

## An update on the genus *Monoon* (Annonaceae) in the New Guinea region

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### Abstract

Five new species and one new record are reported for the genus *Monoon* in Papuasia while the limits of the *M. polycarpum* group are clarified. Confusion regarding the proper application of names between the similar species *M. polycarpum* (Burck) B.Xue & R.M.K.Saunders and *M. oblongifolium* (C.B.Rob.) B.Xue & R.M.K.Saunders has led to either name being used interchangeably in New Guinea, despite the latter being a Philippine endemic. To resolve the confusion among this group, all Papuan specimens formerly treated under these two names are recognized here as a single variable species, combined under *M. chloroxanthum* Miq., with a revised description. An easily recognizable and widespread new species, *M. excelsum* Ezedin, is described, segregated from a large subset of material that had been incorrectly treated under *M. polycarpum* for nearly a century. It is distinguished by its massive size, being an emergent canopy tree with larger leaves, higher secondary vein count, longer petals, fewer carpels and stamens, and fewer but larger monocarps. Four others, *M. ascendens* Ezedin, *M. gisorum* Ezedin, *M. laxatum* Ezedin, and *M. prolixum* Ezedin, are additionally described. Finally, *M. barnesii* (Merr.) B.Xue & R.M.K.Saunders, previously considered a Philippine endemic, is newly reported for New Guinea and Bougainville with an updated description while the distribution of *M. pachypetalum* I.M.Turner & Utteridge is expanded. Brief notes on the genus, including a discussion on species limits, along with a key to the nine Papuan species, are provided.

### Introduction

*Monoon* Miq. (Annonaceae: Miliuseae: Neo-uvariinae) is a genus of around 80 species of small to large trees found throughout tropical Asia, from southern India to northern Australia. Originally established by Miquel (1865) as a heterogeneous assemblage of taxa, it was later reduced to a section of *Polyalthia* Blume by Benthham & Hooker (1867). Following their genetic study of the *Polyalthia* group, Xue et al. (2012) reinstated the genus *Monoon* with a revised definition, transferring many former *Polyalthia* species in the process. The genus can be separated from the other three *Polyalthia* segregates by the following: eucamptodromous secondaries with decurrent insertion to the midvein, percurrent tertiaries, uniovulate carpels producing single-seeded monocarps, and lamelliform ruminations in the endosperm (Xue et al. 2012). For a key to the four *Polyalthia* segregates, along with the other 11 Annonaceae tree genera present in New Guinea, see Utteridge (2021). The genus is well-supported as sister to *Neo-uvaria* Airy Shaw of western Malesia and together they are the only two members of the newly established subtribe Neo-uvariinae (Nge et al. 2024).

Currently, four species of *Monoon* are recognized in New Guinea (Utteridge 2021). Of these, *M. polycarpum* (Burck) B.Xue & R.M.K.Saunders is the most commonly collected

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and widespread. However, confusingly, most herbarium specimens of this species are often identified as *Polyalthia oblongifolia* Burck, or more recently as *M. oblongifolium* (C.B.Rob.) B.Xue & R.M.K.Saunders. Yet the species *M. oblongifolium* is actually endemic to the Philippines (Pelser et al. 2011–). The confusion between the two names is rooted in the publication history of the epithet “oblongifolium”.

On July 1911, Charles B. Robinson first published the name *Polyalthia oblongifolia* C.B.Rob. based on a Philippine type (Robinson 1911). Just a few months later in November 1911, William Burck separately published a species from New Guinea using the same epithet, *Polyalthia oblongifolia* Burck (Burck 1911). The illegitimate latter homonym was eventually synonymized under *Polyalthia polycarpa* Burck, a name that was published in the same publication, on the same page, and described with very similar morphology. The only apparent differences noted by Burck (1911) of the former being smaller petals and fewer sessile carpels.

However, confusion around the epithet eventually led to confusion of the species, with the majority of Papuan specimens collected in the 20<sup>th</sup> and 21<sup>st</sup> centuries belonging to *M. polycarpum* still being determined under the ‘oblongifolia/um’ epithet. Moreover, the similar morphologies of the Papuan and Filipino type material added another layer of complication in considering them separate taxa. Although it would be rather satisfying to simply synonymize the two names – for both morphological and nomenclatural purposes – a proper molecular study would be needed. However, in an attempt to better clarify the Papuan species, the description of *M. polycarpum* is here updated based on material observed from across New Guinea, but recognized here as a synonym of *M. chloroxanthum*.

Over several decades, the ‘oblongifolia/um’ epithet became overused in New Guinea as collectors and taxonomists started applying the name quite broadly to a sizeable proportion of material believed to belong to *Polyalthia*, the genus name itself also having been applied rather broadly. It could even be assumed that the determination of ‘*Polyalthia* sp.’ simply became the go-to designation for any obscure Annonaceae tree collected. This led to morphologically distinct entities being allowed to fall within the variation of *P. oblongifolia*. Upon inspection, a large subset of these specimens were found to form a morphologically distinct and homogenous group easily separable from the latter even when sterile. Here, this subset is split out of *M. polycarpum* (= *M. chloroxanthum*) and newly recognized as *M. excelsum* Ezedin. An additional four species are described alongside it, each with varying degrees of distinction from one another.

This account brings the total number of *Monoon* species present in New Guinea to eight, the number of species in the Solomons Archipelago to two, and the total for Papuasias to nine. The genus extends further south into Australia, with three species occurring there (Turner 2018). Despite all currently known Papuasian species being treated here in some form, further efforts are needed to clarify species limits. Further investigations in the field, herbaria, and lab are likely to reveal additional taxa or nomenclatural changes for the region.

## Materials and methods

Recent fieldwork in Papua New Guinea (PNG), followed by an extensive examination of specimens within the former *Polyalthia*

s. lat. group prompted a revision of species limits within the genus. Herbarium specimens were studied in person at BO, HUH [A, ECON, GH], LAE, MIN, and SING. Specimens available digitally from BRI, CANB, CNS, K, L, MEL, NSW, NY, RSA, and US were also examined. Those filed under both *Monoon* and *Polyalthia* were checked as most collections are still treated under the latter genus. Fresh collections of three species, *M. ascendens*, *M. chloroxanthum*, and *M. excelsum*, were made by the author and studied in the field. Digitized type specimens were consulted for the known New Guinea *Monoon* species. A total of 175 specimens are included in this account.

Species treated here were often compared against other species of *Monoon* from the Philippines, Borneo, and Sulawesi. All descriptions and measurements are based on dried material, unless otherwise noted. For specimens collected from localities without recorded GPS coordinate data, estimations are made based on verbatim locality data recorded on the labels; the estimated coordinates are then given in brackets. Conservation status was estimated using the online GeoCAT assessment tool (Bachman et al. 2011).

## Taxonomy

### 1. *Monoon ascendens* Ezedin, *sp. nov.*

Type: Papua New Guinea: Chimbu Province: Border of Chimbu and Gulf Province, Crater Mountain Wildlife Management Area, junction of Wara O and the Pio River, 6°47'S, 145°02'E, 510–610 m, 27 Mar 1997, *Takeuchi 11913* (holo: A [A00871751, A00871752]; iso: LAE [280545, 2 sheets]).

Diagnosis: Differs from *Monoon pachypetalum* in bearing strongly arcuate secondary veins, symmetric bases (vs asymmetric), prominently percurrent tertiary venation nearly perpendicular to the costa, thinner and longer petals at 14–26 × 2–4 mm (vs thicker and 10–13 × 7–10 mm), and glabrous monocarps (vs brown tomentose).

Tree to 15 m high and 25 cm dbh, bole to 9 m high. **Outer bark** dark brown to dark greyish brown, smooth, often with weak transverse ridges. **Inner bark** blaze black; sapwood yellowish to orange. **Stems** pale to dark greyish brown to blackish, smooth, with shallow longitudinal ridges. **Leaves** elliptic to obovate, (13.5–)23–35 × (6–)8–12(–16) cm, thick stiff chartaceous to (sub) coriaceous, often (sub)bullate, when fresh glossy dark green above and glossy medium–light green below, drying dark olive green (to reddish) brown above and (light) brown below, base obtuse to acute, apex strongly acuminate, margins often slightly inrolled; petioles 12–19 × 3–4 mm, swollen, often wrinkled, adaxially grooved, drying black; venation eucamptodromous, midvein (deeply) sunken above, prominent below; secondary veins (5–)7–8(–11), broadly spaced, c. 4.5–6 cm apart at center, arcuate, (subparallel to) angled 10–30(–40)° to the costa; tertiary veins straight percurrent, perpendicular to the costa, bifacially prominent, closely spaced. **Inflorescences** ramiflorous to cauliflorous, developing on excrescences when mature, singular (to paired) on branched, woody brachyblasts bearing multiple flowers in progressive sequence, with pairs of opposing bracts running along the brachyblast, sometimes overlapping and becoming shingle-like, the bracts short and thick, ± semicircular, c. 1 × 2 mm, outer side light brown tomentose, inner side glabrous to puberulous, often in basal pairs subtending



pedicels; flowering pedicels slender and thickened distally, 18–21 × 1–2 mm, usually densely tomentose when young then glabrescent, with a single medial bract; bracts basal to medial, up to ½ the distance from pedicel base, broadly triangular-ovate, 2 × 1 mm, outer side densely tomentose, inner side glabrous to puberulous. **Sepals** 3, broadly (triangular) ovate, up to 4 × 5 mm, apex rounded to acute, outer side (sparsely) puberulous to glabrous, inner side glabrous. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, subcoriaceous, 14–26 × 2–4 mm, outer side sparsely puberulous, inner side glabrous, yellow at anthesis; stamens many, in 4–5 series, connective apex truncate, pentagonal; carpels unknown. **Fruits** consisting of up to 8–(9) monocarps per cluster, each cluster up to 15 cm wide; torus small, weakly developed, discoid, up to 1.2 cm wide, sub-woody; pedicels 30–45 × 1–3 mm, (sub)woody, smooth; stipes absent or up to 15 mm long and monocarps appearing subsessile with attenuate bases; monocarps ovoid, 4.5–9 × 3–4 cm, bases acute when sessile or attenuate when shortly stipitate, glabrous, (yellowish) orange when ripe. **Seeds** 1, large, 2–3.3 × 0.9–1.5 cm, semi-lenticular, endosperm ruminant. Fig. 1–2.

**Distribution:** Endemic to Papua New Guinea (Fig. 3).

**Habitat and ecology:** Lowland hill forests, (30–)300–900 m asl. The specimen *Streimann & Kairo* 39236 makes note of the cauliflorous flowers borne on “excrecences on trunk and inhabited by ants,” suggesting that ants may serve as pollen vectors. The laminas sometimes bear insect damage, particularly towards the leaf base, similar to damage seen on species bearing laminar glands or domatia, despite these features being absent. Yet the combination of a prominently raised midvein and the strongly arched secondaries, the vein junctions on the abaxial lamina may serve as false domatia allowing small insects to hide or burrow, thereby possibly funneling increased herbivorous activity. Leaves may sometime be found with galls.

**Etymology:** After the sharply ascending secondary veins and the higher elevational range of the species.

**Conservation status:** Vulnerable (VU). Currently only known from four widely spaced localities spanning both lowlands and lower montane forests with a total estimated extent of occurrence (EOO) of 14,400 km<sup>2</sup> and area of occurrence (AOO) of 600 km<sup>2</sup> with a user defined cell width of 10 km. This species appears to be poorly collected and is likely to be more widespread than is currently known. Its habit as a small understory tree indicates shade preference, meaning it is likely sensitive to disturbance regimes. More intense collection effort will be needed to assess its true extent of occurrence and relative population sizes.

**Vernacular names:** Sé-né (Pawa'an), Yugubnel (Elkei).

**Additional specimens examined:** PAPUA NEW GUINEA. **Chimbu:** O-Pio 1 ha plot, block 17, Crater Mountain Wildlife Management Area, 6°47'19"S, 145°02'12"E, 550 m, 31 Jul 1996, *Weiblen* TP412 (MIN [896783]); Crater Mt. Wildlife Management Area, vicinity of Haia, near the Wara-oo streamcourse (first river E of Mt. Widau), 6°43'S, 145°00'E, 640 m, 18 Sep 1996, *Takeuchi* 11215 (A [A00871753], L [L.1767275], LAE [275415]); Border of Chimbu and Gulf Province, Crater Mt. Wildlife Management Area,

junction of the Wara O and Pio River, 6°47'S, 145°02'E, 510–610 m, 25 Mar 1997, *Takeuchi* 11978 (LAE [280694, 2 sheets]). **East Sepik:** Hunstein Range, 4°30'S, 142°40'E, 270 m, 26 Sep 1989, *Katik* LAE 64220 (L [L.1759861], LAE [268442, 2 sheets], NSW [NSW275630]). **Morobe:** Crater Mt. Wildlife Management Area, E of Haia village, 6°43'S, 145°00'E, 823 m, 13 Sep 1995, *Takeuchi* 11160 (A [A00871754], L [L.1767276], LAE [275678, 2 sheets]). **Sandaun:** Ossima, Vanimo sub-district, 2°56'S, 141°17'E, 30 m, 28 Jan 1969, *Streimann & Kairo* NGF 39236 (L [L.1759715], LAE [110712]); Near Daunda Bridge, Bewani Highway, Vanimo subdistrict, 2°44'S, 141°15'E, 120 m, 9 Sep 1977, *Wiakabu & Mamalai* LAE 70481 (BRI [AQ0350288], L [L.1759817], LAE [237228]); Nuku district, near Almolwol base camp, Mt. Siplin/Sulen complex, Torricelli Range, 3°26'59.6"S, 142°11'13.6"E, 890 m, 26 Jul 2024, *Ezedin* 1773 (A, MIN, SING).

**Notes:** This species is quite distinct as it bears the fewest number of secondary veins (5–10), prominently raised adaxial venation, perpendicular tertiary veins, and sessile monocarps; the last two of these traits being shared by only one other species on the island, *M. pachypetalum*. The only decently flowering specimen, *Katik* LAE 64220, was seen in photograph thus flowers could not be directly examined. This species appears to be closely related to *M. pachypetalum* and *M. salomonicum* based on shared similarities in subsessile monocarps, coriaceous laminas, and prominent perpendicular tertiaries. However, *M. pachypetalum* differs from *M. ascendens* in its smaller and narrower laminas, asymmetric bases, more secondaries (10–14) that are more closely spaced at 1.5–2.5 cm apart (vs 2–5 cm apart), and secondaries not strongly arcuate. Whereas *M. solomonicum* differs in bearing more secondaries (11–15), monocarps that are short stipitate and obloid (vs sessile and elliptic), and petals that are c. 1 × 0.8 cm, triangular, and fleshy (vs 1.4–2.6 × 0.2–0.4 cm, elongate, and thin).

Its current distribution is rather curious, being found in mountainous areas of the Sepik basin and also around the Crater Mountain region. It crosses into the Central Cordilleras which are often considered an effective dispersal barrier. This indicates the species could be more widespread than currently known. It is also unique in being the only *Monoon* species on the island that barely enters the lower montane zone. Although currently only known from the PNG side of the island, it is likely present in Indonesian Papua.

When sterile, it may be reminiscent of *Pseuduvaria*, however the secondary veins in that genus are usually not conspicuously decurrent like in *Monoon*; when fertile, the inner petals are mitriform, and the monocarps contain more than one seed. The arcuate veins and lamina size could also resemble the common lowland species *Cryptocarya caloneura* (Scheff.) Kosterm. (Lauraceae), but the stems are usually hollow the abaxial surface is often iridescent green, the inflorescences paniculate, and the fruits not in clusters radiating from a central torus.

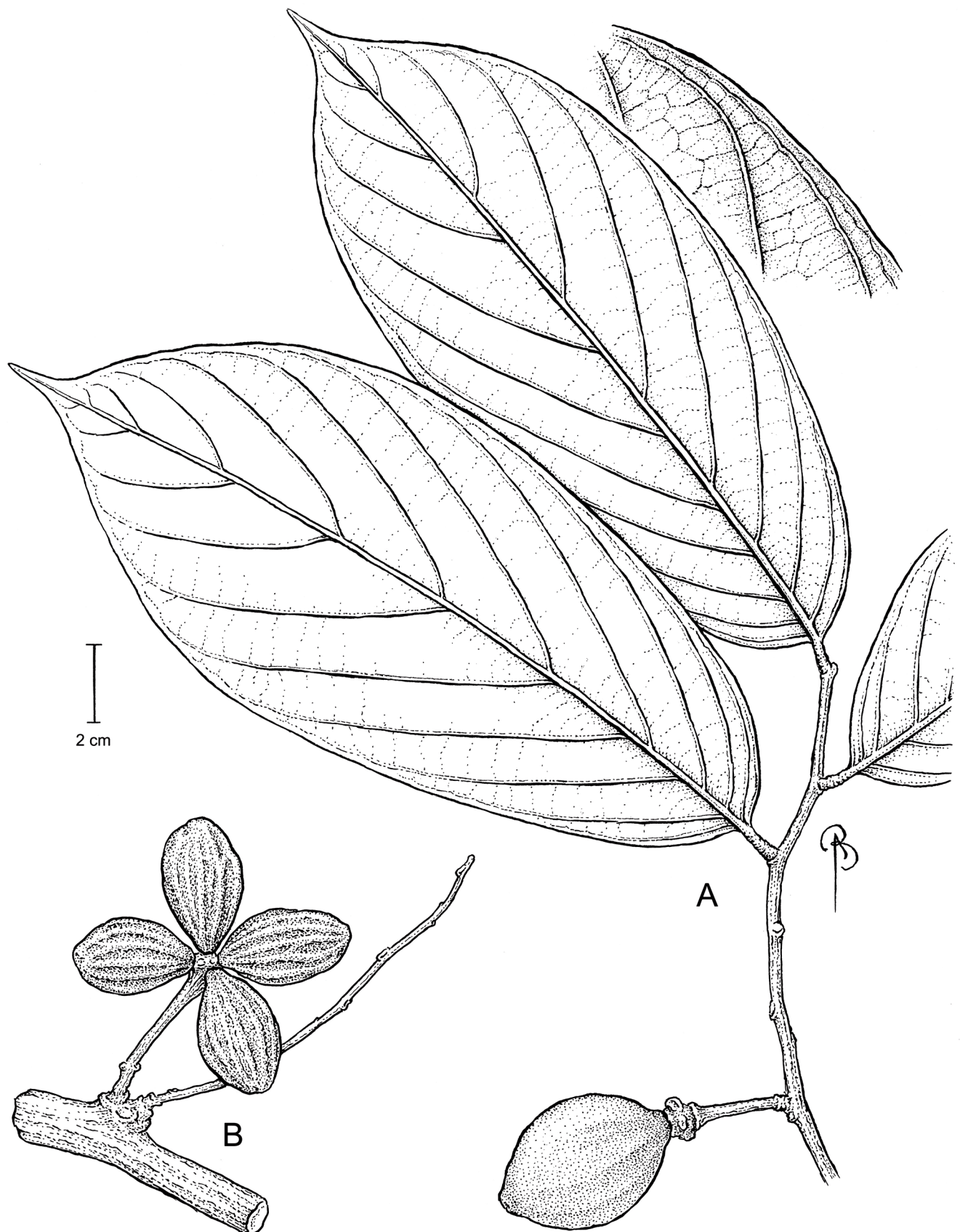
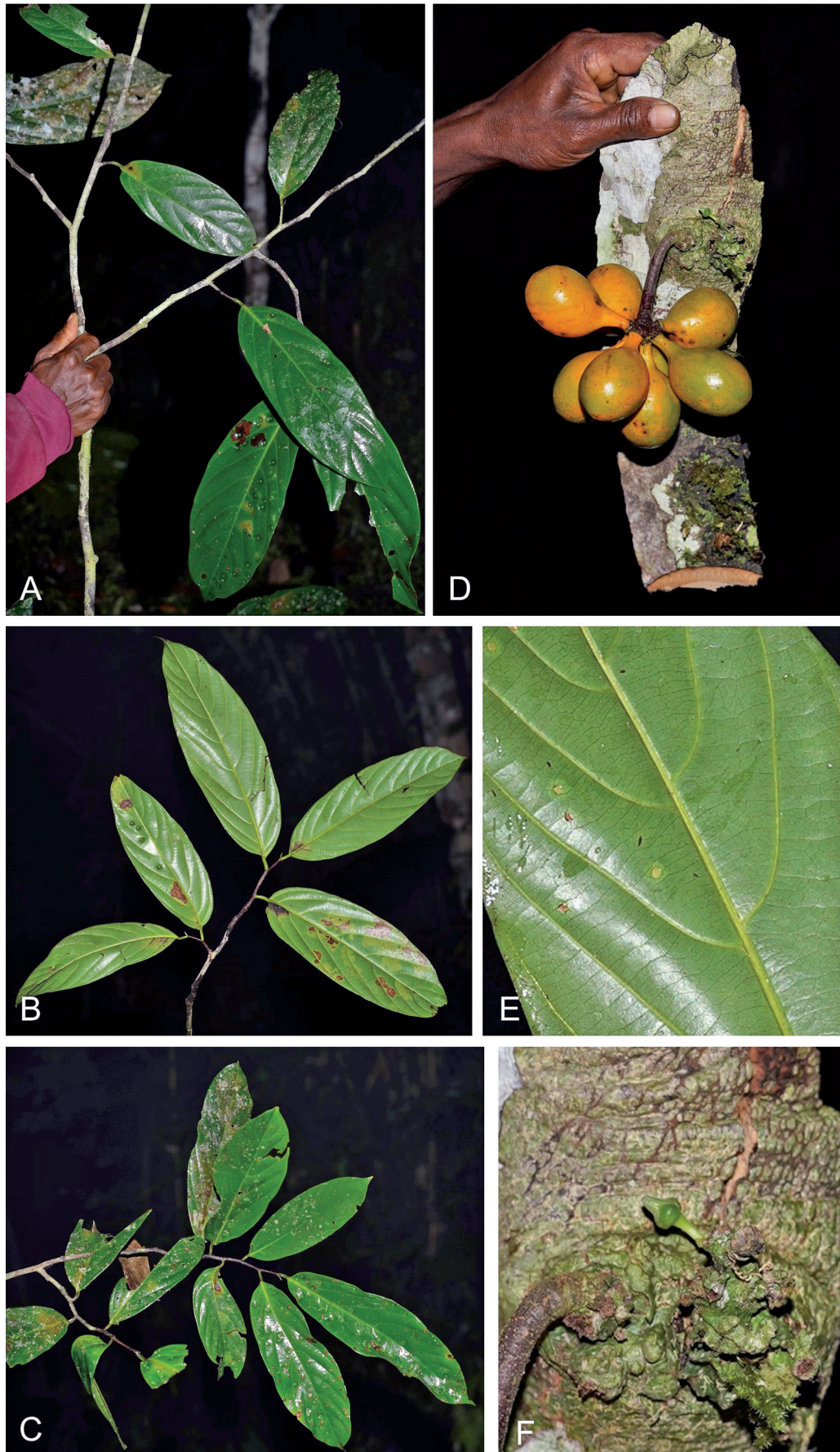


Fig. 1. *Monoon ascendens*. A. Twig with mature fruit. B. Monocarps. A from Takeuchi 11913, B from Takeuchi 11978. Illustration: B. Angell.





**Fig. 2.** *Monoon ascendens*. A. Twig with leaves. B. Abaxial leaves. C. Adaxial leaves. D. Mature cauliflorous fruit and section of outer bark. E. Detail of venation. F. Immature flower bud developing on a cauliflorous excrescence. From Ezedin 1773. Photos: Z. Ezedin.

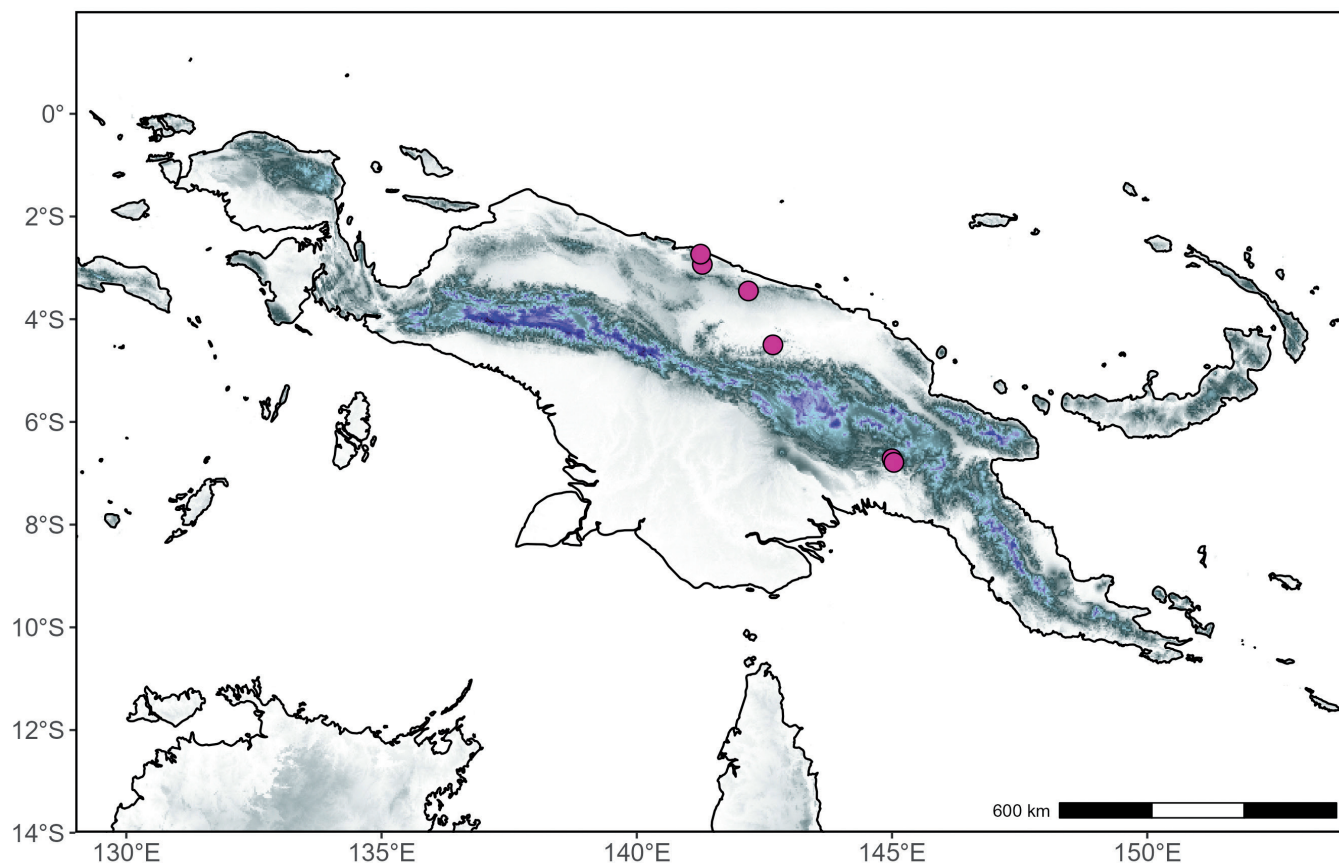


Fig. 3. Distribution map of *Monoon ascendens* (●).

**2. *Monoon barnesii*** (Merr.) B.Xue & R.M.K.Saunders, *Taxon* 61: 1030 (2012).

Basionym: *Polyalthia barnesii* Merr., *Publ. Bur. Sci. Gov. Lab. (Philip.)* 17: 15 (1904).

Type citation: 'No. 596 Forestry Bureau, collected by Barnes, Lamao River, Province of Bataan, Luzon, March 1904. A tree growing in the hill forests at an altitude of 100 m.'

Type: Philippines: Luzon: Lamao River, Prov. of Batan, Mar 1904, *Barnes Forestry Bureau* 596 (holo: PNH, destroyed; lecto: K [K00691640], designated by Xue et al., *Taxon* 61: 1030 (2012); isolecto: NY [NY00026202], US [US00098657]).

Tree to 30 m high and 40 cm dbh, bole to 21 m high, without buttressing. **Outer bark** light grey to dark greyish brown, striate, lenticellate, without fissures, not peeling, up to c. 1.5 cm thick. **Inner bark** blaze light yellow to red, fibrous; sapwood white to dark yellow, moderately hard. **Stems** light greyish brown to blackish, smooth, (deeply) fissured longitudinally, brown tomentose when young, with leaves often clustered towards the tips, lenticellate. **Leaves** variously elliptic to obovate (to oblong), (9–)14–19(–24.5) × (4–)5.5–7.3(–8.5) cm, (sub)coriaceous, when fresh glossy green above and semi-glossy grey green below, drying greyish green (to greyish brown) above and light (reddish) brown below, the lamina often light brown tomentose when young then becoming glabrescent except along abaxial veins, base acute to rounded, weakly asymmetric and often unequal apex acuminate to cuspidate; petioles (3.5–)5–8 × 2 mm, rounded to adaxially flat or shallowly grooved, densely

golden tomentose, becoming late glabrescent, when dry often corrugated or sometimes with cracks, drying black; venation eucamptodromous, often weakly tomentose above and below, the primary and secondaries usually drying conspicuously black; midvein flat to sunken adaxially, prominently raised abaxially; secondary veins in (9–)12–14(–16) pairs, very regular, spaced c. 1 cm apart, angled within ±45° to the costa, tertiary veins irregularly straight(–forked) percurrent, (semi)conspicuous.

**Inflorescences** axillary to ramiflorous, solitary or in fascicles of up to ca. 2, the fascicles often on short, densely branched subwoody brachyblasts bearing up to 8 flowers; flowering pedicels slender, (4–)12–26 × 1(–2) mm, densely light brown pubescent, bracteate; bracts medial, up to ½ the distance from the pedicel base, rounded triangular, 0.9–1.1 × 0.8–1 mm, apex acute, outer side densely pubescent, inner side glabrous. **Sepals** 3, broadly rounded triangular, 1.2–2 × 2 mm, apex acute, outer side densely rusty brown pubescent, inner side glabrous. **Petals** 6, in two whorls of 3, the inner and outer petals undifferentiated, fleshy subcoriaceous, (10–)15–20(–27) × 5–8 mm, outer side pubescent, inner side sometimes pubescent, yellowish green with reddish-brown center at anthesis; stamens 30–50, in 3–4 series, 0.8(–1) mm long, connective apex truncate, rhombic to pentagonal; carpels 15–20, c. 2 mm long, ovaries ellipsoidal, 0.8–1 mm long, densely villous at base, each with a single erect basal ovule, stigmas cylindrical, c. 1 mm long, apically villous, fused. **Fruits** consisting of up to c. 60 monocarps per cluster, each cluster up to c. 12 cm wide, sometimes densely packed; torus irregularly globular, up to 1 cm wide (New Guinea) or 4 cm wide (Philippines), usually densely light brown tomentose; fruiting pedicels 30 × 2 mm, often densely lenticellate, sometimes brown tomentose;



stipes 16–24 × 2–5 mm, sub-woody, densely brown tomentose or glabrescent; monocarps irregularly ovoid–oblong, bases weakly

attenuate, 1.8–3.3 × 1.3–1.8 cm, light brown tomentose, yellowish when ripe. **Seeds** 1, ovoid, irregularly shaped, 7 mm long.

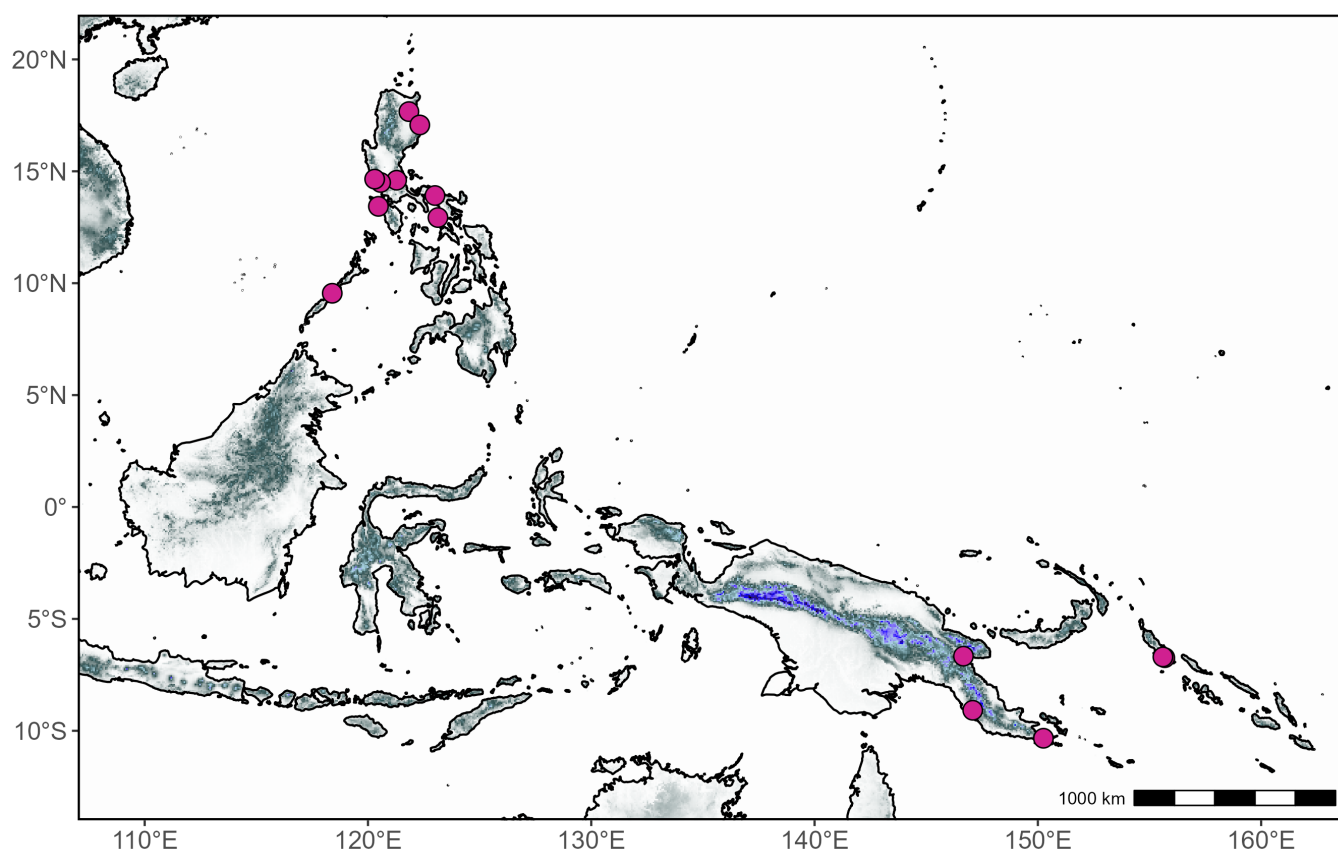


Fig. 4. Distribution map of *Monoon barnesii* (●).

**Distribution:** Philippines, Papua New Guinea and Bougainville (Fig. 4).

**Habitat and ecology:** Lowland hill and swamp forest, up to c. 450 m asl; in the Philippines, sometimes in mixed dipterocarp forest. Found on various substrates including limestone. This species has been described as common in lowland forests on Bougainville.

**Conservation status:** Least Concern (LC). Previously only known from the islands of Luzon and Mindoro, its revised distribution greatly expands this species' range across several islands. Its overall AOO of 48 km<sup>2</sup> is likely an artifact of poor collection records.

**Vernacular names:** Bougainville: Pow-nor-ru (Buin). New Guinea: Koperatoma (Garaina); Philippines: Dalñas-laláki, Latáuan, Anonang (Tagalog), Panaguiáten (Ilocano).

**Additional specimens examined:** PAPUA NEW GUINEA: **Bougainville:** Kugumaru, Buin, [6°44'S, 155°41'E], 150 m, 9 Jun 1930, *Kajewski* 1935 (A [A00871746], L [L.1759648]); Near Aku village, c. 10 miles west of Buin, [6°42'S, 155°36'E], 30 m, 24 Sep 1964, *Craven & Schodde* 537 (A [A02615369], BO [BO-1409350], L [L.1759649], LAE [83410]). **Central:** Kuriva Forestry Area, near Veinauri Rv., Pt. Moresby sub-district, 9°05'S, 147°05'E, 60 m, 5 May 1971, *Streimann & Kairo* LAE 51523 (BRI [AQ0351316], L [L.1759838], LAE [128436]). **Milne Bay:** About 0.5 mile north of Waigani Plantation, [10°20'S, 150°15'E], 23 m, Mar 1945, *Smith* NGF 1289 (L [L.1759770], LAE [1687, 2 sheets]).

**Morobe:** "The Bends" Garagos, 6°40'S, [146° 40'E, 182 m, 15 Mar 1965, *Streimann & Kairo* NGF 17491 (A [A00871747], CANB [CBG8312861.1], L [L.1759666], LAE [90222], NSW [NSW473862], SING [SING0214078], US [US3310520]).

**PHILIPPINES:** **Burias:** [no locality], [12°56'N, 123°08'E], Jun 1904, *Clark For. Bur.* 1722 (NY [NY4727636]). **Luzon:** Lamao River, Mt. Mariveles, Prov. of Batan, [14°30'N, 120°34'E], May 1904, *Borden Forestry Bureau* 760 (NY [NY 04726195]); *ibid.*, Nov 1904, *Borden Forestry Bureau* 802 (NY [NY04726196], US [US625391]); *ibid.*, May 1905, *Borden Forestry Bureau* 3032 (NY [NY04726194]); Prov. of Bataan, Aug–Sep 1909, *Alvarez Forestry Bureau* 12944 (L [L.1770037]); Prov. of Camarines, [13°55'N, 122°60'E], Dec 1913, *Ramos* 1595 (A [A00871737], L [L.1767288, L.1767289], NY [NY4727525]); Rizal, [14°36'N, 121°17'E], Jan 1915, *Ramos Bureau of Science* 22429 (A [A00871738], GH [GH00871739], L [L.1767290]); Vicinity of Peñablanca, Cagayan Province, [17°40'N, 121°50'E], 1 May–18 Jun 1917, *Adduru* 108 (A [A00871742], P [P01983360]); Bucay, Abra Province, Mar–May 1918, *Paraiso Forestry Bureau* 27267 (A [A00871740]); Palanan, Isabela Province, 17°04'12.0"N, 122°19'12.0"E, 120 m, 27 Apr 1991, *Ridsdale et al.* ISU48 (A [A00871744]); Bataan, Morong, road cut to Natib Mt. above Morong River and above the Refugee camp, 14°39'N, 120°18'E, 300 m, 5 Jul 1992, *Soejarto & Fernando* 7775 (A [A00871741]). **Mindoro:** [Occidental Mindoro Province], Paluan, [13°26'N, 120°28'E], Apr 1921, *Ramos Bureau of Science* 39752 (A [A00871743], GH [GH00871745]). **Palawan:** [no

locality], Jan–Feb 1920, *Cenabre et al. Forestry Bureau* 27893 (A [A00871736]); Iraan Mountains (SE slope), Aborlan, [9°33'N, 118°24'E], 200 m, 3 Jun 1950, *Sulit PNH* 12524 (A [A00871735], L [L.1759993]).

**Notes:** Previously considered endemic to the Philippines and here confirmed for New Guinea and Bougainville based on specimens bearing similar laminar and fruit morphology, along with Merrill's (1904) description and cited specimens provided in his *Enumeration* (Merrill 1932). The original protologue describes the flowering pedicels as ebracteolate, however this is likely in error as the flowering type specimen appears to bear medial bracts, as other species do. It is possible Merrill overlooked this due to the bract appearing on the opposing side of the pedicel. The fruits were also not described in the original description due to lack of fruiting material at the time. With this additional information, the description is updated here.

There appears to be some variability in this species in indument density, leaf size and shape, density of lenticels, and torus width. Two specimens cited by Merrill (1932), *Merritt* 9911 and *Whitford* 359, are not listed here as they were not located. This species is recognized by its relatively distinct leaves which dry greyish green above, its densely pubescent young twigs, veins, and monocarps. Although, this trait may be variable at times, as evident in *Sulit PNH* 12524, which lacks prominent hairs on the young twigs and veins but retains them on the petioles and fruits. Leaves of this species are somewhat variable in length and indument density. Fruiting specimens from New Guinea appear to have smaller torus diameters and shorter stipes.

The concept of *M. barnesii* adopted here is restricted to specimens displaying the following key traits: short light brown tomentum on surfaces (young twigs, abaxial veins, fruit torus, monocarps), bifacially discoloured laminas when dry, and thin but broad petals measuring >5 mm wide. A handful of specimens placed here originally due to superficial similarities are excluded and will be treated at a later time. The excluded specimen *Gafui et al. BSIP* 15202 from Nggela approaches this species but differs in bearing notably broader laminas (ca. 20 × 10 cm) and longer pubescent hairs (vs. short tomentose). Although the Papuan specimens included here are considered conspecific with *M. barnesii*, it could be that the Philippine and Papuan material form part of a complex of multiple taxa.

The rather odd Philippine–New Guinea disjunction seen here is known from only a handful of other taxa, most notably in the genera *Kania* Schltr. (Myrtaceae) and *Cyne* Danser (Loranthaceae). Future studies may uncover additional taxa exhibiting this unique disjunction pattern.

**3. *Monoon chloroxanthum*** Miq., *Ann. Mus. Bot. Lugduno-Batavi* 2: 17 (1865).

=*Polyalthia chloroxantha* (Miq.) F.Muell., *Descr. Notes Papuan Pl.* 1: 95 (1877).

Type citation: 'Nova Guinea: Zippelius'

Type: Indonesia: [Papua], [no date], *Zippelius* 208-c (lecto: L [L.1762852], designated by I.M.Turner, *Gard. Bull. Singapore* 70: 596 (2018); isolecto: B [B 10 0365037], L [L.1762849, L.1762850, L.1762851], MEL [MEL2382264]).

*Polyalthia papuana* Warb., *Bot. Jahrb. Syst.* 18: 191 (1893), *nom. illeg.*, non *P. papuana* Scheff. (1881).

Type citation: 'Butaueng bei Finschhafen. – 20./3. 89 (Hellw. n. 472).'

Type: Kaiser Wilhelmsland [=Papua New Guinea], [Morobe], Butaweng near Finschhafen, 20 Mar 1889, *Hellwig* 472 (lecto: K [K000798000], designated by I.M.Turner, *Gard. Bull. Singapore* 70: 596 (2018); isolecto: BO [BO-1373404, 1373405]).

*Monoon polycarpum* (Burck) B.Xue & R.M.K.Saunders, *Taxon* 61: 1033 (2012), **syn. nov.**

=*Polyalthia polycarpa* Burck, *Nova Guinea* 8: 429 (1911).

Type citation: 'Niederl. Neu-Guinea an der Südküste bei Okaba: B. Branderhorst n. 135. bl. und fr. am 7. Okt. 1907'

Type: Indonesia: [Papua], [On the south coast near Okaba], [c. sea level], 7 Oct 1907, *Branderhorst* 135 (lecto: U [U.1090789], designated by Diels, *Bot. Jahrb. Syst.* 49: 133 (1912); isolecto: K [K000691687], L [L0038125, L0038126, L0038127]; possible isolecto (fragment): A [A00871924]).

*Monoon chloranthum* (K.Schum. & Lauterb.) B.Xue & R.M.K.Saunders, *Taxon* 61: 1030 (2012), **syn. nov.**

=*Polyalthia chlorantha* K.Schum. & Lauterb., *Fl. Schutzgeb. Südsee* 316 (1900).

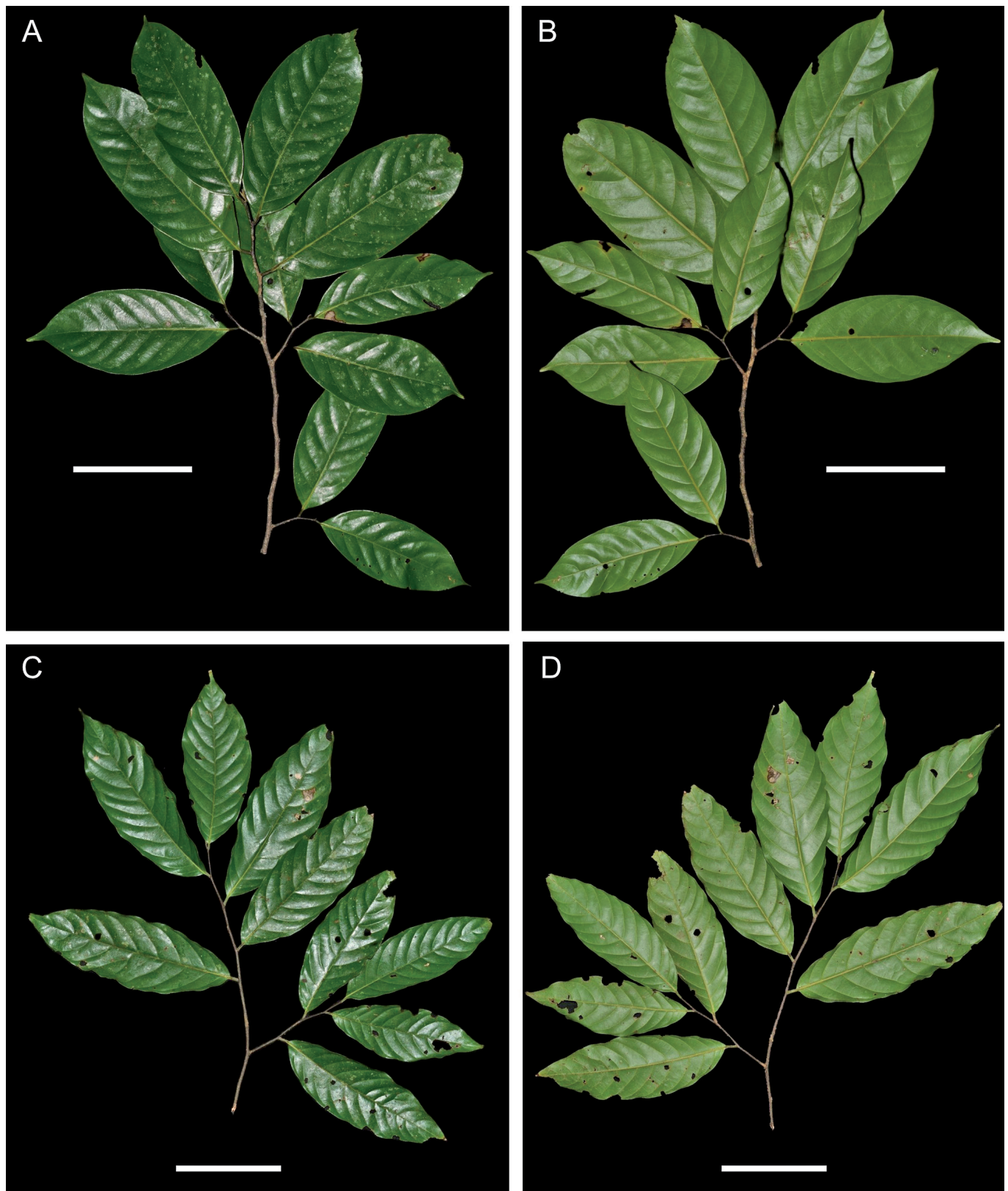
Type citation: 'Kaiser Wilhelmsland: Am Mittellauf des Gogol (Lauterbach, blühend am 21 November 1890).'

Type: Papua New Guinea: [Madang], Gogol Mittellauf [=Middle reaches of the Gogol River], 21 Nov 1890, *Lauterbach* 1024 (holo: B [B 10 0365038]).

*Polyalthia oblongifolia* Burck, *Nova Guinea* 8: 429 (Nov. 1911), *nom. illeg.*, non *Polyalthia oblongifolia* C.B.Rob. (Jul. 1911).

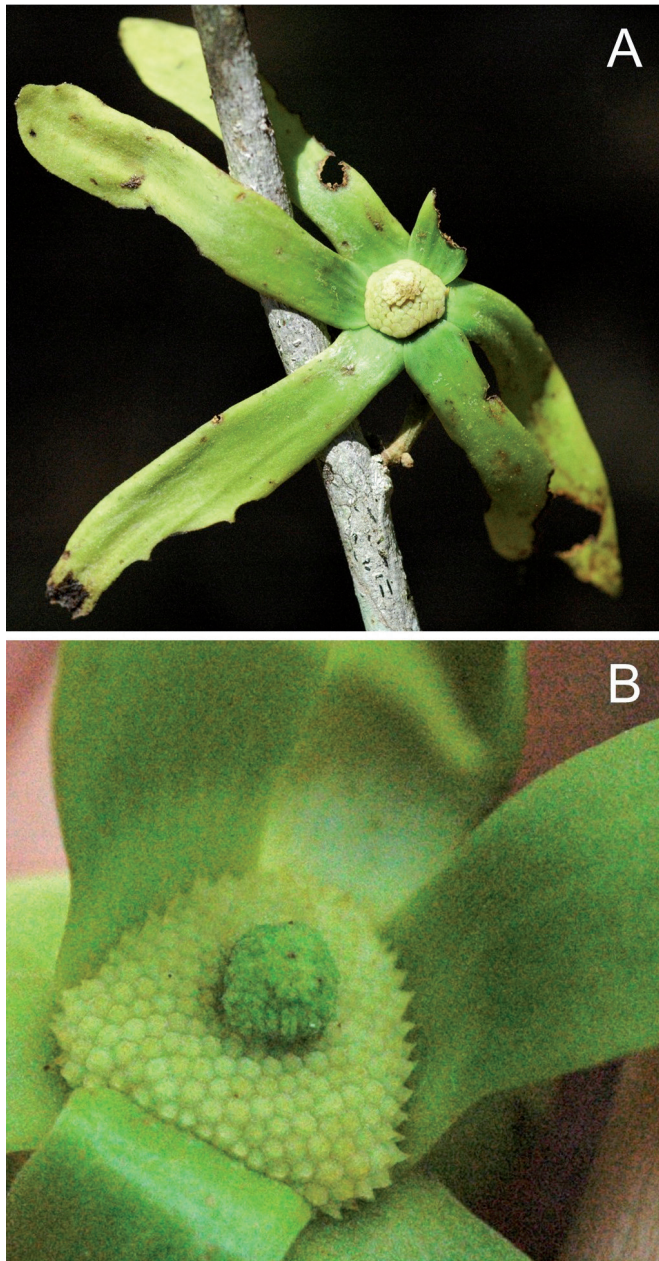
=*Polyalthia branderhorstii* Fedde, *Repert. Spec. Nov. Regni Veg.* 12: 379 (1913)

Type citation: 'Niederl. Neu-Guinea an der Südküste bei Kwalamul bei Okaba: B. Branderhorst n. 39. bl. und fr. am 31. Aug. 1907'



**Fig. 5.** Variation in leaf thickness in *Monoon chloroxanthum*. A–B. Leaves of a thick-leaved variant (the '*M. chloranthum*' morphotype). C–D. Leaves of a thin-leaved variant (the '*M. polycarpum*' morphotype). Scale: 10 cm. A–B from an unvouchered collection taken from WFDP tag no. 223697, C–D from an unvouchered collection taken from WFDP tag no. 391161. Photos: Z. Ezedin.





**Fig. 6.** Flowers of *Monoon chloroxanthum*. A. Mature flower at anthesis with fully reflexed petals and a receptive stigmatic surface. B. Closeup of immature floral chamber with non-receptive parts. Scale: 10 cm. From Munzinger 7053. Photos: J. Munzinger.

Type: Indonesia: [Papua], [On the south coast near Kwalamul near Okaba], [c. sea level], 31 Aug 1907, *Branderhorst* 39 (lecto: U [U.1090790], designated by Diels, *Bot. Jahrb. Syst.* 49: 133 (1912); isolecto: B [B 10 0365022], BO, K [K000691686], L [L0038128]; possible isolecto (fragment): A [A00871925]).

Illustration: Burck, *Nova Guinea* 8(3): t. 70 f. 1, as *Polyalthia polycarpa* (1907).

Tree to 25(–30) m high and 50 cm dbh, bole to 21 m high, without buttressing. **Outer bark** light grey to greyish brown, smooth (to rough), often longitudinally fissured. **Inner bark** blaze light to reddish brown (or pinkish), sometimes with dark streaks, aromatic with fruity odor; sapwood (orangish) yellow to whitish, fibrous, heartwood indistinct. **Stems** dark brown to greyish-black, smooth, longitudinally fissured, glabrous when young. **Leaves**

elliptic to linearly oblong, (9–)15–25(–33) × (3–)5–8(–13) cm, (thin) chartaceous to subcoriaceous, when fresh (highly) glossy dark green above and dull (to glossy) light green below, drying light greyish to (dark) reddish brown above and light greyish-greenish brown below, base acute to rounded (to subcordate), sometimes asymmetric, apex rounded to acuminate; petioles (3–)5–11 × 2(–3) mm, adaxially grooved, glabrous, drying dark brown to black; venation eucamptodromous, secondary veins (9–)10–15(–20), ± regularly spaced, 1–2 cm apart, angled ± 45° to the costa; tertiaries straight (to forked) percurrent, often closely spaced. **Inflorescences** ramiflorous, solitary or in fascicles of up to 5(–8), the fascicles sometimes borne on short brachyblasts, rarely becoming warty and excrescence-like; flowers unscented or with sometimes with slight rank odor; flowering pedicels 15–30(–45) × 1 mm, subglabrous to (densely) light brown tomentose, bracteate; bracts 1(–2), basal to medial, up to ½ the distance from the pedicel base, linear triangular-ovate, 1–2 × 0.8–1 mm, apex acute, outer side glabrous to tomentose, inner side glabrous. **Sepals** 3, broadly triangular ovate, up to 2 × 3 mm, apex acute to rounded, outer side (sub)glabrous to light brown tomentose, inner side glabrous, green when fresh. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, chartaceous, 15–25(–35) × 3–5 mm, weakly tapering towards apex, green at anthesis, maturing light yellowish green (to cream); stamens c. 100(–150), in 4–5(–6) series, 0.7–0.8 mm long, connective apex truncate, pentagonal; carpels c. 50, in 3–4 series, c. 2 mm long, ovaries ellipsoidal, c. 1 mm long, villous, stigmas cylindrical, c. 1 mm long, apex rounded to slightly flattened, apically villous, tightly fused. **Fruits** consisting of up to 24(–40) monocarps per cluster, each cluster up to 10 cm wide, often densely packed; torus globular to irregularly discoid, up to 2.5 cm wide, sub-woody; pedicels (10–)20–40(–50) × 3–5(–8) mm, glabrous, smooth, dark reddish to brown; stipes (5–)10–20(–35) × 2–3 mm, glabrous, drying brownish-black; monocarps ovoid to obloid, (0.8–)1.5–2.5(–3) × 0.6–1.5(–1.8) cm, glabrous, smooth, (yellowish–)orangish red(–brown) to bright red, then turning black when ripe. **Seeds** 1, large, smooth, oblong, 1–2 × 0.6–1 cm, testa light yellow, wrinkled laterally, with a single circumferential longitudinal groove, endosperm ruminate. Fig. 5–6.

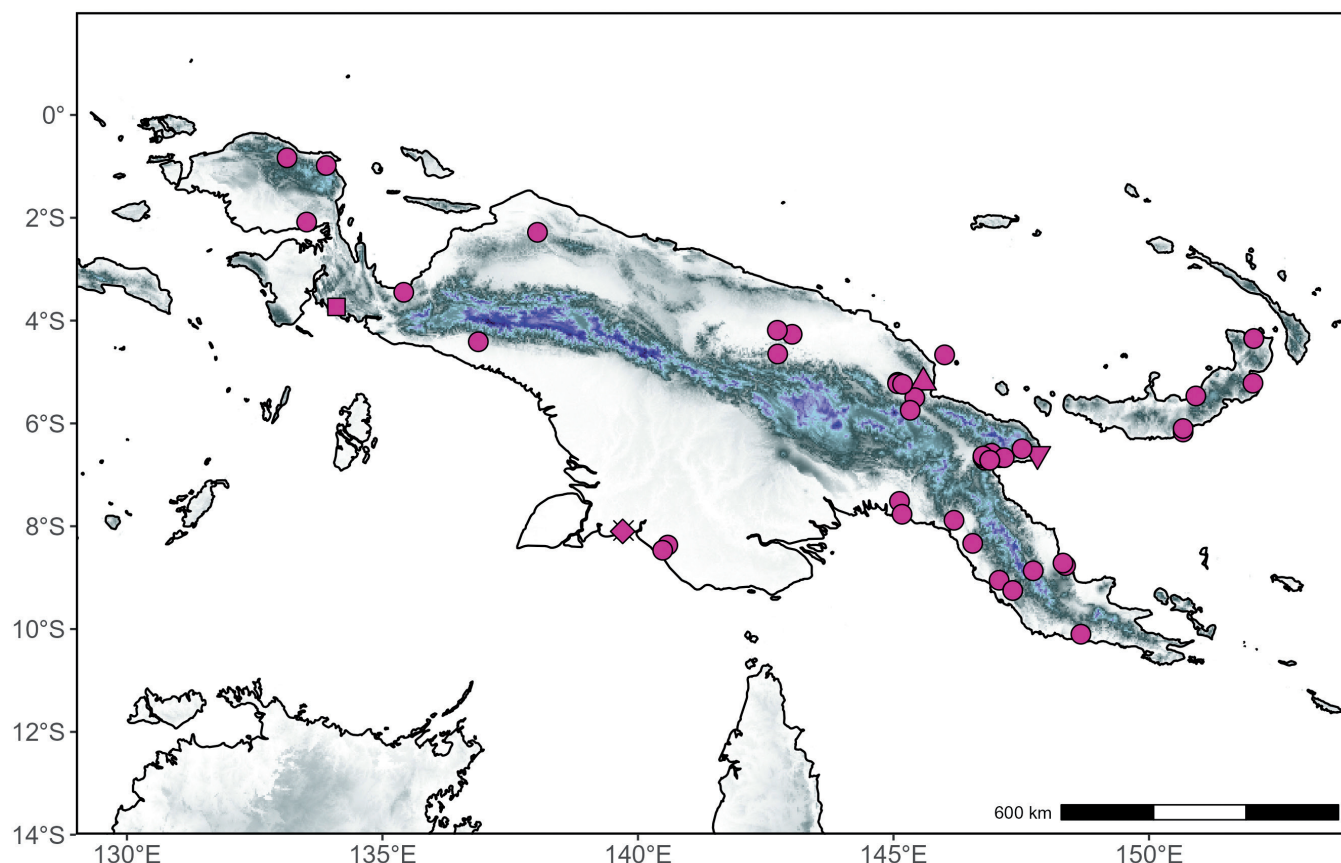
**Distribution:** Indonesian New Guinea and Papua New Guinea (Fig. 7).

**Habitat and ecology:** Lowland hill forests, alluvial floodplains, and swamp forests, up to c. 200(–600) m asl. Found in both primary and secondary regrowth, maturing to become a subcanopy level tree. On various substrates including ultrabasics. Leaves may be found with raised galls.

**Conservation status:** Least Concern (LC). Due to its very wide range and common status at various localities across the archipelago, this species is effectively shielded from threats of logging.

**Vernacular names:** Osios (Karia), Kaha Kaha (Veiya), Giaun / Pan pan ninji (Magi), Tobija (Maprik), Kafakafa (Bush Mekeo), Doem (Wain), Bin (Kabar).





**Fig. 7.** Distribution map of the *Monoon chloroxanthum* group (●). The estimated locations of the original types of *Monoon chloranthum* (▲), *M. chloroxanthum* (■), *Polyalthia oblongifolia* (◆), *P. papuana* (▼), and *P. polycarpa* (x) are given for reference.

**Additional specimens examined:** INDONESIA: **Papua:** Bivak Kanehira, 10 km inward from the mouth of Boemi Riber [=Bumi River], Nabire, [3°27'S, 135°25'E], 50 m, 12 Mar 1940, *Kanehira & Hatusima 12818* (BO [BO-1408166]); Pionier-bivak [c. 3 km N of Kasonaweja], [2°17'S, 138°02'E], 30 m, 26 Mar 1940, *Neth. Ind. For. Service bb 31468* (L [L.1759860]); Sarmi Distr., Foein River [=Fuin River], 50 m, 15 Nov 1961, *Moll BW 6667* (BO [BO-1408185, 1825213]); Merauke Distr., Maro R., village Tambat, [8°22'S, 140°35'E], 29 Apr 1967, *Reksodihardjo 205* (L [L.1757989, L.1757990]); Kali Maro [=Maro River], Wasur National Park, Merauke, [8°28'S, 140°29'E], 10 m, 13 Oct 1992, *Widjaja et al. 6029* (L [L.1757991]); Freeport mining concession, golf course at Kuala Kencana, 4°24' 43"S, 136°52' 32"E, 50 m, 20 Nov 2000, *Lowry II et al. 5246* (L [L.1759690]). **West Papua:** Inanwatan Moetoeri (Steenkool) [=Bintuni], [2°05'S, 133°31'E], 3 m, 11 May 1941, *Neth. Ind. For. Service bb 32665* (L [L.1759739]); Kebar Valley, [0°50'S, 133°08'E], 580 m, 22 Oct 1958, *Koster BW 7159* (L [L.1759719], SING [SING0214077]); Wamare valley, c. 20 km SW. of Manokwari, [0°59'S, 133°54'E], 120 m, 21 Jun 1962, *Kokkelink BW 15561* (L [L.1759777], LAE [226437]).

PAPUA NEW GUINEA: **Central:** Veiya, [9°03'S, 147°04'E], sea level, 10 Mar 1935, *Carr 11632* (L [L.1759791], SING [SING0214079]); Brown River Forest Reserve, 20 miles from Port Moresby, 9°15'S, 147°20'E, 60 m, 5 Jan 1960, *McDonald NGF 8217* (A [A00871921], BRI [AQ0211066], LAE [28569]); Near Maipa village, Kairuku subdistrict, [8°20'S, 146°33'E], 11 Aug 1962, *Saunders 1081* (L [L.1759721]); Brown River at 30 mile, 9°15'S, 147°20'E, 60 m, 2 Feb 1966, *Streimann & Kairo NGF 26181* (A [A02615266], BO [BO-1408116], L [L.1759815],

LAE [85526, 2 sheets], SING [SING0214083]); Cloudy Bay, Cloudy Bay Logging Area, between jetty and logging camp, [10°06'S, 148°40'E], 30 m, 14 Feb 2007, *Johns et al. 11024* (K [K001636057], SING [SING0195907]). **East New Britain:** Bridge LA, Keravat, [4°20' 58"S, 152°02' 55"E], 76 m, 13 Jan 1955, *Floyd NGF 7024* (BO [BO-1409233], L [L.1759762], LAE [300559]); 1955/56 Plantation area, Keravat, [4°21'S, 152°03'E], 3 Jun 1955, *Coppack NGF 7047* (A [A00871908], L [L.1759745], LAE [13818], SING [SING0214110]); Aiwit River East of Fulleborn Harbour, Pomio subdistrict, 6°10'S, 150°40'E, 50 m, 11 May 1973, *Croft & Katik NGF 14982* (A [A00871909], L [L.1759832], LAE [204472, 2 sheets]); Matpa river, near Malpas, Wide Bay, 5°13'S, 152°02'E, 400 m, 15 Jun 1995, *Weiblen 472* (A [A00871913]). **East Sepik:** Garamambu [=Mt. Garamambu], [4°16'S, 143°01'E], 20 Aug 1949, *Womersley 3733* (A [A00871923]); forest along the main streamcourse of the Sitipa River, near the village of Gahom, 4°39'S, 142°44'E, 100 m, 7 Sep 1990, *Takeuchi 6761* (L [L.1759734], LAE [264358]); Waskuk Hills, buttress ridge N of Garuka, 4°11' 19"S, 142°43' 37"E, 200 m, 25 Nov 2004, *Takeuchi et al. 17447* (LAE [291050]). **Gulf:** Near Ravikivau [=Ravi-kevau], Purari delta, [7°46'S, 145°10'E], 3 m, 11 Feb 1966, *Craven & Schodde 806* (A [A02615365], L [L.1768798]); East bank of Tauri River, c. 6 miles south of junction with Kapau River, [7°53'S, 146°11'E], 60 m, 15 Mar 1966, *Schodde 4696* (A [A02615376], L [L.1759723]); Purari R. delta area 32.5 km east of Baimuru, S/dist. Baimuru, 7°31'S, 145°07'E, c. 5 m, 26 Mar 1974, *Croft et al. LAE 61107* (A [A00871920], L [L.1767274]). **Madang:** Usino, 5°30'S, 145°25'E, 122 m, 18 Aug 1966, *Henty NGF 28017* (A [A02615355], BO [BO-1408186], LAE [86010], SING [SING0214082]); NE

Kar Kar, Bulu Plantation, 4°40'S, 146°00'E, 15 m, 11 Jun 1969, *Vandenberg & Mann NGF 42203* (A [A02614409], L [L.1762929], SING); Wanang village, [5°14'14.3"S, 145°10'37.9"E], 115 m, 10 Jul 2007, *BRC & Weiblen WP3A0576* (MIN [1402495], LAE [291778]); Mt. Wilhelm, plot 200C, 5°44'42"S, 145°19'37"E, 200 m, 11 Nov 2012, *Munzinger 7053* (L [L.4404495], MPU [MPU380727], NSW [NSW818329]); Wanang 50ha Forest Dynamics Plot, tag no. 034777, 5°13'39"S, 145°4'47"E, 80–180 m, 29 Jun 2022, *Ezedin 604* (MIN); ibidem, tag no. 041822, 3 Aug 2022, *Ezedin 730* (MIN); ibidem, tag no. 041743, 3 Aug 2022, *Ezedin 731* (MIN). **Morobe:** Lae, July 1944, s.coll. NGF 17 (LAE [1678]); Oomsis logging area, 6°40'S, 146°45'E, 121 m, 4 Dec 1957, *White NGF 9642* (A, BO [BO-1408111], L [L.1759776], LAE [21415], SING [SING0214084]); Oomsis Logging Area, 106 m, 12 May 1960, *Womersley NGF 11846* (LAE [30421, 2 sheets]); Oomsis Creek, about 18 miles W of Lae, 6°43'S, 146°47'E, 122 m, 21 Mar 1962, *Hartley 10052* (A [A00871916], ECON [ECON00871917], L [L.1767281], LAE [52608]); Oomsis Creek, about 18 miles W of Lae, 6°43'S, 146°47'E, 122 m, 25 Feb 1963, *Hartley 10052A* (LAE [67296]); Burep River NE of Lae, 6°40'S, 147°05'E, 30 m, 28 Apr 1962, *Hartley 10118* (A [A00871914], ECON [ECON00871915], L [L.1767280], LAE [53696]); On flat near Oomsis Creek, 6°40'S, 146°45'E, 60 m, 29 May 1962, *Havel & Kairo NGF 9149* (A [A00871910, A02615276], L [L.1759696, L.1759697], LAE [43014]); Masba Creek area, c. 3 miles S of Pindiu, Huon Peninsula, [6°29'39"S, 147°30'55"E], 609 m, 5 May 1964, *Hoogland 8863* (A [A02615280, A02615281], L [L.1762914], US [US03896023, US03896024]); 0.5 miles before Sankwep Bridge, Lae sub-district, 6°34'48"S, 146°55'12"E, 61 m, 21 Apr 1971, *Katik NGF 46770* (A [A00871912], BO [BO-1408287], BRI [AQ0350394], L [L.1767271], LAE [130279, 2 sheets], NSW [NSW538444], SING [SING0275943]); Aluki area, east of Lae, Lae sub-district, [6°40'S, 147°10'E], 100 m, 10 Mar 1972, *Womersley NGF 43910* (A [A00871911], BO [BO-1408123], L [L.1759881], LAE [145106, 3 sheets], SING [SING0214076]); Gabensis creek, [6°38'S, 146°45'E], [sea level], Jul 1981, *Heads 303* (A [A00871919], LAE [253805]); Lowland secondary forest on the outskirts of Labu Swamp, 6°43'S, 146°53'E, 230 m, 15 Dec 1988, *Takeuchi 4318* (A [A00871907, 00871906], LAE [264302, 2 sheets]); Labu swamp, 6°43'S, 146°53'E, 20 m, 29 Mar 1989, *Takeuchi 4525* (A [A00871918, A02615295], BO [BO-1349414], L [L.1759853, L.1759854, L.1759863]); Lae municipality, F.R.I., c. < 10 m, 5 Jul 1993, *Takeuchi 9013* (A [A02615290], LAE [271221]). **Oro:** Kokoda, [8°52'S, 147°44'E], 365 m, 25 Mar 1936, *Carr 16238* (L [L.1768801], NY [NY04727522], SING [SING0275942]); ibidem, 25 Mar 1936, *Carr 16244* (SING [SING0275933, SING0275937, SING0275938]); ibidem, 28 Mar 1936, *Carr 16282* (SING [SING0275936]); Dobodura area, [8°46'S, 148°22'E], 23 Mar 1945, *Cavanaugh & Fryar NGF 2051* (L [L.1767253], LAE [128036, 2 sheets]); Dobodura Plain, Giura River, Soputa area, [8°43'S, 148°19'E], 60 m, 26 Feb 1945, *Cavanaugh & Fryar NGF 2051* (LAE [128036]). **West New Britain:** Unai River, Fullerborn Harbour, Kandrian subdist., 6°06'S, 150°40'E, 15 m, 6 Mar 1965, *Sayers NGF 21846* (A [A00871922], L [L.1767277], LAE [97634, 2 sheets]); Walo, Commodore Bay, 5°28'S, 150°55'E, 60 m, 26 May 1968, *Henty & Lelean NGF 29487* (BO [BO-1408179], L [L.1759833], LAE [104826], SING [SING0214075]).

**Notes:** This large group represents a widespread and variable species formed through the consolidation of *M. chloranthum*, *M. chloroxanthum*, and *M. polycarpum*, and their respective synonyms. Herbarium specimens of this species may be found commonly determined as *M. oblongifolium*, *M. polycarpum*,

or simply *Polyalthia* sp. The formerly separate species *M. chloranthum* and *M. chloroxanthum*, both known only from their type specimens, are confusingly similar in laminar and floral morphology with *M. polycarpum* that they are combined with it. Due to *M. chloroxanthum* being the oldest validly published name of the complex, it takes priority and becomes the default name for the *M. polycarpum* group in the broad sense. Although variable, the broad sense is adopted here to avoid further confusion in the field.

The types of *M. chloranthum* and *M. chloroxanthum* present few minor deviations from *M. polycarpum* s.str. For the former, only notable difference is its thicker, subcoriaceous laminas (vs generally chartaceous), lower venation prominent (vs usually not prominent), fresh leaves with glossier adaxial surfaces (vs semi glossy). For the latter, the only noticeable difference are the leaves which are longer at (26–)30–44 × (8–)9–13 cm and with a slightly higher number of secondary vein pairs. The flowers and fruits of *P. papuana*, a synonym of *M. chloroxanthum*, appear to be practically identical to *M. polycarpum* s.str. The protologue of *M. chloranthum* states the flowering pedicels being “18–30 cm long”. This is likely an error as this would be an extraordinary length given that pedicels generally tend to be > 5 cm long in most *Monoon*. Thus far, the thick-leaved ‘*M. chloranthum*’ morphotype is only known from Madang Province and can be found co-occurring with the widespread thin-leaved ‘*M. polycarpum*’ morphotype at the Wanang Forest Dynamics Plot (WFDP) (Fig. 6).

This species appears similar to the Philippine endemic *M. oblongifolium* and most Papuan specimens have been determined as this species instead of *M. polycarpum* – a nomenclatural confusion that has persisted for nearly a century. However, this confusion may be somewhat warranted as there appears to be few reliable traits to readily separate the Philippine species from this one. Specimens of the Filipino *M. oblongifolium* generally appear to exhibit a more asymmetric base, elongated monocarps, and longer monocarp stipes which is rare in the Papuan material.

As delimited here, *M. chloroxanthum* is restricted to New Guinea and presents variability in lamina thickness, feel, glossiness, size, pedicel and stipe length, and monocarp size and shape. Yet even with all of this variation, it still forms a recognizable unit apart from the other species in this account. Notable deviant morphologies are discussed below:

1. The type specimen of *M. polycarpum* (*Branderhorst 135*), along with some others such as *BRC & Weiblen WP3A0576*, *Floyd 7024*, *Sayers NGF 21846*, and *Takeuchi et al. 17447* sometimes bear leaves that are slightly broader and thicker, with widely spaced veins, approaching *M. laxatum* in general size and shape, but the venation and floral morphology align them with the material here. A few other specimens bear slightly thicker laminas.

2. A subset of specimens including *Croft & Katik NGF 14982*, *Croft et al. LAE 61107*, *Hartley 10052*, *Hartley 10118*, *Henty & Lelean NGF 29487*, *Katik NGF 46770*, *Streimann & Kairo NGF 26181*, and *Womersley NGF 43910* often bear slightly smaller or larger laminas, sometimes with more prominent tertiaries, shorter stipes (c. > 1 cm), shorter pedicels, and monocarps that are more prominently ellipsoid. A few specimens seen from Borneo and Sulawesi with similarly ellipsoid monocarps were found determined as *M. lateriflorum* (Blume) Miq., although the original

description of this species (as *Guatteria lateriflora* Blume) states the monocarps are ovoid with an attenuate base and very long pedicels (Blume 1825). This group is interpreted as intraspecific variation whereas *M. lateriflorum* is not considered to be present in New Guinea.

3. The two specimens collected by C.E. Carr in 1936 from Oro province display what appears to be immature fruits with a wrinkled surface, which differs from all other fruiting specimens seen with smooth monocarps.

4. The specimens *Takeuchi* 4318, *Koster* BW 7159, and *Lowry* II et al. 5246 are distinguished by narrowly elliptic leaves, slightly swollen and wrinkled petioles drying reddish black, monocarps ripening red.

5. The newly flushing leaves of *Takeuchi* 6761 are puberulous along the veins, yet all other specimens with mature leaves are generally glabrous. The young leaves of the type (image) of *M. chloroxanthum* also appear hairy.

Generally, the *M. polycarpum* group may be confused with *M. lateriflorum* or *M. oblongifolium*. All three appear quite similar and are difficult to distinguish, especially when sterile. *Monoon lateriflorum* is thus far not known from New Guinea or the Philippines, its range extending thus far recorded as far east as the Moluccas. Although, some Papuan specimens cited here were found determined as *M. lateriflorum*. Generally, specimens of the latter appear on average to have leaves that appear to be larger (longer), slightly thicker, with higher secondary vein count, bases that are more strongly acute, and what appears to be the most distinct difference: petals that are reddish towards the center (vs solid greenish-yellow). Although, these traits do not seem entirely reliable. The Filipino *M. zamboangaense* (Merr.) B.Xue & R.M.K.Saunders, from Mindanao, also appears rather similar, albeit with slightly larger leaves and more secondaries. A couple specimens seen from the Moluccas (*Jaheri* s.n. and *Mogea* 5501) and one from Sabah (*Wood* SAN A3681), previously determined as *M. polycarpum*, are excluded due to likely belonging to *M. lateriflorum*.

It should be noted that the name *P. papuana* published by Warburg (1893), listed here as a synonym of this species, should not be confused with *P. papuana* Scheff., a synonym of *Huberantha papuana* (Scheff.) I.M.Turner.

#### 4. *Monoon excelsum* Ezedin, *sp. nov.*

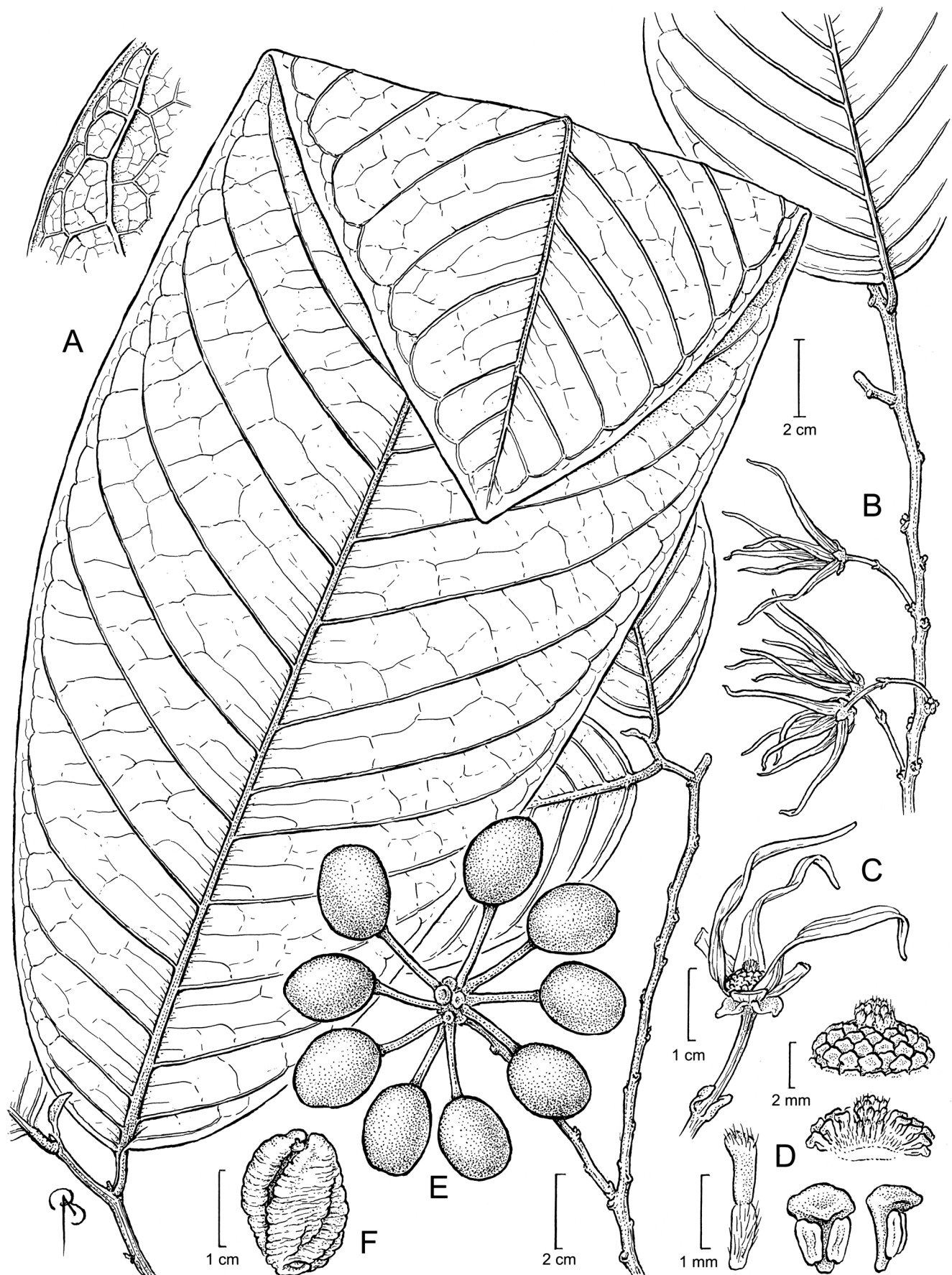
Type: Papua New Guinea: Morobe: Oomsis near Lae, 6°45'S, 146°50'E, 91 m, 10 Jun 1965, *Womersley* NGF 24641 (holo: A [A00871772]; iso: BO [BO-1408284], BRI [AQ0211063], L [L.1759746], LAE [78624], NSW [NSW538441], SING [SING0275941])

Diagnosis: Within New Guinea, differs from *M. chloroxanthum* in bearing a higher number of secondary veins in c. 16–24 pairs (vs 10–15) that are more closely spaced at >1 cm apart (vs 1–2 cm), a thicker midvein, longer petals measuring 35–45 mm long (vs c. 15–35 mm), and larger monocarps on longer and thicker pedicels. Outside New Guinea, comparable to the Philippine *M. ramiflorum* in its densely flowered inflorescences and thin petals but differs in bearing shorter petals, leaves with rounded to cordate bases

(vs acute), acuminate apex (vs acute to rounded), and a higher number of secondary veins in c. 16–24 pairs (vs 10–11).

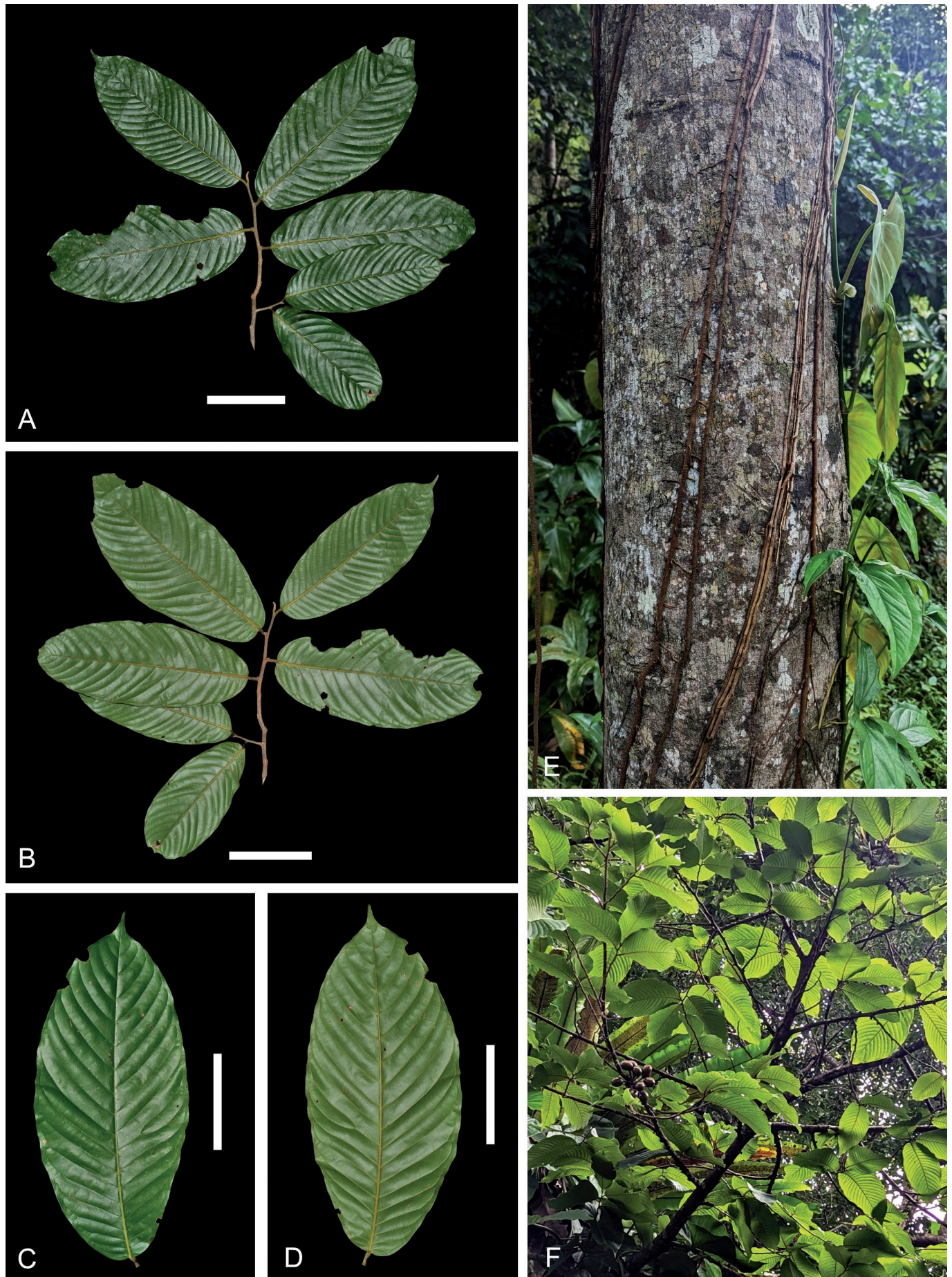
Tree to 42 m high and 100 cm dbh, bole to 30 m high, larger individuals with slight buttressing. **Outer bark** (mid-)dark greyish brown to blackish, smooth, longitudinally fissured or not, sometimes pustular, sometimes peeling off in flakes, up to 2 cm thick. **Inner bark** blaze light brown(–black), often mottled, fibrous, without odor; sapwood usually pale yellow(–yellowish brown) to white, sometimes with dark red flares, oxidizing greyish yellow, corky, moderately soft to hard, dense, non-fibrous, heartwood indistinct, darker yellow. **Stems** dark greyish brown to brown, often mottled, smooth to pustular-lenticellate, weakly fissured longitudinally, glabrous to rarely short pubescent when young. **Leaves** variously rounded elliptic to linearly oblong, (8.5–)17–34.5(–42) × (5.5–)9.5–15(–18) cm, chartaceous(–subcoriaceous), when fresh dark (semi)glossy green above and dull (light–)medium green below, drying grey-brown above and light (reddish) brown below, base (acute–)rounded to truncate or weakly cordate, sometimes weakly asymmetric, apex (sub)acute to obtuse to rounded; petioles 7–10 × 2 mm, adaxially grooved, glabrous (to sparsely tomentose), dark greenish brown when fresh, drying black; venation eucamptodromous to weakly brochidodromous, midvein thick and becoming conspicuously thicker towards the base, sunken adaxially, prominently raised abaxially, when fresh golden-orangish, drying dark orangish brown, secondary veins in (11–)16–24(–30) pairs, closely spaced, c. >1 cm apart, angled ± 45° to the costa, frequently and irregularly ramifying or fusing, rarely with intersecondaries when secondaries are > 1.5 cm apart; tertiary veins straight to forked percurrent, numerous, closely spaced. **Inflorescences** ramiflorous, in loose fascicles of up to 4(–7) flowers, the fascicles sometimes borne on short, wart-like brachyblasts; flowering pedicels (8–)25–45 × 1–2 mm, sparsely to densely short brown tomentose, bracteate; bracts 1(–2), often rather conspicuous, (sub)basal to medial, up to ¾ the distance from the pedicel base, rarely paired and (sub)opposite, elongated triangular-ovate, 4–5.5 × 2–3 mm, outer side sparsely (to densely) brown pubescent, inner side glabrous. **Sepals** 3, (broadly) triangular ovate, up to 8 × 9 mm, apex acute, outer side tomentose, inner side glabrous. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, thin chartaceous, bifacially glabrous, (11–)35–45(–55) × (1–)2–5 mm, weakly tapering towards apex, (yellow–)green to yellow at anthesis, often fragrant; stamens c. 45–150, in (3–)4–7 series, c. 1 mm long, laterally flattened, connective apex truncate, pentagonal; carpels c. 30, in 4–5 series, 3–3.5 mm long, ovaries ellipsoidal, c. 2 mm long, villous, stigmas cylindrical, c. 1–1.5 mm long, densely villous apically, tightly fused. **Fruits** consisting of up to 20 monocarps per cluster, each cluster up to 14.5 cm wide, usually sparsely packed; torus globular to irregularly discoid, up to 2.5 cm wide, (sub)woody; pedicels 25–50 × 4–6 mm, brown, thickly woody, sometimes with persistent brown tomentum; stipes 25–45 × 3–4 mm, glabrous, (dark) red to purplish; monocarps ovoid, 2.5–3.4 × 1.8–2.5 cm, bases rarely attenuate, densely brown tomentose when immature, becoming entirely glabrous smooth when mature, reddish brown to purplish black (rarely bluish grey) when ripe. **Seeds** 1, smooth, ovoid, 1.8–2.2 × 1.5 cm, testa light brown, wrinkled laterally, with an irregular circumferential groove, endosperm ruminant. Fig. 8–9.





**Fig. 8.** *Monoon excelsum*. A. Twig with leaf. B. Twig with inflorescences. C. Flower with anterior outer petal removed. D. (clockwise from top) Floral chamber lateral view, floral chamber cross section, stamens lateral view, stamens abaxial view, and carpel. E. Twig with mature infructescence. F. Seed. A from Ezedin 1112 (MIN), B from Nima for Womersley NGF 37101 (A), C–D from Versteegh BW 51, E from Takeuchi 7162, F from Havel & Henry NGF 9162. Illustration: B. Angell.





**Fig. 9.** *Monoon excelsum*. A. Adaxial twig. B. Abaxial twig. C. Adaxial leaf. D. Abaxial leaf. E. Main stem and outer bark. F. Canopy of leaves as seen from below with ramiflorous infructescence visible. Scale: 10 cm. A–B from an unvouchered collection taken from WFDP tag no. 342679, C–D from an unvouchered collection taken from WFDP tag no. 433078, E–F from an unvouchered individual growing at the Lae Botanic Gardens, Morobe, Papua New Guinea. Photos: Z. Ezedin.



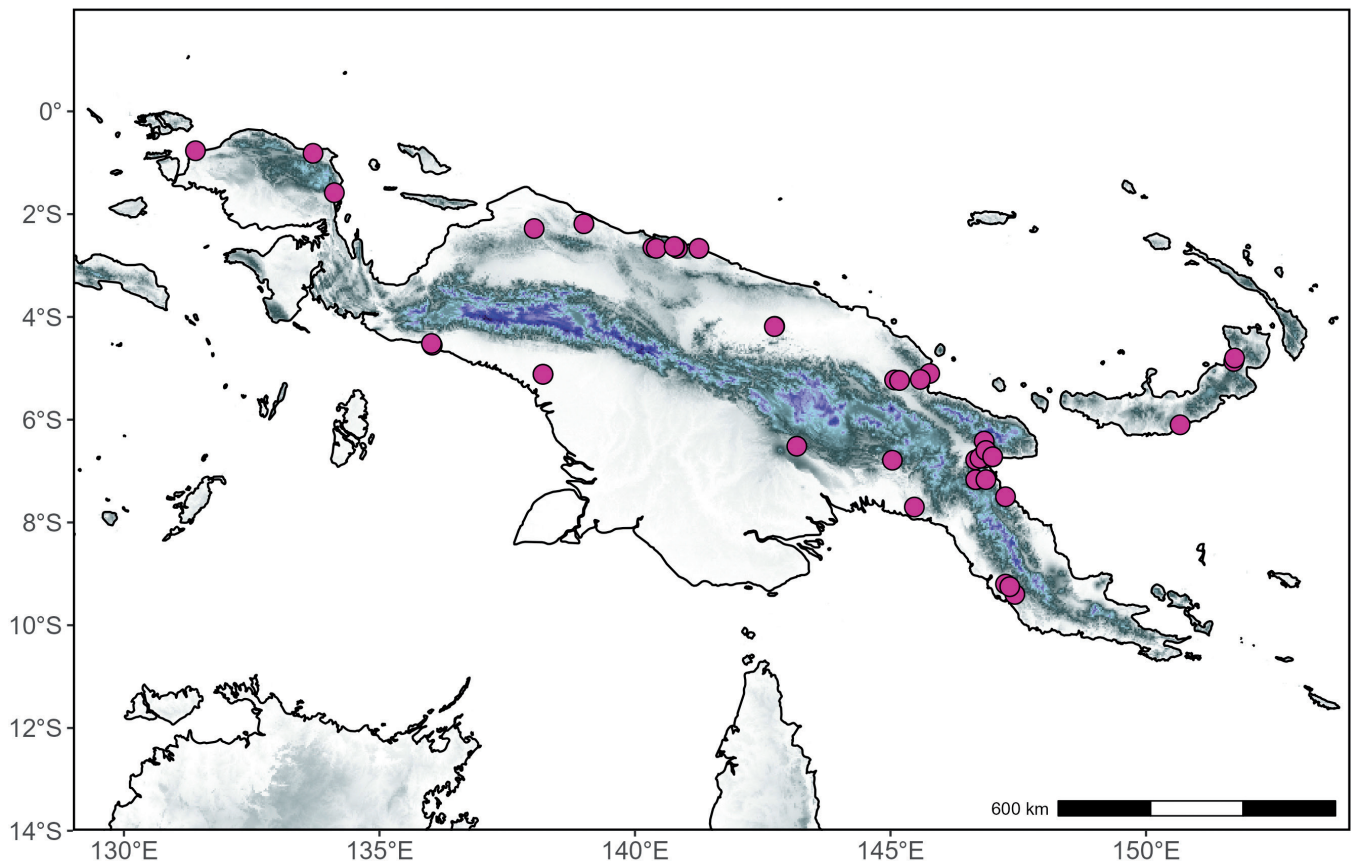


Fig. 10. Distribution map of *Monoon excelsum*.

**Distribution:** Indonesian New Guinea and Papua New Guinea (Fig. 10).

**Habitat and ecology:** Undisturbed primary (rarely secondary) lowland hill, seasonally flooded, swamp, and coastal plain forests. From sea level up to 500(–800) m asl, with the majority of specimens collected from below 200 m. This species is widespread across the New Guinea lowlands and is among the more commonly collected Annonaceae across the island. Trees of this species often get very large, and some fully mature individuals are noted as being canopy emergent. Its population density appears to vary across New Guinea, being described as common in some localities and infrequent or scarce in others. Based on observations at Wanang, the species appears to prefer undisturbed forests and may not be easily encountered in secondary or degraded forests.

**Etymology:** In reference to the large size of mature individuals, along with its leaves, which are among the largest of Papuan Annonaceae.

**Conservation status:** Least Concern (LC). Not only is this species widespread, known from localities throughout the New Guinea lowlands with numerous collections, it has been reported as common in multiple localities. Although logging threats exist in areas across the lowlands, the species is effectively shielded by its relative commonality and wide-ranging distribution.

**Vernacular names:** Lelakai (Manikiong), Nambenien (Berik), Katam pilanĵe (Magi), Manies / Joemoek (Mooi), Gabor (Koiari), Akama (Mimika), Kumlakame (Waskuk Hills), Dasidi (Kemtui),

Menaku (Sougb), Méiakoe (?), Inokona Merkemeoek (Arfak Sidai), Wee (Asmat), Se-ne (Pawaian).

**Additional specimens examined:** INDONESIA: **Papua:** Pionier bivak, Mamberamo gebied [=Mamberamo River], [2°16' 51"S, 138°1' 36"E], 30 m, 6 Nov 1939, *van Eechoud* 89 (BO [BO-1408160]); Mimika Aria (Oeta) [=Uta], [4°33'S, 136°02'E], 4 m, 29 Jun 1941, *Lundquist* 32887 (L [L.1759898]). Holtekang, [2°37'48"S, 140°46'36"E], 2 m, 9 Oct 1953, *Versteegh* BW 51 (A [A00871760], BO [BO-1408112, 1408113], L [L.1759691, L.1759692], LAE [8777]); Hollandia [=Jayapura], Tami [River], [2°40'S, 140°50'E], 25 Jan 1955, *Brouwer* BW 798 (A [A00871762], BO [BO-1408144], L [L.1759667, L.1759668], LAE [19943]); Sauwah, Asmat region, Div. South N. Guinea, [5°07'S, 138°12'E], 0 m, 6 Jul 1957, *Nautje* BW 6594 (L [L.1759724]); Sekoli (Zuidelijk van het Sentani-meer) [=Sekori Plains, S of Sentani Lake], [2°39'S, 140°21'E], 90 m, 7 Aug 1957, *Kalkman* BW 3761 (L [L.1759717]); Oereb (Sidoarsi Mts), about 200 km W of Hollandia [=Jayapura], [2°11'16"S, 139°00'36"E], 50 m, 15 Jun 1959, *Schram* BW 9296 (L [L.1766871], LAE [213336]); Sekoli-vlakte [=Sekori plain], [2°40'S, 140°25'E], 75 m, 12 Feb 1960, *Versteegh* BW 7514 (L [L.1759785], LAE [215349]). **West Papua:** Manokwari [Regency], Momi, [1°35'S, 134°07'E], 50 m, 10 Aug 1948, *Kostermans* bb 33555 (L [L.1759795, L.1759796, L.1759797]); Manokwari [Regency], [illegible], 50 m, 10 Sep 1948, *Kostermans* 380 (L [L.1759795]); Maseni [=Masni], [0°49'S, 133°42'E], 25 Mar 1955, *Schram* BW 1808 (L [L.1759858]); Warsamson River, 25 km east of Sorong, [0°46'60"S, 131°24'E], 60 m, 28 Aug 1957, *Schram* BW 2954 (L [L.1766873], LAE [31925]); Warsamson, ± 25 km east of Sorong, [0°46'60"S, 131°24'E], 60 m, 12 Sep 1957, *Schram* BW 5925 (A

[A00871764], L [L.1757992], LAE [31902], SING [SING0214089]); Warsamson Valley, E. of Sorong, 50 m, 21 Jul 1961, *Schram BW 12297* (L [L.1759756], LAE [64003]); Warsamson valley, E of Sorong, 30 m, 28 Jul 1961, *Moll BW 11682* (L [L.1766872], LAE [73810]).

PAPUA NEW GUINEA: **Central:** Koitaki, [9°24'S, 147°26'60"E], 457 m, 27 Jun 1935, *Carr 12731* (L [L.1759800], SING [SING0214092]); On strip line about 1 mile from site of Brown River Bridge, [9°12'S, 147°15'E], [sea level], 10 Nov 1953, *Jackson & McDonald NGF 4578* (BO [BO-1408172], LAE [300557], NSW [NSW538438]); One mile B. River road, Vanapa sub-district, 9°15'S, 147°20'E, 30 m, 17 Nov 1964, *Eddowes & Kumul NGF 13091* (A [A00871757], BO [BO-1408189], BRI [AQ0211166], L [L.1767266], LAE [99134]). **Chimbu:** O-Pio 1 ha plot, block 2, Crater Mountain Wildlife Management Area, 6°47' 19"S, 145°02' 12"E, 550 m, 31 Jul 1996, *Weiblen TP041* (MIN [896664]). **East New Britain:** Matanakunei, Rabaul sub-district, 4°52'S, 151°43'E, 15 m, 27 Mar 1968, *Ridsdale & Katik NGF 36782* (BRI [AQ0211051], L [L.1759766], LAE [100770, 2 sheets]); ibidem, 27 Mar 1968, *Ridsdale & Katik NGF 36787* (L [L.1759781], LAE [100773, 2 sheets]); Powell Harbour, Rabaul sub-district, 4°48'S, 151°44'E, 30 m, 14 Jun 1972, *Foreman LAE 52078* (BO [BO-1408286], L [L.1767270], LAE [150812], NSW [NSW538437], SING [SING0275939]). **East Sepik:** Waskuk Hills, along the foot track between Garuka and Ambunti, in Glei Clan territory, 4°11'S, 142°44'E, 30 m, 6 Jul 1995, *Takeuchi & Regalado 10293* (A [A00871766], L [L.1759806, L.1759807, L.1759851, L.1759852], LAE [297376], US [3361815]); Ridge towards Waskuk Hills, 4°11'S, 142°44'E, 150 m, 6 Jul 1995, *Regalado & Takeuchi 1500* (A, LAE [272806]); Waskuk Hills, buttress ridge N of Garuka, 4°11'19"S, 142°43'37"E, 200 m, 25 Nov 2004, *Takeuchi et al. 17488* (LAE [291132, 2 sheets]). **Gulf:** West bank of Vailala River c. 3 miles south of junction with Lohiki River, [7°42'S, 145°28'E], 18 m, 3 Feb 1966, *Schodde & Craven 4433* (L [L.1767262], LAE [124331]). **Madang:** Gogol Base, [5°13'S, 145°35'E], 30 m, Katik W 2784 (LAE [116847, 2 sheets]); No. 1 Ramp [=Danip Airfield], Madang district, [5°06'S, 145°46'E], [150 m], 17 Mar 1970, *Wagapani LAE 50001* (L [L.1759731], LAE [118117]); Wanang village, 5°14'14"S, 145°10'38"E, 115 m, 21 Mar 2006, *Weiblen & Binatang Research Centre WP1B0096* (MIN [916721]); Wanang 50ha Forest Dynamics Plot, tag no. 392467, 5°13'39"S, 145°04'47"E, 80–180 m, 18 Oct 2022, *Ezedin 1112* (MIN). **Morobe:** Sattelberg, Boana, Mt. [illegible] below [illegible], [6°25'S, 146°50'E], 762 m, 29 May 1938, *Clemens 8303a* (A); Lae, Apr 1945, *s.coll. NGF 955* (L [L.1759661], LAE [1680]); Yalu, near Lae, [6°36'S, 146°52'E], Nov 1948, *Womersley NGF 3274* (LAE [1681]); Bulolo, 9 Jan 1950, *McIntosh NGF 3582* (A [A00871759], BO [BO-1408134], L [L.1767267], LAE [1683], NSW [NSW538436], SING [SING0214093]); Bulolo, [7°10' 12"S, 146°40' 12"E], 24 Feb 1950, *Fryar NGF 4041* (A [A00871763], BO [BO-1408135], L [L.1759693, L.1759694], LAE [1684], NSW [NSW538442], SING [SING0214091]); Yalu, near Lae, [6°36'S, 146°52'E], 3 Mar 1950, *Fryar NGF 3341* (LAE [1682]); Plantation area 1953/54 – Bulolo, 10 Jul 1953, *Graham 5305* (A [A00871767], L [L.1759725], LAE [2826883], SING [SING0214090]); Oomsis Creek, about 18 miles W of Lae, 6°43'S, 146°47'E, 122 m, 27 Feb 1962, *Hartley 9949* (A [A00871768], BRI [AQ0211660], L [L.1759834], LAE [52337], RSA [RSA0448807]); Crooked Creek, logging area, Bulolo, 7°10'S, 146°40'E, 792 m, 22 Jun 1962, *Havel & Henry NGF 9162* (A [A00871756, A00871761], BO [BO-1408282], BRI [AQ0211060], CANB [CBG8312876.1, CBG8312876.2], L [L.1759783], LAE

[44226]); Taun Logging Area, Bulolo, 7°10'S, 146°52'E, 700 m, 13 Aug 1962, *Havel & Kairo NGF 15407* (CANB [CBG8312875.1], L [L.1767265], LAE [47871]); Ridge near Kui village, 7°30'S, 147°15'E, 152 m, 19 Oct 1965, *Gillison NGF 25006* (A [A00871765], BRI [AQ0211110], L [L.1767261], LAE [91314, 2 sheets]); Oomsis logging area, Lae sub-district, 6°47'S, 147°00'E [=6°47'S, 146°40'E], 152 m, 15 Nov 1967, *Nima for Womersley NGF 37101* (A [A00871758], BRI [AQ0211054], L [L.1759702], LAE [116748, 3 sheets]); Lae, Botanical Garden, [6°43'15"S, 146°59'45"E], 10 m, 27 Jan 1987, *Morawetz & Waha 15-27187* (L [L.3728069], NY [NY4727526]); Herzog Mountains, Gabensis logging track, 6°45'S, 146°45'E, 490 m, 13 Jul 1991, *Takeuchi 7162* (A [A00871755], L [L.1759735]); National Botanical Garden Lae, cultivated, [6°43'20"S, 146°59'43"E], 30 m, 13 Mar 2001, *Fazang LAE 78731* (LAE [281786, 2 sheets]); National Botanical Gardens near Hibiscus garden, back of FRI Office, 6°30'S, 147°00'E, 40 m, 28 Oct 2008, *Bega & Fazang LAE 79217* (LAE [288486]); Botanical Gardens in Lae, MP, 6°43'15"S, 146°59'55"E, 30 m, 10 Nov 2020, *Chiru LAE 92041* (LAE [299812]). **Sandaun:** Vaimo hinterland, Vaimo sub-district, 2°40'S, 141°15'E, 500 m, 29 Nov 1971, *Streimann & Martin LAE 52931* (A [A00871771, A00871769], BO [BO-1408283], L [L.1767255], LAE [141610], NSW [NSW538443], SING [SING0214080]).

**Notes:** All specimens of this species were found determined as either *Polyalthia oblongifolia*, *P. polycarpa*, *P. lateriflora* King, or simply as *Polyalthia* sp. It is rather common throughout New Guinea with numerous collections known from across the lowlands; the tree is often described as being well branched and having good form. The first collection of this species appears to have been made by C.E. Carr in 1935 at Koitaki. This species is present at the WFDP in Madang Province where it appears to be somewhat uncommon but not exactly rare. Like the herbaria specimens, prior surveys of the plot had the species treated under a broadly applied *P. oblongifolia*.

Some characters appear to be variable in this species, with a handful of specimens exhibiting the following outlier morphologies: presence of brown hairy indument on young twigs and leaves soon becoming glabrous, monocarps with attenuate bases (i.e., pear-shaped), and short petals as small as 1.1 cm long. These are interpreted as intraspecific variation as all other character states appear constant. The specimen *Nima & Womersley 7101* is slightly aberrant in displaying laminas that are rounder and broadly spaced tertiaries. The specimen *Gillison NGF 25006* deviates more noticeably in bearing thicker coriaceous laminas, fewer secondaries that are more steeply arcuate and not as closely spaced, inflorescences as branched brachyblasts, larger bracts, and shorter peduncles; thus, it is cautiously included here. Specimens displaying shortly pubescent young twigs, abaxial laminas, and petioles generally appear to be more common in western New Guinea.

The leaves of *M. excelsum* approach those of several other Malesian species which also bear large leaves. This includes the Philippine *M. grandifolium* (Elmer) B.Xue & R.M.K.Saunders which differs in larger (longer) leaves, young twigs and leaves which are hairy, secondary veins that are widely spaced and in > 20 pairs, and petals that are stouter and wider. Leaves and venation of *M. excelsum* approach that of *M. klemmei* (Elmer) B.Xue & R.M.K.Saunders from the Philippines and Borneo, along with the Philippine endemic *M. mindanaense* (Elmer) B.Xue &

R.M.K.Saunders, but these both have flowers with broader, thicker coriaceous calyx and corolla. General appearance also approaches that of *M. membranifolium* (J.Sinclair) B.Xue & R.M.K.Saunders of Peninsular Malaysia due to the closely spaced secondaries, but this still differs in its thinner leaves, generally fewer secondaries, less prominent midrib, flowers with much larger (wider) petals that are densely hairy, and smaller monocarps. A handful of New Guinea specimens were found determined as the Philippine endemic *M. ramiflorum* (Merr.) B.Xue & R.M.K.Saunders. While the latter's flowers may resemble those of this species, it nonetheless clearly differs in the following: leaves which are noticeably smaller, with fewer secondaries, ±strongly acute bases and acuminate apices, twigs that are densely lenticellate, petals that are wider at the base

and noticeably longer. This species also strongly resembles *M. fragrans* (Dalzell) B.Xue & R.M.K.Saunders from the Western Ghats of India, which has similar leaves and fruits but differs in its pubescent pedicels and monocarps, which themselves are more numerous and have wrinkled surfaces, and usually thicker, wider petals.

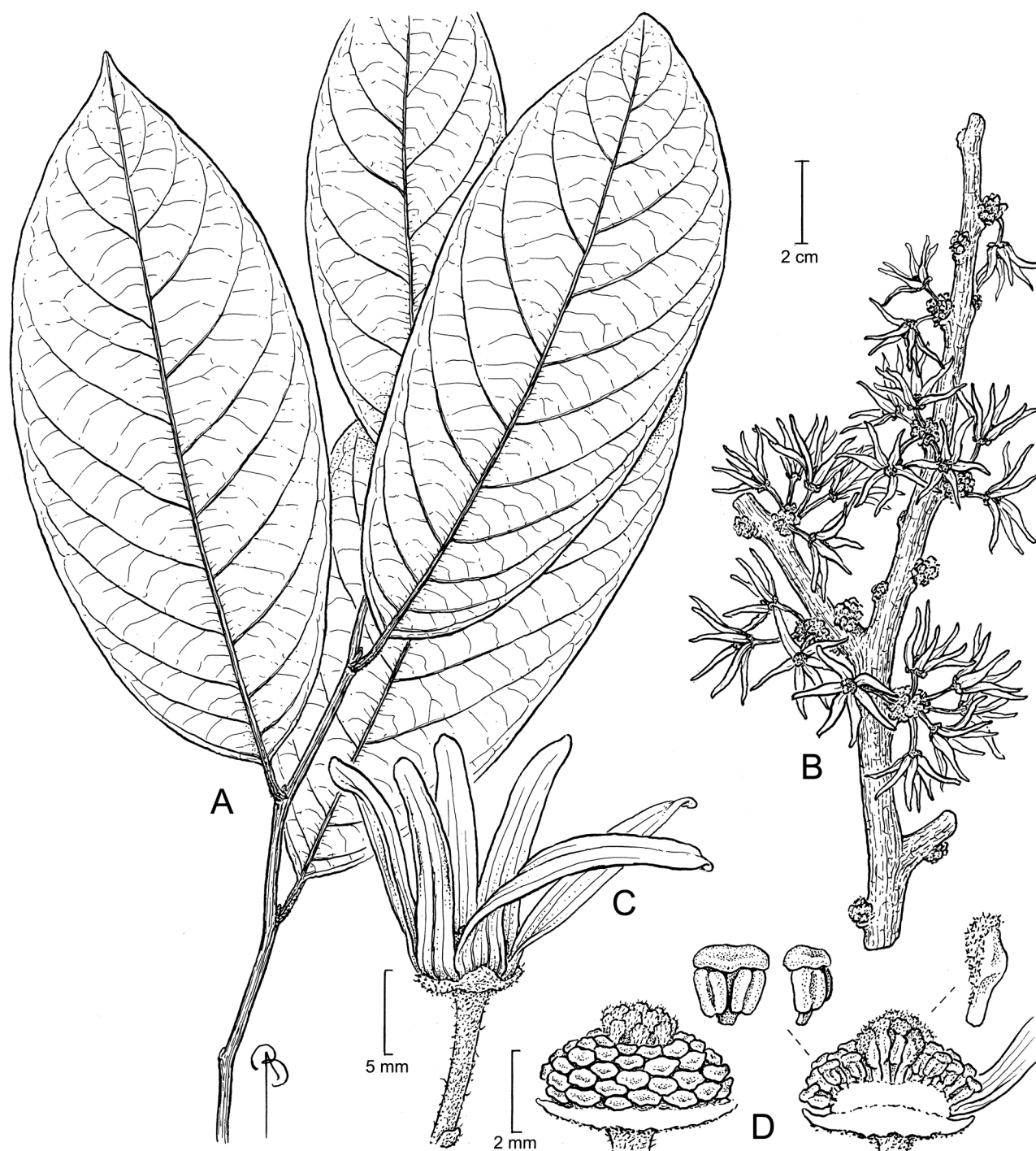
##### 5. *Monoon gisorum* Ezedin, *sp. nov.*

Type: Papua New Guinea: Oro: c. 20 km SE of Budi Barracks, Tufi subdistrict, [9°04'47"S, 149°18'33"E], 150 m, 28 Aug 1954, Hoogland 4613 (holo: A [A00871773]; iso: L [L.1759768, L.1759769], LAE [13787, 2 sheets], MEL [MEL2383132A]).



**Fig. 11.** *Monoon gisorum*. A. Twig with both immature and spent inflorescences and mature fruit. B. Detail of axial inflorescence cluster. From Kanis 1184. Illustration: B. Angell.





**Fig. 12.** *Monoon gisorum*. A. Twig with leaves. B. Older twig bearing ramiflorous inflorescences. C. Flower. D. (from left to right) Floral chamber lateral view, stamen abaxial view, stamen lateral view, floral chamber cross section, and carpel. From Hoogland 4613. Illustration: B. Angell.

**Diagnosis:** Differs from *M. chloroxanthum* in its inflorescences borne on dense excrescences, shorter flowering pedicels measuring 3–10 mm long (vs 15–45 mm), shorter petals measuring 7–22 × 2–4 mm (vs 15–35 × 3–5 mm), fewer stamens of c. 50 (vs c. 100), fewer carpels of c. 10–20 (vs c. 50), the carpels not bearing distinct ovary chambers, and fewer but larger monocarps with 3–4 per cluster measuring 15–20 × 3–5 cm (vs up to 40 per cluster at 0.8–3 × 0.6–2 cm).

Tree to 25 m high and 40 cm dbh, bole to 15 m high. **Outer bark** dark greyish brown to dark brown, rather smooth, shallowly fissured, vertically lenticellate. **Inner bark** blaze dark cream

to orangish, sapwood (light) yellow. **Stems** light greyish to light brown, rough with deep longitudinal fissures, lenticellate, glabrous. **Leaves** elliptic to obovate, (6–)9–15(–20) × (2.5–)4–7.5(–9) cm, chartaceous, when fresh glossy medium green above and glossy light green below, drying greyish to reddish brown above and light brown below, base (acuminate to) acute to obtuse, apex (bluntly) acute to cuspidate; petioles (5–)6–9(–14) × 1–2 mm, adaxially grooved, drying dark brown to black; venation eucamptodromous, midvein slightly thickening towards base, weakly sunken adaxially, raised abaxially, drying rusty red to blackish, secondary veins (6–)10–13, regularly spaced, c. (0.5–)1 cm apart, angled c. ± 45° to the costa; tertiary veins straight (to

irregularly forked) percurrent, regularly spaced. **Inflorescences** axillary to ramiflorous, in dense fascicles of up to 20 flowers, the fascicles borne on dense warty excrescences covered in dense brown tomentum; flowering pedicels (3–)6–10 × 1 mm long, densely brown tomentose, bracteate; bracts 1, sub-basal to medial, up to ½ the distance from the pedicel base, triangular-ovate, 1.8 × 0.5 mm, apex acute, outer side light brown tomentose, inner side glabrous. **Sepals** 3, broadly triangular, up to 3.5 × 4 mm, apex acute to rounded, outer side densely light brown tomentose, inner side glabrous. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, chartaceous, glabrous to (weakly) tomentose on the outer side, (7–)13–16(–22) × 2–3.5(–4) mm, apex rounded and not tapered, green to yellow-green at anthesis; stamens c. 50–60, in 3–4 series, c. 0.9 mm long, thick,

connective apex truncate, pentagonal, with tufts of short brown hairs at base; carpels c. 10–20(–30), in 2–3(–4) series, 1.8–2 mm long, ovaries linearly obloid, indistinct from the stigmatic column, 0.5–0.9 mm long, villous towards the base, stigmas tightly fused, cylindrical to irregular, c. 1 mm long, apex minutely verrucose.

**Fruits** consisting of up to 3(–4) monocarps per cluster, each cluster up to 12 mm wide; torus globular to weakly discoid, up to 5 × 8 mm, woody, often small and weakly defined; pedicels 15–25 × 3–4 mm, light brown, woody; stipes 15–25 × 3.5–4.5 mm, when mature turning dark red to purple; monocarps ovoid, bases attenuate, 2–4 × 1.6–2.4 cm, glabrous, smooth, dark red to purplish black when ripe. **Seeds** not examined. Figs. 11–12.

**Distribution:** Endemic to Papua New Guinea (Fig. 13).

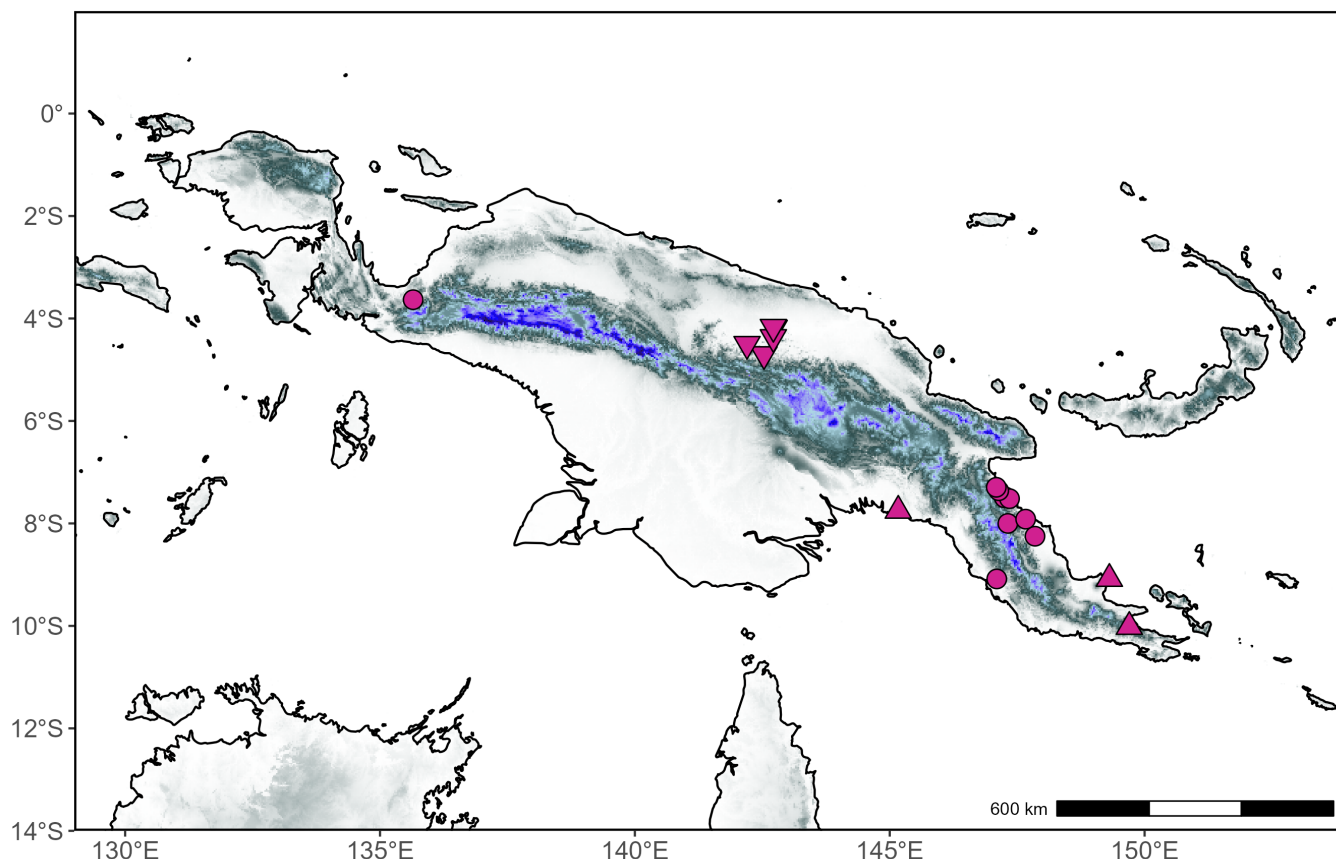


Fig. 13. Distribution map of *Monoon gisorum* (▲), *M. laxatum* (●), *M. prolixum* (▼).

**Habitat and ecology:** Lowland hill forest, including secondary forests, up to 800 m asl.

**Etymology:** From *gisor*, an indigenous Papuan name for Annonaceae found in at least two unrelated languages.

**Conservation status:** Near Threatened (NT). Known from three localities in the Papuan Peninsular region, to which it may be endemic. Although the EOO is just over 20,000 km<sup>2</sup>, pressures from logging and, to a lesser extent, LNG pipelines may serve as a threat to the species.

**Vernacular names:** Gisor (Onjob, Koreaf dialect), Gisorwenga (Keapara, Wanigela dialect).

**Additional specimens examined:** PAPUA NEW GUINEA: **Gulf:** Near Ravikivau, Purari delta, [7° 45' S 145° 10' E], 3 m, 19 Feb 1966, Craven & Schodde 862 (CANB [CANB208248.1, CANB208249.1], L [L.1768825, L.1768826], LAE [208307]). **Milne Bay:** Baniara subdistrict, W. of Opanabu village, 10°01'S, 149°42'E, 800 m, Kanis 1184 (A [A00871750], CANB [CANB215236.1, CANB215237.1], L [L.1759826], LAE [207542]).

**Notes:** These specimens, one in flower and two in fruit, were originally posited to be two separate species. Upon close inspection of the twigs and inflorescences, however, it is believed they represent the same species at different phenological stages and are here united as such. The uniting features are the inflorescences which are borne on distinctly warty excrescences on the stem along with the densely brown tomentose flower

buds and scale-like bracts. The fruiting *Kanis 1184* specimen differs in the leaves being smaller and a different shape than the flowering type, but this is interpreted as intraspecific or perhaps environmental variation. Nonetheless, *Kanis 1184* bears short fruiting pedicels which appear to match the short flowering pedicels of the type. Additional collections would help to provide further proof in properly defining this species.

Its morphology approaches *M. chloroxanthum*, for which it could be confused. However, *M. chloroxanthum*, despite its variability, forms more or less a homogenous morphological unit. This species falls outside the norm of the former due to its distinct inflorescences and flowers. The flowering type stands apart from all other *M. chloroxanthum* material seen. The carpels of this species are rather unique in that they bear indistinct ovary chambers whereas all other species described herein bear distinct ovary chambers below the stigmatic region.

## 6. *Monoon laxatum* Ezedin, *sp. nov.*

Type: Papua New Guinea: Morobe: Near Kui, Lae subdist., 7°29'S, 147°16'E, 15 m, 5 Apr 1967, *Ridsdale NGF 31638* (holo: A [A00871774]; iso: BRI [AQ0211053], L [L.1767279], LAE [90616, 3 sheets]).

Diagnosis: Differs from *Monoon chloroxanthum* in bearing coriaceous laminas (vs chartaceous), petioles that are often thickened and wrinkled, secondary veins spaced 2–5 cm apart (vs 1–2 cm), red to purplish petals (vs greenish-yellow), and monocarps ripening orangish (vs reddish).

Tree to 15 m high and 15 cm dbh, bole to 9 m high. **Outer bark** mottled greyish green, longitudinally fissured, rough, sparsely lenticellate. **Inner bark** blaze brownish, fibrous, sapwood (orangish) yellow, with distinct pale rays, medium hardness. **Stems** greyish to dark brown, smooth, weakly fissured longitudinally, without lenticels (to sparsely lenticellate), glabrous when young. **Leaves** variously ovate to elliptic (to oblong), (15–)19–30(–38) × (6–)8–14.5(–18.5) cm, (thick) (sub)coriaceous, when fresh glossy dark green above and dull medium green below, drying glossy greyish light brown above and glossy light (reddish) brown below, base (subcordate to) rounded (to acute), sometimes weakly asymmetric, apex rounded to acute (to acuminate); petioles 8–13 × 2–4 mm, adaxially weakly grooved to rounded, often thickened with wrinkles or cracks, drying jet black; venation eucamptodromous (to weakly brochidodromous), midvein thick and becoming thicker towards the base, sunken above, prominently raised below and often weakly grooved, secondary veins (9–)11–13, irregularly spaced, 2–3.5(–4.8) cm apart, angled 35–50° to the costa, rarely with irregular ramifying or fusing, intersecondaries absent; tertiary veins straight (to forked) percurrent, lower venation reticulate and bifacially prominent. **Inflorescences** ramiflorous, solitary or in pairs; flowering pedicels 20–25 × 1–2 mm, glabrous to sparsely puberulous, bracteate; bracts 1, medial, rounded to broadly triangular-ovate, 2–3 × 1 mm, apex rounded to acute, outer side glabrous to lightly tomentose, inner side glabrous. **Sepals** 3, broadly triangular, up to 5 × 6 mm, apex rounded to acute, outer side glabrous to sparsely puberulous, inner side glabrous. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, chartaceous, glabrous to lightly puberulous on the outer side, (30–)40–48 × (3–)4–8 mm, apex rounded and not tapered,

red to purple at anthesis; stamens many, in 5–6 series, 1.2 mm long, thick, connective apex truncate, pentagonal, anthers as long as stamens; carpels many, in 5–7 series, 2–2.5 mm long, ovaries ellipsoidal, c. 1 mm long, villous, stigmas rounded to slightly flattened, c. 0.5 mm long, densely light brown tomentose apically, tightly fused. **Fruits** consisting of up to 40 monocarps per cluster, each cluster up to 9.5 cm wide; torus irregularly discoid, up to 2.3 cm wide, (sub)woody; pedicels 20–40 × 3–5 mm, dark brown, woody, often longitudinally fissured; stipes 10–23 × 2 mm, glabrous, drying blackish; monocarps (obovoid to) ellipsoid to obloid, often widest towards the apex, 1.7–2.1 × 1 cm, bases distinctly acute, glabrous, smooth, orangish red to orangish brown (to reddish) when ripe. **Seeds** 1, large, smooth, ovoid, 1.5–2 × 0.8–1 cm, testa light brown, shallowly wrinkled laterally, with 4 deep, ±straight longitudinal grooves, endosperm ruminate. Fig. 14.

**Distribution:** Indonesian New Guinea and Papua New Guinea (Fig. 13).

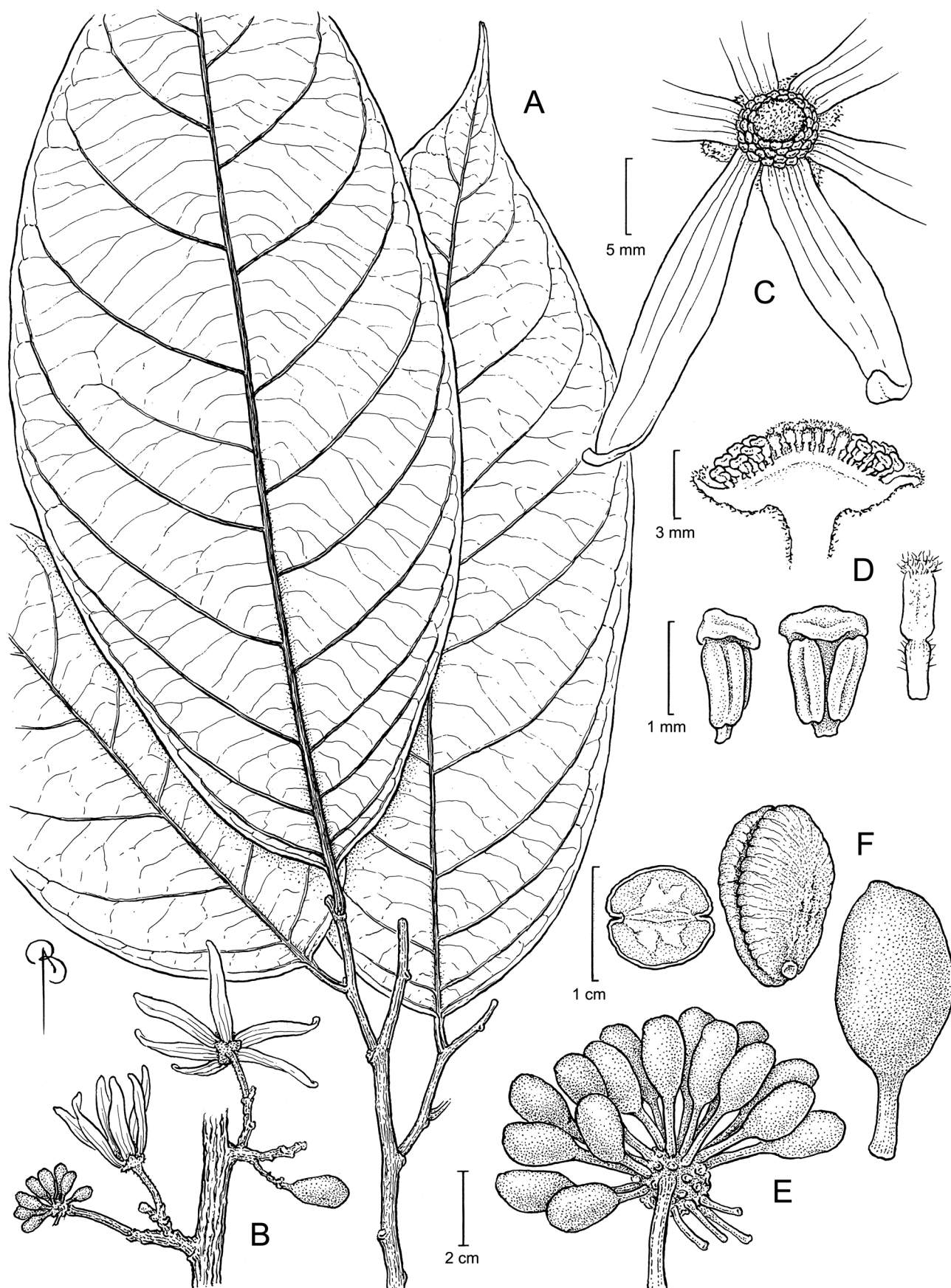
**Habitat and ecology:** Lowland hill forest up to 700 m asl. Found growing on a ridge.

**Etymology:** From Latin *laxatus*, wide or loosened; in reference to the broad laminas.

**Conservation status:** Least Concern (LC). The EOO is over 52,000 km<sup>2</sup> while the AOO is 800 km<sup>2</sup> with a user-defined cell width of 10 km. With the exception of one Indonesian specimen, this species appears to be almost entirely endemic to the Papuan Peninsula. Its oddly disjunct distribution could mean the existence of additional localities on the island harboring this species, or the species could simply be disjunct with no other locations in between. Threats to this species are virtually unknown outside the usual threats from logging.

**Additional specimens examined:** INDONESIA: **West Papua:** Boemi, 40 km inward of Nabire, [3°38'S, 135°39'E], 300 m, 11 Mar 1940, *Kanehira & Hatusima 12761* (A [A00871777]). PAPUA NEW GUINEA: **Central:** Kuvira area, Hiritano Highway, Port Moresby [subdistrict], 9°05'S, 147°06'E, 50 m, 3 Jul 1985, *Gideon LAE 57301* (A [A00871781], L [L.1759736], LAE [256142]). **Morobe:** Ridge near No. 2 ramp Pai'awa logging area near Kui, 7°30'S, 147°15'E, 121 m, 19 Oct 1965, *Gillison NGF 22496* (A [A00871778], L [L.1759701], LAE [98169, 3 sheets], SING [SING0214109]); Natter Bay logging area, 93 km SE of Lae, sub-district Lae, 7°31'S, 147°21'E, 30 m, 28 Jul 1976, *Croft & Lelean LAE 68528* (A [A00871776], BRI [AQ0350299], L [L.1767273], LAE [231961], NSW [NSW538439]); Kusap–Aruai Pat [=Gusap?], 8 Apr 1976, *Johns 1538* (A [A02612577]); Base camp between Waria River and Wivo River, 8°00'S, 147°[19']E, 30 m, 14 May 1981, *Katik LAE 74870* (L [L.3724726, L.3724727, L.3724728]); Kamiali Wildlife Management Area, near mouth of Saia River at Hessen Bay, alluvial flatland forest, 7°21'42"S, 147°08'18"E, sea level, 21 Jul 2001, *Takeuchi & Towati 14865* (A [00871780], L [L.1759811], LAE [277938], US [US3490210]); Waria River, c. 7°55'S, 147°40'E, 200 m, Dec 2002, *Takeuchi & Ama 16503* (LAE [286293]); Kamiali Wildlife Management Area, ridge to Blue Mt. vicinity of the Nembabah plot above the bivouac, 7°17'42"S, 147°05'24"E, 700 m, Apr 2005, *Takeuchi et al. 21155* (A [A00871779], K [K001870084], L [L.3728744, L.3728745]). **Oro:** N of loma on walking track to Nindewari, 8°15'S, 147°51'E, 60 m, 1 Jun 1967, *Coode & Katik NGF 29969* (A [A00871775], L [L.1759747], LAE [87381]).





**Fig. 14.** *Monoon laxatum*. A. Twig with leaves. B. Older twig bearing ramiflorous inflorescences. C. Flower and floral chamber viewed from above. D. (clockwise from top) Floral chamber cross section, carpel, stamen abaxial view, and stamen lateral view. E. Inflorescence. F. (from right to left) Detail of monocarp, seed, and seed cross section. A, E from Takeuchi et al. 21155, B from Ridsdale NGF 31638, C–D from Kanehira & Hatusima 12761, F from Croft & Lelean LAE 68528. Illustration: B. Angell.

**Notes:** This species is similar to *M. chloroxanthum* but is differentiated from the latter due to apparent differences in laminar and floral morphology and, to a lesser extent, the fruits. Differing primarily in the following: generally broader laminas that are coriaceous (vs varying degrees of chartaceous to subcoriaceous) and glossy when dry (vs dull), thickened petioles that are often wrinkled and drying jet black (vs thin, usually not wrinkled petioles drying brownish black), more rounded (to acute) bases (vs usually acute, rarely rounded), similar secondary vein count but the veins that are usually more widely spaced (c. > 3 cm), bifacially prominent tertiaries (vs not usually prominent), flowers dark red (vs greenish-yellow), fruits often ripening red-orange-brown (vs red then black). However, the laminar traits may likely form a continuous grade into larger-leaved individuals of *M. chloroxanthum*, thereby decreasing their diagnostic value in the field. Although molecular efforts may be needed to validate this taxon, the odd reddish color of the flowers, along with the size and thickness of the lamina and petioles currently make it difficult to see this as entirely conspecific with the latter group.

This species is primarily defined by its reddish-purple flowers (vs green-yellow), monocarps that ripen orangish (vs reddish), and thick leaves and petioles (vs thin). Sterile specimens with similarly thick leaves and widely spaced secondaries are also placed here, albeit with some uncertainty. The specimen *Kanehira & Hatusima* 12761, an 8 m tall tree from Indonesian

Papua, was collected in flower and appears to bear the thickest and longest leaves of any New Guinea *Polyalthia* s.lat. examined here with laminas measuring 36.5 × 12 cm. Despite this and its distant locality from all other *M. laxatum* specimens, the floral morphology and color (described on the sheet as “purpur,” likely purple) appear rather similar. Furthermore, the PNG specimen *Coode & Katik* NGF 29969 bears leaves that approach its size.

It should be noted that flower (and fruit) color is not usually regarded a reliable trait to use in forming species concepts as it can be unreliable. However, in a genus where nearly all species have greenish-yellow flowers, the reddish-purple color of this species is difficult to ignore.

**7. *Monoon pachypetalum*** I.M.Turner & Utteridge, *Eur. J. Taxon.* 339: 3 (2017).

Type: Indonesia: Papua: Nordküste [=North coast], Mittellauf des Tor-Flusses [=Mitrell on the Tor River], [1°58'S, 138°54'E], 11 Oct 1911, *Gjellerup* 738 (holo: B [B 10 0365021]; iso: K [K000691685], L [L.1759790]).

Illustration: Turner & Utteridge (2017: 4, Fig. 1).

**Distribution:** Moluccas Islands, Indonesian New Guinea, and Papua New Guinea (Fig. 15).

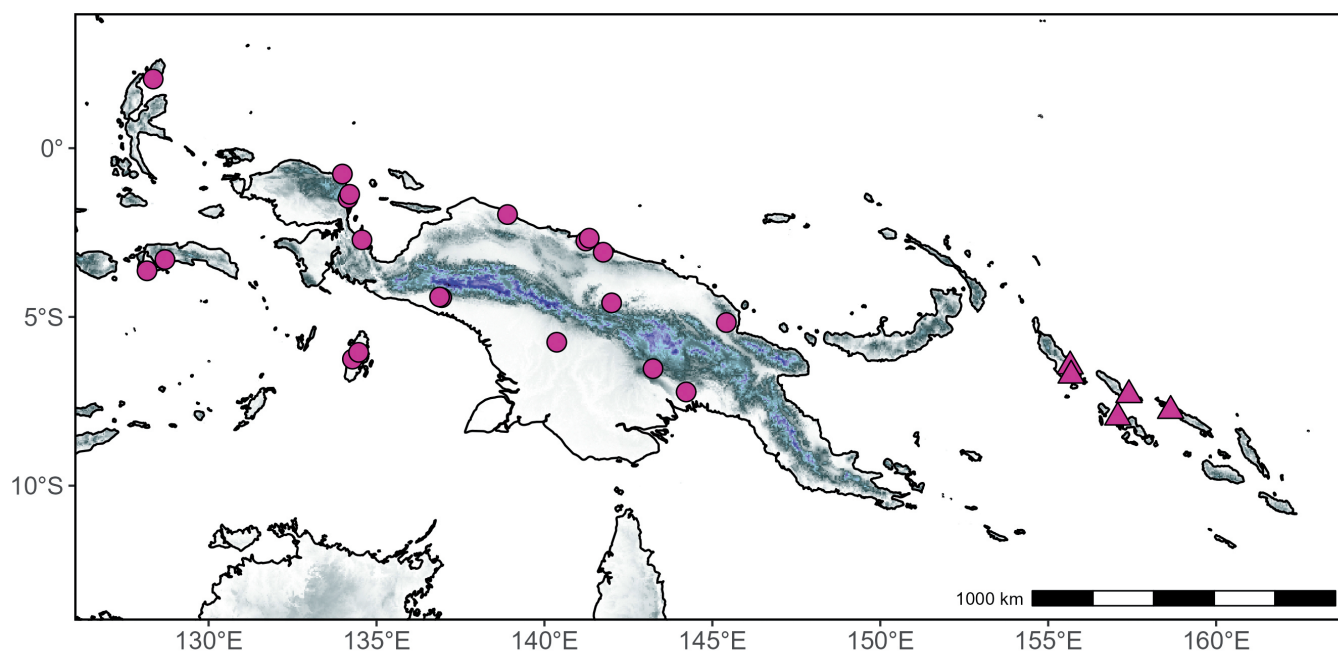


Fig. 15. Distribution map of *Monoon pachypetalum* (●) and *M. salomonicum* (▲).

**Habitat and ecology:** Lowland terra firme, alluvial, foothill, and flooded forests up to 350(–500) m asl.

**Conservation status:** Assessed as Near Threatened (NT) by Turner & Utteridge (2017) which is maintained here along similar lines of reasoning. The species is likely to face relatively minor threats in declining populations across its range, which is broadened here following the discovery of specimens in other nearby islands. The specimen *Schram* BW 13456 notes that the species is “rather common” locally, which helps to lessen its chances of being placed in a higher threat category.

**Vernacular names:** Apies, Pes (Wamesa).

**Additional specimens examined:** INDONESIA: **Maluku:** Amboin [=Ambon], [3°38'S, 128°10'E], 1859–1860, *de Vriese & Teijsmann* s.n. (L [L.1759902]); Ceram [=Seram], [3°18'S, 128°42'E], 1859–1860, *de Vriese & Teijsmann* s.n. (L [L.1759903, L.1759904]); Aroe [=Aru] Islands, P. Kobreör, Namadoebole nearly 15 km West from Dosinamalaoe [=Desa Dosinamalau], [6°03'S, 134°28'E], 8 Jun 1938, *Buwalda* 5192 (BO [BO-1408128]); [Aru Islands], Pulau Kobreör, 6°15'S, 134°17'E, 10 m, 5 Nov 1994, *van Balgooy* 6843 (A [A00871928]). **North Maluku:** Morotai [Island



Regency], Totodokoe [=Totodoku], [2°03'N, 128°21'E], 7 Jun 1949, *Kostermans* 651 (L [L.1759897]). **West Papua:** Vogelkop, Warsoewi near Ransiki, [1°29'S, 134°09'E], 10 m, 21 Jul 1948, *Kostermans* 2688 (A [A00871930], BO [BO-1408158, 1636727]); Vogelkop, Warnapi (15 km north of Ransiki), [1°22'S, 134°12'E], 10 m, Aug 1948, *Kostermans* 2969 (BO [BO-1408154]); Wondiwoi Mts., Wandammen Peninsula, [2°43'S, 134°34'E], 340 m, 14 Mar 1962, *Koster BW* 13790 (BO [BO-1408109, 1408110], L [L.1759778, L.1759779], LAE [226756]); *ibid.*, 300 m, 14 Mar 1962, *Schram BW* 13456 (L [L.1759839, L.1759840]). **Papua:** PT Freeport Indonesia Project Area, Kali Kopi near Mile 38, 4°25'38"S, 136°56'25"E, 85 m, 14 Jan 1998, *Johns et al.* 8790 (BO [BO-1448725]); *ibid.*, river crossing near plot 6, Kuala Kencana, 4°24'32"S, 136°52'41"E, 60 m, 19 Feb 1998, *Dransfield et al.* 7692 (BO [BO-1445281]). **Unknown:** Noordkust [=no locality], 1903, *Atasrip* 12 (L [L.1759772]).

PAPUA NEW GUINEA: **Gulf:** Sirebi River area inside CFI Plot No. 2, near to Lalau village, approx. 20 km N of Kikori Station, Kikori district, 7°13'24"S, 144°13'10.8"E, 40 m, 31 May 2002, *Gebia* LAE 89102 (LAE [289232]). **Madang:** Gogol River, Madang sub-district, 5°10'S, 145°25'E, 30 m, 1 Sep 1969, *Katik NGF* 46510 (A [A00871931], BO [BO-1408107], BRI [AQ021167], L [L.1759744], LAE [117699]). **Sandaun:** Mori village, sub-district Vanimo, 3°05'S, 141°45'E, 60 m, 23 Mar 1964, *Sayers NGF* 19519 (A [A00871929], BRI [AQ0211064], L [L.1767269], LAE [98264]); Vanimo subdistrict, Pevi Vanimo, 2°40'S, 141°20'E, 122 m, 25 Jan 1969, *Streimann & Kairo NGF* 39179 (L [L.1759818], LAE [110742, 2 sheets]); Near Daunda Bridge, Bewani Highway, Vanimo subdistrict, 2°45'S, 141°14'E, 110 m, 15 Sep 1977, *Wiakabu & Feni* LAE 73302 (L [L.1759767], LAE [237122]); Frieda River, airstrip area, subdistrict Telefomin, 4°35'S, 142°00'E, 20 m, 27 Apr 1978, *Kerenga & Lelean* LAE 73977 (A [A00871932], L [L.1759780]). **Southern Highlands:** Wayu Mission Station, Mt. Bosavi, Tari subprovince, 6°35'S, 142°50'E, Aug 1986, *Katik* LAE 78097 (L [L.1757806], NSW [NSW299253, NSW299256]); Kutubu patrol area, alluvial flats E of Ubogo village, [6°32'S, 143°14'E], 490 m, 2 Aug 1991, *Takeuchi* 7260 (A [A00871927]).

**Notes:** Newly reported for the Moluccas and PNG. This species is most similar to the newly described *M. ascendens*, currently only known from the PNG side, the only other Papuan *Monoon* species with sessile monocarps. However, this species can be easily distinguished from the latter by its pubescent twigs, smaller laminae, more secondary veins with closer spacing, asymmetric bases, and pubescent (sub)globose monocarps that are smaller in size. Although the pubescent monocarps are considered to be one of the defining features, a couple specimens cited here appear to show glabrous or glabrescent monocarps.

Leaves can measure up to c. 29 × 12.5 cm (*Wiakabu & Feni* LAE 73302) while the indument density and hair length on young twigs can vary. Young leaves often flush out with dense bifacial pubescence, but this is lost upon maturity; although, the abaxial veins may retain some hairs. The inflorescences are axillary to ramiflorous. The corolla is distinctly fleshy and may be yellow (Turner & Utteridge 2017) or white (*Kostermans* 2688). Monocarps measure up to c. 4.5 × 3.5 cm and are reportedly pink (*Kerenga & Lelean* LAE 73977) or orange (*Kostermans* 2688, *van Balgooy* 6843) when ripe and their surface may be glabrescent with age. The maximum height of this species appears to be 15 m (*Kerenga & Lelean* LAE 73977).

The specimens from Ambon and Seram are sterile and display leaves that are narrower and the bases slightly more acute than the rest. They are placed in this species due to their general similarities in the short petioles, tomentose young twigs, and slightly asymmetric bases. The specimen *Gebia* LAE 89102 displays narrow laminae and glabrous monocarps.

The two additional specimens cited by Turner & Utteridge (2017), *Nedi* 781 (K) and *Dransfield* 7565 (K), were not seen by the author and are thus not listed here. However, coordinates from both are included in the distribution map.

### 8. *Monoon prolixum* Ezedin, *sp. nov.*

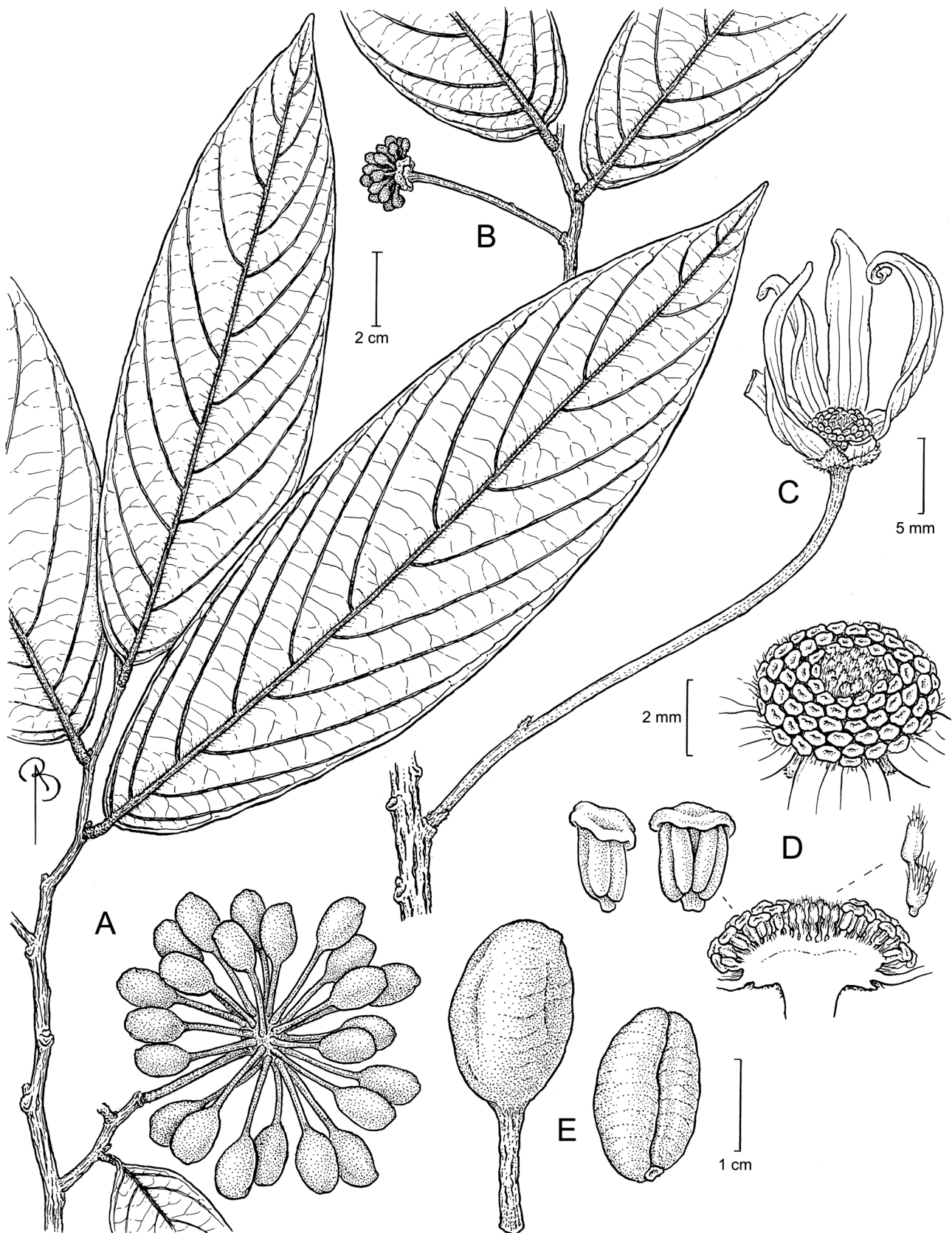
Type: Papua New Guinea, East Sepik, Ambunti subdistrict, Waskuk Hills, area around Langu and Garuka villages, 4°11'S, 142°44'E, 100 m, 22 Jun 1995, *Regalado & Takeuchi* 1443 (holo: A [A02615305]; iso: L [L.1759732], LAE [272596]).

Diagnosis: Differs from *Monoon chloroxanthum* in its arcuate secondary veins angled at 30–40° to the costa (vs 45°), solitary inflorescences (vs fasciculate), elongated pedicels up to 70 mm long (vs up to 45 mm), and reddish-maroon petals that are not spreading at anthesis (vs greenish-yellow, spreading), and petals that are shorter measuring 7–11 mm long (vs 15–35 mm).

Tree to 10 m high and 30 cm dbh, bole height unknown. **Outer bark** dark grey, smooth. **Inner bark** sapwood orangish brown. **Stems** (light) greyish brown to blackish, smooth to somewhat rough and strongly fissured longitudinally, without lenticels, glabrous to weakly puberulous when young. **Leaves** narrowly elliptic, (9–)12–20(–24) × (3–)4–6(–8.5) cm, chartaceous, when fresh glossy medium green above and dull medium to light green below, drying greyish green to reddish brown above, greyish green to light reddish brown below, base acute to rounded, often slightly asymmetric or unequal, apex acute to (strongly) acuminate; petioles (4–)5–7(–10) × 2–3(–3.5) mm, adaxially weakly grooved, often thickened with wrinkles or cracks, drying reddish brown to black, often sparsely covered in short, erect fine hairs; venation eucamptodromous, midvein thin, weakly sunken above, raised below, secondary veins (8–)10–14, irregularly spaced, 1–3 cm apart, arcuate, angled 30–40(–45)° to the costa, rarely with irregular ramifying or fusing, intersecondaries absent, tertiary veins straight percurrent, lower venation reticulate and bifacially prominent. **Inflorescences** axillary to ramiflorous, solitary; flowering pedicels (30–)50–70 × 0.5–1 mm, glabrous, bracteate; bracts (1–)2, often one basal and another medial to 1/3 from the base or apex, narrowly oblong, 1–1.5 × 1 mm, apex rounded, outer side densely brown tomentose, inner side glabrous. **Sepals** 3, (broadly) triangular ovate, up to 3 × 2 mm, apex acute, outer side (densely) tomentose, inner side glabrous. **Petals** 6, in two whorls of 3, inner and outer petals undifferentiated, chartaceous, glabrous to sparsely sericeous with fine white hairs on the outer side, 7–11 × 1.5–2 mm, apex rounded and not tapered, red at anthesis; stamens c. 70–100, in 4–5 series, 2.5 mm long, connective apex truncate, pentagonal, anthers nearly as long as the stamens; carpels many, in 3–4 series, 2–2.5 mm long, ovaries ellipsoid, c. 1 mm long, villous towards base, stigmas obloid, c. 1 mm long, apically villous. **Fruits** consisting of up to 35 monocarps per cluster, each cluster up to 9 cm wide; torus discoid to subglobose, up to 1 cm wide, sub-woody; pedicels 30–50 × 2–4 mm, reddish brown, with

deep longitudinal fissures, often thickened and woody; stipes  $20\text{--}30 \times 1\text{--}1.5$  mm, glabrous, drying black; monocarps ellipsoid,  $1\text{--}1.5(2) \times 0.5\text{--}1$  cm, bases rounded (to acute), smooth, orangish to reddish when ripe, sometimes with mottling. **Seeds** 1, large,

smooth, ellipsoid,  $1\text{--}1.5 \times 0.5\text{--}0.8$  cm, testa light brown, shallowly wrinkled laterally, with a single deep circumferential groove, endosperm ruminant. Fig. 16.



**Fig. 16.** *Monoon prolixum*. A. Twig with leaves and mature infructescence. B. Twig with immature infructescence. C. Flower with anterior inner petal removed. D. (clockwise from top) Floral chamber viewed from above, carpel, floral chamber cross section, stamens abaxial view, and stamens lateral view. E. Detail of monocarp (left) and seed (right). A–B from Katik LAE 64249, C–D from Rogstad 823, E from Rogstad 822. Illustration: B. Angell.



**Distribution:** Endemic to Papua New Guinea (Fig. 13).

**Habitat and ecology:** Lowland forests up to c. 400 m.

**Etymology:** From Latin *prōlixus*, drawn out or extended; in reference to the long pedicels.

**Conservation status:** Endangered (EN). Restricted to the Sepik lowlands with an EOO of 1,500 km<sup>2</sup> and an AOO of 400 km<sup>2</sup> with a user defined cell width of 10 km. Additional collecting across other sites across the lowland basin could reveal more localities, potentially easing the threat.

**Vernacular names:** Waleepan (Niksek), Kamu-laka/Kamulak (Waskuk), Sisi (Wagu).

**Additional specimens examined:** PAPUA NEW GUINEA: **East Sepik:** Near Wagu, Ambunti sub-district, [4°22'S, 142°43'E], 76 m, 9 Jul 1966, *Hoogland & Craven 10518* (A [A00871905], L [L.1759664], LAE [143794]); Niksek village area, near the April River airstrip, 4°42'S, 142°32'E, 100 m, 30 Aug 1984, *Rogstad 822* (A [A02615304], LAE [266311, 266312]); *ibid.*, 30 Aug 1984, *Rogstad 823* (A [A02615303], LAE [266313]); Hunstein Range, 4°30'S, 142°12'E, 270 m, 28 Sep 1989, *Katik LAE 64249* (LAE [268885, 2 sheets], NSW [NSW276389, NSW276392]); Waskuk Hills, first buttress ridge above foot track between Garuka and Waskuk, territory of the Glei Clan, 4°11'S, 142°44'E, 320 m, 29 Jun 1995, *Takeuchi & Regalado 10221* (A [A02615292], L [L.1759808, L.1759809, L.1759843, L.1759844]); Ambunti district, Waskuk Hills, spur ridge NW of Musapien bivouac, hill forest, 4°10'36"S, 142°43'55"E, 360 m, 9 Nov 2007, *Takeuchi et al. 21855* (A [A02267717], L [L.3978300, L.3978301]).

**Notes:** This species is characterized by its axillary to ramiflorous inflorescences comprised of a solitary flower on elongated pedicels, red petals, and fruits with numerous monocarps on long stipes. It is thus far only known from the Sepik basin. Although the flowers are primarily reported as being red, the specimen *Katik LAE 64249* describes the flower color as “cream” whereas *Rogstad 823* notes a change in the petal color being “red early on, [then] turning lighter red-green at maturity” likely indicating some variation in flower color during the course of anthesis; the latter specimen also notes the flowers as having a fragrance like that of ethanol. *Takeuchi et al. 21855* notes the pedicels also being red. Fruits have been described as bright red, orangish red, or orange with red mottling. Little is known about its bark characteristics.

Specimens of this species could possibly be confused with *M. chloroxanthum*, particularly when sterile. However, *M. proluxum* may be differentiated by its slightly narrower laminas, smaller stature and max height, more notably acuminate apex, and strongly arcuate secondaries. These two species may also be sympatric.

**9. *Monoon salomonicum*** I.M.Turner & Utteridge, *Eur. J. Taxon.* 339: 6 (2017).

Type: Solomon Islands: Santa Ysabel: Allardyce Harbour south side, 7°46'48"S, 158°38'46"E, [c. sea level], 24 Jan 1964, *Whitmore's Collectors BSIP 3661* (holo: K [K001129397]; iso: L [L.1759657]).

Illustration: Turner & Utteridge (2017: 7, Fig. 3).

**Distribution:** Bougainville and Solomon Islands (Fig. 15).

**Habitat and ecology:** Lowland to lower montane forests, from c. sea level to 950 m.

**Conservation status:** Assessed as Endangered (EN) by Turner & Utteridge (2017), which is maintained here along similar lines of reasoning. Forest degradation across the islands is expected to continue to increase. However, it is reported to be a common tree species on Bougainville (*Kajewski 2057*), which may lower the threat.

**Additional specimens examined:** PAPUA NEW GUINEA: **Bougainville:** Koniguru, Buin, [6°44'S, 155°41'E], 950 m, 10 Aug 1930, *Kajewski 2057* (A [A02267725]); Kapikavi, 6°27'39"S, 155°39'14"E, 762 m, 3 Feb 1967, *Lavarack & Ridsdale NGF 31349* (L [L.1759647], LAE [95324, 2 sheets]).

SOLOMON ISLANDS: **Choiseul:** NE Choiseul, Ologhata [Ologholata] Harbour, 7°18'45"S, 157°24' 13"E, 106 m, 31 Oct 1969, *Gafui et al. BSIP 17419* (LAE [145939]). **Kolombangara:** River valley, west of camp site, [7°58'34"S, 157°04'18"E], 762 m, 4 Sep 1965, *Iromea RSS 2530* (A [A00871938], L [L.1759655], LAE [126128]).

**Notes:** The two *Monoon* species present on Bougainville and the Solomon Islands are now *M. barnesii* and *M. salomonicum*, which appear similar and could be confused when sterile. The former may be differentiated by the following: maximum height at up to 30 m tall (vs up to c. 12 m), asymmetric rounded bases (vs symmetric acute), laminas widest towards apex (vs at middle), persistent brown hairs along abaxial veins (vs sparse or glabrescent), and the adaxial laminas drying distinctly caramel brown (vs greyish brown). In addition, when fertile, there are further differences: monocarps covered with persistent light brown hairs (vs few adpressed hairs at apex and base), pedicels longer at c. 12–26 mm long (vs c. 8 mm), and the petals longer at c. 15–20 (vs c. 10 mm).

## Discussion

All known species of *Monoon* in New Guinea are restricted to lowland forests with an altitudinal range that appears to max out at 900 m. It remains to be seen if any species are known from the montane zone above 1000 m. Species diversity, along with population density for most species, peaks at elevations below 200 m and gradually decreases as altitude increases. Actually, all species can be encountered below the 200 m line and only *M. ascendens* and *M. salomonicum* appear to be more commonly collected above that elevation. Virtually nothing about their pollinators and dispersers in the region are known given the lack of ecological field observations. Although, it is plausible that the large-fruited species *M. ascendens*, *M. excelsum*, and *M. gisorum*, could be dispersed by large frugivorous birds such as the Papuan hornbill (*Rhyticeros plicatus*), the Victoria crowned pigeon (*Goura victoria*), or some small mammals. Insect herbivory seems prominent in a few species whereas others, such as *M. ascendens* and *M. chloroxanthum*, may occasionally display associations with galling wasps which leave raised, pimple-shaped galls on the abaxial surface of the laminas. It

is currently not known if these species have any medicinal, religious, or cultural value to indigenous Papuan communities.

Both *M. chloroxanthum* (formerly *M. polycarpum* s.lat.) and *M. excelsum* are two of the most common and widespread species of both *Monoon* and Annonaceae found across the New Guinea lowlands. Due to this, the two species are often found co-occurring with one another, with both having been recorded in the same locality in multiple provinces. The newly described *M. excelsum* is easily separable from the material belonging to *M. chloroxanthum*, even when relying on vegetative traits alone. In addition to the differences outlined above, the species appear to further differ in growth habit, bark morphology, and perhaps even wood fibrosity. In fact, the differences between the two are so stark that the identity of *M. excelsum* having been confused with *M. chloroxanthum* for so long might seem quite unusual. Yet this is actually not that surprising in New Guinea given the lack of detailed taxonomic work on most groups. That one of the most widespread and indeed iconic species of Annonaceae on the island had been improperly treated since its earliest collection in 1935 clearly demonstrates the need for additional taxonomic study in this region.

One issue of concern is the delimitation of the morphologically similar species *M. oblongifolium* of the Philippines with *M. chloroxanthum*. The two species appear to broadly overlap morphologically, along with the widespread and variable western Malesian species, *M. lateriflorum*, which serves as the type for *Monoon*. The boundary between all three can get somewhat blurry due to their similar leaf and fruit morphology; however, this account does not attempt to deal with this issue as that is beyond the scope of this paper. Within New Guinea, *M. chloroxanthum* itself appears variable, as interpreted here, with the newly recognized *M. gisorum* and *M. laxatum* perhaps closely related to it. Future studies should seek to test species limits molecularly in order to verify taxonomic concepts.

In addition to the confusion between the Philippine and New Guinea *M. oblongifolium* epithets, the names *M. chloranthum* and *M. chloroxanthum* are very similar and could easily be confused or even incorrectly assumed to be a misspelling of the other. Coincidentally, the former was treated as a synonym of the latter in the New Guinea checklist (Cámara-Leret et al. 2020), likely for that reason. Although, at the time, both names were valid, with separate types and both listed as accepted names by Turner (2018). Since *M. chloroxanthum* is here adopted as the name for the species for the entire *M. polycarpum* group, there should be little confusion of names or identity. As now delimited, *M. chloroxanthum* can be recognized by the following suite of characters: medium-sized elliptic leaves usually measuring around 15–25 × 5–8 cm, secondary veins usually in 10–15 pairs, flowering pedicels that are usually pubescent and measuring 15–45 mm long, greenish-yellow petals, and fruits usually consisting of around 25 monocarps.

There are certainly additional species of *Monoon* that await description from the island. Several Papuan specimens currently deposited in herbaria under the name *Polyalthia* sp. likely harbor novel material. Also lacking are studies of the genus in the Moluccas and Sulawesi. Overall, our understanding of the diversity, phylogeny, and biogeography of *Monoon* remains inadequate.

## Key to *Monoon* in Papuaia

1. Flowers red-purple; petioles often thickened, wrinkled or cracked..... 2
- 1: Flowers green-yellow; petioles usually not thickened, wrinkled or cracked..... 3
2. Flowering pedicels 20–25 × 1–2 mm, petals measuring 30–48 × 3–8 mm; leaves coriaceous ..... ***M. laxatum***
- 2: Flowering pedicels 30–70 × 0.5–1 mm, petals measuring 7–11 × 1.5–2 mm; leaves chartaceous ..... ***M. prolixum***
3. Monocarps sessile to subsessile; secondary veins generally <10..... 4
- 3: Monocarps stipitate; secondary veins generally >10..... 5
4. Leaf bases asymmetric; indumentum usually present on young twigs and fruits..... ***M. pachypetalum***
- 4: Leaf bases symmetric; indument absent on all parts.. ***M. ascendens***
5. Twigs and monocarps tomentose..... 6
- 5: Twigs and monocarps glabrous or glabrescent ..... 7
6. Flowering pedicels c. 12–26 mm long, petals thin and measuring 15–20 mm long ..... ***M. barnesii***
- 6: Flowering pedicels c. 8 mm long, petals thick fleshy and measuring 10 mm long ..... ***M. salomonicum***
7. Inflorescences on dense warty excrescences, flowering pedicels <10 mm, petals c. >20 mm long; monocarps c. 3–4 per cluster..... ***M. gisorum***
- 7: Inflorescences usually not on excrescences, flowering pedicels >10 mm, petals c. >20 mm long; monocarps c. >5 per cluster..... 8
8. Laminas generally broader, measuring c. 9.5–15 cm wide; petals c. 35–45 mm long; monocarps large measuring c. 2.5–3.4 × 1.8–2.5 cm; seeds irregularly grooved ..... ***M. excelsum***
- 8: Laminas generally narrower, measuring c. 5–8 cm wide; petals c. 15–25 mm long; monocarps small measuring c. 1.5–2.5 × 0.6–1.5 cm; seeds longitudinally grooved ..... ***M. chloroxanthum***

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