known species of *Aristolochia* subgenus *Siphisia* in Vietnam

1. Limb saccate2
- Limb discoid, subrotundate-peltate, subcordate, bell- or trumpet-shaped.....4
2. Leaf base cordate, limb abaxially concave*A. vuquangensis*
- Leaf base auriculate, limb abaxially not concave.....3
3. Flower on old woody stems, tube perianth purple, limb unlobed, inner surface of limb dark-purple and dense processes.....*A. putalengensis*
- Flower in axillary, tube perianth yellowish-green, limb 3-lobed, inner surface of limb yellow and glabrous.....*A. luudamcui*
4. Limb bell- or trumpet-shaped; margins of all lobes distinctly revolute.....5
- Limb abruptly expanded discoid, subrotundate-peltate, subcordate or bell-shaped; margins of limb lobes not revolute.....11
5. Limb bell-shaped.....*A. quangbinhensis*
- Limb trumpet-shaped.....6
6. Leaf base slightly to deeply cordate.....7
- Leaf base cuneate to rounded.....9
7. Inner surface of limb lobes bright yellow, smooth, lacking verrucose and bristles*A. quangnamensis*
- Inner surface of limb lobes purple and densely covered by verrucose and bristles.....8
8. Leaf blade broadly ovate to cordate; upper half of throat white, and lower half pinkish*A. faviogonzalezii*
- Leaf blade narrowly ovate to lanceolate-ovate; throat uniformly yellow.....*A. saccata*
9. Upper tube obliquely oblong funnel-shaped, > 2 cm high; throat densely covered with orange dots.....10
- Upper tube shortened funnel-shaped, < 2 cm high; throat without dots.....11
10. Limb nearly rectangular; throat yellow with orange dots.....*A. tadungensis*
- Limb nearly circular; throat white with purple dots.....*A. xuanlienensis*
11. Leaf blade ovate, glabrescent abaxially; petiole glabrous; warts on inner surface of limb lobes dark red.....*A. balansae*
- Leaf blade ovate-lanceolate to broadly ovate, densely villous abaxially; petiole glabrescent; warts on inner surface of limb lobes dark purple.....12
12. Leaves alternate and opposite, lamina with a 2-lobed leaf apex; upper tube chestnut*A. neinhuisii*
- Leaves always alternate, lamina always entire; upper tube yellowish to white.....13
13. Upper tube broadly shortened funnel-shaped, 1.1–1.3 cm high; limb nearly circular, 2.2–2.5 cm wide; throat yellow.....*A. hainanensis*
- Upper tube narrowly oblong funnel-shaped, 1.5–1.8 cm high; limb nearly rectangular, 1.2–1.3 cm high, 0.9–1.0 cm wide; throat white.....*A. tonkinensis*
14. Limb bell-shaped.....15
- Limb abruptly expanded discoid, subrotundate-peltate, or subcordate-shaped.....16

15. Leaf blade as wide as long, ovate-cordate; leaf base deeply cordate; upper and lower tube clearly distinct; throat white.....*A. nuichuaensis*
 - Leaf blade longer than wide, lanceolate-ovate; leaf base shallowly cordate; upper and lower tube indistinct; throat dark-purple.....*A. petelotii*
16. Leaf blade longer than wide, lanceolate-ovate; leaf base round; veins pinnate.....17
 - Leaf blade generally as wide as long, cordate to orbicular; leaf base deeply cordate; veins palmate.....20
17. Limb subcordate-shaped, ca. 2.5 cm wide; inner surface of limb lobes purple without streaks and dots; throat with purple dots.....*A. annamensis*
 - Limb subrotundate-peltate-shaped, > 5 cm wide; inner surface of limb lobes dark-purple with visible streaks and white dots; throat without dots.....18
18. Leaves lanceolate, oblanceolate to obovate, leaf base deeply cordate, throat purple with annulus.....*A. versicolor*
 -. Leaves elliptic, leaf base shallowly cordate to truncate, throat white without annulus.....19
19. Inner surface of limb lobes with light-yellow to white stripes, radiate, throat yellow.....*A. austroyunnanensis*
 - Inner surface of limb lobes with white bands or dots, irregular, throat white.....*A. fangchi*
20. Both leaf surfaces moderately to densely hirsute; perianth white; inner surface of limb lobes reddish to pink with acanthoid protuberances.....*A. kwangsiensis*
 - Abaxial leaf surface densely appressed white villous; perianth yellowish; inner surface of limb lobes uniformly dark purple, smooth, without dots.....*A. bidoupensis*

Table 1. Morphological comparison of *Aristolochia austroyunnanensis* with *Aristolochia petelotii* and *Aristolochia fangchi*

Morphological characters	<i>Aristolochia austroyunnanensis</i> *	<i>Aristolochia petelotii</i> **	<i>Aristolochia fangchi</i> ***
Leaf base	Shallowly cordate at base	Cordate at base	Rounded to truncate at base
Inner surface of the upper portion of tube	Yellow	Dark-purple	White
Limb shape	Subrotund-peltate	Campanulate	Subrotund-peltate
inner surface of limb lobes	Flattened, dark-purple with light-yellow to white stripes, radiate	Sunken, dark-purple with whitish-yellow bands or dots, irregular	Flattened, dark-purple with white bands or dots, irregular
Throat	Yellow	Dark purple or sometimes mixed with cream	White

Notes: *: Morphological characters following Hwang (1981), Hwang et al. (2003), Zhu et al. (2017), and our own observation (the color of tube, limb, and throat); **: Morphological characters following Hwang et al. (2003), Zhu et al. (2017), and our own observation (the color of tube, limb, and throat); ***: Morphological characters following Hwang et al. (2003), Do et al. (2015), Zhu et al. (2017), and our own observation (the color of tube, limb, and throat).



Figure 2. Comparison of *Aristolochia austroyunnanensis* S. M. Hwang (a–c) with *Aristolochia petelotii* (d–f) and *Aristolochia fangchi* (g–h); a, d, g) Shape of leaves; b, e, h) Frontal view of opened flower; c, f, i) Lateral view of opened flower [Photo by: Trinh Ngoc Bon, figure prepared by Do Van Truong]

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