

ORIGINAL ARTICLE

Phyllanthus chacoensis (Phyllanthaceae): new record for the Brazilian Amazon and its lectotypification

Jone Clebson Ribeiro MENDES¹, Ricardo de S. SECCO², Sarah Maria ATHIÊ-SOUZA^{1*}, Margareth Ferreira de SALES¹

¹ Universidade Federal Rural de Pernambuco, Programa de Pós-Graduação em Biodiversidade, Av. Dom Manuel de Medeiros, s.n., Dois Irmãos, CEP 521.719-30, Recife, PE, Brazil

² Museu Paraense Emílio Goeldi, Coordenação de Botânica, Terra Firme, Av. Perimetral 1901, CEP 66040-170, Belém, PA, Brazil

* Corresponding author: sarah_athie@yahoo.com.br;  <https://orcid.org/0000-0002-6090-981X>

ABSTRACT

The first record of *Phyllanthus chacoensis* for the Brazilian Amazon is presented, based on a specimen from Rondônia state. The species can be recognized by its cauliflorous inflorescence, staminate and pistillate flowers with 4 sepals, devoid of a floral disk, 4 stamens, 2-carpellary ovary, drupaceous, ellipsoidal fruits, with one seed per locule. The species was previously known only from the central-western and northeastern regions of the Caatinga and Pantanal domains in Brazil. We provide a list of synonyms, a detailed description, an updated geographic distribution map in Brazil, data on habitat and conservation status, illustrations of its reproductive characters, and detailed photographs. We also propose a lectotype for the species.

KEYWORDS: Neotropics, nomenclature, northern Brazil, taxonomy

Phyllanthus chacoensis (Phyllanthaceae): novo registro para a Amazônia brasileira e sua lectotipificação

RESUMO

Apresentamos o primeiro registro de *Phyllanthus chacoensis* para a Amazônia brasileira, baseado em um espécime encontrado em Rondônia. A espécie pode ser reconhecida pela inflorescência cauliflora, flores de ambos os sexos com 4 sépalas, desprovidas de disco floral, 4 estames, ovário 2-carpelar e frutos elipsoides, drupáceos, com uma semente por lóculo. No Brasil, a espécie era referida, até o momento, apenas para as regiões Centro-Oeste e Nordeste nos domínios Caatinga e Pantanal. Apresentamos a lista de sinônimos, descrição morfológica detalhada, um mapa atualizado da distribuição geográfica no Brasil, dados sobre habitat e status de conservação, assim como fotos em campo e ilustração dos caracteres reprodutivos. Adicionalmente, propomos um lectótipo para o nome.

PALAVRAS-CHAVE: Neotrópicos, nomenclatura, norte do Brasil, taxonomia

INTRODUCTION

The Amazonian lowland rainforest is home to almost 190 plant families, of which Phyllanthaceae is represented by 55 species from eight genera (*Amanoa* Aubl., *Chonocentrum* Pierre ex Pax & K.Hoffm., *Didymocistus* Klotzsch, *Hyeronima* Allemão, *Jablonskia* G.L.Webster, *Margaritaria* L.f., *Phyllanthus* L., and *Richeria* Vahl) (Cardoso *et al.* 2017; Flora do Brasil 2020 [under construction]). The Brazilian Amazon is the third biome in terms of *Phyllanthus* diversity, with 33 species, after the Atlantic Forest (52 species) and Cerrado (43) (Flora do Brasil 2020 [under construction]). *Phyllanthus* has a cosmopolitan distribution, with 880 species globally, of which over 200 occur in the Neotropics; 90 to 110 species have been

recorded for Brazil in all vegetation types (Webster 2002; Kathriarachchi *et al.* 2006; Silva and Sales 2007; Bouman *et al.* 2018; Flora do Brasil 2020 [under construction]).

The species richness of the genus in Brazil is almost certainly underestimated, since the last major revision was published in the Flora Brasiliensis by Müller Argoviensis in 1873 and included 71 species. More recently, floristic studies by Webster (2002) and Silva and Sales (2007) made important contributions to the understanding of the morphology of several taxa. The floristic knowledge of the Amazon basin is even more precarious, as pointed out by Hopkins (2005) and Ter Steege *et al.* (2013) and, consequently, the diversity of *Phyllanthus* in the region is probably underestimated, as exemplified here with the recognition of a new record of a

CITE AS: Mendes, J.C.R.; Secco, R.S.; Athiê-Souza, S.M.; Sales, M.F. 2021. *Phyllanthus chacoensis* (Phyllanthaceae): new record for the Brazilian Amazon and its lectotypification. Acta Amazonica 51: 52-57.

Phyllanthus tree species in the Brazilian Amazon, *Phyllanthus chacoensis* Morong.

Taxonomic advances in the Amazon region are hampered by low numbers of herbaria and deposited specimens, low collection rates, and relatively few specialized taxonomists (Barbosa *et al.* 2003), which helps explain the relatively few studies and the low capacity for determining the real diversity of *Phyllanthus* (e.g., Rodrigues 1971; Webster 2004; Secco 2013; Secco and Rosário 2015; Secco and Silveira 2016). Additionally, *Phyllanthus* is one of the most morphologically complex groups of Phyllanthaceae due to its variable habits (herbs to trees), phyllanthoid or non-phyllanthoid branching, and tiny gamosepalous pistillate flowers with disks commonly entire, and disks segmented and alternisepalous in staminate flowers (Silva and Sales 2004, 2007).

As a result of increased collection efforts and extensive analyses of herbarium specimens as part of a revision of *Phyllanthus* conducted by the first author, an indeterminate specimen (with duplicates deposited at INPA, NY and RB herbaria) that had been collected 58 years ago in what is now Rondônia state (northern Brazil) was encountered. We identified the collection as *P. chacoensis*, representing a new record for the Amazonian flora. In addition to the description of the new record, we propose its lectotypification and discuss its conservation status.

MATERIAL AND METHODS

Specimens of *Phyllanthus chacoensis* deposited in collections at the INPA, NY and RB herbaria were identified based on the types stored at CORD, F, G, GH, K, MICH, MO, MPU, NDG, NY, P, PH, UC and US (acronyms according to Thiers 2020, updated continuously) and compared with information published by Silva and Sales (2007, 2008) and Melo *et al.* (2013). Data concerning their geographic distributions were obtained from herbarium labels and from the aforementioned literature. The descriptive terminology follows Silva and Sales (2007), complemented by Radford *et al.* (1974). The typification was based on the rules of International Nomenclature (Turland *et al.* 2018). Maps were prepared using QGIS 2.3 software, based on data from geographic coordinates from herbarium labels, or estimated from locality data. The conservation status of the species was reevaluated according to the IUCN methodology and the IUCN Red List Categories and Criteria (IUCN 2012), using the Geocat web tool (<http://geocat.kew.org/>), following Bachman *et al.* (2011).

RESULTS

Phyllanthus chacoensis Morong, Ann. New York Acad. Sci. 7: 218. 1892. *Aporosella chacoensis* (Morong) Speng., Cat. Descr. Maderas 349. 1910. **Type:** PARAGUAY. Gran Chaco, Asunción, *T. Morong* 355 (lectotype designated here

NY00273054!; isoelectotypes CORD00003196!, F0057015F!, G00307040!, GH00048576!, K000573219!, MICH1104948!, NDG29188!, NY00579396!, NY00273055!, NY00273056!, PH00031117!, US00109220!, US00997721!).

= *Aporosella hassleriana* Chodat, Bull. Herb. Boissier, II. 5: 489. 1905. **Type:** PARAGUAY. Concepción, *E. Hassler* 7161 (lectotype G00229904!, designated by Ramella & Zuloaga 2017: 404; isoelectotypes [negative F0BN005009!], G00229906!, G00229907!, G00229911!, G00229912!, MO260328!, MPU014790!, MICH1107950!, NY00246237!, P00608946!, P00608947!, P00608948!, P00608949!, UC941632!).

= *Sebastiania singularis* Rizzini, Leandra 3–4(4–5): 7. 1974. **Type:** BRAZIL. Bahia. Casa Nova: crescit in caatinga ad Casa Nova, *F.B. Ramalho* 190 (holotype RB00549688!, isotypes HST4106!, HUCPE611!, PEUFR37471!).

Tree 2–6 m high (Figure 1a), monoecious. Branching phyllanthoid, glabrous, reddish; branches 6–20 cm long, angular, lenticellate, brown. Cataphylls ca. 2 mm long, widely triangular, membranous; cataphyllary stipules, triangular-ovate, ca. 1.5 mm long, with fimbriate margins. Stipules 1–1.5 mm long, triangular, margins fimbriate. Petiole ca. 2 mm long, glabrous. Leaf blade 1.5–2.5 × 1–2.5 cm (Figure 1b), green-opaque, chartaceous, widely elliptic to orbicular or obovate; base obtuse; apex rounded to retuse; glabrous; margins slightly denticulate, with the presence of glands in the indentations; venation brochidodromous. Inflorescences cauliflorous, 3–4 cm long, thyrsiform (Figure 1c, d), unisexual, peduncle ca. 4 mm long, glabrous; staminate thyrses 9 to 12-cymules, each cymule with 3 flowers; pistillate thyrses with 8–10 cymules, each cymule with 1 to 2-flowers; staminate and pistillate cymules each subtended by a bract, oval-deltoid, acuminate, each flower surrounded by a lanceolate bracteole. Staminate flowers (Figure 1f), ca. 2 mm long, pinkish or green; pedicel 1–2 mm long, glabrous; sepals 4, 1–1.5 mm long, oblong-spatulate, rounded at the apex, margins entire to slightly fimbriate; disk absent; stamens 4, subsessile, free, anthers oblong, vertically dehiscent. Pistillate flowers (Figure 1g), 1–2 mm long, pinkish or green; pedicel ca. 3 mm long, glabrous; sepals 4, 0.8–1.5 mm long, oblong-spatulate, rounded at the apex, margins entire to slightly fimbriate; disk absent; ovary ca. 0.6–0.8 mm long, ellipsoidal, reddish; 2-locular, with 1 ovule per locule; styles connate at the base, deeply bifid, curved downward. Fruits drupaceous, 6–8 × 4–5.2 mm (Figure 1e, h), green, ellipsoidal, with sepals and styles persistent; fruit pedicel 4–6 mm long. Seeds 3–5 × ca. 4 mm, subglobose, grayish-brown, smooth to slightly wrinkled.

Representative specimens examined: Brazil. **Alagoas:** Traipu, 18.II.2014 (fr.), E. Melo *et al.* 12421 (HUEFS, P). **Bahia:** Morpará, 15.XII.2007 (fl., fr.), A.A. Conceição *et al.* 2638 (HUEFS). **Mato Grosso do Sul:** Corumbá, 15.IX.1989 (fl., fr.), A. Pott *et al.* 4936 (SP, CPAP). **Pernambuco:** Petrolina,

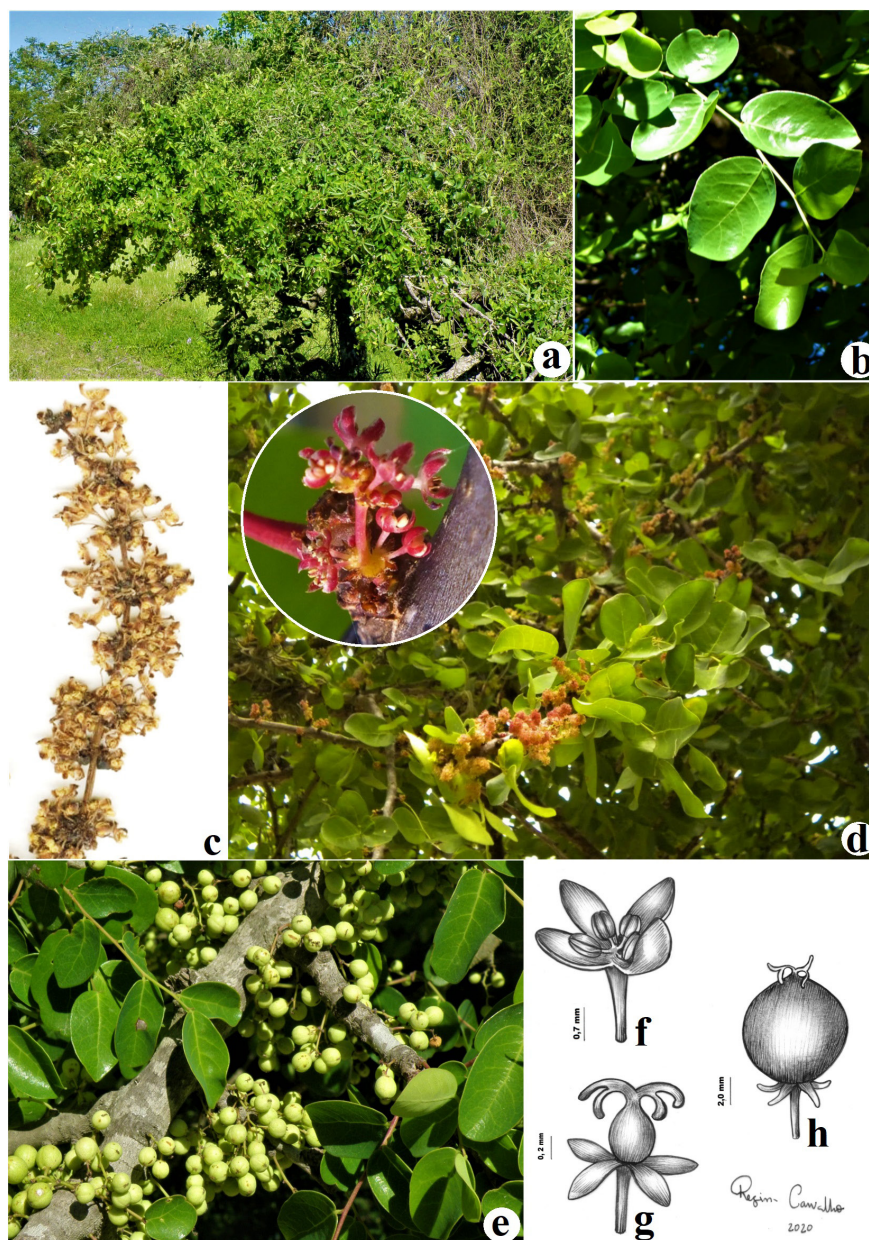


Figure 1. *Phyllanthus chacoensis*. A – Habit; B – Leaf blade; C and D – Cauliflorous inflorescence (with details of the flowers in D); E – Fruits; F – Staminate flower; G – Pistillate flower; H – Drupaceous fruit, ellipsoidal, with persistent sepals and styles. A, B, D and E: images provided by Paraguay Biodiversity; C: E. Hassler (7161); F, G and H: drawing by Regina Carvalho. This figure is in color in the electronic version.

15.III.1983 (fl., fr.), Fotius 3652 (IPA). **Rondônia** [new record]: Forte Príncipe da Beira, 6.I.1962 (fl.), W.A. Rodrigues & B.W.P. Albuquerque 4256 (INPA10822, NY01461186, NY01461187). **Sergipe**: Neópolis, 19.II.2014 (fr.), E. Melo *et al.* 12458 (HUEFS, P).

Distribution and habitat: Exclusive to South America, recorded in Argentina, Paraguay, and Brazil. In Brazil, it was previously known from northeastern (Alagoas, Bahia, Pernambuco, Sergipe) and midwestern (Mato Grosso do Sul) states (Lourteig and O’Donell 1942; Silva and Sales 2007; Secco *et al.* 2018, Flora do Brasil 2020 [under construction]).

The distribution of *P. chacoensis* is expanded here to the northern region of that country (the Brazilian Amazon; Figure 2). The new record was found along the margins of an *igapó* (seasonally inundated forest), which confirms the species’ preference for swampy or riparian environments.

Conservation status: According to IUCN (2012) criteria, the species is classified as endangered (EN) - ENB1ac (iii), as it has an extent of occurrence (EEO) of 204,000 km² (including the new record). *Phyllanthus chacoensis* should therefore be the target of collection efforts to assist in the selection of priority areas for its conservation. Most of the collected specimens in

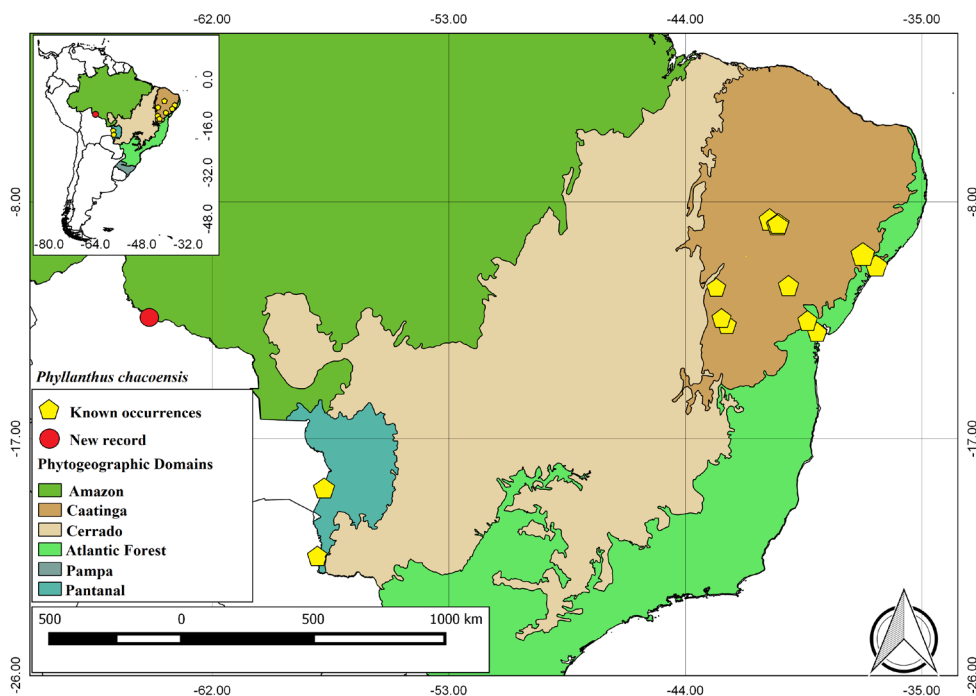


Figure 2. Geographic distribution of *Phyllanthus chacoensis* in Brazil, including the new record. This figure is in color in the electronic version.

Brazil were encountered in riparian vegetation, such as along the banks of the São Francisco River (northeastern region), the Paraguay River (midwestern region), and Guaporé River (northern region), which suffer from constant anthropic impacts, including dense urban occupation and the discharge of untreated domestic sewage, resulting in biodiversity loss.

Taxonomic notes: Thomas Morong (1892) described *Phyllanthus chacoensis* based on syntypes “*In the Gran Chaco, opposite Asuncion (355)*”. = *Balansa 1712, Fendler Panama 140, Fendler 323*”. The collection *Morong 355* is the most likely to have been used by the author in the description. However, four specimens were found in the author’s main herbarium (NY). The material selected as a lectotype is deposited under registration (NY00273054; Figure 3), as it is the best conserved and has flowers of both sexes.

DISCUSSION

The Amazon region represents a distinct phytogeographic province characterized by a humid tropical forest of enormous biomass, heterogeneity, and diversity (Braga 1979). Collection efforts such as the “Projeto Flora Amazônica (CNPq/NSF)”, initiated in 1976 (Secco 2018), have made significant progress in increasing our knowledge of the flora of the Brazilian Amazon, with many expeditions and a large number of plant specimens deposited in regional herbaria (with duplicates distributed among national and international herbaria). However, considering the extent of the region, the collection rate in the region is still the lowest in Brazil (Hopkins 2019). The new record of *P. chacoensis* for the Brazilian Amazon

reinforces the importance of these botanical collections, as the species had not been collected in the region since 1962. We have not found any more recent collection in the region. However, collections of *P. chacoensis* are much more numerous in northeastern and central-western Brazil (ca. 33 and six specimens respectively), collected since 1984.

Phyllanthus chacoensis is the only species in the subsection *Aporosella* (Chodat) G.L.Webster (*P. sect. Cicca* (L.) Müll.Arg. and *P. subg. Kirganelia* (A.Juss.) Kurz) (Webster 1957, 2001; Bouman *et al.* 2018), and can be differentiated from other Brazilian species by the absence of a floral disk in staminate and pistillate flowers, and by having four sepals and stamens, cauliflorous inflorescences, a 2-carpellar ovary, and fruits with one seed per locule (Silva and Sales 2007; Melo *et al.* 2013). *Phyllanthus chacoensis* is morphologically similar to *P. elsiae* Urb., which is found in Argentina (Silva and Sales 2007), although the former can be distinguished by being monoecious (vs dioecious in *P. elsiae*), by having a 2-locular ovary (vs 3-locular), styles deeply 2-fid, curved downwards (vs joined in a column and descending) and ellipsoidal fruits (vs oblate-spheroidal).

CONCLUSIONS

A new record of *Phyllanthus chacoensis* in the Brazilian Amazon expands the distribution of the species in Brazil and confirms its preference for swampy habitats close to water bodies. It also reinforces the need for investments in botanical collections in northern Brazil, especially in the Amazon region, as well as the training of specialized human resources, as the

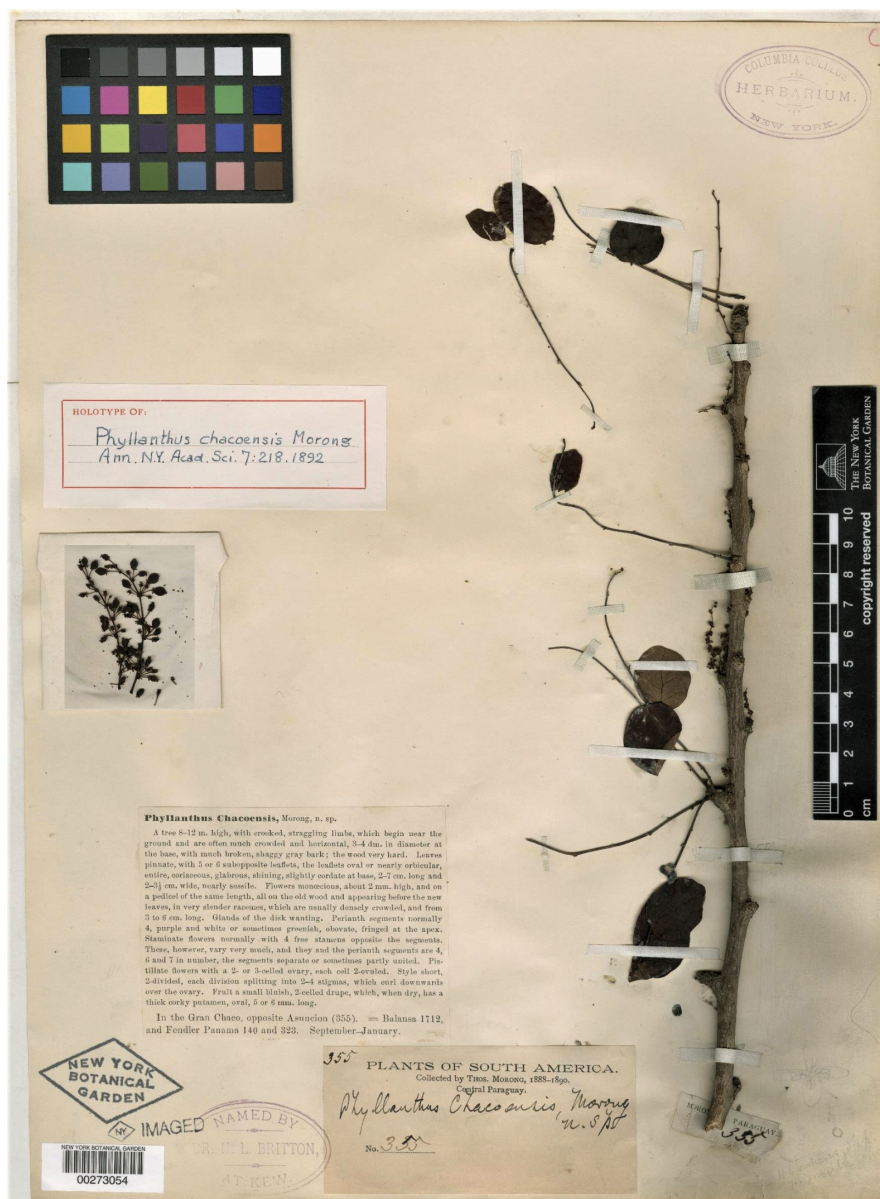


Figure 3. Lectotype of *Phyllanthus chacoensis* at NY (NY00273054). Reproduced with the permission of the curator of The New York Botanical Garden. This figure is in color in the electronic version.

specimen examined here had lain for more than 50 years in a herbarium without being identified. The conservation status of *P. chacoensis*, associated with its occurrence in highly threatened sites, indicates the need to protect this species.

ACKNOWLEDGMENTS

The authors thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the grant to the first author and for the productivity grant to Margareth Sales; Wesley Cordeiro for making the map; and the organization Paraguay Biodiversity for the images.

REFERENCES

- Bachman, S.; Moat, J.; Hill, A.W.; Torre, J.; Scott, B. 2011. Supporting red list threat assessments with GeoCAT: Geospatial conservation assessment tool. *ZooKeys*, 150: 117–126.
- Barbosa, M.R.V.; Peixoto, A.L. 2003. Coleções botânicas brasileiras: situação atual e perspectivas. In: Peixoto, A.L. (Org.). *Coleções Biológicas de Apoio ao Inventário, Uso Sustentável e Conservação da Biodiversidade*. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro, p.113–125.
- Bouman, R.W.; Keßler, P.J.A.; Telford, I.R.H.; Bruhl, J.J.; Welzen, P.C. van. 2018. Subgeneric delimitation of the plant genus *Phyllanthus* (Phyllanthaceae). *Blumea*, 63: 167–198.

- Braga, P.I.S. 1979. Subdivisão fitogeográfica, tipos de vegetação, conservação e inventário florístico da floresta amazônica. *Acta Amazonica*, 9: 53–80.
- Cardoso, D.; Särkinen, T.; Alexander, S.; Amorim, A.M.; Bittrich V.; Celis, M.; *et al.* 2017. Amazon plant diversity revealed by a taxonomically verified species list. *Proceedings of the National Academy of Sciences*, 114: 10695–10700.
- Flora do Brasil. 2020. [under construction]. (<https://floradobrasil.jbrj.gov.br/>). Accessed on 03 Feb 2020.
- Hopkins, M.J.G. 2005. Flora da Reserva Duke, Amazonas, Brasil. *Rodriguésia*, 56: 9–25.
- Hopkins, M.J.G. 2019. Are we close to knowing the plant diversity of the Amazon? *Anais da Academia Brasileira de Ciências (online)*, 91: e20190396.
- IUCN. 2012. *The IUCN Red List Categories and Criteria: Version 3.1*. 2nd ed. Gland and Cambridge, 32p.
- Kathriarachchi, H.; Samuel, R.; Hoffmann, P.; Mlinarec, J.; Wurdack, K.J.; Ralimanana, H.; Stuessy, T.F.; Chase, M.W. 2006. Phylogenetics of tribe Phyllanthae (Phyllanthaceae; Euphorbiaceae sensu lato) based on *nrITS* and plastid *matK* DNA sequence data. *American Journal of Botany*, 93: 637–655.
- Lourteig, A.; O'Donnell, C.A. 1942. Euphorbiaceae Argentinae-Phyllanthae, Dalechampiae, Cluytieae e Manihotiae. *Lilloa*, 9: 77–173.
- Melo, A.L.; Silva, M.J.; Sales, M.F. 2013. *Sebastiania singularis* (Euphorbiaceae): um novo sinônimo para *Phyllanthus chacoensis* (Phyllanthaceae). *Rodriguésia*, 64: 665–666.
- Müller, J. 1873. Euphorbiaceae, Phyllanthae. In: Von Martius, C.F.P. (Ed.). *Flora Brasiliensis* 11. Oldenbourg, Munich & Leipzig, p.7–80.
- Radford, A.E.; Dickson, W.C.; Massey, J.R.; Bell, C.R. 1974. *Vascular Plant Systematics*. Harper & Row Publishers, New York, 891p.
- Ramella, L.; Zuloaga, F.O. 2017. Typification of *Aporosella hassleriana* Chodat (Phyllanthaceae) of the flora of Paraguay. *Candollea*, 72: 403–404.
- Rodrigues, W.A. 1971. Novo *Phyllanthus* (Euphorbiaceae) da Amazônia Brasileira. *Acta Amazonica*, 2: 17–18.
- Secco, R.S. 2013. A new infraspecific taxon of *Phyllanthus myrsinites* (Phyllanthaceae) from the Brazilian Amazon. *Phytotaxa*, 142: 51–54.
- Secco, R.S. 2018. A Coordenação de Botânica do Museu Paraense Emílio Goeldi no decorrer de 150 anos da instituição. *Boletim do Museu Paraense Emílio Goeldi, Ciências Naturais*, 13: 261–269.
- Secco, R.S.; Rosário, A.S. 2015. A new species of *Phyllanthus* (Phyllanthaceae) endemic to Amazonas state, Brazil. *Novon*, 24: 209–211.
- Secco, R.S.; Silveira, J.B. 2016. Flora das cangas da Serra dos Carajás, Pará, Brasil: Phyllanthaceae. *Rodriguésia*, 67: 1437–1442.
- Secco, R.S.; Bigio, N.C.; Cordeiro, I.; Pscheidt, A.C.; Marques, O.; Caruzo, M.B.R. 2018. Check-list de Euphorbiaceae, str., Phyllanthaceae e Peraceae de Mato Grosso do Sul, Brasil. *Iberingia, Série Botânica*, 73: 207–215.
- Silva, M.J.; Sales, M.F. 2004. O gênero *Phyllanthus* L. (Phyllanthaceae - Euphorbiaceae Juss.) no bioma Caatinga do estado de Pernambuco – Brasil. *Rodriguésia*, 55: 101–126.
- Silva, M.J.; Sales, M.F. 2007. *Phyllanthus* L. (Phyllanthaceae) em Pernambuco, Brasil. *Acta Botanica Brasilica*, 21: 79–98.
- Silva, M.J.; Sales, M.F. 2008. Sinopse do gênero *Phyllanthus* (Phyllanthaceae) no Nordeste do Brasil. *Rodriguésia*, 59: 407–422.
- Ter Steege, H.; Pitman, N.C.A.; Daniel, S.; Baraloto, C.; Salomão, R.P.; Andino, J.E.G.; *et al.* 2013. Hyperdominance in the Amazonian tree flora. *Science*, 342: 1243092.
- Thiers, B. 2020. [continuously updated] Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. (<http://sweetgum.nybg.org/science/ih/>). Accessed on 29 Feb 2020.
- Turland, N.J.; Wiersema, J.H.; Barrie, F.R.; Greuter, W.; Hawksworth, D.L.; Herendeen, P.S.; *et al.* 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Vegetabile* 159. Koeltz Botanical Books, Glashütten, 254p.
- Webster, G.L. 1957. A monographic study of the West Indian species of *Phyllanthus*. *Journal of the Arnold Arboretum*, 38: 51–80, 170–198, 295–373.
- Webster, G.L. 2001. Synopsis of *Croton* and *Phyllanthus* (Euphorbiaceae) in western tropical Mexico. *Contributions from the University of Michigan Herbarium*, 23: 353–388.
- Webster, G.L. 2002. A Synopsis of the Brazilian taxa of *Phyllanthus* section *Phyllanthus* (Euphorbiaceae). *Lundellia*, 5: 1–26.
- Webster, G.L. 2004. A revision of *Phyllanthus* section *Hylaeanthus* (Euphorbiaceae). *Lundellia*, 7: 11–27.

RECEIVED: 20/06/2020

ACCEPTED: 26/09/2020

ASSOCIATE EDITOR: Ricarda Riina



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.