

Aristolochia versicolor S.M. Hwang (Aristolochiaceae), a new record for the flora of Vietnam

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Abstract:

With over 600 species, the genus *Aristolochia* L. (Aristolochiaceae) is extensively spread in temperate, subtropical, and tropical climates. Numerous *Aristolochia* species are significant host plants for the Papilionidae family of butterflies and are regarded as a key group to research the relationship between plants and butterflies. Moreover, traditional Chinese and Vietnamese medicine frequently use a few *Aristolochia* species. *Aristolochia* biodiversity hotspots are found in southern China and northern Vietnam. There are currently 25 *Aristolochia* species recognized from Vietnam. We just gathered some intriguing *Aristolochia* specimens in northern Vietnam's protected forests while updating the taxonomy of the species. After a thorough analysis of the specimens and comparisons with the protologue and type specimens of previously identified *Siphisia* species, it was determined that the specimens perfectly matched *A. versicolor* S.M. Hwang, a medicinal plant that was previously identified. As a result, *A. versicolor* is now listed as a new record for Vietnam's flora. The description of the morphology, color images, iconography, distribution, phenology and habitat, state of conservation, and comparison with other morphologically are provided.

Keywords: *Aristolochia westlandii*, biodiversity hotspot, *Siphisia*, Vietnam.

Classification number: 3.4

1. Introduction

The genus *Aristolochia* L. (Aristolochiaceae) comprises around 600 species and is widely distributed throughout the tropics, subtropics, and temperate regions [1]. Many *Aristolochia* species are important host plants for the butterfly family Papilionidae, and considered as a major group for studying plant-butterfly interaction [2]. Furthermore, some *Aristolochia* species are commonly used in Chinese and Vietnamese traditional medicine [3]. Southern China and northern Vietnam are considered biodiversity hotspots of the genus *Aristolochia* [4]. Additionally, some *Aristolochia* species that are known endemically to southern China (Guangxi, Guangdong, and Yunnan provinces) [3], were also newly recorded for the country by recent investigations in northern Vietnam [5-8] due to similarities of topology and habitats. Currently, 25 *Aristolochia* species belonging to two subgenera are known from Vietnam, of which 18 are in subgenus *Siphisia* and seven are in subgenus *Aristolochia* [9-12].

While revising taxonomy of *Aristolochia* from Vietnam, we recently collected some interesting *Aristolochia* specimens in protected forest areas in northern Vietnam. These specimens have the morphological characters such as a U-shaped perianth, a 3-lobed limb, and a 3-lobed

gynostemium, which are specific for the subgenus *Siphisia* [4]. Detailed examination of these specimens and studies on the protologue and type specimens of previously known *Siphisia* species revealed that these specimens completely matched with *A. versicolor* S.M. Hwang, which was a medicinal plant and previously known to southern China [13] and northern Thailand [14]. Thus, we herein report *A. versicolor* as a new record for the flora of Vietnam. The morphological description, colour illustrations, iconography, habitat and phenology, distribution, conservation status, and comparison with the morphologically similar species are provided.

2. Materials and methods

Materials were gathered from numerous field works conducted in protected forest areas of the Lao Cai and Lang Son provinces in northern Vietnam. The morphological characters of productive organizations (e.g., the morphology and the colouration of perianth, utricle, tube, and limb) were observed and taken by a Pentax Optio W80 digital camera (Indonesia), which are probably not indicated in dried specimens.

Herbarium specimens available from the following major herbaria: BKF, HITBC, HN, HNU, IBK, IBSC, KUN, NIMM, and VNMN (herbarium code according

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to <http://sweetgum.nybg.org/science/ih/>) were examined. The protologue, taxonomic treatments, and type specimens of previously described *Siphisia* species from Vietnam [4, 10] and adjacent areas such as the flora of China [3], the flora of Thailand [14], and the flora Malesianae [15] were also consulted.

The terminology of species description followed the works of J.G. Harris, et al. (2001) [16], S.M. Hwang, et al. (2003) [3], and T.V. Do, et al. (2015) [4].

Assessment of the conservation status has been performed in accordance with the categories and criteria of IUCN (2019) [17].

3. Taxonomic treatment

A. versicolor S.M. Hwang, Acta Phytotax. Sin. 19(2): 224. 1981. (Figs. 1, 2).

Type: China. Yunnan: Xishuangbanna, alt. 1050m, 6 December 1961, Y.H. Li 3694 (holotype: KUN, isotype: IBK!, IBSC!).

Description: Perennial woody lianas, with cylindrical underground organs. Stem terete, internode 1-1.5 cm long, glabrescent to pubescent, corky when older. Petiole 1-1.2 cm long, straight, glabrescent. Leaf blade lanceolate, oblanceolate to obovate, 12-20 cm long, 4-8 cm wide, subcoriaceous, base cordate, sinus 3-4 mm deep, apex acute to acuminate, sometime cuspidate, adaxially glabrescent, abaxially pubescent, glaucous, venation pinnate, 8-10 pairs, slightly sunken on the adaxial surface, prominent on the abaxial surface, margin entire. Inflorescence cymose, 1-2-flowered cymes, solitary or in pairs on young branches and old woody stems, flowers clearly separated from each other. Inflorescence axis 2-2.2 cm long, straight, dark-purple, pubescent. Bracteole oblong, clasping the axis, conspicuous, 3-3.5 mm long, 1.2-1.5 mm wide, both surfaces densely brown villous, sessile, persistent. Pedicel 3.5-4 cm long, pendulous, sparsely villous. Ovary linear-oblong, 1.8-2 cm long, 0.3-0.4 cm in diam., yellowish-green, densely brown villous. Perianth narrowly U-shaped, 7-9 cm in height, outside densely brown villous, purple with visibly parallel ridges. Utricle oblong-cylindrical, 4-4.2 cm high, 0.8-1 cm in diam., inside dark purple, lower a half densely covered by glandular trichomes. Tube geniculately curved, lower part horseshoe-shaped, 1.1-1.2 cm high, 0.8-0.9 cm in diam., inflated, inside dark-purple, smooth, upper part bent upwards and attached to the utricle, funnel-shaped, 1.5-1.8 cm high, 0.6-1.2 cm in diam., inside cream, with or without purple blotches, smooth. Limb subequally deltoid 3-lobed, valvate in pre-anthesis, the two

lateral lobes 3.7-4 cm wide, 1.7-2 cm high, the median lobe 3-3.2 cm wide, 1.1-1.3 cm high, outside greenish-yellow, densely brown villous, with visibly purple blotches and veins, during anthesis forming a discoid-subrotund-shaped limb, 5-7(-8) cm in diam., broadly rounded 3-lobed, inside exclusively reddish to dark-purple with sunken veins, smooth, the two lateral lobes curved backward. Annulus present, ring-like. Mouth 5-6 mm in diam. with cream throat. Gynostemium 3-lobed, 6 mm high, 4 mm in diam., yellowish-white, the lobes with obtuse apices. Anthers 6 in 3 pairs, oblong, 3.5-4 mm long, yellow. Young capsule cylindrical, 6-angled, 3-4 cm long, 6-8 cm in diam., yellowish-green, densely brown villous (Figs. 1, 2).

Iconography citation: See Fig 4: *Aristolochia versicolor* in [13], S.M. Hwang (1981:225).

Habitat and phenology: This species grows in evergreen forests, thickets, moist shady valleys, and one sandstone in mixed deciduous forests, alt. 500-1500 m. Flowering from April to June and fruiting from June to October.

Distribution: Southern China (Yunnan, Guangxi, Guangdong provinces), north-eastern Thailand (Loei province), and new to northern Vietnam (Lang Son province).

Conservation status: *A. versicolor* is known from more than 30 collections in a wide range of protected forest areas in the Indo-Chinese floristic region (including southern China, north-eastern Thailand, and northern Vietnam) where the habitats are still protected very well. Furthermore, the large-sized populations occurring together with well-generated saplings are also recorded from these areas. Therefore, this species has been assessed as being of Least Concern (LC) according to IUCN (2019).

Taxonomic notes: *A. versicolor* is greatly varying in shape and size of leaves and perianth limb. The specimens were collected in northern Vietnam having a larger leaf blade and limb in comparison with the type specimens from China. Morphologically, *A. versicolor* is most similar to *A. westlandii*, a *Siphisia* species occurring in China [3, 11] and Thailand [12]. It is also quite similar to *A. quangbinhensis*, another *Siphisia* species endemic to central Vietnam [18]. However, it is distinguished from these two species by the size of perianth, lower part of tube, the shape, size, inside of limb lobes, and the colour of throat. A detailed morphological comparison of *A. versicolor* with *A. westlandii* and *A. quangbinhensis* is given in Table 1 and Fig. 2.

Table 1. Morphological comparison of *A. versicolor* with *A. westlandii* [3, 12] and *A. quangbinhensis* [18].

Characteristics	<i>A. versicolor</i>	<i>A. westlandii</i>	<i>A. quangbinhensis</i>
Perianth	7-9 cm in high	10-15 cm in high	3.2-3.5 cm in high
Tube			
lower part	1.1-1.2 cm in diam.	5-6 cm in diam.	0.6-0.8 cm in diam.
upper part	funnel-shaped, inside cream with or without purple blotches	cylindrical-shaped, inside dark-purple	cylindrical-shaped, inside cream without purple blotches
Limb shape	discoid-subrotund	discoid-subrotund	campanulate
Limb lobes			
shape	Sub-equally 3-lobed	unequally 3-lobed	unequally 3-lobed
size	5-7 cm	8-13 cm	2-2.5 cm
inner surface	exclusively reddish to dark purple without dots or blotches	purple with visibly white veins or blotches	exclusively purplish-pink without dots or blotches
Throat	cream	dark purple	dark purple

Additional specimens examined: Vietnam. Lang Son: Loc Binh, Loi Bac, Con Sung, 30 March 2021, DVT404 (VNMN).

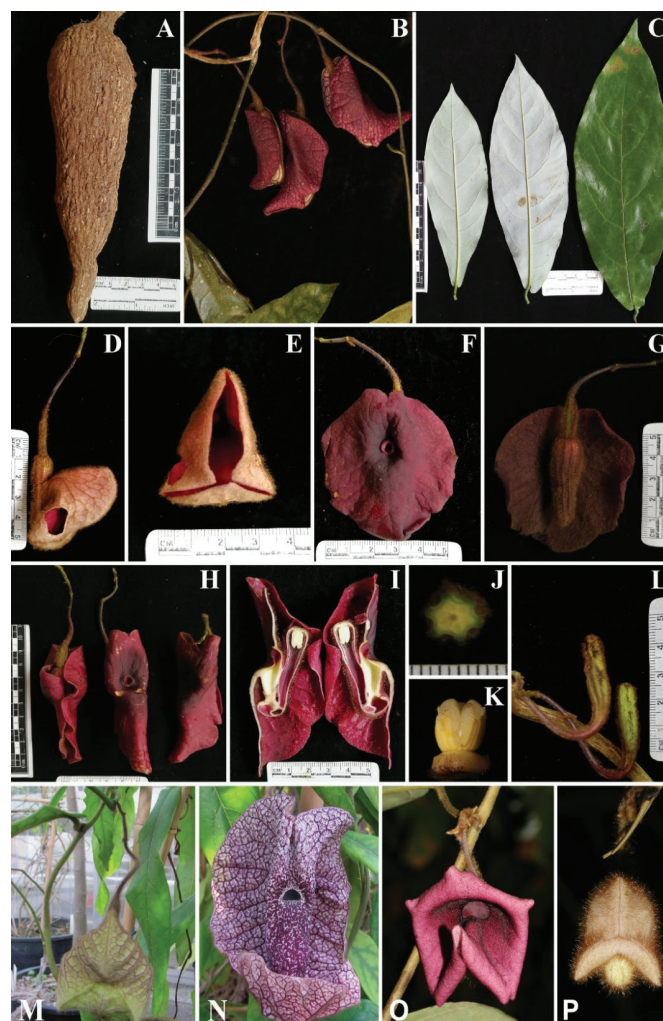
**Fig. 1. *A. versicolor*, a new record for the flora of Vietnam.**

Fig. 2. Detailed illustrations of *A. versicolor* (A-L). (A) Underground organ; (B) A branch; (C) Leaf shape; (D-E) Lateral and frontal views of flower in pre-anthesis; (F-G) Frontal and dorsal views of opened flower; (H) Different views of two lateral lobes curved backward; (I) General view of a longitudinally dissected perianth; (J) Crossed section of ovary; (K) Close up of 3-lobed gynostemium; (L) Young capsule; and comparison with *A. westlandii* (M-P). (M) Frontal views of flower in pre-anthesis; (N) Frontal views of opened flower; *A. quangbinhensis* (O-P). (O) Dorsal views of opened flower and longitudinally dissected perianth; (P) Close up of 3-lobed gynostemium.

CRediT author statement

Van Truong Do: Conceptualisation, Methodology, Writing, Reviewing and Editing; Thi Thao Hoang: Conceptualisation, Writing and Editing.

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COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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