

## A contribution to the systematics of *Xylopia* (Annonaceae) in the New Guinea region

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**ABSTRACT.** In the New Guinea region, including the Solomon Islands and Halmahera, three species of the pantropical genus *Xylopia* L. have been previously recognised: *X. calosericea* Diels, *X. papuana* Diels, and *X. peekelii* Diels. In recent floristic tabulations the genus has thus comprised a minor component of the Annonaceae flora. Here we present descriptions and illustrations of 14 new species of the genus from the region: *Xylopia aenea* D.M.Johnson & N.A.Murray, *X. ampla* D.M.Johnson & N.A.Murray, *X. brunneola* D.M.Johnson & N.A.Murray, *X. bullata* D.M.Johnson & N.A.Murray, *X. chlorosperma* D.M.Johnson & N.A.Murray, *X. cornuta* D.M.Johnson & N.A.Murray, *X. corrugata* D.M.Johnson & N.A.Murray, *X. makiraensis* D.M.Johnson & N.A.Murray, *X. musella* D.M.Johnson & N.A.Murray, *X. pachysericea* D.M.Johnson & N.A.Murray, *X. rogstadii* D.M.Johnson & N.A.Murray, *X. sulangwane* D.M.Johnson & N.A.Murray, *X. takeuchii* D.M.Johnson & N.A.Murray, and *X. vulcanicola* D.M.Johnson & N.A.Murray. We distinguish the 17 species in a diagnostic key. The region includes *Xylopia* species that are among the tallest in this genus of c. 220 species, one with the largest leaves and another with the largest fruit, as well as several species with distinctive cataphyll-covered resting buds. The genus has undergone multiple dispersals both to and within the region, with higher diversity on smaller islands than on New Guinea. Its presence on oceanic islands indicates over-water dispersal.

**Keywords.** Aril, dispersal, frugivore, Halmahera, sarcotesta, Solomon Islands, ultramafic

### Introduction

*Xylopia* L. (Annonaceae) is a pantropical tree and shrub genus of c. 220 species. Over its wide distribution *Xylopia* is distinguished from other Annonaceae by axillary inflorescences, septate anthers, and dehiscent fruits that present the seeds against a bright-coloured endocarp. The plants often have relatively small lanceolate to elliptic leaves with indistinct venation, as well as connate sepals and narrow petals. Across the tropics roughly equal numbers of species occur in the Americas, Africa/Madagascar, and Asia/Pacific. All four major clades of the genus are present in Africa, but only a single clade in tropical America and two in Asia and the Pacific (Stull et al., 2017). That analysis, however, did not address *Xylopia* diversity in the New Guinea region, and included only a single species from east of Wallace's Line.

In the early years of the last century Diels (1915, 1931) described three species of *Xylopia* from the New Guinea region. These are the species included in recent

overviews of the New Guinea flora (Cámara-Leret et al., 2020; Utteridge & Jennings, 2021). *Xylopia* collections with small leaves and small monocarps have been identified as *Xylopia calosericea* Diels if the leaves were sericeous below and as *X. papuana* Diels if the leaves were lacking sericeous pubescence; collections with large leaves and monocarps have been identified as *X. peekelii* Diels. Wayne Takeuchi (pers. comm., 2023), drawing upon his wide experience with the New Guinea flora (e.g., Takeuchi & Golman, 2002; Takeuchi, 2003a, 2003b, 2004), indicated that “*Xylopia* was an obscure genus during my time as a field botanist. The plants were never in extensive populations, and the lack of reliable information or keys made it nearly impossible to identify [the species]”. Our study was undertaken to address this problem. We examined specimens from a broad geographic area encompassing the main island of New Guinea and the surrounding islands that historically and phytogeographically have been linked with New Guinea: Aru, Tanimbar, Raja Ampat islands, Bismarck Archipelago, Solomon Islands. The island of Halmahera, not usually associated with New Guinea phytogeographically, was also included because of resemblances of *Xylopia* species occurring there to New Guinea specimens.

## Materials and methods

Over 200 collections from the following herbaria were examined directly or in digital images (acronyms from Thiers, continuously updated): A, AAU, AMES, B, BISH, BM, BO, BRI, BRIT, CANB, F, G, GH, K, KEP, L, M, MEL, MICH, MIN, MO, NY, P, SING, US, WAG. In addition, we examined herbarium material of *Xylopia* from other areas of Asia and the Pacific to place the New Guinea species in a regional systematic context. Measurements were made on dried material unless otherwise indicated. Smaller measurements were made on a Zeiss stereomicroscope with an ocular micrometer to the nearest 0.1 mm, and drawings of small parts were made using a drawing tube attachment. ArcGIS-Pro was used to generate distribution maps.

Conservation assessments using IUCN guidelines and criteria (IUCN Standards and Petitions Committee, 2022) are not included in this account as more data are required than we currently have available. Although historical Extent of Occurrence (EOO) and Area of Occupancy (AOO) can be calculated, we are aware that many of the collections have been made in lowland forest areas that have suffered rapid deforestation. In these cases criterion A (population reduction) would be more appropriate, as has been used for many dipterocarp species (Khoo et al., 2023), but again we would require more on-the-ground knowledge.

## Results

### *Morphology*

The 17 species *Xylopia* species of the New Guinea region all share the unifying morphological features of axillary flowers, perianth with petals in two whorls of three,

septate anthers, and dehiscent monocarps typical for the genus (Fig. 1). *Xylopia* sect. *Stenoxylopia* Engl. & Diels, a paleotropical clade defined by smooth seeds with a sarcotesta and, when present, arils corky or ringlike (Stull et al., 2017; Johnson & Murray, 2018), accommodates the regional species with the exception of *X. aenea* D.M.Johnson & N.A.Murray, a puzzling isolate, which is perhaps best accommodated in *Xylopia* sect. *Rugosperma* D.M.Johnson & N.A.Murray.

Most species are slender monopodial trees, and collectors have remarked on the narrow crown in multiple species. A maximum height of about 30 m and dbh of 40 cm are typical. Several species reach emergent heights, notably *Xylopia calosericea*, which can reach a height of 48 m, but most species are canopy or subcanopy trees. *Xylopia ampla* D.M.Johnson & N.A.Murray is a shrub or treelet of 10 m or less, the only species with this smaller habit. Small buttresses may be present; *Xylopia aenea*, and rarely *X. papuana*, also form stilt roots. Label data indicate that the plants have the spiral branch architecture typical of the genus (Johnson, 2003). The lateral branches are held horizontally or slightly drooping toward the tips; *Xylopia cornuta* D.M.Johnson & N.A.Murray, described as having erect branches, is an exception. Bark is usually smooth and light coloured (grey, white, brown), rarely dark brown or fissured, pustular, or scaly. The twigs of several species, *Xylopia corrugata* D.M.Johnson & N.A.Murray, *X. musella* D.M.Johnson & N.A.Murray, *X. pachysericea* D.M.Johnson & N.A.Murray, *X. rogstadii* D.M.Johnson & N.A.Murray, and *X. takeuchii* D.M.Johnson & N.A.Murray, exhibit paddle-shaped vegetative buds enclosed by cataphylls (Fig. 2C, 3B). Bud scale scars on the twigs indicate where growth increments originated, suggesting that the buds represent a dormant resting stage. “Double-branching”, i.e. collateral axillary branches, seen in other Old World *Xylopia* species (Johnson et al., 1999; Johnson, 2003; Johnson & Murray, 2018; Fig. 3A) occurs and is conspicuous in many species but is lacking in *X. peekelii* and similar species. Axillary branches may elongate synchronously with the elongation of the main axis, a feature not seen in the genus in other parts of the world. In this developmental pattern, the thickness of main and lateral shoots is more or less equivalent. Hairs are small and simple and vary from closely appressed to spreading. Collectors often comment on the aromatic nature of all plant parts.

Leaves have traits typical of Annonaceae, i.e. distichous arrangement on the branches, relatively short petiole, and exstipulate simple blades with entire margins. A common *Xylopia* leaf type, relatively small, lanceolate to elliptic, and without conspicuous veins, occurs in a few species, such as *X. calosericea* and *X. papuana*, but leaves in the region vary. Length ranges from around 7 cm in *Xylopia papuana* to 26 cm in *X. ampla*, which has the largest recorded leaf length in the genus. Leaves are chartaceous to coriaceous, often acuminate at the apex, and at the base usually cuneate and short-decurrent on the petiole. Secondary venation is brochidodromous, although the loops are weakly closed in many species; the veins are somewhat ascending in *Xylopia musella* and *X. rogstadii*.

Inflorescences of one to five flowers arise from the axils of leaves or fallen leaves; in *Xylopia peekelii* and *X. sulangwane* D.M.Johnson & N.A.Murray they may occasionally be supra-axillary, and in several species they may be pseudo-terminal.



**Fig. 1.** *Xylopia chlorosperma* D.M.Johnson & N.A.Murray. **A.** Flower buds. **B.** Opening flower. **C.** Fully open flower. **D.** Fruit nearing maturity. **E.** Fully dehiscent monocarp, showing presentation of seeds. **F.** Portion of dehiscent monocarp, showing sarcotesta and aril of seeds. **G.** Dehiscent monocarp, showing green exocarp and fragmentation of pericarp into three pieces. A from *Mahroji* 169; B from *Mahroji* 36; C from *Bangun* 168; D from *Bangun* 536; E–G from *Bangun* 374. All photographs used under the terms of the Creative Commons license for Tropicos. (Photos: A: Idris Abdul Haris; B, C: Roji Mahroji; D: Bahar Fabanyo; E–G: Tjut Zul Fatisa Bangun)



**Fig. 2.** *Xylopia rogstadii* D.M.Johnson & N.A.Murray. **A.** Leaves. **B.** Fruits; monocarp on left has been cut lengthwise. **C.** Shoot apex, showing bud with protective cataphyll. From *Rogstad 816*. (Photos: S.H. Rogstad)



**Fig. 3.** *Xylopiya pachysericea* D.M.Johnson & N.A.Murray. **A.** Branches with attached fruits, showing undeveloped and developed monocarps; instances of “double-branching” visible in lower left quadrant of photograph. **B.** Shoot apex, showing two paddle-shaped buds. **C.** Fruit. **D.** Portion of developed monocarp, showing red endocarp and attached seed with sarcotesta. From Takeuchi & Ama 16674. (Photos: W. Takeuchi)

No species in the region is known to be cauliflorous, but in *Xylopia vulcanicola* D.M.Johnson & N.A.Murray the inflorescence develops into an axillary tubercle as the shoot expands; flowers emerge from the tubercle after the leaves have fallen. Cauliflory is in fact rare in the genus, being known only from a few tropical American species (pers. obs.). In *Xylopia brunneola* D.M.Johnson & N.A.Murray the inflorescence develops precociously, with flower buds enlarging along with the leaves at the apex; the subtending leaf can be full-sized or bract-like, and is sometimes caducous. Peduncles are usually short and are marked by a weak articulation of the floral axis; a branching inflorescence occurs in *Xylopia corrugata* and *X. takeuchii*. Short pedicels may arise from the peduncle or directly from the axil; in *Xylopia calosericea* the multiple pedicels are superposed in the axil. The pedicels have 1–4 small bracts that are attached at various points along the length and are often caducous. Specimens are regularly collected with the flowers still in bud. Flower bud shape is included in the species descriptions because it is a reliable indicator for the size and shape of the mature petals.

Sepals are connate and much shorter than the outer petals. When connate only at the base they are spreading or even reflexed at maturity; when 1/2-connate or more they form a cup-like calyx. Sepals are coriaceous to rarely chartaceous and usually have an indument similar to that of the twigs and pedicels.

Petals are coriaceous to fleshy and vary in colour from greenish white to orange-yellow; cream-coloured and pale yellow are common descriptors. Each of the two petal whorls is valvate in aestivation, and the petals remain appressed in bud until the flower is near anthesis. As assessed from dried specimens, the petals of both whorls spread apart slightly at the apices at anthesis, but with the bases cupped around the androecium, as is common in the genus. The label of a specimen of *Xylopia bullata* D.M.Johnson & N.A.Murray, *Lelean & Stevens LAE 51187*, however, describes the inner petal apices as bent outward through the gaps between the more erect outer petals, an orientation found in other species of the genus, for example *X. arenaria* Engl. and *X. collina* Diels in Africa (Johnson & Murray, 2018). The outer petals are mostly linear to lanceolate or narrowly oblong, but species such as *Xylopia peekelii* and *X. sulangwane* have broader elliptic petals, wider near the midpoint than at the base. The petals are more or less trigonous at the apex where they meet in bud and concave at the base. The inner petals are shorter and narrower than the outer petals, usually keeled on both the adaxial and abaxial surfaces, and deeply concave at the base. The inner petals of *Xylopia aenea* are only 4.1–4.5 mm long and easily overlooked.

Stamens vary in number from 50 to 200, and in length from 1 mm or less in *Xylopia calosericea*, *X. makiraensis* D.M.Johnson & N.A.Murray, *X. pachysericea*, and *X. papuana* to over 3 mm in *X. rogstadii*. The truncate anther connective apex, which predominates in the genus elsewhere in its distribution, occurs in a few species of the New Guinea region, but in other species the apex is dome-shaped, conical, or flattened and tongue-shaped. Anther septa separating the pollen polyads are always present and usually easily visible. A staminal cone, formed by a ring of connate filaments surrounding the ovary (Dias et al., 1998), is present in all regional species except *Xylopia aenea*. The cone persists on the receptacle after the stamens have

fallen, and usually covers only the bases of the ovaries, but in *Xylopia chlorosperma* D.M.Johnson & N.A.Murray and *X. papuana* it fully conceals the ovaries, simulating an inferior ovary. The innermost and outermost stamens of the *Xylopia* androecium are usually staminodial, i.e. more flattened and lacking anther thecae. Material for examining this feature was limited for the regional species, but presence of outer staminodes was documented for 11 species and inner staminodes also for 11 species. Both outer and inner staminodes were found in *Xylopia aenea* and *X. chlorosperma*, and in *X. calosericea* staminodes appear to be absent. Stamminodes of all New Guinea region species are similar in length to the fertile stamens, and usually oblong, clavate, or narrowly elliptic, rarely wedge-shaped or quadrate.

Carpels vary in number from two up to 13 in *Xylopia peekelii*. The ovaries are tightly pressed together, ovoid to oblongoid, and usually densely pubescent; those in *Xylopia peekelii* are exceptional in being virtually glabrous. The stigmas are sometimes connivent and sometimes free and separate; they are commonly subglobose and less than 1 mm long, but filiform and up to 7.6 mm long in *Xylopia rogstadii*. The stigmas of *Xylopia aenea*, which are distinctive in being coiled and wormlike, are described and illustrated under the species.

Aggregate fruits consist of up to eight monocarps borne on a thickened pedicel and torus. Monocarps are more or less ellipsoid to oblongoid and vary in length from 1.3 cm in *Xylopia papuana* to 12 cm in *X. rogstadii* (Fig. 2B), the latter among the largest monocarps of any Annonaceae. Monocarps are dehiscent in all species except unknown for *Xylopia brunneola*. The monocarps dehisce along an abaxial line that is visible as a ridge or sulcus in some species. Mature monocarps may have a green to red glabrate exterior or may be covered with brown lenticels, which are usually rough and scale-like. The surface may be marked by wrinkles, folds, papillae, and raised venation; deep wrinkles form a bullate surface to the monocarp in *Xylopia bullata* and to a lesser extent in *X. peekelii*. The mature monocarp of *Xylopia aenea* differs from that of other species in being uniformly red at maturity and narrowly oblongoid and torulose (bean-pod shaped). The endocarp in all species is red or pink and spongy or fleshy, while the remainder of the pericarp may be either thin and leathery, or in a few species thickened by the formation of air channels and loosely packed coarse fibers (Fig. 4). Monocarps of most species narrow gradually at the base into a short stipe or are sessile, but in species including *Xylopia bullata*, *X. calosericea*, *X. corrugata*, and *X. peekelii* the stipe is more distinct.

Seeds within each monocarp are commonly in two longitudinal rows and more or less perpendicular to the long axis of the monocarp. In *Xylopia cornuta* and *X. chlorosperma* the seeds are interdigitated to form a single row, in *X. calosericea*, *X. cornuta*, *X. corrugata*, and *X. vulcanicola* seeds may be slightly oblique to the long axis, and in *X. aenea* seeds are parallel to the long axis. Maximum number of seeds per monocarp is 5–7 for nine of the species, 10–15 for five of the species, and 18–20 for two species. Seeds are usually ellipsoid to oblongoid, often a little flattened, and vary in length from 7.6 mm in *Xylopia papuana* to 22.2 mm in *X. sulangwane*. In seeds of *Xylopia peekelii*, *X. sulangwane*, and *X. makiraensis* an unusual hollow enlargement forms around the micropyle; in *X. cornuta* the seed is slightly thickened around the



**Fig. 4.** *Xylopia takeuchii* D.M.Johnson & N.A.Murray, showing branches with fruits. Inset: Close-up of dehiscent monocarp, showing fibrous pericarp and seeds with sarcotestas. From *Takeuchi 9187*. (Photos: W. Takeuchi)

micropyle but the air space is small to absent. Corner (1976), who made a histological examination of the seed of *Xylopia makiraensis* (identified as *X. peekelii*), described the enlargement as “a slightly thickened or dilated base over which the exotesta seems to have the last traces of arillar development”. The seed coat is smooth, or less commonly with slight pitting or wrinkles, drying brown to black, and slightly shiny. The perichalazal ring, often raised and conspicuous in *Xylopia* seeds, is usually indistinct, visible only as a slight ridge in *X. calosericea*, *X. musella*, *X. sulangwane*, and *X. vulcanicola*. In several cases (*Xylopia corrugata* and Appendix 1) seeds did not develop in full-sized fruits, suggesting parthenocarpy.

Seeds can have both sarcotestas and arils. Most regional species have a sarcotesta, which consists of a thin fleshy coating on the outside of the seed that is highly visible when the seed is fresh (Fig. 1F, 3D, 4) but quickly collapsing and losing its colour upon drying. In dried specimens the sarcotesta is sometimes detectable as a white crust on the outside of the seed, or by the greasy or waxy “feel” of the seed coat; the seed in a collection of *Xylopia makiraensis* has retained its waxy texture for 60 years. Sarcotestas are usually pale blue or grey; the yellow-green sarcotesta of *Xylopia chlorosperma* (Fig. 1F) is exceptional. In *Xylopia aenea* the sarcotesta is absent. Arils, found in the majority of *Xylopia* species worldwide, are infrequent and in most species not conspicuous when present. In *Xylopia ampla*, *X. chlorosperma*, and *X. brunneola* a small and slightly corky aril is present (Fig. 1F), a type found among some other *Xylopia* species of Southeast Asia and the Pacific (Stull et al., 2017). The only conspicuous aril, which is cup-shaped, white, and fleshy, is found in *Xylopia aenea*; the aril resembles those of the East African species *Xylopia mwasumbii* D.M.Johnson and *X. tenuipetala* D.M.Johnson & Goyder (Johnson & Murray, 2018).

In summary, *Xylopia* species of the New Guinea region, compared to those of other geographic areas globally, have a more uniform habit as canopy or subcanopy trees, a more variable androecial structure, and sarcotestas as the most common seed adaptation. The cataphyll-covered resting buds, large monocarp size, and hollow expanded seed bases of some species are features unique to the region.

### **Morphologically-defined species groups**

1) *Xylopia papuana* and *X. calosericea*, characterised by small flowers with weakly connate sepals, short stamens, small leaves, and small fruits, have the greatest resemblance to species from further west in Southeast Asia such as *X. caudata* Wall. ex Hook.f. & Thomson and *X. dehiscens* (Blanco) Merr.

2) *Xylopia peekelii*, along with *X. bullata*, *X. cornuta*, *X. sulangwane*, and *X. vulcanicola*, share monocarps with a green exterior and relatively large seeds, including the largest seeds of species in the region. Seeds with a hollow enlargement around the micropyle occur in *Xylopia makiraensis*, *X. peekelii*, and *X. sulangwane*. There is a trend in these species toward larger flowers with fleshy petals, most pronounced in *Xylopia peekelii* and *X. sulangwane*. Collateral “double-branching” was not present in any of these species, exceptional for Asian *Xylopia*. A specimen from the Bird’s Head Peninsula of western New Guinea may also belong here.

3) *Xylopia musella*, *X. pachysericea*, *X. rogstadii*, and *X. takeuchii* share connate sepals, cataphyll-covered resting buds, and scaly-lenticellate monocarps; the seeds never have a hollow enlargement at the base. *Xylopia corrugata* shares the connate sepals and resting buds with these species but the fruits are glabrous. An extreme form of collateral “double-branching”, with branch elongation synchronised with the elongation of the main shoot, occurs in several species. At the species level this group remains poorly known—only *Xylopia corrugata* is known from more than seven collections, *X. musella* is unknown in flower, and there are a number of collections listed in Appendix 1 that belong to this group but cannot be placed with any of the described species.

4) *Xylopia brunneola* and *X. chlorosperma* share characteristics of *Xylopia* sect. *Stenoxylopia* but do not appear similar to the species groups above. The yellow-green sarcotesta, reduced corky aril and well-developed staminal cone of *Xylopia chlorosperma* are shared by *X. vieillardii* Baill. of New Caledonia (Johnson et al., 2013). *Xylopia brunneola* has a similar aril and flowers, but its sarcotesta features are unknown and the staminal cone is reduced. On the basis of its reduced corky aril *Xylopia ampla* may also belong to this group.

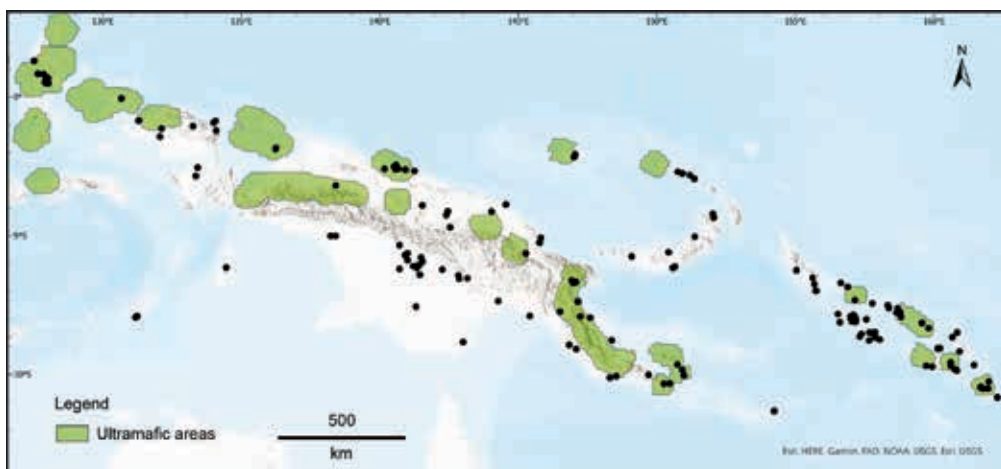
5) *Xylopia aenea* has a number of traits that are unique in the region: extremely reduced inner petals, coiled wormlike stigmas, and seeds lacking a sarcotesta but with a distinct fleshy white aril.

### **Distribution**

The genus *Xylopia* is widespread across the region, inhabiting the New Guinea mainland and the surrounding islands of Halmahera, Waigeo, Japen, Aru, Tanimbar, Manus, New Ireland, New Britain, Normanby, Fergusson, Rossel, Bougainville, and the Solomon Islands (Fig. 5). Only two species are widespread (Fig. 14). *Xylopia calosericea* uniquely occurs in eastern New Guinea and the Solomon Islands; on New Guinea its distribution does not extend much beyond the Indonesia/Papua New Guinea border (Fig. 14). *Xylopia papuana*, while absent from the Bismarck and Solomon Archipelagos and most of western New Guinea, reaches Aru and Tanimbar Islands southwest of New Guinea (Fig. 14).

Six species have distributions centered on New Guinea, where the genus is still poorly collected. *Xylopia rogstadii* and *X. takeuchii* are sparsely distributed across lowlands and foothills to the north and to the south of the Central Highlands, respectively (Fig. 17). *Xylopia musella* is found both to the north and to the south of the Central Highlands (Fig. 17). *Xylopia pachysericea* and *X. corrugata* mostly occur to the north of the Central Range (Fig. 17), often in association with ultramafic sites. *Xylopia aenea* has a disjunct distribution between the Bird’s Head Peninsula and south-central New Guinea (Fig. 7). The genus has not been documented from the Central Highlands, the southwest, or the north coast between Japen Island and Jayapura.

A number of species are narrowly distributed on smaller islands surrounding New Guinea. *Xylopia chlorosperma* is found on Halmahera and Waigeo, *Xylopia ampla* on Halmahera and Japen (Fig. 7). Four species are restricted to the Solomon Islands



**Fig. 5.** Distribution of *Xylopiya* in the New Guinea region, showing known occurrences of ultramafic outcrops. Collections listed in Appendix 1 are included. Ultramafic distribution based on map in Fig. 1 of Galey et al. (2017), used under the terms of the Creative Commons Attribution 4.0 International License.

(Fig. 10). *Xylopiya sulangwane* occurs throughout the archipelago. *Xylopiya vulcanicola* occurs on Bougainville and northern Solomon Islands, *X. brunneola* on several central islands, and *X. makiraensis* on Makira and Malaupaina islands at the southern end of Solomon chain. *Xylopiya peekelii* is restricted to New Ireland; *X. bullata* and *X. cornuta* only occur on New Britain (Fig. 12). Taken together, these nine species occur in an arc around New Guinea to the north and east.

All species occur in the lowlands at elevations of 100 m or below, and about half are not known to occur above 300 m. Three species in the region reach 800 m and only a single record of one species, *Xylopiya aenea*, exceeds 1000 m, a specimen collected at 1200 m in westernmost New Guinea. All occur in forest habitats, with “primary forest” the most frequent descriptor. Notably only three, *Xylopiya aenea*, *X. sulangwane*, and *X. calosericea*, were occasionally described as occurring in disturbed or secondary growth sites. Eleven species are described as growing on ridges and no species seems to be confined to swamp or floodplain forest. *Xylopiya aenea* and *X. peekelii* were sometimes documented as growing in areas of karst topography, and *X. bullata* and *X. vulcanicola* were associated with volcanic soils. Collections of *Xylopiya takeuchii* have been made in both karst and volcanic areas. A number of species occur on ultramafic sites.

Garnica-Díaz et al. (2022) drew attention to the “gap in knowledge” of ultramafic vegetation in the New Guinea region. To address this gap, we used three criteria to assess ultramafic associations in *Xylopiya*: mention of ultrabasic or ultramafic geology on the specimen label; specific collection data that indicate provenance from an ultramafic site reported in the literature; coincidence of a mapped locality for a specimen with the ultramafic geology mapped based on Galey et al. (2017) (Fig. 5). On the basis of these criteria we placed species in three groups: 1) all or most

localities occurring on ultramafic sites, 2) some localities on ultramafic sites, and 3) no overlap with ultramafic geology, or, at most, with some localities appearing close to ultramafic areas. The first group includes six species, *Xylopia ampla*, *X. brunneola*, *X. chlorosperma*, *X. corrugata*, *X. makiraensis*, and *X. pachysericea*. *Xylopia chlorosperma* has the strongest documented association, with its localities on Halmahera and Waigeo islands falling within ultramafic zones, and a number of the Halmahera collections are from the Missouri Botanical Garden/Herbarium Bogoriense Weda Bay Nickel Project, for which ultramafic soil chemistry and plant adaptations were documented by Lopez et al. (2019). For *Xylopia pachysericea*, there was one specimen label report of its occurrence in an ultramafic site; in addition, it occurs in the Cyclops Mountains, an area known for its ultramafic geology (see Davies, 2012). *Xylopia corrugata* has a single label mention of ultramafic conditions (“ultra basic series”) and its remaining localities are highly associated with mapped ultramafic sites. *Xylopia brunneola* on the Solomon Islands is limited to islands on which ultramafic outcroppings occur: Choiseul, Santa Isabel, Guadalcanal, and Makira. There are several collections of the species on Guadalcanal from the Wanderer Bay and Marau Sound area forests, explicitly stated by Whitmore (1969) to be located on ultramafic substrates. *Xylopia brunneola* also appears to occur on non-ultramafic sites, however. The two remaining species, *Xylopia ampla* and *X. makiraensis*, are both known from very limited numbers of collections, but all localities correspond to areas with mapped ultramafic geology. The species in the second category, *Xylopia calosericea*, *X. musella*, *X. rogstadii*, and *X. sp.* from Manus Island, had weak associations with ultramafic sites based on available data, and require more information to determine their status. The remainder of the species fall in the third group, having no known ultramafic associations.

### Dispersal

*Xylopia* monocarps dehisce as they ripen, displaying the endocarp and seeds of contrasting colours. The monocarp opens partially, displaying the seeds against the endocarp (Fig. 3, 4), or nearly completely, turning inside out so that the seeds hang freely from the endocarp surface (Fig. 1). Seeds are hard, shiny and dark-coloured, overlaid by a coloured sarcotesta or, in *Xylopia aenea*, a cupular white aril. Documentation of dispersal in other regions indicates that contrasting colours serve as attractants, and sarcotestas and fleshy arils serve as “high-value” food rewards containing lipids and protein (Sourd & Gautier-Hion, 1986; Lamperti et al., 2014). This suite of traits suggests diurnal dispersers with trichromatic colour vision, and birds and mammals have been documented to feed on the seeds in Africa and Madagascar (Whitney et al., 1998; Poulsen et al., 2001; Koné et al., 2008; Joromampionona Andriamadijaona, 2013). Because the seed is the diaspore, seed dimensions constrain the sizes of avian dispersers. In the New Guinea region, *Xylopia* seeds are 7.6–22.2 mm long and 4.6–13.3 mm wide, within the size range of bird dispersed fruits and seeds in the region (Pratt & Stiles, 1985; Brown & Hopkins, 2002). Mammals are known to take *Xylopia* seeds with sarcotestas in Africa and Madagascar (e.g., Koné et al., 2008; Joromampionona Andriamadijaona, 2013) and so are plausible *Xylopia* dispersers in New Guinea, although the pool of frugivorous mammals is small (Mack & Wright, 2005).

Brown & Hopkins (2002) observed dispersal of 20 tree species in Varirata National Park, at an elevation of 840 m. One of their focal species was identified as *Xylopia papuana*, although the brief description and habitat suggest that the species was *X. calosericea*. Three bird species, *Ptilinopus superbus* (Superb Fruit-dove), *Cicinnurus magnificus* (Magnificent Bird of Paradise), and *Paradisaea raggiana* (Raggiana Bird of Paradise) regularly (20–40 times) removed the seeds; six other species were observed visiting once or twice. *Cicinnurus magnificus* also regularly visited *Elmerrillia tsiampacca* (L.) Dandy (now placed in *Magnolia* L.), a species with similar fruit morphology. In another study of *E. tsiampacca* at a similar site, Oppel & Mack (2010) observed seed removal by 26 bird species, including fruit-pigeons, birds-of-paradise, and hornbills; several hornbill species are important dispersers of *Xylopia* species in tropical Africa (Whitney et al., 1998; Holbrook & Smith, 2000). Kitamura & Poonswad (2013) documented the importance of hornbills to dispersal of Myristicaceae in the Asian tropics; like *Xylopia*, these trees have dehiscent fruits and seeds with bright-coloured fleshy food rewards.

Avian frugivore assemblages of tropical rainforest trees typically range from 22 to 45 species (Oppel & Mack, 2010). An example of a typical assemblage was documented for *Cymbopetalum baillonii* R.E.Fr., a tropical American Annonaceae species with the same seed presentation and reward system as *Xylopia*, where 31 species of birds made feeding visits (Murray, 1993). Given the bird fauna of the region, we expected a comparable diversity to be documented for New Guinea. The Brown & Hopkins study site was near the upper elevational limit for *Xylopia* species in the region, which may account for the smaller frugivore assemblage they observed.

Most regional *Xylopia* species are subcanopy to canopy trees with fruit and seed morphology typical of the genus, and frugivores may partition the canopy. For example, in Cameroon, Clark et al. (2001) found that monkeys fed lower in the canopy and on more species of plants, and hornbills fed higher in the canopy and dispersed greater numbers of seeds (Clark et al., 2001; Poulsen et al., 2001). In the New Guinea region other variations may also influence seed dispersers. *Xylopia ampla* is an understorey shrub or small treelet, while, at 48 meters, *X. calosericea* may reach emergent height. Varied seed colours, such as the yellow-green sarcotesta in *Xylopia chlorosperma* or the white fleshy aril and black seed in *X. aenea*, are present in species with notably small seeds. A hollow enlargement is present around the micropyle in the seeds of *Xylopia peekelii* and several other species. Olfactory cues are suggested by the scent of the broken fruit pericarp noted for several species: *Xylopia aenea* (“aromatic when broken”), *X. musella* (“acid-smelling when crushed”), *X. pachysericea* (“sour” and “recalling an odour of wintergreen mixed with fenugreek”), *X. peekelii* (“strong smell of unripe mango when cut”), *X. takeuchii* (“with *Pittosporum* smell”), and *X. vulcanicola* (“smell of turpentine”). Although protection from herbivory is a likely function of these scents, mammalian dispersers might associate them with a food reward, as has been documented for volatile organic compounds of *Piper* L. fruits, which attract bats (Santana et al., 2021).

Monocarps of *Xylopia rogstadii* and *X. takeuchii* (Fig. 2, 4) are the largest among the 220 species of the genus. They have an exceptionally thick fibrous pericarp surrounding the seeds, which are more numerous than in other species but of just

average size. In the Annonaceae, dehiscent monocarps of comparable size are only found in *Cymbopetalum steyermarkii* N.A.Murray from Guatemala (Murray, 1993). Other large fruits in the family, such as those of *Alphonsea* Hook.f. & Thomson, *Mezzettia* Becc., and *Porcelia* Ruiz & Pavón, are indehiscent with a juicy dull-coloured endocarp in which the seeds are embedded. More comparable to *Xylopia* is the syndrome described by Mack (1995) for a species of *Aglai*a (Meliaceae), a canopy tree producing dehiscent fruits up to 18 cm diameter enclosing 1–3 arillate seeds. The seeds of this plant were effectively dispersed by the cassowary (*Casuaris bennetti*) from fruits that had fallen to the ground, suggesting the possible importance of ground-feeding dispersers for *Xylopia*.

### Key to the species of *Xylopia* in the New Guinea region

- 1a. Leaf base long-attenuate, narrowly cuneate; inner petals 4.1–4.5 mm long; monocarp with seeds parallel to long axis in a single row ..... 1. *X. aenea*
- 1b. Leaf base cuneate to rounded, sometimes short-decurrent; inner petals > 7 mm long; monocarps with seeds oblique to perpendicular to long axis in one or two rows ..... 2
- 2a. Leaves densely appressed-pubescent abaxially, hairs on young leaves shiny ..... 3
- 2b. Leaves somewhat pubescent, especially on midrib, to glabrous abaxially, hairs on young leaves dull-coloured ..... 4
- 3a. Outer petals c. 20 mm long; leaf blades with granular upper surface (with hand lens), margins often slightly revolute, midrib distinctly raised and often keeled abaxially; seed-containing portion of monocarp 3.1–4.7 cm long, 1.6–2.8 cm wide, subsessile or with thick stipe 1.5–6 mm long ..... 11. *X. pachysericea*
- 3b. Outer petals to 11 mm long; leaf blades with smooth upper surface, margins usually flat, midrib slightly raised but not keeled abaxially; seed-containing portion of monocarp 1.6–3.2 cm long, 1.1–1.6 cm wide, slender stipe 4–12 mm long ..... 5. *X. calosericea*
- 4a. Twigs initially glabrous or with only a few scattered hairs ..... 5
- 4b. Twigs initially densely pubescent, sometimes minutely so, eventually glabrate ..... 8
- 5a. Flower and fruit pedicels 8.9–17 mm long; monocarps slightly flattened ..... 15. *X. sulangwane*
- 5b. Flower and fruit pedicels < 8 mm long; monocarps terete ..... 6
- 6a. Outer petals < 12 mm long; monocarps globoid or broadly ellipsoid, subsessile ..... 9. *X. makiraensis*
- 6b. Outer petals 15–35 mm long; monocarps oblongoid or ovoid, stipitate or sessile ..... 7

- 7a. Outer petals linear, flat abaxially, marked with fine transverse corrugations; monocarps stipitate; leaf blades 10.7–13.3 cm long ..... 8. *X. corrugata*
- 7b. Outer petals linear-lanceolate, keeled abaxially but without transverse corrugation; monocarps subsessile; leaf blades 13.5–26 cm long ..... 2. *X. ampla*
  
- 8a. Twigs with paddle-shaped resting buds covered by a brown cataphyll; sepals > 1/2-connate, forming a cup-shaped calyx; monocarps always scaly-lenticellate, orange-brown to brown in vivo ..... 9
- 8b. Twigs lacking resting buds; sepals ≤ 1/2-connate, spreading; monocarps usually with a green glabrous exterior, rarely brown and scaly-lenticellate ..... 11
  
- 9a. Leaf blades 8.2–10.7 cm long, midrib impressed or rarely plane adaxially, acumen more or less falcate ..... 16. *X. takeuchii*
- 9b. Leaf blades 12.3–24.3 cm long, midrib plane to slightly raised adaxially, acumen straight ..... 10
  
- 10a. Leaf blades 12.3–19.2 cm long, 3.5–5.7 cm wide; monocarps 1.6–2.6 cm wide, bluntly triangular in cross-section, pericarp < 2 mm thick, lacking coarse fibers ..... 10. *X. musella*
- 10b. Leaf blades 19.3–24.3 cm long, 5.6–7.9 cm wide; monocarps 2.8–6.3 cm wide, terete in cross-section, pericarp > 2 mm thick, coarsely fibrous ..... 14. *X. rogstadii*
  
- 11a. Flowers emerging from axillary tubercles that persist on twig; monocarps reniform ..... 17. *X. vulcanicola*
- 11b. Flowers emerging from axils on leafy twigs or axils of fallen leaves; monocarps ovoid to oblongoid ..... 12
  
- 12a. Monocarps with brown, scaly-lenticellate exterior; flowers maturing precociously on very young shoots ..... 3. *X. brunneola*
- 12b. Monocarps with green exterior, sometimes tinted red; flowers maturing after leaves are fully expanded or fallen ..... 13
  
- 13a. Monocarps subsessile (stipe ≤ 2.5 mm long); outer petals < 11 mm long ..... 12. *X. papuana*
- 13b. Monocarps distinctly stipitate; outer petals 11–28 mm long ..... 14
  
- 14a. Outer petals less than 15 mm long; monocarps strongly bullate ..... 4. *X. bullata*
- 14b. Outer petals 16–28 mm long; monocarps smooth, wrinkled, or marked by deep irregular folds ..... 15
  
- 15a. Bracts on pedicel persistent; thick petioles flat to terete at base; monocarps 2.4–2.5 cm long; outer petals 2.5–5 mm wide at midpoint (Halmahera and Waigeo) ..... 6. *X. chlorosperma*

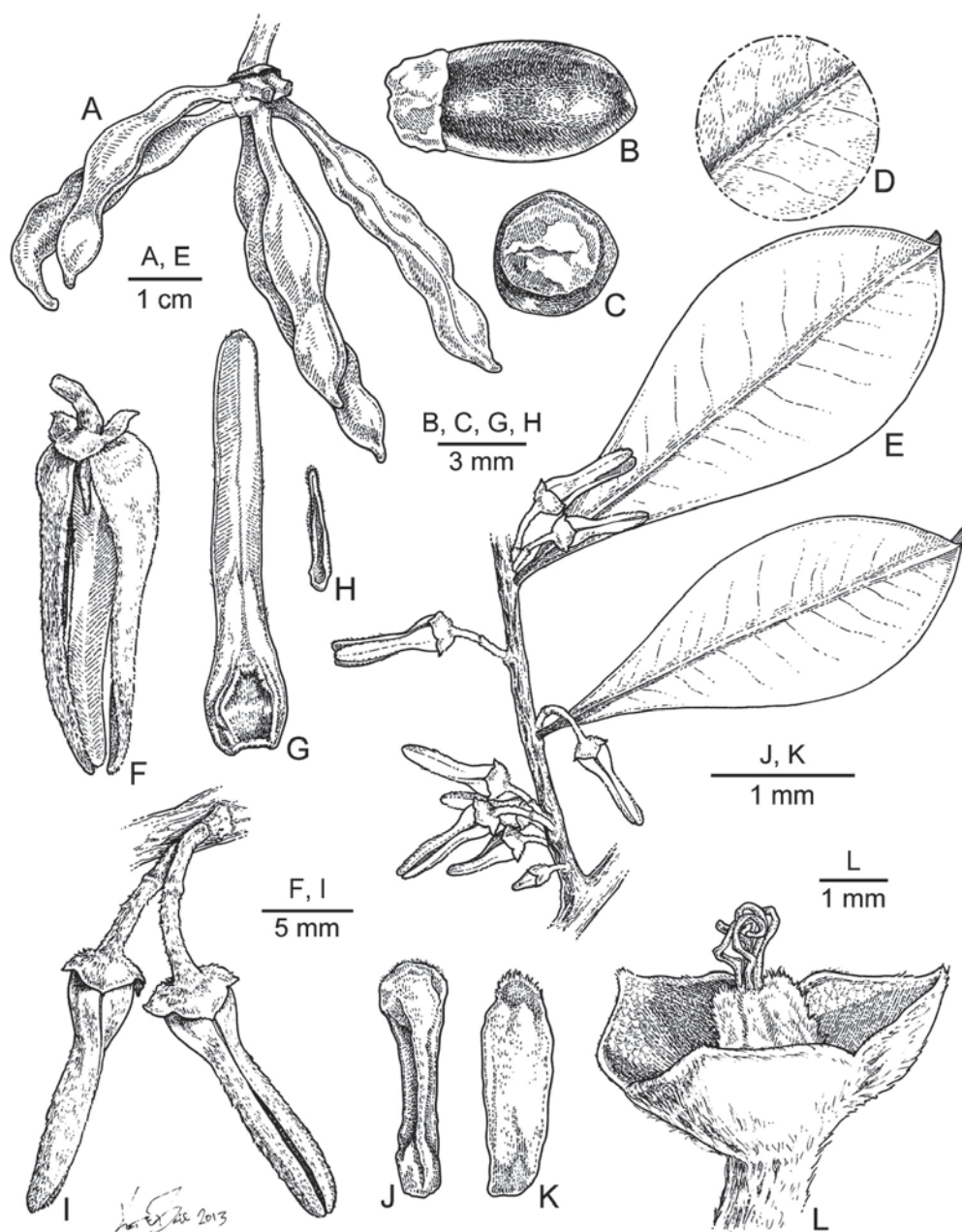
- 15b. Bracts on pedicel caducous; slender petioles canaliculate to the base; monocarps 3.8–7.2 cm long; outer petals 5–6.4 mm wide at midpoint (Bismarck Archipelago) ..... 16
- 16a. Monocarps oblong-falciform, wrinkled, 1.4–1.8 cm wide; leaves lanceolate, 2.8–4.2 cm wide ..... 7. *X. cornuta*
- 16b. Monocarps ellipsoid, marked by deep irregular folds, 2–3.6 mm wide; leaves oblong, elliptic, or oblanceolate, 4.6–5.9 cm wide ..... 13. *X. peekelii*

### Taxonomic treatment

#### 1. *Xylopia aenea* D.M.Johnson & N.A.Murray, **sp. nov.**

Species resembling *Xylopia fusca* Hook.f. & Thomson in the presence of stilt roots, the conspicuous coppery to golden appressed abaxial hairs on young leaves, the attenuate leaf base and relatively long flower pedicels. It differs in the inner petals much shorter than the outer petals, coiled and wormlike stigmas, narrowly oblongoid and slightly torulose monocarps that are beaked at the apex, and smooth seeds with a cupular aril. – TYPE: Papua New Guinea, Western District, c. 1 mile N of Kiunga, Upper Fly River, c. 300 ft, 6 September 1967 (fl, fr on CANB), Pullen 7257 (holotype A; isotypes BISH, CANB [CANB173670.1, CANB173671.1], G, K, L [L0047158], MEL [MEL2122510A]). (Fig. 6)

Tree to 30(–45) m tall, dbh to 34(–45) cm, trunk with buttresses and stilt roots to 1 m high, bark grey to coppery brown, with shallow vertical fissures. **Twigs** brown, longitudinally wrinkled, initially covered with loosely appressed hairs 0.2–0.6 mm long, soon glabrate; nodes more or less with two axillary branches. **Leaves** with larger blades 6.6–11.6 cm long, 2–4.5 cm wide, subcoriaceous, concolorous or slightly discoloured, oblanceolate to rarely elliptic, base long-attenuate, narrowly cuneate, long-decurrent on petiole, apex acute or with an abrupt acumen 1–2 mm long, margins slightly to strongly revolute, glabrous adaxially, finely appressed-pubescent abaxially, the hairs giving a coppery to golden sheen to the new leaves; midrib impressed adaxially, raised abaxially, secondary veins 9–12 per side, diverging from midrib at 60–70°, brochidodromous, secondary and higher-order veins indistinct, plane on both surfaces; petiole 2.5–5 mm long, flattened adaxially, glabrous to sparsely appressed-pubescent. **Inflorescences** 1–3-flowered, arising from axils on leafy twigs, peduncle 1–2.3 mm long or absent, pedicels 5–8 mm long, 0.9–1.3 mm thick, sericeous, bracts 1–2, c. 2.5 mm long, caducous, attached below midpoint of pedicel, ovate, apex acute, sericeous; buds lanceolate, apex obtuse. **Sepals** 1/3–1/2-connate, slightly spreading, 1.9–3 mm long, 3.4–3.9 mm wide, coriaceous, broadly ovate, apex acute, sparsely sericeous abaxially. **Petals** yellow-green to cream-coloured in vivo, fleshy; outer petals slightly spreading at maturity, 11.8–17.1 mm long, 2–4 mm wide at base, 1.2–1.8 mm wide at midpoint, ligulate, base concave with a rudimentary tooth, apex obtuse, with adaxial ridge from apex to concavity, glabrous except for pubescent base



**Fig. 6.** *Xylopia aenea* D.M.Johnson & N.A.Murray. **A.** Fruit with five monocarps. **B.** Seed, side view. **C.** Seed, micropylar view. **D.** Close-up of abaxial leaf blade surface. **E.** Habit. **F.** Flower, side view. **G.** Outer petal, adaxial surface. **H.** Inner petal, adaxial surface. **I.** Flower buds. **J.** Stamen, abaxial view. **K.** Staminode, abaxial view. **L.** Gynoecium and sepals. A, F from *Versteegh 10339* (L); B, C from *Reksodihardjo 482* (US); D, E, G–L from *Pullen 7257* (A). Drawn by Kate Stenger.

adaxially, loosely dense appressed-pubescent abaxially; inner petals erect at maturity, 4.1–4.5 mm long, 0.7–0.9 mm wide at base, 0.3–0.5 mm wide at midpoint, lanceolate, keeled abaxially, base concave and narrowing distally to a groove, apex acute to obtuse, pubescent except for glabrous base on both surfaces. **Stamens** 57–65, 1.7–2 mm long, narrowly oblong to slightly clavate, connective apex short tongue-shaped, outer staminodes 1.4–1.8 mm long, oblong to clavate, inner staminodes 1.1–1.2 mm long, narrowly elliptic; staminal cone absent. **Carpels** 3–6, ovaries 1.3–1.4 mm long, ovoid to oblongoid, densely reddish pubescent, stigmas 1.5–2 mm long, coiled and wormlike, free, glabrous or with a tuft of hairs at the apex. **Torus** 2.3–2.6 mm diam., plane. **Fruit** of up to 5 monocarps borne on a pedicel 9–14.5(–29) mm long, 1.5–3 mm thick, glabrate, torus 3.5–6 mm diam., 1.5–5 mm high, depressed-globose; monocarps red in vivo, 2.7–5.3 cm long, 0.6–0.8 cm wide, c. 0.8 cm thick, narrowly oblongoid, slightly torulose, wrinkled, glabrate, base contracted into a stipe 2–6 mm long, 2.5–3 mm thick, apex narrowed to a beak 2.5–4.5 mm long, pericarp 0.2–0.6 mm thick, lacking air spaces and coarse fibers. **Seeds** 1–5 in a single row, parallel to long axis of monocarp, 8.5–9.8 mm long, 4.7–5.2 mm wide, 4.1–5.3 mm thick, ellipsoid, black, shiny, smooth with faint pitting, perichalazal ring not evident on surface; sarcotesta absent; aril white, cupular, 3.4–4 mm diam., 1.7–3.3 mm high.

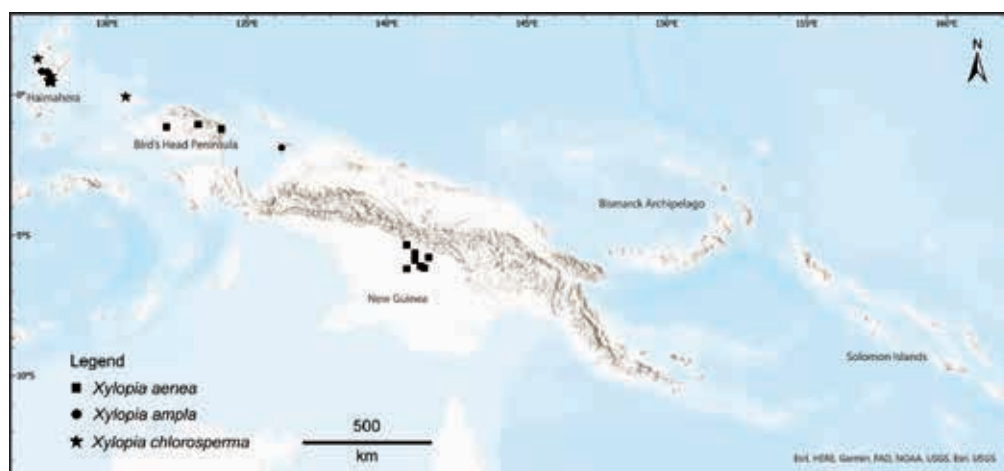
**Distribution.** Known at present from two widely separated areas on New Guinea, the West Papua area of Indonesian New Guinea and the upper Fly River basin in south-central New Guinea (Fig. 7).

**Ecology.** *Xylopia aenea* occurs in primary and secondary forests on hilly, flat, or somewhat swampy terrain, at elevations of 20–480(–1200) m. The Ayawasi site in West Papua is a karst area at 480 m dominated by *Syzygium* P.Browne ex Gaertn., *Haplolobus* H.J.Lam, and *Lithocarpus* Blume (Polak, 2000). Specimens with flowers have been collected in June, August, September, November, and December and with fruits in June, July, September, and November.

**Etymology.** From Latin *aeneus*, brazen, alluding to the metallic sheen of the young leaves noted by multiple collectors.

**Local names.** *Ai'yuon* (Henty et al. NGF 31812), *ara hari mapi* (Ridsdale 2163), *mowes* (Polak 954), *ocwar* (Keban, Versteegh BW 10339).

**Additional specimens examined.** INDONESIA: **West Papua:** Warami, 30 Sep 1982 (fr), Kostermans 29110 (K, L [2 sheets]); surroundings of Ayawasi, 1.14 S, 132.12 E, 3 Nov 1995 (fl), Ridsdale 2163 (L); N of Ayawasi, 1.14 S, 132.12 E, [Plot 5 (Hyot) tree number 10334], 13 Dec 1995 (fl), Polak 954 (L); Watjetoni Mt, Keban Valley, 1200 m, 24 Nov 1960 (fl, fr), Versteegh BW 10339 (L). **Papua:** SE West Irian, Ingembit, road to Opka [5°37'59"S 141°E], 8 Jun 1967 (fr), Reksodihardjo 396 (AAU, G, K, L, US); SE West Irian, Jaat, 5°52'39"S 141°E, 12 Jun 1967 (fr), Reksodihardjo 482 (G, K, L, US).



**Fig. 7.** Distributions of *Xylopiya* species restricted to Halmahera and western New Guinea: *X. aenea*, *X. ampla*, and *X. chlorosperma*.

PAPUA NEW GUINEA: **Western Province:** Yat, 5°53'S 141°E, 14 Jun 1967 (fl, fr on L sheet), *Henty et al. NGF 33027A* (A, BRI [AQ0211374], L); near Ingambit village, 5°38'S 141°E, 8 Jun 1967 (fr), *Henty et al. NGF 31812* (A, BO, BRI [AQ0350396], K, L, SING); Kiunga Sub-district, Ingembit, 5°38'S 141°E, 4 Jul 1967 (fr), *Ridsdale & Galore NGF 33347* (A, BISH, BRI [AQ0350366], K, L, SING); Kiunga Sub-district, near Ingembit, 5°38'S 141°E, 7 Jul 1967 (buds, fr), *Ridsdale & Galore NGF 33361* (A, BRI [AQ0350365], L, SING); Kiunga Sub-district, Kiunga, 6°10'S 141°20'E, 11 Aug 1971 (fl), *Streimann LAE 51820* (A, BRI [AQ0351325], K [2 sheets], L, SING [2 sheets]).

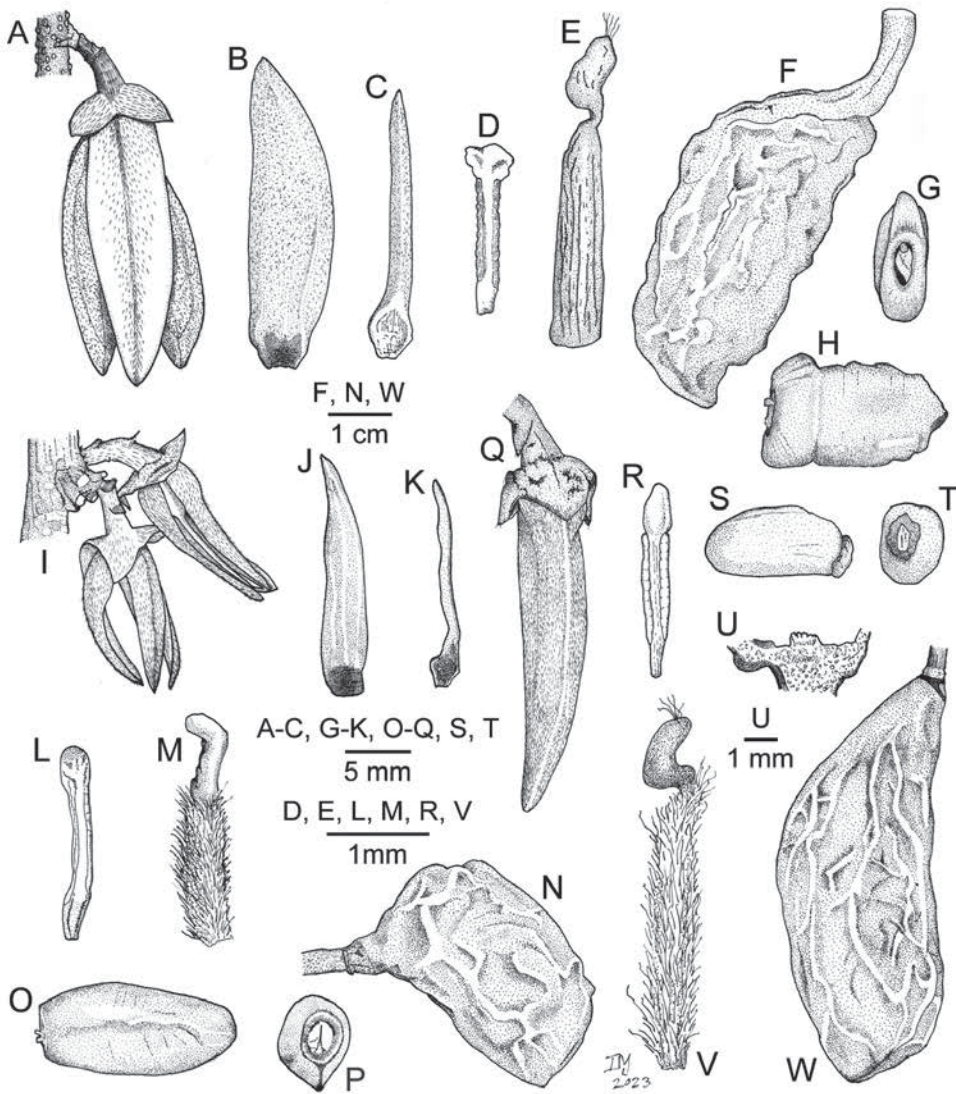
*Notes.* *Xylopiya aenea* is unique among Asian species of the genus in its highly reduced inner petals. Along with the coppery to golden sheen of the abaxial leaf surface, collectors have noted the straight cylindrical bole, the straight horizontal branching, and the strongly aromatic fruit. The leaves often have a granular surface texture adaxially. The presence of double axillary branches seen in many Paleotropical *Xylopiya* species is well developed in *X. aenea*, but cataphyll-covered resting buds have not been observed. The species shares with members of the Asian *Xylopiya* sect. *Rugosperma* (Stull et al., 2017) the presence of stilt roots, tongue-shaped anther connective apices, and narrow monocarps with seeds arranged in a single row. It differs from other members of *Xylopiya* sect. *Rugosperma*, however, in the arillate seeds and smooth seed coat. As far as we can determine, the seeds of *Xylopiya aenea* also lack a sarcotesta, which is well-developed in *Xylopiya* sect. *Rugosperma* species.

The specimen *Versteegh BW 10339* from West Papua was collected from an elevation of 1200 m on clay soil and has a more elliptic leaf and slightly broader outer petals (Fig. 6F) than other specimens from West Papua or central New Guinea. In central New Guinea the species grows in the general region of the Ok Tedi mine, and it is unknown what threats, if any, mining activity has posed to the plants.

**2. *Xylopia ampla* D.M.Johnson & N.A.Murray, *sp. nov.***

Species differing from all congeners in the combination of shrub or treelet habit, glabrous vegetative parts, pedicels, and sepals, large leaf blades 13.5–26 cm long, acute broadly ovate to triangular sepals 5–6.5 mm long, and angular flower buds. – TYPE: Indonesia, Halmahera, 20 km SE of Dodinga, Darco/Modul logging camp, Tapayo, 0°30'N 125°30'E, 600 m, 9 September 1985 (buds, fr), *Sidiyasa et al. TCW 3614* (holotype K + carpol.; isotype L [L0191438, L0191439]). (Fig. 8Q–W)

Shrub or treelet to 10 m tall, dbh c. 5 cm, bark grey, smooth. **Twigs** stout, slightly sinuous, black, becoming light grey-brown, smooth, glabrous or rarely with a few scattered hairs c. 0.2 mm long and soon glabrate with sparse inconspicuous lenticels; nodes more or less with two axillary branches. **Leaves** with larger blades 13.5–26 cm long, 6.2–14 cm wide, subcoriaceous, discolorous (grey/brown), elliptic to broadly elliptic or oblong-elliptic, base cuneate to broadly cuneate and short-decurrent on petiole, apex acute or acuminate with an acumen 4–11 mm long, margins flat or slightly revolute, glabrous on both surfaces; midrib slightly raised to plane adaxially, raised abaxially, secondary veins 7–14 per side, diverging from midrib at 60–80°, brochidodromous well within the leaf margin, secondary and higher-order veins indistinct to slightly raised adaxially, more distinct and raised abaxially; petiole 4–20 mm long, shallowly canaliculate adaxially, glabrous or with a few scattered hairs. **Inflorescences** 1–2-flowered, arising from axils on leafy twigs (fruits sometimes pseudo-terminal), peduncle absent, pedicels arising separately from axil, 5–6.3 mm long, 2.3–2.9 mm thick at midpoint, glabrous, bracts 1–2, 2.4–3.4 mm long, persistent, clasping, attached below pedicel midpoint, broadly ovate, apex obtuse, glabrous except for short hairs along margin; buds linear-oblong, strongly three-sided in cross-section, apex obtuse. **Sepals** 1/4–1/3-connate, slightly spreading toward maturity, 5–6.5 mm long, 4–4.9 mm wide, coriaceous, broadly ovate to triangular, apex acute, glabrous or with a few scattered hairs abaxially. **Petals** yellow in vivo, fleshy; outer petals 26–35 mm long, c. 5 mm wide at base, 5.2–5.3 mm wide at midpoint, narrowly oblong to lanceolate, base concave, apex obtuse, flat toward the concave base adaxially, strongly keeled abaxially, puberulent adaxially, densely appressed-pubescent abaxially; inner petals with full dimensions unknown, length unknown but at least half the length of the outer petals, c. 1.9 mm wide at base, c. 1.6 mm wide near midpoint (i.e. narrower than outer petals), keeled abaxially, base concave, densely puberulent except for the glabrous base on both surfaces. **Stamens** c. 50–60, c. 2.4 mm long (re-hydrated), linear, connective apex tongue-shaped, presence of staminodes not determined; staminal cone c. 0.8 mm diam., c. 0.4 mm high. **Carpels** 2, ovaries c. 3.3 mm long (re-hydrated), oblongoid, densely pubescent, stigmas c. 0.8 mm long (re-hydrated), oblong, slightly falciform, free, glabrous or with a few fine hairs at the apex. **Torus** c. 2 mm diam., flat. **Fruit** of 1–2 monocarps borne on a pedicel 11–13 mm long, 4–4.5 mm thick, glabrous, torus 7–8 mm diam., 2–3 mm high, flat or slightly pyramidal; monocarps with green or red exterior and red endocarp in vivo, 5.3–7.8 cm long, 2.1–4.4 cm wide, 2.1–3.1 cm thick, obovoid, ellipsoid, or reniform, marked by deep irregular folds, glabrous, base sessile or contracted into a stipe 3.5–7 mm long, 5–10 mm thick, apex obtuse to



**Fig. 8.** A–H. *Xylopioid peekelii* Diels. A. Flower, side view. B. Outer petal, adaxial view. C. Inner petal, adaxial view. D. Stamen, abaxial view. E. Carpel, side view. F. Monocarp, side view. G. Seed, micropylar view. H. Seed, side view. I–P. *Xylopioid vulcanicola* D.M.Johnson & N.A.Murray. I. Inflorescence. J. Outer petal, adaxial view. K. Inner petal, adaxial view. L. Stamen, abaxial view. M. Carpel, side view. N. Monocarp, side view. O. Seed, side view. P. Seed, micropylar view. Q–W. *Xylopioid ampla* D.M.Johnson & N.A.Murray. Q. Flower bud, side view. R. Stamen, abaxial view. S. Seed, side view. T. Seed, micropylar view. U. Longitudinal section of receptacle, showing staminal cone and sepal bases. V. Carpel, side view. W. Monocarp, side view. A from Coode & Katik NGF 40140 (K); B–E from Gideon LAE 57250 (L); F–H from Coode & Katik NGF 29834 (K carpol.); I–M from Whitmore et al. BSIP 5850 (K); N–P from Craven & Schodde 258 (A carpol.); Q, R, U, V from de Vogel 3213 (L); S, T, W from Sidiyasa et al. TCW 3614 (K carpol.). Drawn by David Johnson.

rounded, pericarp c. 3.2 mm thick, lacking air spaces and coarse fibers. **Seeds** in two rows, perpendicular to long axis of monocarp, 12–13 mm long, c. 6 mm wide, 4.5–5 mm thick, flattened-oblongoid, light brown, dull, slightly wrinkled, perichalazal ring slightly sunken; sarcotesta likely present, on the basis of label description “yellow aril completely surrounding the black seed” (*Sidiyasa et al. TCW 3614*); aril surrounding micropyle circular, slightly raised, 3–4 mm diam., 1.5–2 mm high.

**Distribution.** Known at present from the islands of Halmahera and Japen in eastern Indonesia (Fig. 7).

**Ecology.** Occurs in primary forest on clay or stony clay, at elevations of 35–800 m, on steep slopes and ridge crests with little undergrowth. Specimens with flowers have been collected in September and with fruits in July and September.

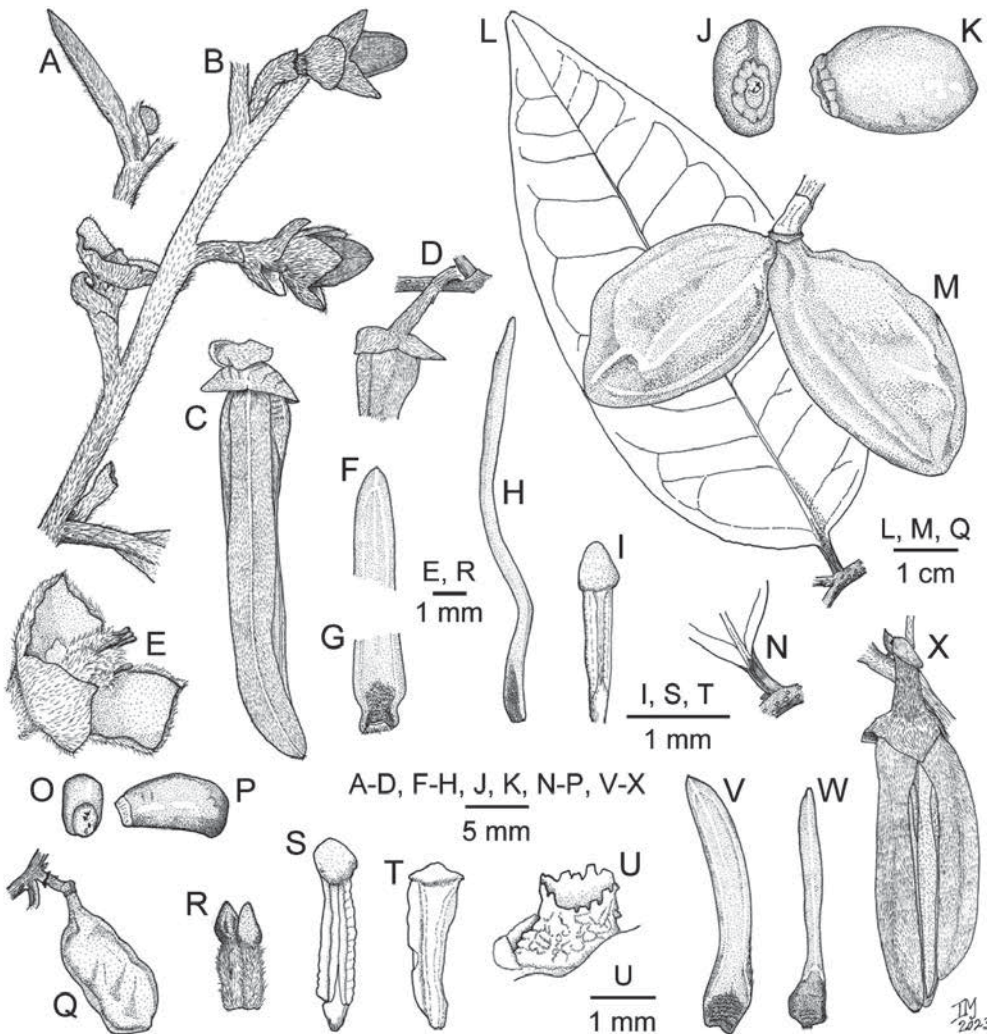
**Etymology.** Named for the large leaves, stout branches, and large monocarps, in contrast to the overall small stature of the plants.

**Additional specimens examined.** INDONESIA: **North Maluku:** Halmahera, Ekor, Bukit Talikimangari, 0°49'N 127°52'E, 35 m, 29 Sep 1974 (fl), *de Vogel 3213* (L). **Papua:** Woda, Isl. Japen, Subdiv. Seroei, Div. Geelvinckbaai, 50 m, 16 Jul 1961 (fr), *Koster BW 11188* (L); Seroei, Eil. Japen, c. 800 m, 3 Aug 1939 (st), *Netherlands Indies Forest Service bb. 30360* (L, MICH).

**Notes.** Leaves of *Xylopia ampla* are the longest in the genus. The large monocarps, marked by deep irregular folds when dried, resemble those of *Xylopia peekelii* and *X. sulangwane*, but *X. ampla* lacks the hollow enlargement surrounding the micropyle of the seed seen in those two species. Even though the seeds available for study were not fully mature, they showed a small slightly raised aril (Fig. 8S–T) similar to those found in *Xylopia chlorosperma* and *X. brunneola*. A single label description suggests that *Xylopia ampla* may have a yellow sarcotesta, more like the yellow-green sarcotesta of *X. chlorosperma* than that of other species in the region. *Netherlands Indies Forest Service bb. 30360* is sterile but closely matches the specimen *Koster BW 11188* collected from the same general area. The description of inner petals, stamens, carpels, and torus for *Xylopia ampla* is based on limited material that was re-hydrated for dissection and study.

### 3. *Xylopia brunneola* D.M.Johnson & N.A.Murray, **sp. nov.**

Species differing from all congeners by the combination of flowers maturing precociously on young shoots, densely pubescent twigs, pedicels, and sepals, pedicel with a persistent uppermost bract 3–4 mm long, ligulate to linear-lanceolate outer petals 17–35 mm long, and sessile keeled lenticellate monocarps. – **TYPE:** Solomon Islands, SW Guadalcanal, Wanderer Bay area, 18 October 1968 (fl, fr), *Mauriasi & collectors BSIP 12230* (holotype K; isotypes L [L0047106], SING [SING0044990]). (Fig. 9A–N)



**Fig. 9.** A–N. *Xylopia brunneola* D.M.Johnson & N.A.Murray. A. Flower bud developing from axil of expanding leaf. B. Several inflorescences emerging from new growth, with and without subtending leaves. C. Flower, side view. D. Pedicel and sepals of Santa Isabel specimen, showing variation in sepal shape. E. Flower with petals and stamens fallen, showing sepals and carpels. F. Outer petal apex, adaxial view. G. Outer petal base, adaxial view. H. Inner petal, adaxial view. I. Stamen, abaxial view. J. Seed, micropylar view. K. Seed, side view. L. Leaf. M. Fruit, side view. N. Leaf base of Santa Isabel specimen, showing longer decurrence of blade. O–X. *Xylopia chlorosperma* D.M.Johnson & N.A.Murray. O. Seed, micropylar view. P. Seed, side view. Q. Fruit, side view. R. Carpels. S. Stamen, abaxial view. T. Staminode, abaxial view. U. Staminal cone. V. Outer petal, adaxial view. W. Inner petal, adaxial view. X. Flower, side view. A, B from Mauriasi *et al.* BSIP 11270 (L); C, F–H, M from Mauriasi *et al.* BSIP 12230 (K); D, N from Brass 3427 (SING); E from Gafui *et al.* BSIP 9114 (L); I from Gafui *et al.* BSIP 10849 (SING); J, K from Gafui *et al.* BSIP 10980 (K carpol.); L from Mauriasi *et al.* BSIP 12230 (SING); O–Q from Bangun *et al.* 753 (MO); R–X from Mahroji *et al.* 36 (OWU). Drawn by David Johnson.

Tree to 27 m tall, dbh to 68 cm, trunk with buttresses absent, rarely present as thin to c. 0.5 m, bark dark brown to light brown, smooth. **Twigs** brown, with fine longitudinal wrinkles, densely appressed-pubescent, with whitish brown hairs 0.4–0.5 mm long, eventually glabrate; nodes with one or occasionally two axillary branches. **Leaves** with larger blades 7–13.6 cm long, 2.6–5.1 cm wide, chartaceous to subcoriaceous, discolorous (grey/brown), lanceolate, elliptic, or oblong, base cuneate to nearly rounded and slightly decurrent on petiole, apex obtuse, acute, or occasionally acuminate with obtuse acumen 4–12 mm long, margins flat or rarely slightly revolute, glabrous adaxially, sparsely appressed-pubescent to glabrate abaxially; midrib plane to slightly impressed adaxially, raised abaxially, secondary veins 10–15 per side, diverging from midrib at 60–70°, brochidodromous, these and higher-order veins indistinct adaxially, slightly raised abaxially; petiole 3–8 mm long, canaliculate adaxially, pubescent. **Inflorescences** 1(–2)-flowered, rarely forming fasciculate clusters, developing from leaf axils of very young twigs, subtending leaves full-sized or bract-like, persistent or caducous, peduncle 2.2–3 mm long, 1–1.5 mm thick, or peduncle absent, pedicels 3.5–8 mm long, 1.1–1.9 mm thick, pubescent, the hairs denser and often rust-coloured distal to the uppermost bract, bracts 2–3, 3–4 mm long, one attached near the pedicel midpoint and the others near the base, lower bracts caducous, upper bract usually persistent, ovate to oblong, apex acute to obtuse, pubescent; buds linear-lanceolate, apex obtuse. **Sepals** c. 1/4-connate, spreading, 2.3–4.5 mm long, 2.5–4 mm wide, coriaceous to slightly fleshy, triangular, apex acute, pubescent abaxially. **Petals** white, cream, light brown, yellow-brown, or brown in vivo, coriaceous to slightly fleshy; outer petals slightly spreading at maturity, 17–35 mm long, 3–4.5 mm wide at base, 2.4–4 mm wide at midpoint, ligulate to linear-lanceolate, base concave, apex trigonous, acute or obtuse, canaliculate adaxially, flat or with a slight ridge abaxially, puberulent adaxially except for the glabrous base, appressed-pubescent abaxially; inner petals erect at maturity, 15–26 mm long, 2–2.3 mm wide at base, 1–1.5 mm wide at midpoint, linear, keeled on both surfaces, base deeply concave, apex obtuse to acute, densely puberulent except for glabrous proximal half of the concavity adaxially, sparsely puberulent, becoming more densely hairy toward the base abaxially. **Stamens** 80–100, 1.4–2 mm long, narrowly oblong, connective apex dome-shaped to bluntly conical, possible outer staminodes adhering to bases of inner petals c. 1.5 mm long, clavate, but otherwise not determined; staminal cone 1–1.7 mm diam., 0.2–0.4 mm high. **Carpels** 5–8, ovaries 1.4–1.5 mm long, ovoid to oblongoid, densely pubescent, stigmas 0.7–1.4 mm long, club-shaped, free, glabrous. **Torus** 1.9–3 mm diam., plane. **Fruit** of up to 5 monocarps borne on a pedicel 7–18 mm long, 2.8–5 mm thick, pubescent, torus 4.5–8.5 mm diam., 1.5–7.5 mm high, flat or somewhat pyramidal; monocarps with greenish brown to brown exterior in vivo, 3.3–5.2 cm long, 1.6–2.6 cm wide, 1.5–2.3 cm thick, ellipsoid, oblongoid, or ovoid, often keeled abaxially, wrinkled, densely scaly-lenticellate, sparsely pubescent to glabrate, base narrowed but sessile, apex obtuse, pericarp 1.3–1.5 mm thick, lacking air spaces and coarse fibers. **Seeds** 7–10 in two rows, perpendicular to long axis of monocarp, 12–16 mm long, 7.6–9.6 mm wide, 3.9–6.6 mm thick, irregularly oblongoid to ellipsoid and somewhat flattened, pinkish brown to dark brown, slightly shiny, mostly smooth with slight wrinkles, perichalazal

ring indistinctly raised; sarcotesta presence undetermined; aril an inconspicuous corky ring c. 4 mm diam. and c. 1 mm high surrounding the micropyle.

*Distribution.* Known from the islands of Choiseul, Santa Isabel including Barora Ite and Barora Fa, Guadalcanal, and Makira in the Solomon Islands archipelago (Fig. 10).

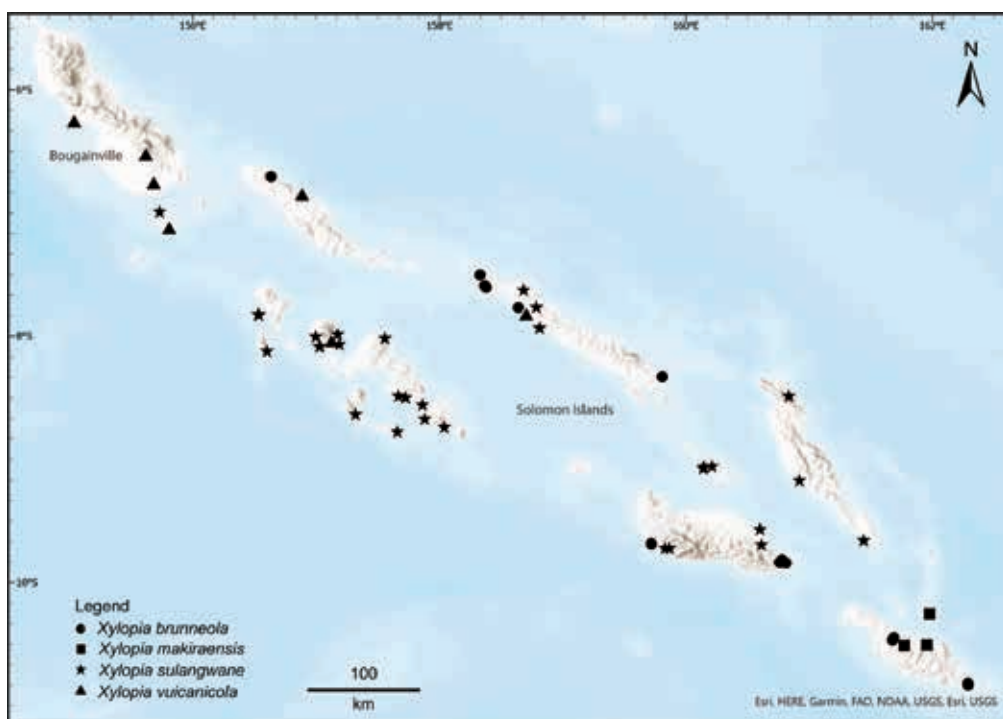
*Ecology.* Well-drained primary forest on ridgetops and slopes at elevations of 50–300 m. Specimens with flowers have been collected in January, May, and August–November and with fruits in January, April, May, September, and October.

*Etymology.* Name alludes to the brown or brownish colouration of many plant parts, including the bark, twigs, flowers, and mature fruits, noted by collectors.

*Local names.* *Aikao* (on both Guadalcanal and San Cristobal, from multiple informants). This name is also used for other *Xylopia* species in the Solomon Islands, especially *X. calosericea*. In addition, collectors reported the name *sulangwane*, which is used for other Solomon Islands *Xylopia* species as well.

*Additional specimens examined.* SOLOMON ISLANDS: **Choiseul:** Ologhata Area, North Choiseul Island, Western Solomons, 300 ft, 21 Oct 1969 (fl, fr), *Gafui & collectors BSIP 17540* (K, SING). **Guadalcanal:** Makina River, Marau, East Guadalcanal, 9 May 1968 (fl, fr), *Boraule & collectors BSIP 9327* (K, L, SING); ridge W of Bilikovu River, Wanderer Bay, West Guadalcanal, 3 Apr 1968 (fr), *Gafui & collectors BSIP 9114* (K, L, SING); Makina area, East Guadalcanal, 21 Sep 1968 (fl, fr), *Mauriasi & collectors BSIP 11270* (K, L, SING); East Guadalcanal, Makina Area, 25 Sep 1968 (fr), *Mauriasi & collectors BSIP 11807* (K, L, SING). **Makira:** East San Cristobal, Namunga Area, 3 Oct 1968 (fl), *Gafui & collectors BSIP 10849* (K, L, SING); Namunga, Star Harbour Area, East San Cristobal, 3 Oct 1968 (buds, fr), *Gafui & collectors BSIP 10980* (K + carpol., L, SING); San Cristobal, Wairaha River, 5 miles from N coast, 12 May 1964 (fl, fr), *Whitmore BSIP 4299* (K + carpol., L); ibidem, 15 May 1964 (fr), *Whitmore BSIP 4383* (K, L, SING). **Santa Isabel:** Ysabel Island, Tatamba [“Tataba”], 4 Jan 1933 (fl, fr), *Brass 3427* (A, BISH, BM, G, L, SING); Barora Ite Island, Santa Ysabel, 25 ft, 19 Aug 1969 (fl), *Mauriasi & collectors BSIP 16019* (K, SING); Barora Ite Island, Suguliliu Mountain Area, Santa Ysabel, 50 ft, 23 Aug 1969 (fl), *Mauriasi & collectors BSIP 16042* (K, SING); Barora Ite Island, Madagha Bay Area, Santa Ysabel, 25 ft, 27 Aug 1969 (fl), *Mauriasi & collectors BSIP 16164* (K, SING); Barora Fa Island, Isaisao Pt. Area, Santa Ysabel, 200 ft, 4 Sep 1969 (fl), *Mauriasi & collectors BSIP 16589* (K, SING); Allardyce Harbour, Santa Ysabel, 16 Nov 1967 (fl), *Susui BSIP 8315* (K, L, SING).

*Notes.* Precocious flower development on very young shoots (Fig. 9A, B) is a distinctive feature of *Xylopia brunneola*. The subtending leaf can be full-sized or bract-like, and is sometimes caducous. Several collectors noted the sweet smell of the flowers. Compared to specimens from Guadalcanal and Makira, specimens of *Xylopia brunneola* from the islands of Choiseul and Santa Isabel have flowers with thinner, more broadly ovate sepals with an apiculate apex, which are less pubescent (Fig. 9D), and leaf bases with more extended decurrence (Fig. 9N).



**Fig. 10.** Distributions of *Xylopia* species restricted to Bougainville and Solomon Islands: *X. brunneola*, *X. makiraensis*, *X. sulangwane*, and *X. vulcanicola*.

Most specimens of this species were identified as *Xylopia papuana* in the past, but *X. brunneola* is easily distinguished by the longer and narrower leaves, often with blunt apices, much larger flowers, larger monocarps, and larger seeds. The seeds of *Xylopia brunneola* are peculiar among regional *Xylopia* species, having an inconspicuous corky aril most similar to that of *X. chlorosperma*; presence of a sarcotesta in *X. brunneola* could not be determined.

The distribution of *Xylopia brunneola* lies entirely within the geological Central Province of the Solomon Islands defined by Coleman (1970), which includes the major ultramafic outcroppings of the archipelago. No explicit association with ultramafic geology was noted on any of the collection labels for *Xylopia brunneola*.

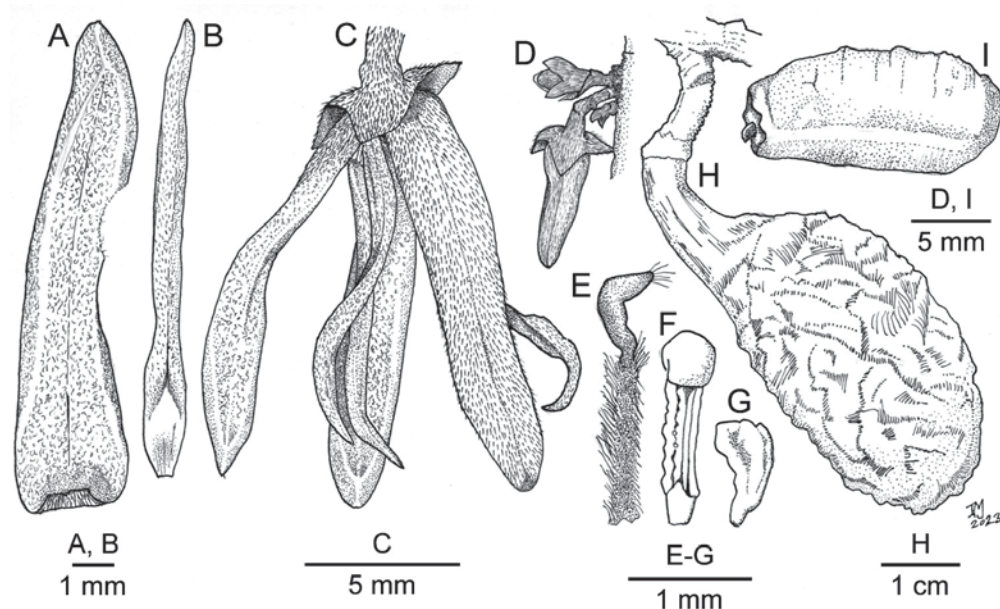
#### 4. *Xylopia bullata* D.M.Johnson & N.A.Murray, **sp. nov.**

Species resembling *Xylopia peekelii* Diels in its broad leaves and deeply wrinkled stipitate monocarps, but differing in the broadly elliptic to obovate leaf blade shape, and flowers with coriaceous lanceolate outer petals less than 15 mm long. From *Xylopia sulangwane* D.M.Johnson & N.A.Murray, which it resembles in leaf size and shape, it is likewise distinguished by outer petal size, shape, and texture, as well as the bullate, distinctly stipitate monocarps. – TYPE: Papua New Guinea, New Britain,

[East New Britain Province], Keravat, 4 January 1955 (fl, fr), *Floyd 3457* (holotype L [L0047089, L0047090]; isotypes A, SING [SING0045107], US). (Fig. 11)

Tree to 25 m tall, dbh up to 25 cm, bark grey-brown, smooth. **Twigs** brown to light gray, initially appressed-pubescent with hairs 0.2–0.4 mm long, soon glabrate, longitudinally wrinkled, lenticellate; nodes with single axillary branches. **Leaves** with larger blades 12.1–19.6 cm long, 5.9–10.2 cm wide, chartaceous, discolorous (grey/brown), broadly elliptic to obovate, base rounded to broadly cuneate, short-decurrent on petiole, apex acuminate with acumen 5–11 mm long or occasionally obtuse, margins flat or slightly revolute, glabrous adaxially, sparsely appressed-pubescent along midrib but otherwise glabrous abaxially; midrib plane adaxially, raised abaxially, secondary veins 9–14 per side, diverging from midrib at 60–80°, irregularly brochidodromous, these and higher-order veins slightly raised adaxially, raised abaxially; petiole 6–13 mm long, plane to shallowly canaliculate adaxially, pubescent. **Inflorescences** arising from axils of fallen leaves, 1–3-flowered, peduncle c. 1 mm long or absent, pedicels 3.5–5.1 mm long, 1–1.2 mm thick, pubescent, bracts c. 3, caducous, leaving encircling scars on proximal half of pedicel, c. 2 mm long; buds lanceolate, apex obtuse. **Sepals** basally connate, spreading, 2–2.9 mm long, c. 2 mm wide, coriaceous, broadly ovate to triangular, apex acute, pubescent abaxially. **Petals** pale green, white or yellowish, coriaceous; outer petals 11.1–14.7 mm long, 2.2–3.2 mm wide at base, 2.3–2.6 mm wide at midpoint, lanceolate, base shallowly concave adaxially, apex obtuse and trigonous, flattened medially from the trigonous apex to the base adaxially, with a faint longitudinal ridge but otherwise flat abaxially, sparsely puberulent except for the glabrous base adaxially, appressed-pubescent abaxially; inner petals spreading through gaps between the outer petals at maturity [ex *Lelean & Stevens LAE 51187*], 9.7–12.9 mm long, c. 1.4 mm wide at base, c. 0.8 mm wide at midpoint, linear, sinuous, base concave adaxially, apex acute, strongly keeled and puberulent on both surfaces, hairs slightly longer at apex of basal concavity adaxially. **Stamens** 50–60, 1.2–1.7 mm long, oblong or slightly clavate, connective apex dome-shaped but sometimes pressed down over the tops of the anthers, outer staminodes 0.9–1.3 mm long, clavate, inner staminodes absent; staminal cone c. 1.8 mm diam., c. 0.2 mm high. **Carpels** 4–5, ovaries c. 1.4 mm long, oblongoid, pubescent, stigmas c. 1.1 mm long, narrowly cylindrical, slightly falcate, acute, glabrous except for apical tuft of hairs. **Torus** c. 2.1 mm diam., plane. **Fruit** of 1(–2) monocarp(s) borne on a pedicel 7–10 mm long, 3.8–4.5 mm thick, glabrate, torus 8–10 mm diam., c. 6.5 mm high, globose; monocarps with green exterior and reddish pink endocarp in vivo, 4.7–5.4 cm long (including stipe), 2.4–3.1 cm wide, c. 2.9 cm thick, ovoid, bullate, glabrate, base contracted into a stipe 10–14 mm long, 4.5–6 mm thick, apex obtuse, pericarp c. 0.5 mm thick, lacking air spaces and coarse fibers. **Seeds** at least 6 in two rows, perpendicular to long axis of monocarp, 15.2–19 mm long, 8.4–9.4 mm wide, 4–6.1 mm thick, irregularly flattened-oblongoid, grey, dull, smooth, perichalazal ring indistinct; sarcotesta probably present [“seeds blue black”, *Floyd 3457*]; aril absent, with a slight thickening around micropyle.

**Distribution.** Currently known only from the northern and western slopes of the island of New Britain, Papua New Guinea (Fig. 12).



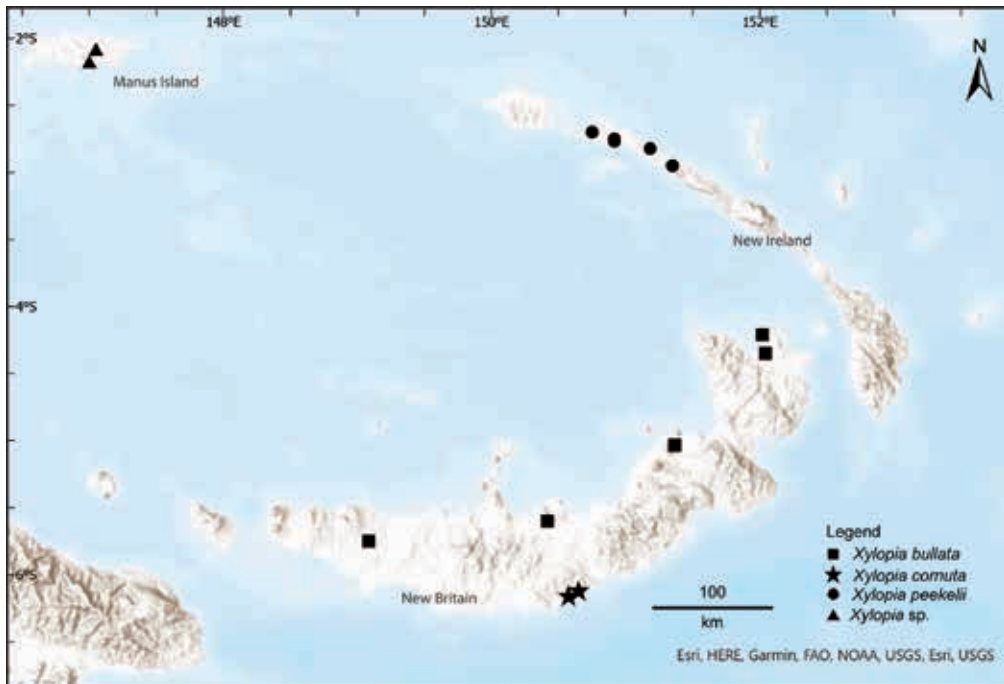
**Fig. 11.** *Xylopia bullata* D.M.Johnson & N.A.Murray. **A.** Outer petal, adaxial view. **B.** Inner petal, adaxial view. **C.** Flower, side view. **D.** Buds of inflorescence. **E.** Carpel, side view. **F.** Stamen, abaxial view. **G.** Staminode, abaxial view. **H.** Fruit, side view. **I.** Seed, side view. A, B, D–G, I from *Floyd 3457* (L); C from *Lelean & Stevens LAE 51187* (A); H from *Womersley 3427* (A). Drawn by David Johnson.

**Ecology.** Forest at elevations of 30–180 m. At one site the plant was growing on volcanic scoria. Specimens with flowers have been collected in January, February, and May and with fruits in January, April, and May.

**Etymology.** From Latin *bullā*, bubble, inflated, for the bullate monocarp surface.

**Additional specimens examined.** PAPUA NEW GUINEA: **West New Britain Province:** West New Britain District, Nuau Logging Site, Hoskins Subdistrict, 5°02'S 151°22'E, 600 ft, 18 Feb 1971 (fl), *Lelean & Stevens LAE 51187* (A, L [2 sheets]); South New Britain, nr Urin Village, 5°45'S 149°05'E, 100 ft, 13 May 1958 (st), *White NGF 10089* (A, SING); Talasea Subdistrict, at cave camp Liuru River 3 miles S of Mt Otto peak, approx. 5°36'S 150°25'E, 500 ft, Apr 1959 (bud, fr), *White NGF 10970* (A, K + carpol., L). **East New Britain Province:** Keravat, 400 ft, 26 May 1963 (fr), *Womersley 3427* (A, K, L, SING).

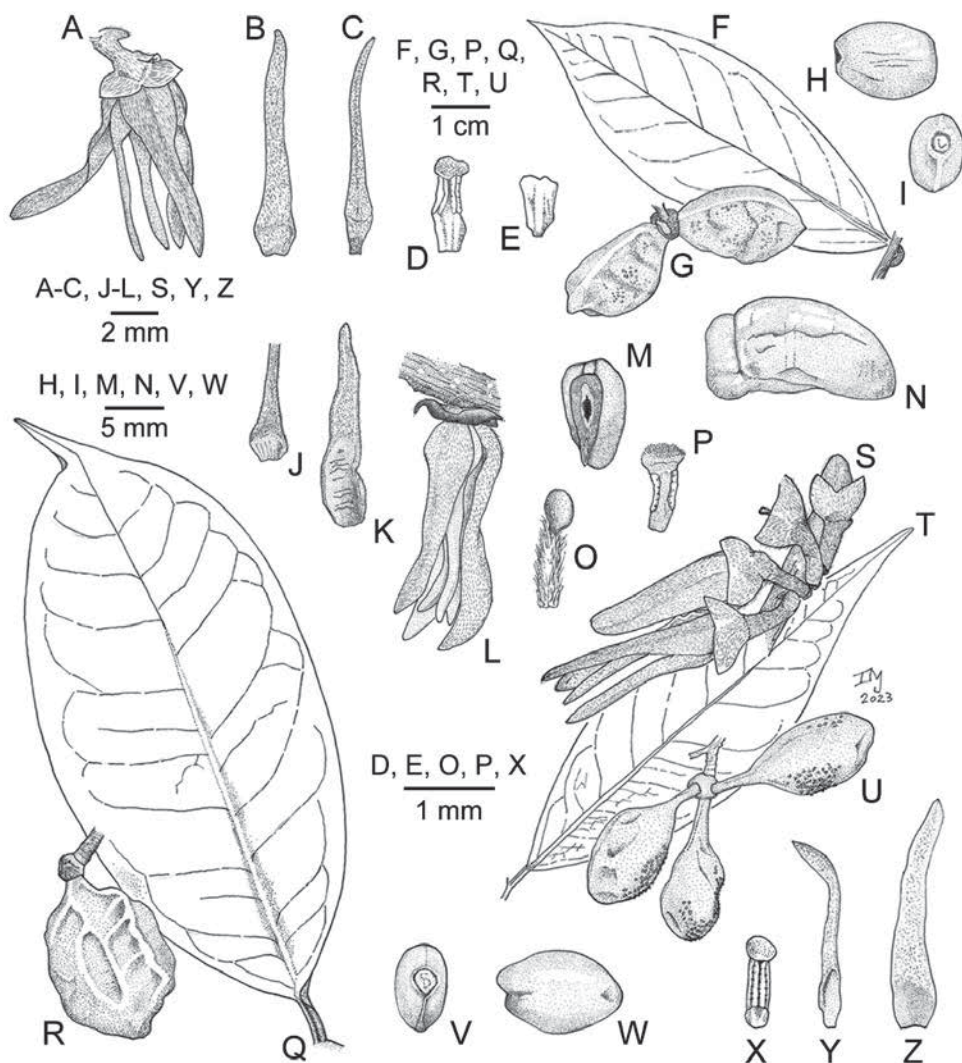
**Notes.** *Xylopia bullata* has been identified as *X. peekelii* in the past as it has similar relatively large leaves and monocarps. The leaf blades of *Xylopia bullata* are proportionally broader, with a length:width ratio of 1.7–2.3 (rarely 2.5, median 2) while those of *X. peekelii* have a length:width ratio of 2.2–2.7 (median 2.45); *X. bullata* also has shorter perianth parts than *X. peekelii*: sepals 2–2.9 mm (vs 4.8–5.1 mm), outer petals 11.1–14.7 mm (vs 22–28 mm), and inner petals 9.7–12.9 mm (vs 20–23



**Fig. 12.** Distributions of *Xylopiya* species restricted to the Bismarck Archipelago: *X. bullata*, *X. cornuta*, and *X. peekelii*. Specimens from Manus Island are possibly most similar to *Xylopiya bullata* (see text).

mm). The monocarps of the two species are similar, but those of *Xylopiya peekelii* are only slightly bullate and are more often marked by irregular folds. A specimen from Manus Island, *Kerenga & Croft LAE 77360* (A, K, L, M), Admiralty Islands, Manus I., Lorengau Sub-province, S. of Buyang, 2°04'30"S 147°03'E, 150 m, 11 Mar 1981 (fl, fr), shares a similar floral morphology with *Xylopiya bullata* and may represent this species. The monocarps are immature, but are distinctly stipitate and already strongly wrinkled, suggesting a fruit morphology in keeping with that of *Xylopiya bullata*. A second specimen from Manus Island, *Foreman LAE 52441* (L), Admiralty Islands, District Manus, Wali River near Derimbat, 2°10'S 147°E, 210 m, 6 Jul 1973 (fl on label), lacks flower and fruit but in vegetative features matches the Kerenga & Croft specimen.

**5. *Xylopiya calosericea*** Diels, Bot. Jahrb. Syst. 52: 181 (1915). – TYPE: Papua New Guinea [Nordöstl. Neu-Guinea], Kaiserin-Augusta-Fluß-(Sepik-)Gebiet: April-fluß, Urwald, 100 m, September 1912 (fr), *Ledermann 8700* (lectotype B [B 10 0249560], designated by Turner (2018); isoelectotypes K, SING [SING0044839]). (Fig. 13S–Z)



**Fig. 13.** A–I. *Xylopia papuana* Diels. A. Flower, side view. B. Outer petal, adaxial view. C. Inner petal, adaxial view. D. Stamen, abaxial view. E. Staminode, abaxial view. F. Leaf. G. Fruit. H. Seed, side view. I. Seed, micropylar view. J–R. *Xylopia makiraensis* D.M.Johnson & N.A.Murray. J. Inner petal base, adaxial view. K. Outer petal, adaxial view. L. Flower, side view. M. Seed, micropylar view. N. Seed, side view. O. Carpel, side view. P. Stamen, abaxial view. Q. Leaf. R. Fruit. S–Z. *Xylopia calosericea* Diels. S. Inflorescence. T. Leaf. U. Fruit. V. Seed, micropylar view. W. Seed, side view. X. Stamen, abaxial view. Y. Inner petal, adaxial view. Z. Outer petal, adaxial view. A, C from Pullen 7476 (A); B, D, E from Pullen 7476 (K); F, G from Womersley NGF 46479 (L); H, I from Womersley NGF 46479 (BISH); K, O, P from Corner R.S.S. 3 (A); J, Q from Corner R.S.S. 3 (K); L from Corner R.S.S. 3 (L); M, N from Corner R.S.S. 3 (BISH); R from Corner R.S.S. 3 (K carpol.); S, X from Smith NGF 1186 (A); T, U from Pullen 8112 (L); V, W from Pullen 8112 (L); Y from Mauriasi et al. BSIP 8772 (L); Z from Mauriasi et al. BSIP 8726 (K). Drawn by David Johnson.

Tree to 48 m tall, dbh to 68 cm, trunk with buttresses to 3 m high, steep, thick or thin, bark white, pale brown, or pale grey, rarely dark brown, smooth or slightly scaly. **Twigs** light brown to dark brown or dark grey, longitudinally wrinkled, with dense closely appressed white hairs 0.1–0.5 mm long, at length glabrate; nodes frequently with two axillary branches. **Leaves** with larger blades 5.9–11.6 cm long, 1.5–3.8 cm wide, chartaceous, concolorous, lanceolate to elliptic, rarely oblanceolate, sometimes falcate, base cuneate to broadly cuneate and short-decurrent on petiole, apex acuminate, the acumen 8–18 mm long, margins usually flat, occasionally slightly revolute, glabrous or with hairs only along the midrib adaxially, initially densely covered with appressed shining golden or silver hairs abaxially, becoming sparsely appressed; midrib plane to slightly impressed adaxially, raised abaxially, secondary veins 9–12 per side, diverging from midrib at 50–70°, brochidodromous, indistinct to slightly raised on both surfaces, higher-order veins indistinct on both surfaces; petiole 2–7 mm long, deeply canaliculate adaxially, appressed-pubescent. **Inflorescences** 1–5-flowered, arising from axils on leafy twigs or of fallen leaves, peduncle absent, pedicels superposed in axil, 1.3–6.7 mm long, 0.6–1 mm thick, pubescent, bracts 2–3, 1.1–1.9 mm long, spaced evenly along the pedicel but usually caducous, ovate, apex obtuse to rounded, pubescent; buds lanceolate, apex obtuse. **Sepals** 1/3–1/2-connate, erect to slightly reflexed, 1.5–2.1 mm long, 2–2.6 mm wide, coriaceous, broadly ovate, apex acute to obtuse, appressed-pubescent abaxially. **Petals** white, cream, or yellow in vivo, coriaceous; outer petals erect to slightly spreading at maturity, 8.4–10.7 mm long, 1.7–2.7 mm wide at base, 1.2–1.6 mm wide at midpoint, ligulate or lanceolate, base concave, apex obtuse to rounded, slightly trigonous, shallowly canaliculate adaxially, slightly keeled abaxially, pubescent except for the glabrous base on both surfaces; inner petals more or less erect at maturity, 7.2–10 mm long, 1.1–1.3 mm wide at base, 0.6–0.8 mm wide at midpoint, linear, keeled on both surfaces, base shallowly concave, apex obtuse, pubescent on both surfaces except for glabrous basal concavity. **Stamens** up to c. 70, 0.8–1 mm long, oblong or clavate, connective apex truncate to dome-shaped, staminodes absent; staminal cone 1.2–1.6 mm diam., c. 0.5 mm high. **Carpels** 2–5, ovaries 0.6–0.9 mm long, ovoid to oblongoid, densely pubescent, stigmas 0.6–0.9 mm long, club-shaped, loosely connivent, glabrous. **Torus** 1.6–2 mm diam., plane. **Fruit** of up to 7 monocarps borne on a pedicel 4–9.5 mm long, 2–3.5 mm thick, sparsely pubescent to glabrate, torus 2.5–6 mm diam., 2–4 mm high, globose, depressed-globose or pyramidal; monocarps with brown exterior and red endocarp in vivo, seed-containing portion 1.6–3.2 cm long, 1.1–1.6 cm wide, c. 0.9 cm thick, irregularly ovoid, ellipsoid, or oblongoid, wrinkled, lenticellate, sparsely pubescent to glabrate, base contracted into a stipe 4–12 mm long, 1.7–3.3 mm thick, apex rounded, pericarp 0.5–1 mm thick, lacking air spaces and coarse fibers. **Seeds** 4–5 in two rows or interdigitated to form a single row, oblique to long axis of monocarp, 8.3–11.9 mm long, 6.2–8.1 mm wide, 3.8–5.2 mm thick, flattened-ellipsoid to broadly ellipsoid, brown, dull to slightly shiny, smooth, perichalazal ring evident on surface; sarcotesta absent? (“seeds grey black”, *Womersley & Havel NGF 17715*, suggests a sarcotesta is present); aril absent.

*Distribution.* Distributed from northeastern North Papua, Indonesia, across Papua New Guinea and widely throughout the Solomon Islands, from Choiseul south to Guadalcanal and Malaita (Fig. 14). Many of the localities are coastal.

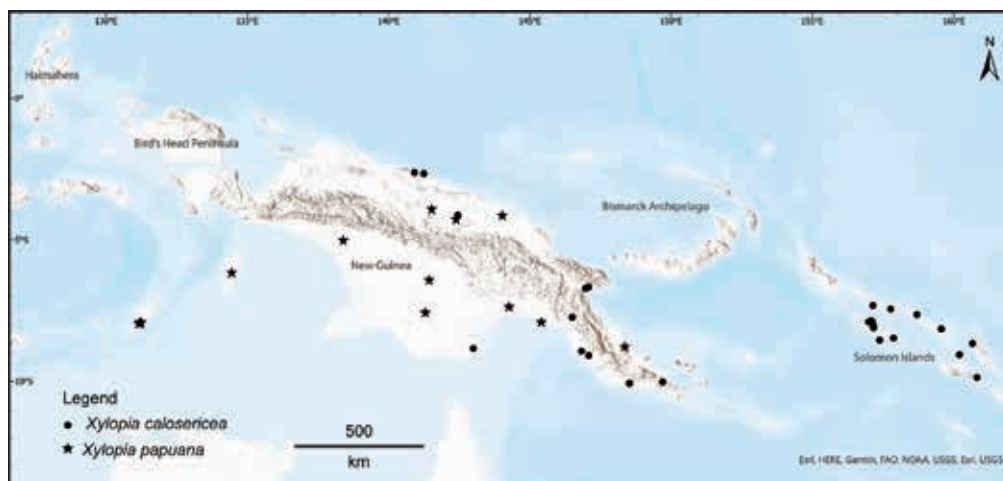
*Ecology.* Occurs in lowland rainforest on well-drained flat land, slopes, and ridges, rarely on swampy, floodplain alluvium, or disturbed sites, at elevations from near sea level to 600 m; most collections are from below 300 m. Specimens with flowers have been collected in January, June, October, and November and with fruits in all months except December.

*Local names.* *Ae'kao* (Kwara'ae, *Whitmore & Womersley BSIP 800*), *aikao* (Kwara'ae, reported by multiple collectors and confirmed by multiple informants on many different islands), *aikwisi* (Kwara'ae, *Whitmore BSIP 5469*), *pirie* (Sko dialect, *Kalkman BW 3433*), *vipi* (Vella, *Whitmore & Womersley BSIP 800*), *yem* (*Womersley & Havel NGF 17715*). According to Kwa'ioloa and Burt (2001), the name *aik'ao* translates to English as "bamboo tree", in reference to the smooth, straight bole.

*Additional specimens examined.* INDONESIA: **North Papua:** Onderrajd. Hollandia, Tamimonding [i.e. mouth of the Tami River], 23 Mar 1956 (fr), *Kalkman 3433* (L).

PAPUA NEW GUINEA: **Central Province:** Kubuna, Central Division, Nov 1933 (fl), *Brass 5575* (BRI, NY, US); Mori River, c. 15 km NE of Cape Rodney, Central District, 10°04'S 148°32'E, 15–30 m, 27 Aug 1969 (fr), *Pullen 8112* (A, CANB, L); Kuriva Forestry area nr Ueimaui Rv., Port Moresby Subdist., Cent. Dist., 9°05'S 147°05'E, 5 May 1971 (fr), *Streimann & Kairo 51518* (A, K, L, SING). **Gulf Province:** Lakekamu, E branch of the Avi Avi River, 7°44'S 146°30'E, 213 m, 11 Nov 1996 (fl), *Takeuchi & Kulang 11636* (A, BRIT, K, L, M, NY [2 sheets]). **Milne Bay Province:** Milne Bay District, Baniara Subdistrict, W of Opanabu village, approx. 149°42'E 10°01'S, 500–600 m, 23 Jul 1969 (fr), *Kanis 1301* (A, K [2 sheets], L). **Morobe Province:** Burep River NE of Lae, Morobe Dist., 6°40'S 147°05'E, 75 ft, 3 May 1962 (fr), *Hartley 10160* (A, AMES, K, L); between Busu and Bupu Rivers N of Lae, 25–50 ft, Jan 1945 (fl), *Smith NGF 1186* (A, K, L). **Western Province:** Oriomo River, mouth of Yakup Creek, 40 mi from sea, 8°50'S 143°E, 50 ft, 20 Sep 1963 (fr), *Womersley & Havel NGF 17715* (A, K, L). **West Sepik Province:** Vanimo hinterland, Vanimo Sub-district, West Sepik District, 2°40'S 141°15'E, 500 m, 29 Nov 1971 (fl), *Streimann LAE 52936* (A, L).

SOLOMON ISLANDS: **Choiseul:** South Choiseul, Mt Sanabe area, Zongga, 1000 ft, primary forest, 18 Mar 1970 (fr), *Gafui & collectors BSIP 18475* (K, L, SING). **Guadalcanal:** SW Guadalcanal, Lambi Bay area, 100 ft, 1 Nov 1968 (fl), *Fa'arodo & collectors BSIP 12382* (K, L, SING). **Kolombangara:** Rei area, West Kolombangara, ridge top, 120 ft, 8 Feb 1968 (fr), *Gafui & collectors BSIP 8931* (K, L, SING); NE Kolombangara, 95 ft, 9 Jan 1968 (fl), *Mauriasi & collectors BSIP 7566* (K, L, SING); Shoulder Hill area, North Kolombangara, 5 ft, 20 Jan 1968 (fl), *Mauriasi & collectors BSIP 8726* (K, L, SING); ibidem, 680 ft, 24 Jan 1968 (fl, fr), *Mauriasi & collectors BSIP 8772* (K, L, SING); Lodomae, North West Kolombangara, 100 ft, 26 Jan 1968 (fl), *Mauriasi & collectors BSIP 8810* (K, L, SING); SE Kolombangara, 50 ft, 31 May 1968 (fr), *Mauriasi & collectors BSIP 9767* (K, L, SING); Shoulder Hill area, SE Kolombangara, 100 ft, 12 Jun 1968 (fl), *Mauriasi & collectors BSIP 11414* (K, L, SING); SE Kolombangara, Rei area, 140 ft, 29 Jun 1968 (fl, fr), *Mauriasi & collectors BSIP 11588* (K, L, SING); Kolombangara, Kape Harbour, 22 Nov 1962 (fr), *Whitmore & Womersley BSIP 800* (K, L, SING); New Georgia group, N coast of Kolombangara, Rei Cove, 200 ft, 23 Feb 1963 (fr),



**Fig. 14.** Distributions of *Xylopia* species widespread in the New Guinea region: *X. calosericea* and *X. papuana*.

*Whitmore BSIP 1528* (K, L, SING). **Malaita:** Buma, 8 Feb 1946 (fr), *Walker BSIP 233* (K, L). **New Georgia:** Mango River, SE New Georgia, 15 Apr 1966 (fr), *Burn-Murdoch's collectors 7132* (K, L, SING). **Nggela:** Sole Area, Nggela Island, 25 ft, 13 Mar 1970 (fr), *Mauriasi & collectors BSIP 18222* (K, L, SING). **Rendova:** New Georgia group, Rendova Island, West coast, 1 mile inland behind Kenelo Plantation, ridge top at 100 ft, 13 Sep 1963 (fr), *Whitmore BSIP 1874* (K, L, SING). **Santa Isabel:** Ysabel, Tarahao NW Sta., 3 Oct 1966 (fl), *Beer's Collectors BSIP 7818* (L, SING); Santa Ysabel, Garona, a few miles W of Maringe Lagoon, 30 Oct 1963 (fl, fr), *Whitmore BSIP 2478* (K, L, SING). **Wagina:** Wagina Island, ridge top, 30 ft, 16 Mar 1964 (fr), *Whitmore's collectors BSIP 5469* (K, L, SING).

*Notes.* *Xylopia calosericea* has the widest distribution of any *Xylopia* species in the region. The shining appressed pubescence of the new leaves is conspicuous, but the hairs fade and separate as the leaves expand. In the original description, Diels (1915) stressed the distinct stipe of the monocarp as a key feature to distinguish the species from *Xylopia papuana*, and in this treatment it is a character separating it from *X. pachysericea* as well. The collection *Takeuchi & Kulang 11636*, with flowers only, is tentatively included here; it differs from other collections of the species in having more loosely appressed and coarser indument on the leaves and twigs, leaf length toward the small end of the range, and slightly shorter pedicels.

The collections *Gafui & collectors BSIP 18475*, *Mauriasi & collectors BSIP 7566*, *Mauriasi & collectors BSIP 8772*, and *Whitmore BSIP 1528* were identified as *Xylopia papuana* in Turner & Utteridge (2017), but all of these collections have the indument, leaf shape, and stipitate fruits characteristic of *X. calosericea*. For distinctions between *Xylopia calosericea* and *X. pachysericea*, see notes under the latter species. The specimen *Brass 5575* was located under *Diospyros* L. (Ebenaceae) at NY and US and duplicates may be filed similarly in other herbaria.

**6. *Xylopia chlorosperma* D.M.Johnson & N.A.Murray, *sp. nov.***

Species resembling *Xylopia brunneola* D.M.Johnson & N.A.Murray in the fleshy, ligulate to linear-lanceolate outer petals and persistent pedicellar bracts, but differing in the proportionally broader leaves that are usually slightly revolute at the margin, pronounced staminal cone, smaller monocarps and smaller seeds. The small corky aril and yellow-green sarcotesta of the seeds resemble those of *Xylopia vieillardii* Baill., but *X. chlorosperma* differs from that species in the much larger flowers and non-lenticellate monocarps. – TYPE: Indonesia, North Maluku Province, central Halmahera, Weda Bay, km 8 to Bukit Limber, 0°31'13"N 127°54'55"E, 583 m, 25 October 2012 (fl), *Mahroji et al.* 36 (holotype MO [MO6430896]; isotypes L [L.3967688], OWU). (Fig. 1, 9O–X)

Tree to 20(–30) m tall, dbh to 15 cm, bark grey to brown, smooth. **Twigs** black, becoming light grey-brown, longitudinally wrinkled, sparsely appressed-pubescent with hairs 0.1–0.3 mm long but soon glabrate; nodes sometimes slightly thickened, with one or occasionally two axillary branches. **Leaves** with larger blades 9.7–16.8(–24.7) cm long, 3.5–8.6(–10.1) cm wide, subcoriaceous to coriaceous, rarely chartaceous, concolourous or slightly discolourous, ovate, elliptic, elliptic-oblong, or broadly lanceolate, base broadly cuneate to rounded and short-decurrent on petiole, apex blunt-acuminate, the acumen 4–9 mm long, margins flat to slightly revolute, glabrous on both surfaces except for appressed hairs on midrib abaxially; midrib slightly impressed to plane adaxially, raised abaxially, secondary veins 7–14 per side, diverging from midrib at 50–70°, brochidodromous, these and higher-order veins slightly raised adaxially, more distinct and raised abaxially; petiole 4.5–7 mm long, shallowly canaliculate adaxially, becoming flat to terete at base, glabrous or with scattered appressed hairs. **Inflorescences** 1–2-flowered, arising from axils of leafy twigs or of fallen leaves, occasionally pseudo-terminal, peduncles rudimentary, less than 1 mm long, pedicels 4–11 mm long, 1.5–2.5 mm thick, appressed-pubescent, bracts 2–3, 1.2–2.1 mm long, more or less persistent, between pedicel base and midpoint, ovate, splitting at apex, pubescent; buds oblong, apex obtuse. **Sepals** 1/4-connate, slightly spreading, 2.7–4.5 mm long, 3.9–4.3 mm wide, coriaceous, broadly ovate to triangular, apex broadly acute, densely appressed-pubescent abaxially. **Petals** cream to yellow in vivo, fleshy; outer petals spreading at maturity, (13–)17–33 mm long, 3–4.3 mm wide at base, 2.5–5 mm wide at midpoint, ligulate to lanceolate, base flat, apex obtuse, with a weak keel on both surfaces, puberulent adaxially, appressed-pubescent abaxially; inner petals slightly spreading at maturity, 20–25 mm long, 3–3.2 mm wide at base, 1.2–1.3 mm wide at midpoint, linear, keeled on both surfaces, more strongly so abaxially, base concave, apex acute, puberulent on both surfaces, glabrous at base. **Stamens** c. 100, 1.7–1.9 mm long, oblong to clavate, connective apex tongue-shaped but somewhat thickened, outer staminodes 1.4–1.8 mm long, clavate, inner staminodes 1.6–1.7 mm long, clavate; staminal cone c. 2 mm diam., c. 1.3 mm high. **Carpels** c. 3, ovaries c. 2 mm long, oblongoid, pubescent, stigmas c. 1.6 mm long, ovoid, loosely connivent, glabrous. **Torus** c. 2.9 mm diam., plane. **Fruit** of 1–2 monocarps borne on a pedicel 6–8.3 mm long, 1.8–2.1 mm thick, pubescent, torus 2.5–2.8 mm diam., 1.5–2.3 mm

high, depressed-globose or slightly pyramidal; monocarps with green exterior and red endocarp in vivo, 2.4–2.5 cm long, 1.1–1.2 cm wide, c. 0.7 cm thick, oblongoid, slightly torulose, wrinkled, sparsely pubescent to glabrate, base contracted into a stipe 2.5–4 mm long, c. 2.5 mm thick, apex obtuse, pericarp c. 0.6 mm thick, lacking air spaces and coarse fibers. **Seeds** c. 6 per monocarp, interdigitated to form a single row, nearly perpendicular to long axis of monocarp, 9.4–9.7 mm long, 4.6–5.2 mm wide, 3.2–4.1 mm thick, flattened-oblongoid, shiny, yellow-brown, smooth, perichalazal ring not evident on surface; sarcotesta yellow-green in vivo; aril a corky ring c. 2.6 mm diam., 0.7 mm high, surrounding the micropyle.

*Distribution.* Known at present only from eastern Indonesia, on the islands of Halmahera and Waigeo (Fig. 7). On Halmahera all localities are within a region with ultramafic surface geology (Van Gorsel, 2018; Lopez et al., 2019); an association with ultramafic geology on Waigeo has not been determined, but the Go Isthmus has an area of ultramafic geology and associated plants (Webb, 2005).

*Ecology.* Degraded primary and secondary forest on slopes and in open places, at elevations from near sea level to 600 m. Red soils were noted by one collector. Specimens with flowers have been collected in January, March, June, August, and October–December and with fruits in January, February, June, October, and December.

*Etymology.* Named for the yellow-green colour of the sarcotesta, unusual among *Xylopia* species.

*Additional specimens examined.* INDONESIA: **North Maluku:** Central Halmahera, Weda Bay, Uni-uni forest, 0°29'16"N 127°56'21"E, 195 m, 24 Nov 2012 (bud), *Bangun et al.* 168 (L, MO, OWU); East Halmahera, Weda Bay, Kao Rahai, 0°40'01"N 127°58'36"E, 390 m, 10 Dec 2012 (fl, fr on label but not on sheet), *Bangun et al.* 374 (L, MO); Central Halmahera, Weda Bay, Tjetju, 0°28'59"N 127°58'59"E, 43 m, 16 Jan 2013 (bud, young fr), *Bangun et al.* 536 (L, MO [2 sheets]); Central Halmahera, Weda Bay, Sake West, 0°29'39"N 127°57'40"E, 223 m, 14 Jun 2013 (fl), *Bangun et al.* 747 (MO); ibidem, 0°29'44"N 127°57'41"E, 240 m, 15 Jun 2013 (fr), *Bangun et al.* 753 (MO); ibidem, 0°29'50"N 127°57'31"E, 254 m, 19 Jun 2013 (fl, fr on label), *Bangun et al.* 828 (MO); Central Halmahera, Weda Bay, Camp 10, 0°30'20"N 127°58'19"E, 226 m, 5 Oct 2013 (young fr), *Bangun & Lasut* 936 (MO); Central Halmahera, Weda Bay, Casuarina, 0°31'39"N 127°54'36"E, 188 m, 15 Mar 2013 (fl, young fr), *Gushilman et al.* 462 (MO, OWU); ibidem, 0°31'47"N 127°54'31"E, 186 m, 8 Apr 2013 (buds), *Gushilman et al.* 550 (MO, OWU); ibidem, 0°31'11"N 127°54'51"E, 230 m, 28 Mar 2013 (young fr), *Lasut et al.* 64 (MO); Central Halmahera, Weda Bay, Gwomdi, 0°29'13"N 127°58'19"E, 75 m, 9 Jan 2013 (bud), *Mahroji et al.* 169 (L, MO); Central Halmahera, Weda Bay, Bukit Limber, 0°29'17"N 128°01'40"E, 245 m, 6 Aug 2013 (fl), *Mahroji et al.* 324 (MO, OWU); East Halmahera, Weda Bay, Kao Rahai, Camp 5, 0°40'38"N 128°00'38"E, 309 m, 5 Jan 2014 (fl), *Haris et al.* 109 (MO, OWU); East Halmahera, Kao Rahai, Camp Central 7, Weda Bay, 0°41'28"N 128°00'07"E, 383 m, 17 Nov 2013 (fl), *Mahroji et al.* 388 (MO, OWU); Halmahera, Maluku, Gn. Sembilan [location given as near the road from Desa Gamsungi to Tosoa, c. 1°18'N 127°31'E in Utteridge & Rustiami, 2022], 600 m, 2 Oct 1951 (fl), *Pleyte* 418 (BO, K, SING). **Southwest Papua:** Distr. Radjah Ampat, Waigeo Island, Go Isthmus, path

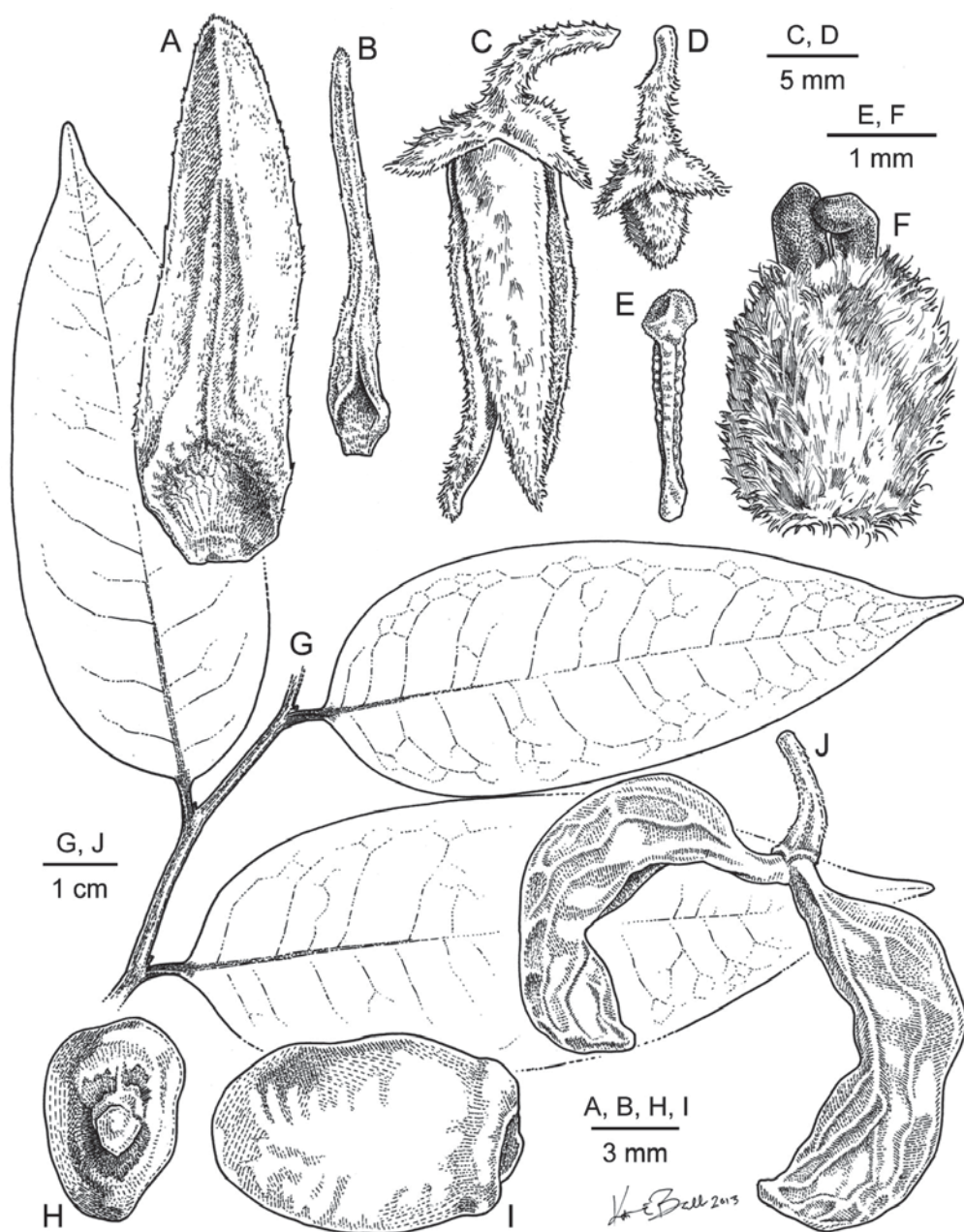
from Poean to Fofak Bay, Vatica forest on bank of northern Poean Creek, 3 m, 17 Feb 1955 (buds, fr), *Van Royen* 5552 (L).

*Notes.* Among *Xylopia* species of the New Guinea region, *X. chlorosperma* only overlaps in distribution with *X. ampla*, and can be distinguished from that species by its tree habit, smaller leaves, more pubescent twigs, pedicels, and sepals, and much smaller monocarps. The specimen *Van Royen* 5552 from Waigeo Island, is more glabrous than *X. chlorosperma* from Halmahera but otherwise similar. Most collections of this species were made in 2012 and 2013 in plant surveys of the Weda Bay Nickel Project site (<http://legacy.tropicos.org/Project/Weda%20Bay>). Several of the sites are within the Weda Bay Industrial Park area, now in operation. If, as it appears to be, *Xylopia chlorosperma* is an obligate ultramafic plant, it is likely to be vulnerable to expanded mining operations.

**7. *Xylopia cornuta* D.M.Johnson & N.A.Murray, sp. nov.**

Species resembling *Xylopia peekelii* Diels and *X. sulangwane* D.M.Johnson & N.A.Murray in the broad fleshy outer petals and large laterally compressed monocarps, but differing from both of those species in the dense pubescence of the pedicels, sepals, and abaxial surface of the outer petals, the lanceolate leaves, and differing from all regional congeners in the falciform beaked monocarps with seeds in a single row. – TYPE: Papua New Guinea, Dist. E New Britain, Subd. Gasmata, 2 miles E of Fullerborn [sic] Harbour, 06°10'S 150°35'E, 10 May 1973 (fl, fr), *Womersley* NGF 41238 (holotype L [L0047164]; isotypes A, BISH + carpol., K, M, MO, SING [SING0045115], US). (Fig. 15)

Tree to 18 m tall, dbh c. 12 cm, bark grey-brown. **Twigs** brown, initially densely pubescent with brown to coppery hairs 0.6–0.7 mm long but soon glabrate, longitudinally wrinkled; nodes with single axillary branches. **Leaves** with larger blades 7.4–11.4 cm long, 2.8–4.2 cm wide, chartaceous to subcoriaceous, discolorous (olive-grey/brown), lanceolate, base broadly cuneate, rounded, or subcordate and short-decurrent on petiole, apex acute to acuminate, acumen 6–12 mm long, margins flat, glabrous adaxially, sparsely pubescent to glabrate abaxially; midrib plane adaxially, raised abaxially, secondary veins 9–12 per side, diverging from midrib at 50–70°, indistinctly brochidodromous, plane to slightly raised adaxially, raised abaxially, higher order-veins indistinct adaxially, slightly raised abaxially; petiole 4–8 mm long, shallowly canaliculate adaxially, glabrous to sparsely appressed-pubescent. **Inflorescences** 1(–2)-flowered, arising from axils on leafy twigs, sometimes pseudo-terminal in fruit, peduncles absent, pedicels 7.7–10.4 mm long, 1.3–2.3 mm thick, densely pubescent, bract 1, 1.5–1.9 mm long, caducous, attached below midpoint of pedicel, semicircular, apex rounded, sparsely pubescent; buds conical, apex obtuse. **Sepals** 1/4-connate, spreading, 4.5–6.6 mm long, 4.1–4.4 mm wide, coriaceous, triangular, apex acute, densely pubescent abaxially, the hairs making the apex appear long and hairlike. **Petals** yellow to cream-coloured in vivo, coriaceous; outer petals slightly spreading at maturity, 16–25 mm long, 4.7–6 mm wide at base, 5–5.4 mm



**Fig. 15.** *Xylopia cornuta* D.M.Johnson & N.A.Murray. **A.** Outer petal, adaxial view. **B.** Inner petal, adaxial view. **C.** Flower, side view. **D.** Flower bud, side view. **E.** Stamen, abaxial view. **F.** Gynoecium, comprised of two carpels. **G.** Habit. **H.** Seed, micropylar view. **I.** Seed, side view. **J.** Fruit. A, B, E, F from *Womersley NGF 41238* (US); C from *Isles NGF 31480* (BISH); D from *Womersley NGF 41238* (MO); G–I from *Womersley NGF 41238* (SING); J from *Womersley NGF 41238* (L). Drawn by Kate Stenger.

wide at midpoint, narrowly triangular to oblong-lanceolate, base concave, apex obtuse, slightly concave medially with a thin central ridge, distal 1/4–1/3 of petal trigonous adaxially, faintly keeled abaxially, densely puberulent except for glabrous base adaxially, densely appressed-pubescent abaxially; inner petals erect and pressed together in bud, 13–14.7 mm long, 1.9–2.6 mm wide at base, 0.7–0.9 mm wide at midpoint, linear, keeled on both surfaces, base deeply concave, apex acute, puberulent on both surfaces except for glabrous base. **Stamens** c. 120, 2.2–2.5 mm long, narrowly oblong, connective apex irregularly dome-shaped, presence of staminodes not determined; staminal cone c. 1.7 mm diam., c. 0.3 mm high. **Carpels** 2–8, ovaries 2.1–2.7 mm long, ovoid to oblongoid, densely pubescent, stigmas 0.6–0.8 mm long, clavate to oblong, free, glabrous. **Torus** c. 3 mm diam., flat, slightly bumpy. **Fruit** of up to 4 monocarps borne on a pedicel 14–17 mm long, 3–3.5 mm thick at midpoint, sparsely pubescent, torus 2.9–6.5 mm diam., 3.9–5 mm high, irregularly globose; monocarps with green exterior and red endocarp in vivo, 4.3–7.2 cm long, 1.4–1.8 cm wide, 0.8–1.4 cm thick, oblong-falciform, wrinkled, sparsely pubescent to glabrate, base contracted into a stipe 4–13 mm long, 3.9–5.2 mm thick, apex a blunt beak 2–7 mm long, pericarp 0.5–1.6 mm thick, air spaces absent but occasionally slightly fibrous. **Seeds** up to 12 in a single row, oblique to perpendicular to long axis of monocarp, 8.7–11.8 mm long, 5.7–9 mm wide, 3.9–6.2 mm thick, flattened-ellipsoid to oblongoid, brown with fragments of white crust [purple to black in vivo, *Womersley NGF 41238*], slightly shiny, smooth, perichalazal ring faintly visible on surface; sarcotesta probably present (white crust); aril absent, thickening surrounding micropyle solid or with a small air space, 5.5–7.5 mm wide, 1–2 mm high.

*Distribution.* Known at present from a small area on the southwestern coast of New Britain, Papua New Guinea (Fig. 12).

*Ecology.* Found in rainforest at an elevation of 70–100 m. Specimens with both flowers and fruits were collected in May.

*Etymology.* From Latin *cornu*, horn, alluding to the horn-shaped monocarps.

*Additional specimen examined.* PAPUA NEW GUINEA: Dist. W New Britain, 2 miles W of Fulleborn Harbor, Subdist. Gasmata, 6°07'S 150°39'E, 70 m, 4 May 1973 (fl, fr), *Isles et al. NGF 31480* (A, BISH, K, L, M, MO, SING, US).

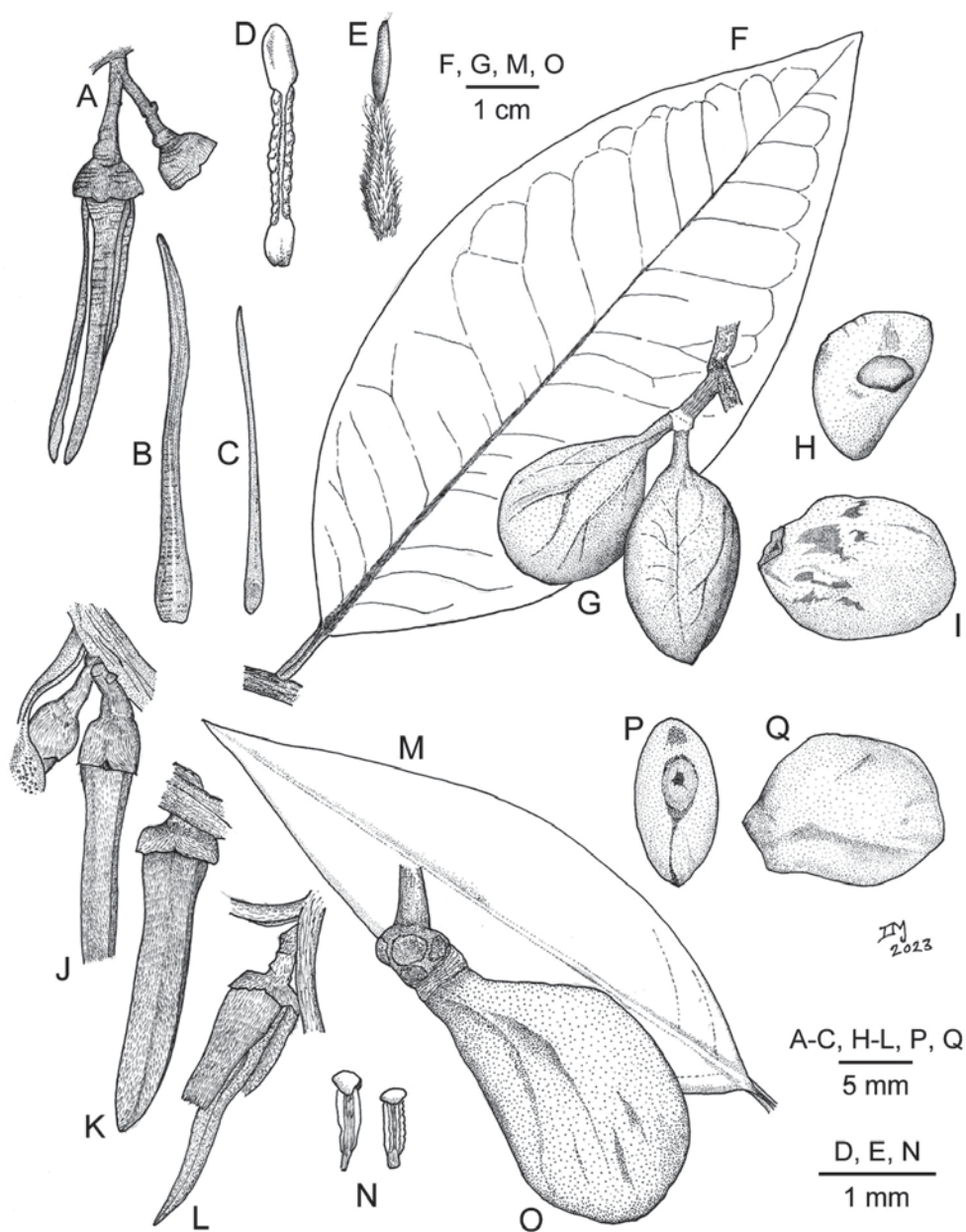
*Notes.* The *Xylopia cornuta* fruit, comprised of falciform beaked monocarps strongly marked by raised veins and wrinkles, is unique among *Xylopia* species of the New Guinea region. With the exceptions of *Xylopia aenea* and *X. chlorosperma*, it is the only regional species with a single row of seeds in the monocarp. The seeds have a slight thickening around the micropyle but it is not as pronounced as in *Xylopia peekelii* and similar species. The formation of flower buds at the proximal nodes of an expanding shoot was present on the MO sample of *Isles et al. NGF 31480*; this characteristic occurs regularly in *Xylopia brunneola*. The sepals are relatively large

compared to those of other species in the region, with conspicuous pubescence that forms hair-like tips on the sepal apices, and the inner petals are much shorter than the outer petals. The label of *Womersley NGF 41238* notes that the tree branching was “rather erect”. Typically, the branches from the trunk in *Xylopia* are either horizontal or slightly drooping toward the tips.

**8. *Xylopia corrugata* D.M.Johnson & N.A.Murray, sp. nov.**

Species differing from all congeners in the fine transverse corrugations marking the pedicels, sepals, and outer petals, and regionally by the smooth glabrous monocarps abruptly contracted into short slender stipes. – TYPE: Papua New Guinea, [Milne Bay Province], Normanby Island, near Miadeba airstrip, Subdist. Esa’ala, Dist. Milne Bay, 9°50’S 150°55’E, 22 November 1976 (fl), *Croft et al. LAE 68847* (holotype A; isotypes BISH, BRI [BRI-AQ350345], K, L [L0047181], M). (Fig. 16A–I)

Tree to 25 m tall, dbh to 40 cm, trunk with narrow buttresses to 2 m high, bark grey to dark red-brown, with vertical pustular fissures or flaking. **Twigs** brown, slightly longitudinally wrinkled, initially sparsely covered with appressed hairs 0.1–0.2 mm long, soon glabrate; nodes occasionally with two axillary branches; paddle-shaped resting buds present. **Leaves** with larger blades 10.7–13.3 cm long, 5.1–6.7 cm wide, chartaceous to subcoriaceous, concolorous, lanceolate, elliptic, or ovate, base cuneate, rounded, or truncate, short-decurrent on petiole, apex acuminate, the acumen 3–11 mm long, margins flat to slightly revolute, glabrous adaxially, glabrous, occasionally with appressed hairs on midrib, abaxially; midrib slightly raised to plane adaxially, raised abaxially, secondary veins 11–14 per side, diverging from midrib at 55–70°, brochidodromous, secondary and higher-order veins slightly raised and conspicuous on both surfaces; petiole 6–11 mm long, shallowly canaliculate adaxially, glabrous or appressed-pubescent. **Inflorescences** 1–5-flowered, arising from axils on leafy twigs or sometimes from axils of fallen leaves, peduncle 1.5–3 mm long, up to 11 mm long in inflorescences with > 2 flowers, appressed-pubescent, pedicels 4–6.9 mm long, 0.9–1.4 mm thick, marked with fine transverse corrugations, appressed-pubescent, bracts 1–2, not seen, caducous, scars near pedicel midpoint; buds narrowly oblong to linear, apex obtuse to acute, petals sometimes separating toward the base before separating at the apex. **Sepals** 3/4- to fully connate, 2.5–3.1 mm long, 3.3–4.2 mm wide, coriaceous, broadly ovate, apex broadly acute to rounded, transversely corrugated, appressed-pubescent abaxially. **Petals** yellow to yellow-orange in vivo, fleshy; outer petals slightly spreading at maturity, 15–28 mm long, 1.8–3.4 mm wide at base, 0.9–1.7 mm wide at midpoint, linear, base slightly concave, apex obtuse and slightly incurved, canaliculate except at apex adaxially, flat abaxially, transversely corrugated, puberulent adaxially, appressed-pubescent abaxially; inner petals slightly separating at maturity, (14.2–)21–25 mm long, c. 2 mm wide at base, 0.7–0.9 mm wide at midpoint, linear, keeled on both surfaces, base somewhat flattened, apex obtuse, smooth, puberulent adaxially, appressed-pubescent abaxially. **Stamens** 50–80, 2.1–2.2 mm long, narrowly oblong, connective apex bluntly conical, outer staminodes absent, inner staminodes c. 2 mm long, narrowly elliptic; staminal cone c. 1.7 mm diam., c.



**Fig. 16.** A–I. *Xylopia corrugata* D.M.Johnson & N.A.Murray. **A.** Inflorescence, side view. **B.** Outer petal, adaxial view. **C.** Inner petal, adaxial view. **D.** Stamen, abaxial view. **E.** Carpel, side view. **F.** Leaf. **G.** Fruit. **H.** Seed, micropylar view. **I.** Seed, side view. **J–Q.** *Xylopia pachysericea* D.M.Johnson & N.A.Murray. **J.** Flower bud showing cupular calyx, side view. **K.** Flower bud with calyx expanded by enlarging petals, side view. **L.** Flower with calyx tearing from petal expansion, outer petal broken away showing inner petals, side view. **M.** Leaf. **N.** Stamens, abaxial view. **O.** Fruit. **P.** Seed, micropylar view. **Q.** Seed, side view. A–F from Croft *et al.* LAE 68847 (A); G–I from Kairo 755 (BISH); J, K from Mair NGF 1802 (BRI); L from Mair NGF 1802 (BISH); M, N from Mair NGF 1802 (L); O–Q from Takeuchi & Ama 16674 (A carpol.). Drawn by David Johnson.

0.4 mm high. **Carpels** 2–5, ovaries c. 1.4 mm long, oblongoid, pubescent, stigmas 0.4–0.7 mm long, linear, loosely connivent, with a few hairs at the apex. **Torus** c. 2.1 mm diam., flat or a little sunken in the center. **Fruit** of up to 3 monocarps borne on a pedicel 7.5–9 mm long, 2.6–4.5 mm thick, glabrate or with a few hairs, torus 5.5–9.5 mm diam., 4–5.5 mm high, globose to depressed-globose; monocarps with green to purplish green and sometimes glaucous exterior and red endocarp in vivo, seed containing portion 2.2–3.6 cm long, 1.8–2.5 cm wide, 2–2.2 cm thick, subglobose to broadly ellipsoid, often narrowly keeled, smooth, glabrate, base abruptly contracted into a stipe 6–8 mm long, 2–2.5 mm thick, apex occasionally with a broad umbo c. 2 mm long, pericarp c. 2.2 mm thick, lacking air spaces and coarse fibers. **Seeds** 2–5, in two rows, oblique to long axis of monocarp, 13.6–13.9 mm long, 10.8–11 mm wide, 7.7–7.8 mm thick, irregularly ellipsoid, brown with overlying patchy whitish crust, slightly shiny, smooth, perichalazal ring not evident on surface; sarcotesta unknown; aril absent, ring around micropyle slightly different in colour from rest of seed coat but not ariloid.

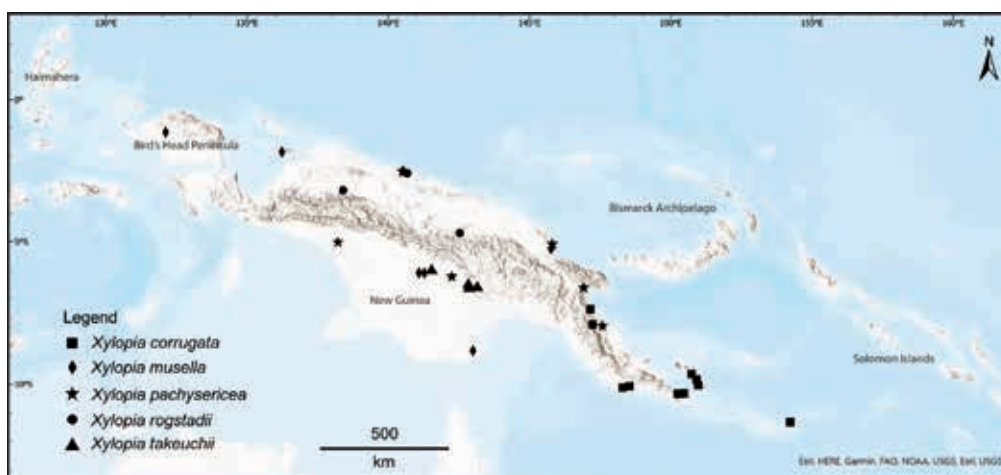
**Distribution.** Known only from southeastern Papua New Guinea, including Normanby, Fergusson, and Rossel Islands (Fig. 17).

**Ecology.** *Xylopia corrugata* occurs in lowland forest at elevations from sea level up to c. 30 m; an outlier was collected from c. 600 m. One specimen was collected on an ironstone-capped gravel ridge. Only the specimen from c. 600 m was reported as growing on ultramafic (“ultrabasic”) soils, but the distribution of *Xylopia corrugata* is largely co-extensive with the Papuan Ultramafic Belt, which has perhaps the highest concentration of ultramafic rock on the island of New Guinea. Specimens with flowers have been collected from September to December and with fruits in April and July.

**Etymology.** From Latin alluding to the conspicuous transverse wrinkling of the pedicels, sepals, and outer petals.

**Local names.** *Agalo* (Waigani, *Smith NGF 1291*), *nerida* (Upper Waria, *Smith NGF 1291*).

**Additional specimens examined.** PAPUA NEW GUINEA: **Central Province:** Cape Rodney, TP107, Abau Sub-dist., Central Dist., Papua, 10°07'S 148°18'E, 21 Jun 1968 (fr), *Henty NGF 38571* (A, BRI, K, L, SING); Central District, E Papua, road from Mori River to Yanu village, c. 15 km NE of Cape Rodney, 10°04'S 148°32'E, c. 30 m, 5 Sep 1969 (fr described on label but not on sheet), *Pullen 8222* (A, CANB, L [2 sheets]). **Milne Bay Province:** Rossel Island, Jinju, 26 Oct 1956 (fl), *Brass 28564* (A, K, L, US); track between Gamwabila and Tutubea, Fergusson Island, Subdist. Esa'ala, Dist. Milne Bay, 7°35'S 150°45'E, 170 m, 10 Nov 1976 (fr described but not on sheet), *Croft et al. LAE 68734* (A, BISH, BRI, K, L, M); Kulumedau Is. Alotao, Milne Bay, sea level, 17 Sep 1979 (fl), *Kairo 254* (A, K, L); Eastern District, Milne Bay area, about 1/2 mile north of Waigani Plantation, on an ironstone-gravel capped ridge, 100 ft, Mar 1945 (young fr), *Smith NGF 1291* (A, K, L); Milne Bay Province, Normanby Is., Sewa Bay, Sibonai, 30 Dec 2006 (fl), *Simaga et al. 09207* (A, BRIT). **Morobe Province:** Buso, 42 km S of Salamava [“Salamaua”], 7°23'S 147°09'E, 5 m, 3 Jul 1980 (fr), *Kairo 755* (A, BISH,



**Fig. 17.** Distributions of *Xylopia* species on New Guinea with cataphyll-covered resting buds: *X. corrugata*, *X. musella*, *X. pachysericea*, *X. rogstadii*, and *X. takeuchii*.

BRI, K, L); Saru River 7 miles SE of Garaina, Lae Subdist., Morobe Dist., 7°55'S 147°14'E, 2000 ft, 20 Jul 1970 (fr), *Streimann et al.* NGF 43480 (A, BISH, BRI, K, L, SING).

*Notes.* *Xylopia corrugata* is readily recognised by the pedunculate inflorescences of multiple flowers, 3/4- to fully connate sepals, and fine but conspicuous transverse corrugations on the pedicels, sepals, and outer petals. In addition, the relatively broad monocarps have slender stipes and are completely glabrous. Label data describing the seeds as “glaucous” and “grey” suggest that the whitish crust on the dried seeds is a sarcotesta. Three collections, *Henty* NGF 38571, *Smith* NGF 1291, and *Streimann* NGF 43480, report the middle bark layer to be green, a feature that has been noted in two other New Guinea *Xylopia* collections (see under *X. musella* and in Appendix 1).

There is variability in the shape of the leaf base—rounded to truncate in some specimens but cuneate to broadly cuneate in others. The specimen *Brass* 25504 (Normanby Island, Waikaiuna, 20 m, 19 Apr 1956 (A, L, US)) was not included in the description but may be *Xylopia corrugata*. It has rounded to truncate leaf bases, but the monocarps are reniform, have a scurfy brownish surface, and are slightly larger (up to 4.4 cm long). The label describes the fruit as immature; the one dissected did not have any maturing seeds inside.

### 9. *Xylopia makiraensis* D.M.Johnson & N.A.Murray, **sp. nov.**

Species resembling *Xylopia papuana* Diels in its multiple small flowers and sessile monocarps. It differs in the larger leaf blades that are glabrous or with a few hairs along the midrib abaxially, larger monocarps, and seed with a dilated base similar to that of *X. peekelii*. – TYPE: Solomon Islands, Makira [San Cristobal], Warahito River, 21 July 1965 (fl, fr), *Corner* R.S.S. 3 (holotype K + carpol.; isotypes A, BISH, L [L0191290], SING [SING0044971]). (Fig. 13J–R)

Tree to 18 m tall, dbh c. 8 cm, trunk with small buttresses or buttresses absent, bark drab yellow to light brown, smooth. **Twigs** black, becoming reddish brown, longitudinally wrinkled, with a few hairs c. 0.5 mm long, soon glabrate; nodes with single axillary branches. **Leaves** with larger blades 10.2–16 cm long, 5–8.3 cm wide, chartaceous, discolorous (grey/brown), oblong-ob lanceolate to elliptic, base cuneate and short-decurrent on petiole, apex acuminate to cuspidate, the acumen 5–13 mm long, margins flat or slightly revolute, glabrous adaxially, glabrous or with a few hairs along midrib abaxially; midrib plane adaxially, raised abaxially, secondary veins 9–12 per side, diverging from midrib at 60–80°, irregularly brochidodromous, secondary and higher-order veins slightly raised on both surfaces; petiole 5–10 mm long, flat to shallowly canaliculate adaxially, glabrous. **Inflorescences** 1–3-flowered, arising from axils of leafy twigs, peduncle absent, pedicels 2.4–4.5 mm long, 0.8–1.4 mm thick, glabrous or with a few scattered hairs, bracts 2, 1–1.5 mm long, one attached near the pedicel midpoint and the other just below the sepals, ovate, apex acute, pubescent; buds linear-lanceolate, apex obtuse. **Sepals** basally connate, spreading to reflexed at maturity, incurved at the apex, 2.3–3 mm long, 1.8–2.5 mm wide, coriaceous, triangular, apex acuminate, pubescent abaxially. **Petals** white to cream in vivo, coriaceous; outer petals with apices slightly spreading, 8.3–11.6 mm long, 2.1–2.6 mm wide at base, 1.2–1.5 mm wide at midpoint, linear-lanceolate to ligulate, base concave, apex obtuse, flat on both surfaces, pubescent except for glabrous concave base adaxially, densely appressed-pubescent abaxially; inner petals “with rose-pink mark at base” [ex Corner], position at maturity unknown, 8.9–9 mm long, 1.6–2 mm wide at base, 0.5–0.6 mm wide at midpoint, linear-subulate, slightly keeled on both surfaces, base concave, apex acute, densely pubescent on both surfaces except for glabrous concavity adaxially. **Stamens** c. 60, 0.8–1.2 mm long, oblong, connective apex truncate, outer staminodes 0.7–0.9 mm long, wedge-shaped, presence of inner staminodes not determined; staminal cone 1.1–1.3 mm diam., 0.5–0.7 mm high. **Carpels** c. 5, ovaries c. 1 mm long, narrowly oblongoid, pubescent, stigmas 0.5–0.8 mm long, club-shaped or obovoid, free or connivent, glabrous. **Torus** c. 1.5 mm diam., plane. **Fruit** of 1–2 monocarps borne on a pedicel 5–7 mm long, 2–3 mm thick, glabrate, torus 6–7 mm diam., 5–6 mm high, pyramidal or depressed-globose; monocarps “dehiscing irregularly, green outside, mauve-red and mealy inside” [ex Corner], 2.4–3.2 cm long, 2.1–2.5 cm wide, 2–2.2 cm thick, broadly ellipsoid to globoid, wrinkled, glabrate, base sessile or contracted into a stipe 1–2 mm long, 4.5–6 mm thick, apex rounded, pericarp 0.5–1 mm thick, lacking air spaces and coarse fibers. **Seeds** c. 5 in two rows, perpendicular to long axis of monocarp, 14.6–18 mm long, 8.9–11.5 mm wide, 5.2–6 mm thick, flattened-oblongoid, dark brown with whitish crusty patches, dull, slightly wrinkled, perichalazal ring not evident on surface; sarcotesta “thin waxy grey” [ex Corner]; aril absent, hollow thickening surrounding the micropyle 8–9 mm wide, 2.5–3.5 mm high.

**Distribution.** Known only from two southern islands of the Solomon Islands archipelago (Fig. 10).

*Ecology.* Basalt ridge in deep clay soil and well-drained primary forest on ridge top, at elevations of 15–150 m. Specimens with flowers have been collected in July and December and with fruits in July.

*Etymology.* Named for the primary island from which the species is known.

*Local names.* *Sala* (Whitmore R.S.S. 6196), *sulangwane* (Mauriasi & collectors BSIP 17993), *sula-waneh* (Corner R.S.S. 3).

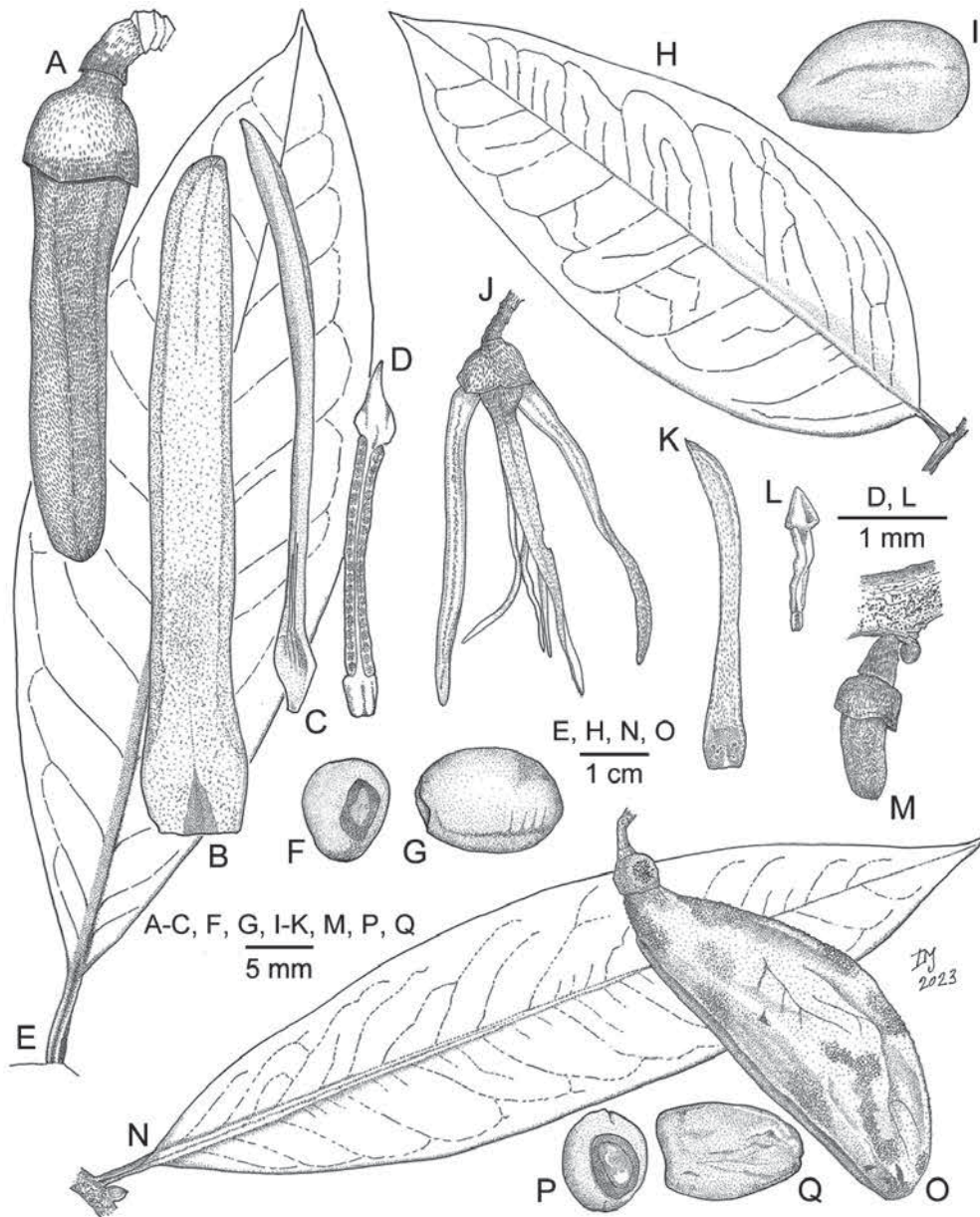
*Additional specimens examined.* SOLOMON ISLANDS: **Makira:** San Cristobal, basalt ridge between Warahito and Pegato Rivers, c. 500 ft, 27 Jul 1965 (fl), Whitmore R.S.S. 6196 (A, K, L, SING). **Malaupaina:** Malaupaina Island, 8 Dec 1969 (fl), Mauriasi & collectors BSIP 17993 (K).

*Notes.* The monocarps of *Xylopia makiraensis* are broadly ellipsoid to globose and 2.1–2.5 cm wide (vs ellipsoid and 1.1–1.5 cm wide in *X. papuana*). A description of the fruit and seed of the type collection are given in Corner (1976), where the plant was identified as *Xylopia peekelii*. Both Corner and Whitmore noted the colouration of the anther connective apices, magenta (Whitmore) or rose-pink (Corner), a common trait of *Xylopia* species in other parts of the world but connective colour was not described for other species from the New Guinea region. Corner also noted that the flowers were “fragrant of honey”.

**10. *Xylopia musella* D.M.Johnson & N.A.Murray, sp. nov.**

Species resembling *Xylopia rogstadii* D.M.Johnson & N.A.Murray in the nearly fully connate sepals, scaly-lenticellate brown monocarps, and raised to plane adaxial leaf midrib. It differs in the smaller leaves and smaller monocarps (up to 6 cm long vs up to 12 cm long) that are narrowly oblong and usually slightly falciform and bluntly triangular in cross-section. – TYPE: Papua New Guinea, [Western Province], Western District, Rumganae Rd, 5 km from Kiunga, Kiunga Subdist., 6°05'S 141°20'E, 150 ft, 12 August 1971 (bud, fr), Womersley & Streimann NGF 43833 (holotype SING [SING0045103]; isotypes A, BISH, BRI [BRI-AQ350376], K, L [L0047097], M, US). (Fig. 18M–Q)

Tree to 30 m tall, dbh to 40 cm, bark silver-grey, whitish brown, grey-brown, whitish grey or patchy white and grey, smooth. **Twigs** brown, initially densely covered with light brown appressed hairs 0.2–0.3 mm long, eventually glabrate, longitudinally wrinkled and fluted; nodes occasionally with two axillary branches; paddle-shaped resting buds present. **Leaves** with larger blades 8.8–19.2 cm long, 3.1–5.7 cm wide, subcoriaceous, slightly discolourous, narrowly elliptic or elliptic-oblong, base cuneate to nearly rounded and short-decurrent on petiole, apex acuminate with an acumen 3–12 mm long, margins slightly revolute, glabrous adaxially, glabrous or appressed-pubescent along midrib but otherwise glabrate abaxially; midrib slightly raised to



**Fig. 18.** A–G. *Xylopiopsis rogstadii* D.M.Johnson & N.A.Murray. **A.** Flower bud, side view. **B.** Outer petal, adaxial view. **C.** Inner petal, adaxial view. **D.** Stamen, abaxial view. **E.** Leaf. **F.** Seed, micropylar view. **G.** Seed, side view. **H–L.** *Xylopiopsis takeuchii* D.M.Johnson & N.A.Murray. **H.** Leaf. **I.** Seed, side view. **J.** Flower, side view. **K.** Outer petal, adaxial view. **L.** Stamen, abaxial view. **M–Q.** *Xylopiopsis musella* D.M.Johnson & N.A.Murray. **M.** Flower bud, side view. **N.** Leaf. **O.** Fruit with one monocarp, side view. **P.** Seed, micropylar view. **Q.** Seed, side view. A–E from Brass & Versteegh 14121 (A); F, G from Rogstad 816 (A carpol.); H, J–L from Brass 7293 (A); I from Brass 7293 (A carpol.); M from Womersley & Streimann NGF 43833 (SING); N–Q from Womersley & Streimann NGF 43833 (L). Drawn by David Johnson.

plane adaxially, slightly raised abaxially, secondary veins 8–15 per side, diverging from midrib at (30–)50–70°, sometimes slightly ascending, weakly to distinctly brochidodromous, secondary and higher-order veins slightly raised and sometimes indistinct adaxially, more strongly raised and conspicuous abaxially; petiole 7–13 mm long, shallowly canaliculate adaxially, glabrous. **Inflorescences** 1–2-flowered, arising from axils of fallen leaves, peduncle absent, pedicels 2–3 mm long, 1.8–2.3 mm thick, appressed-pubescent, bracts 2–3, uppermost bract 2.5–2.7 mm long, caducous, ovate, apex rounded, appressed-pubescent; buds oblong, apex obtuse. **Sepals** fully connate, 3.1–3.6 mm long, 2.5–3.1 mm wide, coriaceous, broadly ovate, apex obtuse to rounded, appressed-pubescent abaxially. **Petals** fleshy; outer petals obtuse, appressed-pubescent abaxially. **Stamens** unknown, except for remnants of staminal cone 0.3–0.5 mm high on torus of very young fruit. **Carpels** at least 2. **Torus** not examined. **Fruit** of up to 6 monocarps borne on a pedicel 8–13 mm long, 2.5–7 mm thick, glabrate, torus 5–14 mm diam., 3–9 mm high, depressed-globose; monocarps with brown exterior and red endocarp in vivo, 3.4–6 cm long, 1.9–2.4 cm wide, 1.8–2.3 cm thick, oblongoid, usually slightly falciform, bluntly triangular in cross-section, irregularly sunken in places with a distinct abaxial keel, scaly-lenticellate, glabrous, base contracted into a stipe 2–3 mm long, 6–9 mm thick, apex obtuse, pericarp 0.8–1 mm thick, lacking air spaces and coarse fibers. **Seeds** 4–12 in two rows, perpendicular to long axis of monocarp, 10.2–13.2 mm long, 7.8–9.3 mm wide, 5–6.6 mm thick, flattened-ellipsoid, dark brown with whitish overlying crusty patches, shiny, slightly wrinkled, perichalazal ring visible as a slight ridge on surface; sarcotesta “grey” [Henty & Foreman NGF 42873] in vivo; aril a flat ring surrounding the micropyle.

**Distribution.** Occurs in several locations on and near the island of New Guinea: Bird’s Head Peninsula and Japen Island of Indonesian New Guinea and southwestern and northeastern Papua New Guinea (Fig. 17).

**Ecology.** Found in primary rainforest on slopes, hills, and ridges, rarely on streambanks, at elevations of 15–200(–450) m. Specimens with flower buds were collected in August, September, and November and with fruits in August, September, November, and December.

**Etymology.** From the genus *Musa* + diminutive *-ella*, alluding to the clusters of small banana-shaped monocarps.

**Local names.** *Jakeroera* (Roberbai, Japen dialect, *Iwanggin BW 9238*), *mandrempi* (Roberbai, Japen dialect, *Iwanggin BW 9238*), *yem* (*Womersley & Havel NGF 17720*).

**Additional specimens examined.** INDONESIA: Div. Geelvinckbay, Subdiv. Serui, Isle of Japen, Aisau, Sebosiari, c. 200 m, 21 Sep 1960 (fr), *Iwanggin BW 9238* (A, L); W of Ayawasi, 1.14 S 132.12 E, near plot 6 [450 m, see Polak (2000)], 9 Nov 1995 (buds, fr), *Polak 919, 919A* (L). PAPUA NEW GUINEA: **Madang Province:** Dumpu Usino Rd, nr Amiaba River, Madang District, 500 ft, 18 Dec 1969 (fr), *Henty & Foreman NGF 42873* (A, K, L, M, SING, US).

**Western Province:** near old Songerom village, Elevala River, upper Fly River system, Western District, c. 100 ft, 7 Sep 1967 (fr), *Pullen* 7273 (CANB spirit collection, L); Oriomo River, mouth of Yakup Creek, 40 mi from sea, Western District, 50 ft, 8°50'S 143°E, 21 Sep 1963 (buds, fr), *Womersley & Havel NGF 17720* (A, BM, BRI [2 sheets], K, L, M, MO).

*Notes.* *Xylopia musella* has conspicuous paddle-shaped, cataphyll-covered resting buds, more or less ascending leaf venation, and clusters of brown, scaly-lenticellate banana-shaped monocarps. It is similar to *Xylopia rogstadii*, but can most easily be distinguished by the smaller leaves and much smaller monocarps. Despite its distinctive features, this species has been difficult to circumscribe and compare to other *Xylopia* species, primarily because it has not been collected with mature flowers. A few floral details were afforded by a very young fruit on the L sheet of *Iwanggin BW 9238*: the torus has already expanded to c. 3 mm diameter and the two ovaries to c. 3 mm in length, but remnants of the staminal cone, although stretched by the torus expansion and partially broken, are still visible. Collectors have described *Xylopia musella* as a canopy tree, with a narrow crown, and with the fruit “acid-smelling when crushed”. The type specimen label describes the bark as “silver-grey, dark green on the back”.

#### 11. *Xylopia pachysericea* D.M.Johnson & N.A.Murray, **sp. nov.**

Species resembling *Xylopia calosericea* Diels in the lanceolate to lanceolate-elliptic leaves with dense appressed shining abaxial pubescence and lenticellate brown monocarps. It differs in the lanceolate outer petals nearly twice as long (c. 20 mm), sepals more connate, and larger monocarps subsessile or with shorter thicker stipes. – TYPE: Papua New Guinea, [Madang Province], Madang District, Alexishaffen Vitar Plantation [ $\pm 5.074081$  S  $145.806212$  E], February 1945 (fl, fr), *Mair NGF 1802* (holotype BRI [BRI-AQ211294]; isotypes A, BISH, K, L [L0047161]). (Fig. 3, 16J–Q)

Tree to 40 m tall, dbh to 40 cm, trunk with buttresses [“spur rooted to 2 ft” ex *Mair 1802*], bark dark brown or chocolate brown, with fine longitudinal lenticellate ridges. **Twigs** dark grey, covered with dense closely appressed hairs 0.1–0.4 mm long, at length glabrate; nodes frequently with two axillary branches; paddle-shaped resting buds often present. **Leaves** with larger blades 6.5–11.6 cm long, 1.7–3.6 cm wide, subcoriaceous, occasionally chartaceous, concolorous to slightly discolorous, lanceolate to lanceolate-elliptic, base cuneate to broadly cuneate, short-decurrent on petiole, apex gradually acuminate, the acumen 6–12 mm long, margins flat to slightly revolute, glabrous or with a few hairs on the midrib adaxially, densely covered with appressed shining golden or silver hairs abaxially; midrib plane to slightly impressed adaxially, raised and keeled abaxially, secondary veins 10–13 per side, diverging from midrib at 55–60°, brochidodromous, these and higher-order veins indistinct adaxially, indistinct to slightly raised abaxially; petiole 4–8 mm long, deeply canaliculate adaxially, sparsely pubescent. **Inflorescences** 1–2-flowered, arising from axils of leafy twigs, pedicels 3.7–5.4 mm long, 1.5–2 mm thick, pubescent; bracts 2–3, spaced evenly along the pedicel but caducous, 1.1–1.9 mm long, ovate, apex

obtuse to rounded, pubescent; buds lanceolate, apex obtuse. **Sepals** erect or slightly spreading,  $> 1/2$ -connate, 2.3–3.8 mm long, c. 3.7 mm wide, coriaceous, broadly ovate, apex broadly acute, appressed-pubescent abaxially. **Petals** cream-coloured in vivo, coriaceous to slightly fleshy; outer petals more or less erect, c. 20 mm long, c. 4 mm wide at base, 2–3 mm wide at midpoint, lanceolate, apex obtuse, faintly keeled abaxially, densely puberulent adaxially, appressed-pubescent abaxially; inner petals c. 19 mm long, base not visible, c. 1.1 mm wide at midpoint, linear, apex acute, keeled abaxially, finely puberulent on both surfaces. **Stamens** c. 100, 0.7–1 mm long, clavate, connective apex dome-shaped, staminodes absent; staminal cone c. 1.7 mm diam., 0.5–0.7 mm high. **Carpels** several, ovaries c. 1.6 mm long, narrowly oblongoid, densely sericeous, stigmas not seen. **Torus** 2.2–3 mm diam., flat. **Fruit** of up to 8 monocarps borne on a pedicel 4.5–10 mm long, 3.1–4.5 mm thick, sparsely pubescent, torus 6–12 mm diam., 4–9.5 mm high, depressed-globose, sepals usually persistent on base; monocarps with brown exterior and red endocarp in vivo, 3.1–4.7 cm long, 1.6–2.8 cm wide, 1.5–2.8 cm thick, irregularly oblongoid or ellipsoid, sometimes keeled, scaly-lenticellate, glabrate, base subsessile or contracted into a stipe 1.5–6 mm long, 2.5–7 mm thick, apex rounded, pericarp 0.8–1.7 mm thick, grainy, lacking air spaces and coarse fibers. **Seeds** 6–7 in two rows, perpendicular to long axis of monocarp, 10–14.3 mm long, 7.9–10.7 mm wide, 4.7–7.4 mm thick, flattened-ellipsoid to broadly ellipsoid or obovoid, slightly narrowed to micropyle, dull to slightly shiny, brown with some white overlying crust, smooth, perichalazal ring visible on surface but not raised; sarcotesta bluish; aril absent.

**Distribution.** New Guinea, mostly north of the Central Range, from the Cyclops Mountains in northeastern Indonesian New Guinea east to Morobe Province of Papua New Guinea (Fig. 17). The two collections from south of the Central Highlands are from the Asmat Region of Indonesian New Guinea and northern Western Province of Papua New Guinea, respectively.

**Ecology.** Forest at elevations of 0–400 m; at least one collection is from ultramafic soils. The specimen with flowers was collected in February and specimens with fruits have been collected in February–April, June, and October, and possibly also July (see Notes).

**Etymology.** From Greek *pachy*-, thick, *sericea*, silky, alluding to the leaves that are thicker than those of *Xylopia calosericea* but covered abaxially with similar dense shining appressed hairs.

**Local names.** *Sellak* (Asmat, *Nautje BW 6589*), *wamel* (Kerenga & Lelean LAE 73919).

**Additional specimens examined.** INDONESIA: **North Papua:** Subdist. Hollandia, Cycloop Mts above Hollandia, c. 400 m, 19 Mar 1957 (fr), *Koster BW 4314* (A, K, L, SING); Res. Hollandia, Cycloop Mts, 16 Feb 1956 (fr), *Schram BW 1984* (A, K + carpol., L, SING). **South Papua:** Sauwah, Asmat Region, Div. South N. Guinea, 6 Jul 1957 (old fl, fr on label, see below), *Nautje BW 6589* (L).

PAPUA NEW GUINEA: **Morobe Province:** Papua New Guinea, Pao River, Yae Village, Waria Valley, Morobe, Morobe Province, 7°57'14"S 147°35'55"E, 80 m, Pao Hill Forest, 5 Jun 1999, *Lovave LAE 82226* (L); Lae, hills near Taraka, 6°37'S 146°55'E, 200 m, 25 Oct 2003 (fr), *Takeuchi & Ama 16674* (A + carpol., K [2 sheets], L). **Western Province:** Trisagobabi – 3 miles NE of Nomad, Subprovince Nomad, 100 m, 6°13'S 142°15'E, 18 Apr 1978 (fr), *Kerenga & Lelean LAE 73919* (A, BISH, K, L, M).

*Notes.* *Xylopia pachysericea* has been previously confused with *X. calosericea*, having similar lanceolate to lanceolate-elliptic leaves covered with shining appressed abaxial hairs and dense fine appressed pubescence on the young twigs; both are slender canopy trees that reach the greatest heights of any *Xylopia* species in the New Guinea region. The flowers of *Xylopia pachysericea* are much larger than those of *X. calosericea*, and the sepals are more connate and often persistent in fruit; an odd feature of the sepals is that they become distorted as the petals enlarge (Fig. 16J–L). The monocarps of *Xylopia pachysericea* are larger than those of *X. calosericea*, with a thicker pericarp and shorter thicker stipe, or subsessile; the monocarp exterior develops the scaly-lenticellate surface similar to that seen in several other New Guinea species. In addition, branches of *Xylopia pachysericea* are stouter and the leaves have a granular rather than smooth adaxial surface texture, the venation not usually visible. Cataphyll-covered resting buds, frequent in *Xylopia pachysericea*, have not been noted for *X. calosericea*. Two collectors described a narrow crown for the tree, and collectors noted the odour of the fruit as being either “sour” (*Nautje BW 6589*) and “recalling a combination of wintergreen and fenugreek” (*Takeuchi & Ama 16674*).

*Xylopia pachysericea* has a much narrower distribution than *X. calosericea* but the two distributions overlap. Ecological differences may play a role: while the label of *Lovave LAE 82226* is the only one explicitly stating that the plant was growing on ultramafic soils, the Cyclops Mountains, from which two collections of *Xylopia pachysericea* have been made, are a known site of ultramafic geology along the northern New Guinea coast (Davies, 2012). The geology of the other localities is unknown.

“Vitar Plantation”, the type locality, is mapped in a publication by Ballantyne & Buck (1979). The dehiscent fruit of the collection *Schram BW 1984* is shown in Plate 50B of Van Setten & Koek-Noorman (1992), where it is identified as *Xylopia papuana*. The label of the specimen *Nautje BW 6589* claims that the specimen has a fruit, but there is no fruit on the sheet at L. However, the sheet of *Nautje BW 6585* at L, which is a specimen of *Xylopia papuana*, has a monocarp in its packet that is not from *X. papuana* but more likely came from the *Nautje BW 6589* collection.

**12. *Xylopia papuana*** Diels, Bot. Jahrb. Syst. 52: 180 (1915). – TYPE: Papua New Guinea [“Nordöstl. Neu-Guinea”], Kaiserin-Augusta-Fluß-(Sepik-) Gebiet, am Pionierlager, im Sumpfwald, 20–40 m, May 1912 (fl, fr), *Ledermann 7276* (lectotype B [B 10 0249557], designated by Turner & Utteridge (2017); isoelectotypes K, SING [SING0044982]). (Fig. 13A–I)

Tree to 25 m tall, dbh to 30 cm, trunk with buttresses up to 1.5 m high, rarely with prop roots, bark brown, grey, or reddish, smooth or with fine cracking and flaking. **Twigs** brown, slender and a little flexuous, finely wrinkled, initially covered with loosely appressed hairs 0.1–0.5 mm long, at length glabrate; nodes occasionally with two axillary branches. **Leaves** with larger blades 6.8–9.3 cm long, 2.5–3.5 cm wide, chartaceous, concolorous, elliptic or occasionally oblong-elliptic or oblanceolate, base cuneate, short-decurrent on petiole, apex acuminate, the acumen 5–11 mm long, margins flat, glabrous adaxially, sparsely appressed-pubescent to glabrate abaxially; midrib plane adaxially but with a sunken central area toward the base, raised abaxially, secondary veins 9–11 per side, diverging from midrib at 50–65°, indistinctly brochidodromous, secondary and higher-order veins slightly raised on both surfaces; petiole 3–6.5 mm long, somewhat flattened to shallowly canaliculate adaxially, pubescent to glabrate. **Inflorescences** 1–4-flowered, arising from the axils of leafy twigs, peduncle 1.9–2.5 mm long, 0.6–0.7 mm thick, densely pubescent, or peduncle absent, pedicels 2–3 mm long, 0.6–0.8 mm thick, densely appressed-pubescent, bracts 2, lower bract between pedicel base and midpoint caducous, upper bract subtending sepals persistent, 1.2–1.7 mm long, ovate, apex obtuse, densely pubescent; buds narrowly oblong to linear, apex obtuse to acute. **Sepals** 1/4-connate, spreading, 1.5–1.7 mm long, 2–2.3 mm wide, chartaceous, broadly ovate, apex obtuse to acute, appressed-pubescent abaxially. **Petals** yellow in vivo, coriaceous; outer petals slightly spreading at maturity, 8–10.3 mm long, 1.7–2.5 mm wide at base, 0.8–1.1 mm wide at midpoint, linear-lanceolate, base concave, apex obtuse, shallowly canaliculate adaxially, flat or faintly keeled abaxially, pubescent on both surfaces; inner petals slightly spreading at maturity, sometimes with the apices curved inward, 8.7–10.3 mm long, 1.6–1.7 mm wide at base, 0.6–0.7 wide at midpoint, linear, flat adaxially, faintly keeled abaxially, base flattened or shallowly concave, apex acute, densely pubescent on both surfaces. **Stamens** numerous, 0.7–1 mm long, oblong or slightly clavate, connective apex truncate, outer staminodes absent, inner staminodes 0.6–0.7 mm long, wedge-shaped to quadrate; staminal cone 1.6–1.8 mm diam., 0.5–1 mm high. **Carpels** 4–6, ovaries approximately the height of the staminal cone and enclosed by it, oblongoid, pubescent, stigmas 1.8–2.2 mm long, linear-lanceolate, narrowed toward base, connivent, glabrous. **Torus** co-extensive with staminal cone and of the same diam. **Fruit** of up to 4 monocarps borne on a pedicel 3.7–8.5 mm long, 2.2–2.6 mm thick, sparsely pubescent, torus 4.6–5.9 mm diam., 3–4.3 mm high, depressed-globose; monocarps green to red in vivo, 1.3–2.2(–3.2) cm long, 1.1–1.5 cm wide, 1.2–1.3 cm thick, ellipsoid, slightly torulose, keeled, surface papillate, somewhat wrinkled, glabrate, base subsessile, contracted into a stipe 1.5–2.5 mm long, 2.9–5 mm thick, apex occasionally with a blunt umbo, pericarp c. 0.6 mm thick, lacking air spaces and coarse fibers. **Seeds** c. 5 in two rows, perpendicular to long axis of monocarp, 7.6–10.9 mm long, 6–7.5 mm wide, 3.6–5.4 mm thick, flattened-ellipsoid, brown with overlying patchy whitish crust, slightly shiny, smooth, perichalazal ring slightly raised on outer surface or indistinct; sarcotesta possibly present; aril absent but sunken area around micropyle may appear aril-like.

**Distribution.** Known from Indonesia (Aru Islands, Tanimbar, Papua, and South Papua) and Papua New Guinea (Fig. 14).

*Ecology.* Rainforests, sometimes in riverine vegetation, at elevations of 100 m or less. Specimens with flowers have been collected in March–May, August, and October and with fruits in February–May and August.

*Additional specimens examined.* INDONESIA: **Maluku:** Aru Islands, P. Kobroor, Kp. Kobroor, 6°15'S 134°45'E, 10 m, 27 Apr 1993 (fr), *Van Balgooy & Mamesah 6487* (A, L); Tenimber Island, Timor lao et P. Jamdena, forest near resthouse between Ilgne and Otimmer, 18 Mar 1938 (fl), *Buwalda 4288* (A, K, L, SING); Tanimber, eilander Ilgnei Otimmer, 18 Mar 1938 (fl), *Netherlands Indies Forest Service bb. 24303* (A, K, L, NY, SING); Tanimber eilanden Arkilo, c. 100 m, 18 Apr 1938 (fl), *Netherlands Indies Forest Service bb. 24417* (A, K, L, SING). **Papua:** Hollandia Berap (Nimboeran), 1 Aug 1939 (fr), *Netherlands Indies Forest Service bb. 28915* (A, K, L, SING). **South Papua:** Div. South N. Guinea, Asmat region, Sauwah, 0 m, 6 Jul 1957 (st), *Nautje BW 6585* (L).

PAPUA NEW GUINEA: **Gulf Province:** Vailala River, Ihu, 12 Feb 1926 (fr), *Brass 954* (A, K, P); Gulf District, Subdist. Kikori, Mina River, upstream from limit of ship navigability, 29 Mar 1974 (bud, fr), *Womersley NGF 46479* (A, BISH, K, L, MO, US). **West Sepik Province:** Neu-Guinea, Kaiser Wilhelmsland, Augustfluss [now Sepik R.], 1887, *Hollrung 794* (K); Deutsch-Neuguinea, Sepikgebiet, [“Malu, im Urwald bei etwa 40–60 m ü. M., blühend und fruchtend im Juli” [1912]: Diels, 1915] (fl, fr), *Ledermann 8091* (K). **Morobe Province:** Dodobura area, 7 Apr 1945 (fr), *Anonymous NGF 2410* (L). **Western Province:** Lake Daviumbu, Middle Fly River, Aug 1936 (fl), *Brass 7563* (A, BM, L); June River, northern Lake Murray area, 06°41'S, West Dist. of Terr. Papua, 30 ft, 11 Oct 1967 (fl), *Pullen 7476* (A, K, L).

*Notes.* The name *Xylopia papuana* has been widely misapplied to *Xylopia* collections from the New Guinea region. The species can distinguished from other regional species of *Xylopia* by the relatively small, chartaceous, sparsely pubescent leaves, small flowers (petals less than 11 mm long), and small (2.2 cm long or less) thin-walled ellipsoid monocarps. It can be distinguished from *Xylopia calosericea*, with which it is most often confused, by the sparsely pubescent to glabrate abaxial leaf surface and the subsessile green to red monocarps. Specimens from Tanimbar Island are placed here tentatively, as resembling *Xylopia papuana* in leaf shape, pubescence, and shape of the flower buds, but none of the specimens we examined had mature flowers or fruits. The specimen *Nautje BW 6585* (L) is a mixed collection: the fruit in the packet is probably *Xylopia pachysericea*; see comments under that species. Except for the type, most of the specimens cited by Diels in the protologue have not been relocated and were probably destroyed. The white crust observed on the dried seeds suggests that a sarcotesta is present, but label data do not give enough information for confirmation.

**13. *Xylopia peekelii*** Diels, Notizbl. Bot. Gart. Berlin-Dahlem 11: 83 (1931). – TYPE: Papua New Guinea, New Ireland [“Papuasia, in insula Neu-Mecklenburg”], Lemakot [“Lamekot”], “Buschland”, April 1924 (fl, fr), *Peekel 947* (holotype B [B 10 0249553]). (Fig. 8A–H)

Tree to 20 m tall, dbh to 30 cm, bark brown to white, occasionally densely pustular. **Twigs** brown to grey-brown, loosely appressed-pubescent, the hairs 0.2–0.8 mm long, eventually glabrate, usually with inconspicuous round light-coloured lenticels and exfoliating bark; nodes with single axillary branches. **Leaves** with larger blades 11.3–15.2 cm long, 4.6–5.9 cm wide, subcoriaceous to chartaceous, slightly discoloured (grey/brown), oblong, elliptic, or oblanceolate, base cuneate to broadly cuneate, short-decurrent on petiole, apex acuminate, the acumen 3–12 mm long, margins flat or slightly revolute, glabrous adaxially, sparsely appressed-pubescent along midrib but otherwise with scattered hairs or glabrous abaxially; midrib plane adaxially, raised abaxially, secondary veins 9–12 per side, diverging from midrib at 50–60°, irregularly brochidodromous, these and higher-order veins indistinct adaxially, slightly raised abaxially; petiole 4–8 mm long, canaliculate adaxially, pubescent. **Inflorescences** 1–2(–4)-flowered, arising from axils of leafy twigs or of fallen leaves, occasionally supra-axillary, peduncle c. 1 mm long or absent, pedicels 5.1–8.5 mm long, 1.4–1.8 mm thick at midpoint, pubescent; bracts 3–4, caducous, leaving encircling scars; buds oblong, obtuse. **Sepals** 1/4–1/3-connate, slightly spreading, 4.8–5.1 mm long, c. 4.1 mm wide, coriaceous, ovate to broadly ovate, apex obtuse to acute, pubescent abaxially. **Petals** cream, pale yellow, or cream-green, fleshy; outer petals 22–28 mm long, 4–6.5 mm wide at base, 5.7–6.9 mm wide at midpoint, elliptic-oblong, base slightly narrowed and concave adaxially, apex obtuse, trigonous, flattened medially from the trigonous apex to the base adaxially, sometimes with a faint keel but otherwise flat abaxially, puberulent adaxially except for the glabrous base, appressed-pubescent abaxially; inner petals 20–23 mm long, 2.4–3 mm wide at base, 1.8–2.1 mm wide at midpoint, linear, keeled on both surfaces, base deeply concave adaxially, apex acute, puberulent on both surfaces except inside the glabrous basal concavity. **Stamens** c. 100, 1.7–1.8 mm long, narrowly oblong, connective apex tongue-shaped but somewhat thickened, outer staminodes c. 1.6 mm long, oblong, inner staminodes absent; staminal cone c. 3 mm diam., 0.7–0.8 mm high. **Carpels** c. 13, ovaries 2.3–2.8 mm long, oblongoid, glabrous or with a few hairs, stigmas 0.8–0.9 mm long, clavate or slightly falciform, free, glabrous except for tuft of apical hairs. **Torus** c. 2.5 mm diam., plane. **Fruit** of 1–3 monocarps borne on a pedicel 12–22 mm long, 3–4.8 mm thick, glabrate, torus 5–11 mm diam., 2.5–5.5 mm high, discoid to depressed-globose; monocarps with green exterior and red endocarp in vivo, 3.8–7 cm long (including stipe), 2–3.6 cm wide, 2–2.8 cm thick, ellipsoid, sometimes keeled abaxially, marked by irregular folds to slightly bullate, glabrate, base contracted into a stipe 7–14 mm long, 3–5.1 mm thick, apex rounded to obtuse, pericarp 0.7–2.2 mm thick, lacking air spaces and coarse fibers. **Seeds** up to 15 in two rows, perpendicular to long axis of monocarp, 15–17.5 mm long, 7–9.5 mm wide, 3.7–6.6 mm thick, irregularly flattened-oblongoid, brown, smooth, slightly shiny but often with a whitish crust over most of the seed, perichalazal ring evident or not on surface; sarcotesta bluish in vivo; aril absent, hollow thickening surrounding the micropyle 7.5–10 mm wide, 3–5 mm high.

*Distribution.* Endemic to the island of New Ireland, Papua New Guinea (Fig. 12).

**Ecology.** Reported from lowland rainforest hills and swamps, sometimes in karst areas, up to 600 m in elevation. Associates in the swamp forest included *Terminalia archipelagi* Coode, and species of *Homalium* Jacq. and *Vitex* L. Specimens with flowers have been collected in January, April, October, and November, and with fruits in January, February, April, and October.

**Additional specimens examined.** PAPUA NEW GUINEA: **New Ireland Province:** 1 mile inland from Kaut Harbour, 2°45'S 150°55'E, 50–100 ft, 14 Feb 1967 (fr), *Coode & Katik NGF 29834* (K + carpol.); Namanee Island, Kavieng Subdistrict, New Ireland District, 2°42'S 150°45'E, 100 ft, 16 Jan 1969 (fl, fr), *Coode & Katik NGF 40140* (K, L); 5 km S of Logagan village, N. Schleinitz Range, Subdistr. Kavieng, 2°57'S 151°21'E, 600 m, 24 Oct 1974 (fl, fr), *Croft & Lelean LAE 65627* (A + carpol., BISH, BRI, K + carpol., L, SING, US); Kaut Timber Area, 10 km NW Kaut harbour, Kavieng Subprovince, New Ireland Province, 2°46'S 150°55'E, 40 m, 20 Nov 1984 (fl), *Gideon LAE 57250* (K, L).

**Notes.** The name *Xylopia peekelii* has been applied to any *Xylopia* from the New Guinea region with relatively large leaves, flowers, or fruits—many specimens of new species described in this paper were originally determined as *X. peekelii*. As circumscribed here, the species is confined to New Ireland; a recent report of the species from southern Sulawesi (Riley et al., 2023) has not been confirmed. *Xylopia peekelii* is most easily distinguished from congeners in the region by the combination of thick fleshy petals and monocarps marked by irregular folds to slightly bullate. The label of *Coode & Katik NGF 29834* reports that the fruit has a “strong smell of unripe mango when cut”.

Diels's protologue for the species includes this description of the fruit and seeds: “Carpella matura ampla, stipite ad 1 cm longa suffulta, glabra, late cylindrica, dehiscentia, intus saturate rubra, (sicca) ad 7 cm longa, 2 cm lata. Semina numerosa, 1,5–1,6 cm longa, 0,8 cm lata; testa fulva, nitida, arillo conspicuo, cupulato”. We could not find any fruit associated with the holotype specimen at B but the description corresponds closely to fruits and seeds collected more recently from the vicinity of the type locality. The aril described by Diels, however, appears to be the hollow thickening surrounding the micropyle rather than a true appendage.

#### 14. *Xylopia rogstadii* D.M.Johnson & N.A.Murray, **sp. nov.**

Species resembling *Xylopia musella* D.M.Johnson & N.A.Murray in the oblongoid shape and scaly-lenticellate surface of the monocarps and connate sepals, but differing in the much larger monocarps with coarsely fibrous pericarp > 2 mm thick. The ligulate outer petals up to 50 mm long and stamens up to 3.9 mm long with a sharply conical connective apex are unique among the species of the region. – TYPE: Indonesia, [Papua], Bernhard Camp, Idenburg River [map and details in Rand (1940)], May 1939 (fl, fr), *Brass & Versteegh 14121* (holotype A + carpol.; isotypes BRI [BRI-AQ0211572], L [L0047168]). (Fig. 2, 18A–G)

Tree to 19 m tall, dbh to 22 cm, bark reddish, smooth to slightly wrinkled. **Twigs** dark grey to light grey, slightly wrinkled, initially densely covered with light brown appressed hairs 0.1–0.3 mm long, eventually sparsely pubescent; no branch nodes with two axillary buds; paddle-shaped resting buds present, rusty appressed-pubescent. **Leaves** with larger blades 19.3–24.3 cm long, 5.6–7.9 cm wide, subcoriaceous, slightly discolorous, narrowly elliptic to oblong or oblanceolate, base cuneate to broadly cuneate, short-decurrent on petiole, apex acuminate with an acumen 4–13 mm long, margins slightly revolute, glabrous adaxially, sparsely and finely appressed-pubescent abaxially, hairs densest on the midrib; midrib slightly raised or occasionally plane adaxially, raised and somewhat darkened abaxially, secondary veins 11–16 per side, diverging from midrib at 60–80°, sometimes slightly ascending, weakly brochidodromous, secondary and higher-order veins slightly raised adaxially, more strongly raised abaxially; petiole 8.5–18 mm long, flattened adaxially, glabrous. **Inflorescences** 1-flowered, arising from axils of fallen leaves, peduncle absent, pedicels 7.2–11 mm long, 2.4–3 mm thick, densely cinnamon-brown appressed-pubescent, bracts 2, not seen, caducous, scars encircling most of pedicel circumference; buds narrowly oblong, apex obtuse. **Sepals** fully connate, erect, 5.3–6 mm long, c. 6.6 mm wide, coriaceous, broadly ovate, apex broadly acute, densely cinnamon-brown appressed-pubescent abaxially. **Petals** white in vivo, fleshy; outer petals with position at anthesis unknown, 36–50 mm long, 5.9–7.5 mm wide at base, 5.5–6.9 mm wide at midpoint, ligulate, base shallowly concave, apex minutely trigonous, obtuse, with a fine central longitudinal groove from the base to apex adaxially, flat abaxially, densely puberulent except for glabrous base adaxially, densely sericeous except for glabrous base abaxially; inner petals 39–46 mm long, 3.8–4.5 mm wide at base, 2.5–2.7 mm wide at midpoint, linear-ligulate, strongly keeled on both surfaces, base deeply concave, apex obtuse, puberulent except for glabrous base adaxially, uniformly densely appressed-pubescent abaxially. **Stamens** c. 200, 1.9–3.9 mm long, linear, connective apex sharply conical, staminodes 1.8–1.9 mm long, oblong to clavate, position within androecium undetermined; staminal cone 2–2.4 mm diam., 0.5–0.7 mm high. **Carpels** 3–6, ovaries c. 2.5–3.4 mm long, narrowly oblongoid, densely pubescent, stigmas 6.7–7.6 mm long, filiform, connivent, glabrous or with a few hairs. **Torus** 4.2–6 mm diam., plane. **Fruit** of 1–2 monocarps borne on a pedicel 8–19 mm long, c. 13 mm thick, glabrate, torus 19–29 mm diam., 4–20 mm high, irregularly depressed-globose; monocarps red-brown to deep orange-brown with pink endocarp in vivo, 6–12 cm long, 2.8–5.8 cm wide, 4.1–5.4 cm thick, oblongoid and slightly curved, terete in cross-section, scaly-lenticellate, sparsely appressed-pubescent, base contracted into a stipe 3–7 mm long, 13–19 mm thick, apex rounded, pericarp 2.6–15 mm thick, with air spaces and conspicuous coarse fibers. **Seeds** 12–20 in two rows, perpendicular to long axis of monocarp, 10.7–15.7 mm long, 7.2–9.1 mm wide, 5.5–5.9 mm thick, flattened-ellipsoid, dark brown, dull, smooth, perichalazal ring not evident on surface; sarcotesta present [label description of *Rogstad 816* “with white .1 mm aril layer” interpreted as a sarcotesta]; aril absent.

**Distribution.** Three collections are known at present, from widely separated localities across New Guinea north of the Central Highlands (Fig. 17).

*Ecology.* Found in moderately open primary rainforest at elevations of 100–200 m on steep slopes, river valleys, and ridges. Specimens with flowers have been collected in May and August and with fruits in May and September.

*Etymology.* Named for Steven Rogstad, collector and photographer of the specimen from which the distinctive fruit of the species could be fully described.

*Additional specimens examined.* INDONESIA: **North Papua:** town of Sukarnapura (= Hollandia = Djajapura), 200 m, 8 Aug 1966 (fl), *Kostermans & Soegeng* 270 (L).

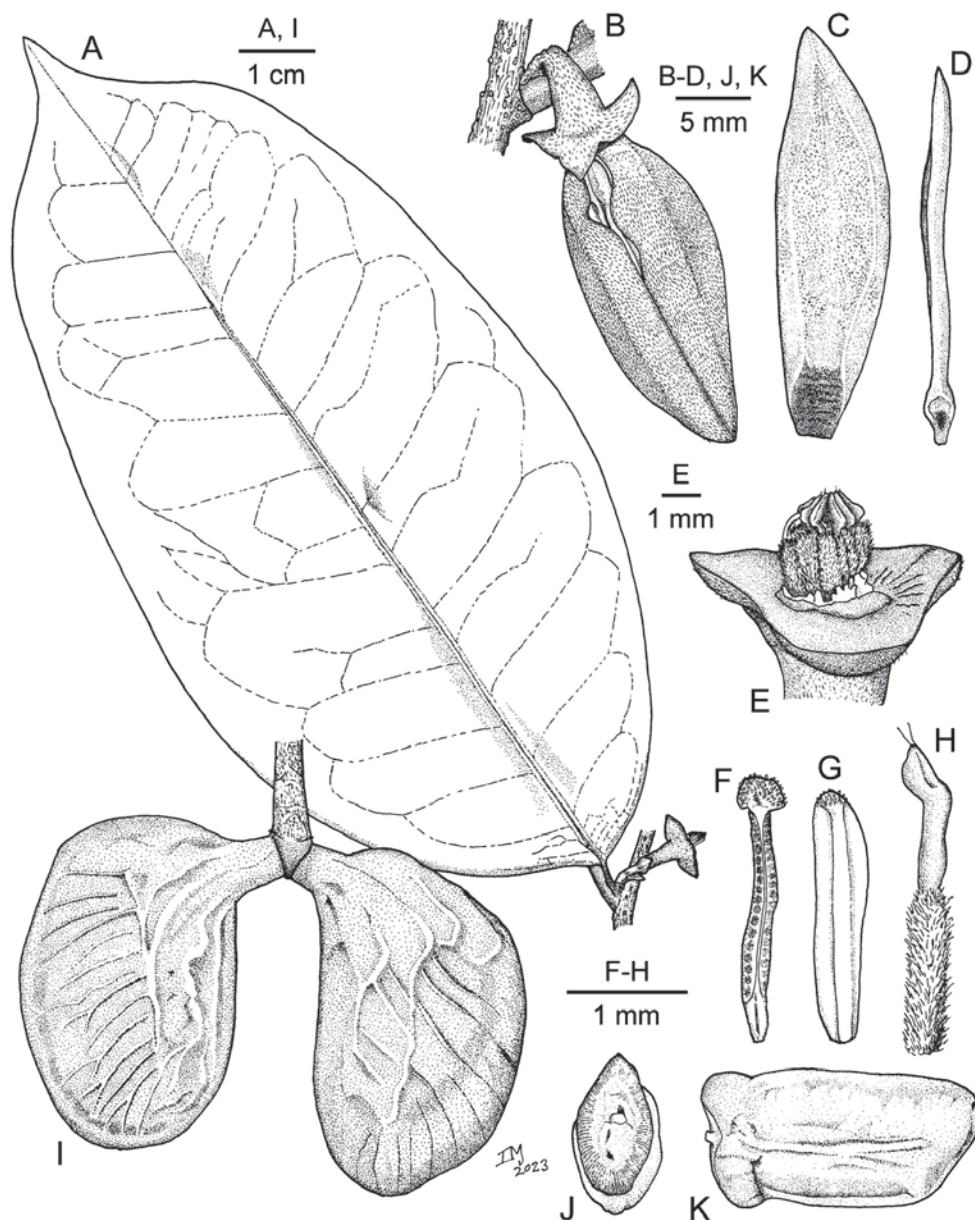
PAPUA NEW GUINEA: **East Sepik Province:** Niksek Village area nr the April River airstrip, 4°42'S 142°32'E, 200 m, 16 Sep 1984 (fr), *Rogstad* 816 (A + carpol., KEP, L [2 sheets]).

*Notes.* In overall features *Xylopia rogstadii* is most similar to *X. musella*. The massive monocarps, terete in cross-section with a thick fibrous pericarp, more strongly resemble those of *Xylopia takeuchii*, but the leaves and flowers of the two species are very different. The monocarps of *Xylopia rogstadii* are the largest known for any species in the genus and among the largest for the entire family. There are no branches on any of the specimens, thus presence or absence of two axillary branches per node is undetermined. A sterile specimen, *Takeuchi et al.* 14941 (A, K, L) from the Kamiali Wildlife Management Area, banks of the Saia River near Hessen Bay, alluvial forest, sea level, near 7°21.7'S 147°08.3'E, in Morobe Province, Papua New Guinea, is from a large tree with large oblong orange-brown resting buds and may be this species.

**15. *Xylopia sulangwane* D.M.Johnson & N.A.Murray, sp. nov.**

Species resembling *Xylopia peekelii* Diels in the few-flowered inflorescences, broad fleshy outer petals, and large monocarps with two rows of seeds, but differing in sparsely pubescent to glabrous young twigs, pedicels, sepals, and petals, greater number of stamens, densely pubescent ovaries, and slightly wrinkled monocarps with stipes 2–7 mm long and 3.9–6 mm thick. – TYPE: Solomon Islands, Guadalcanal, South West Guadalcanal, Wanderer Bay Area, 21 October 1968 (fl), *Fa'arodo & collectors BSIP 12184* (holotype K; isotype L [L0191300]). (Fig. 19)

Tree to 12(–18) m tall, dbh to 15 cm, trunk rarely with buttresses, bark light brown, grey, or white, smooth. **Twigs** brown to blackish brown, becoming light grey-brown, glabrous or sparsely pubescent with loosely appressed hairs 0.2–0.4 mm long but soon glabrate, smooth, becoming sparsely lenticellate; nodes with single axillary branches. **Leaves** with larger blades 13.1–18.7(–22) cm long, 6.2–8.5 cm wide, chartaceous, discolorous (grey/brown), elliptic, ovate, oblong, or obovate, base broadly cuneate to rounded and short-decurrent on petiole, apex acuminate, with an acumen 7–14 mm long, or occasionally obtuse, margins slightly revolute, glabrous adaxially, glabrous or with a few hairs along midrib abaxially; midrib plane adaxially, raised abaxially, secondary veins 10–13 per side, diverging from midrib at 60–75°, irregularly brochidodromous, slightly raised on both surfaces, higher-order veins indistinct to slightly raised adaxially,



**Fig. 19.** *Xylopia sulangwane* D.M.Johnson & N.A.Murray. **A.** Habit. **B.** Flower bud near maturity, side view. **C.** Outer petal, adaxial view. **D.** Inner petal, adaxial view. **E.** Sepals, androecium, and gynoecium, showing portion of staminal cone. **F.** Stamen, abaxial view. **G.** Staminode, abaxial view. **H.** Carpel. **I.** Fruit. **J.** Seed, micropylar view. **K.** Seed, side view. A, C, D from *Fa'arodo et al. BSIP 12184* (K); B, E–H from *Fa'arodo et al. BSIP 12184* (L); I from *Gafui et al. BSIP 10185* (SING); J, K from *Burn-Murdoch's collectors BSIP 6881* (US). Drawn by David Johnson.

slightly raised abaxially; petiole 4–11 mm long, flat to shallowly canaliculate adaxially, glabrous to sparsely pubescent. **Inflorescences** 1(–2)-flowered, arising from axils of leafy twigs or occasionally supra-axillary, peduncle absent, pedicels 6.5–14 mm long, 1.5–2.7 mm thick, glabrous to sparsely pubescent, bracts 3–4, 1.7–3 mm long, the 2–3 toward pedicel base often caducous, leaving only an encircling scar, bract nearest midpoint persistent, elliptic to broadly ovate, slightly clasping, apex acute to rounded, pubescent abaxially; buds narrowly ellipsoid, apex acute. **Sepals** 1/5–1/4-connate, spreading at maturity, apices occasionally reflexed, 3.5–5 mm long, 4.2–5.7 mm wide, coriaceous to a little woody, triangular, apex acute to obtuse, glabrous to sparsely pubescent abaxially. **Petals** pale yellow to cream, sometimes green-tinted in vivo, coriaceous to fleshy; outer petals more or less erect at maturity, 19.5–30(–41) mm long, 2.9–4.5 mm wide at base, 7.4–9 mm wide at midpoint, narrowly elliptic or elliptic, rarely lanceolate, base shallowly concave, apex trigonous, acute to obtuse, shallowly concave with a faint keel adaxially, flat with a faint keel abaxially, puberulent except for the glabrous base adaxially, sparsely pubescent to glabrate abaxially; inner petals more or less erect at maturity, 23–25.5 mm long, 1.8–3 mm wide at base, 1.3–2.3 mm wide at midpoint, linear, keeled on both surfaces, base deeply concave, apex acute, puberulent except for the glabrous basal concavity adaxially, puberulent except glabrous at the very base abaxially. **Stamens** 160–180, 2.5–2.9 mm long, linear-oblong, connective apex dome-shaped, occasionally slightly tongue-shaped, presence of outer staminodes not determined, inner staminodes 2.3–2.4 mm long, narrowly oblong to clavate; staminal cone 2.1–3 mm diam., 0.3–1 mm high. **Carpels** 4–12, ovaries 1.5–2.4 mm long, narrowly oblongoid, densely pubescent, stigmas 1–1.6 mm long, falciform, loosely appressed, glabrous except for small tuft of hairs at apex. **Torus** 3.2–4 mm diam., 0.4–0.5 mm high, plane. **Fruit** of 1–2 monocarps borne on a pedicel 12.5–17 mm long, 2.7–3.2 mm thick, glabrous, torus 4–5.6 mm diam., 3–5 mm high, somewhat pyramidal; monocarps with green exterior and magenta to vermilion endocarp in vivo, 3.9–5.8 cm long, 2.3–3.5 cm wide, 1.7–2.3 cm thick, flattened-ovoid to flattened-oblongoid, keeled abaxially, slightly wrinkled, glabrate, base contracted into a stipe 2–7 mm long, 3.9–6 mm thick, apex rounded to truncate, pericarp c. 2.9 mm thick, lacking air spaces and coarse fibers. **Seeds** 4–13 in two rows, perpendicular to long axis of monocarp, 13.7–22.2 mm long, 9.6–12.2 mm wide, 3.6–6.4 mm thick, flattened-ovoid, chalazal end umbonate, light brown, slightly shiny, smooth, perichalazal ring prominently raised; sarcotesta slate-grey in vivo; aril absent, hollow thickening surrounding the micropyle 8–9.5 mm wide, 2–2.5 mm high.

**Distribution.** *Xylopia sulangwane* is known only from the Solomon Islands, where it occurs from Shortland Island southward to Malaita and Guadalcanal (Fig. 10).

**Ecology.** Primary rainforest, rarely secondary forest, on low ridges and flat plains, most often on well-drained sites, at elevations to 100 m. Specimens with flowers have been collected in March, July, August, and October–December and with fruits in January, March, May–September, November, and December.

*Etymology.* A widely used local name for this species is adopted for the specific epithet.

*Local names.* *Aikao* (*Maenu'u* BSIP 5960, *Maenu'u* BSIP 6405), *lolofia* (*Hunt* 2377), *sulangwane* or *sulangwani* (Kwara'ae, all other collections). According to Whitmore (1966) the name *lolofia* is only used for two species of *Garcinia* L.

*Additional specimens examined.* SOLOMON ISLANDS: **Baga:** New Georgia Group, Baga Island, 8 Jan 1963 (fr), *Whitmore* BSIP 1302 (K, SING); New Georgia group, Baga Island, 28 Jan 1964 (fl, fr), *Whitmore* BSIP 2817 (K, L). **Guadalcanal:** SW Guadalcanal, Duidui area, 1500 ft, 11 Oct 1968 (fr), *Fa'arodo & collectors* BSIP 12141 (K, L); NE Guadalcanal, Rere River, 3 miles inland, 20 Nov 1963 (fl), *Lipageto* BSIP 3349 (K, L); NE Guadalcanal, Rere River, c. 3 miles inland, 28 Nov 1963 (fl, fr), *Whitmore* BSIP 3841 (K, L). **Kolombangara:** 2 miles E of Kuzi, camp site, 75 ft, 8 Sep 1965 (fr), *Arifanata* RSS 2569 (A, BISH, K); 2 miles NNW of Kuzi village, 75 ft, 23 Aug 1965 (fl, fr), *Hunt* 2377 (A, K, P, SING); S of Bambari Harbour, 6 Jan 1968 (fl), *Mauriasi & collectors* BSIP 7540 (K, L); South East Kolombangara, 31 May 1968 (fr), *Mauriasi & collectors* BSIP 9765 (K, SING); W Kolombangara, Rei area, 125 ft, 6 Feb 1968 (fl), *Gafui & collectors* BSIP 8925 (K, L). **Malaita:** Kwariakwa River Area (Su'u), West Malaita, 120 ft, 3 Jul 1968 (fr), *Gafui & collectors* BSIP 10185 (K, L, SING); Rokera, South Malaita, 26 Jul 1968 (st), *Gafui & collectors* BSIP 10421 (K, L); Small Malaita, Waiusuusu Area, 26 Aug 1969 (fr), *Gafui & collectors* BSIP 16319 (K, L); North East Malaita, 21 Nov 1968 (fl), *Mauriasi & collectors* BSIP 13460 (K, L). **New Georgia:** Segiline 81, SE New Georgia, valley bottom, 9 Sep 1966 (fr), *Burn-Murdoch's collectors* BSIP 6881 (K, L, US); NW New Georgia, Kinikini River, 130 ft, 30 Oct 1964 (fr), *Cowmeadow's Collectors* BSIP 3226 (K + carpol., L); Viru Harbor, SE New Georgia, 2 Jun 1965 (fr), *Maenu'u* BSIP 5960 (K, SING, US); New Georgia, Viru along reforestation road about 10 km E of Arara Forestry Camp, 8°29'S 157°40'E, 50 m, 5 Aug 1993 (fr), *Regalado & Sirikolo* 792 (F, K). **Nggela:** Big Nggela, Haleta area, 400 ft, 12 Jun 1969 (fl), *Gafui & collectors* BSIP 15037 (K, L); Nata River Area, Ghairavu-Big Nggela, 100 ft, 29 Jul 1969 (fl), *Gafui & collectors* BSIP 16844 (K, SING); Nggela Island, Taroaniara Area, 100 ft, 14 Mar 1970 (fl, fr), *Mauriasi & collectors* BSIP 18244 (K, SING). **Ranongga:** South East Ranongga, Viri upper area, 1 Jul 1969 (fl), *Mauriasi & collectors* BSIP 15747 (L). **Rendova:** SE Rendova Island, 150 ft, 14 Aug 1967 (fl, fr), *Burn-Murdoch's collectors* BSIP 7474 (K, SING). **Santa Isabel:** Binusa, NW Santa Isabel, 21 Jan 1966 (fr), *Beer's collectors* 6636 (K, US); Pilena Bay, SW Santa Isabel, 19 Apr 1966 (fr), *Beer's Collectors* 6478 (K, L); Ysabel Island, Garona, 22 Dec 1939 (fl, fr), *Brass* 3376 (A [2 sheets], BM, BO). **Shortland:** Kupala River Area, North West Shortland, 320 ft, 4 Mar 1969 (fl), *Mauriasi & collectors* BSIP 13153 (K, SING). **Tetepari:** Memesengo Point, E Tetepari Island, 150 ft, 21 Jul 1969 (fr), *Mauriasi & collectors* BSIP 15932 (K + carpol., L); East Tetepari Island, Memesengo Point, 100 ft, 22 Jul 1969 (fr), *Mauriasi & collectors* BSIP 15990 (K, L). **Vangunu:** Jalive (Vangunu), SE New Georgia, 25 ft, 21 Jul 1965 (st), *Maenu'u* BSIP 6405 (K + carpol., SING, US); New Georgia group, West Vangunu, inland from Bopo Village, 200 ft, 17 Dec 1962 (fl), *Whitmore* BSIP 1270 (K, L).

*Notes.* *Xylopia sulangwane* is widespread in the Solomon Islands archipelago and the large number of collections indicates that it may also be a relatively common species. It differs most conspicuously from *Xylopia peekelii* in the characters indicated in the diagnosis; in addition, it often has a persistent pedicel bract and the 160–180 stamens (vs c. 100) per flower are longer, 2.5–2.9 mm (vs 1.7–1.8 mm). *Xylopia sulangwane*

is remarkably uniform morphologically over its distribution, but two collections stand out as variants. One flower from the *Hunt 2377* collection from Kolombangara is notable for the length of the petals (up to 41 mm) on a plant that otherwise resembles the numerous collections of the species from that island. The significance of this outlier is unclear as mature flowering material is extremely limited. The collection *Mauriasi & collectors BSIP 13153* from Shortland Island, at the northernmost limit of the distribution of the species, has more pubescent leaves up to 22 cm long and narrower than those of other collections. Flowers of the latter collection conform to other material of the species.

**16. *Xylopia takeuchii* D.M.Johnson & N.A.Murray, sp. nov.**

Species resembling *Xylopia rogstadii* D.M.Johnson & N.A.Murray in the large brown scaly-lenticellate monocarps with a coarsely fibrous pericarp > 2 mm thick. It differs in the smaller leaf blade with impressed adaxial midrib, and smaller flowers with linear outer petals 25–29 mm long. – TYPE: Papua New Guinea, [Western Province], Palmer River, 2 miles below junction Blk R, 100 m, July 1936 (fl, fr), *Brass 7293* (holotype A + carpol.; isotypes BM, L [L0191275]). (Fig. 4, 18H–L)

Tree to 35 m tall, dbh unknown, “trunk spurred at base” [ex Brass], bark grey-brown to dark brown, rough. **Twigs** brown to grey, slightly wrinkled longitudinally, initially covered with light brown appressed hairs 0.2–0.3 mm long, soon glabrate; nodes with one or two axillary branches; paddle-shaped resting buds present. **Leaves** with larger blades 8.6–12.2 cm long, 3.2–4.7 cm wide, subcoriaceous to chartaceous, concolorous, elliptic or lanceolate, base cuneate and short-decurrent on petiole, apex acuminate with a somewhat falcate acumen 7–13 mm long, margins flat to slightly revolute, glabrous adaxially, with appressed hairs along midrib but otherwise glabrous abaxially; midrib impressed or nearly plane adaxially, raised abaxially, secondary veins 8–11 per side, diverging from midrib at 55–60°, sometimes slightly ascending, weakly to distinctly brochidodromous, secondary and higher-order veins slightly raised and indistinct adaxially, raised and conspicuous abaxially; petiole 5–9.5 mm long, canaliculate adaxially, sparsely pubescent. **Inflorescences** 1-flowered, arising from axils of fallen leaves, peduncle 3.5–6.3 mm long, 1–1.3 mm thick, pedicels 2–2.5 mm long, 1.2–1.5 mm thick, appressed-pubescent, bracts 2–4, 1.8–2.5 mm long, usually caducous except the uppermost bract subtending sepals persistent, broadly ovate to semicircular, apex obtuse, pubescent; buds narrowly oblong, occasionally falciform, apex obtuse. **Sepals** 1/2–2/3-connate, 3.2–3.7 mm long, 3.4–4.1 mm wide, coriaceous, broadly ovate, apex broadly acute, appressed-pubescent abaxially. **Petals** cream-coloured in vivo, coriaceous; outer petals slightly spreading at maturity, 25–29 mm long, 2.9–3.5 mm wide at base, 1.5–1.8 mm wide at midpoint, linear, base shallowly concave, apex minutely trigonous, obtuse, canaliculate to near apex adaxially, slightly keeled abaxially, densely puberulent except for the glabrous base adaxially, loosely appressed-pubescent abaxially; inner petals erect with tips spreading at maturity, 23–24 mm long, 1.5–2.3 mm wide at base, 0.7–0.8 mm wide at midpoint, linear, strongly keeled

on both surfaces, base concave, apex acute, puberulent on both surfaces. **Stamens** c. 140, 1.1–1.4 mm long, narrowly oblong, connective apex bluntly conical, presence of staminodes not determined; staminal cone 1.7–2 mm diam., 0.4–0.5 mm high. **Carpels** 2–3, ovaries c. 2 mm long, narrowly oblongoid, sparsely pubescent, stigmas not examined. **Torus** 2.6–3.1 mm diam., plane. **Fruit** of 1–2 monocarps borne on a pedicel 7–14 mm long, 6–9.5 mm thick, appressed-pubescent to glabrate, torus 10–17 mm diam., plane to 3 mm high; monocarps with brown exterior and brilliant red endocarp in vivo, 7.4–8.8 cm long, 4.8–6.3 cm wide, 5.2–6.2 cm thick, broadly ellipsoid to subglobose, terete in cross-section, scaly-lenticellate, glabrate, base contracted into a stipe 6–9 mm long, 18–19 mm thick, apex rounded, pericarp 18–24 mm thick, with air spaces and coarse fibers. **Seeds** 12–18 in two rows, perpendicular to long axis of monocarp, 15.2–20.2 mm long, 8.7–12.7 mm wide, 4.4–7.8 mm thick, flattened-ellipsoid to flattened-oblongoid, dark brown, shiny, smooth, perichalazal ring visible as faint ridge on surface; sarcotesta thin, whitish-blue in vivo; aril absent.

**Distribution.** Known at present from the lowlands and foothills on the southern slope of the Central Highlands in the Western and Southern Highlands Provinces of Papua New Guinea (Fig. 17).

**Ecology.** Ridge forest, hill forest on karst limestone, and primary forest on old well-drained volcanic soil, at elevations of 100–700 m. The specimen with flowers was collected in July and specimens with fruits were collected in July, September, and October.

**Etymology.** The species is named for Wayne Takeuchi, in recognition of his contributions to knowledge of the New Guinea flora, and his excellent and informative collection of the species, complete with photographs.

**Additional specimens examined.** PAPUA NEW GUINEA: **Southern Highlands Province:** Mt Bosavi, N side, 6°26'S 142°50'E, 600–700 m, NW of mission, 8 Oct 1973 (fr), *Jacobs 9075* (BISH, L [2 sheets], US); Mt Bosavi, 29 Oct 1973 (fr), *Jacobs 9516* (BISH, L [2 sheets], US); karst NW of Yorokobain, 6°32'S 143°09'E, 600 m, 10 Sep 1993 (fr), *Takeuchi 9187* (A [2 sheets] + carpol., L [2 sheets] + carpol.).

**Notes.** The massive monocarps of *Xylopia takeuchii* are exceeded in size only by those of *X. rogstadii*, which occurs north of the Central Highlands. The two species are readily distinguished by both their leaves and flowers. The label of *Jacobs 9075* provides a vivid description of the dehiscent fruit of *Xylopia takeuchii*: “at maturity ± turned inside out, exposing the glossy velvety black seeds in a mess of meat-like appearance. No taste, but a pitch-like aroma recalling *Pittosporum* fruits”.

The collection *Takeuchi & Kulang 11419* (A, BRIT, K, KEP, L, NY), Papua New Guinea, Gulf Province, Lakekamu, E branch of the Avi Avi River, lowland alluvial forest along the Bulldog track from base camp, 7°44'S 146°29.5'E, 105 m, 23 Oct 1996 (fl), may represent this species. The flowers are still in bud stage and thus

difficult to compare with the mature flowers of the type specimen, but the specimen has long inflorescence peduncles and small leaves with an impressed adaxial midrib. Three additional specimens show similarity in leaf shape and long peduncles of the inflorescence: *Aet* (*exp. Lundquist*) 134 (K, L), McCluer gulf, Anakasi near Babo, 50 m, 16 May 1941 (bud), and *Moll BW 12996* (BISH, L [2 sheets], WAG), Armina, Sjuga-Wagura area, Bomberai Peninsula, 7 May 1962 (buds, young fr), have flowers still in bud and are from the Bird's Head Peninsula of Indonesian New Guinea. *Weiblen TP 397* (MIN), Simbu Province, Crater Mountain Wildlife Management Area, O-Pio 1 ha plot, block 17, 6°47'19"S 145°02'12"E, 550 m, 31 Jul 1996 (st), is from Papua New Guinea in the general area of other *Xylopia takeuchii* collections and is sterile, but has leaf and bud shape similar to those of the species.

**17. *Xylopia vulcanicola* D.M.Johnson & N.A.Murray, *sp. nov.***

Species differing from all congeners in the woody tubercles forming near the shoot apex, from which flowers emerge after leaves have fallen. It is most similar to *Xylopia peekelii* Diels, *X. bullata* D.M.Johnson & N.A.Murray, and *X. sulangwane* D.M.Johnson & N.A.Murray in the relatively broad leaves and large wrinkled monocarps with green exocarp at maturity, but distinguished from these species by the combination of monocarps short-stipitate and wrinkled but not keeled, small rigid wide-spreading sepals, and outer petals lanceolate, 10.3–20.3 mm long. – TYPE: Papua New Guinea, Bougainville, lower south slopes of Lake Loloru crater, c. 14 miles N of Buin, primary montane rainforest, c. 2300 ft, 13 August 1964 (fl, fr), *Craven & Schodde 258* (holotype L [L0191297, L0191298]; isotypes A + carpol., CANB spirit coll., K + carpol.). (Fig. 8I–P)

Tree to 25 m tall, dbh to 38 cm, trunk with thick buttresses “steep, spreading, to 2 ft.” [*Whitmore's collectors BSIP 5850*] or buttresses absent, bark light brown to white, pustular or smooth. **Twigs** brown, slightly wrinkled, appressed-pubescent with hairs 0.1–0.4 mm long, becoming glabrate, whitened and the loosening bark marked with abundant round light-coloured lenticels; nodes with single axillary branches. **Leaves** with larger blades 9.5–14.5 cm long, 4.2–6.1 cm wide, subcoriaceous to chartaceous, discolorous (grey/brown), elliptic, oblong-elliptic, or oblong-oblancheolate, base broadly cuneate and short-decurrent on petiole, apex acuminate with an acute or obtuse acumen 4–11 mm long, margins flat to slightly revolute, glabrous adaxially, sparsely appressed-pubescent to glabrate abaxially; midrib plane adaxially, raised abaxially, secondary veins 8–10 per side, diverging from midrib at 45–70°, irregularly brochidodromous, these and higher-order veins indistinct adaxially, slightly raised abaxially; petiole 2.5–6 mm long, shallowly canaliculate adaxially, sparsely pubescent. **Inflorescences** 1–3-flowered, initiated in leaf axils but flowers not emerging until after leaves have fallen, persistent as conspicuous tubercles on leafless portions of twigs, with a widened somewhat woody base from which the pedicels arise, pedicels 3.5–7.1 mm long, 1.5–2 mm thick, appressed-pubescent, bracts 2, 1.5–2.5 mm long, attached near base of pedicel, broadly ovate to semicircular, apex rounded and slightly notched,

pubescent; buds lanceolate, apex obtuse. **Sepals** basally connate, spreading from early in development, 3.2–3.8 mm long, c. 4 mm wide, coriaceous, triangular-ovate, apex acute to acuminate, pubescent abaxially. **Petals** whitish green, white, or yellow in vivo, coriaceous to slightly fleshy; outer petals slightly spreading at maturity, 10.3–20.3 mm long, 3.1–3.9 mm wide at base, 1.9–3.4 mm wide at midpoint, lanceolate, base shallowly concave, apex trigonous, obtuse, flat or shallowly concave with a faint keel adaxially, slightly keeled abaxially, densely puberulent except for the glabrous base adaxially, densely appressed-pubescent abaxially; inner petals erect at maturity, 12.2–17.4 mm long, 2–2.8 mm wide at base, 0.5–1 mm wide at midpoint, linear-subulate, keeled on both surfaces, more strongly so abaxially, base concave, apex acute, densely puberulent except for the glabrous base on both surfaces. **Stamens** c. 100, 2–2.4 mm long, narrowly oblong, connective apex short tongue-shaped and slightly thickened, presence of staminodes not determined; staminal cone 2–2.2 mm diam., 0.2–0.5 mm high. **Carpels** 6–7, ovaries 1.3–1.4 mm long, oblongoid, densely pubescent, stigmas 0.8–1.2 mm long, falciform, free or loosely connivent, glabrous. **Torus** 2–3.2 mm diam., plane. **Fruit** of up to 5 monocarps borne on a pedicel 8–14 mm long, 2.9–5.5 mm thick, glabrate, torus 5.5–12.5 mm diam., 4–8 mm high, depressed-globose to pyramidal; monocarps with green exterior and magenta to red endocarp in vivo, 3.4–4.8 cm long, 1.9–2.7 cm wide, 0.9–1.9 cm thick, reniform, wrinkled, glabrate, base contracted into a stipe 2–3.5 mm long, 6–6.5 mm thick, apex obtuse to truncate, pericarp 1–3 mm thick, lacking air spaces and coarse fibers. **Seeds** 5–7, in two slightly overlapping rows, perpendicular or slightly oblique to long axis of monocarp, 13.5–16 mm long, 7.6–13.3 mm wide, 5.3–5.8 mm thick, flattened-ovoid, ellipsoid, or narrowly oblongoid, light reddish or pinkish brown, slightly shiny, slightly wrinkled, perichalazal ring visible on surface, sometimes forming a slight ridge; sarcotesta not obviously present; aril absent, a slight thickening surrounding the micropyle.

*Distribution.* Known from Bougainville Island, Papua New Guinea, and Shortland, Kolombangara, Choiseul and Santa Isabel islands of the Solomon Islands (Fig. 10).

*Ecology.* Often collected in areas of volcanic soils, the species grows in rainforest on ridges, slopes, and hillsides, from lowlands up to 850 m. One collection label indicates a soil substrate of light grey sand mixed with pumice. Species of *Alstonia* R.Br., *Celtis* L., *Ficus* L., and *Vitex* L. were associated at one site on Bougainville (Volk & Robinson NGF 817). Specimens with flowers have been collected in January, May, August, November, and December and with fruits in February, August, and November.

*Etymology.* The specific epithet alludes to the volcanic features of sites where the species occurs on the island of Bougainville.

*Local names.* *Boranco* (N. Buka, Volk & Robinson NGF 817), *sulangwane* (Kwara'ae, Gafui & collectors BSIP 18633), *sulangwani* (Kwara'ae, Whitmore's Collectors BSIP 5850), *wara waro* ("L", Volk & Robinson NGF 817).

*Additional specimens examined.* PAPUAN NEW GUINEA: **Bougainville Province:** Bougainville Island, Bau-noui, Konigururu, Buin, 850 m, 8 Feb 1930 (fr), *Kajewski 2005* (A, L, SING); Kieta District, Bougainville Island, 2/2 Forestry Sawmill area, Torokina, 24 Jan 1945 (fl), *Volk & Robinson* [*K. Mair* on BISH, L sheets] *NGF 817* (A, BISH [2 sheets], BRI, K, L). SOLOMON ISLANDS: **Choiseul:** Susuka Area, N Choiseul Island, 120 ft, 16 Dec 1969 (fl), *Gafui & collectors BSIP 18633* (K, SING). **Kolombangara:** SE Kolombangara, Bambari Harbour, Lever's enumeration line, 24 Nov 1962 (fl, fr), *Whitmore & Womersley 845* (K, L). **Shortland:** Northern Shortland Island, 7 May 1964 (fl), *Whitmore's Collectors BSIP 5850* (K, L). **Santa Isabel:** Santa Ysabel, Allardyce Harbour, 10 Jan 1964 (fl), *Whitmore's collectors BSIP 3611* (K, L, SING).

*Notes.* *Xylopi*a *vulcanicola* overlaps in distribution with *X. sulangwane* on several of the northern Solomon Islands, but may be readily distinguished by the unique inflorescence tubercles of the former. The label of *Whitmore's Collectors BSIP 5850* reports the flowers as "scented" and of *Volk & Robinson NGF 817* as flowers having a "pleasant smell". The fruit is described as smelling "strongly of turpentine when cut" (*Kajewski 2005*). Collectors note that the bole is straight. *Xylopi*a *vulcanicola* was identified as both "*Cyathocalyx* sp." (*Kajewski 2005*) and "*Xylopi*a *peekelii*" (*Volk & Robinson NGF 817*, *Craven & Schodde 258*) in Foreman (1971).

### Excluded species

*Xylopi*a *micrantha* Scheff., Ann. Jard. Bot. Buitenzorg 2: 27 (1885). – TYPE: Indonesia, New Guinea, Monte Arfak a Putat, Oct 1872, *Beccari P.P. 849* (lectotype FI-B [FI007586], designated by Diels (1912); isoelectotype B [B 10 0365074]).

*Notes.* Diels (1912) indicated that the descriptions of Scheffer were based on the Beccari collections at Florence. Turner (2018) interpreted the statement of Diels as a lectotypification. In the same publication, Diels (p. 150) suggested that the type specimen was probably a species of *Mitrella* Miq., but he did not make the combination. We agree that it belongs to this genus and not to *Xylopi*a.

### Conclusions

A complex picture of *Xylopi*a diversity emerged from the study, which documents a wide distribution across islands and a more than five-fold increase in the known species, from three to 17. Distinctive features in species of the region include exceptionally tall trees to 48 meters, paddle-shaped cataphyll-covered resting buds, massive thick-walled fruits, hollow expanded seed bases, and ultramafic associations. Based on currently available collections, island size is not indicative of species richness: New Guinea, by far the largest regional island, with exceptional elevational and geological heterogeneity, has eight species; New Britain, more than an order of magnitude smaller, has two; Santa Isabel Island, an order of magnitude smaller still, has four.

Sympatry in the region is rare, with only a handful of situations where two (but no more) species have been collected at the same site. Multiple species in a small area are known elsewhere. For example, seven species occur in both the 50 hectare plot at Pasoh Reserve in Malaysia and the 29 hectare Betampona Reserve in Madagascar, six species are known from Bukit Timah localities in Singapore, and the authors have observed three species growing side by side in the Pugu Reserve in Tanzania. These species-rich sites can include narrowly restricted species related to Pleistocene refugia (Cannon et al., 2009; Johnson & Murray, 2015).

The island of New Guinea is the second-largest in the world, but it was assembled in many stages and from disparate elements (Quarles van Ufford & Cloos, 2005; Davies, 2012). The lowland moist forests have a greater floristic affinity to those of the Sunda region than to the Sahul region, explained by eastward dispersal from Southeast Asia since the mid-Miocene (Van Balgooy, 1976; Joyce et al., 2021). At higher elevations, the New Guinea flora is dominated by Sahul-derived taxa (Brambach et al., 2020). The eight *Xylopia* species of the island share Sunda region affinities and have low elevational ranges—only a single specimen has been collected above 1000 meters—and ranges are generally of wide amplitude. In contrast, on Madagascar, a drier island about two-thirds the size of New Guinea, 30 species of *Xylopia* mostly occupy narrow sharply-defined elevational ranges and six have ranges exceeding 1000 m (Johnson & Murray, 2020).

As a group, the New Guinea species are taller trees than those of the smaller islands and include species among the tallest in the genus. *Xylopia calosericea* and *X. papuana*, which share floral traits, are the most widespread species, extending beyond New Guinea to the Solomon Islands and Tanimbar and Aru Islands, respectively. *Xylopia aenea*, a morphological isolate, has a disjunct distribution in the Bird's Head Peninsula and the upper Fly River basin. Given the paucity of collections further field work is needed to understand this pattern, but Diamond (1973) observed that similar patchy distributions occur in taxonomically isolated New Guinea bird species. The remaining species, *Xylopia corrugata*, *X. musella*, *X. pachysericea*, *X. rogstadii*, and *X. takeuchii*, share resting bud morphology; none is common, but as a group they are widely distributed on the island. The cataphyll-covered buds are unexpected in a rainforest environment and unique in the genus, perhaps suggesting dormancy periods associated with past seasonal climates. Although the resting bud group remains poorly known, it includes the two species with the largest monocarps in the genus and the New Guinea *Xylopia* species with ultramafic associations.

With 11 species, the surrounding regional islands have a slightly greater aggregate diversity than New Guinea itself. Two New Guinea species also occur on regional islands. Confined to the Bismarck and Solomon archipelagos are *Xylopia peekelii* and five similar species, some of which have seeds with a hollow enlargement that may promote flotation. The Bismarck Archipelago species occur only on individual islands (Fig. 12), a pattern also noted by Timm et al. (2016) for the rodent fauna. A final *Xylopia* group comprises *X. chlorosperma* and *X. ampla* from Halmahera, an island that is usually considered part of Wallacea, but they are not similar to species from other Wallacean islands such as Sulawesi. They do, however, occur on islands usually

associated with New Guinea, Waigeo and Japan. The distribution suggests a mixed picture of the floristic ties of Halmahera, an interpretation in keeping with the results of Joyce et al. (2021) and Skeels et al. (2023). We should also consider the hypothesis that smaller islands played a role as sources of colonisation for continents and larger islands in *Xylopi*a, as demonstrated for hydromyine rodents (Roycroft et al., 2022) and fruit-eating arboreal pigeons (Oliver et al., 2023).

Throughout the region we documented *Xylopi*a species associated with ultramafic sites, some appearing to have obligate associations, others facultative. The adaptations that allow species in the genus to grow on ultramafic sites are unknown, but ultramafic-associated *Xylopi*a species also occur in other areas, notably Cuba (pers. obs.) and New Caledonia (Johnson et al., 2013). Garnica-Díaz et al. (2022) pointed to the “gaps in knowledge” of ultramafic vegetation in the New Guinea region and, despite progress, this remains true for *Xylopi*a. Whitmore (1966) commented that there were few known endemics on Solomon Island ultramafic sites, and viewed the ultramafic soils as “a kind of sieve, which lets part of the flora through, that part then proliferates”, an interpretation which, without more data, still seems apt for *Xylopi*a. Are the ultramafic-associated *Xylopi*a species of the New Guinea region related to one another? Perhaps. Occurring on Halmahera and in the Solomon Islands, respectively, *Xylopi*a *chlorosperma* and *X. brunneola* share the same type of small corky aril, which may also occur in *X. ampla* (poor material), a trait not otherwise found among the regional species. And, as noted above, on New Guinea all species associated with ultramafic sites share cataphyll-covered resting buds.

The present-day distribution of *Xylopi*a in the region, which includes a number of oceanic islands, indicates the plants’ capacity for over-water dispersal and establishment. Although all species share a dispersal syndrome favoring birds or other diurnal vertebrates, regional documentation is limited to a single study on New Guinea (Brown & Hopkins, 2002). These authors found nine avian dispersers, including widely foraging fruit-pigeons and resident birds-of-paradise. Fruit and seed variations in the regional species, as well as studies of analogous dispersal systems, lead us to predict that a larger more diverse suite of extant dispersal systems exists for *Xylopi*a (Pratt & Stiles, 1985; Mack, 1995; Oppel & Mack, 2010; Holzmeyer et al., 2023) and that evolution of the genus may have been shaped by the dispersal community as has been documented in palms (Onstein et al., 2018). For *Xylopi*a, the concurrent evolution of fruit-pigeons in the region may be particularly significant (Oliver et al., 2023). *Xylopi*a is one of five of 42 Asian Annonaceae genera that extend eastward to New Caledonia and Fiji (Turner & Utteridge, 2017). In contrast, another Annonaceae genus, *Pseuduvaria* Miq., with 20 species on the island of New Guinea, has only two species on surrounding islands, both of which are shared with New Guinea, and the genus extends no further east (Su & Saunders, 2006).

The present study and previous work (Thomas et al., 2015; Stull et al., 2017) provide evidence that *Xylopi*a dispersed into the region from west of Wallace’s Line, multiple times and along different routes. For example, the aril type found in *Xylopi*a *chlorosperma* and *X. brunneola* is also known from *X. vielana* Pierre and *X. platycarpa* D.M.Johnson & N.A.Murray of mainland Southeast Asia as well as *X. vieillardii*, *X.*

*pallescens* Baill., and *X. dibaccata* Däniker from New Caledonia. *Xylopia calosericea* and *X. papuana*, the most widespread regional species, resemble yet another Southeast Asian species group. *Xylopia aenea* is a regional isolate, but is best accommodated in *Xylopia* sect. *Rugosperma* from Southeast Asia. An analogous pattern of multiple dispersals from Southeast Asia was recently described for *Dysoxylum* Blume ex Raspail, s.l. (Meliaceae), which, like *Xylopia*, is a group of lowland forest trees predominantly dispersed by birds (Holzmeyer et al., 2023). *Xylopia* may therefore be part of a pattern of lowland trees exhibiting repeated regional dispersals.

With its wide distribution and dispersal-related traits, *Xylopia* can serve as a model for understanding dispersal dynamics of tropical forest trees across Asia and the Pacific. In *Xylopia* sect. *Stenoxylonia*, preliminary data indicate that divergence between the Asian/Pacific and African species took place c. 16 Ma, with divergence of Australian from Southeast Asian species at c. 14 Ma (Thomas et al., 2015). An ongoing phylogenomic study will provide a more complete framework for evolutionary reconstruction, including for *Xylopia* sect. *Rugosperma*, but these dates suggest that multiple dispersals were plausible after the collision of the Sunda and Sahul shelves at about 25 Ma brought the Asian and Australian areas into their closest proximity (Joyce et al., 2021). Joyce et al. (2021) stressed the importance of environmental variables and available landmass, i.e. establishment, over dispersal barriers in determining floristic composition in the New Guinea region. However, multiple successful dispersals and speciation across a complex and changing landscape suggest that *Xylopia* is well-suited in terms of both dispersal and establishment traits.

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**Appendix 1.** Collections not confidently assignable to a described species, but identifiable as *Xylophia* and included in Fig. 5.

### Indonesian New Guinea:

*Aet (exp. Lundquist) 134* (K, L), Irian Jaya, McCluer gulf, Anakasi near Babo, 50 m, 16 May 1941 (buds). Most similar to *Xylophia takeuchii*.

*Kalkman BW 6423* (L), Jibi, c. 5 km N from Ninati, Sb. Division Moejoe, Div. Sth. New Guinea, 9 Mar 1959 (st). The fruit description on the label makes clear that the specimen is a *Xylophia* but no fruit is present.

*Koster BW 13550* (L), Maroeni Creek, near Andai, SW of Manokwari, 20 m, 17 Dec 1961 (fr). The label indicates that the specimen came from a shrub with brown fruits and, visible after dehiscence, an orange-red endocarp. In habit and distribution the plant resembles *Xylophia ampla*, but the stipitate monocarps and fine appressed orange-brown pubescence of the twigs and flower buds are more similar to *X. peekelii*. More material is needed, but it is probably an undescribed species. The plant was reported to be common in the site where it was collected.

*Kostermans & Soegeng 442* (K, L), town of Sukarnapura (= Hollandia = Djajapura), 150 m, 21 Aug 1966 (st). Resembles *Xylophia calosericea* but the leaves are large for that species.

*Moll BW 12996* (BISH, L [2 sheets], WAG), Irian Jaya, Armina, Sjuga-Wagura area, Bomberai Peninsula, 7 May 1962 (buds, young fr). Most similar to *Xylophia takeuchii*.

*Netherlands Indies Forest Service bb. 30552* (L, SING), Seroei, Eil. Japon, c. 350 m, 23 Aug 1939 (st). Resembles *Xylophia papuana*.

*Netherlands Indies Forest Service bb. 30606* (BISH, L, NY, SING), Hollandia Noenggoeakoe, 7 Sep 1939 (st). Resembles *Xylophia papuana*.

*Schram BW 1731* (L), Manokwari, Sidei, 9 Mar 1955 (fr). Specimen with paddle-shaped resting buds. Monocarps appear full-sized but seeds are undeveloped.

*Schram BW 6163* (A, BO, L), Skendi, N of Teminaboean, Vogelkop Peninsula, 20 May 1958 (bud, fr). Monocarps similar to those of preceding, but seeds also undeveloped. Paddle-shaped resting buds present.

*Schram BW 9476* (BISH, L), Sekoli, S of Lake Sentani, Div. Hollandia, 25 Feb 1960 (buds). Resembles *Xylophia pachysericea* in the narrow acuminate leaves and cup-shaped calyx, but all parts of the specimen are glabrous.

*Schram BW 12414* (L), Warsamson valley, E of Sorong, 40 m, 4 Aug 1961 (buds). Buds minute, specimen has paddle-shaped resting buds and double-branching.

### Papua New Guinea:

*Hoogland & Craven 10820* (A + carpol., K, L, US), Sepik District, along Yapa (Hunstein) River, Abunti Subdistrict, 500 ft, 3 Aug 1966 (fr). Immature fruit has fibrous pericarp with air spaces but specimen does not resemble any of the species with that fruit morphology; seeds undeveloped.

*Kairo NGF 45026* (A, BISH, K, L, SING, US), Morobe Province, Morobe District, Saru River 7 miles SE of Garaina, Lae subdistrict, Morobe district, 7°55'S 147°14'E, 2000 ft, 21 Jul 1970 (fr). Specimen was collected at the same site as *Streimann NGF 43480* but does not appear to be the same species. It differs from that species in the smaller leaf and ellipsoid brown scaly-lenticellate monocarps. Label reports green middle bark, also noted for some specimens of *Xylophia corrugata* and *X. musella*.

*Saunders 263* (A, L), Madang Subdist., Ramu valley c. 5 m SE Faita airstrip, 14 Jun 1955 (st). Specimen with paddle-shaped resting buds. In vegetative features resembles *Xylopia corrugata*.

*Takeuchi & Kulang 11419* (A, K, KEP, L, NY), Gulf Province, Lakekamu, E branch of the Avi Avi River, lowland alluvial forest along the Bulldog track from base camp, 7°44'S 146°29.5'E, 105 m, 23 Oct 1996 (buds). Most similar to *Xylopia takeuchii*.

*Takeuchi et al. 14941* (A, K, L), Morobe Province, Kamiali Wildlife Management Area, banks of the Saia River near Hessen Bay, alluvial forest, sea level, near 7°21.7'S 147°08.3'E, 14 Jan 2001 (st). Specimen taken from a large tree with large orange-brown paddle-shaped resting buds. Identified as *Xylopia* sp. in Takeuchi (2003b). Most similar to *Xylopia rogstadii*.

*Weiblen TP 397* (MIN), Simbu Province, Crater Mountain Wildlife Management Area, O-Pio 1 ha plot, block 17, 6°47'19"S 145°02'12"E, 550 m, 31 Jul 1996 (st). Resembles *Xylopia takeuchii* in leaf shape, impressed leaf midrib, and axillary bud shape.

