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

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Abstract

Aristolochia rethyae, a new species from Arunachal Pradesh, north-east India, is described. Aristolochia rethyae 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 Lice (1911) described two more Aristolochia species, A. dilatata (Hook.f.) N.E.Br. (1911: 274) and A. punjabensis Lice (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, urticle 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 rethyae* S. Kashung, Rimi Barman et P. R. Gajurel, *sp. nov.* (Fig. 1 & 2).

*Aristolochia rethyae* 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, Soyal 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. Stamens 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.
A NEW SPECIES OF ARISTOLOCHIA RETHYAE

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 rethyae 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), Gymelina 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 rethyae—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**

<table>
<thead>
<tr>
<th>Key</th>
<th>Descriptions</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Limbs saccate, lobe distinct</td>
<td><em>A. transsecta</em></td>
</tr>
<tr>
<td>1b</td>
<td>Limbs not saccate, lobe distinct or indistinct</td>
<td>2</td>
</tr>
<tr>
<td>2a</td>
<td>Limbs bell or trumpet shaped, lobe margin distinctly revolute</td>
<td>3</td>
</tr>
<tr>
<td>2b</td>
<td>Limbs abruptly discoid, lobe margin slightly or non-revolute</td>
<td>5</td>
</tr>
<tr>
<td>3a</td>
<td>Leaves palmately 3-lobed</td>
<td><em>A. plataniifolia</em></td>
</tr>
<tr>
<td>3b</td>
<td>Leaves entire</td>
<td>4</td>
</tr>
<tr>
<td>4a</td>
<td>Perianth tube 1.5–2 cm long, limb nearly rounded</td>
<td><em>A. saccata</em></td>
</tr>
<tr>
<td>4b</td>
<td>Perianth tube 3–4 cm long, limb nearly rectangular</td>
<td><em>A. cathcartii</em></td>
</tr>
<tr>
<td>5a</td>
<td>Flowers on old branches, cauliflorous</td>
<td>6</td>
</tr>
<tr>
<td>5b</td>
<td>Flowers on young branches, ramiflorous</td>
<td>7</td>
</tr>
<tr>
<td>6a</td>
<td>Flowers in cluster, capsule densely pubescent, apex stipitate</td>
<td><em>A. rethyae</em></td>
</tr>
</tbody>
</table>
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 rethyae* with *A. griffithii* and *A. tanzawanum.*

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

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

**Acknowledgements**

The authors are thankful to the Director, NERIST and Head, Department of Forestry, for providing all necessary facilities. We are also thankful to Mr. Dhiman Kakoti, Research Scholar, Department of Forestry, for his help during field work and collection of species. Our sincere thanks to Dr. K. N. Gandhi, Senior Nomenclatural Registrar, Harvard University, for his kind help in framing the specific epithet. We would also like to thank the officials of the Kanagawa Prefectural Museum of Natural History (KPMNH), Japan, for providing the image of the type specimen of *A. tanzawanana.*
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