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Aristolochia rethya, a new species from Arunachal Pradesh, north-east India

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Abstract

Aristolochia rethya, a new species from Arunachal Pradesh, north-east India, is described. *Aristolochia rethya* is affinis to *A. griffithii* and *A. tanzawana* with similar leaf texture and shallowly 3-lobed perianth limb, but differs from *A. griffithii* in its ovate to narrowly ovate leaf shape, cauliflorous flower borne in a cluster and densely hirsute brown capsule, and from *A. tanzawana* in their cauliflorous inflorescence, S-shaped perianth and capsule size with distinct wavy ridges.

Keywords: Arunachal Pradesh, Critically Endangered, India, new taxon, *Siphisia*

Introduction

The family Aristolochiaceae in the order Piperales (APG IV, 2016) is represented by five genera: *Saruma* Olive (1889: 1895), *Asarum* Linnaeus (1753: 442), *Aristolochia* Linnaeus (1753: 960), *Thottea* Rottboll (1783: 529), and *Isotrema* Rafinesque (1819: 195) (Neinhuis *et al.* 2005). The genus *Aristolochia s.l.* is commonly differentiated into three subgenera viz. *Aristolochia*, *Siphisia* (Duch.1854: 29) Schmidt (1935: 236), and *Pararistolochia* (Hutch. & Dalziel 1927: 75) Schmidt (1935: 241) (Duchartre 1864, Ma 1989). *Isotrema* was earlier recognized as an independent genus (Rafinesque 1819, Huber 1993), but was ascribed to *Aristolochia* subgen. *Siphisia* after the infrageneric classification and optimization of *Aristolochia* by Duchartre (1854, 1864), Bentham & Hooker (1880), and Schmidt (1935). The species of subgen. *Siphisia* can be distinguished from other *Aristolochia* species by their strongly curved perianth with 3-lobed limbs and a 3-lobed gynostemium with paired anthers on the outer surface of each segment.

Currently, the subgen. *Siphisia* comprises about 110 species, of which more than 80% are distributed in East and South Asia, mainly in China, and the remaining in North and Central America (Wagner *et al.* 2012, Gonzalez *et al.* 2014, Wang *et al.* 2021). In India, records of the occurrence of about 20 *Aristolochia* species are found (Ravikumar *et al.* 2014, Borah *et al.* 2019), of which 7 belong to subgen. *Siphisia*. Except for *Isotrema transsectum* Chatterjee (1948: 64), all other species were described as *Aristolochia*. However, the species was also later transferred to *Aristolochia* as *A. transsecta* (Chatterjee) C.Y.Wu (1981: 231). Hooker (1886) primarily recorded four species, namely *A. platanifolia* Duch (1864: 437), *A. saccata* Wall. (1830: 103), *A. griffithii* Hook.f. & Thomson ex Duch. (1864: 437), and *A. cathcartii* Hook.f. (1886: 77) in *Aristolochia* subgen. *Siphisia* from India based on the gynostemium characters. Later on, Brown (1911) and Lace (1911) described two more *Aristolochia* species, *A. dilatata* (Hook.f.) N.E.Br. (1911: 274) and *A. punjabensis* Lace (1911: 273) in the subgen. *Siphisia*. The perusal of various taxonomic literature (Hooker 1886, Kanjilal *et al.* 1940, Chowdhery *et al.* 2008, Barooah & Ahmed 2014) from the country confirmed the occurrence of seven species belonging to subgen. *Siphisia*. All these species are found to be distributed in the Indian Himalayan and sub-Himalayan regions, having extension to the adjacent countries. However, *A. dilatata* is endemic to India only.

During our floristic expedition in Arunachal Pradesh, north-east India, an unknown species of *Aristolochia s.l.* was collected from a tropical evergreen forest in Papum Pare district. After a critical examination of the specimen and

following the taxonomic treatment of Asian *Aristolochia* (Do *et al.* 2015), it is found that it belongs to the subgen. *Siphisia* of *Aristolochia* by having a strongly curved perianth, utricle and tube not sharply delimited, and a 3-lobed gynostemium. Further comparison of its morphological characteristics with type specimens, protologues, and relevant taxonomic literature, we found that the species is an undescribed one. Hence, it is described here as a new species, giving details of its morphological characteristics, colour plates, ecology, etc. A key for the identification of Indian *Aristolochia* species in subgen. *Siphisia* is also presented.

Materials and methods

As a continuous process of plant exploration particularly for collections of climbing flora of Arunachal Pradesh, a field trip was conducted in the tropical forests of Kimin area in Papum Pare district. The samples were collected and herbarium specimens were prepared following Jain & Rao (1977). Data of the habit, habitat, morphology, etc. were collected during the fieldwork. Further detailed morphological characters were recorded in the laboratory. Photographs of the plant were taken in the wild as well as in the laboratory using a Canon EOS 3000D camera and a Stereo Dissecting Microscope (Carl Zeiss Stemi 305) with microphotography attachment. The description of the new species follows the terminology used by Harris & Harris (2001).

Available digital images of herbarium specimens including types of *Aristolochia* subgen. *Siphisia* from different herbaria (E, GH, K, KAG, MNHN, NL, and US) were critically examined. Additionally, various related literature, particularly the protologues of published names was collated and reviewed. All the relevant taxonomic literature pertaining to Indian flora was also reviewed for clarification of the present status of the occurrence of *Aristolochia* subgen. *Siphisia* in India.

The type specimen of the new species will be deposited in the Central National Herbarium of Botanical Survey of India (CAL), the Herbarium of Botanical Survey of India, Arunachal Field Station (ARUN), and Forestry herbarium NERIST (yet to be registered).

Taxonomic treatment

Aristolochia rethya S. Kashung, Rimi Barman et P. R. Gajurel, *sp. nov.* (Fig. 1 & 2).

Aristolochia rethya is morphologically close to *A. griffithii* and *A. tanzawana* (Kigawa) Watan.-Toma & Ohi-Toma (2014:160) in its leaf texture which is densely pubescent abaxially, and the perianth limb being shallowly 3-lobed. However, it can be distinguished very easily from *A. griffithii* in its ovate to narrowly ovate leaves, cauliflorous inflorescence, pubescent perianth and capsule texture. It is also distinctly different from *A. tanzawana* in its cauliflorous inflorescence, S-shaped perianth and much larger capsule with distinct wavy ridges.

Type:—INDIA. Arunachal Pradesh: Papum Pare district, Kimin forest, 27°20'26.1276"N, 93°59'2.4756"E, elev. 195 m, 17 November 2021, *Soyala K. et al.* 190 (holotype CAL! isotypes ARUN! NERIST!)

Perennial, semi-woody liana, 10–15 m high, twining dextrorse. Stem cylindrical, mature stem glabrescent, bark corky, furrowed longitudinally, young stem densely pubescent. Petiole 6–7 cm long, densely pubescent. Leaves simple, alternate, lamina ovate to narrowly ovate, 10–15 × 9–10.5 cm, chartaceous, abaxially pubescent, adaxially pubescent along the veins, margin entire, apex acuminate, base cordate, sinus 2.5–3 cm deep, 2–2.5 cm wide, auricles rounded, basal veins palmately 3-nerved, prominent. Inflorescence cyme on old woody stem, fasciculate, each cluster with 2–16 cymes, with 3 or 4 flowers in each axis, axis ca. 10–14 cm long, densely pubescent. Bracteoles small, triangular, 0.2–0.3 × ca. 0.2 cm, densely pubescent. Pedicel slender, 2–3 cm long, densely pubescent. Perianth S-shaped, ca. 3–3.5 × 2.5–3 cm, tubular, abaxially densely villous, adaxially glabrous. Utricle not sharply delimited with perianth tube, 0.8–1 cm high, 0.5–0.6 cm diam. at base, 0.4 cm diam. at apex, inside with dark purple band towards the base, and densely distributed trichomes. Tubes geniculately curved at middle, curving upward, 1–2 × 0.5–0.6 cm. Limb 3-lobed, disc-shaped, 2.5–3 cm wide, margin slightly recurved, apex acute, yellowish green with dark brown striation, throat colour same as limbs, circular, annulus 0.8–1.2 cm wide. Gynostemium 3-lobed, 0.7 × 0.4 cm, lobes with rounded apices. Stamen 6, sessile, anther bilobed, oblong, ca. 0.4 × 0.1 cm, adnate in pairs in the gynostemium lobes. Ovary elongated, 1–1.5 × ca. 0.2–0.3 cm, 6-ridged, densely brown tomentose, stipe absent. Capsule linear-elliptic, 15–17 × ca. 2.8–3.2 cm, apex stipitate, distinctly 6 longitudinal and wavy ridges, yellowish green and covered with dense dark brown hairs.

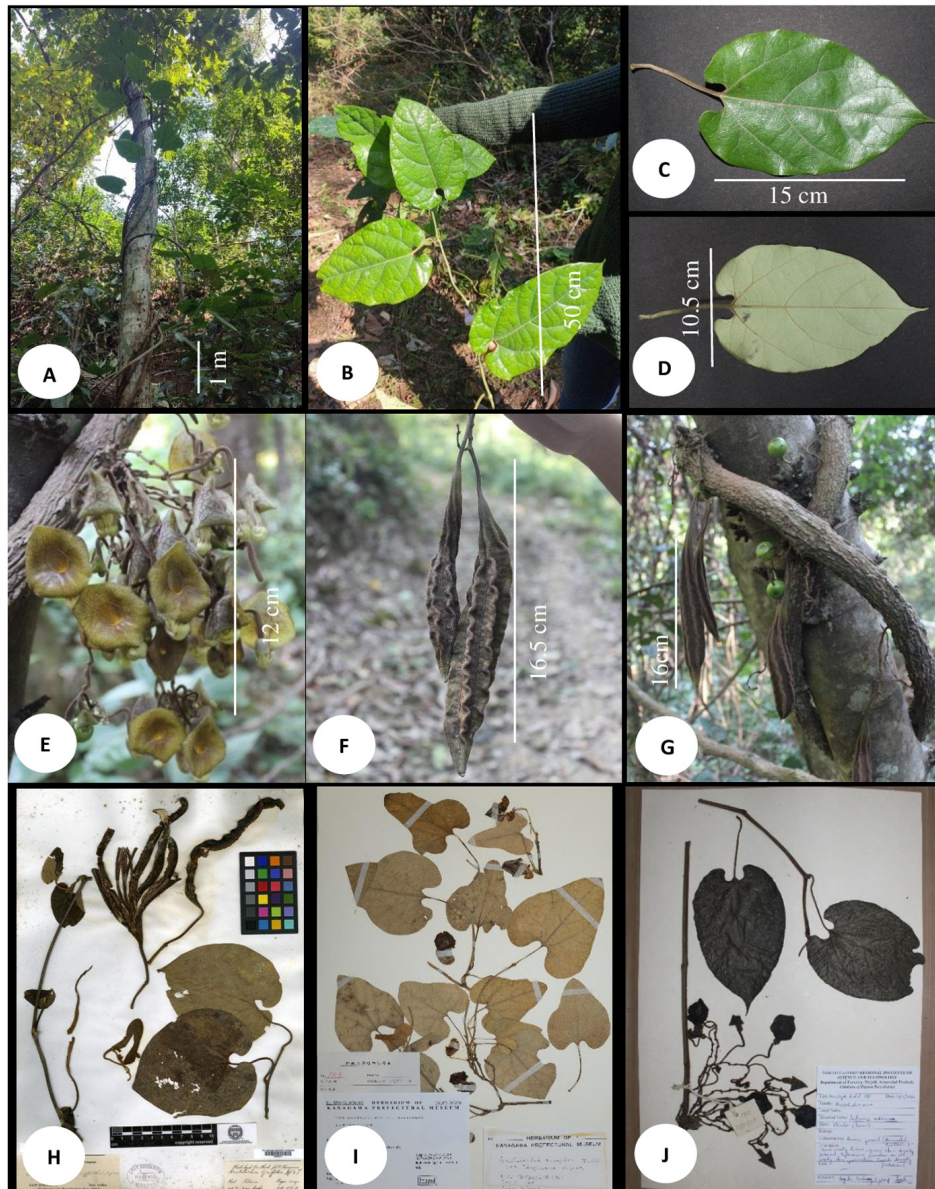


FIGURE 1. *Aristolochia rethya*—**A.** Habit; **B.** A branch; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface; **E.** Cymose inflorescence; **F** & **G.** Immature capsules; All photographed by Soyala Kashung; **H.** Isotype image of *Aristolochia griffithii* (GH00353571); **I.** Holotype image of *Aristolochia tanzawana* (KPM-NA1000103) provided by Kanagawa Prefectural Museum of Natural History, Japan; **J.** Holotype image of *Aristolochia rethya* S. Kashung, Rimi Barman et P. R. Gajurel.

Etymology:—The specific epithet honors Dr. Parakkal Rethy, former Professor of Department of Forestry, North Eastern Regional Institute of Science and Technology, Arunachal Pradesh, India, for her contribution to the field of Angiosperm taxonomy.

Phenology:—Flowering from October to December and fruiting from December to April.

Distribution and ecology:—*Aristolochia rethya* is currently known only from one population in the forest of Kimin area, Papum Pare district, Arunachal Pradesh, India. It grows near the roadside in a humid area in a tropical evergreen forest at around 195 m elevation. Only a single mature plant with flowering and fruiting was observed, twining on a *Ficus* species and growing in association with *Dipterocarpus retusus* Blume (1823: 77), *Alstonia scholaris* (L. 1767: 53) R. Br. (1810: 65), *Gmelina arborea* Roxb. (1814: 46), *Magnolia pterocarpa* Roxb. (1820: 62), *Piper acutistigmum* C.DC. (1925: 196), *Phrynium pubinerve* Blume (1827: 38), and *Diplazium esculentum* (Retz. 1791: 38) Sw. (1801: 312). Additionally, about 10 immature individuals were observed nearby within a radius of 100 m.

Conservation status:—The habitat of the species being on the roadside is highly disturbed. It was observed that the forest area near the new species has recently been cleared for road construction, thereby imposing high threats to the population. As the species is growing with a limited population in a highly disturbed area, there is a high risk of

complete habitat destruction and hence warrants an immediate conservation effort. It may be considered a Critically Endangered (CR) by applying the IUCN criteria B1a, B2a, and D (IUCN, 2001). The authors are trying to impart awareness to the local communities of nearby areas and are also growing the plant in the NERIST campus through collections of seeds.

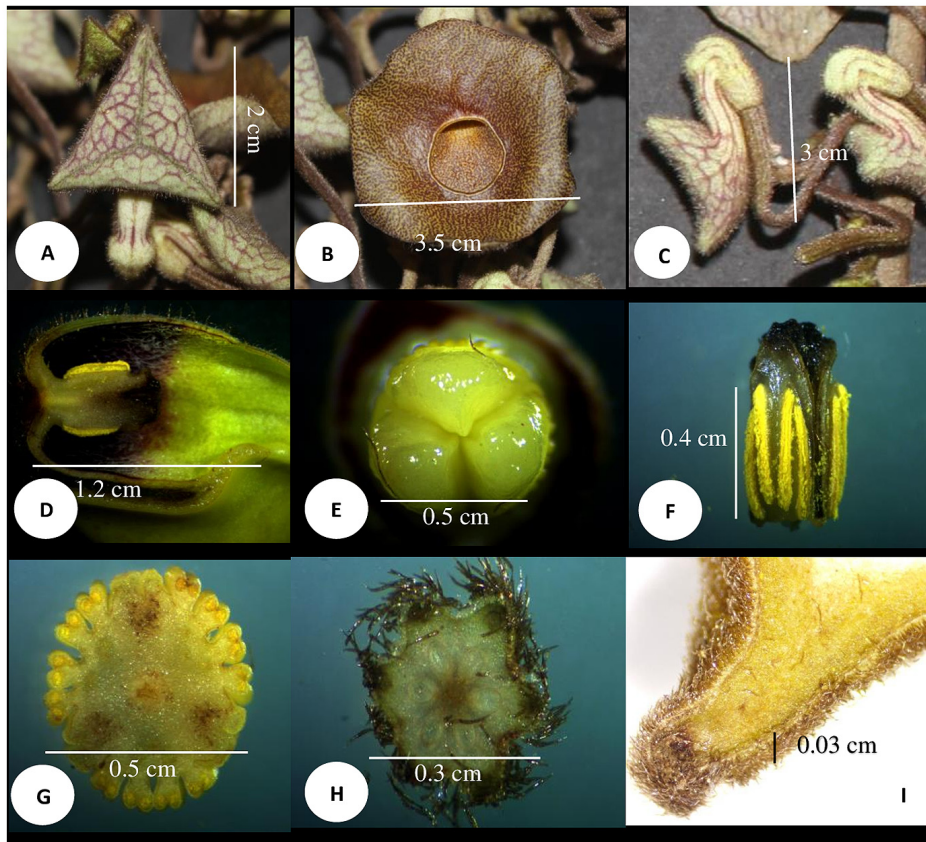


FIGURE 2. *Aristolochia rethya*—**A.** Flower in pre-anthesis; **B.** Frontal view of flower; **C.** Lateral view of flower; **D.** Longitudinal section of utricle showing the gynostemium; **E.** Tip of the gynostemium; **F.** Stamens on gynostemium; **G.** Cross section of gynostemium showing the stamen arrangement; **H.** Cross section of ovary; **I.** Hair on capsule. **A–C** photographed by Soyala Kashung; **D–I** photographed by Rimi Barman.

Taxonomic notes:—Morphologically, the new species described here resembles *A. griffithii* by having similar leaf texture, limb shape, and capsule shape, but differs from the latter by the morphology of the leaf lamina, inflorescence, perianth texture, and capsule texture. The new species is also similar to *A. tanzawana* with respect to the perianth texture, limb shape, and capsule texture, but differs in their inflorescences, perianth shape, capsule size, and capsule ridges. A more detailed analysis of character similarity and differences is given in **Table 1**.

Indian *Siphisia*

With the addition of the present new species, the number of *Siphisia* species in India has become eight. A key for identification of the Indian species in the subgenus *Siphisia* is given below.

Keys to the Indian species of *Aristolochia* in subgen. *Siphisia*

- | | | |
|-----|---|------------------------|
| 1a. | Limbs saccate, lobe distinct..... | <i>A. transecta</i> |
| 1b. | Limbs not saccate, lobe distinct or indistinct | 2 |
| 2a. | Limbs bell or trumpet shaped, lobe margin distinctly revolute..... | 3 |
| 2b. | Limbs abruptly discoid, lobe margin slightly or non-revolute | 5 |
| 3a. | Leaves palmately 3-lobed..... | <i>A. platanifolia</i> |
| 3b. | Leaves entire..... | 4 |
| 4a. | Perianth tube 1.5–2 cm long, limb nearly rounded | <i>A. saccata</i> |
| 4b. | Perianth tube 3–4 cm long, limb nearly rectangular..... | <i>A. cathcartii</i> |
| 5a. | Flowers on old branches, cauliflorous..... | 6 |
| 5b. | Flowers on young branches, ramiflorous | 7 |
| 6a. | Flowers in cluster, capsule densely pubescent, apex stipitate | <i>A. rethya</i> |

- 6b. Flowers solitary and axillary, capsule lightly pubescent, apex folded *A. griffithii*
 7a. Perianth glabrescent, limb indistinctly 3-lobed *A. dilatata*
 7b. Perianth villous, limb distinctly 3-lobed *A. punjabensis*

TABLE 1. Comparison of *Aristolochia rethymae* with *A. griffithii* and *A. tanzawanum*.

Characters	<i>Aristolochia rethymae</i>	<i>A. griffithii</i> *	<i>A. tanzawanum</i> *
Leaf shape	ovate to narrowly ovate	cordate to orbicular	cordate, ovate to narrowly ovate
Leaf size	10–15 × 9–10.5 cm	10–8 × 8–26 cm	3–18 × 4–16 cm
Leaf base	cordate	cordate	cordate
Leaf apex	acuminate	acute or shortly acuminate	obtuse or acuminate
Leaf margin	entire	entire	entire or lobed
Leaf texture	abaxially densely whitish pubescent, adaxially glabrous and pubescent along the veins	abaxially densely red-brown or white villous, adaxially sparsely pubescent	abaxially greyish pubescent, adaxially densely pubescent
Inflorescence	cauliflorous, flowers in cluster of 2–16 cymes, each with 2–4 flowers	ramiflorous, flowers solitary	ramiflorous, flower solitary or few
Perianth	pale green with purplish striation, S-shaped, inside glabrous, outside hairy	dark purple with yellow spots, S-shaped, glabrous both inside and outside	whitish yellow to creamy with purple markings, U-shaped, inside glabrous, outside hairy
Limb	shallowly 3-lobed, discoid-rotund, 2.5–3 cm wide, yellowish green with dark brown striation	shallowly 3-lobed, discoid-rotund, 6–12 cm wide, yellow with lines of red warts or dark purple with yellow spots	shallowly 3-lobed, rotund-broadly obovate, 1.9–3.2 cm wide, whitish to greenish yellow with dark purple striae
Throat	yellowish green with dark brown striation, annulus 0.8–1.2 cm wide	yellow with red warts or blood red, annulus present	dark purple leopard brindle, annulus 0.7–1.4 cm wide
Capsule	linear-elliptic, 15–17 × ca. 2.8–3.2 cm, distinctly 6 wavy ridges, apex stipitate, densely pubescent	cylindric, 10–18 × 2.5–3 cm, distinctly 6 ridges, apex folded, lightly pubescent	cylindrical-narrowly ellipsoid, 3.5–6 cm long, 6 indistinct ridges, pubescent

*Morphological characters following de Candolle (1864), Hwang *et al.* (2003) and Ohi-Toma *et al.* (2014)

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