

## *Syzygium jiewhoei* (Myrtaceae), a new endemic tree from Western New Guinea, Indonesia

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**ABSTRACT.** *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low, a new species from Western New Guinea, Indonesia, is described and illustrated. It is closely related to *Syzygium recurvovenosum* (Lauterb.) Diels but differs in a range of vegetative and reproductive morphological characteristics.

**Keywords.** East Malesia, Papua Province, Sahul shelf, *Syzygium recurvovenosum*

### Introduction

New Guinea, the largest tropical island in the world, is located in the Malesian region with an area of approximately 800,000 km<sup>2</sup>. Politically, it is divided into two roughly equal halves: to the east is Papua New Guinea and to the west is Indonesian New Guinea, comprising the provinces of Papua and West Papua. Biogeographically, New Guinea is part of the Sahul shelf, that also includes Australia and Tasmania, and these regions share similar floristic elements that are distinct from those on the Sunda shelf (Gressitt, 1982; Pieters, 1982). Hence, the phytogeography of the Malesian region has been a focus of research by tropical botanists (Van Steenis, 1950; Van Welzen et al., 2011; Crayn et al., 2015). A comprehensive Flora of New Guinea is still lacking. However, efforts by various botanical institutions have led to checklists, guides and monographs of selected plant groups, such as the orchids (Schuiteman & de Vogel, 2001, 2002, 2005, 2006, 2008; Schuiteman et al., 2010), palms (Heatubun, 2002; Baker & Dransfield, 2006; Heatubun et al., 2012), and alpine plants (Van Royen, 1979a, 1979b, 1982, 1983; Johns et al., 2006), etc.

*Syzygium* Gaertn. is one of the largest genera in the world, with about 1200–1800 species occurring principally in the Old World (Frodin, 2004; Parnell et al., 2007; *Syzygium* Working Group, 2016). A recent analysis reveals that *Syzygium* is

the genus with the largest number of tree species, about 1069 species in all (Beech et al., 2017). *Syzygium* diversity in New Guinea is expected to be extremely rich, with species occurring from the lowlands to the highlands (Craven, 2006), but identification of *Syzygium* species has always been difficult due to a lack of good morphological diagnostic characters, resulting in an accumulation of unidentified materials in many herbaria (Hartley & Perry, 1973; Craven, 2006; Craven & Biffin, 2010).

Among the earliest botanists to examine New Guinean *Syzygium* was Carl Lauterbach (Van Steenis-Kruseman, 1950). He described many new species, including some under segregate genera that are now considered synonyms of *Syzygium*, such as *Aphanomyrtus* Miq. and *Jambosa* Adans. (Lauterbach, 1910, 1912). Later, Friedrich Diels (see Van Steenis-Kruseman, 1950) described many more *Syzygium* species for New Guinea, some of them under *Jambosa* (Diels, 1922; Diels et al., 1929). Merrill & Perry (1939a, 1942a, 1942b) meticulously examined the enormous volume of material of New Guinean *Syzygium* gathered during the Archbold Expeditions. It was Merrill & Perry (1939b), in a treatment of *Syzygium* in Borneo, who synonymised *Jambosa*, and also a few other segregate genera in the *Syzygium* alliance, under *Syzygium*. Later, Hartley & Perry (1973) attempted to revise the by-then much larger *Syzygium* diversity of Papuasia. They recognised 138 species and also listed 69 species of unknown status or which were to be excluded from Papuasia, citing lack of materials for close examination while preparing the account. A recent enumeration in the *World Checklist of Myrtaceae* recorded 195 species of *Syzygium* for New Guinea (Govaerts et al., 2017).

In 1993, while assisting Freeport to establish a plant nursery at Timika under the Incubator Project, the first author stumbled upon several attractive juvenile plants of an unidentified *Syzygium* species with exceptionally long pendulous leaves in the forested area of Kuala Kencana. Ten years later, the first author visited Timika again and this provided an opportunity to procure seeds and seedlings of the peculiar Kuala Kencana *Syzygium* species for cultivation. From these materials, one of the plants was successfully established and is growing vigorously in the garden of Mr Tan Jiew Hoe in Singapore. The tree in Singapore eventually produced flowers and fruits, providing us with sufficient materials to examine for this study. The unidentified Kuala Kencana *Syzygium* is closely related to *Syzygium recurvovenosum* (Lauterb.) Diels but is distinct based on the suite of morphological characters listed in Table 1. It is concluded that the attractive Kuala Kencana *Syzygium* is an undescribed novelty from Western New Guinea and is named here as *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low.

## Material and methods

A review of all New Guinean *Syzygium* species was conducted, based on herbarium specimens preserved in BO, K and SING (herbarium acronyms follow Thiers, 2017, continuously updated). Conventional methods employed in herbarium taxonomy were applied in this study. All measurements were taken from dried herbarium specimens. Photographic documentation is of the living specimen growing in Mr Tan Jiew Hoe's

**Table 1.** Comparison of morphological characteristics between *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low and *S. recurvovenosum* (Lauterb.) Diels.

	<i>Syzygium jiewhoei</i>	<i>Syzygium recurvovenosum</i>
Young twigs	Prominently quadrangular and winged	Prominently quadrangular
Lamina	Slightly bullate	Unknown
Secondary veins	90–100 pairs	Up to 55 pairs
Inflorescence	c. 14–16 cm long	Up to 9 cm long
Peduncle	c. 13–15 mm wide	Up to 3.5 mm wide
Style	c. 8–18 mm long	c. 4 mm long
Fruits	Ovoid to broad-ellipsoid, 4–6 cm long, maturing salmon-pink	Pyriform, 2.3 cm long, red (immature)

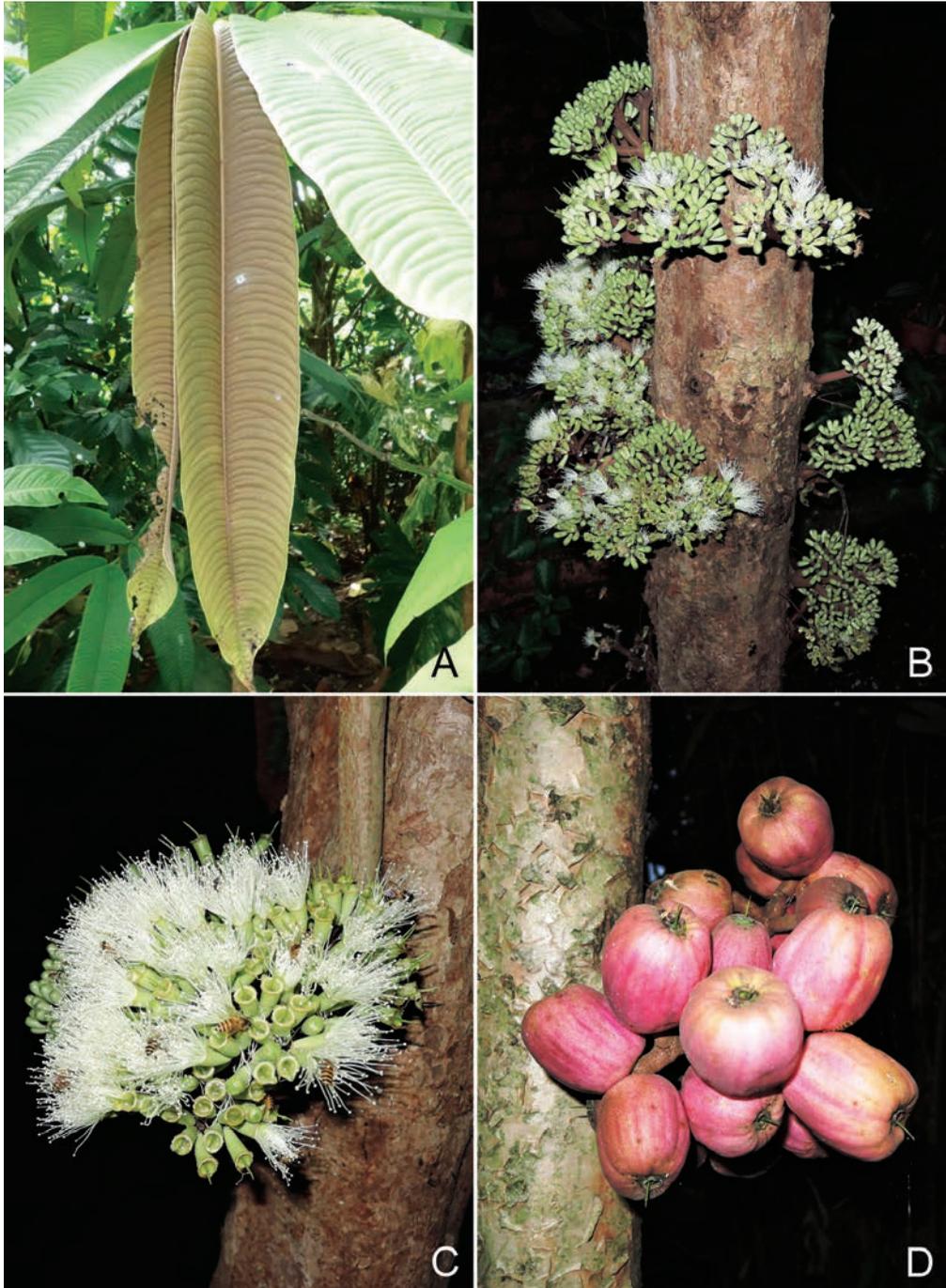
garden in Singapore, from which the material for the herbarium was taken. Type materials of *Syzygium* species at BO, K and SING were examined, including type images of all Malesian *Syzygium* species available on JSTOR® Global Plants website (<http://plants.jstor.org>). Provisional conservation assessments are made using the methodology proposed by IUCN (2012).

### Taxonomy

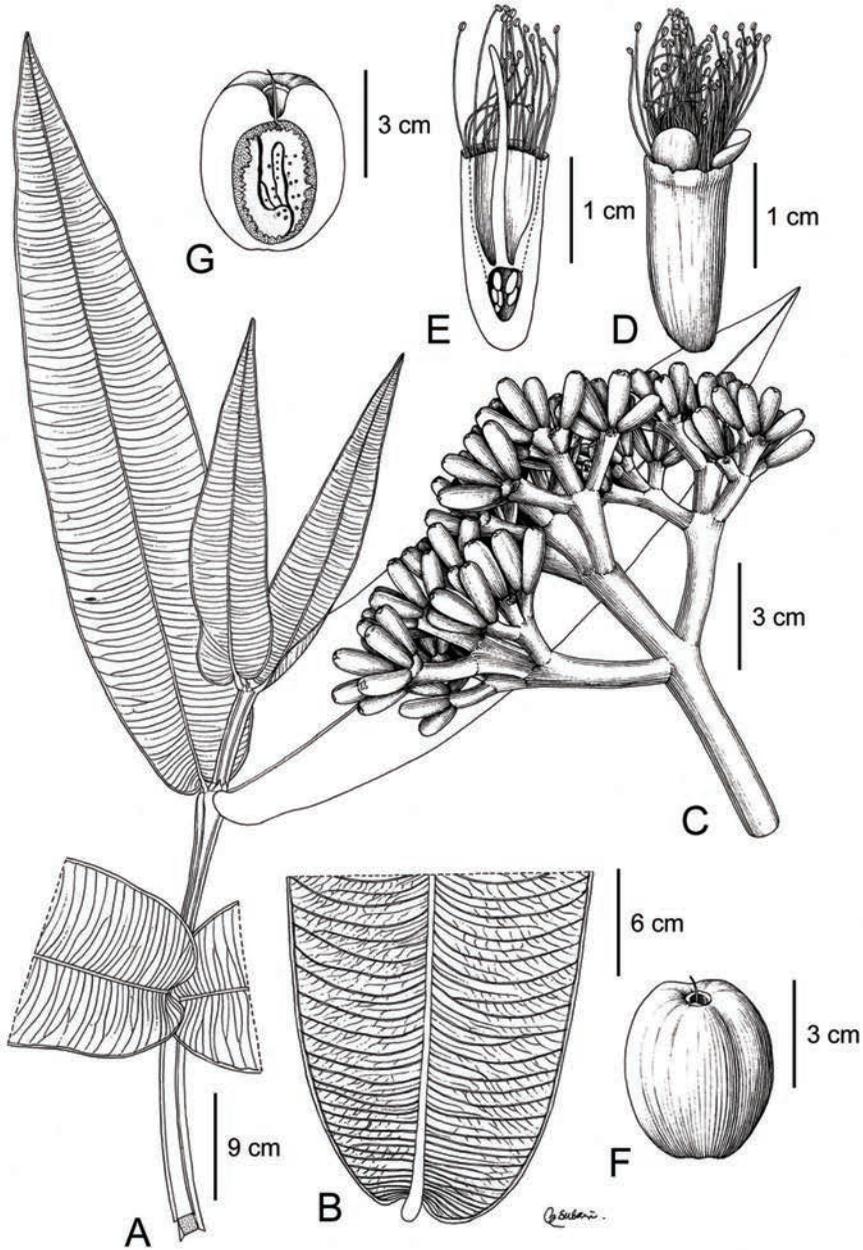
*Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low, **sp. nov.**

Similar to *Syzygium recurvovenosum* (Lauterb.) Diels but differs in having 90–100 pairs of secondary veins (vs up to 55 pairs of secondary veins in *S. recurvovenosum*), 14–16 cm long inflorescences with 13–15 mm wide peduncles (vs up to 9 cm long and c. 3.5 mm wide in *S. recurvovenosum*), and 8–18 mm long styles (vs 4 mm long in *S. recurvovenosum*). – TYPE: Native to Indonesia, Western New Guinea, Papua, Timika, Kuala Kencana, living collection cultivated in Mr Tan Jiew Hoe’s garden in Singapore, vouchered on 3 July 2016 as *Hambali*, *G.G. s.n.* (holotype BO; isotype SING). (Fig. 1, 2)

**Tree** up to 9 m tall, diameter at breast height c. 20 cm, without buttresses. Bark papery, peeling, greyish brown. **Branchlets** glabrescent, green, prominently quadrangular and winged when young, becoming terete on older branches. **Leaves** purple when young, opposite and decussate on erect shoots, becoming secondarily distichous on lateral branches; blades narrowly elliptic to broadly linear, 60–105 × 14–25 cm, with hardly visible minute oil glands; margin entire; base cordate, apex long-acuminate; midrib and secondary veins on lower surface prominent, midrib flat and secondary veins sunken on upper surface; secondary veins 90–100 pairs, rather abruptly curving out from the midrib, intramarginal vein c. 2 mm from the leaf margin; glabrous on



**Fig. 1.** *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low. **A.** Young leaves. **B.** Cauliflorous habit with many inflorescences at various stages. **C.** Close-up of inflorescences showing flowers at anthesis. **D.** Close-up of infructescence. All from type *Hambali*, G.G. *s.n.* (Photos: G.G. Hambali)



**Fig. 2.** *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low. **A.** Young leafy branch showing winged and angular stem. **B.** Close-up of cordate leaf base and numerous almost parallel secondary veins arranged very closely together. **C.** An immature inflorescence. **D.** Close-up of a mature flower showing the numerous stamens. **E.** Close-up of a longitudinal section of a mature flower depicting the arrangement of stamens along the rim of the hypanthium. **F.** A mature fruit. **G.** Longitudinal section of a mature fruit showing echinate testa intrusions into the cotyledons. Drawn by Subari from holotype, *Hambali, G.G. s.n.*(BO).

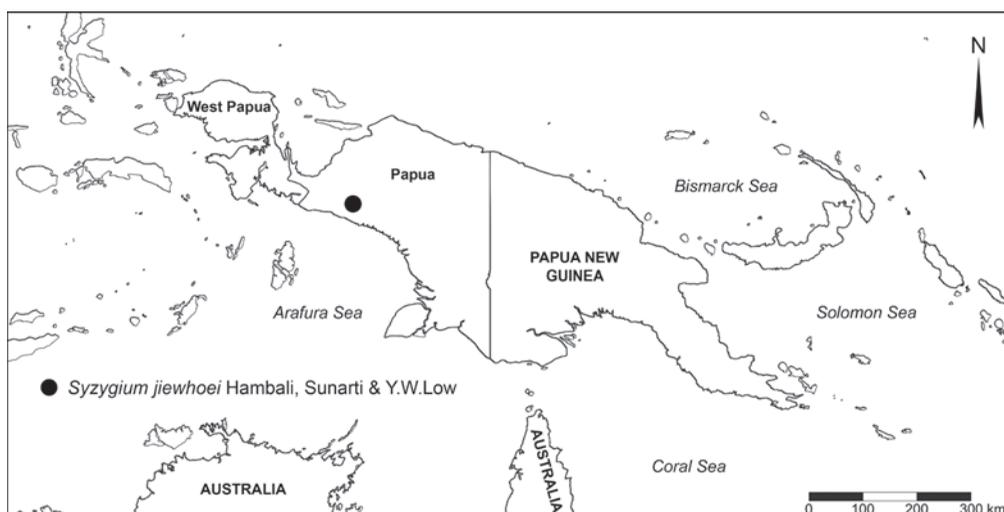
both sides; upper surface green, drying dark brown, lower surface pale green, drying brown; petiole c. 7–10 mm long, 6–13 mm wide, leaves appearing sessile due to length of blades. **Inflorescences** developing on the stem (cauliflorous), compound cymes 14–16 cm long with up to c. 250 flowers; peduncle dark brown, 3.5–6.5 cm long, 13–15 mm wide, branching to 4 orders, bearing flowers usually in triads at their tips; bracteoles rudimentary, caducous. **Flowers** bisexual, white, 18–24 mm long, hypanthium turbinate, 12–14 mm long, 3–4 mm wide at the top; sepals rudimentary; petals roundish, 3–4 mm across, pale green, caducous at anthesis. **Stamens** numerous, up to 76; filaments 6–10 mm, white; anthers c. 0.3 mm long, dirty white. **Pistil** persistent, green; style 8–18 mm long; ovary inferior. **Fruits** 4–6 × 4.5–5 cm, ovoid to broad-ellipsoid, slightly grooved longitudinally, salmon-pink and sour when fully ripe. **Seeds** 3.5 × 2.8 cm.

*Etymology.* We are pleased to name this handsome tree, with foliage very much resembling that of *Anthurium veitchii* Mast. (Araceae), after Mr Tan Jiew Hoe, a benefactor of science who has a great interest in natural history, particularly in the fields of botany and horticulture (see Kurzweil & Lwin, 2014; Kiew et al., 2015; Leong-Škorničková & Newman, 2015; Lamb & Rodda, 2016).

*Distribution and habitat.* *Syzygium jiewhoei* is so far known only from the lowland forests around the vicinity of Timika, Papua Province, Indonesian New Guinea. However, the species has now been introduced for cultivation as an ornamental tree in Bogor (Java, Indonesia) and Singapore (Fig. 3).

*Provisional IUCN conservation assessment.* Data Deficient DD, following the guidelines in IUCN (2012). *Syzygium jiewhoei* is known only from Kuala Kencana, Timika, Papua Province, Indonesian New Guinea. As the distribution of this species is inadequately known, we propose a status of Data Deficient (DD). As for all species given this status, reassessment will be required as more data is gathered to document the flora of New Guinea. One current initiative is the Tropical Important Plant Areas-Indonesian New Guinea programme (TIPAs Indonesian New Guinea), led by the Royal Botanic Gardens, Kew in collaboration with Universitas Papua (UNIPA), Manokwari, to identify important areas for plant conservation with an emphasis on the Bird's Head Peninsula, West Papua Province based on a set of criteria proposed by a team of plant conservationists (Darbyshire et al., 2017; Royal Botanic Gardens Kew, 2017).

*Notes.* *Syzygium jiewhoei* is a majestic free-flowering tree with a somewhat broad conical crown, which makes it a highly desirable ornamental tree. At maturity it produces showy inflorescences on its trunk. Flowers of *Syzygium jiewhoei* produce copious nectar for up to three days after anthesis, thereby attracting large numbers of the Asian honey bee (*Apis cerana*) and stingless bee (*Trigona laeviceps*). The mature salmon-pink fruits of *Syzygium jiewhoei* range from ovoid to broad-ellipsoid and somewhat oblong.



**Fig. 3.** Distribution of *Syzygium jiewhoei* Hambali, Sunarti & Y.W.Low in New Guinea.

It's worth noting that there is a solitary tree of *Syzygium jiewhoei* growing beside the road at the back of PT Freeport's Environmental Department building in Kuala Kencana. It was previously erroneously identified as *Syzygium versteegii* (Lauterb.) Merr. & L.M.Perry. *Syzygium versteegii* differs from *Syzygium jiewhoei* in having terete branchlets and oblong leaves with only 15 pairs of secondary veins.

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## References

- Baker, W.J. & Dransfield, J. (2006). *Field Guide to the Palms of New Guinea*. London: Royal Botanic Gardens, Kew.
- Beech, E., Rivers, M., Oldfield, S. & Smith, P.P. (2017). GlobalTreeSearch: The first complete global database of tree species and country distributions. *J. Sustainable For.* 36(5): 454–489.
- Craven, L.A. (2006). Myrtaceae of Papua. In: Marshall, A.J. & Beehler, B.M. (eds) *The Ecology of Papua*, vol. 1, pp. 429–434. Hong Kong: Periplus Editions (HK) Ltd.
- Craven, L.A. & Biffin, E. (2010). An infrageneric classification of *Syzygium* (Myrtaceae). *Blumea* 55: 94–99.
- Crayn, D.M., Costion, C. & Harrington, M.G. (2015). The Sahul–Sunda floristic exchange: dated molecular phylogenies document Cenozoic intercontinental dispersal dynamics. *J. Biogeogr.* 42(1): 11–24.
- Darbyshire, I., Anderson, S., Asatryan, A., Byfield, A., Cheek, M., Clubbe, C., Ghrabi, Z., Harris, T., Heatubun, C.D., Kalema, J., Magassouba, S., McCarthy, B., Milliken, W., de Montmollin, B., Lughadha, E.N., Onana, J.-M., Saïdou, D., Sârbu, A., Shrestha, K. & Radford, E.A. (2017). Important Plant Areas: revised selection criteria for a global approach to plant conservation. *Biodivers. Conserv.* 26(8): 1767–1800.
- Diels, L. (1922). Die Myrtaceen von Papuasien. *Bot. Jahrb. Syst.* 57: 356–426.
- Diels, L., Markgraf, R., Mansfeld, R., Schmidt, O.C., Gilg, E. & Markgraf, T. (1929). Descriptions of new species collected in British Papua by L.J. Brass. *J. Arnold Arbor.* 10(2): 75–84.
- Frodin, D.G. (2004). History and concepts of big plant genera. *Taxon* 53(3): 753–776.
- Govaerts, R., Sobral, M., Ashton, P.S., Barrie, F., Holst, B.K., Landrum, L.L., Matsumoto, K., Fernanda Mazine, F., Nic Lughadha, E., Proenca, C., Soares-Silva, L.H., Wilson, P.G. & Lucas, E. (2017). *World Checklist of Myrtaceae*. Royal Botanic Gardens, Kew. <http://apps.kew.org/wcsp/>. Accessed 29 Aug. 2017.
- Gressitt, J.L. (1982). General introduction. In: Gressitt, J.L. (ed.) *Biogeography and Ecology of New Guinea*, vol. 1, pp. 3–13. The Hague: Dr W. Junk Publishers.
- Hartley, T.G. & Perry, L.M. (1973). A provisional key and enumeration of species of *Syzygium* (Myrtaceae) from Papuasiasia. *J. Arnold Arbor.* 54(2): 160–227.
- Heatubun, C.D. (2002). A monograph of *Sommieria* (Arecaceae). *Kew Bull.* 57: 599–611.
- Heatubun, C.D., Dransfield, J., Flynn, T., Tjitrosoedirdjo, S.S., Moge, J.P. & Baker, W.J. (2012). A monograph of the betel nut palms (*Areca*: Arecaceae) of East Malesia. *Bot. J. Linn. Soc.* 168(2): 147–173.
- IUCN (2012). *IUCN Red List Categories and Criteria: Version 3.1*, 2<sup>nd</sup> ed. Gland, Switzerland and Cambridge, UK: IUCN.
- Johns, R.J., Edwards, P.J., Utteridge, T.M.A. & Hopkins, H.C.F. (2006). *A Guide to the Alpine and Subalpine Flora of Mount Jaya*. London: Royal Botanic Gardens, Kew.
- Kiew, R., Sang, J., Repin, R. & Joffre, A.A. (2015). *A Guide to Begonias of Borneo*. Kota Kinabalu: Natural History Publications (Borneo).
- Kurzweil, H. & Lwin, S. (2014). *A Guide to Orchids of Myanmar*. Kota Kinabalu: Natural History Publications (Borneo).
- Lamb, A. & Rodda, M. (2016). *A Guide to Hoyas of Borneo*. Kota Kinabalu: Natural History Publications (Borneo).
- Lauterbach, C. (1910). Myrtaceae. In: Lorentz, H.A. (ed.) *L'Expedition scientifique Neerlandaise a la Nouvelle-Guinee*. *Nova Guinea* 8(1): 319–323.

- Lauterbach, C. (1912). Myrtaceae. In: Lorentz, H.A. (ed.) *Uitkomsten der Nederlandsche Nieuw-Guinea-Expeditie. Nova Guinea* 8(2): 849–855.
- Leong-Škorničková, J. & Newman, M.F. (2015). *Gingers of Cambodia, Laos and Vietnam*. Singapore: National Parks Board, Singapore Botanic Gardens.
- Merrill, E.D. & Perry, L.M. (1939a). Plantae Papuanae Archboldianae, I. *J. Arnold Arbor.* 20(3): 324–345.
- Merrill, E.D. & Perry, L.M. (1939b). The Myrtaceous genus *Syzygium* in Borneo. *Mem. Amer. Acad. Arts* 18(3): 135–202.
- Merrill, E.D. & Perry, L.M. (1942a). Plantae Papuanae Archboldianae, IX. *J. Arnold Arbor.* 23(2): 233–265.
- Merrill, E.D. & Perry, L.M. (1942b). Plantae Papuanae Archboldianae, IX. *J. Arnold Arbor.* 23(3): 267–297.
- Parnell, J.A.N., Craven, L.A. & Biffin, E. (2007). Matters of scale: Dealing with one of the largest genera of angiosperms. In: Hodkinson, T.R. & Parnell, J.A.N. (eds) *Reconstructing the Tree of Life: Taxonomy and Systematics of Species Rich Taxa*, pp. 251–273. Boca Raton, Florida: CRC Press.
- Pieters, P.E. (1982). Geology of New Guinea. In: Gressitt, J.L. (ed.) *Biogeography and Ecology of New Guinea*, vol. 1, *Monographiae Biologicae*, vol. 42, pp. 15–38. The Hague: Dr W. Junk Publishers.
- Royal Botanic Gardens Kew (2017). *Tropical Important Plant Areas-Indonesian New Guinea (TIPAs-Indonesian New Guinea)*. <https://www.kew.org/science/projects/tipas-indonesian-new-guinea>. Accessed 21 Sep. 2017.
- Schuiteman, A. & de Vogel, E.F. (2001). *Flora Malesiana: Orchids of New Guinea, vol. 1: Illustrated Checklist and Genera*. CD-ROM. Expert-Center for Taxonomic Identification.
- Schuiteman, A. & de Vogel, E.F. (2002). *Flora Malesiana: Orchids of New Guinea, vol. 2: Dendrobium and Allied Genera*. CD-ROM. Expert-Center for Taxonomic Identification.
- Schuiteman, A. & de Vogel, E.F. (2005). *Flora Malesiana: Orchids of New Guinea, vol. 3: Genera Acanthephippium to Hymenorchis (excluding Dendrobiinae s.l.)*. CD-ROM. Expert-Center for Taxonomic Identification.
- Schuiteman, A. & de Vogel, E.F. (2006). *Flora Malesiana: Orchids of New Guinea, vol. 4: Genera Kuhlhasseltia to Ophioglossella (excluding Dendrobiinae s.l.)*. CD-ROM. Expert-Center for Taxonomic Identification.
- Schuiteman, A. & de Vogel, E.F. (2008). *Flora Malesiana: Orchids of New Guinea, vol. 5: Genera Pachystoma to Zeuxine (excluding Dendrobiinae s.l.)*. CD-ROM. Expert-Center for Taxonomic Identification.
- Schuiteman, A., Vermuelen, J.J. & de Vogel, E.F. (2010). *Flora Malesiana: Orchids of New Guinea, vol. 6: Genus Bulbophyllum*. CD-ROM. Expert-Center for Taxonomic Identification.
- Syzygium* Working Group (2016). *Syzygium* (Myrtaceae): Monographing a taxonomic giant via 22 coordinated regional revisions. *PeerJ Preprints* 4: e1930v1.
- Thiers, B. (2017, continuously updated). *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>. Accessed 24 Aug. 2017.
- Van Royen, P. (1979a). *The Alpine Flora of New Guinea*, vol. 1, General Part. Vaduz: J. Cramer.
- Van Royen, P. (1979b). *The Alpine Flora of New Guinea*, vol. 2, Taxonomic Part: Cupressaceae to Poaceae. Vaduz: J. Cramer.
- Van Royen, P. (1982). *The Alpine Flora of New Guinea*, vol. 3, Taxonomic Part: Winteraceae to Polygonaceae. Vaduz: J. Cramer.

- Van Royen, P. (1983). *The Alpine Flora of New Guinea*, vol. 4, Taxonomic Part: Casuarinaceae to Asteraceae. Vaduz: J. Cramer.
- Van Steenis, C.G.G.J. (1950). The delimitation of Malaysia and its main plant geographical divisions. In: *Flora Malesiana*, ser. I, vol. 1, pp. lxx–lxxv. Jakarta: Noordhoff-Kolff N.V.
- Van Steenis-Kruseman, M.J. (1950). Malaysian plant collectors and collections: being a cyclopaedia of botanical exploration in Malaysia and a guide to the concerned literature up to year 1950. In: van Steenis, C.G.G.J. (ed.) *Flora Malesiana*, ser. I, vol. 1, pp. 3–639. Jakarta: Noordhoff-Kolff N.V.
- Van Welzen, P.C., Parnell, J.A.N. & Slik, J.W.F. (2011). Wallace's Line and plant distributions: two or three phytogeographical areas and where to group Java? *Biol. J. Linn. Soc.* 103(3): 531–545.