

Aristolochia brunneomaculata, a new threatened species of Aristolochiaceae from the Atlantic Forest in Bahia, Brazil

Ivan Silva Abreu^{1*} & Ana Maria Giulietti^{1,2,a}

¹ Programa de Pós-graduação em Botânica, Universidade Estadual de Feira de Santana, Feira de Santana, Bahia, Brasil.

² Instituto Tecnológico VALE de Desenvolvimento Sustentável, Belém, Pará, Brasil.

Abstract – We describe and illustrate *Aristolochia brunneomaculata*, a new species from the Atlantic Forest in Bahia state, Brazil, a region known for its high number of endemic and threatened species, such as the one described here. The new species is known only from a small population in a disturbed area, near a major industrial complex.

Additional key words: conservation, taxonomy.

Resumo (*Aristolochia brunneomaculata*, uma espécie nova e ameaçada de Aristolochiaceae da Mata Atlântica na Bahia, Brasil) – Neste trabalho, descrevemos e ilustramos *Aristolochia brunneomaculata*, uma nova espécie da Mata Atlântica do estado da Bahia, Brasil, uma região conhecida pelo grande número de espécies endêmicas e ameaçadas, como a descrita aqui. A nova espécie é conhecida somente por uma pequena população, em uma área antropizada, próxima a um grande polo industrial.

Palavras-chave adicionais: conservação, taxonomia.

The monophyletic genus *Aristolochia* L., with approximately 550 species, is the most diverse in the family Aristolochiaceae and has a pantropical distribution (Neinhuis 2005; Ohi-Toma et al. 2006; Wanke et al. 2006; González 2012). Ninety-two accepted species of *Aristolochia* are recorded for Brazil, approximately 40% of which are endemic (Barros et al. 2015). They occur in all phytogeographic dominions and various species are characteristic of forested areas. Although there are a few herbaceous species in Brazil, the majority have a twining habit and overall there is great morphological diversity among them (Hoehne 1927, 1942).

Only 7.25% of the original area of Brazil's Atlantic Forest remains, and in the state of Bahia, less than 4%, consisting only of discontinuous fragments (Thomas et al. 1998; Câmara 2003). These figures clearly show the fragility of what remains of this phytogeographic dominion and the great need to intensify research and conservation efforts focussed on it. In regard to *Aristolochia*, it is highly significant that in the last 15 years, when systematic studies in this dominion have intensified, five new species have been discovered in the Atlantic Forest of the states of Bahia and Espírito Santo (González 1998, 2000, 2011; Freitas et al. 2013, 2014).

Twenty species of *Aristolochia* have been recorded during a survey of the family Aristolochiaceae for the Flora of Bahia (Abreu & Giulietti 2016 in press). The aim of the present paper is to formally describe and name one of these newly discovered species from the Atlantic Forest of Bahia.

*Corresponding author: ivanabreuacad@gmail.com;

^aana.giulietti@vale.org

Corresponding editor: Alessandro Rapini

Submitted: 2 maio 2016; accepted: 18 jul. 2016

First published: 12 ago. 2016; final version: 25 out. 2016

Aristolochia brunneomaculata I. Abreu & Giul., **sp. nov.**

TYPE:—BRASIL. BAHIA: Camaçari, margem da rodovia BA-535, dentro do polo industrial e próximo ao prédio da Companhia de Bebidas das Américas (Ambev), 12°40'36.5"S, 38°19'46"W, 65 m a.s.l., 19 Mar. 2015 (fl., fr.), I.S. Abreu 135 (holotype HUEFS, isotype ALCB).

Figures 1–3.

Aristolochia brunneomaculata resembles *Aristolochia tamnifolia* (Klotzsch) Duch. in its vegetative and inflorescence morphology, but differs in the greenish-yellow colour of the external surface of the perianth (vs. vinaceous), by the size of the lower part of the perianth tube (utricle) ca. 2.3 × 1.7 cm (vs. c. 1.7 × 1.3 cm), the lower lip c. 1.5 cm long (vs. c. 0.5 cm) and by the upper lip of the perianth not revolute (vs. revolute), with its internal surface not fimbriate (vs. fimbriate).

Twining vine. Stems glabrous, not corky when mature. Young branches cylindrical, internodes 3.6–13.4 cm long. Leaves with petiole 0.7–2.6 cm long, glabrous, cylindrical throughout; lamina broadly ovate, 5.3–10 × 6–11 cm, chartaceous, glabrous on both sides, base cordate to lobate, not peltate, sinus 1–2.3 cm deep, apex acute to mucronate, basal primary veins 5. Axillary prophylls (pseudostipules) absent. Flowers 1 or 2, arranged in axillary or cauliflorous short rhipidia, rachis c. 0.6 cm long, internodes c. 0.2 cm long, subtending sessile deltoid bracts c. 0.2 × 0.2 cm. Pedicel c. 0.8 cm long, glabrous. Outer surface of perianth glabrous, yellowish green; lower tube (utricle) ovoid, c. 2.3 × 1.7 cm, inner surface covered with white trichomes, except for macula with vinaceous trichomes, behind syrinx a brown circle bordering a region of translucent cells at base of lower tube (utricle); syrinx unequal, c. 0.5 mm wide; upper tube c. 2.4 × 0.4 cm, inner surface covered by white

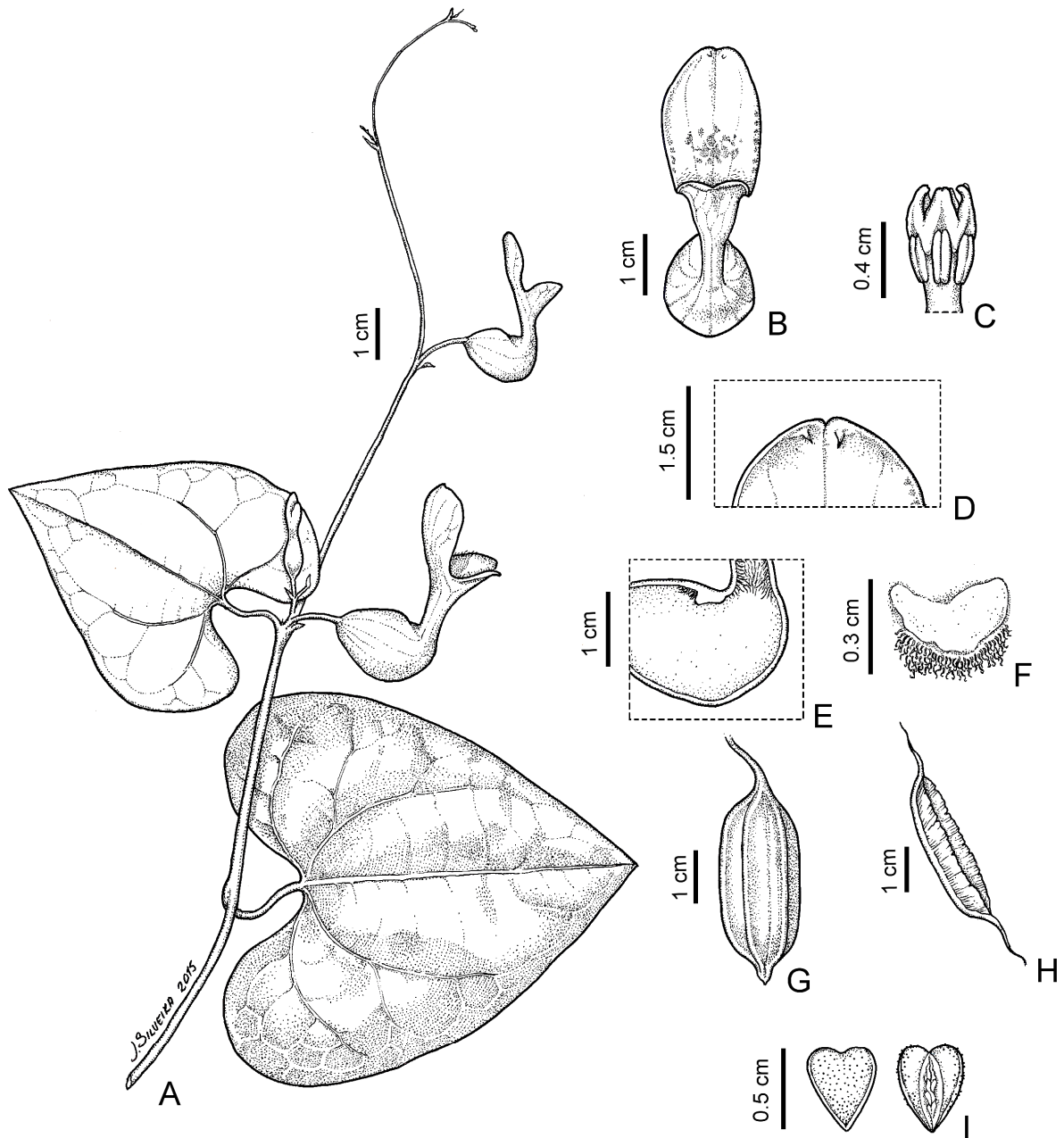


Figure 1. *Aristolochia brunneomaculata*: A- shoot with leaves and inflorescences; B- perianth, frontal view; C- gynostemium; D- upper lip, with emarginate apex bearing two glands with multiserial trichomes; E- lower tube (“utricle”), longitudinal section showing the syrinx in lateral view; F- syrinx, seen from within the lower tube; G- capsule; H- capsule locule with fibrous septa; I- seed, showing upper and lower surfaces (drawings by I. Abreu and J. Silveira).

trichomes, with rose-coloured apex, proximal diameter c. 0.4 cm, distal c. 1 cm; lower lip elliptical, c. 1.5 × 1.5 cm, inner surface covered by white trichomes with rose-coloured apex, margin revolute, apex emarginate; upper lip elliptical, c. 2.2 × 1.3 cm, margin flat, apex mucronate, inner surface glabrous with two fimbriate glands near apex, brown maculae concentrated in lower half and margin. Ovary c. 0.8 cm long, glabrous. Gynostemium 6-lobed, c. 0.4 cm long, stipe c. 1.5 mm long, anthers linear, c. 3 mm long. Capsules ellipsoid, 2.9–3.3 × 1.3–1.5 cm, 5- or 6-locular, hexagonal or

pentagonal in cross section, dehiscence acropetally, apical rostrum cylindrical, c. 0.4 cm long, septae fibrous. Seeds broadly ovate, 3–4 × 3.5–4.5 mm, concave-convex, not winged, testa warty, raphe protruding.

Additional specimen examined (paratype) – BRASIL. BAHIA: Camaçari, Área Controle da Caraíba Metais, 12°40'17"S, 38°29'40"W, 49 m a.s.l., 1 Dec. 1982 (fl., fr.), L.R. Noblick *et al.* 2261 (CEPEC, HUEFS).

Distribution and habitat. The only known population of *Aristolochia brunneomaculata* occurs

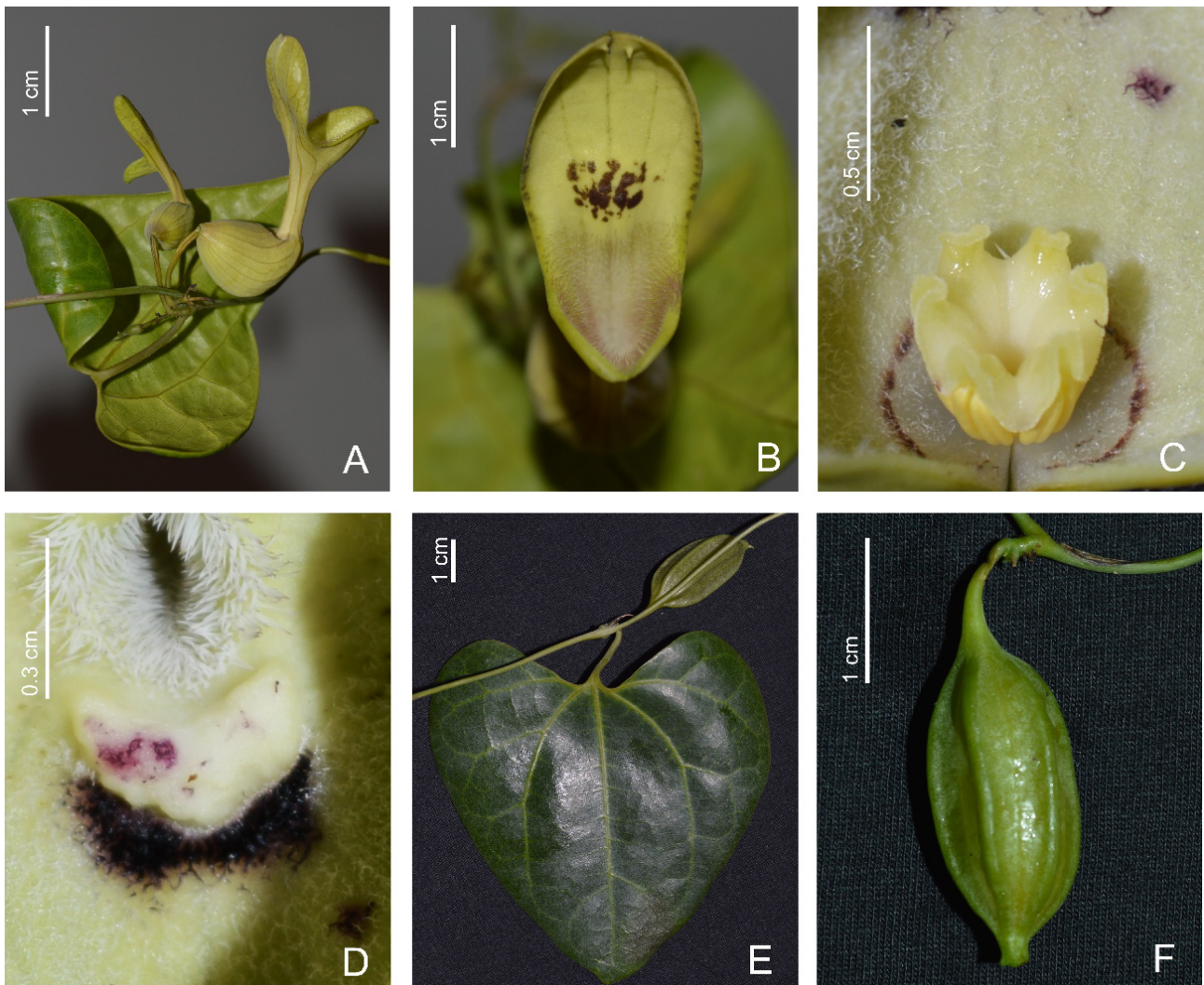


Figure 2. *Aristolochia brunneomaculata*: **A-** leafy shoot with two inflorescences; **B-** perianth, frontal view; **C-** gynostemium; **D-** interior of the lower tube (“utricle”), showing the syrinx and the opening into the upper tube; **E-** leafy shoot with an immature capsule; **F-** immature capsule (photos by Ivan Abreu).

near the east coast of Bahia state, in the municipality of Camaçari (Figure 3). This municipality lies within the Atlantic Forest dominion, which here consists of disturbed fragments of the vegetation type “mata de tabuleiro”, at elevations between 50 and 65 m a.s.l., with rare individuals of the species near the roads running through the area.

Phenology. The population was observed to produce flowers and fruits in December and March. The Atlantic Forest of the region of Camaçari has a mean annual rainfall of c. 1.608 mm throughout the year (CPRM 2009), with lower mean rainfall between December and April and the highest between May and July.

Conservation status. The area where the single population of *Aristolochia brunneomaculata* occurs is the petrochemical complex of Camaçari (Polo Petroquímico de Camaçari), and is exposed to environmental pressures caused by industrial activity and reforestation projects using exotic species of *Pinus* and *Eucalyptus*. *Aristolochia brunneomaculata* was observed only in forest fragments that include native

species of the Atlantic Forest and does not occur in the extensive reforested areas. A thorough search was made within the overall area where the species could have been expected to occur, but without success. The known population occupies a total area of approximately 12 km² and consists of about 10 individuals. Using the IUCN (2001), together with the associated habitat conditions and environmental pressures, we tentatively conclude that this should be considered a species in danger of extinction (EN), according to the criteria A3bce, B2b(i, ii, iii), C1 and D2.

Etymology. The specific epithet refers to the spots on the inner surface of the upper perianth lip, which are characteristic of the species (from Latin *brunneus* = brown and *maculatus* = spotted).

Notes. The vegetative and inflorescence morphology of *Aristolochia brunneomaculata* are superficially similar to those of *A. tamnifolia*, another Bahian species, which explains why the only previous collection, made in 1982, was identified as *A. tamnifolia*. Both species are found in the vegetation

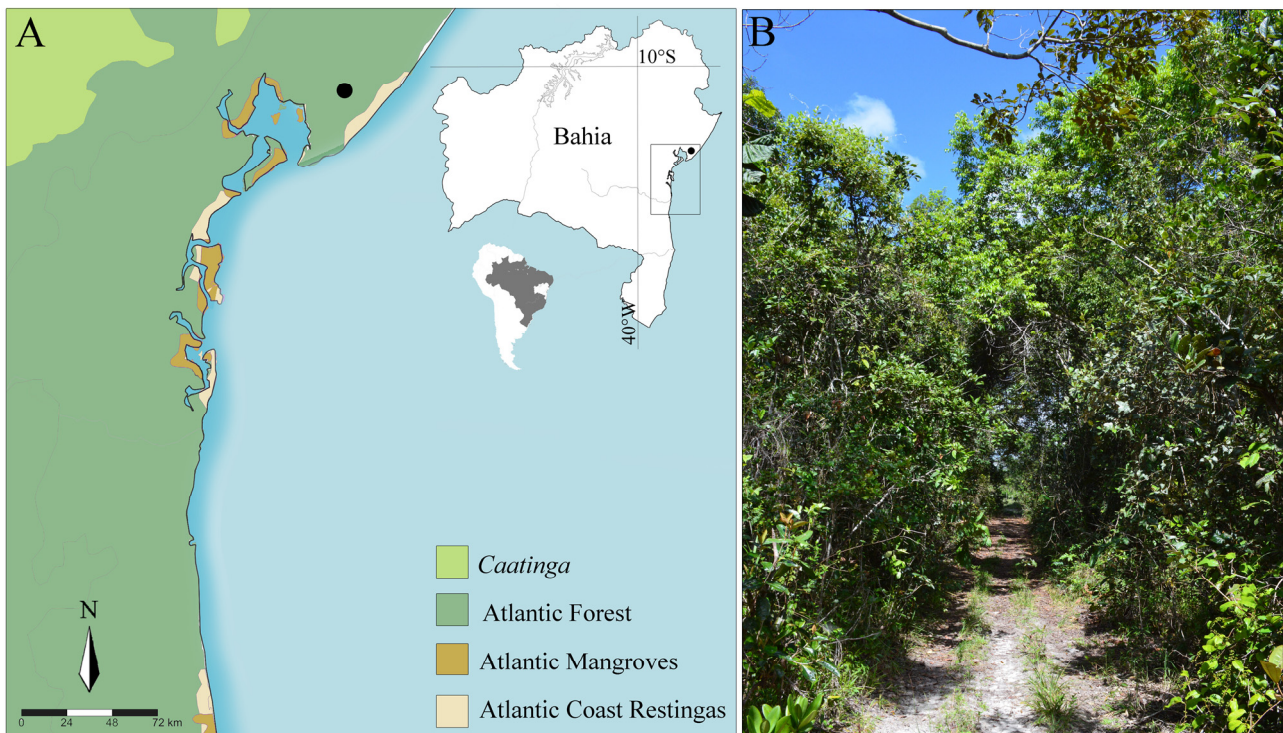


Figure 3. Geographical distribution of *Aristolochia brunneomaculata*. **A-** location on the Atlantic Forest of Bahia. **B-** vegetation type where the species occurs.

type "mata de tabuleiro", near the coast, but *A. tamnifolia* occurs in other areas in the Northeast and Southeast regions of Brazil. In Bahia, the nearest populations of the two species are approximately 56 km distant. The difference in perianth colour between *A. brunneomaculata* and *A. tamnifolia* is the most striking field character by which to distinguish these two twining species, followed by the presence in *A. tamnifolia* of large, dark and very obvious fimbriae on the inner surface of the upper perianth lobe, which are absent or vestigial in *A. brunneomaculata*. Both species also have ramiflorous rhipidia and similar leaf shape. The widely ovate leaf blades also resemble those of *Aristolochia assisii* J.Freitas, Lírio & F.González, but this latter species is easily distinguished by its erect, herbaceous habit, among other differences (Table 1).

The rhipidia of *Aristolochia brunneomaculata* are reduced to a pair of flowers or one solitary flower and are similar to those of other species, such as *A. birostris* Duch. and *A. disticha* Mast. This type of inflorescence was reported to *Aristolochia* by Nair (1961). We assign our new species to *Aristolochia* sect. *Gymnolobus* subsect. *Hexandrae* Duch., which is characterized by a hexamerous gynostemium. The capsules are generally formed of five carpels and present five locules. In the holotype plant, however, we observed one capsule with six locules. The flowers of this species did not have a scent detectable to human observers, but 32 diptera and one coleopteran were collected within the perianth.

ACKNOWLEDGEMENTS

This study is part of the Masters dissertation of the first author, carried out in the Postgraduate Programme in Botany at the State University of Feira de Santana (PPGBot-UEFS). We thank the curators of the herbaria ALCB, CEPEC and HUEFS for access to their collections, and FAPESB for financial support provided to the Flora da Bahia project (process APR0162/2007). We thank CNPq for financial support provided to the projects of the Flora da Bahia (processes 562278/2010-9 and 483909/2012), including support for herbarium visits and field expeditions. ISA thanks the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) for the Masters grant and AMG thanks CNPq for her Research Productivity grant (PQ Senior). We also thank Raymond Harley and Simon Mayo for the English translation.

REFERENCES

- Abreu, I.S. & Giulletti, A.M. 2016 (in press). Flora da Bahia: Aristolochiaceae. *Sitientibus série Ciências Biológicas* 16: 10.13102/scb1059.
- Barros, F.; Araújo, A.A.M. & Freitas, J. 2015. Aristolochiaceae. In: *Lista de Espécies da Flora do Brasil*. Jardim Botânico do Rio de Janeiro. Available from <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB54>; accessed in 24 Apr. 2015.
- Câmara, I.G. 2003. Breve história da conservação da Mata Atlântica. In: C. Galindo-Leal & I.G. Câmara (eds), *The Atlantic Forest of*

TABLE 1: Comparison of *Aristolochia brunneomaculata* with two morphologically similar species.

Characters	<i>A. brunneomaculata</i>	<i>A. tamnifolia</i> ¹	<i>A. assisii</i> ²
Habit	climber	climber	herb
Petiole length	0.7–2.6 cm	1.2–6.8 cm	5.6–16.5 cm
Leaf blade size	5.3–10 × 6–11 cm	3.5–12.4 × 3.4–12.7 cm	13.8–16.5 × 11–17.5 cm
Leaf blade texture	chartaceous	chartaceous	membranaceous
Leaf blade sinus	1–2.3 cm deep	0.7–2.2 cm deep	2.8–4.4 cm deep
Leaf blade apex	acute to mucronate	acute	acuminate
Rhipidia: rachis size	0.8–1.5 cm long	c. 0.5 cm long	0.4–3 cm long,
Rhipidia: number of flowers	1 or 2	1 or 2	6–23
Rhipidia: position	ramiflorous or cauliflorous	ramiflorous	ramiflorous
Perianth outer surface: colour at anthesis	yellowish green	vinaceous	beige with small vinaceous spots
Lower tube size (utricle)	c. 2.3 × 1.7 cm	c. 1.7 × 1.3 cm	c. 1.1 × 0.7 cm
Upper tube length	c. 2.4 cm	c. 1.4 cm	c. 1.6 cm
Upper lip shape	elliptic	oval	broadly elliptic
Upper lip size	c. 2.2 × 1.3 cm	c. 2 × 0.8 cm	1.8–2.0 × 1.1–1.3 cm
Upper lip margin	not revolute	revolute	revolute
Upper lip inner surface	fimbriae absent or with two fimbriae near apex	covered with fimbriae	fimbriae absent
Lower lip size	c. 1.5 × 1.5 cm	c. 0.5 × 1.5 cm	inconspicuous
Capsule form	longitudinally ellipsoid	longitudinally oblong	longitudinally fusiform
Capsule size	2.9–3.3 × 1.3–1.5 cm	3.3–4.1 × 1.2–1.5 cm	c. 3.2 × 1.15 cm
Capsule: rostrum length	c. 0.4 cm long	c. 0.3 cm long	c. 1.2 cm long

Based on ¹ Duchartre (1864) and *Lewis* 817 (CEPEC); ² Freitas et al. (2014), *Santos* 80 (holotype MBML) and *Fontana* 5884 (paratype MBML).

South America: biodiversity status, trends, and outlook. Island Press, Washington, p. 31–42.

CPRM 2009. Serviço Geológico do Brasil. Atlântico Sul, trecho leste, sub-bacia 50. In: *Atlas Pluviométrico do Brasil e Estudos de Chuvas Intensas em Sistema de Informações Geográficas*. Available from <http://www.cprm.gov.br/publique/Hidrologia/Mapas-e-Publicacoes/Atlas-Pluviometrico-do-Brasil-1351.html>; accessed in Apr. 2015.

Duchartre, P. 1864. Aristolochiaceae. In: A. de Candolle (ed.), *Prodromus Systematis Naturalis Regni Vegetabilis*. Vol. 15, part. 1. Masson, Paris, p. 421–498.

Freitas, J.; Lirio, E.J. & González, F. 2013. A new cauliflorous species of *Aristolochia* (Aristolochiaceae) from Espírito Santo, Brazil. *Phytotaxa* 124(1): 51–59.

Freitas, J.; Lirio E.J. & González, F. 2014. *Aristolochia assisii*, a new neotenic species of Aristolochiaceae from Espírito Santo and Bahia, Brazil. *Phytotaxa* 163(5): 262–268.

González, F. 1998. Two new species of *Aristolochia* (Aristolochiaceae) from Brazil and Peru. *Brittonia* 50: 5–10.

González, F. 2000. A new species of *Aristolochia* (Aristolochiaceae) from Bahia, Brazil. *Novon* 10: 371–374.

González, F. 2011. A new pseudostipule-bearing species of *Aristolochia* (Aristolochiaceae) from Bahia and Espírito Santo, Brazil. *Brittonia* 63: 430–435.

González, F. 2012. Florística y sistemática filogenética innecesariamente disyuntas: el caso de *Aristolochia*, *Euglypha* y *Holostylis*. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 36(139): 193–202.

Hoehne, F.C. 1927. Monographia illustrada das Aristolochiaceas brasileiras. Memórias do Instituto Oswaldo Cruz 20(1): 67–175; t. 16–103.

Hoehne, F.C. 1942. Aristolochiaceas. *Flora Brasílica*. Vol. 15, part 2. Instituto de Botânica, São Paulo, p. 1–141, t. 1–123.

IUCN 2001. *IUCN Red List Categories and Criteria*. Version 3.1. IUCN Species Survival Commission, Gland & Cambridge. Available from <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria>; accessed in Apr. 2015.

- Nair, N.C.; Dun, D. & Narayanan, K.R.** 1961. Studies on the Aristolochiaceae. I. Nodal and floral anatomy. *Proceedings of the National Institute of Sciences of India* 28: 211–227.
- Neinhuis, C.; Wanke, S.; Hilu, K.W.; Müller, K. & Borsch, T.** 2005. Phylogeny of Aristolochiaceae based on parsimony, likelihood, and Bayesian analyses of *trnL-trnF* sequences. *Plant Systematics and Evolution* 250: 7–26.
- Ohi-Toma, T.; Sugawara, T.; Murata, H.; Wanke, S.; Neinhuis, C. & Murata, J.** 2006. Molecular phylogeny of *Aristolochia* sensu lato (Aristolochiaceae) based on sequences of *rbcl*, *matK*, and *phyA* genes, with special reference to differentiation of chromosome numbers. *Systematic Botany* 31:481–492.
- Thomas, W.W.; Carvalho, A.M.V.; Amorim, A.M.A.; Garrison, J. & Arbeláez, A.L.** 1998. Plant endemism in two forests in Southern Bahia, Brazil. *Biodiversity and Conservation* 7: 311–322.
- Wanke, S.; González, F. & Neinhuis, C.** 2006. Systematics of pipevines: combining morphological and fast-evolving molecular characters to investigate the relationships within subfamily Aristolochioideae (Aristolochiaceae). *International Journal of Plant Sciences* 167: 1215–1227.