



## *Philodendron josephii* (Araceae), a new species from central Amazonia, Brazil

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### Abstract

*Philodendron josephii* sp. nov. is described from terra firme tropical humid forest in Amazonas state, Brazil. This new species is similar in its leaf morphology to two other Amazonian species, *P. maximum* and *P. megalophyllum*, but differs by characters of the prophyll, petiole, flagelliform branches and ovary. The description is accompanied by illustrations, notes on the habitat, geographic distribution and conservation status.

**Keywords:** Monocotyledons, Alismatales, Araceae, Amazon Forest

### Introduction

The family Araceae is currently estimated to include 144 genera and approximately 3,645 species (Boyce & Croat 2011 onwards). *Philodendron* Schott (1829: 780) is the second largest genus of the family, with 487 species currently accepted and an exclusively neotropical distribution (Croat 1997, Boyce & Croat 2011 onwards). This genus is among the 20 most speciose of the angiosperms (BFG 2015) and is an ecologically important component of neotropical forests (Boelter *et al.* 2014).

The genus *Philodendron* is currently divided into the two subgenera *Philodendron* and *Pteromischum* (Schott 1856: 77) Mayo (1989: 168) with the closely related genus *Thaumatophyllum* Schott (1859: 31) (formerly *Philodendron* subgen. *Meconostigma* Schott (1832: 20) as sister group (Sakuragui *et al.* 2018, Vasconcelos *et al.* 2018). Subgenus *Philodendron* is the most diverse and the most complex taxonomically; recent phylogenetic studies have shown that many of its ten traditional sections are not supported as monophyletic groups by molecular data (Vasconcelos *et al.* 2018). In Brazil the genus is represented by 153 species, of which 98 occur in the Amazonian biome, especially Amazonas state where approximately 77% of these Amazonian species are recorded (Flora and Funga do Brasil 2022).

Here we present a new species from Amazonas state, *Philodendron josephii* sp. nov., first collected by the second author in 2013 in tropical humid forest, during an expedition in the Uatumã region. The population was not in flower when collected, but herbarium vouchers were made and two plants were cultivated at the National Institute of Amazonian Research, Manaus (INPA). Later, the species was recollected, this time in flower, during the doctoral studies of the first author in an area of mature terra firme forest in the Reserva de Cabo Frio (Amazonas state). Careful comparison of the field collected plants, cultivated material and comparison with other similar species, led us to the conclusion that a new species should be recognized since it matched no other known from Amazonia.

### Material and methods

The original collection from Uatumã was cultivated by the second author at Campus 1 at INPA. The forest plot at Reserva do Cabo Frio (Reserva do Cabo Frio; 2°25'21.50"S, 59°53'49.83"W), where the second field collection

was made, is part of the Continuous Forest element of the Biological Dynamics of Forest Fragments Project, Area of Relevant Ecological Interest (ARIE PDBFF in Portuguese), located in the municipality of Rio Preto da Eva, Amazonas, 80 km north of Manaus. The material was compared with the collections of the INPA herbarium. Observations and photographic images of morphological characters were made with the aid of a Leica® (model S8APO) binocular microscope with a digital camera attachment Canon® (model eos rebel t5). The descriptive terminology follows that of Soares (1996), Croat (1997) and Beentje (2012). The map showing the distribution of the known records was prepared using R software (R Core Team 2020); the assessment of conservation status, area of occupation (AOO) and extent of occupation (EEO) were made according to the criteria of the IUCN Red List (IUCN 2019), using the R package ConR (Dauby *et al.* 2017).

## Taxonomy

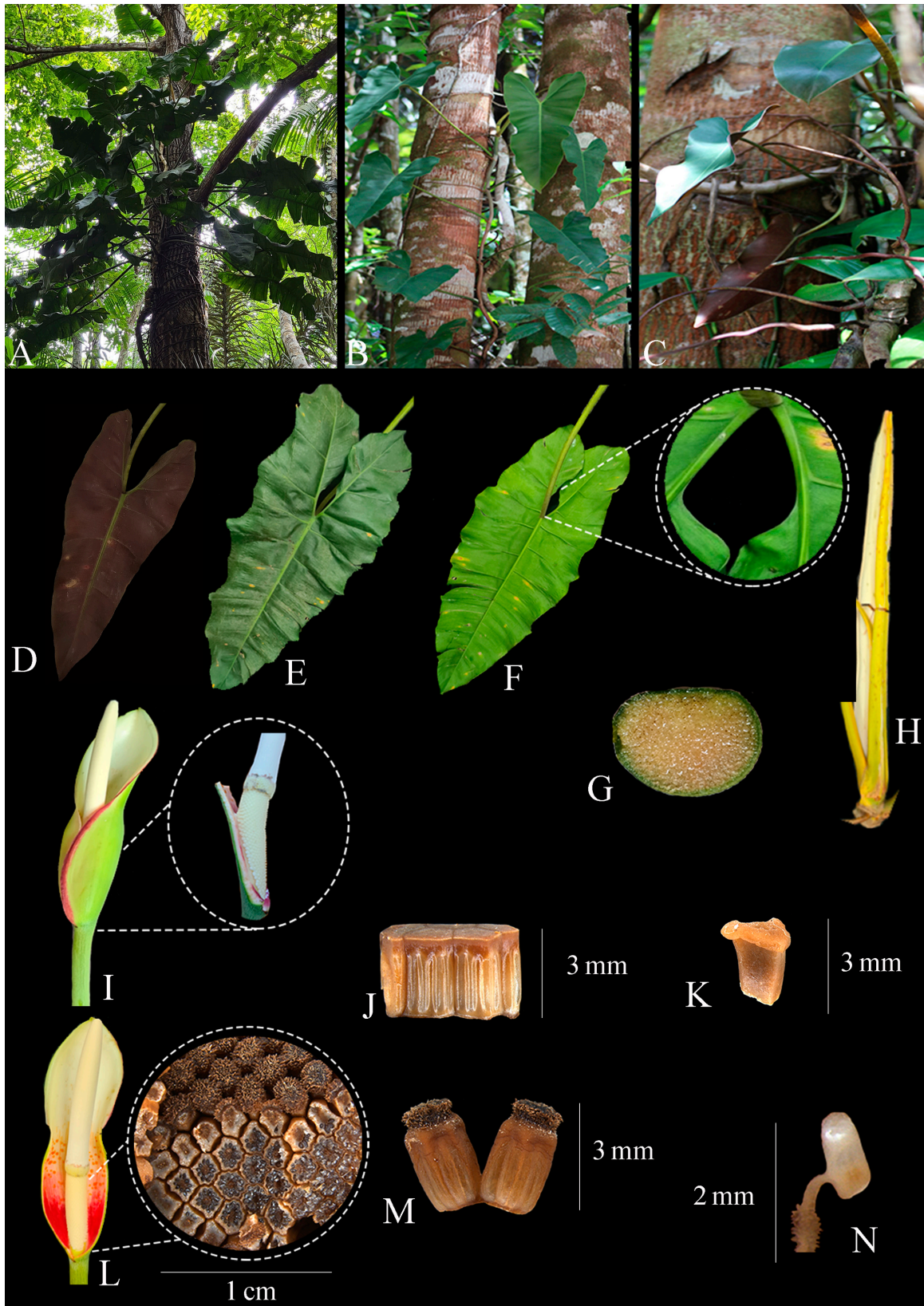
### *Philodendron josephii* C.A.S. Bat. & M.L. Soares *sp. nov.* (Figs 1, 2).

*Philodendron josephii* is similar to *P. maximum* Krause (1913: 49) and *P. megalophyllum* Schott (1860: 279) in the elongated petiole and the sagittate to hastate leaf blade. However, *P. josephii* differs in the following characters: petiole tissue dense (vs. spongy in *P. maximum* and semi-spongy in *P. megalophyllum*); leaf blade of flagelliform shoots reddish to vinaceous abaxially (vs. pale green in both the other species); sinus of mature leaf blade 5.0–7.5 cm long (vs. 24–32 cm and 7–28 cm respectively); ovary locules 8–12 with 12–14 ovules per locule (vs. 5–6 locules with many ovules in *P. maximum*, and 4–5 locules with a single ovule per locule in *P. megalophyllum*).

**Type:**—BRAZIL, Amazonas state: Rio Preto da Eva, BR-174, Parcelas do PDBFF, acampamento do Cabo Frio; 2°25'21.50"S, 59°53'49.83"O, 15 October 2021 (fl.), C.A.S. Batista 22 (holotype INPA!, isotype INPA!).

*Plant a climbing hemiepiphyte*, reaching 3–15(–20) m in height; juvenile plant usually producing flagelliform branches with elongated, cream-coloured internodes 20–29 cm long, epidermis breaking away in flakes, leaf blade sagittate, adaxial surface glossy green, abaxial surface reddish to vinaceous; juvenile attached climbing stems transversely striate, internodes 4–6 cm long, 0.4–0.5 cm diam., leaf scars 4 cm wide, cream to dark cream; adult flowering stem not forming leaf rosette, internodes abbreviated, 1.0–2.5 cm long, 0.2–0.8 cm diam., greenish cream; grampform roots 1.3–6.9 mm diam., 4 per node, pale brown when young, dark brown when older, epidermis flaking off, feeder roots ca. 0.5–0.6 cm diam., fibrous, with small, dispersed lenticels, dark green when young, dull dark green when mature, with transparent liquid exsudate having an astringent odour; *prophyll* 23.5–75.0 cm long, 0.2–0.5 cm diam., pale green to yellowish, somewhat bicarinate, erect to extrorse at apex, with a reddish line on the abaxial surface and small reddish spots over the whole surface. *Leaf: petiole* 51–111 cm long, dense in texture, pale green, lightly striate longitudinally, adaxial surface invaginate to flattened, abaxial surface semi-cylindric, containing orange resin with strong odour; *leaf blade* 79–104 cm long, 32–42 cm wide, elongated, oblong, sagittate to hastate, chartaceous, margin sinuate, apex acuminate, base strongly sagittate, usually dilacerated when older, adaxial surface dark green, non-glossy, with primary and secondary veins impressed, abaxial surface paler green with prominent primary and secondary veins, tertiary veins more visible towards the leaf apex, anterior division 54–70 cm long, 22–43 cm wide, primary lateral veins in 6–8 pairs, arising from the midvein at 70° angle, posterior divisions each 25–34 cm long, 13–21 cm wide, oblong to rounded, apex rounded to acuminate, sinus 5.0–7.5 cm long, 4–7 cm wide, obovate, acroscopic veins 3, basisopic veins (2–)3–5. *Inflorescence:* (2–)3–5(–6) per floral sympodium, cataphyll 10–18 cm long, dark brown, striate, caducous; inflorescence in bud 14.0–17.5 cm long, pale green, spathe slightly constricted and reddish at margin; *peduncle* 12–26 cm long, 1–2 cm diam., subcylindric, green, longitudinally striate and more evident near the apex, striate pale green, resin white with sweet aroma; *spathe* at anthesis 19.0–27.5 cm long, slightly constricted, entire margin vinaceous, apex acuminate, tube 9.0–13.5 cm long, 3.5–4.0 cm wide, outer surface pale green, inner surface reddish towards the base with orange resin canals, blade 10–14 cm long, 4.5 cm wide, pale green on outer surface, white on inner surface with resin canals towards the base; *spadix* 15–25 cm long, 17 mm, base strongly decurrent for ca. 85% of the female zone, stipitate, *stipe* 0.5–1.0 cm long on ventral side, greenish cream, *female zone* 3.5–6.5 cm long, 4.6–12.8 mm diam., pale cream, *sterile male zone* 0.7–1.5 cm long, ca. 5.4 mm diam., pale green to intense yellow with a reddish line at apex, *fertile male zone* 11–16 cm long, 7.49–12.70 mm wide, subcylindric, pale green to white, apex rounded. *Flowers:* stamens 3–6 per male flower, each 2–3 mm long, 1.0–1.5 mm wide; staminode 1 mm long, 2.5 mm wide, prismatic; gynoecium 3.0–3.5 mm long, 1.5–2.0 mm wide, prismatic; ovary subcylindric; locules

8–12 per ovary, filled with translucent mucilage; ovules 12–14 per locule, 2–3 mm long, hemianatropous; funicle as long as ovule, 2.0–2.5 mm long, with trichomes in the basal half; placentation axile, biseriata; stigma discoid to capitate. *Fruits*: unknown; seed unknown.



**FIGURE 1.** *Philodendron josephii*. **A.** Habit of adult plant; **B.** Habit of juvenile plant; **C.** Flagelliform branch; **D.** Abaxial surface, leaf of flagelliform branch showing reddish coloration; **E.** Adaxial surface of adult leaf; **F.** Abaxial leaf surface showing sinus; **G.** Petiole in transverse section; **H.** Prophyll; **I.** Inflorescence showing decurrency; **J.** Frontal view of fertile stamens; **K.** Sterile stamen; **L.** Transverse section of female zone showing locules and apical view of stigmas; **M.** Gynoecium; **N.** Ovule.



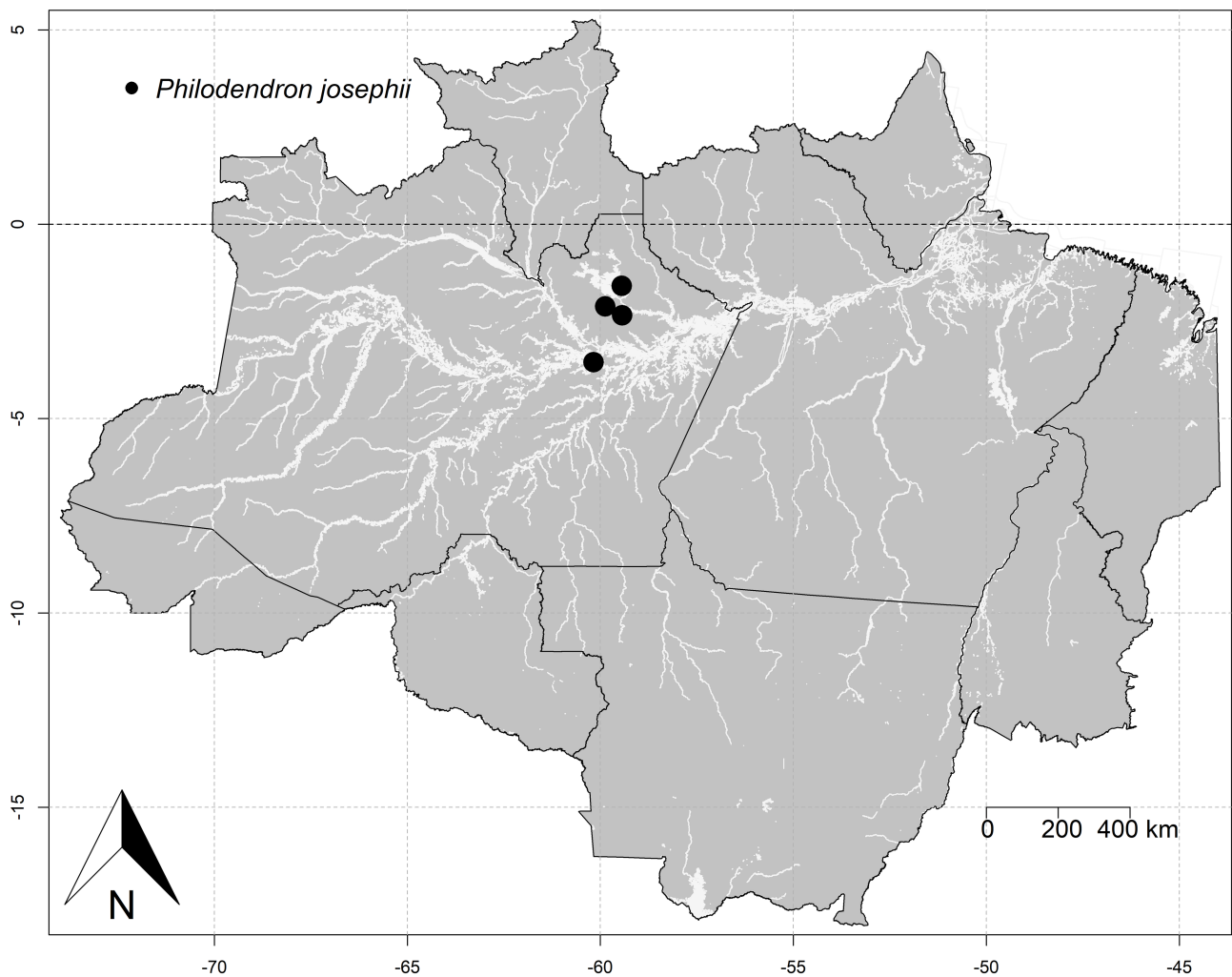


FIGURE 2. Distribution map of *Philodendron josephii*.

**Additional specimens examined (paratypes):**—BRAZIL, Amazonas: Manaus, ASSINPA - clube do INPA, no muro do INPA V8, 13 December 2021 (fl.), *C.A.S. Batista 23* (INPA 292768!); Rio Preto da Eva, ARIE PDBFF. Acampamento do Colosso, 2°14'24.00"S 59°47'24.00"O, 4 October 2021 (fl.), *C.A.S. Batista 24* (INPA 292769!); Presidente Figueiredo, Uatumã: cultivada no Instituto Nacional de Pesquisas da Amazônia-INPA, ao lado do herbário, 1° 0'0.00"S 58°59'60.00"O, 25 May 2021 (fl.), *Soares et al. 988* (INPA 292770!), 22 July 2021 (fl.), *Soares et al. 989* (INPA 292771!).

**Distribution, habitat and phenology:**—The distribution of this species is so far known only from the localities indicated on the map (Figure 1). It occurs in humid, tropical *terra firme* forest (forests that are not seasonally flooded by rising rivers) and near streams at altitudes between 50 and 140 m. Inflorescences were seen from May to December.

**Conservation Status:**—*Philodendron josephii* is known only for Amazonas state in the municipalities of Manaus, Rio Preto da Eva and Uatumã. It has an EOO of 2.915 km<sup>2</sup> and AOO of 16 km<sup>2</sup>, representing 4 subpopulations. The species is thus evaluated with the preliminary status of Endangered (EN): B1a+B2a according to the IUCN categories and criteria.

**Eponymy:**—The specific epithet honours Dr. Simon Joseph Mayo of the Royal Botanic Gardens Kew, United Kingdom, who has contributed to knowledge of the family Araceae in Brazil, especially in Amazonia, as well as participating in the training and qualification of various Brazilian taxonomists.

**Notes:**—*Philodendron josephii* can be recognized in the field by the length and usually yellowish prophyll, the often-vinaceous abaxial surface of juvenile leaves of flagelliform branches, the elongated and dense-textured petioles of adult leaves, the adult leaf longer than wide and usually becoming dilacerated with age. Only the juvenile flagelliform branches show the colour difference. Once the plant has become attached to the supporting tree trunk and no longer has contact with the soil, the vinaceous colour of the leaves is lost as they expand in size. Leaves that do not arise from flagellae, even when juvenile, do not exhibit reddish or vinaceous coloration.

This species can be confused with *P. megalophyllum* because of the sagittate to hastate leaf blade, peduncle length of 14–23 cm (12–26 cm in *P. josephii*) and inflorescence number of 2–5 (3–5 in *P. josephii*), but *P. megalophyllum* differs in its basal placentation and uniovulate ovary locules (vs. axile placentation and 12–14 ovules per locule in *P. josephii*). Another species which is has similar leaf blades to *P. josephii* is *P. maximum* but the latter species differs mainly by the spongy textured petiole (vs. densely textured in *P. josephii*), the width of each posterior division of 30–35 cm (vs. 13–21 cm in *P. josephii*), the lack of dilaceration of the mature leaf blade, the 5–6 multiovulate locules per ovary with the ovules inserted along the entire extent of the septum (vs. 8–12 locules per ovary, 12–14 ovules per locule, inserted along only the lower half of the septum to the base). Other taxonomic characters that separate these two species from *P. josephii* are given in Table 1.

**TABLE 1.** Comparison of vegetative and reproductive characters showing morphological differences among *Philodendron josephii*, *Philodendron maximum* and *Philodendron megalophyllum*.

Characters	<i>P. josephii</i>	<i>P. maximum</i>	<i>P. megalophyllum</i>
Cataphyll persistence	deciduous	persistent	marcescent
Petiole consistency	dense	spongy	semi-spongy
Sinus length	5.0–7.5	24–32	7–28
Spathe length	19.0–27.5	8–17	12.0–15.5
Spadix length	18.0–25.8	7–15	15
Placentation	axile	axile	basal
Ovule insertion	up to the middle	throughout septum	basal
Locules number	8–12	5–6	4–5
Ovules per locule	12–14	multiovulate	uniovulate
Funicle length	as long as ovule	smaller than ovule	smaller than ovule

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The authors declare that they have no conflict of interest.

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