Aristolochia mishuyacensis (Aristolochiaceae), a new record for Ecuador, with taxonomic notes

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ABSTRACT

Aristolochia mishuyacensis is recorded for the first time in the Ecuadorian Amazon. Two specimens were collected in two banks of black water tributaries of the Yasuní river, Yasuní National Park. This species is currently distributed in Bolivia, Brazil, Colombia, Ecuador, and Peru, below 200 m. An updated description and images of the species are provided, and its relationships with other species are discussed.

RESUMEN

Se registra por primera vez a Aristolochia mishuyacensis en la Amazonia Ecuatoriana. Dos especímenes fueron recolectados en las riberas de dos afluencias de aguas negras del río Yasuní, Parque Nacional Yasuní. La especie se distribuye actualmente en Bolivia, Brasil, Colombia, Ecuador y Perú por debajo de los 200 m. Se incluye una descripción actualizada de la especie junto con fotografías y se discuten sus relaciones con otras especies.

Introduction

Aristolochia L., the largest genus of the family Aristolochiaceae, comprises ~500 species [1,2]. The genus presents a pantropical distribution that extends to the subtropics, Mediterranean zones, and some temperate areas [3–6]. Aristolochia can be recognized by its alternate, distichous leaves, usually with corulate-lobate base and palmate venation; zygomorphic apetalous flowers with a showy petaloid calyx formed by three fused sepals and differentiated into a basal utricle, a median tube, and an expanded distal limb; a gynostemium formed by the fusion of anders and stigmas; and an inferior ovary that develops into a septicidal cylindrical capsule [3,4,7]. Pollination in Aristolochia is carried out by flies and beetles [8]. The genus has floral adaptations for brood site mimicry, especially scents and sometimes the appearance of carrion, dung, and fungi [9], a pollination syndrome known as sapromyiophily [10].

Aristolochia reaches its highest diversity in the tropics but declines sharply toward the temperate zones [11]. In South America, the highest diversity and endemism has been reported in Brazil (93 species, 38 endemics) [12], followed by Bolivia (39 species, 11 endemics) [13], Colombia (32 species, 4 endemics) [1], Peru (23 species, 16 endemics) [14], Venezuela (18 species, 1 endemic) [15], and Ecuador with 23 species including this new record [4,16]. The altitudinal distribution of Aristolochia in Ecuador ranges from the sea level to 2000 m; its highest diversity is found in the central and north Amazonian provinces (Napo, Orellana, Pastaza, and Sucumbios) (14 species), whereas the coastal region (Esmeraldas province) hosts 5 species.

During the first comprehensive botanical expedition of the Yasuní river, an undercollected area in the Yasuní National Park, we collected Aristolochia mishuyacensis O.C. Schmidt, which is the first record of the species to the Ecuadorian flora (Figures 1 and 2). Here, we update and illustrate the description of the species, as fruits and seeds were not described before [3,17]. Additionally, we provide a map of distribution and comments on its relationships with other species.

Methods

Material was collected along the Rumiyaku and Salado rivers; both are black water tributaries of the Yasuní river system, in the Yasuní National Park during July 2016 and March 2017, respectively. Collections at COL and QCA and relevant literature were revised, as well as type images of Aristolochia available at JSTOR Global Plants (http://plants.jstor.org/ [18]). Online herbaria, databases, and protologues were additionally consulted. The description is based on dry material.
New record to the Flora of Ecuador

*Aristolochia mishuyacensis* O.C. Schmidt, Repert. Spec. Nov. Regni Veg. 32: 96. 1933. = *A. williamsii* O. C. Schmidt, Repert. Spec. Nov. Regni Veg. 30: 70. 1932, non Rusby 1910.

Type: Peru. Loreto: lower Rio Huallaga, Yurimaguas, Fortaleza, 155–210 m, 29 October 1929 (fl), L. W. Williams 4314 (Holotype F [F0042318F]).

Slender vines. Stems glabrous. Pseudostipules present, circular, 1–5 × 1–3 cm. Petiole 3–9 cm long, glabrous; blade ovate, narrowly ovate or slightly hastate, 7.0–18.5 × 4–10 cm, membranaceous, base deeply cordate, sinus 1.5–4.5 cm in depth, apex acute, glabrous above, finely puberulous below especially along the veins; venation palmate, primary veins 5 (7), higher order veins forming a dense reticulum.

Figure 1. *Aristolochia mishuyacensis* O.C. Schmidt. (A) Dorso/lateral view of the flower; (B) habit; (C) cutural utricle showing the gynostemium; (D) frontal view of the flower; (E) flower, lateral view, and capsule; (F) leaves, pseudostipules and flowers. A, V, D and e from A.J. Pérez 10862, C and F from A.J. Pérez 9637.
Peduncle plus ovary 5–13 cm long, glabrous. Perianth strongly reflexed between the utricle and the tube, glabrescent outside; utricle obovoid, 3.0–5.7 cm long, 1.5–2.5 cm in diameter, base entire; syrinx inequilateral, 3–4 mm long; tube subinfundibular, slightly curved at its proximal end, 2.0–2.5 cm long, 6–10 mm in proximal diameter, 20–25 mm in distal diameter, forming an angle <90° with the utricle; annulus absent; limb bilabiate, upper lip ovate, cucullate, 4–5 × 3–4 cm, prolonged into a long, tapering cauda to 85 × 0.1–0.3 cm, lower lip broadly ovate, 1–2 × 1.0–1.5 cm, apex emarginate. Gynostemium 6–8 mm long, 4–5 mm in diameter; anthers narrowly oblong, 4.5–5.0 mm long, equidistant. Capsule broadly cylindrical, to 6.5–7.5 × 1.2–2 cm, rostrate. Seeds triangular, ca. 8 × 7 mm, with a short peripheral wing, margin and abaxial surface warty, raphe laterally prolonged into a membranous process almost as large as the seed proper.

**Distribution and habitat**

Primary or secondary, flooding Amazonian forests at elevations below 200 m of southern Colombia, eastern Ecuador, northern Peru, Brazil, and Bolivia (Figure 2). In Ecuador, *A. mishuyacensis* was collected on vegetation growing along the banks of black water tributaries that flow into the Yasuní river. According to [19], an area dominated by “bosque siempreverde de tierras bajas del Napo-Curaray (BstA02)”. According to the field notes of the specimens Pérez et al. 9637 and 10862, it grows associated with tree species including the palms *Astrocaryum jauari* Mart. and *Bactris riparia* Mart., the legume *Macrolobium acacifolium* (Benth.) Benth., and the Rubiaceae *Bothriospora corymbosa* (Benth.) Hook. f. and *Rosenbergiodendron longiflorum* (Ruiz & Pav.) Fagerl.

**Phenology**

The species has been collected in flower from March to May, July, October, and November, and sets fruits in March and from July to October.

**Vernacular name**

*Aristolochia mishuyacensis* is locally known as “zapaticito de difunto” in Peru and “saragosa” in Ecuador.

**Discussion**

*Aristolochia mishuyacensis* belongs to the subgenus *Aristolochia*, section *Gymnolobus*, subsection *Hexandrae*, series *Hexandrae* [3,4,20]. The species was originally described as *A. williamsii* O.C. Schmidt [17], but the same author provided a new name two years later [21], given that the former name was already in use for another species. It is related to the remaining species that conform the informal group *Pseudostipulosae* proposed by Hoehne [22], which comprises approximately 60 species of *Aristolochia*, all of them restricted to the neotropics. The diagnostic trait for these species is the atypical development of the prophyll (first or basal-most leaf) of each vegetative shoot. These prophylls are sessile.

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**Figure 2.** Distribution map of *Aristolochia mishuyacensis* O.C. Schmidt.
or nearly so, considerably smaller than the normal leaves, and remain in contact to the shoot axis, giving thus the appearance of (false) stipules. *Aristolochia mishuyacensis* is easily distinguished from the remaining pseudostipulate-bearing species by the ovate to slightly hastate leaf blade, the bilabiate limb with its upper lip ovate, cuticulate and prolonged into a long tapering cauda to 85 × 0.1–0.3 cm (Figure 1). The latter character is found also in four pseudostipulate-bearing species: *Aristolochia paulistana* Hoehne, *Aristolochia pohliana* Duch. and *Aristolochia weddellii* Duch. from Brazil, as well as *Aristolochia trilobata* L., which is widely distributed in the neotropics. However, *A. mishuyacensis* differs from *A. paulistana* in the leaf consistency and shape (membranaceous and deeply cordate vs. chartaceous to coriaceous and truncate or nearly so, respectively). It differs from *A. pohliana* in the leaf and perianth shape (leaves ovate to narrowly ovate and lower lip of the perianth broadly ovate, 1–2 × 1.0–1.5 cm vs. leaves broadly ovate and lower lip of the perianth 3.5–4.5 × 2 cm, respectively). *A. mishuyacensis* differs from *A. weddellii* primarily in the seeds, which are winged in the former and not winged in the latter. Finally, it differs from *A. trilobata* by its entire leaves vs. the deeply lobed leaves in the latter species.

The morphology of capsules and seeds of *Aristolochia mishuyacensis* facilitates anemochory. The capsules are formed upside-down in the distal portions of the climbing shoots, which usually reach the forest canopy. The capsules dehisce acropetally and acquire a basket-shaped due to the incomplete separation of the six carpels, which remain apically fused at the level of the rostrum. The position and opening of the capsules expose the numerous winged seeds to the wind, promoting long-distance dispersal.

**Additional specimens examined**

**ECUADOR.** Orellana: Parque Nacional Yasuní, río Yasuní, colecciones en la ribera del río Rumiayaku, 00°55′07″S, 75°53′26″W, 200 m, 31 July 2016 (fl, fr), A.J. Pérez et al. 9637 (QCA); colecciones en la ribera del río Salado, 00°56′57″S, 75°28′02″W, 175 m, 23 March 2017 (fl, fr), A.J. Pérez et al. 10862 (QCA). **BOLIVIA.** Santa Cruz: Velasco, Reserva Ecológica El Refugio, a 200 m al SE del campamento Refugio, sobre el Río Paragua, hacia la junta con el Río Tarbo, 14°46′15.6″S, 61°01′56.8″W, 160 m, 24 Abr 1995 (fl, fr), R. Guillén & R. Choré 3273 (F, MO, NY). **BRASIL.** Amazonas: Río Tefé, igarapé Pauixubinha, igapó, 14 April 1950 (fl), R. L. Fröes 26576 (NY, RB). Pará: Antonio Lemos, varzeado Igapé Pixuna, 18 June 1948 (fl), G.A. Black 48-2992 (RB); Río Jaracu, vársea à cabeceira do rio, região do levantamento estatístico florestal feito pelo IAN, SPVEA e FAO, 8 October 1955 (fr), R. L. Fröes 32177 (NY, RB). 

Sin localidad precisa: Río Jahú, curso medio (Elpidio), 26 March 1942 (fl), A. Duce s.n. (RB 53202). **COLOMBIA.** Amazonas: Puerto Nariño, 24 July 1965 (fl), G. Lozano-Contreras et al. 646 (COL). **PERU.** Loreto: Iquitos, 100 m, 4 March 1979 (fl), F. Ayala & J. Torres 1631 (AMAZ); Iquitos, Quistococha, 120 m, 4 September 1989 (st), F. González et al. 1762 (AMAZ, COL); Prov. Requena, trocha de la cocha Yarina, 120 m, 9 July 1985 (fl), C. Grández & R. Vásquez 437 (AMAZ); Mishuyacu, near Iquitos, 100 m, April 1930 (fl), G. Klug 1177 (F, NY, US); Mishuyacu, near Iquitos, 100 m, May 1930 (fl), G. Klug 1302 (US); Prov. Maynas, Padre Isla (Cocha Barbón), 73°10′W, 03°45′S, 28 October 1981 (fl), R. Vásquez & C. Grández 2656 (MO); Reserva Nacional Pacaya (Cocha Yarina), 74°30′W, 05°15′S, 125 m, 9 July 1985 (fl), R. Vásquez et al. 6636 (MO).

**Acknowledgments**

We thank the Ministry of the Environment of Ecuador for granting the permit MAE-DNB-CM-2015-0031 to carry out this research; the staff of the Yasuní Scientific Station of the Pontificia Universidad Católica del Ecuador (PUCE) for logistics planning, especially David Lasso and Miguel Rodríguez; the Waorani community of Dicaro and the Kichwa community of Pompeya for field assistance. Special thanks to the staff of the Yasuní National Park, Luis Tonato and Darío Maldonado. Rubén D. Jarrín E. kindly designed Figure 2. Secretaría de Educación Superior, Ciencia, Tecnología e Innovación de la República del Ecuador (SENESCYT, Arca de Noé Initiative; S. R. Ron and O.Torres–Carvajal, Principal Investigators). PUCE and Columbus State University for their generous financial and logistical support to botanical expeditions in the Yasuní region. We thank for the comments from the editor and two anonymous reviewers.

**Associate Editor:** Nora Oleas

**Disclosure statement**

No potential conflict of interest was reported by the authors.

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