

## **A gold mine: four more new species of *Tovomita* (Clusiaceae: Clusieae) from Amazonia**

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## A gold mine: four more new species of *Tovomita* (*Clusiaceae*: *Clusieae*) from Amazonia

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**Abstract:** Four new species of *Tovomita* endemic to Amazonia are here described. *Tovomita caudata* and *T. grandis* occur in the Department of Loreto in Amazonian Peru, and *T. caudata* also occurs in W Amazonian Brazil. *Tovomita nervosa* and *T. nidiae* are endemic to the Amazonian region of Venezuela, in the states of Amazonas and Bolívar, respectively. Descriptions, illustrations, a distribution map, and taxonomic comments about similar species are provided.

**Resumen:** Se describen cuatro nuevas especies endémicas de *Tovomita* de la Amazonia. *Tovomita caudata* y *T. grandis* ocurren en la Amazonia peruana, las dos en el departamento de Loreto, y *T. caudata* que también ocurre en la Amazonia occidental brasileña. *Tovomita nervosa* y *T. nidiae* son endémicas de la región de la Amazonia venezolana, en los estados de Amazonas y Bolívar, respectivamente. Se presentan descripciones, ilustraciones, un mapa de distribución geográfica y comentarios acerca de las afinidades taxonómicas de las especies de estudio.

**Key words:** Amazonia, Brazil, *Clusiaceae*, *Clusieae*, diversity, *Malpighiales*, neotropics, new species, Peru, South America, taxonomy, *Tovomita*, Venezuela

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## Introduction

*Tovomita* Aubl., with about 50 species, is not a large genus compared to other genera of *Clusiaceae*, such as *Clusia* L. and *Garcinia* L., each with about three hundred species (Stevens 2001+). However, detailed taxonomic studies have revealed several new species of *Tovomita*, demonstrating that investigations of relatively old groups without recent revisions can be very promising in discovering new species. *Tovomita* has had two important moments throughout its taxonomic history. In 1860, Planchon & Triana described about 15 new species based on Amazonian collections, while at the end of the 20<sup>th</sup>

century brief comments and a taxonomic key to 27 species of the genus were published in *Flora of the Venezuelan Guayana* (Cuello 1998), and three new species were published from Amazonian Peru and Venezuela (Cuello 1999, 2003).

A revision of *Tovomita* was started in 2013, and since then several new taxa and nomenclatural changes have been proposed (Marinho & al. 2015, 2016a, 2016b, 2016c, 2018, 2019; Marinho 2018). With experience, one can recognize plants and specimens of *Tovomita* even sterile or with only staminate inflorescences by the branches with proximal internodes longer than distal internodes, terminal inflorescences, and floral buds

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enclosed by the outer pair of sepals (Cuello 1998). To continue this task, here we describe four new species of *Tovomita* from Brazilian, Peruvian and Venezuelan Amazonia, further harvesting from the gold mine of *Tovomita* diversity. Illustrations, a distribution map and comments about etymology, occurrence and habitat, and similar species are provided.

## Material and methods

The descriptions are based on collections from the herbaria CAS, GH, MG and NY (herbarium codes according to Thiers 2019+). Flower measurements were taken from rehydrated flowers and floral buds, and flower colours are from herbarium labels. Leaf terminology follows Ellis & al. (2009), except when indicated, and flower and fruit terminology follows Radford & al. (1974). The geographic distribution map was created using the website Simple-Mappr (Shorthouse 2010); the style of the map was modified. The conservation status of the new species was assessed based on IUCN (2012) criteria.

## Results and Discussion

The four species described here occur in the W portion of Amazonia. Based on the conservation assessments, all four species are Data Deficient (DD) because there are few records.

***Tovomita caudata* L. Marinho, sp. nov.** – Fig. 2A–G. Holotype: Peru, Loreto, Río Mamón [Momón] near Nanay, 03°41'27"S, 73°15'56"W, 1 Sep 1972, *T. B. Croat 19887* (holotype: MO MO-1593390 [photo!]; isotypes: CAS accession no. 649489!, GH!, NY NY02859725!).

**Diagnosis** — *Tovomita caudata* is similar to *T. amazonica* (Poepp.) Walp. by the small leaves, ovoid floral buds and number of stamens (c. 23). The species can be distinguished from *T. amazonica* by the subcoriaceous (vs chartaceous) leaf blades with a long-acuminate apex (0.6–1.2 cm vs up to 0.8 cm long on large leaves) and

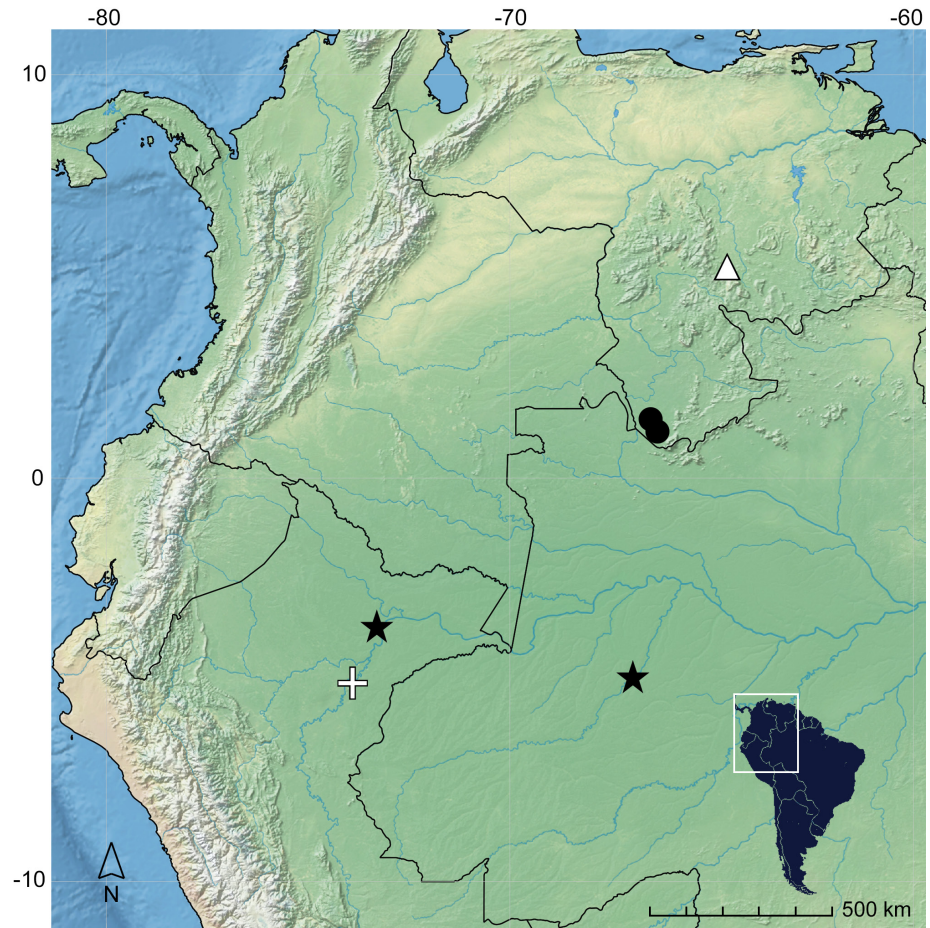


Fig. 1. Distribution of *Tovomita caudata* (black stars), *T. grandis* (white cross), *T. nervosa* (black circles) and *T. nidiae* (white triangle).

18–26 (vs 13–18) secondary veins, and smaller floral buds, sepals, petals and stamens.

**Description** — Trees up to 8 m tall, prop roots and exudate not seen. Petioles 0.7–1 cm long, smooth, colour not seen, lenticels absent. Leaf blades 4.4–8.2 × 1.6–3.2 cm, elliptic to oblong, greenish *in sicco*, subcoriaceous, black dots absent, base decurrent, apex long-acuminate, acumen 0.6–1.2 cm long; papillae and lenticels absent; exudate channels prominent adaxially, immersed abaxially, parallel to secondary veins. Venation: secondary veins in 18–26 pairs, 1.5–3 mm apart, forming angle 70°–80° to midvein, prominent adaxially, immersed abaxially, straight near margin; intersecondary veins present, two or more per intercostal area, similar to secondary veins, > 50% of length of subjacent secondary veins; tertiary veins inconspicuous; intramarginal vein present. Inflorescences: ♂ a lax dichasium with up to 21 flowers, lacking primary flower, ♀ not seen. Pedicel 6–11 mm long, colour not seen, thin, proximally articulated on lateral flowers of dichasia, bracteoles non calyptrate and lenticels absent. Floral buds 2–4 mm long, ovoid, apex rounded, lenticels absent. Sepals 4, 2–4 × 2.3–3.5 mm, ovate, apex rounded, green; petals 4, 3–4 × 0.9–1.1 mm, oblong to linear, patent, apex rounded, colour not seen. Staminate flowers



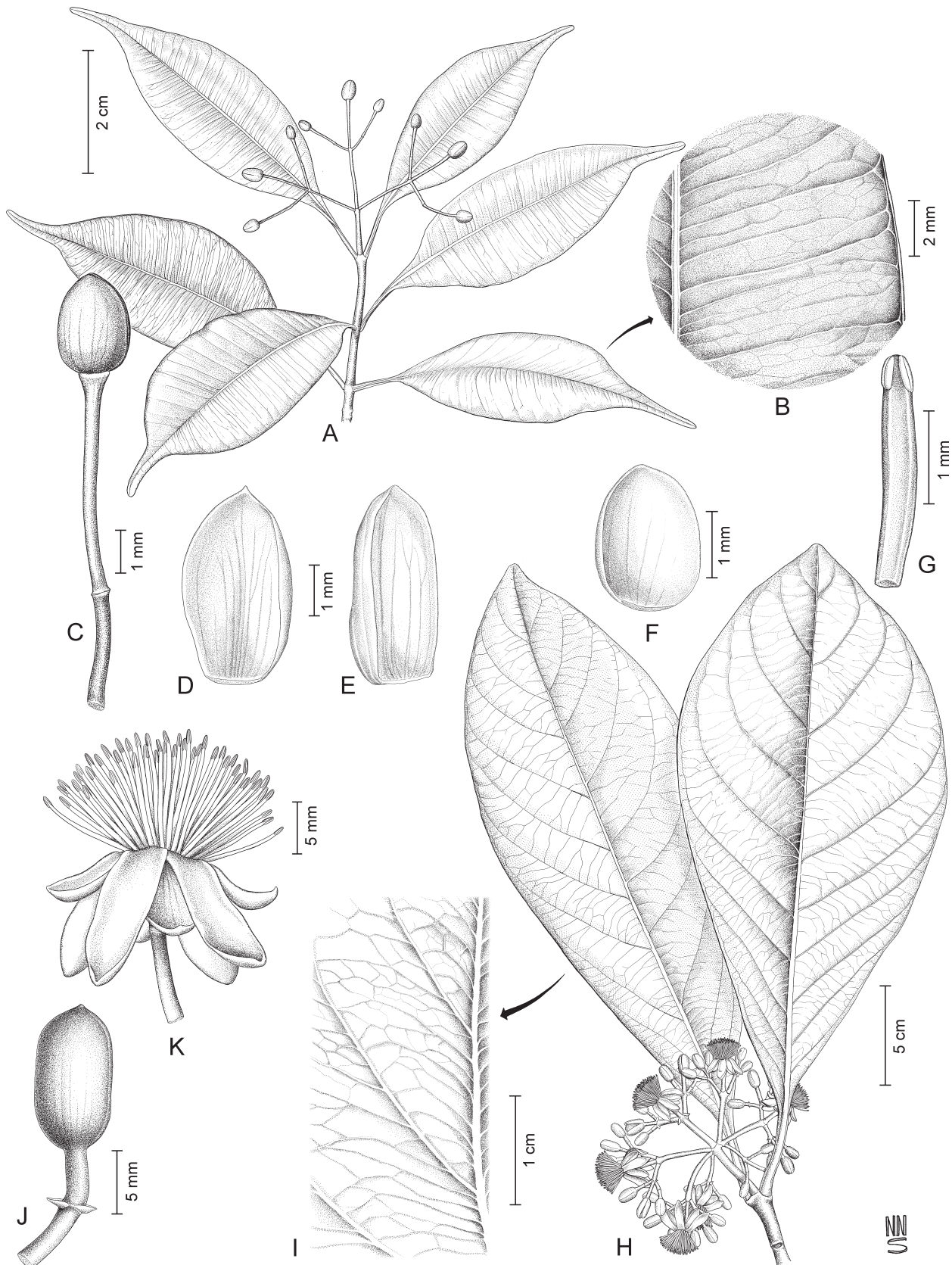


Fig. 2. A–G: *Tovomita caudata*; A: branch with staminate inflorescence; B: detail of adaxial surface of leaf blade; C: staminate floral bud; D, E: petal, adaxial and side view; F: sepal, adaxial view; G: stamen, adaxial view. – H–K: *Tovomita grandis*; H: branch with staminate inflorescence; I: detail of abaxial surface of leaf blade; J: staminate floral bud; K: staminate flower. – Illustrations by Natanael Nascimento.

with c. 23 stamens, 2.3–2.8 mm long, heterodynamous; filaments terete, colour not seen; anthers 0.4–0.5 mm long, yellow, same thickness as filaments, connective not exceeding thecae; pistillode c. 0.2 mm long, conical, colour not seen. Pistillate flowers and fruits not seen.

*Distribution and ecology* — *Tovomita caudata* occurs in the Juruá River basin in Brazil (Amazonas state) and Amazon River basin (Momón River) in Peru (Fig. 1). The species occurs in areas with clay soil, near watercourses.

*Etymology* — The specific epithet refers to the long-acuminate apex of the leaves (caudate, from the Latin word *caudatus*, sensu Beentje [2016]).

*Recognition and discussion* — *Tovomita caudata* can be easily recognized, even when sterile, by the small leaves with a long-acuminate apex (0.6–1.2 cm long) (Fig. 2A). *Lisboa 1614*, which belongs to *T. caudata*, was mistakenly included by Marinho & al. (2016b) as a paratype of *T. trachycarpa* L. Marinho (= *T. amazonica*). These two species can be differentiated by their leaf blade texture (subcoriaceous vs chartaceous to membranaceous in *T. amazonica*) and number of secondary veins (18–26 vs 13–18 pairs in *T. amazonica*). The abaxial leaf surface of *T. caudata* resembles that of *T. calophyllophylla* García-Villacorta & Hammel and *T. colombiana* L. Marinho because of the presence of two or more intersecondary veins per intercostal area. *Tovomita caudata* can also be distinguished from these two species by the long-acuminate leaf apex.

*Additional specimen examined* — BRAZIL: AMAZONAS: Carauari, rio Juruá, Poço Munguba-1 (MG-1) da Petrobrás, a 32 km do Gavião ES-50, 24 Oct 1980, P. Lisboa & al. 1614 (MG!).

*Tovomita grandis* L. Marinho, **sp. nov.** – Fig. 2H–K.

Holotype: Peru, Loreto, Provincia Requena, swampy forest along creeks, dominated by palms (aguajal) and forest on sandy soil, 140 m, 11 Aug 1988, H. van der Werff & al. 10104 (holotype: NY NY02859715!; isotype: MO accession no. 3705235 [photo!]).

*Diagnosis* — *Tovomita grandis* is similar to *T. choisyana* Planch. & Triana but can be differentiated by the secondary veins forming an angle 30°–45° to the midvein (vs 65°–75°), intersecondary veins usually absent (vs always present), lax inflorescence lacking a primary flower (vs usually congested inflorescence with primary flower), and 45–50 (vs 55–75) stamens.

*Description* — Trees up to 18 m tall, prop roots not seen; exudate yellowish, abundant. Petioles 4.6–5 cm long, colour not seen, smooth, lenticels absent. Leaf blades 29.5–35.5 × 12.5–14.3 cm, spatulate to obovate, dark brown *in sicco*, black dots absent, coriaceous, base decurrent, apex rounded; papillae and lenticels absent;

exudate channels inconspicuous. Venation: secondary veins in 8–10 pairs, 20–45 mm apart, forming an angle 30°–45° to midvein, prominent on both surfaces, slightly arcuate near margin; intersecondary veins usually absent, rarely present, one per intercostal area, thinner than secondary veins, distal course reticulating, < 50 % of length of subjacent secondary veins; tertiary veins perpendicular; intramarginal vein absent. Inflorescences: ♂ a lax 7-branched pleiochasium with up to 94 flowers, lacking primary flower, ♀ not seen. Pedicel 8–12 mm long, colour not seen, distal portion slightly thickened, proximally articulated in all flowers of dichasia, bracteoles non calyprate and lenticels absent. Floral buds 8–12 mm long, oblong, apex rounded, lenticels absent. Sepals 4, 8–12 × 4–5 mm, oblong, apex rounded, greenish to white; petals 4, c. 16 × 6 mm, oblong, reflexed, apex rounded, white. Staminate flowers with 45–50 stamens, 10–12 mm long, heterodynamous; filaments terete, white; anthers 1–1.1 mm long, slightly wider than filaments, connective not exceeding thecae; pistillode 1.2 mm long, conical. Pistillate flowers and fruits not seen.

*Distribution and ecology* — *Tovomita grandis* occurs in Loreto, Peru (Fig. 1) in swampy lowland forests (140 m a.s.l.) on sandy soils.

*Etymology* — The epithet is derived from the Latin word *grandis* and means great or large, referring to the large leaves and flowers.

*Recognition and discussion* — *Tovomita grandis* can be recognized by the large and spatulate leaves, 29.5 to 35.5 cm long, and secondary veins forming an angle 30°–45° to the midvein, which is not common in *Tovomita*. Its floral buds and flowers are also large, similar to those found in *T. choisyana* and *T. megantha* L. Marinho & Amorim. However, *T. grandis* can be differentiated from these two species by the secondary veins forming an angle 30°–45° to the midvein (vs 65°–75° in *T. choisyana* and > 45° in *T. megantha*), intersecondary veins usually absent (vs always present in *T. choisyana* and *T. megantha*), and flowers with 45–50 stamens (vs 55–75 in *T. choisyana* and 60–80 in *T. megantha*). The staminate inflorescence of *T. grandis* is a lax, 7-branched pleiochasium that lacks a primary flower, which differs from the usually congested, 5-branched pleiochasium with a primary flower in *T. choisyana*, and the 9-flowered dichasium of *T. megantha*. Also, the geographic distributions of these species do not overlap, since *T. megantha* is endemic to the Atlantic Forest and *T. choisyana* occurs in coastal areas from the Atlantic Forest and Amazonia, in Brazil and the Guianas.

*Tovomita nervosa* L. Marinho, **sp. nov.** – Fig. 3A–E, Table 1.

Holotype: Venezuela, Amazonas, lower part of the río Baria, inundated forest along river, 01°27'–01°10'N,



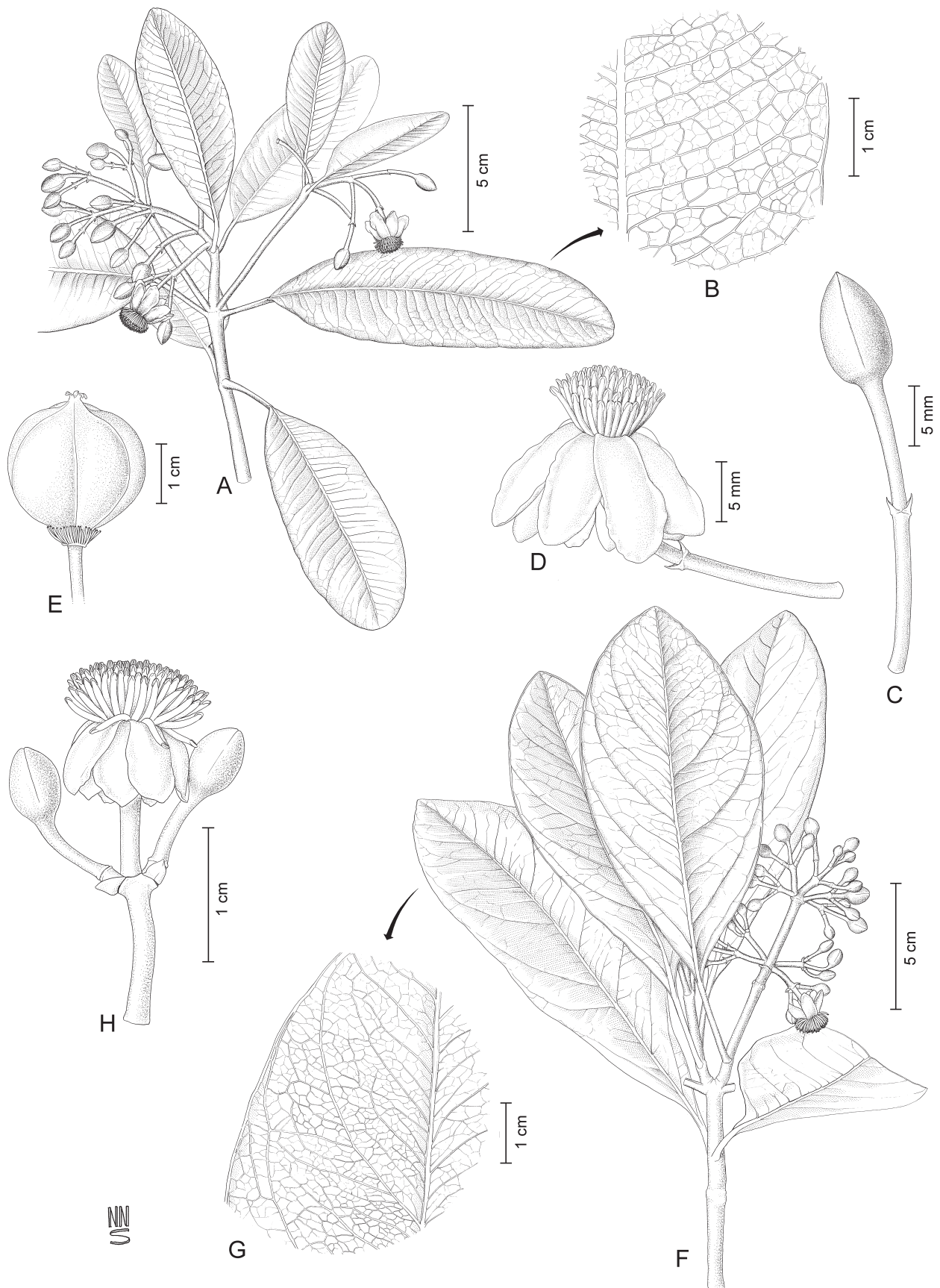


Fig. 3. A–E: *Tovomita nervosa*; A: branch with staminate inflorescence; B: detail of adaxial surface of leaf blade; C: staminate floral bud; D: staminate flower; E: closed fruit. – F–H: *Tovomita nidiae*; F: branch with staminate inflorescence; G: detail of abaxial surface of leaf blade; H: staminate dichasium. – Illustrations by Natanael Nascimento.

Table 1. Morphological comparison between *Tovomita nervosa* and two morphologically similar species.

	<i>T. calophyllophylla</i>	<i>T. clarkii</i>	<i>T. nervosa</i>
Shape of leaf blade apex	acuminate	rounded to slightly retuse	acuminate to rounded
Number of pairs of secondary veins of leaf blade	24–47	15–20	27–30
Distance between secondary veins of leaf blade	3–4 mm	3.3–6.7 mm	3–4 mm
Floral bud shape	spheroid	spheroid	ovoid to oblong
Floral bud length	4–6 mm	6–7.5 mm	8.5–12 mm
Stamen number	40–50	c. 25	70–75
Anther length	0.8–1 mm	1.5–2 mm	1.5–1.7 mm
Fruit shape	pyriform to rhombic	ovoid	spheroid

66°32'–66°25'W, 80 m, 22–23 Jul 1984, *G. Davidse* 27596 (holotype: NY NY02859716!; isotypes: MO accession no. 5622868 [photo!], MO accession no. 5687866 [photo!], VEN accession no. 324563 [photo!]).

**Diagnosis** — *Tovomita nervosa* can be differentiated from *T. clarkii* Pipoly ex. L. Marinho & Gahagen by the number of secondary veins (27–30 pairs vs 15–20), from *T. calophyllophylla* by the floral bud length (8.5–12 mm vs 4–6 mm), and from both species by the ovoid to oblong floral buds (vs spheroid) and number of stamens (70–75 vs < 50).

**Description** — Trees up to 8 m tall, prop roots not seen; exudate yellow, abundant. Petioles 1.3–2.5 cm long, colour not seen, transversely striate, lenticels absent. Leaf blades 7.6–16.8 × 3.5–7.5 cm, oblong to obovate, greenish to yellowish *in sicco*, black dots inconspicuous abaxially, sparsely distributed, coriaceous, base convex, apex acuminate to rounded; exudate channels inconspicuous. Venation: secondary veins in 27–30 pairs, 3–4 mm apart, forming an angle 70°–75° to midvein, strongly prominent on both surfaces, straight near margin; intersecondary veins present, one or rarely two per intercostal area, similar to secondary veins, distal course reticulating, > 50% of length of subjacent secondary veins; tertiary veins percurrent, sinuous; intramarginal vein present. Inflorescences: ♂ a lax dichasium with up to 27 flowers, lacking primary flower, ♀ a 3-flowered dichasium. Pedicel 9–15 mm long, colour not seen, proximally articulated in lateral flowers of dichasia, bracteoles non calyptrate and lenticels absent. Floral buds 8.5–12 mm long, ovoid to oblong, apex rounded to acute, lenticels absent. Sepals 4, 8.5–12 × 5–6.5 mm, oblong to obovate, apex rounded to acute, greenish to white; petals 4, 12–18 × 6–9 mm, spatulate to obovate, reflexed, apex rounded, white. Staminate flowers with 70–75 stamens, 5–7 mm long, isodynamous; filaments terete, white; anthers 1.5–1.7 mm long, slightly wider than filaments, connective not exceeding thecae; pistillode not seen. Pistillate flowers with 40–45 staminodes, 3.5–4 mm long, white to pale yellow; gynoecium not seen. Capsules fleshy, c. 1.9

× 2.2 cm, 5-septate, spheroid when closed, not costate, slightly lobed, epicarp smooth, green when immature, mature fruit and mesocarp colour not seen; sepals and petals caducous, staminodes and stigmas persistent; fused part of styles c. 3 mm long, free part c. 3.5 mm long. Seed aril colour not seen.

**Distribution and ecology** — *Tovomita nervosa* is presumably endemic to Amazonas State, Venezuela, near the N border of Amazonas State, Brazil (Fig. 1). All of the known specimens were collected in a flooded forest on the lower part of the Baria River, in the Negro River basin.

**Etymology** — The specific epithet refers to the conspicuously prominent veins on both surfaces of the leaf blades. It is derived from the Latin word *nervus*, which means rope or tendon.

**Recognition and discussion** — All specimens of *Tovomita nervosa* had previously been treated as *T. clarkii* by Pipoly (on the sheet) and as “*Tovomita* sp. F” in *Flora of the Venezuelan Guayana* (Cuello 1998). In the valid description of *T. clarkii*, Marinho & al. (2016c) excluded two specimens (*Davidse* 26796 and 27596, from MO) based on subtle differences in the leaves and floral buds. These two specimens are here included under *T. nervosa*. This new species is similar to *T. calophyllophylla* and *T. clarkii* by the long (1.2–2.2 cm) striate petioles, coriaceous to subcoriaceous leaf blades, and a large number of secondary veins. However, these species can be distinguished by several features of the leaves, floral buds and fruits (Table 1).

**Additional specimens examined** — VENEZUELA: AMAZONAS: Departamento Río Negro, lower part of the río Baria, inundated forest along river, 01°27'–01°10'N, 66°32'–66°25'W, 80 m, 22–23 Jul 1984, *G. Davidse* 27716 (MO [photo!], NY!); *ibid.*, middle part of the río Baria, forest around small laja, margin of the flooded forest, 01°05'N, 66°25'W, 80 m, 29 Jul 1984, *G. Davidse* & *J. S. Miller* 26796 (MO [photo!], NY!, VEN [photo!]).

*Tovomita nidiae* L. Marinho, **sp. nov.** – Fig. 3F–H.

Holotype: Venezuela, Bolívar, selva de galería y sabana a lo largo del río Kanarakuni, norte y noroeste de la Misión de Campamento Sanidad del río Kanarakuni, 400 m, 17–29 Mar 1967, *J. Steyermark* 98189 (holotype: NY NY02859717!; isotypes: NY!, VEN accession no. 267599 [photo!]).

**Diagnosis** — *Tovomita nidiae* can be distinguished from other species of *Tovomita* by the combination of a decurrent leaf base and 5–6 pairs of secondary veins, forming an angle 40°–45° to the midvein and connecting near the margin of the blade. The species can also be distinguished from the morphologically similar *T. grandis* by the ovoid (vs oblong) floral buds and smaller flowers (floral buds: 7–9 vs 8–12 mm long in *T. grandis*).

**Description** — Trees up to 15 m tall, prop roots inconspicuous; exudate yellow, abundant. Petioles 1.2–3.3 cm long, colour not seen, smooth, lenticels absent. Leaf blades 8.4–14.3 × 3.3–5.8 cm, spatulate to obovate, greenish to brownish *in sicco*, black dots absent, subcoriaceous, base decurrent, apex rounded to straight; papillae and lenticels absent; exudate channels inconspicuous. Venation: secondary veins in 5–6 pairs, 15–28 mm apart, forming an angle 40°–45° to midvein, immersed adaxially, prominent abaxially, arcuate, connecting near margin; intersecondary veins present, one to three per intercostal area, much thinner than secondary veins, distal course reticulating, c. 50% length of subjacent secondary veins; tertiary veins reticulate, composite admedial; intramarginal vein absent. Inflorescences: ♂ a lax, 5-branched pleiochasium with up to 35 flowers, lacking primary flower, ♀ not seen. Pedicel 8–16 mm long, green, proximally articulated in lateral flowers of dichasia, rarely in central flower, bracteoles non calyptrate and lenticels absent. Floral buds 7–9 mm long, ovoid, apex rounded, lenticels absent. Sepals 4, 7–9 × 6–7 mm, ovate to oblong, apex rounded, greenish to white; petals 4, 11–12 × 3.5–4 mm, oblong, deflexed, apex rounded, white. Staminate flowers with 60–65 stamens, 4.5–7 mm long, heterodynamous; filaments terete, creamy white; anthers 0.5–0.9 mm long, same thickness as filaments, connective not exceeding thecae; pistillode c. 0.5 mm long, styles 6, amorphous. Pistillate flowers and fruits not seen.

**Distribution and ecology** — *Tovomita nidiae* is endemic to Bolívar State, Venezuela (Fig. 1), where it occurs in areas of savanna associated with watercourses (from the label). The species is distributed in lowlands from 170–400 m a.s.l.

**Etymology** — The specific epithet honours Dr. Nídia Cuello (Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora, Venezuela), who was responsible for advancing taxonomic studies of *Tovomita*, especially in Peru and Venezuela.

**Recognition and discussion** — *Tovomita nidiae* can be easily recognized, even when sterile, by the decurrent leaf blade base and low number of secondary veins (5–6 pairs) that form an angle 40°–45° to the midvein and connect to each other near the blade margin. In *T. schomburgkii* Planch. & Triana, which also has a low number of secondary veins (6–11 pairs), the leaves have an acuminate apex (vs rounded to straight in *T. nidiae*) and the flower buds are smaller (3.5–5.5 mm vs 7–9 mm long in *T. nidiae*). *Tovomita nidiae* is also similar to *T. grandis*. These two species have spatulate to obovate leaf blades with decurrent bases; however, they differ by the number of secondary veins (5–6 in *T. nidiae* vs 8–9 in *T. grandis*), floral bud shape (ovoid in *T. nidiae* vs oblong in *T. grandis*), and size of flower parts (e.g. stamens 4.5–7 mm long in *T. nidiae* vs 10–12 mm long in *T. grandis*). Although the pistillate flowers and fruits of *T. nidiae* have not been analysed, it is possible to infer that the species is 6-carpellate based on the number of pistillode stigmas. The type specimens of *T. nidiae* were treated as *T. longifolia* in *Flora of the Venezuelan Guayana* (Cuello 1998).

**Additional specimens examined** — VENEZUELA: BOLÍVAR: Distrito Cedeño, along tributary of the río Erebató, 05°09'N, 64°34'W, 170 m, 12 Mar 1992, *B. Boom & E. Marin* 10438 (NY 2 sheets!).

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