
Four New Species of *Philodendron* subg. *Philodendron* (Araceae) from Caquetá Department, Colombia

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ABSTRACT. Four new species of *Philodendron* Schott (Araceae) from Caquetá Department in Colombia are published: *P. agudelo* Croat, Edwin Trujillo & T. Mines, *P. arevaloi* Croat, *P. crystallum* Croat & Edwin Trujillo, and *P. dalyi* Croat. All are members of subgenus *Philodendron*: *P. agudelo* is in section *Macrobelyium* (Schott) Sakur. subsect. *Macrobelyium* (Schott) Engl.; *P. arevaloi* is in section *Philodendron* subsect. *Philodendron*; *P. crystallum* is in section *Macrobelyium* subsect. *Glossophyllum* (Schott) Croat ser. *Ovata* Croat; and *P. dalyi* is in section *Macrobelyium* subsect. *Glossophyllum* ser. *Glossophyllum* Croat.

Key words: Colombia, new species, *Philodendron*, South America, subgenus *Philodendron*.

There are presently 487 published species in *Philodendron* Schott (Araceae) subg. *Philodendron* (Boyce & Croat, 2023), and a recent paper has summarized all of the species presently described in subgenus *Philodendron* (Croat et al., 2019). A Lucid Key has been designed for *Philodendron* that presently encompasses 619 species, many of which are yet unpublished, and there are hundreds of additional specimens that have not been keyed out to any known species. Moreover, based on the disparity of the number of known species in Panama versus Colombia and the relative differences in the size of these two countries, there are a minimum of 5000 additional species of Araceae to be expected in Colombia alone. So, there is potential for many more undescribed *Philodendron* given its normal share of any aroid flora.

The Lucid Keys mentioned in this paper are the result of technology developed at the University of Queensland in Australia, but Identific Pty Ltd. is an independent company that has marketed and developed the Lucid software since 2014. The tool we are using is a computer-generated key, developed by the Royal Botanic Gardens, Kew, and the Missouri Botanical Gar-

den, which contains all important taxonomic characters of all known species (published or unpublished). It works by a process of elimination using only the most conservative and least variable characters (e.g., cataphylls, blade shape, primary lateral veins, sinus shape, basal veins). At present, keys have been developed for *Adelonema* Schott, *Anthurium* Schott, *Dieffenbachia* Schott, *Dracontium* L., *Philodendron*, *Stenospermation* Schott, and *Xanthosoma* Schott, and work is underway to develop Lucid Keys for *Chlorospatha* Engl. and *Spathiphyllum* Schott. The present keys are unpublished, since most still contain much unpublished work, but they are intended to be placed online for public use in the future. For examples of published keys, see <http://www.lucidcentral.com>.

In this paper, we name and describe four species of *Philodendron* endemic to Caquetá Department, Colombia, which were identified as new with the aid of the Lucid Key. Descriptions are standardized based on outlines by Croat and Bunting (1979). We designate the IUCN Red List category rankings for these four new species as Data Deficient [DD] (IUCN, 2022). Definitions of ecology are based on the Holdridge life zone system (Holdridge, 1967). For a discussion of *Philodendron* sections, including sectional descriptions and a key to sections, refer to Croat (1997: 326–339).

1. *Philodendron agudelo* Croat, Edwin Trujillo & T. Mines, sp. nov. TYPE: Colombia. Caquetá: Mpio. Florencia, Corregimiento El Caraño, Vereda Las Brisas, Finca de Arsenio Espinoza por el camino del platanal, 01°37'03"N, 75°37'03"W, 1300 m, Nov. 2007, E. Trujillo & C. M. Agudelo 1219 (holotype, HUAZ!). Figure 1A, B.

Diagnosis. *Philodendron agudelo* Croat, Edwin Trujillo & T. Mines differs from *P. coriaceum* Croat & D. C. Bay by having unribbed (vs. obtusely 2-ribbed) cataphylls, sharply C-shaped (vs. D-shaped to broadly sulcate, weakly sheathed)

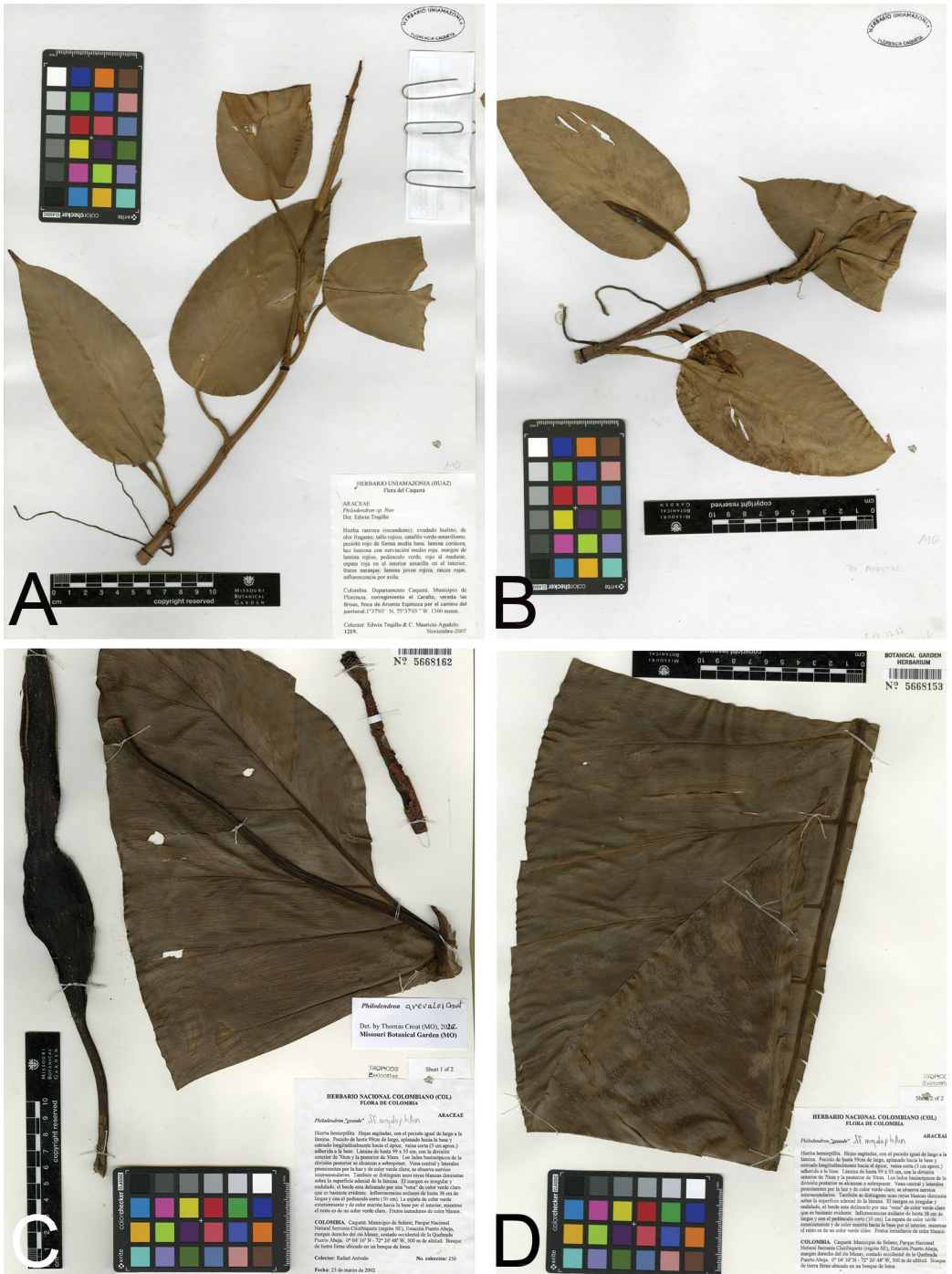


Figure 1. A, B. *Philodendron agudeloii* Croat, Edwin Trujillo & T. Mines. —A. Type specimen (E. Trujillo & C. M. Agudelo 1219, HUAZ) showing abaxial leaf surface. —B. Type specimen showing abaxial leaf surface with inflorescences. C, D. *Philodendron arevaloii* Croat. —C. Type specimen (R. Arevalo 256) showing abaxial surface of posterior lobe and inflorescence. —D. Type specimen showing abaxial surface of posterior lobe.

petioles, smaller leaf blades, 13.7–16 × 6–9.3 cm, with veins 9 per side (vs. larger, 13–21 × 5–12 cm, with 13 to 18 primary lateral veins), and a much smaller inflorescence, 4.5–5.5 cm (vs. 10.4–18 cm for *P. coriaceum*).

Scandent epiphytic climber; **stem** red, drying tan to brown, closely ribbed longitudinally, terete; roots red; sap fragrant; **internodes** reddish elongated, 4.5–7.5 cm, 4–6 mm diam., terete, closely ribbed longitudinally, drying tan to brown; **cataphylls** green yellowish, 7–9 cm, unribbed, deciduous. LEAF 17.7–20.2 cm; **petiole** reddish, sharply C-shaped, 3–5 cm, 2–3 mm diam., drying tan to brown, longitudinally ribbed, terete, when sheathed on flowering plants 34%–50%; **geniculum** indistinct; **blade** ovate-triangular-cordate, 13.7–16 × 6–7.3 cm, 1.8–2.2× longer than wide, 3.2–4.5× longer than petiole, gradually acuminate at apex, rounded at base, drying brown, semiglossy above and below; **midrib** concolorous, slightly sunken at base to flat at apex above, concolorous, raised at base to flat at apex below; **primary lateral veins** obscure, 9 per side, meeting midrib at 35°, drying concolorous, slightly raised above and below, concolorous, interprimary veins present; minor veins visible. INFLORESCENCE 1 per axil, 8.5–9.5 cm; **peduncle** green, red when maturing, 3–4 cm, 2 mm diam., drying brown, longitudinally ribbed; **spathe** red on inner surface and yellow externally, 4.5–5.5 cm, 6–8 mm wide, short-acuminate, drying dark brown to reddish brown or blackened, slightly longitudinally ribbed; **spadix** (post-anthesis) 5.3 cm; staminate portion 2 cm, 1.8 mm diam. at thickest part in distal 2/3; sterile staminate portion indistinguishable in post-anthesis spadix; pistillate portion 3.3 cm, 3.5 mm diam.; pistils tan with dark brown stigma, 0.6–0.8 mm diam.; style not obvious; ovary 5-locular, each locule with 2 seeds. INFRUDESCENCE with berries orange; **berries** 2.5 mm, 2.2–2.8 mm diam., 5-lobed and 5-locular, seeds 1.1 mm, 0.8 mm diam.

Distribution and habitat. *Philodendron agudelo* is endemic to Colombia, known only from the type locality in Caquetá Department at 1300 m in a *Tropical wet forest* life zone.

Etymology. The species is named in honor of Colombian biologist, Carlos Mauricio Agudelo, who, along with Edwin Trujillo Trujillo, collected the type specimen.

Discussion. The species is a member of *Philodendron* sect. *Macrobelyum* (Schott) Sakur. subsect. *Macrobelyum* (Schott) Engl. It is characterized by its scandent habit, elongated reddish internodes, unribbed cataphylls, reddish, sharply C-shaped petioles that are sheathed to the lower 1/3 or nearly to the middle when

subtending an inflorescence, short-petiolate, narrowly ovate, gradually acuminate, greenish-brown–drying blades with a rounded leaf base, and obscure primary lateral veins, as well as by having one small inflorescence per axil with the spathe red on the inner surface and yellow externally while the berries are orange.

In the Lucid *Philodendron* Key, *P. agudelo* tracks to *P. bakeri* Croat & Grayum, from Costa Rica, Colombia, Nicaragua, and Panama, with which it shares orange berries, but which differs by having proportionately longer (2.5–3 times longer than broad), more oblong-elliptic leaf blades with only three or four primary lateral veins per side and longer peduncles (4–12 cm); to *P. dalyi* Croat (published in this paper), which differs by having leaf blades decidedly broader above the middle and acute at the base; to *P. ligulatum* Schott from Central America, which differs by having ribbed cataphylls, petioles with a purple ring at the apex, and blades that are usually cordulate at the base; and to *P. linnaei* Kunth, which differs by its much larger, oblanceolate to oblong elliptic blades (mostly 53–91 × 9–17 cm), which are 3.7–5.9 times longer than wide and appear to lack any primary lateral veins.

2. *Philodendron arevaloi* Croat, sp. nov. TYPE:

Colombia. Caquetá: Mpio. de Solano, Parque Nacional Natural Serranía Chiribiquete (región SE), Estación Puerto Abeja, margen derecho del Río Mesay, a orillas de la Quebrada Puerto Abeja, 00°04'16"N, 72°26'48"W, 500 m, bosque inundable, 23 Feb. 2002, R. Arévalo 256 (holotype, COL-000039506!, 000040158!, 000039462!). Figure 1C, D.

Diagnosis. *Philodendron arevaloi* Croat differs from *P. deflexum* Poepp. ex Schott in having a more coriaceous blade with more prominently raised minor veins and with cross-veins on the upper surface, as well as a more shortly pedunculate inflorescence 10 cm long (vs. 8.5–23[–40] cm). It differs from *P. megalophyllum* Schott by having leaves drying darker brown (vs. greenish to light brown), more coriaceous, with the posterior rib prominently directed to the end of the posterior lobe (vs. branching and not clearly directed toward the tip of the lobe), as well as by typically having the peduncle shorter than the spadix.

Hemiepiphytic vine. LEAF with **petiole** 76–99 cm, ca. 1.3× longer than blades, drying 5 mm diam. toward apex, subterete, flattened toward base and fluted, drying dark brown to black, longitudinally striate throughout and ribbed, sheathed ca. 5 cm; **geniculum** indistinct; **blade** ovate-sagittate, 76–99 × 38–55 cm, broadest across tips of posterior lobes, 1.8–2× longer than wide, 0.76× as long as petioles, gradually moderately long-acuminate at apex, deeply lobed at base, drying brown, matte above, grayish brown, matte below; **anterior lobe** 53.5–70 cm, with broadly convex mar-

gin (drying minutely undulate); **posterior lobes** 28–30 × 15.6–16.58 cm, directed downward and somewhat outward at 135°, outer margin nearly straight, inner margin 5 cm wide, attenuated to base onto posterior rib; major veins light green; **basal veins** 5 pairs longitudinally ribbed, slightly basisropic, those of upper side nearly perpendicular to midrib, 3–8 cm apart, those of lower side 3, 1st pair free to base, 2nd pair fused 3 cm, 3rd pair fused 6 cm, 4th pair fused 12.5 cm, 5th pair fused 20.5 cm; interbasal veins present; **posterior ribs** 20 cm, 5.5 cm naked, straight to tip of lobe, drying blackened, acute on lower surface; **sinus** parabolic, 17.3 × 10.4 cm; **midrib** dark brown, slightly raised, paler above, raised, longitudinally ribbed below; **primary lateral veins** 8 per side, meeting midrib at 75°, deeply sunken, slightly paler to concolorous above, raised and flattened with undercut margins, darker brown below, minor veins distinct, cross-veins closely spaced but weak, present on both upper and lower surfaces; upper surface usually minutely dark-speckled, weakly and sparsely short–pale-lineate; lower surface often more conspicuously dark-speckled, lacking short pale lineations. INFLORESCENCE 1 per axil, 33.6–38 cm (post-anthesis); **peduncle** dark brown to black, 10 cm, drying 6 mm wide, weakly longitudinally ribbed; **spathe** dark green outside, dark purplish (turning brown) inside tube, otherwise light green on blade inside, 23.6 cm, 3.8 cm diam., acuminate, drying black, with small tan bumps, constricted 10.5 cm above base, 1.5 cm wide at constriction; inner surface of tube drying light brown, moderately glossy, closely areolate-ridged with irregular transverse ridges (some becoming cracked open) and pale ring-shaped protuberances 0.1 mm diam., lacking longitudinal resin canals (but with irregular, sinuous to circular dark lines, perhaps resin canals); **spadix** 19.3 cm (dried); staminate portion 12.1 cm, 1.1 cm diam. at thickest area; sterile staminate portion 1.2 × 1.2 cm; pistillate portion 7.7 × 2.5 cm; **pistils** 5 × 2.5 mm; stigma 1.2 mm diam., button-shaped, with 5 to 7 small pits on drying; **ovary** 5- to 7-locular. INFRUCTESCENCE with white, immature berries; **seeds** dark brown, 8 to 10 per locule, ellipsoid, 0.6–0.8 mm, 0.4–0.5 mm diam.

Distribution and habitat. *Philodendron arevaloi* is endemic to Colombia, known only from the Serranía de Chiribiquete in Caquetá Department at 500 m in a *Pre-montane wet forest* life zone.

Etymology. The species is named in honor of Colombian botanist Rafael Arévalo, who collected the type specimen. Arévalo earned a B.S. degree from Universidad de Los Andes in Colombia and did his Ph.D. thesis at the University of Wisconsin with the orchid genus *Mormolyca* Fenzl. He is currently employed as a

research scientist in the Wood Anatomy Lab at the USDA's Forest Products Research Laboratory in Madison, Wisconsin.

Discussion. The species is a member of subgenus *Philodendron* sect. *Philodendron* subsect. *Philodendron* and is characterized by its hemiepiphytic habit, long-petiolate leaves, subterete petioles, narrowly ovate-sagittate, dark gray-drying, undulate-margined, gradually long-acuminate, moderately coriaceous blades with prominent posterior ribs that are straight to the apex of the posterior lobes and with a single pair of free basal veins, the posterior rib naked less than 1/3 of its length, eight primary lateral veins per side, rather prominently raised minor veins, and close but weak cross-veins as well as by the single inflorescence with its moderately short-pedunculate green (purplish in the tube inside) spathe and whitish immature berries.

In the Lucid *Philodendron* Key, the species tracks to *P. atratum* Croat, which differs by having blackish drying, broadly ovate blades that are broadest above the petiolar plexus and have a curved posterior rib that does not extend to the tip of the posterior lobe; *P. danteanum* G. S. Bunting, which differs by having the posterior rib prominently curved and not directed to the tip of the posterior lobe; *P. schmidtiae* Croat & Cerón, which differs by having a more ovate leaf blade that is broadest near the petiolar plexus and by having a short posterior rib that does not extend to the tip of the posterior lobes; and *P. tenue* K. Koch & Augustin, which differs by having leaf blades with the anterior lobe having sides more nearly parallel and a sharply V-shaped sinus.

3. *Philodendron crystallum* Croat & Edwin Trujillo, sp. nov. TYPE: Colombia. Caquetá: Corregimiento El Caraño, Vereda Las Brisas, finca de Arsenio Espinosa, por el camino al platanal, 1°42'41"N, 75°24'52"W, 1300 m, *E. Trujillo 1224* (holotype, HUAZ!). Figure 2A.

Diagnosis. *Philodendron crystallum* Croat & Edwin Trujillo differs from *P. edwinii* Croat & Marco Correa by its larger, darker gray-green–drying leaves with closely raised minor veins along with cross-veins and a lack of laticifers and by its solitary inflorescence (vs. a cluster of 4 to 6 tiny pale green inflorescences).

Hemiepiphytic vine, stem appressed-climbing. STEM ribbed longitudinally; **internodes** 4.5 cm, 4 mm diam., terete; **cataphylls** 18 cm, weakly 1-ribbed. LEAF with **petiole** terete, 25–26 cm, 2 mm near apex, 6 mm diam. above sheath, 7 mm diam. at sheath, drying mostly brown, flat with faint white deposits, weakly longitudinally ribbed, margin sometimes loosening and flattening, sheathed 1/3 of its length; **geniculum** indistinct; **blade** ovate-sagittate, 29 × 11 cm, 2.6× longer than



Figure 2. —A. *Philodendron crystallum* Croat & Edwin Trujillo. Type specimen (E. Trujillo 1224, HUAZ) showing abaxial leaf surface. —B. *Philodendron dalyi* Croat. Type specimen (D. C. Daly, D. Cárdenas, W. Rodríguez, W. Trujillo, H. González, N. Hoyos, E. Silva, N. Marín & L. F. Charri 14186, NY) showing abaxial leaf surface.

broad, slightly longer than petiole, acuminate at apex, deeply lobed at base, drying brownish and semiglossy above with small white crystalline deposits, light brown with tinge of green and matte below; **anterior lobe** 24 × 13 cm, straight to weakly concave along margin; **posterior lobes** 6 × 5.5 cm, narrowly rounded; **sinus** parabolic 4.5–5 × 3–4 cm, rounded at apex; **basal veins** 6 pairs, 1st pair free to base, 2nd pair fused 5 mm, 3rd pair fused 7 mm, 4th pair fused 1.5 cm, 5th and 6th pairs fused 2.2 cm; **posterior ribs** 2.2 cm from base, naked 1.5 cm to base; **midrib** above convex, finely and distinctly ribbed, densely granular, weakly pale to concolorous, below narrowly rounded, darker and coarsely ribbed, densely granular; **primary lateral veins** 9 per side, meeting midrib at 60°, above longitudinally ribbed, flat, and concolorous, narrowly raised, below longitudinally ribbed, brown; interprimary veins present; laticifers common but weakly visible on lower surfaces. **INFLORESCENCE** 1 per axil, 16.4 cm; **peduncle** 6 × 5 mm, drying flat and dark brown with faint white deposits; **spathe** 11.4 cm × 9 mm, green on outside, white on interior of blade, red on interior of tube with prominent laticifers, drying dark brown

to reddish brown or blackened, tan at apex, constricted 7 cm above base, 7 mm wide at constriction, longitudinally ribbed; **spadix** 9–10 cm; staminate portion 4.4 cm, 8 mm in diam.; fertile portion cream; sterile staminate portion white, 5 mm, 1 cm diam. (partly eaten) with constricted portion 7 mm wide; pistillate portion 5.4 cm in front and 4 cm in back; **pistils** moderately closely aggregated, ovoid, 5 mm, 6 mm diam.; ovary 5- to 7-locular (based on observations of pits in style); style 1.2–1.3 mm diam.; stigma 0.8–0.9 mm wide, 0.2 mm thick; **ovules** 2 per locule, basally attached, 0.4 mm; funicle 0.4–0.5 mm.

Distribution and habitat. *Philodendron crystallum* is endemic to Colombia, known only from the type locality in Caquetá Department on the eastern slopes of the Cordillera Occidental at 1300 m in a *Tropical wet forest* life zone.

Etymology. The species epithet is from the Latin “crystallus,” meaning “crystal,” referring to the scattered, whitish, branched crystals that are like ice crystals scattered on both leaf blade surfaces.

Discussion. The species is a member of subgenus *Philodendron* sect. *Macrobelyium* subsect. *Glossophyllum* (Schott) Croat ser. *Ovata* Croat. It is characterized by its appressed-climbing habit, elongated internodes, very long, weakly 1-ribbed, deciduous cataphylls, long-petiolate leaves, terete petioles sheathed 0.25%–0.37% of their length, narrowly ovate-sagittate, brownish-drying, gradually acuminate leaf blades with moderately short, narrow posterior lobes, a parabolic sinus, five or six pairs of basal veins, and eight or nine primary lateral veins per side, a solitary, moderately long pedunculate inflorescence with spathe green outside, white on the interior blade and red with prominent laticifers on the inside of the tube, and a spadix with a prolonged, slender pistillate portion and a much shorter, thicker staminate spadix.

The species is unusual in having a dense array of short black laticifers aligned end to end between all of the minor veins and by having whitish snowflake-like crystals scattered on both leaf blade surfaces. In the Lucid *Philodendron* Key, the species tracks to *P. hebetatum* Croat, which differs by having much larger leaves that are whitish on the lower surface; *P. lindenii* Schott from the northern parts of Venezuela and Colombia, which differs by having sharply 2-ribbed cataphylls, leaf blades with a V-shaped sinus, and proportionately more thickly pedunculate inflorescence with pistillate spadix much shorter than the staminate spadix; *P. varifolium* Schott, which differs by having smaller blades that are 3.3–3.7 times longer than broad with shorter posterior lobes; *P. tenue*, which differs by having much larger posterior lobes with a narrow V-shaped sinus and persisting cataphyll fibers; and *P. ventricosum* Madison, which differs by having much larger blades with a narrow sinus and much thicker spathes.

4. *Philodendron dalyi* Croat, sp. nov. TYPE: Colombia. Caquetá: Belén de los Andaquíes, Parque Municipal Natural Andaki, Vereda Los Angeles, 1°36'22.4"N, 75°54'1.5"W, 630 m, dense forest on steep slopes, 28 Oct. 2010, *D. C. Daly, D. Cárdenas, W. Rodríguez, W. Trujillo, H. González, N. Hoyos, E. Silva, N. Martín & L. F. Charri 14186* (holotype, NY!). Figure 2B.

Diagnosis. *Philodendron dalyi* Croat differs from *P. spalterum* Schott in having the blade broadest toward the apex (vs. broadest toward the base and attenuated onto the petiole) and pistils with a stigma that is short and depressed-globose in outline (vs. tube-like stigma). It differs from *P. longistilum* K. Krause in having a smooth (vs. conspicuously warty) stem and a short and inconspicuous style (vs. a unique elongated style).

Hemiepiphytic vine, appressed-climbing. STEM drying closely ribbed longitudinally, grayish; **internodes** 2–4 cm, 3 mm diam., drying brownish tan, terete, glossy,

ribbed longitudinally, **cataphylls** deciduous, green, unribbed. LEAF 16.5–17 cm; **petiole** 2.8–3.5 cm, 1 mm diam., drying black, flat, weakly longitudinally ribbed, sheathed 30% of length; **geniculum** indistinct; **blade** 13–13.5 × 5.3–6 cm wide, blade 2.2–2.5× longer than broad, 3.9–4.6× longer than petiole, narrowly obovate, acuminate at apex, acute at base, drying greenish gray and semiglossy above, paler and semiglossy below; **midrib** above drying slightly raised and concolorous, below tan, longitudinally ribbed, slightly sunken, and ridged at edges; **primary lateral veins** 3 or 4 per side, meeting midrib at 40°, slightly raised and concolorous above, below tan, longitudinally ribbed and raised; interprimary veins present. INFLORESCENCE 1 per axil, 8 cm; **peduncle** 2.3 cm, 2 mm wide, drying dark brown, longitudinally ribbed; **spathe** 5.4 cm, closed, green, drying blackened, weakly constricted; tube ca. 3 cm, 7 mm diam.; **spadix** 5 cm; staminate spadix 3.5 cm; sterile staminate portion drying pale orange, 3–4 mm, 4 mm diam., lowermost spiral sometimes with staminodia rounded, remainder ca. 1 × 0.4 mm; pistillate portion 1.5 mm; **pistils** closely compacted, 0.8–1 mm, 0.6 mm diam., style ca. 0.5 mm diam.; stigma short, depressed-globose in outline; ovary 5-locular; ovules 1 per locule, basal, not contained in gelatinous envelope, 0.4 mm (including funicle), oblong, ovule proper 0.2 mm; funicle, 0.2 mm.

Distribution and habitat. *Philodendron dalyi* is endemic to Colombia, known only from the type locality in Caquetá Department at 630 m in a *Lower montane wet forest* life zone.

Etymology. The species is named in honor of Dr. Douglas Daly of the New York Botanical Garden, who collected the type specimen. Daly is a veteran collector in South America, notably in Brazil, where he collected for many years in the department of Acre and where he wrote and published a *Flora of Acre* (Daly et al., 2008).

Discussion. The species is a member of subgenus *Philodendron* sect. *Macrobelyium* subsect. *Glossophyllum* ser. *Glossophyllum* Croat. It is characterized by its appressed-climbing life form, slender grayish-drying stems with elongated internodes, unribbed, deciduous, green cataphylls, short-petiolate leaves, slender petioles, narrowly obovate, acuminate, dark gray-drying, acuminate blades with an acute base and four primary lateral veins per side, and a small solitary green inflorescence with solitary basal ovules.

Literature Cited

Boyce, P. C. & T. B. Croat. 2018 (2011 onward). The Überlist of Araceae, Totals for Published and Estimated Number of

- Species in Aroid Genera. <<http://www.aroid.org/genera/180211uberlist.pdf>>, accessed 5 May 2023.
- Croat, T. B. 1997. A revision of *Philodendron* subgenus *Philodendron* (Araceae) for Mexico and Central America. *Ann. Missouri Bot. Gard.* 84(3): 311–704, figs. 1–496.
- Croat, T. B. & G. S. Bunting. 1979. Standardization of *Anthurium* descriptions. *Aroideana* 2: 15–25.
- Croat, T. B., T. E. Mines & C. V. Kostelac. 2019. A review of *Philodendron* subg. *Philodendron* from South America with the descriptions of 22 new species. *Webbia* 74(2): 193–246. <https://doi.org/10.1080/00837792.2019.1660559>
- Daly, D. C., M. Silveira & collaborators. 2008. First Catalogue of the Flora of Acre, Brazil. EDUFAC, Rio Branco.
- Holdridge, L. R. 1967. Life Zone Ecology. Tropical Science Center, San José, Costa Rica.
- IUCN. 2022. Guidelines for using the IUCN Red List Categories and Criteria, Version 15.1. Prepared by the Standards and Petitions Committee. <<https://www.iucnredlist.org/documents/RedListGuidelines.pdf>>.