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ORIGINAL RESEARCH

# *Virola williamii*, a new psychoactive myristicaceous species from the Amazon basin

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**Abstract**
A new species of *Virola* (Myristicaceae) from Amazonian terra firme forests is described and illustrated. ***Virola williamii*** has been confused with *V. elongata* and belongs to a group of species with reported hallucinogenic use. The new species is characterized morphologically by small, elliptical leaves that are abaxially glaucous and sparsely puberulent with stellate-sessile trichomes, but soon glabrescent; fruits that are sparsely puberulent with sessile-stellate trichomes but glabrescent; and fresh branchlets having a guava-like odor. We discuss relationship of the new species with morphologically similar and likely closely related species, and provide a line drawing and photographic illustrations of the species, a distribution map, and comments on its ecology, uses, and conservation status.

**Keywords** Cumala · ebená · hallucinogen · Magnoliales · paricá · ucuúba

## Introduction

*Virola* Aubl. is the fourth most species-rich genus of the pantropical family Myristicaceae (Smith & Wodehouse, 1938), which comprises 21 genera and ca. 500 species distributed in Africa, the Americas, and Asia (Kühn & Kubitzki, 1993). With ca. 70 currently accepted species (*Plants of the World Online*, https://powo.science.kew.org/), *Virola* is the most diverse genus of Neotropical Myristicaceae, comprising trees or rarely shrubs, distributed from Central to South America (Santamaría-Aguilar & Lagomarsino, 2022). This genus is characterized by having stellate or dendritic trichomes on the vegetative and reproductive structures, broadly paniculate inflorescences, and ebracteolate flowers, with the stamen filaments connate into a column and the anthers connate to their apices or distally divergent (Smith & Wodehouse, 1938; Rodrigues, 1980; Santamaría-Aguilar et al., 2019).

In South America, approximately 56 species of *Virola* have been recorded, including several recently described species (Santamaría-Aguilar & Lagomarsino, 2022; Vásquez Martínez & Soto Shareva, 2020; Vásquez Martínez & Valenzuela Gamarra, 2022), as well as the new species presented in this work. *Virola* species grow mainly in lowland tropical rain forests, and the Amazon basin is the center of diversity for the genus (Ducke, 1936). Indeed, *Virola* is an important component of the Amazonian tree flora (Cardoso et al., 2017), with seven of its species—*Virola surinamensis* (Rol. ex Rottb.) Warb., *V. calophylla* (Spruce) Warb., *V. elongata* (Benth.) Warb., *V. michelii* Heckel, *V. pavonis* (A. DC.) A.C. Sm., and *V. sebifera* Aubl.—ranked in the top 100 on a list of hyperdominant Amazonian tree species (ter Steege et al., 2013). Many species of *Virola* are vital food resources for fauna (Holbrook, 2007), and the genus has long-standing cultural ties with indigenous peoples of the Amazon, being used for medicinal and ritualistic purposes (Schultes, 1954; Schultes & Holmstedt, 1968; Holmstedt et al., 1980). Furthermore, some species of *Virola* have significant economic importance in the timber and pharmacological industries (Rodrigues, 1980; Pesce, 2009; González-Rodríguez et al., 2021).

One of the earliest documentations of the use of *Virola* resin for hallucinogenic purposes was made by the Brazilian

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naturalist and explorer Alexandre Rodrigues Ferreira in 1786, who recorded its application in the preparation of a hallucinogenic snuff, known as *paricá* or *ebená*, inhaled by the Mura and Mawé peoples in the Brazilian Amazon (Ferreira, 1974; Daly, 2001; Fig. 1 A–B). He also detailed the instruments used for storing and inhaling the snuff, as well as its preparation methods (Ferreira, 1974; Fig. 1 C). In the mid-twentieth century, further records by anthropologists Theodor Koch Grünberg and Alfred Métraux, and by botanist Adolfo Ducke, highlighted the use of unspecified *Virola* species as crucial components in hallucinogenic snuff (Schultes & Hofmann, 1979). However, it was not until 1954 that Richard Evans Schultes identified the species used (e.g., *Virola calophylla*, *V. elongata*, *V. pavonis*, and *V. surinamensis*) and gave more detailed description of the associated preparation techniques and cultural practices of various indigenous groups (Schultes, 1954).

During his review of materials of *Virola* collected from the permanent plots of the Biological Dynamics of Forest Fragments Project (BDFFP) in the central Brazilian Amazon, the first author of the current study encountered several collections, mainly in the INPA herbarium and the digital repositories of the IAN and RB herbaria, that were not assignable to any previously described species. Subsequently, the second author encountered additional material of the same entity in the following herbaria: B, COAH, COL, CR (including former INB), JAUM, LSCR, LSU, MO, NO, and NY (acronyms follow Thiers, 2022). After detailed study of the material and comparison with material of the currently recognized species of *Virola* in the same herbaria, we determined that the morphotype in question had also been collected in other parts of the Amazon basin, as far west as the Peruvian Amazon. Here, we describe this morphotype as a new species and provide an illustration, photographs of fresh material, and a distribution map. We also discuss the species' ecology, uses, conservation status, and its distinction from other species of *Virola*.

## Taxonomic Treatment

***Virola williamii*** Farroñay, **sp. nov.** TYPE: Brazil: Amazonas, Mun. Manaus, ARIE-PDBFF, Sítio amostral Fazenda Colosso, Árvore marcada 1202–7174, 2°24'16''S, 59°52'16''W, 150 m, 12 Aug 2023 (♂ fl.), *F. Farroñay et al. 2032* (holotype: INPA, accession 298593[!]; isotypes to be distributed: RB, IAN, MG). Figs. 2,3,4

***Diagnosis.*** *Virola williamii* is morphologically similar to *V. elongata* (Benth.) Warb. (Fig. 5). The two species share stellate and sessile trichomes and are similar in the shape and size of the perianth, filament column, and anthers. Morphologically, the new species differs from *V. elongata* in having elliptic (vs. narrowly oblong to oblong-elliptic), smaller (5.5–12.1 × 1.8–4.1 vs. 12–35 × 4–11 cm), sparsely puberulent but abaxially almost glabrescent leaf blades (vs. densely puberulent abaxially), and glabrescent to sparsely puberulent fruits with sessile-stellate trichomes (vs. densely tomentose with dendritic trichomes).

***Description.*** Trees 3–25 m tall, 10–30 cm DBH. Exudate watery, orange or reddish in the inner bark. Twigs 0.7–1.9 cm thick, terete, without lenticels, striate, sparsely pubescent but soon glabrescent, the trichomes stellate, sessile. Young terminal buds 0.2–0.7 cm long. Leaves with the petiole 0.6–1.5 × 0.5–1.3 cm, canaliculate, pubescent, soon glabrescent, the trichomes stellate, sessile; blades 5.5–12.1 × 1.8–4.1 cm, the base cuneate, the apex attenuate, the margin entire, flat, the adaxial surface of mature leaves drying pale to blackish, smooth, shiny, mostly glabrous, sometimes sparsely pubescent on the midvein, the abaxial surface drying pale grayish, sparsely pubescent, soon glabrescent, the trichomes stellate, dendritic, sessile, 0.1–0.15 mm in diameter; lateral veins 9–13 per side, spaced 0.4–1.2 cm, the same color as the adaxial surface, slightly impressed, abaxially brown to blackish, slightly prominent, arcuate, weakly anastomosing near the margin without forming a marked intramarginal vein, the tertiary veins inconspicuous on both surfaces, the midvein adaxially and abaxially prominent. Staminate inflorescence 3.5–11.5 cm long, peduncle 1.4–2.8 × 0.5–1.3 cm; the main axes with 5–10 ramifications, the first pair opposite to subopposite, the others alternate, all axes flattened, sparsely pubescent, with the trichomes stellate or dendritic, sessile, 0.07–0.08 mm in diameter, yellowish; bracts not seen. Staminate flowers arranged in lax terminal fascicles of 2–6 flowers, on a slender receptacle; pedicels 1.1–2.5 mm long, pubescent; perianth 1–3.4 mm long, campanulate, yellowish when fresh, densely pubescent on the external and internal surfaces with stellate, dendritic, sessile trichomes, the tepals basally connate for 1.2–2 mm, the lobes 3–4, 0.5–1.4 × 0.7–1.3 mm and 0.1–0.3 mm thick; stamens 3, the filament column 0.2–0.6 × 0.3–0.5 mm, glabrous, the anthers 0.8–1.2 × 0.5–0.7 mm, connate, apiculate; the apiculus ca. 0.1 mm long. Pistillate inflorescence 3.3–3.7 cm long; peduncle 1.4–1.5 × 1.1–1.3 cm; main axes with 4–5 ramifications, all axes flattened, sparsely pubescent, with the trichomes stellate or dendritic, sessile; bracts not seen. Pistillate flowers arranged in lax terminal fascicles of 4–5 flowers, on a slender receptacle; pedicels 1.5–2 mm long, pubescent; perianth 2.5–2.9 mm long, campanulate, densely pubescent on the external and internal surfaces, the tepals basally connate for 1.6–2 mm, the lobes 3–4, 0.9 × 1 mm and 0.2 mm thick; gynoecium 1.2–1.4 × 0.7–1.1 mm, globose, tomentose, the stigma 2-lobed, 0.2–0.4 mm long.


**Fig. 1.** First records of *Virola* being used for hallucinogenic snuff by Alexandre Rodrigues Ferreira in *Viagem filosófica pelas capitanias do Grão Pará, Rio Negro, Mato Grosso e Cuiabá, 1783–1792*. **A.** Mura Indian inhaling snuff. **B.** Watercolor of *Virola* sp. **C.** Instruments associated with the use and storage of snuff. Collection of the Fundação Biblioteca Nacional, Brasil.

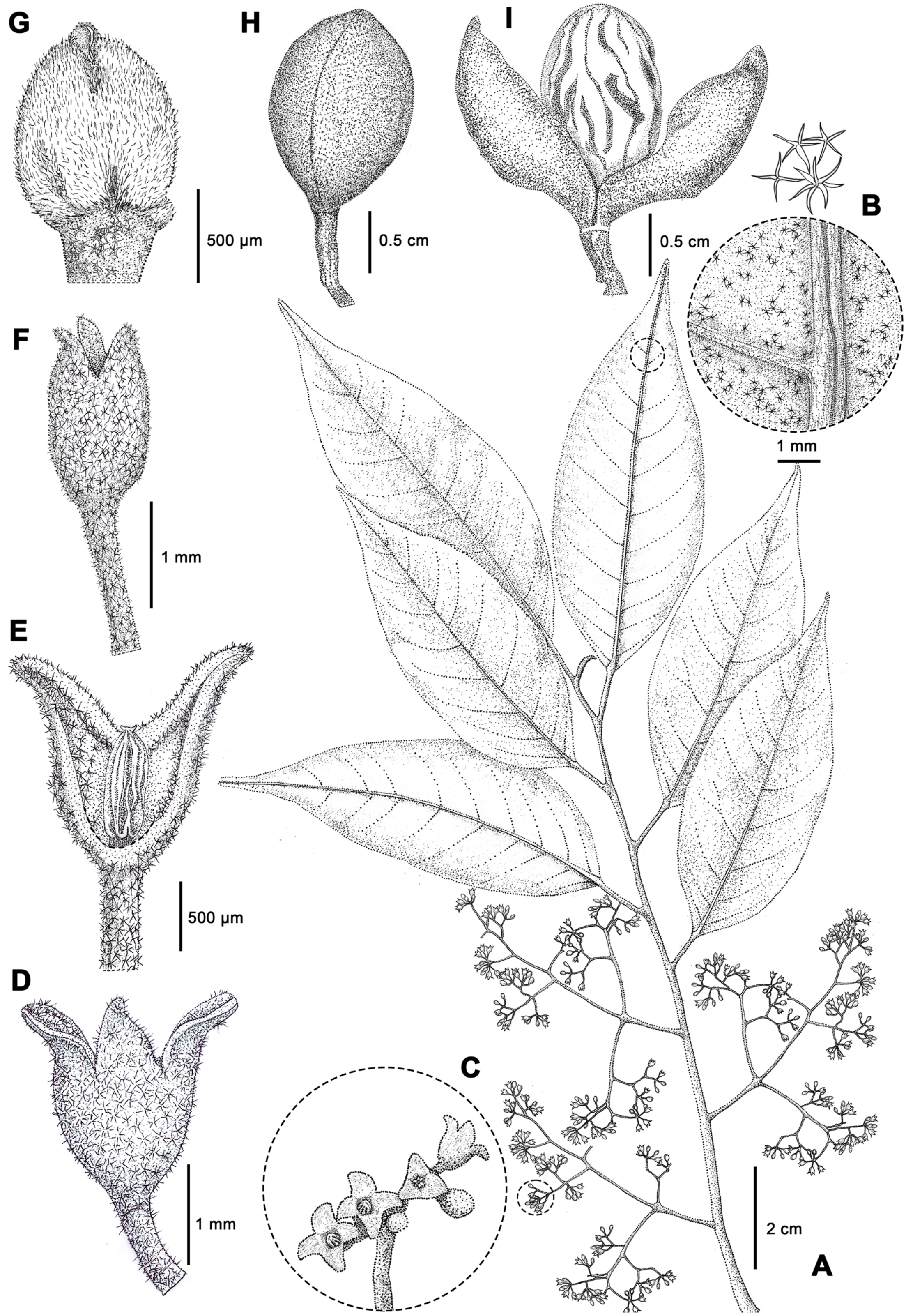


**Fig. 2.** *Virola williamii*. **A.** Fertile branch with staminate inflorescences. **B.** Close-up of stellate-sessile trichomes. **C.** Close-up of partial staminate inflorescence. **D.** Staminate flower, lateral view. **E.** Medial sections of staminate flower showing the internal surface and androecium. **F.** Pistillate flower, lateral view. **G.** Gynoecium, lateral view. **H.** Fruit. **I.** Fruit with exposed seed. (A–C. from *Farroñay* et al. *2032*, INPA; D–E. from *Silva* et al. *319*, INPA; F–G. from *Ducke 933*, US; H. from *Krukoff 8689*, NY; I. from *Stancik* et al. *125*, INPA. Drawn by Maria Thamiris de Sousa Macedo.).

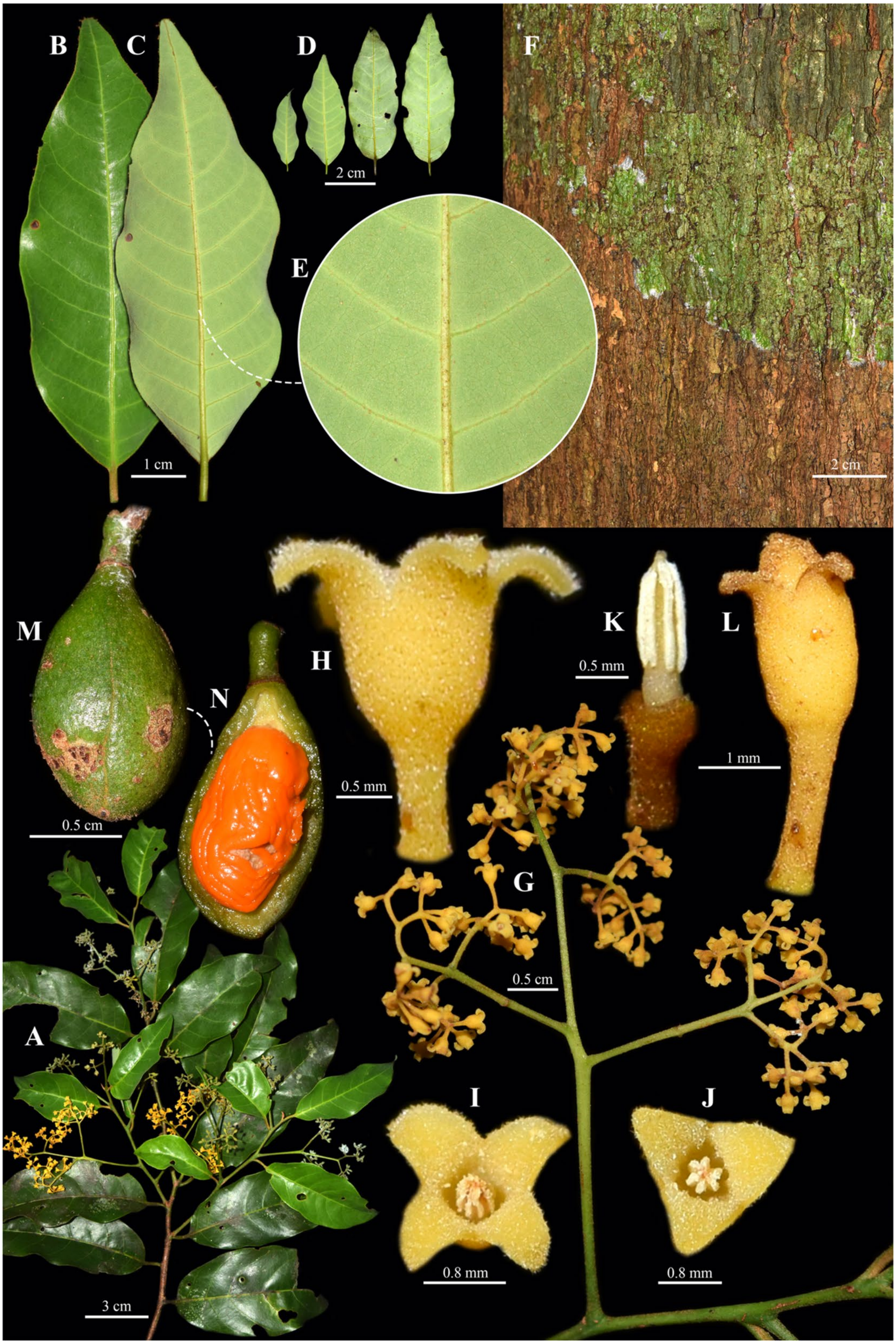


**Fig. 3.** *Virola williamii*. **A.** Fertile branch with staminate inflorescences. **B, C.** Adaxial and abaxial lamina surface, respectively. **D.** Variation on lamina size. **E.** Detail of abaxial surface. **F.** External bark. **G.** Staminate inflorescence. **H.** Staminate flower, lateral view. **I, J.** Tetramerous and trimerous staminate flower, top view. **K.** Androecium. **L.** Pistillate flower, lateral view. **M.** Fruit. **N.** Open fruit showing laciniate aril. (A–K. from *Farroñay* et al. *2032*; L. from *Ramírez 1961*, HRUIP; M–N. from *Farroñay* et al. *2109*, INPA. All photos by Francisco Farroñay, except L. by Fred Ramírez.).

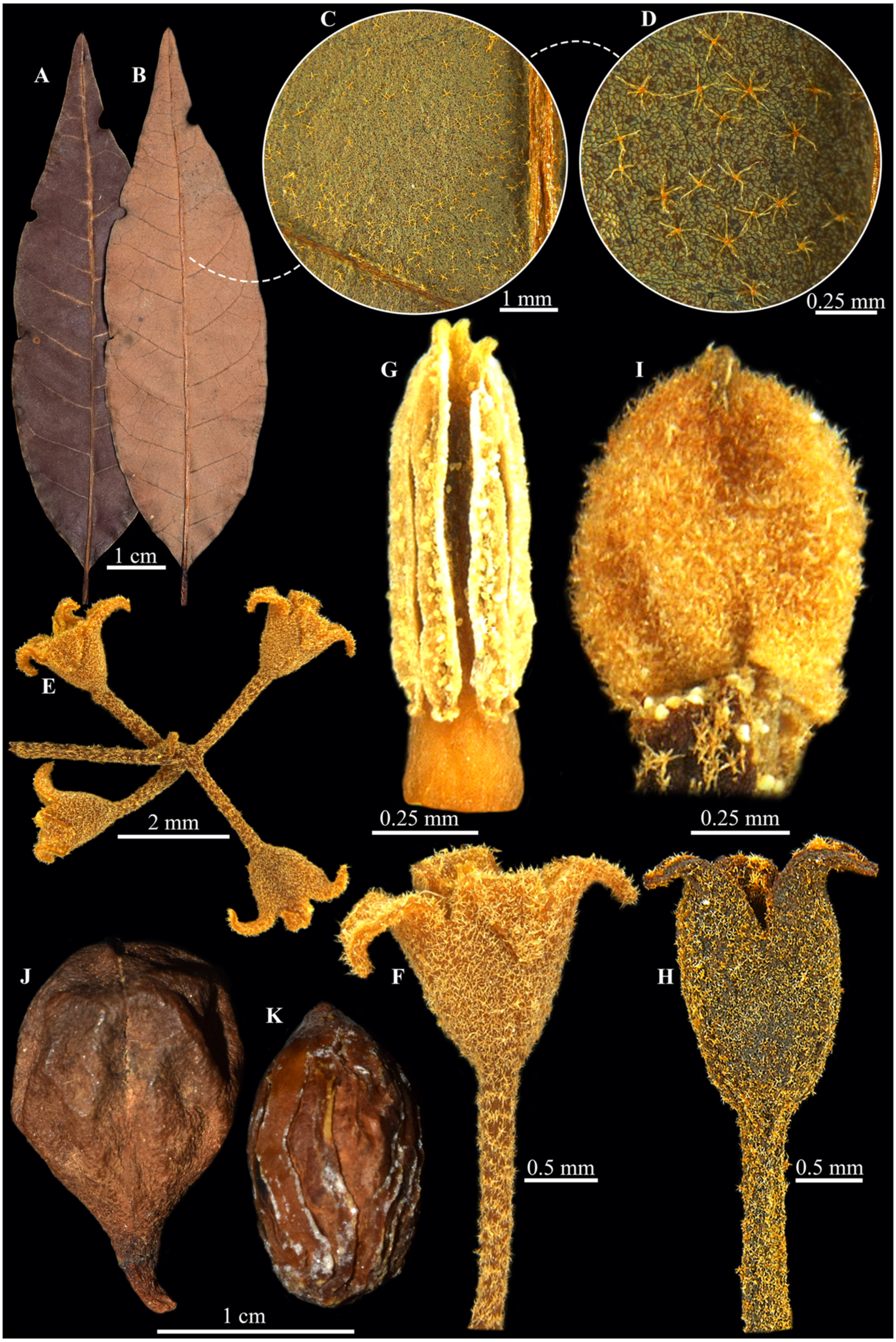


**Fig. 4.** *Virola williamii*. **A, B.** Adaxial and abaxial lamina surface respectively. **C.** Detail of abaxial surface. **D.** Close-up of trichomes. **E.** Detail of staminate inflorescence. **F.** Staminate flower, lateral view. **G.** Androecium. **H.** Pistillate flower, lateral view. **I.** Gynoecium. **J.** Fruit. **K.** Seed with laciniate aril (A–D. from *Silva* et al. *319*, INPA; E–G. from *Farroñay* et al. *2032*, INPA; H. from *Ramírez 1961*, HRUIP; I. from *Nascimento 559a*, INPA; J–K. from *Stancik* et al. *125*, INPA. All photos by Francisco Farroñay.).

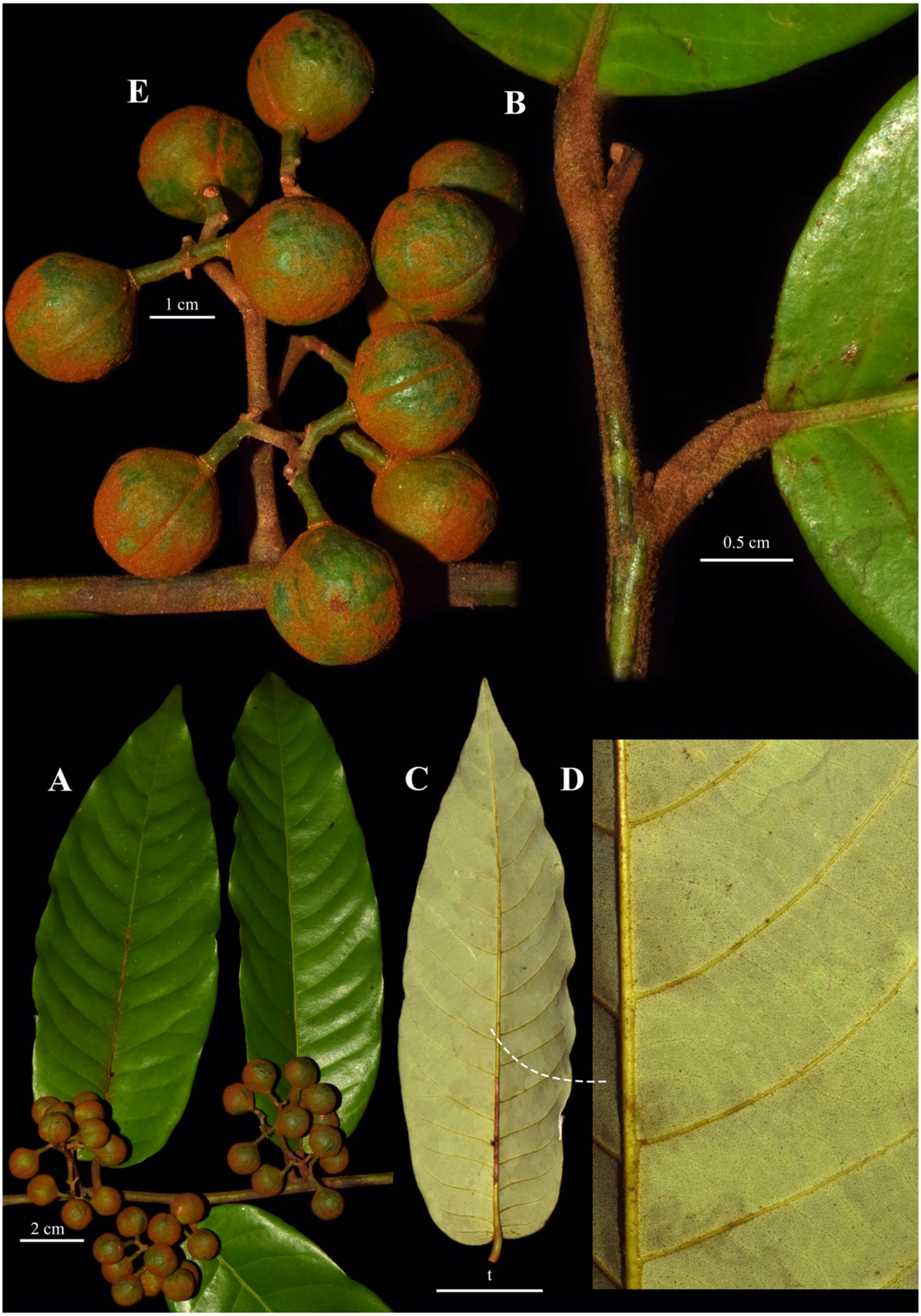


**Fig. 5.** *Virola elongata*. **A.** Fertile branch with infructescence. **B.** Close-up of shoot apex. **C.** Abaxial surface. **D.** Detail of abaxial surface. **E.** Infructescence (A–E. from *Farroñay* 14, INPA. All photos by Francisco Farroñay.).

Infructescence 4.7–4.9 cm long, with 2–4 fruits; peduncle 2.5–4.5 × 1–1.1 cm; fruiting pedicel 0.5–0.7 cm long. Fruits 1.3–1.6 × 0.9–1.1 cm, without a stipe, globose to elliptic, green when fresh, brownish when dry, sparsely puberulent to glabrescent, the trichomes sessile-stellate; line of dehiscence smooth; pericarp 0.6–0.8 mm thick. Seed 1 × 0.8 cm; testa drying brownish, grooved; aril laciniate to the base, when fresh described as orange, brownish when dry, the texture thin.

***Additional Specimens Examined.*** **BRAZIL. Amazonas:** Mun. Presidente Figueiredo, REBIO Uatumã, grade do PPBio, 1°00'S, 59°00'W, 6 Oct 2006 (♂ fl.), *J.G. Carvalho-Sobrinho* et al. *1072* (INPA); ibid, 27 Sep 2007 (♂ fl.), *J.G. Carvalho-Sobrinho* et al. *1687* (INPA); BR 174, km 156, 3 Aug 1976 (♂ fl.), *D.F. Coêlho 805* (INPA); Tonantins, Rio Solimões, silva region altis supra Vila Velha, 30 Nov 1940 (♀ fl.), *A. Duck*e 933 (F, IAN, MO, NY, RB, US); ARIE-PDBFF, Sítio Amostral Fazenda km 41, 27 Feb 2024 (fr.), *F. Farroñay* et al. *2109* (INPA); Distrito Agropecuário, ZF-3, Reserva 1202, 23 Sep 1980 (♂ buds), *A.J.C. Ferreira s/n* (INPA-126670); Rio Urubu, 12 Jan 1949 (fr.), *R.L. Fróes 23,910* (IAN, US); Igarapé Jandiatuba, 22 Sep 1949 (♂ fl.), *R.L. Fróes 25,368* (IAN, US); ZF-2, Vicinal de origem no Km 50 da Rodovia BR-174, 2°23′00''S, 60°05′37''W, 1 Jun 2012 (♂ buds), *T. D. Gaui* et al. *233* (INPA); Basin of Rio Juruá, near mouth of Rio Embira (tributary of Rio Tarauacá), 19 Jun 1933 (♂ fl. bud), *B.A. Krukoff 4947* (F, K, MO, NL, NY); São Paulo de Olivença, Basin of Rio Solimões, 26 Oct 1936 (fr.), *B.A. Krukoff 8689* (F, K, NY, MO, NL, US); Rio Juruá, Poço Jaraqui-1 da Petrobrás, 30 Oct 1980 (fr.), *P.L.B. Lisbôa 1625* (INPA); AM 010, Estrada Manaus-Itacoatiara Km 118, 16 Jun 1977 (st.), *O.P. Monteiro 1445* (INPA); Distrito Agropecuário, 90 km NNE de Manaus, 22 Sep 1981 (fr.), *J.R. Nascimento 1302.744* (INPA); Reserva Florestal Adolfo Ducke, 8 Aug 1994 (♀ fl.), *J.R. Nascimento 559a* (INPA, K, B); ibid, 23 Sep 1976 (st.), *A. Oliveira s/n* (INPA-63255); Distrito Agropecuário, 90 km NNE de Manaus, 2°25′31''S, 59°45′50''W, 21 Mar 1992 (fr.), *A.A. Oliveira* et al. *371* (NY); Cucuí, Rio Xié, 24 Oct 1987 (♂ fl.), *W.A. Rodrigues 10,727* (F, INPA, K, MO, NY, US!); Distrito Agropecuário da SUFRAMA, estrada da ZF-3, 7 Aug 1980 (♂ fl.), *J.L. Santos 1202.5887* (INPA); Presidente Figueiredo, REBIO Uatumã, Base Waba, 17 Sep 2015 (♂ fl.), *D.P. Saraiva* et al. *682* (INPA); Vila de Balbina, UHE de Balbina, 20 Sep 2007 (♂ fl.), *J.A.C. Silva* et al. *1391* (INPA); Sítio amostral Km 37, ARIE-PDBFF, 2°26′30''S, 59°47′8''W, 2 Sep 2008 (♂ fl.), *J.B.D. Silva* et al. *319* (INPA); Reserva Florestal Adolfo Ducke, 27 Jul 1976 (st.), *J.A. Souza s/n* (INPA-59587!); Presidente Figueiredo, REBIO Uatumã, grade do PPBio, 1°00'S, 59°00'W, 1 Mar 2008 (fr.), *J.F. Stancik* et al. *125* (INPA). **PERU. Loreto:** Jenaro Herrera, parcela estructural, 26 Sep 1974 (♂ buds), *B.C. Abadie 53* (INPA); ibid, 26 Sep 1974 (♂ buds), *B.C. Abadie 56* (INPA); Maynas, Río Ampiyacu, 27 Apr 1977 (st.), *T. Plowman* et al. *7094* (INPA, F, K); Ucayali, Contamana, sector Aguas Calientes, 19 Sep 2023 (♀ fl.), *F. Ramírez 1961* (HRUIP); Requena, Arboretum del Centro de Investigaciones Jenaro Herrera, 4°53′59''S, 73°38′55''W, 13 Jun 2022 (st.), *M. Rojas* et al. *424* (HH); ibid., 13 Jun 2022 (st.), *M. Rojas* et al. *425* (HH); Ucayali, Parque Nacional Cordillera Azul, 7°03′55''S, 75°59′39''W, 21 Jul 2018 (♂ fl.), *Y. Soto-Shareva* et al. *3211* (HOXA); IIAP au Centre de Recherche, 24 Sep 1985 (♀ fl.), *R. Spichiger & P.A. Loizeau 1820* (K, US); ibid, 30 Sep 1986 (♂ fl.), *R. Spichiger & P.A. Loizeau 1826* (K, US); Jenaro Herrera, Arboreto, 11 May 1981 (st.), *R. Trucíos 65* (INPA); Ucayali, Parque Nacional Cordillera Azul, 7°21′34''S, 76°00′21''W, 10 Sep 2018 (fr.), *R. Vásquez 42,063* (HOXA, MO, USM); Yurimaguas, Lower Rio Huallaga, San Ramón, 11 Nov 1929 (fr.), *L. Williams 4575* (F).

***Ecology & Distribution.*** *Virola williamii* is a tree species native to the Amazonian lowlands of Brazil (Amazonas state) and Peru (Loreto Department) (Fig. 6), where it occurs in *terra-firme* or upland primary forests on clay soils. More than half of the collections of this new species come from the Manaus area, which is considered one of the extensively sampled regions in the Amazon (Hopkins, 2007). Most of the specimens were collected from the most important floristic projects in the Central Amazon: The Biological Dynamics of Forest Fragments Project (BDFFP) (Nee, 1995) and the Projeto Flora da Reserva Ducke (PFRD) (Hopkins, 2005). In the BDFFP forest plots, *Virola williamii* is locally rare, with fewer than 1 individual per hectare. Only 20 trees (< 10 cm DBH) were found in 94 ha, and 116 trees (1 > DBH < 10 cm DBH) in 25 ha.

***Phenology.*** Staminate flowers of the new species have been collected from June to November, and pistillate flowers from August to September, and in November. Fruits have been collected in January, March, and September to November.

***Preliminary Conservation Status.*** *Virola williamii* is known from 35 collections in the Amazon basin and has an extent of occurrence (EOO) of 892,384 km$^2$, which suggest a preliminary status of Least Concern (LC) according to the IUCN Red List criteria B1a and B2a (IUCN, 2020). Additionally, most specimens have been collected in protected natural areas, including Reserva Florestal Adolpho Ducke, BDFFP, and Reserva Biológica de Uatumã in Brazil, as well as in the Centro de Investigaciones Jenaro Herrera and the Parque Nacional Cordillera Azul in Peru.

***Etymology.*** The specific epithet is dedicated to the Brazilian botanist William Antônio Rodrigues (b. 1928), who was curator of the INPA herbarium and who first suspected that the species was a new to science. He is a specialist on the Myristicaceae, and for his Ph.D., he carried out a taxonomic revision of *Virola* in Brazil (Rodrigues, 1980). His contribution to the knowledge of the Amazonian flora is enormous, not only for his studies in Myristicaceae but also for his numerous collections made throughout the Amazon basin (Melo & Rebêlo, 2004). Furthermore, during his career, he described a new genus (*Micrandropsis* W.A. Rodrigues, Euphorbiaceae) and 41 new species (11 of them in Myristicaceae) in 13 families (see *Tropicos.org*, https://tropicos.org/). The eponymous genus *Williamodendron* Kubitzki & H.G. Richt. (Lauraceae) honors him.

***Field Characters.*** Plants are trees to 25 m tall and to 30 cm DBH. Bark cuts are aromatic, and have a 'guava-like' smell, with reddish to orange resin. The leaf blades are glaucous abaxially. Staminate flowers have a yellow perianth and produce a sweet aroma. The mature fruit is green and glabrescent, and the seed has an orange aril (*F. Farroñay* et al. *2109*, INPA; *A.A. Oliveira* et al. *371*, NY; *J.F. Stancik* et al. *125,* INPA).

***Common Name & Uses.*** Among the names in Peru we have compiled: *cumala-blanca* (*R. Spichiger & P.A. Loizeau 1826*, *R. Trucíos 65* in Spichiger et al., 1990), *pucuna-caspi* (*B.C. Abadie 56*), *cumala-de-hojas-pequeñas* (*B.C. Abadie 53*), *ko-de-ko* (in Bora language, *T. Plowman 7094*); in Brazil: *ucuuba* (*O.P. Monteiro 1445*) and *ucúuba-branca* (*T.D. Gaui* et al. *233*), from tupi *uku* (fat, grease, tallow) and *uba* (tree) (Rodrigues, 1972).

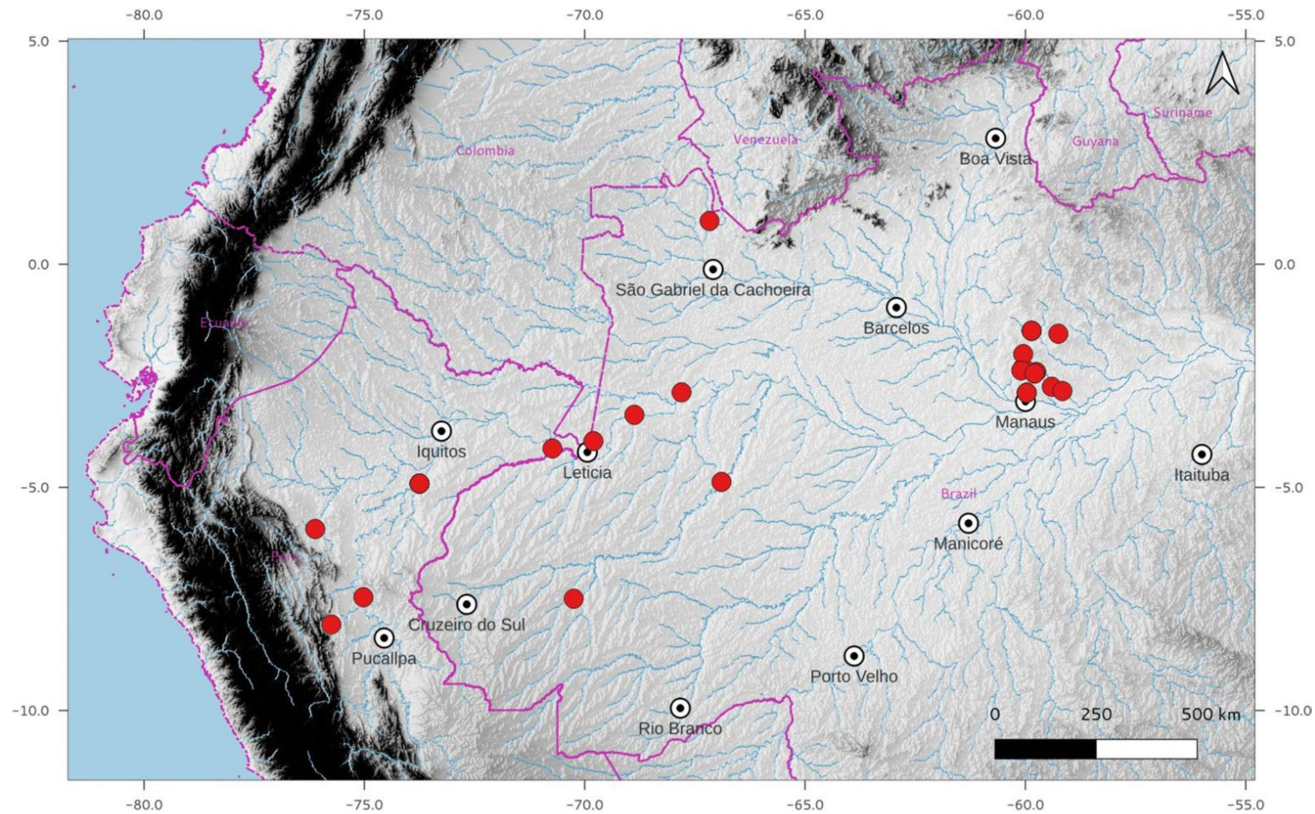


**Fig. 6.** Geographic distribution of *Virola williamii.*

According to Schultes et al. (1977; and based on *T. Plowman et al. 7094*), the resin from the bark of *Virola williamii* (cited as *V. elongata*) is used to make a narcotic paste, from which small balls (pellets) are formed that are then ingested alone or mixed with the leaf ashes of *Carludovica* Ruiz & Pav. (Cyclanthaceae) and *Attalea* Kunth (Arecaceae). The ash from such leaves contains beta-carbolines, which inhibit the monoamine oxidase enzyme in the stomach, allowing the tryptamines present in *Virola williamii* bark to produce their narcotic effects (Davis, 1996, p. 571). According to the Bora Indigenous people of the Peruvian Amazon, this species produces the strongest degree of hallucinogenic effect (Schultes & Hofmann, 1979).

Holmstedt et al. (1980; based on *T. Plowman* et al. *7094*, cited as *V.* aff. *venosa*) reported the percentages of hallucinogenic alkaloid fraction of the bark extract as 58% 5-methoxy-N, N-dimethyltryptamine, 20% N-methyltryptamine, 16% 5-methoxy-N-methyltryptamine, and 6% N, N-dimethyltryptamine, and of the leaves as 90% N-methyltryptamine, 8% N, N-dimethyltryptamine, and 2% 5-methoxy-N, N-dimethyltryptamine.

In the Upper Rio Negro region, the Yanomami people apparently use *Virola williamii* bark in combination with species of Loganiaceae and Menispermaceae for producing poisonous arrows used in hunting (Biocca, 1966: photo no. 85, p. 182).

***Notes.*** Many of the herbarium collections of *Virola williamii* were previously determined as *V. elongata* (Benth.) Warb. or *V. sebifera* Aubl. (e.g., Smith & Wodehouse, 1938; Rodrigues, 1980; Spichiger et al., 1990), both widely distributed in the Neotropics (Rodrigues, 1980; Santamaría & Lagomarsino, 2022; Brito et al., 2023) and considered hyperdominant in the Amazon (ter Steege et al. 2013). All three species are similar in perianth size and in having the androecial column shorter than the anthers. However, vegetatively, *Virola williamii* typically has relatively smaller leaves and fewer secondary veins than in the other two species.

Based on morphological and molecular evidence, the analysis of Steeves (2011) supported the monophyly of the informal infrageneric groups Multinervae and Sebiferae proposed by Smith & Wodehouse (1938). *Virola williamii* could be included in the Sebiferae clade, along with *V. elongata* and *V. sebifera*, due to having fewer secondary veins than in species of the Multinervae clade (9–13 vs. 20–60), and a thinner pericarp (0.6–0.8 mm thick vs. 1–7 mm thick). The morphological differences between these three species are summarized in Table 1.

**Table 1.** Comparison of *Virola williamii* with the morphologically most similar species (based in part on Rodrigues, 1980).

| Morphological character | *V. williamii* | *V. elongata* | *V. sebifera* |
|---|---|---|---|
| Leaf blade size | 5.5–12.1 × 1.8–4.1 cm | 12–35 × 4–11 cm | 15–47 × 6–15 cm |
| Leaf blade shape | elliptic | narrowly oblong to oblong-elliptic | oblong, ovate, elliptic to deltoid-oblong |
| Leaf blade base | cuneate | obtuse to subcordate | cordate, rounded, truncate or broadly obtuse |
| No. of secondary veins | 9–13 | 9–25 | 10–28 |
| Abaxial pubescence on leaves | sparsely puberulent, soon glabrescent, stellate-sessile to dendritic trichomes | puberulent, sessile-stellate to dendritic trichomes | uniformly tomentose, stalked and ferruginous trichomes |
| Fruit size | 1.1–1.6 × 0.9–1.1 cm | 1.1–2.1 × 0.8–1.5 cm | 1–1.9 × 0.7–1.4 cm |
| Pubescence on fruits | sparsely puberulent to glabrescent, also with sessile-stellate trichomes | densely tomentose but soon glabrescent, also with dendritic trichomes | densely tomentose at maturity, also with dendritic trichomes |

A few specimens of the new species had been determined as *Virola venosa* (Benth.) Warb. (e.g., *J.G. Carvalho-Sobrinho* et al. *1072*, INPA; *T. Plowman* et al. *7094*, INPA in Holmstedt et al., 1980), with which the new species can be confused due to similarities in the size and shape of their leaves. However, *V. williamii* differs from *V. venosa* in having fewer lateral veins in the leaves, less conspicuously reticulated veinlets on both sides, a shorter filament column, and less persistent pubescence on the fruits. Both species occur in sympatry in the permanent plots of both the BDPFF project and the Reserva Florestal Adolpho Ducke in the Central Amazon.

The new species might also be confused with *Virola parvifolia* Ducke, with which it shares small elliptical, glabrous leaves, but it differs morphologically from that species by having fewer secondary veins in the leaves (9–13 vs. 14–16), fewer flowers per cluster (2–6 vs. 5–15), and a shorter filament column (0.2–0.6 mm long vs. 1 mm long), and by growing on clay soils (vs. white-sands).

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**Author contributions**

FF, JBDS, MTSM, ACSA, MVP and AV collected plant materials during field expeditions. FF and DSA reviewed herbarium material and investigated the taxonomy of species involved. All authors contributed to the writing of the manuscript. FF and AV prepared the figures.

## Declarations

**Competing Interests**

The authors declare that they have no competing interests.

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