BioOne COMPLETE

Xylopia maasiana (Annonaceae), a New Species from the Brazilian Amazon, and Taxonomic Notes on Xylopia nitida Dunal

Authors: Pontes-Pires, Aline Fernandes, Barbosa, Maria Regina De V., and Johnson, David M.

Source: Systematic Botany, 46(2) : 273-279

Published By: The American Society of Plant Taxonomists

URL: https://doi.org/10.1600/036364421X16231782047424

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

Systematic Botany (2021), 46(2): pp. 273–279
© Copyright 2021 by the American Society of Plant Taxonomists
DOI 10.1600/036364421X16231782047424
Date of publication August 11, 2021

Xylopia maasiana (Annonaceae), a New Species from the Brazilian Amazon, and Taxonomic Notes on *Xylopia nitida* Dunal

Aline Fernandes Pontes-Pires,[1,2,5] Maria Regina de V. Barbosa,[3] and David M. Johnson[4]

[1]Instituto de Ciências Naturais, Humanas e Sociais, Campus Universitário de Sinop, Universidade Federal de Mato Grosso, Av. Alexandre Ferronato, 1200, Bairro Residencial Cidade Jardim, 78550-728, 78557-267, Sinop, Mato Grosso, Brazil; afpont@hotmail.com
[2]Programa de Pós-Graduação em Biologia Vegetal, Universidade Federal de Pernambuco, Av. Prof. Moraes Rego s/n, Cidade Universitária, 50670-901, Recife, Pernambuco, Brazil
[3]Departamento de Sistemática e Ecologia, Universidade Federal da Paraíba, Caixa Postal 5065, Cidade Universitária, 58051-970, João Pessoa, Paraíba, Brazil; mregina@dse.ufpb.br
[4]Department of Botany and Microbiology, Ohio Wesleyan University, Delaware, Ohio 43015, USA; dmjohnso@owu.edu
[5]Author for correspondence

Communicating Editor: Ricarda Riina

Abstract—During a taxonomic and phylogenetic study of *Xylopia* from the Amazon River basin, South America, we examined collections from the Brazilian states of Amazonas, Mato Grosso, Pará, Rondônia, and Tocantins that resembled *Xylopia nitida* by some characteristics of the leaves, but differed consistently from the latter in a number of floral and fruit characters. On the basis of these specimens we describe here a new species, ***Xylopia maasiana***. The new species is a small to medium-sized tree encountered mostly in riparian habitats across the southern Brazilian Amazon and in some transition areas between the Amazon forest and cerrado biomes in Central Brazil. In addition to the detailed description, we include a preliminary assessment of conservation status, taxonomic comments, illustrations, a distribution map of the new species, and comparison with *X. nitida*.

Keywords—Arc of deforestation, conservation, endemic, riparian forests.

Xylopia L. is one of the largest genera of Annonaceae, and the only pantropical genus in the family (Dias 1988; Stull et al. 2017; Johnson and Murray 2018). Molecular phylogenetic analyses including several *Xylopia* species (Doyle et al. 1998; Chatrou et al. 2012; Thomas et al. 2015; Stull et al. 2017) have repeatedly recovered the genus as monophyletic. Stull et al. (2017), in the first morphological and molecular phylogeny surveying the entire geographic distribution of the genus, recovered four major clades within *Xylopia*, one of them including all the Neotropical species sampled.

The Neotropical species of *Xylopia* were revised by R. E. Fries (1900, 1930, 1931, 1934, 1937, 1939, 1959), who ultimately recognized 48 species in the Neotropics. Currently, we estimate that around 55 species of *Xylopia* are known from the region. Of these, 34 species are known from Brazil, 16 of them endemic to the country (Pontes-Pires and Johnson 2020). These species occur all over the country, in forests or in the transition zones between forests and savanna, but their greatest diversity is in the Amazon region (Dias 1988), where 28 species are currently known (Pontes-Pires and Johnson 2020). The species of *Xylopia* from the Amazon basin have not been comprehensively studied, however, since the revisions of Fries in the 1900s.

The rainforest of the Amazon basin is widely recognized as one of the most diverse ecosystems on Earth (Ter Steege et al. 2016), and its flora has been recently estimated to comprise around 6700 (Cardoso et al. 2017) tree species attaining a size of 10 cm dbh or greater. Cardoso et al. (2017) listed 36 species of *Xylopia*, but they included some synonyms and the new species described here was not included. From our ongoing investigations, we currently estimate that 35 species of *Xylopia* occur in the Amazon basin. Nonetheless, there are still undescribed *Xylopia* species in the Amazonian flora.

During a taxonomic and phylogenetic study of the Amazonian species of *Xylopia* we analyzed the morphological variation among specimens that had mostly been identified in herbaria as *X. nitida* Dunal, a species originally described from French Guiana (Dunal 1817). One group of specimens, despite a superficial similarity to *X. nitida* in the shape and texture of the leaves, was found to differ consistently from *X. nitida* in both flower and fruit characters. These specimens are assigned here to a new species, *X. maasiana*, and nomenclatural and distribution data for *X. nitida* are also included to explain how the two species can be distinguished. *Xylopia maasiana* has been collected in the Brazilian states of Amazonas, Mato Grosso, Pará, Rondônia, and Tocantins, in and near the region currently known as the "Arc of Deforestation" (IBGE 2002), geographically separated from populations of *X. nitida*, which lie mainly north of the Amazon River.

Materials and Methods

We examined collections from the following herbaria: A, B, BM, CEN, CNMT, EAC, ESA, F, FI, G, GB, HAMAB, HCF, HERBAM, HFSL, HUEFS, IAC, IAN, INPA, JPB, K, L, LA, LE, MBM, MG, MICH, MO, NY, OWU, P, R, RB, RON, S, SP, SPF, U, UB, UEC, UFMT, UFP, US, and TANG (acronyms following Thiers 2019). Collections were analyzed in loco and/or through loans, or by consulting the INCT – Virtual Herbarium of the Flora and Fungi of Brazil (http://inct.splink.org.br), or by consulting individual herbarium websites. We analyzed 30 collections of *Xylopia maasiana* and around 40 of *X. nitida*. The study followed the standard methodology used in plant taxonomy, and morphological terminology follows Radford et al. (1974), Van Heusden (1992), and Van Setten and Koek-Noorman (1992). In the description, the term stamens includes both fertile stamens and staminodes. The length of monocarps does not include the stipe length. Distribution, habitat, phenological data, flower and fruit colors, and habit data were obtained from herbarium labels. When the coordinates were not cited in the labels we searched for the locality (when possible) or municipality in "geoLoc", a tool of "speciesLink", available at http://splink.cria.org.br. The distribution map was made using the software Quantum GIS v. 2.18 (Quantum GIS Development Team 2018). The preliminary conservation status of the new species was determined using Geospatial Conservation Assessment Tool software (GeoCAT) (Bachman et al. 2011). We used 28 points or localities (from the total of 30 records studied here) to perform the preliminary conservation status assessment in GeoCAT.

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

Specimens with barcodes are indicated with a hyphen between the herbarium acronym and the barcode number, and when they had no barcode we used a blank space between the herbarium acronym and the accession number.

Taxonomic Treatment

Xylopia maasiana Pontes-Pires, sp. nov. Type: Brazil. Mato Grosso: [Sorriso] Nobres, along rio Celeste at BR163, 52 Km S of Sinop (Km 775), 12°18′S, 55°37′W, 16 Sep 1985, *W. W. Thomas, D. Ackerly & R. P. Lima 3813* (holotype: MG-191800!, isotypes: F 2019795!, HFSL 128, INPA 150327!, MG-121672!, MO-1922945!, NY!, SPF-00045525!, U-0134169 (digital image!), US 3101263!).

Xylopia maasiana resembles *X. nitida*, but can be distinguished from the latter by having narrowly oblong to narrowly triangular buds, nearly panduriform, slightly constricted above the base (vs. buds enlarged at the base, narrowing progressively towards the apex, without constriction, in *X. nitida*); sepals only slightly connate at the base, connate ca. 1/3–1/6 of their length, not forming a short cup-shaped calyx (vs. sepals connate from 1/2 to 2/3 of their length, forming a short cup-shaped calyx); 130–165 stamens (vs. 170–270), fertile stamens 0.6–0.8(–0.9) mm long (vs. 1–1.5 mm); 5–9 carpels (vs. 20–30), glabrous stigmas (vs. stigmas tomentellous at the apex); fruits of 3–9 monocarps (vs. 10–27); often compressed-falcate to obliquely clavate monocarps, slightly constricted between the seeds (vs. mostly narrowly cylindrical or extremely narrowly oblong, sometimes slightly falcate, torulose, or moniliform); only 1–3 seeds per monocarp (vs. mostly 4–7, rarely 1–3), 7–7.5 mm long (vs. 5–6.5 mm), and oblong (vs. obovoid).

Trees 4–15(–20) m tall, and **shrubs** 2–3 m tall, dbh 10–25 cm; **bole** with buttresses. Twigs, abaxial surfaces of leaves, inflorescences, and flowers with golden or golden hyaline hairs. **Twigs** tomentose to short sericeous, hairs becoming less dense with age, glabrate when older, pale brown to gray brown; with lenticels. **Petioles** 4–7 mm long, canaliculate, brown to dark brown, tomentose to short sericeous; **leaf blades** (4.2–)5.8–10.5(–11.8) × (1.8–)2.2–4.4(–5.8) cm, elliptic to oblong-elliptic, chartaceous to subcoriaceous, margin frequently slightly revolute to revolute, translucent glands rare (visible under stereomicroscope), pale brown to yellowish and densely short sericeous abaxially, brown and glabrous adaxially, apex mostly acute, sometimes short acuminate, less frequently rounded, acumen 3–6 mm long, base cuneate, acute, or attenuate; midrib raised abaxially, forming a keel, impressed adaxially, secondary veins (9–)12–15(–17) per side, raised on both surfaces, more visible adaxially. **Inflorescences** axillary, 2–3(–4–6)-flowered; **peduncle** 1.5–3 mm long, tomentose; **pedicels** 1.2–1.5 mm long, tomentose; **buds** narrowly oblong to narrowly triangular, nearly panduriform, slightly constricted above the base; **bracts** 2, one at the base of the pedicel, and one at the midpoint, persistent, ca. 1.5 × 1 mm, triangular ovate, clasping, short sericeous abaxially, adaxially glabrous. **Sepals** slightly connate at the base, ca. 1/3–1/6 of their length connate, 1.5–2 × 1.5 mm, ovate, smooth, short sericeous abaxially, glabrous adaxially, apex acute; **petals** white, yellowish, or cream, becoming maroon to purple towards the base; **outer petals** 13–14(–18) mm long, 2.5–5 mm wide at base, 1.5–2.5 mm wide at constriction, 2–3.5 mm wide at midpoint, narrowly triangular to narrowly oblong, lanceolate, slightly fleshy, reflexed in the median region at anthesis, apex acute, abaxially densely short sericeous, tomentellous, base enlarged and concave, papillate adaxially; **inner petals** 12–14 mm long, ca. 2 mm wide at base, 0.8 mm wide at constriction, ca. 1 mm wide at midpoint, linear from midpoint to apex, lanceolate, longitudinally keeled adaxially from midpoint to apex, tomentellous with base and convex region short sericeous abaxially, glabrous with the base slightly papillate and glabrous adaxially, apex acute to acuminate, base enlarged and concave; **stamens** 130–165; **fertile stamens** 80–100, slightly club-shaped, 0.6–0.8(–0.9) × 0.2 mm, glabrous, apex of connective 0.1–0.3 mm long, often rounded or slightly angular, flattened, papillate, anthers 6–8(–12)-locellate, filament 0.1–0.2 mm long; **outer staminodes** 35–40, 0.8–0.9 × 0.2 mm, slightly club-shaped, glabrous, anther connective apex 0.2–0.3 mm long, often rounded, or only slightly angular, or elongate, or sometimes longer and triangular, anthers (3–)4–6(–10)-locellate, filament ca. 0.1 mm long; **inner staminodes** 17–23, obtriangular, 0.5–0.8(–0.9) × (0.2–)0.3–0.4 mm, glabrous, apex of the connective ca. 0.2 mm long, very slightly dilated, or sometimes not differentiated, sometimes papillate, without locellate anthers and filaments; **staminal cone** depressed urceolate, 1.2–1.5 mm in diameter, 0.8 mm high, sometimes not completely concealing the ovaries; **carpels** 5–9, 3.2–4.5 mm long, ovary (0.5–)0.7–1 mm long, semifusiform to obclavate, densely sericeous; **ovules** 2–3, stigmas 2.7–3.5 mm long, linear, slightly geniculate above base, finely verruculose, glabrous. **Fruit** of 3–9 monocarps borne on **pedicels** 5–7.5 mm long, sparsely tomentose to glabrate; **torus** ca. 2.5 mm in diameter, 1.5 mm high, globose. **Monocarps** (6–)8–15(–17) × (5–)6–7.5 mm, 4–4.5 mm thick, oblong, compressed-falcate and obliquely clavate, slightly constricted between seeds, or obovoid and clavate (1-seed), glabrous to glabrate, reddish brown, brown to dark brown when dried, obliquely wrinkled when dried, apex rounded or obtuse, sometimes obliquely apiculate, apiculus 1(–2) mm long; **stipes** 6–8 mm long, wrinkled when dried, glabrate. **Seeds** 1–3, oblong, 7–7.5 × 3–3.5 mm, ca. 3 mm thick, dark brown to black when dried, shiny; aril yellowish beige, yellowish, orange, or transparent orange, lobes 1.5–2 × ca. 2.5 mm, ellipsoid, truncate or slightly oblique, fleshy. Figure 1.

Vernacular Name—The label of *J. A. Ratter et al. 4432* gives "Pindaíba" as the vernacular name. This common name is widely used in Brazil for many *Xylopia* species.

Distribution and Habitat—*Xylopia maasiana* is endemic to the Brazilian Amazon, occurring only south of the Amazon River, in the states of Amazonas, Mato Grosso, Pará, Rondônia, and Tocantins (Fig. 2). It is found in riverine forests, flooded forest (igapó forest), or seasonally flooded forest (várzea forest), and less frequently in lowland non-flooded forests (terra firme forest) in the Brazilian Amazon, or in forests in the transition areas at the border of the Amazon forest and the Central Brazilian savanna (cerrado).

Conservation—Following the criteria established by the IUCN (2012, 2017), the extent of occurrence (EOO) for *Xylopia maasiana*, approximately 771,000 km^2, results in its classification as of Least Concern (LC). However, its area of occupancy (AOO), 108 km^2, results in an Endangered (EN) classification. It is important to note that the areas of occurrence of *X. maasiana* are mostly within or near the Arc of Deforestation (IBGE 2002), an area in the form of an arc that includes parts of the Brazilian states of Acre, Amazonas, Maranhão, Mato Grosso, Rondônia, and Tocantins that have experienced dramatic levels of forest loss along their southern and eastern borders (Fearnside 2005). Soares-Filho et al. (2006) mentioned that by 2050

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

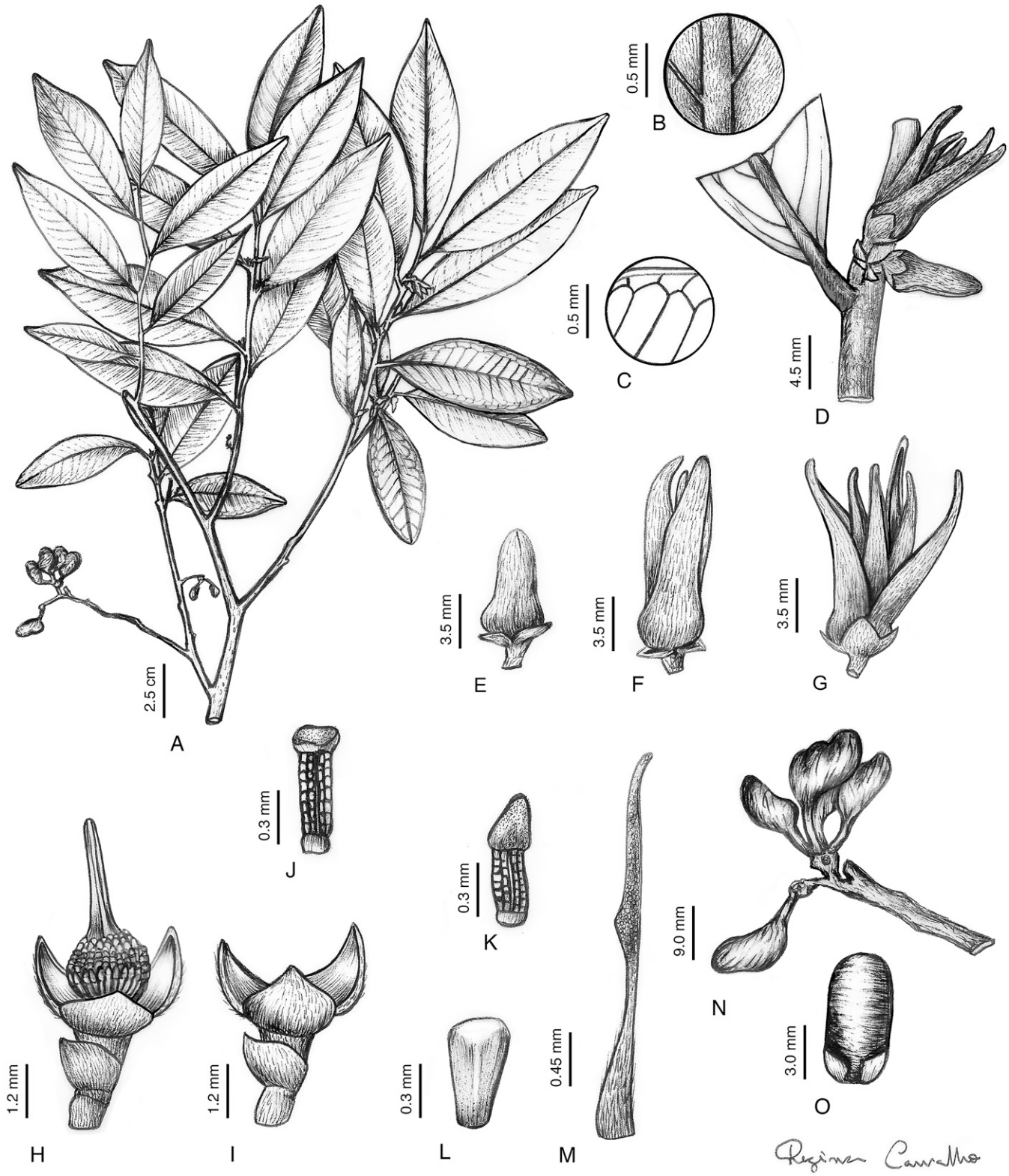


FIG. 1. *Xylopia maasiana*. A. Fertile branch. B. Detail of the indument on the abaxial face of the leaf. C. Detail of the secondary veins and the arcs of the tertiary veins near the leaf margins on the adaxial face. D. Detail of the axillary inflorescence with two flowers. E. Young floral bud. F. Flower at the beginning of anthesis. G. Flower. H. Floral receptacle after removing the outer and inner petals, showing the stamens, staminodes, and carpels (center). I. Calyx with sepals only slightly connate at their base. J. Fertile stamen in abaxial view. K. Outer staminode in abaxial view. L. Inner staminode in abaxial view. M. Carpel. N. Detail of a portion of a branch with two fruits, one fruit with only a single monocarp and the other with four monocarps. O. Seed with a bilobed aril. (A–K, N, O: *W. W. Thomas, D. Ackerly & R. P. Lima 3813*; L, M: *B. Dubs 1665*).

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

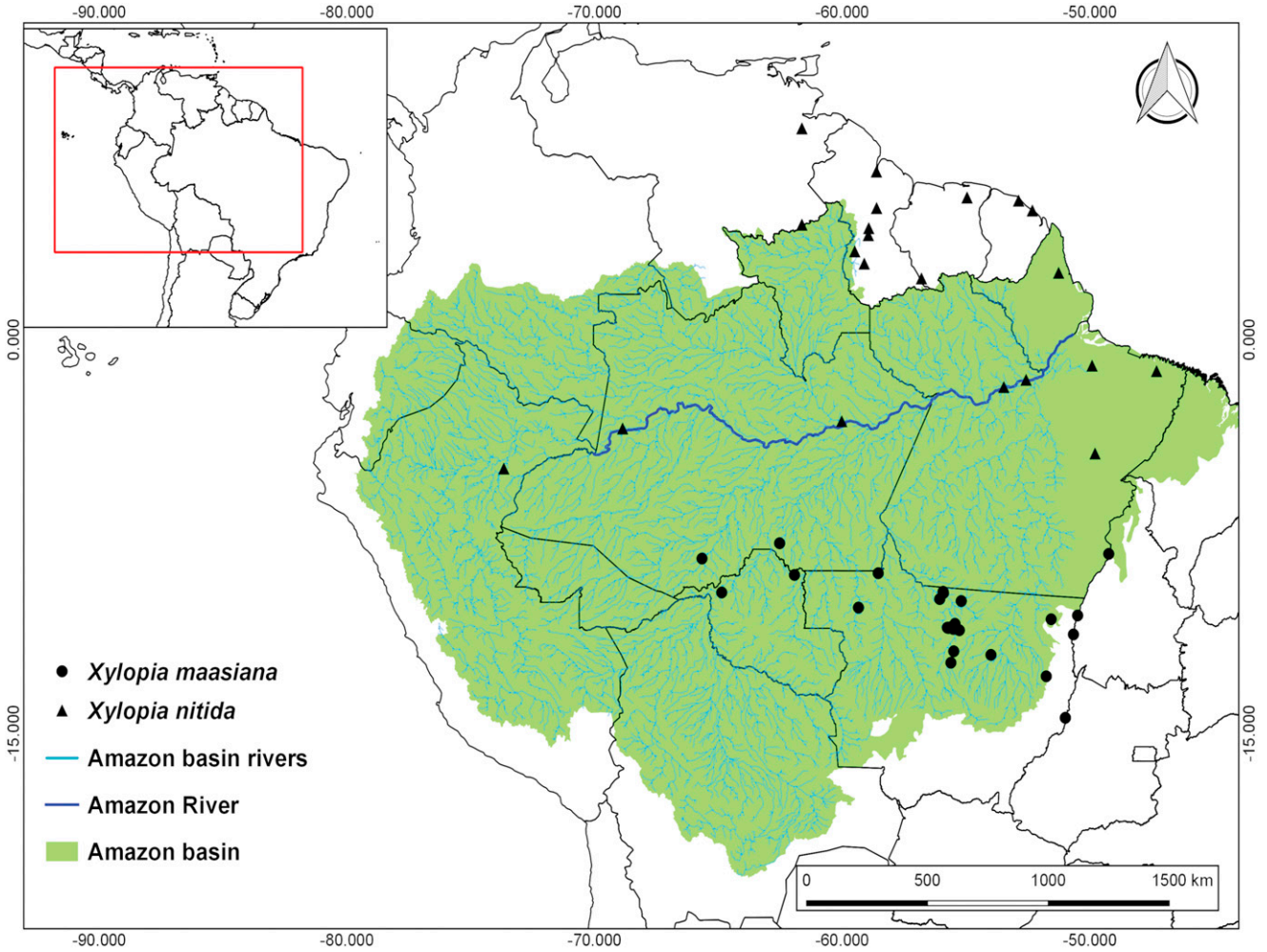


FIG. 2. Geographic distribution map showing the localities of occurrence for *Xylopia maasiana* and *X. nitida*.

agricultural expansion will reduce the Amazon forests by 40%, and this loss will be most severe in forests in Maranhão, Mato Grosso, and Pará (the last two states are part of the AOO of *X. maasiana*). More recently, Ter Steege et al. (2015) also estimated that by 2050, 34–66% and 42–76% of the forest in southern and eastern Amazonia (the region of the Arc of Deforestation) will be destroyed, reinforcing our concern with the deforestation in the AOO of the new species. It is also important to mention that the majority of records of *X. maasiana* are from Mato Grosso, and recent collections were from areas that probably were flooded by the Colíder Hydroelectric Plant (Usina Hidrelétrica Colíder, UHE Colíder, in Portuguese). This hydroelectric plant will be part of the Teles Pires River Hydroelectric Complex, composed of a total of six hydroelectric plants, representing a serious threat to the conservation of *X. maasiana*. However, we also found a few other specimens of the new species from two protected areas, the Araguaia National Park, a federal conservation unit, and the Xingu Indigenous Park, an indigenous reserve. So, we expect the species has some protection in these areas. Therefore, it is consistent to accept the preliminary categorization of *X. maasiana* as Near Threatened (NT).

Phenology—Specimens with flowers have been collected from May through October, and with fruits from May to September.

Etymology—The specific epithet honors Dr. Paul J. M. Maas, a Dutch botanist dedicated to the study of Neotropical plant taxonomy, with an expertise in Annonaceae and other plant groups. For over four decades he has led a large project investigating the systematics of the family (Maas 1983). Dr. Maas has contributed immensely to our knowledge of the family, having revised most of the Neotropical genera, such as *Rollinia* (now included in *Annona* L.) (Maas et al. 1992), *Duguetia* (Maas et al. 2003), and *Guatteria* (Maas et al. 2015), and he has also been responsible for the training of many specialists in Annonaceae.

Taxonomy—The leaves of *Xylopia maasiana* closely resemble those of *X. nitida*. Both have leaf blades that are oblong-elliptic or elliptic, with a golden-hyaline to golden sericeous abaxial indument, and the midrib prominently raised and keeled on the abaxial face. *Xylopia maasiana* can be distinguished, however, by all the characters described in the diagnosis and Table 1. During an overall survey for the taxonomic revision of Amazonian *Xylopia* species (Pontes-Pires et al. in prep.), the first author discovered that *X. maasiana* shares a larger number of similarities with another Amazonian species, *X. pittieri* Diels: the fusion of the sepals (only slightly connate at base), the shape and size of the sepals and petals, carpel number, monocarp shape and size, and the seed number. However, *X. maasiana* can be easily differentiated from the latter by the number of stamens (130–165 vs. (38–)50–60 in *X. pittieri*), number of locelli

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

TABLE 1. Principal morphological characters that differentiate *Xylopia maasiana* from *X. nitida*.

Character	Xylopia maasiana	Xylopia nitida
Shape of the floral bud	Narrowly oblong to narrowly triangular, nearly panduriform, slightly constricted above the base	Narrowly oblong to oblong, narrowing progressively towards the apex, without constriction
Fusion of the sepals	Sepals slightly connate at the base, connate ca. 1/3–1/6 of their length, not forming a short cup-shaped calyx	Sepals connate from 1/2 to 2/3 of their length, forming a short cup-shaped calyx
Number of stamens	130–165	170–270
Length of the fertile stamens	0.6–0.8(–0.9) mm	1–1.5 mm
Size of the staminal cone (diameter × height)	1.2–1.5 × 0.8 mm	1.8–2.2 × 1.2–1.5 mm
Number of carpels	5–9	20–30
Indument of stigma	Glabrous	Tomentellous at the apex
Number of monocarps per fruit	3–9	10–27
Shape of the monocarps	Compressed-falcate and obliquely clavate, or clavate to obovoid (when having only one 1 seed); slightly constricted between the seeds	Narrowly cylindrical or extremely narrowly oblong, sometimes slightly falcate; torulose or moniliform
Length of the seeds	7–7.5 mm	5–6.5 mm
Shape of the seeds	Oblong	Obovoid

from anthers of fertile stamens (6–8(–12) vs. 2–4(–5) in *X. pittieri*) (Fig. 1J), indument of the stigma (entirely glabrous stigmas vs. villous to tomentellous from the apex to the midpoint and glabrous from the midpoint to the base in *X. pittieri*), monocarp stipe length (6–8 mm long vs. (2.5–)3–4.5 mm in *X. pittieri*), and seed shape (oblong vs. flattened obovoid, obovoid, or ellipsoid in *X. pittieri*) and width (3–3.5 mm vs. 4–4.5 mm in *X. pittieri*). Nevertheless, in general, *X. maasiana* is not confused with *X. pittieri* in herbarium collections.

***Additional Specimens (Paratypes) Examined*—Brazil.** —AMAZONAS: Humaitá, estrada Humaitá-Jacarecanga, km 45, rio Maici-Mirim, 7°45′S, 62°32′W, 19 Jun 1982, *L. O. A. Teixeira et al. 1230* (INPA, JPB, MG, MO, NY, RB, US); Rio Curuquetê, vicinity of Cachoeira Santo Antônio, 14 Jul 1971, *G. T. Prance et al. 14205* (INPA, MG, MO, NY, OWU, R). —MATO GROSSO: Alta Floresta. Área particular de preservação ambiental, delimitada pelo Parque Estadual do Cristalino e pelos rios Teles Pires e Cristalino, a leste do rio Cristalino, nas proximidades da margem do rio Teles Pires, 9°00′S, 55°00′W, 17 Jul 2006, *D. Sasaki et al. 79* (INPA, K, SPF); Entre o Cristalino Jungle Lodge e base do Limão, em curva acentuada do rio Cristalino, 17 Dec 2006, *D. Sasaki et al. 1294* (HERBAM, K). Aripuanã, Núcleo Pioneiro de Humboldt, forest along margin of rio Aripuanã, 59°21′S, 10°12′W, 20 Oct 1973, *C. C. Berg et al. P19802* (INPA, MG, MO, NY, US). [Cocalinho]. Região de Cocalinho, 1997, *A. Rozza et al. 449* (ESA, JPB, UFMT, RB); *A. Rozza et al. 498* (ESA, JPB, UFMT, RB). Colíder. Canteiro de obras da UHE Colíder, 18 May 2011, *C. R. A. Soares et al*. 3548 (HERBAM, RB); Resgate da Flora da UHE Colíder, Lote B de supressão, 255 m elev., 2 Oct 2014, *M. Lautert et al. s.n.* (CNMT 8109, MBM 402949, RB 653442, TANG 3918); 385 m elev., 11 Aug 2015, *J. P. Battisti s.n.* (MBM 403120, RB 641501, TANG 3111); 257 m elev., 5 Sep 2014, *L. F. Sardelli et al. s.n.* (MBM 403114, RB 652317). Confresa, faz. Promissão, 8 Aug 1997, *L. C. Bernacci 2326* (ESA, IAC). Expedition Base Camp, by the Suiá Missu Ferry, c. 40 km NW of base camp, 24 Sep 1968, *R. M. Harley & R. Souza 10240* (IAN, MO, NY, RB, UB). Itaúba. Margem do rio Renato, afluente do rio Teles Pires, 14 Jul 2008, *V. Maioli et al. 718* (RB, SPF); Resgate da Flora da UHE Colíder, Lote C de supressão, 255 m elev., 19 Sep 2014, *D. C. Dias et al. s.n.* (HCF 24488, HERBAM 12498, MBM 402618, RB 640724, TANG 3232). Luciara, margem direita rio Preto, Parque Indígena do Xingu, 8 Jun 1990, *M. Macedo & S. Assumpção 2519* (INPA). Nova Canaã do Norte. Resgate de Flora da UHE Colíder, Lote A de supressão, 251 m elev., 10 Sep 2014, *S. A. Antoniazzi et al. s.n.* (HERBAM 12497, MBM 398648, TANG 2235); 256 m elev., 14 Jul 2015, *H. R. W. Zanin s.n.* (CNMT 8565, MBM 404594, RB 669481). Novo Mundo, Ilha do Sol no rio Teles Pires, 9°38′48″S, 55°55′06″W, 223 m elev., 14 Sep 2007, *G. S. Henicka et al. 91* (HERBAM, INPA, K, SPF). Parque Indígena do Xingu. Posto Leonardo, 15 Jul 1973, *M. Emmerich 3753* (R); Posto Leonardo, Aldeia Savalapíti, 29 Sep 1974, *M. Emmerich 4199* (R); Aldeia as Camaiuras, Sep 1965, *E. A. Filho & D. F. Coelho s.n.* (UEC 30821). Rio Juruena, nas proximidades da Cachoeira de Todos os Santos, SC 21 VB PT1, 20 May 1977, *N. A. Rosa & M. R. Santos 1947* (HAMAB, INPA, MG, NY [2 sheets]). Rio Teles Pires, Instituto Ecológico Cristalino, margin of rio Cristalino, 9°35′48″S, 55°55′55″W, 16 Aug 1994, *B. Dubs 1665* (ESA, U). Sinop, margem direita rio Nandico, 30 May 1995, *M. Macedo et al. 4165* (INPA, UFMT). — PARÁ: Conceição do Araguaia, entre Morro de Areia e Bacabau, 9 Sep 2001, *L. C. B. Lobato et al. 2848* (MG). —RONDÔNIA: Machadinho do Oeste, Tabajara, rio Machado, beira do rio Marmelo, 8°57′24″S, 61°55′57″W, 95 m elev., 1 Jun 2015, *N. C. Bigio et al. 1672* (MO, NY, RON). Porto Velho, saída leste de Mutum Paraná, margem esquerda do rio Mutum Paraná, 9°37′32″S, 64°52′14″W, 90 m elev., 28 Jun 2010, *G. Pereira-Silva et al. 15543* (CEN, HUEFS, INPA, RB, RON). —TOCANTINS [GOIÁS, before the division]: Ilha do Bananal, Parque Nacional do Araguaia (IBDF) nr HQ, ca. 2 Km from Macaúba, 10°30′S, 50°30′W, 17 Sep 1980, *J. A. Ratter et al. 4432* (MO, NY, UB, UEC).

Our herbarium and field studies have confirmed that *Xylopia maasiana* is not known to occur north of the Amazon River, where *X. nitida* is mainly distributed. In order to clarify our taxonomic delimitation, we present some aspects of the nomenclature and geographic distribution of *X. nitida*, in anticipation of a full treatment of the Amazonian *Xylopia* species (Pontes-Pires et al. in prep.).

XYLOPIA NITIDA Dunal, Monogr. Anonac. 122. t. 20. 1817. *Xylopicrum nitidum* (Dunal) Kuntze, Rev. Gen. Pl. 1: 8. 1891. TYPE: FRENCH GUIANA. Hab. in montibus Orjac propè Cayennam, *Martin s.n.* (holotype: G-00201468 (digital image!) [photo in F!, MO!, NY!], isotypes: B-10-0249564 (digital image!) [photo in F!, MO!, NY!], FI-FI004818 (digital image!), FI-FI004819 (digital image!), K-000221079 (digital image!), P-00202480 (digital image!), P-P00202481 (digital image!), P-P00202482 (digital image!), P-P00202483 (digital image!), R 60814 [2 sheets, R-000060814!, R-000060814a!], US-1379829!).

Xylopia cinerea Sandw., Bull. Misc. Inform. Kew. 10: 478. 1930. TYPE: GUYANA. Essequibo River, Moraballi Creek, near Bartica, 1 Nov 1929, *N. Y. Sandwith 543* (holotype: K-000221076 (digital image!), K-000221077 (digital image!), K-000221078 (digital image!), isotypes: B-100242294 (digital image!), F-893773 [fragment!], NY-00066756!, P-00202501 (digital image!) [photo in F!, MO!], RB-00577778!, U-0000438 (digital image!), US-00098772!).

Xylopia nitida Dunal var. *nervosa* R.E.Fr., Acta Horti Berg. 12(2): 286. 1937. TYPE: BRAZIL, Amazonas, Municipality of São Paulo de Olivença, 26 Oct - 11 Dec 1936, *B. Krukoff 8715* (holotype: NY!, isotypes: A-00039724 (digital image!), BM-000554090 (digital image!), G-00226130 (digital image!), GB-GB-0047048 (digital image!), F!, K-000221080 (digital image!), LA-00000050 (digital image!), LE-00001860 (digital

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

image!), L-LP002769 (digital image!), MICH-1115460 (digital image!), MO!, P-00734913 (digital image!), S-R-6861 (digital image!), U-000418 (digital image!), US-00149228! [2 sheets]).

Distribution and Habitat—*Xylopia nitida* is a widely distributed species, occurring in Brazil, French Guiana, Guyana, Peru, Suriname, and Venezuela. In Brazil, it is found in the states of Amapá, Amazonas, and Pará. It occurs in lowland moist forests, in riverine seasonally flooded areas (várzea forest) or not (terra firme forest), and also in lowland dry forests, all generally less disturbed.

***Selected Specimens Examined*—Brazil.** —Amapá: Calçoene, 11 Dec 1984, *B. V. Rabelo et al. 2985* (HAMAB, MG, OWU). —Amazonas: Manaus. Estação Biológica, Km 60, Manaus-Caracaraí, 16 Jan 1991, *D. Coelho & J. Coelho s.n.* (INPA 161808); EEFT, Km 40, 6 Apr 2000, *V. F. Kinupp s.n.* (INPA 208836, JPB); Estrada do Jardim Tarumãzinho, a 2 Km da Cachoeira, 18 Nov 1975, *O. P. Monteiro s.n.* (INPA 53553). —Pará: Almeirim, Mt. Dourado, área do ideal, 07 Feb 1980, *N. T. Silva 5238* (INPA, MG). Ilha de Marajó, rio Anajás, logo acima de Anajás, 0°59′S, 49°55′W, 1 Nov 1987, *G. T. Prance et al. 30199* (EAC, F, INPA, HAMAB, MG, MO, NY, U). [Novo Repartimento], Remansão, rio Tocantins, 1 Jul 1948, *R. L. Fróes 23508* (INPA). Peixe-Boi, Vila do Ananim, 1 Apr 2000, *F. Cardoso et al. s.n.* (MG 105031). Prainha, Curuá-Una, Distrito de Barreirinha, Projeto Curuá-Una, 8 Sep 1977, *Pessoal do L.P F./Brasília 971* (INPA). **French Guiana.** Cayenne, piste de Saint-Elie – Interfluve Sinnamary/Counamana, piste km 22, 5°20′S, 53°0′W, 9 Oct 1989, *D. Sabatier & M. F. Prevost 3032* (INPA, MO, NY, P, U, US). **Guyana.** Base of Mt. Makarapan, Makarapan Creek about 1/2 mile downstream from rapids, near abandoned balata bleeders camp, 3°59′N, 58°57′W, 80–130 m elev., 17 Sep 1988, *P. J. M. Maas et al. 7498* (INPA, MG, NY, U); 17 Sep 1988, *P. J. M. Maas et al. 7512* (F, INPA, MO, NY, U, US). Demerara compartment, CD 920 road forest, and Mabura region, Centra, 5°1.95′95′′N, 58°37.73′73′′W, 11 Mar 1993, *R. C. Ek 746* (NY). Kanuku Mts., Maipaima, Camp 3 on Tsikoma Creek, 3°22′N, 59°30′W, 160 m elev., 25 Nov 1987, *M. J. Jansen-Jacobs et al. 1232* (MO). Rupununi Distr., Bushmouth Shea to Quitaro R., Bowl Creek, 2°54′N, 59°7′W, 200 m elev., 28 Aug 1995, *M. J. Jansen-Jacobs et al. 4892* (NY). U. Takutu – U. Essequibo Region: Bulldozed treefall along road clearing, ca. 15 km NE of Surama village, 4°15′N, 58°56′W, 90 m elev., 27 Feb 1990, *T. McDowell et al. 2072* (NY). **Peru.** —Loreto: Requena, Centro Forestal J. Herrera, cerca al arboretum, márgem derecha del Río Ucayali, 25 Feb 1982, *F. Encarnación 26047* (MBM). **Suriname.** Jodensavanne-Mapane Creek área, rain forest near camp 8, 9 Nov 1968, *L.B.B. 1076* (U, digital image!). Sipaliwini, 3.13 km SW from Kwamalasamutu village center, access trail begins at confl. Peritu Eeku (creek) & Sipalawini R. (1.0 ha research plot "KW3"), 2°20′4′′N, 56°48′21′′W, 220 m elev., 26 Apr 2005, *B. Hoffman 6201* (U, digital image!). **Venezuela.** —Bolívar: Dist. Roscio, "El Abismo", dry forested slopes of small range S of río Samay and N of río Icabaru, 4°23′N, 61°38′W, 600–700 m elev., 23 Oct 1985, *B. K. Holst & R. Liesner 2436* (MO). —Delta Amacuro: Campamento de río Grande, este-Noreste de El Palmar, cerca de los límites del Estado Bolívar, 25 Feb 1982, *L. Marcano-Berti 581* (INPA, MBM, NY, SP, UFP).

Acknowledgments

The authors thank Fundação de Amparo à Pesquisa do Estado de Mato Grosso (FAPEMAT) for partially financing this project (Process no. 161293/2014) and for the doctoral grant awarded to AFPP; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) for a PDSE grant (Process no. 88881.135436/2016-01) awarded to AFPP and also for financing in part this study (Finance Code 001); and Ohio Wesleyan University (OWU) for kindly hosting AFPP during her stay in the USA. We also thank the curators and staff of the herbaria mentioned in the text; Regina Carvalho for preparing the illustration; Raimundo Luciano Soares Neto for preparing the distribution map; Guilherme Pontes Leitão for helping to prepare the figure plate. The authors also thank Dr. Adriana Lobão and Dr. W. Wayt Thomas for their valuable comments and critical review of the first version of this manuscript, and Dr. Thomas Couvreur and an anonymous reviewer for their helpful suggestions on the manuscript.

Author Contributions

This study is part of AFPP's Ph.D. thesis, supervised by MRVB and DMJ. AFPP collected the data, carried out the taxonomic study, described the new species, and prepared the first draft of the manuscript. All authors discussed the data. MRVB and DMJ made relevant suggestions and additions to the final version of the manuscript.

Literature Cited

Bachman, S., J. Moat, A. W. Hill, J. de la Torre, and B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: Geospatial conservation assessment tool. *ZooKeys* 150: 117–126.

Cardoso, D., T. Särkinen, S. Alexander, A. M. Amorim, V. Bittrich, M. Celis, D. C. Daly, P. Fiaschi, V. A. Funk, L. L. Giacomin, R. Goldenberg, G. Heiden, J. Iganci, C. L. Kelloff, S. Knapp, H. C. de Lima, A. F. P. Machado, R. M. dos Santos, R. Mello-Silva, F. A. Michelangeli, J. Mitchell, P. Moonlight, P. R. L. de Moraes, S. A. Mori, T. S. Nunes, T. P. Pennington, J. R. Pirani, G. T. Prance, L. P. de Queiroz, A. Rapini, R. Riina, C. A. V. Rincon, N. Roque, G. Shimizu, M. Sobral, J. R. Stehmann, W. D. Stevens, C. M. Taylor, M. Trovó, C. van den Berg, H. van der Werff, P. L. Viana, C. E. Zartman, and R. C. Forzza. 2017. Amazon plant diversity revealed by a taxonomically verified species list. *Proceedings of the National Academy of Sciences USA* 114: 10695–10700.

Chatrou, L., M. D. Pirie, R. H. J. Erkens, T. L. P. Couvreur, K. M. Neubig, J. R. Abbott, J. B. Mols, J. W. Maas, R. M. K. Saunders, and M. W. Chase. 2012. A new subfamilial and tribal classification of the pantropical flowering plant family Annonaceae informed by molecular phylogenetics. *Botanical Journal of the Linnean Society* 169: 5–40.

Dias, M. C. 1988. *Estudos Taxonômicos do Gênero* Xylopia *L. (Annonaceae) no Brasil Extra-Amazônico.* Masters Dissertation. Campinas: Universidade Estadual de Campinas.

Doyle, J. A., P. C. Bygrave, and A. Le Thomas. 1998. Combined analyses of morphological and *rbcL* data: Implications for phylogeny and morphological evolution in Annonaceae. *Annonaceae Newsletter* 12: 20–24.

Dunal, M. F. 1817. *Monographie de la Famille Anonacées.* Paris: Treuttel et Würtz.

Fearnside, P. M. 2005. Deforestation in Brazilian Amazonia: History, rates, and consequences. *Conservation Biology* 19: 680–688.

Fries, R. E. 1900. Beiträge zür Kenntnis der Süd-Amerikanischen Anonaceen. *Kungl. Svenska Vetenskapsakademiens Handlingar* 34: 1–59.

Fries, R. E. 1930. Revision der Arten einiger Anonaceen-Gattungen I. *Acta Horti Bergiani* 10: 1–128.

Fries, R. E. 1931. Revision der Arten einiger Anonaceen-Gattungen II. *Acta Horti Bergiani* 10: 129–341.

Fries, R. E. 1934. Revision der Arten einiger Anonaceen-Gattungen III. *Acta Horti Bergiani* 12: 1–220.

Fries, R. E. 1937. Revision der Arten einiger Annonaceen-Gattungen IV. *Acta Horti Bergiani* 12: 221–288.

Fries, R. E. 1939. Revision der Arten einiger Annonaceen-Gattungen V. *Acta Horti Bergiani* 12: 289–577.

Fries, R. E. 1959. Annonaceae. Pp. 1–171 in *Die Natürlichen Pflanzenfamilien*, ed. 2, vol. 17aII, ed. H. Melchior. Berlin: Duncker und Humblot.

IBGE. 2002. Instituto Brasileiro de Geografia e Estatística. Perfil dos Municípios Brasileiros Meio Ambiente 2002. https://biblioteca.ibge.gov.br/index.php/bibliotecacatalogo?view=detalhes&id=26063 (last accessed May 2018).

IUCN. 2012. IUCN red list categories and criteria version 3.1. Ed. 2. Gland, Switzerland and Cambridge, UK: IUCN.

IUCN. 2017. Guidelines for using the IUCN Red List categories and criteria, version 13. IUCN.

Johnson, D. M. and N. A. Murray. 2018. A revision of *Xylopia* L. (Annonaceae): The species of tropical Africa. *PhytoKeys* 97: 1–252.

Maas, P. J. M. 1983. Project systematics of Annonaceae. *Taxon* 32: 528–529.

Maas, P. J. M., L. Y. T. Westra, J. Koek-Noorman, B. J. H. ter Welle, W. Morawetz, W. Hemmer, M. Waha, A. Le Thomas, E. van der Heijden, F. Bouman, A. Cavé, M. Leboeuf, O. Laprévote, A. C. Webber, and K. S. Brown Jr. 1992. Rollinia. *Flora Neotropica Monograph* 57: 1–188.

Maas, P. J. M., L. Y. T. Westra, L. W. Chatrou, M. E. Bakker, J. Koek-Noorman, B. J. H. ter Welle, A. M. Benko-Iseppon, G. Gottsberger, L. M. K. Junikka, A. Le Thomas, W. Morawetz, F. Roblot, R. Hocquemiller, M. Leboeuf, A. Cavé, M. G. M. van Roosmalen, E. Svoma, and A. C. Webber. 2003. *Duguetia* (Annonaceae). *Flora Neotropica Monograph* 88: 1–274.

Maas, P. J. M., L. Y. T. Westra, S. A. Guerrero, A. Q. Lobão, U. Scharf, N. A. Zamora, and R. H. J. Erkens. 2015. Confronting a morphological nightmare: Revision of the Neotropical genus *Guatteria* (Annonaceae). *Blumea* 60: 1–219.

Pontes-Pires, A. F. and D. Johnson. 2020. *Xylopia* in Flora do Brasil 2020. Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB110555 (accessed January 2020).

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

Quantum GIS Development Team. 2018. Quantum GIS Geographic Information System. Open Source Geospatial Foundation Project. http://qgis.osgeo.org/.

Radford, A. E., W. C. Dickison, J. R. Massey, and C. R. Bell. 1974. *Vascular Plant Systematics*. New York: Harper & Row.

Soares-Filho, B. S., D. C. Nepstad, L. M. Curran, G. C. Cerqueira, R. A. Garcia, C. A. Ramos, E. Voll, A. McDonald, P. Lefebvre, and P. Schlesinger. 2006. Modelling conservation in the Amazon basin. *Nature* 440: 520–523.

Stull, G. W., D. M. Johnson, N. A. Murray, T. L. P. Couvreur, J. E. Reeger, and C. M. Roy. 2017. Plastid and seed morphology data support a revised infrageneric classification and an African origin of the Pantropical genus *Xylopia* (Annonaceae). *Systematic Botany* 42: 211–225.

Ter Steege, H., N. C. A. Pitman, T. J. Killeen, W. F. Laurance, C. A. Peres, J. E. Guevara, R. P. Salomão, C. V. Castilho, I. L. Amaral, F. D. A. Matos, L. S. Coelho, W. E. Magnusson, O. L. Phillips, D. A. Lim Filho, M. J. V. Carim, M. V. Irume, M. P. Martins, J. Molino, D. Sabatier, F. Wittmann, D. C. López, J. R. S. Guimarães, A. M. Mendoza, P. N. Vargas, A. G. Manzatto, N. F. C. Reis, J. Terborgh, K. R. Casula, J. C. Montero, T. R. Feldpausch, E. N. H. Coronado, A. J. D. Montoya, C. E. Zartman, B. Mostacedo, R. Vasquez, R. L. Assis, M. B. Medeiros, M. F. Simon, A. Andrade, J. L. Camargo, S. G. W. Laurance, H. E. M. Nascimento, B. S. Marimon, B. Marimo. Jr., F. Costa, N. Targhetta, I. C. G. Vieira, R. Brienen, H. Castellanos, J. F. Duivenvoorden, H. F. Mogollón, M. T. F. Piedade, G. A. Aymard C., J. A. Comiskey, G. Damasco, N. Dávila, R. García-Villacorta, P. R. S. Diaz, A. Vincentini, T. Emilio, C. Levis, J. Schietti, P. Souza, A. Alonso, F. Dallmeier, L. V. Ferreira, D. Neill, A. Araujo-Murakami, L. Arroyo, F. A. Carvalho, F. C. Souza, D. D. do Amaral, R. Gribel, B. G. Luize, M. P. Pansonato, E. Venticinque, P. Fine, M. Toledo, C. Baraloto, C. Cerón, J. Engel, T. W. Henkel, E. M. Jimenez, P. Maas, M. C. P. Mora, P. Petronelli, J. D. C. Revilla, M. Silveira, J. Stropp, R. Thomas-Caesar, T. R. Baker, D. Daly, M. R. Paredes, N. F. da Silva, A. Fuentes, P. M. Jørgensen, J. Schöngart, M. R. Silman, N. C. Arboleda, B. B. L. Cintra, F. C. Valverde, A. Di Fiore, J. F. Phillips, T. R. van Andel, P. von Hildebrand, E. M. Barbosa, L. C. M. Bonates, D. de Castro, E. S. Farias, T. Gonzales, J. Guillaumet, B. Hoffman, Y. Malhi, I. P. A. Miranda, A. Prieto, A. Rudas, A. R. Ruschell, N. Silva, C. I. A. Vela, V. A. Vos, E. L. Zent, S. Zent, A. Cano, M. T. Nascimento, A. A. Oliveira, H. Ramirez-Angulo, J. F. Ramos, R. Sierra, M. Tirado, M. N. U. Medina, G. van der Heijden, E. V. Torre, C. Vriesendorp, O. Wang, K. R. Young, C. Baider, H. Balslev, N. de Castro, W. Farfan-Rios, C. Ferreira, C. Mendoza, I. Mesones, A. Torres-Lezama, L. E. U. Giraldo, D. Villarroel, R. Zagt, M. N. Alexiades, K. Garcia-Cabrera, L. Hernandez, I. Huamantupa-Chuquimaco, W. Milliken, W. P. Cuenca, S. Pansini, D. Pauletto, F. R. Arevalo, A. F. Sampaio, E. H. V. Sandoval, and L. V. Gamarra. 2015. Estimating the global conservation status of more than 15,000 Amazonian tree species. *Science Advances* 1: e1500936.

Ter Steege, H., R. W. Vaessen, D. Cárdenas-López, D. Sabatier, A. Antonelli, S. M. de Oliveira, N. C. A. Pitman, P. M. Jørgensen, and R. P. Salomão. 2016. The discovery of the Amazonian tree flora with an updated checklist of all known tree taxa. *Scientific Reports* 6: 1–15.

Thiers, B. 2019. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/science/ih/ (last accessed July 2019).

Thomas, D. C., L. W. Chatrou, G. W. Stull, D. M. Johnson, D. J. Harris, U. Thongpairoj, and R. M. K. Saunders. 2015. The historical origins of paleotropical intercontinental disjunctions in the pantropical flowering plant family Annonaceae. *Perspectives in Plant Ecology, Evolution and Systematics* 17: 1–16.

Van Heusden, E. C. H. 1992. Flowers of Annonaceae: Morphology, classification, and evolution. *Blumea* Supplement 7: 1–218.

Van Setten, A. K. and J. Koek-Noorman. 1992. Studies in Annonaceae. XVII. Fruits and seeds of Annonaceae: Morphology and its significance for classification and identification. *Bibliotheca Botanica* 142: 1–152.

Downloaded From: https://complete.bioone.org/journals/Systematic-Botany on 28 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use