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Taxonomic review of *Polyosma* (*Escalloniaceae*) in Papuasia

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Key words

Escalloniaceae
morphology
New Guinea
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Abstract Evaluation of the morphological variation within the genus *Polyosma* (*Escalloniaceae*) of Australia, New Caledonia and Papuasia quantified the similarities within and between species from these geographical areas. This taxonomic review of the genus *Polyosma* recognizes 33 species for Papuasia, 12 of which are here described as new species, namely, *P. affinis*, *P. alipensis*, *P. brassii*, *P. flenleyi*, *P. forbesii*, *P. glaberrima*, *P. infernaralis*, *P. kamialiensis*, *P. leptorhachis*, *P. pachyrhachis*, *P. schulzemenzii*, and *P. scyphocalyx*. Lectotypes are designated for *P. finisterrae*, *P. forbesii*, *P. ilicifolia*, *P. integrifolia*, *P. macrobotrys*, *P. serrulata*, *P. torricellensis*, and *P. torricellensis* var. *pittosporoides*, and neotypes for *P. buxea*, *P. dentata*, and *P. helicioides*.

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INTRODUCTION

Polyosma Blume has been placed in many different families by various authors. Traditionally, it was included in the *Saxifragaceae* (Moore & Betche 1893), sometimes *Grossulariaceae* (Cronquist 1981), or classified in its own family, *Polyosmaceae* (APG 2003), the latter being regarded as sister to the *Escalloniaceae* s.str. (Soltis et al. 2000). In this study, *Polyosma* is included in the *Escalloniaceae* s.lat. (Lundberg 2001, APG IV 2016), based on congruent 3-gene support from *atpB*, *ndhF*, and *rbcL* nucleotide sequences.

Our application of the taxonomy of *Polyosma* is based on the research of many authors. Currently, there are 80 – 90 species of *Polyosma* recognized (Lundberg 2001, Saw 2004, 2020a, b, Esser & Saw 2015, Lundberg 2016, Bean & Forster 2021, Stevens continuously updated), ranging from southern China (*P. cambodiana* Gagnep.), through South East Asia (41 species, including eight unnamed species, LaFrankie 2010), Papuasia (about 15 species; Reeder 1946, Van Royen 1983) to Australia (eight species; Bean & Forster 2021) and New Caledonia (seven species, Pillon 2018).

The genus consists mostly of small to medium-sized trees up to 30 m tall with bark brown and rough, although there are several species that are small shrubs with a smooth bark. The leaves are simple, opposite or subopposite, with margin either entire or toothed, and both surfaces of the lamina being hairy or glabrous. The inflorescences are either axillary or terminal with flowers arranged in racemes. The fruit is an ovoid or ellipsoid 1-seeded drupe (Beaulieu & Donoghue 2013), maturing to bluish or purplish black.

Papuasia, as defined by Diels (1912) and Womersley (1978), includes the island of New Guinea, the islands of the Bismarck Archipelago, Buka, Bougainville, and the Solomon Islands. This predominantly tropical genus is mostly found above elevations of 1 000 m. However, species can occur from lowland, often in near-coastal forests, up to alpine forests at 3 500 m elevation (*P. subalpina* Schulze-Menz ex P.Royen). Some species are widespread, whereas a few are locally restricted to certain habitats in disjunct localities. A few of the lowland tropical forest species grow to be large trees. For instance, *P. forbesii* Valeton ex Lauterb. reaches more than 30 m tall and has trunks greater than 35 cm dbh (personal observation BJC and OKP in Papua New Guinea). The extent of the morphological variation within and between the species of *Polyosma* in Papuasia remains inadequately known. Hence, the taxonomic status of several species is poorly resolved.

It is well understood that the power of any study that aims to resolve taxonomic entities by using analyses of morphological trait variation rests on the size of the morphological and geographical samples (Pender et al. 2021). Morphologically and geographically representative samples permit a more robust and phylogenetically meaningful recognition of taxa when DNA data are included, and form the foundation for well-informed integrative studies aimed at understanding the timing and tempo of historical events within and between taxa (Conn et al. 2021). Even when research material is relatively sparse, a geographically more inclusive study can provide more robust insights into generalized processes and patterns of trait variation than a geographically restricted study.

Historically, revisions of *Polyosma* have been limited to comparatively small geographic regions, and have mostly been characterized by access to relatively few samples (Esser & Saw 2015, Pillon 2018, Bean & Forster 2021). In this study we take the opportunity to address this by using botanical collections and field observations of species from the islands of Indonesia (Jawa and Maluku), Australia, and New Caledonia. We developed a set of widely applicable morphological traits (characters) and employed them in a multivariate statistical analysis of the

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Table 1 Specimens of *Polyosma* species used in the multivariate analysis.

Species of *Polyosma*	Specimens	Locality: Region (Country)
P. affinis Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Sayer NGF 19517*	West Sepik (P.N.G.)
	Hartley 11816	Morobe (P.N.G.)
P. alangiacea F.Muell	Gray *1918*, *von Mueller s.n.* [K739774]	Cook, Qld (Australia)
	Hyland 4028, *25241*	South Kennedy, Qld (Australia)
P. alipensis B.J.Conn & O.K.Paul, *sp. nov*.	*Bowers 433*, *524*, *674*, *Womersley NGF 43508*	Western Highlands (P.N.G.)
P. amygdaloides Reeder	*Brass 13335* (Type)	Snow Mountains, Indonesia Papua (Indonesia)
	Streimann NGF 27671, *Takeuchi 12073*	Eastern Highlands (P.N.G.)
P. brachystachys Schltr.	*Schlechter 15694* (Type)	Nord (New Caledonia)
P. brassii Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Brass 29597*, *Hartley 11739*	Morobe (P.N.G.)
P. buxea Mattf.	*Brass 32235, Womersley NGF 4429*	Eastern Highlands (P.N.G.)
	Brass 23299, 24726	Milne Bay (P.N.G.)
	Woods NGF 17590	Central (P.N.G.)
P. cestroides Schltr.	*Ledermann 12566* (Type)	West Sepik (P.N.G.)
	Brass 29725, *Millar NGF 22815, Sayers NGF 19964*	Morobe (P.N.G.)
	Brass 31306, *31813*	Eastern Highlands (P.N.G.)
	Brass 23207	Milne Bay (P.N.G.)
'*P. consimilis*' unpublished ms.	*Ridsdale NGF 36833*, *van Royen NGF 20483*	Central (P.N.G.)
P. cunninghamii Benn.	*McDonald 4163*	Wide Bay, Qld (Australia)
	Constable s.n. [NSW24092], *Gilbert s.n.* [NSW183150]*, Maiden 302*, *Story 6595*	NC, N.S.W. (Australia)
	Donaldson 2684 & Golson, *Schodde 3195*, *3521 & Hayes*, *Schodde 5135*	NT, N.S.W. (Australia)
	Camfield s.n. [NSW183157], *Cunningham 84*, *Gilmour 7509*, *Johnson s.n.* [NSW23538], *Paul 3*, *5*, *6*, *7*, *8*, *15*	CC, N.S.W. (Australia)
	Floyd 1782, Johnson & Constable s.n. [NSW438805]	SC, N.S.W. (Australia)
	Coveny 10141, *Maiden s.n.* [NSW628705]	CT, N.S.W. (Australia)
P. dentata Schltr.	*Vinas LAE 59527*	West Sepik (P.N.G.)
	Hoogland 10954	East Sepik (P.N.G.)
P. discolor Baill.	*Joffre 3245*, *McKee 35815*	Nord, New Caledonia
	McKee 25755, 38402, *45083*	Sud, New Caledonia
P. finisterrae Schltr.	*Takeuchi 21049, 21051*, *21124*	Morobe (P.N.G.)
P. flenleyi Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Flenley ANU 2584*	Western Highlands (P.N.G.)
P. forbesii Valeton ex Lauterb.	*Barker LAE 67506*	West Sepik (P.N.G.)
	Hartley 11535, *Havel & Kairo NGF 9125*	Morobe (P.N.G.)
	Hartley 12145	Eastern Highlands (P.N.G.)
	Galore & Ridsdale NGF 33739	Western (P.N.G.)
	Hartley 10725	Central (P.N.G.)
	Sayers NGF 24173	New Britain (P.N.G.)
P. gigantea Baker f.	*Forbes 716* (Type)	Central (P.N.G.)
P. glaberrima Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Brass 25739*	Milne Bay (P.N.G.)
P. globosa A.R.Bean & P.I.Forst.	*Foreman 1859*, *Hyland 13593*, *Wilson 532 & Renner*	Cook, Qld (Australia)
P. helicioides F.Muell.	*Henty NGF 14302*, *Katik LAE 70757*, *Lovave 36*	Morobe (P.N.G.)
	Kerenga & Cruttwell LAE 56696, *Womersley NGF 24567*	Eastern Highlands (P.N.G.)
	Katik 605 & Rali	Central (P.N.G.)
P. hirsuta C.T.White	*Forster 10758*, *Gray 8870*, *Michael s.n.* [BRI-AQ342399] (Type), *Telford11400 & Rudd*, *Wannan 3892*, *C.T. White s.n.* (BRI)	Cook, Qld (Australia)
P. ilicifolia Blume	*McDonald 3631*, *4887*	Jawa Barat (Indonesia)
	Zollinger 2956	without locality (presumed Jawa, Indonesia)
P. infernaralis B.J.Conn & . O.K.Paul, *sp. nov*	*Brass 30567*, *Grubb 256*, *Robbins 674*	Eastern Highlands (P.N.G.)
	Croft LAE 65319	Southern Highlands (P.N.G.)
P. integrifolia Blume	*de Vogel 5439*	Sulawesi (Indonesia)
	Robinson 1816, *Sands 2605*	Ambon, Maluku (Indonesia)
	Takeuchi 21173, *van Valkenburg 700*	Morobe (P.N.G.)
	Foreman LAE 52356, *Kerenga LAE 77334*	Manus (P.N.G.)
	Berena 217	Bougainville (P.N.G.)
P. kamialiensis B.J.Conn & O.K.Paul, *sp. nov.*	*Conn 5232* (Type), *5571*, *5804*, *Takeuchi 14329*, *14884*, *14894*, *15090*, *15413*, *21047*	Morobe (P.N.G.)
P. kouaouana Pillon	*McKee 35814*	Nord, New Caledonia
P. leptorhachis Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Frodin NGF 28355*, *NGF 28448*	Southern Highlands (P.N.G.)
P. leratii var. *puberula* Guill.	*Lecard s.n.* (*bois n°31*; (Pillon 2018)) (Type)	Nord, New Caledonia
P. macrobotrys Mattf.	*Clemens 1414a* (Type), *Hartley 10483*	Morobe (P.N.G.)
	McVeagh NGF 8279	Western (P.N.G.)

Table 1 (cont.)

Species of *Polyosma*	Specimens	Locality: Region (Country)
P. mucronata Reeder	*Brass 4310*, *Hartley 12912*	Central (P.N.G.)
P. nigrescens A.R.Bean & P.I.Forst.	*Hyland 3391*, *3391RFK*, *13794*, *25416*, *25416RFK*	Cook, Qld (Australia)
P. occulta Reeder	*Brass 4524* (Type), *Ridsdale NGF 36833*, *van Royen NGF 20483*	Central (P.N.G.)
P. pachyrhachis Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Womersley NGF 14275* *Brass 32162* *Croft LAE 60920*	Western Highlands (P.N.G.) Eastern Highlands (P.N.G.) Southern Highlands (P.N.G.)
P. pancheriana Baill.	*McKee 32894* *Pancher 17* (Type)	Nord, New Caledonia Sud, New Caledonia
P. pancheriana var. *subintegrifolia* Guill.	*Balansa 1030* (Type)	Sud, New Caledonia
P. podophylla Schltr.	*Compton s.n.* (NSW) *Schlechter 15515*	New Caledonia Nord, New Caledonia
P. pubescens Ridl.	*Kloss s.n.* [BM 600388] *Stevens LAE 55753*	East Sepik (P.N.G.) Milne Bay (P.N.G)
P. reducta F.Muell.	*Ford 2917*, *4338*, *Sayer s.n.* [K739773] (Type)	Cook, Qld (Australia)
P. rhytophloia C.T.White & W.D.Francis	*Foster 29576 & Jensen*, *Francis s.n.* (Type), *Hind 6648*, *McDonald 4479*	Cook, Qld (Australia)
P. rigidiuscula F.Muell. & F.M.Bailey	*Costion 1585*, *Foster 29558*, *Meston 16* (Type), *van Balgooy 1450*, *Worboys 850*	Cook, Qld (Australia)
P. schulzemenzii B.J.Conn & O.K.Paul, *sp. nov.*	*Brass 31168*	Eastern Highlands (P.N.G.)
P. scyphocalyx Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*	*Hoogland 7414 & Schodde* (Type), *7652*, *Walker ANU 749* *Saunders 787*, *Stevens LAE 51004* *Damas LAE 58879*	Western Highlands (P.N.G.) Eastern Highlands (P.N.G.) Southern Highlands (P.N.G.)
P. subalpina Schulze-Menz ex P.Royen	*Brass 29839*, *Kairo NGF 35753*, *Obedi 8614*, *Robbins 717*, *Stevens LAE 54613, Vandenberg NGF 35040* *Stevens LAE 51368* *Croft LAE 65051*	Eastern Highlands (P.N.G.) Central (P.N.G.) Northern (P.N.G.)
‘*P. subfoliacea*’ unpublished ms.	*Womersley NGF 39926*	Western Highlands (P.N.G.)

The columns represent the specific epithets of *Polyosma*, specimens (collector and/or collection number); generalized locality including country (in parenthesis). Locality abbreviations: CC = Central Coast; CT = Central Tablelands; NC = North Coast; N.S.W. = New South Wales; NT = Northern Tablelands; P.N.G. = Papua New Guinea; Qld = Queensland; SC = South Coast; ST = Southern Tablelands. The geographical regions were taken from: Bostock & Holland (2010; Australia, Queensland), Jacobs & Pickard (1981; Australia, New South Wales), Anonymous (2022; New Caledonia), and Womersley (1978 – Papuasia). Note: within-country spelling of geographic provinces and localities are followed. Herbarium specimens held at the following herbaria were examined: BO, BR, BRI, CANB, K, L, LAE, and NSW (herbarium abbreviations used follow Thiers Continuously updated). Note: the ‘McKee’ collections examined from New Caledonia refer to Hugh Shaw McKee (alternative spelling ‘MacKee’).

morphological variation amongst 31 currently accepted species of *Polyosma* with the aim of revising the Papuasian members of the genus, and to place them in a broader geographic context. An additional outcome of our approach is that we can highlight where previous taxonomic concepts might require reevaluation and indicate where deeper sampling might reveal new taxa.

MATERIALS AND METHODS

The distribution of the Papuasian species are summarized according to the botanical regions of Womersley (1978). Official within-country spelling of provinces and other geographical localities are used when known. Herbarium abbreviations follows Thiers (Continuously updated). A total of 166 herbarium specimens of *Polyosma* from Indonesia, Papua New Guinea, Solomon Islands, Australia, and New Caledonia were analyzed, representing 43 taxa, of which 31 were currently recognised species (see Table 1 for the list of taxa and details of species authorities). Measurements were made on mature parts of plants. Herbarium specimens and freshly collected field samples (deposited at LAE and NSW) were targeted to capture the morphological variation and geographic distribution of the genus throughout the region of study. To limit the impact of missing data on our analyses, flowering and/or fruiting specimens were preferred. Sterile material was only used when no reproductive specimens of a species were available. We mitigated the impact of missing data by rejecting any characters with an over-representation of missing data.

Specimen selection

Morphological features were used in the multivariate analysis to investigate, distinguish, and circumscribe species. A total of 180 specimens of *Polyosma* were examined comprising 43 taxa held in various herbaria. The core characters used to examine the infrageneric morphological variation were based on previous published studies. Thirty-one characters were examined (Table 2). Of these, 14 were vegetative characters and 17 were associated with reproductive features (Table 2). Twenty-one characters were qualitative (with various characters states in Table 2) and ten were quantitative (scale mentioned in Table 2). The dataset is available at: https://doi.org/10.25901/e76j-s496.

The number of specimens used for each species varied depending on availability and quality of material (Table 1) and ranged from one fertile specimen (*P. pubescens*) to more than 20 (*P. cunninghamii*). The morphological characters of the nomenclatural types of several taxa were measured from digital photographs (available at JSTOR 2020), so that any morphological cluster could be assigned taxonomic names.

Characters and their uses in classification

The morphological characters used in this study were based on concepts used by previous monographers of the genus, particularly those by Schlechter (1915) and Reeder (1946). We have interpreted the most useful morphological characters that described the morphological diversity of the species we studied (Table 2).

The morphological characters (data matrix of 4 048 cells) were analyzed with the software package, PATN v. 3.12 (Belbin &

Table 2 Characters used in the morphometric analysis and character states recognized. Although the leaf width, corolla colour, and fruiting characters were not used in the final analyses, they are listed here as reference to how they were scored.

Characters	States
Petiole	
length	mm
Leaf	
texture	(0) coriaceous, hence rough to touch; (1) papery and smooth
shape of lamina	(0) ovate; (1) elliptic; (2) obovate
length of lamina	mm
width of lamina	mm
apex	(0) mucronate; (1) shortly acuminate (subacute); (2) acuminate; (3) attenuate; (4) decurrent
base	(0) rounded; (1) subacute; (2) cuneate; (3) obtuse
margin	(0) entire; (1) serrate
indumentum density	(0) glabrous or sparse; (1) moderately hairy; (2) densely hairy
indumentum orientation	(0) appressed or antrorse; (1) ± spreading or patent; (2) retrorse to reflexed
Venation	
secondary vein number	number of secondary veins arising from midrib (observable on either abaxial or adaxial surface); counted on one side of midrib. Note: the veins of the same leaves as used for length and width measurements were used
tertiary vein prominence	(0) not prominent on abaxial surface; (1) prominent on abaxial surface
indumentum	
density	(0) glabrous to sparse; (1) moderately sparse; (2) densely hairy
orientation	(0) appressed or antrorse; (1) ± spreading or patent; (2) retrorse to reflexed
Inflorescence	
position on branch	(0) exclusively terminal; (1) terminal or axillary; (2) exclusively axillary
length of rachis	measured from point of attachment to branch and to end of primary inflorescence axis, excluding the pedicel of the terminal flower (mm)
flower density	(0) loosely arranged; (1) densely and tightly arranged
number of flowers per rachis	(0) < 20; (1) 20–30; (2) > 30
Pedicel	
length	mm
Bracteole	
length	mm
indumentum density	(0) glabrous or sparse; (1) moderately sparse; (2) densely hairy
texture (of surface)	(0) smooth; (1) rough
Calyx	
length	mm
indumentum density	(0) glabrous or sparse; (1) moderately sparse; (2) densely hairy
Corolla	
length	mm
colour	(0) brown; (1) green, or green with yellow tinge; (2) yellow; (3) white; (4) mauve/purple; (5) pink
shape (at anthesis)	(0) split into 4; (1) tubular with 4 small lobes
indumentum density	(0) glabrous or sparse (hairs covering < 25 % of surface); (1) moderately sparse (surface visible, hairs covering c. 50 % of surface); (2) densely hairy (surface obscured, with hairs covering > 75 % of surface).
Fruit	
length	mm
width (diam)	mm
colour	(0) brown; (1) green; (2) yellow; (3) white; (4) red; (5) mauve/purple; (6) pink; (7) black; (8) orange
texture (surface)	(0) smooth; (1) rough with ridges
indumentum density on fruiting hypanthium	(0) glabrous or sparse; (1) moderately sparse; (2) densely hairy

Collins 2009). A range-standardised dissimilarity matrix generated by the Gower metric (Gower 1971) was analyzed by the flexible unweighted pair-group method using averages (UPGMA) fusion strategy (with β-value = -0.1000). Association measures were used to ordinate samples in semi-strong hybrid (SSH) multidimensional scaling (Belbin & Collins 2009). The SSH ordinations were generated from 50 iterations, with CutOff = 0.900; number of random starts = 100; maximum iterations = 1,000; random seed value = 1,235 (Belbin 1991). Correlation values for each morphological character in the SSH were calculated using Principal Coordinate Correlation (PCC) and these vectors were plotted to visualize how each character affected the composition of the ordination. Kruskal-Wallis H scores (Kruskal & Wallis 1952) and box-whisker plots (Tukey 1977) were calculated for the UPGMA to further investigate the discriminatory power of the morphometric characters. Visualization of the SSH ordination of these data were presented as a minimum spanning tree (MST), generated using PATN software, according to Gower & Ross (1969).

Since there was considerable missing fruiting information in the dataset and the difficulty in determining the maturity of fruits from herbarium collections, fruit characters were not included in the analyses. Furthermore, the colour of the corolla was excluded from the final dataset because corolla colour varies from recently opened flowers to senescence. The length of the leaf lamina and lamina width were correlated (Pearson coefficient = 0.85763), so lamina width was excluded from further analyses. The initial analyses assessed the degree of clustering of the individual samples (as listed in Table 1) into taxon groups (results not presented here). The morphological characters were then averaged according to taxon groupings and analyzed according to the above method.

RESULTS

The range-standardised dissimilarity matrix generated by the Gower metric (Gower 1971) and analyzed by the flexible

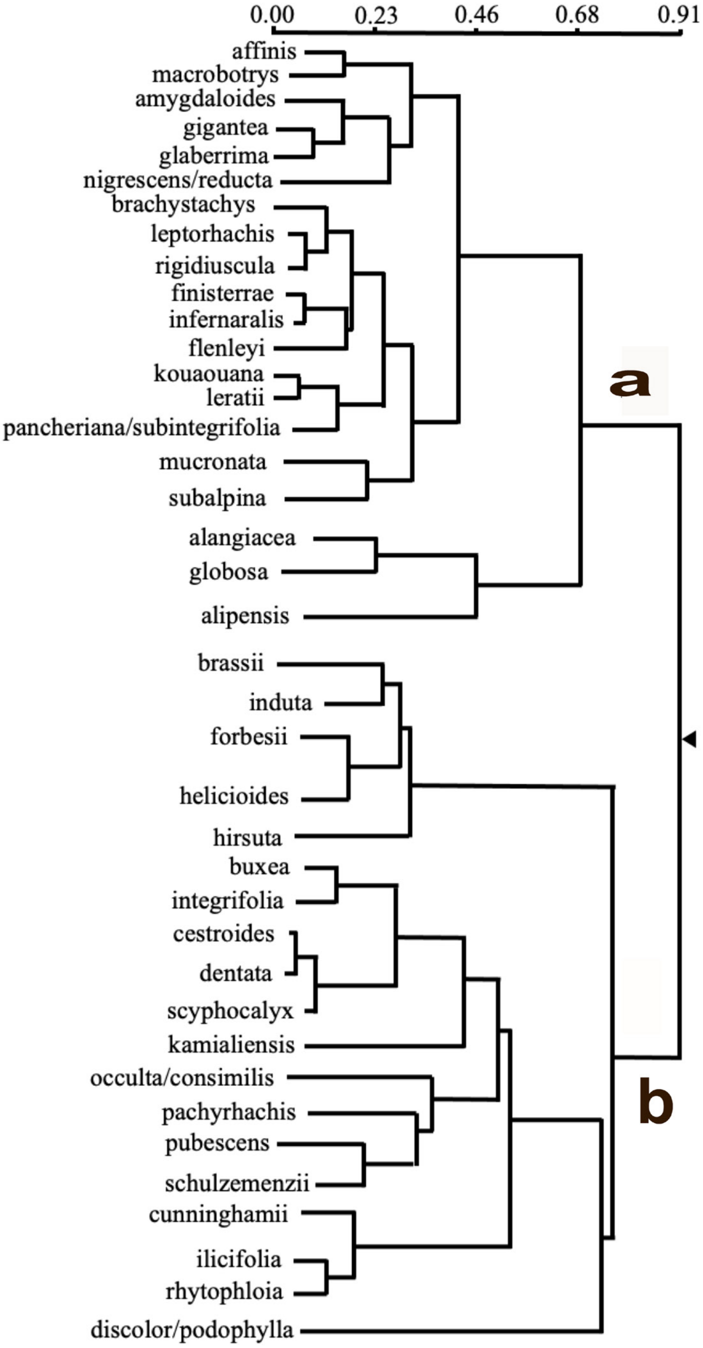

Fig. 1 Dendrogram of a priori-defined species, based on a range-standardised dissimilarity matrix of morphological characteristics, generated by the Gower metric, and analyzed by the flexible unweighted pair-group method using averages (UPGMA) fusion strategy (with β-value = -0.1000; stress = 0.1305). Note: the end point of the terminating branches indicates the maximum level of dissimilarity within each species or species group. a. Cluster species with glabrous or sparsely hairy leaves; b. species with leaves moderately to densely hairy.

unweighted pair-group method using averages (UPGMA) fusion strategy clustered most taxa together according to their *a priori* species (taxon) determinations (Fig. 1). However, the morphological variation and taxonomic heterogeneity within some species-clusters amongst some species, such as *P. nigrescens* and *P. reducta*; *P. pancheriana* and *P. subintegrifolia*; and *P. occulta* and '*P. consimilis*' (unpublished manuscript name sensu Schulze-Menz) suggests that our *a priori* circumscription of these species/taxa may not be taxonomically robust.

In our analysis, two taxonomically mixed clusters of *P. discolor* and *P. podophylla* were recovered within a broader cluster comprising specimens of each taxon. Specimens initially identified as *P. finisterrae* (as originally circumscribed), formed two morphological clusters, with one here recognized as the new species *P. infernaralis*. Likewise, specimens initially identified as *P. forbesii* s.lat., formed two distinct morphological clusters, with one here recognized as the new species *P. kamialiensis*.

Two large clusters are recovered by the UPGMA analysis (Fig. 1a, b). Most of the species grouped in cluster A have glabrous or sparsely hairy leaves. Moderately hairy species of this cluster include *P. alangiacea*, *P. alipensis*, *P. flenleyi*, *P. globosa*, *P. mucronata*, and *P. scyphocalyx*. Cluster B is characterized by species that are densely hairy, apart from *P. buxea*, *P. cestroides*, *P. dentata*, and *P. integrifolia* (all of which are glabrous), and *P. cunninghamii*, *P. ilicifolia*, *P. occulta*/*consimilis*, *P. pachyrhachis*, *P. pubescens* (densely hairy on secondary veins), *P. rhytophloia*, and *P. schulzemenzii*.

Although a dendrogram is an efficient method for summarising dissimilarities and similarities between OTUs, there can be a loss of resolution when reducing the morphological variation

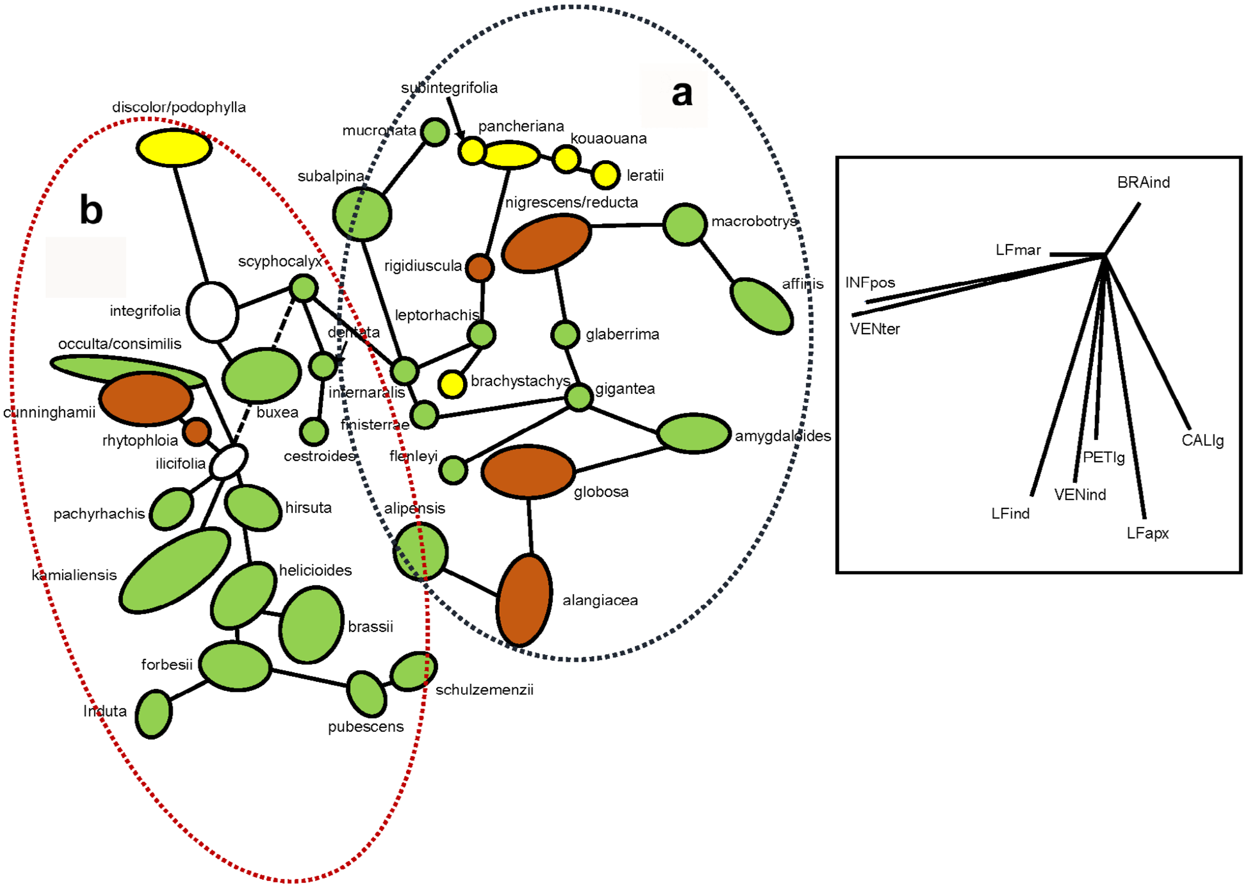

Fig. 2 Semi-strong hybrid (SSH) multidimensional scaling analysis of the morphological data for each species and species groups of *Polyosma*, presented as a minimum spanning tree (MST), approximating to the perspective of axes 2 and 3 (stress = 0.1266), illustrates the dissimilarities and similarities between *a priori* species clusters and geographic distributions. The character vector diagram of the nine most informative characters (based on Kruskal–Wallis *H* statistic, KW) are presented to the right of SSH-MST diagram. Note: since SSH-MST diagram has been modified for visual clarity, the precision of the character vector diagram is approximate for some species. The species notation presents the specific epithet; the colour of the species nodes represents geographic distribution of each species: white dots = *P. ilicifolia* (Indonesia) and *P. integrifolia* (specimens from The Philippines, Indonesia, Papuasia and the Solomon Islands); yellow = New Caledonia; green = Papuasia; brown = Australia. 'Clusters a' and 'b', as recognized in Fig. 1, are circled by dotted coloured lines. Character codes abbreviations: BRAind = bracteole – density of indumentum (KW = 127.34); CALlg = calyx length (KW = 117.59); INFpos = inflorescence position (KW = 116.66); LFapx = leaf apex shape (KW = 115.86); LFind = leaf – density of indumentum (KW = 147.37); LFmar = leaf margin (KW = 120.27); PETlg = petiole length (KW = 121.34); VENind = secondary leaf venation – density of indumentum (KW = 146.64); VENter = secondary leaf venation – prominence of secondary veins (KW = 112.50).

to construct the dendrogram. The construction of UPGMA dendrograms enforces an agglomeration of objects whereas ordination (in this case, SSH) allows objects to freely associate in morphometric space (Belbin & Collins 2009). The perspective presented in Fig. 2 (SSH-MST) approximates axes 2 and 3 of the SSH-MST ordination. The position of some species/species-groups in Fig. 2 have been 'enhanced' to graphically clarify the morphological similarities and differences when the three-dimensional SSH plot is reduced to a two-dimensional graph (Fig. 2). In particular, the positions of *P. finisterrae*, *P. infernaralis*, *P. leptorhachis*, and *P. rigidiuscula*, as well as the group that includes *P. cestroides*, *P. dentata*, and *P. scyphocalyx*, have been adjusted.

The SSH analysis provides support for the two major clusters (A and B) obtained from the UPGMA analysis (Fig. 1), and all groups recovered by flexible UPGMA were also recovered when analyzed by SSH. The pairs of species recovered from the UPGMA analysis. *Polyosma nigrescens* and *P. reducta* were shown to be morphologically very similar in the SSH analysis (Fig. 2) and not readily distinguishable from each other with our data; *P. pancheriana* and *P. subintegrifolia* were morphologically very similar, but distinguishable, with *P. subintegrifolia* morphologically closest to *P. pancheriana* s.str. and morphologically distant to *P. kouaouana*; and *P. occulta* (s.str.) was morphologically indistinguishable from '*P. consimilis*' sensu Schulze-Menz (ms), but with one specimen (*van Royen NGF 20483*) as a morphological outlier compared to the other two collections examined (*Brass 4524* and *Ridsdale NGF 36833*). Although *P. discolor* and *P. podophylla* are rendered as morphologically similar, supporting the conclusions of Guillaumin (1920, 1939) and Pillon (2018), the SSH analysis (Fig. 2) indicated that the specimens analyzed represent a morphologically diverse cluster that requires further investigation. *Polyosma pubescens* and *P. schulzemenzii* remained morphologically similar but were clearly delineated by the SSH analysis (Fig. 2) and by the UPGMA analysis (Fig. 1). All other new species recognized in the UPGMA analysis (Fig. 1) were also recovered by the SSH-MST analysis (Fig. 2). The taxonomic status of the unpublished manuscript name '*P. subfoliacea*' *sensu* Schultze-Menz was evaluated and was found to be morphologically indistinct from *P. induta* Reeder (included within '*induta*' Fig. 2).

The three most informative morphological characters (presented in Fig. 2) quantified the density of indumentum on leaves (LFind and VENind), and on bracteoles (BRAind). The length of the petiole (PETlg) and degree of irregularities of the leaf margin (LFmar) were the next most useful characters for distinguishing species/species groups. Other important morphological characters are listed, together with KW – H statistics (see the legend of Fig. 2).

The SSH analysis suggests that several species have close morphological similarities to *P. ilicifolia* (Fig. 2b); whereas *P. discolor/P. podophylla* is most similar, albeit distantly, to the geographically widespread *P. integrifolia* (Fig. 2b). Several morphological series of species, 'linking' (via the SSH-MST analysis) through *P. scyphocalyx* (Fig. 1b, 2b) and *P. infernaralis* (Fig. 1a, 2a), include the species grouped together in cluster B (Fig. 1). Morphologically similar species include those 'linking' from (1) *P. gigantea* (Fig. 2a, centre right) to *P. amygdaloides*, *P. globosa*, *P. alangiacea*, and *P. alipensis* (Fig. 2a, lower right); to *P. affinis* and *P. macrobotrys* (via the Australian species group of *P. nigrescens/P. reducta* – Fig. 2a, upper right); and to New Caledonian species (*P. leratii*, *P. kouaouana*, *P. pancheriana*, and *P. subintegrifolia* – Fig. 2a, upper centre), via *P. finisterrae*, *P. infernaralis*, *P. leptorhachis* (both Papuasian species), and *P. rigidiuscula* (Australian). The New Caledonian species *P. brachystachys* is morphologically more similar to *P. leptorhachis* (from Papuasia) than to the previous New Caledonian species (Fig. 2a); *P. infernaralis* is morphologically most like other Papuasian species (*P. subalpina* and *P. mucronata* – Fig. 2a, upper centre); (2) 'linking' from *P. scyphocalyx* (Fig. 2b, centre right) to other Papuasian species (*P. dentata*, *P. cestroides*, and *P. buxea*) and to the widespread *P. integrifolia*, and to the New Caledonian species group *P. densa/P. podophylla* (Fig. 2b, upper right).

The following New Caledonian species, *P. kouaouana*, *P. leratii*, *P. pancheriana* (including *P. subintegrifolia*) (Fig. 2a) are morphologically similar because of their elliptic leaves, terminal inflorescences, leaves with indistinct secondary veins (not prominent) on abaxial surface, and leaves (and veins) that are usually glabrous or sparsely hairy.

DISCUSSION

The paucity of field studies of this genus, throughout much of its range, is a serious impediment to understanding the systematics of the genus. Although most Australian species are relatively well-known, some are not, for example *P. nigrescens* and *P. reducta*. Likewise, a similar lack of knowledge applies to several New Caledonian species. Many of the species occurring in eastern Malesia (Indonesia and Papuasia) and the Solomon Islands are very inadequately known and poorly represented in herbaria. The extent and spatial pattern of morphological diversity in geographically widespread species, such as *P. integrifolia* and *P. forbesii*, also remains elusive. The difficulty in obtaining contemporary comparative field data for this study meant that our evaluation of morphology relied, in some cases, on relatively few historical herbarium collections representing different life-history stages. Even when taxa are well represented in herbaria, there are relatively few unequivocal morphological characters available. Despite the relative lack of data, we discerned the taxonomic limits of most previously recognised taxa, and our analyses revealed eleven undescribed species.

The following species were previously included within more broadly circumscribed species, namely: *P. alipensis* had not been distinguished from *P. affinis*; *P. alangiacea* was frequently not distinguished from *P. globosa*; and *P. kamialiensis* was included in a broadly circumscribed *P. forbesii*. However, these newly recognised species are morphologically different from their most similar congeners (Fig. 2). *Polyosma schulzemenzii* was included within the morphological variation of *P. pubescens* (Fig. 1, 2), although, albeit distant, its next most morphologically similar congener is *P. forbesii* (Fig. 2). Hence, it is not unexpected that *P. schulzemenzii* had been included within a broadly circumscribed *P. forbesii*. Conversely, pairs of morphologically similar species, separated by short branch lengths in the SSH-MST analysis (Fig. 2), such as *P. nigrescens* and *P. reducta*, *P. pancheriana* and *P. subintegrifolia*, and *P. cestroides* and *P. scyphocalyx* indicate close morphological similarity. These examples illustrate the difficulty of distinguishing species, whether they are morphologically similar or not, because there are relatively few morphological features, particularly on herbarium material, upon which to circumscribe species. Although species that are subtly distinct morphologically have proven difficult to recognise, there have been sufficient morphological differences to enable us to recognize these as separate species.

There was a lack of a strong geographic signal in our data, and we recommend that broader geographical sampling is essential for future taxonomic studies of *Polyosma*. This also avoids over-emphasizing the local expression of what may prove to be taxonomically trivial characters in narrowly defined geographic regions due to plastic responses to different habitats. For example, the taxonomic status of *P. nigrescens* and *P. reducta* requires further evaluation because insignificant characters may have inadvertently been regarded as taxonomically more important than they deserve. There is a need to examine populations of inadequately sampled SE Asian species, as well as those of widespread species complexes, like *P. integrifolia*, so that previously unrecognised taxa might be revealed. Several Australian and Papuasian species have densely hairy leaves (including secondary veins of leaves) and corollas, together with large corollas (such as *P. alangiacea*, *P. alipensis*, *P. globosa*, *P. induta*, *P. occulta*, and *P. pubescens*). The status of these shared morphological characteristics is unknown until evaluated using molecular sequence-based phylogenetic analyses. Papuasia appears to be the centre with the greatest morphological diversity within *Polyosma*, compared to species of western Malesia and Australasia. Whether or not the large number of habitats available within Papuasia has supported the evolution of many species of *Polyosma* remains unclear because the specific habitat requirements of most species are very inadequately known. However, it is not possible with our data to confirm the relative antiquity of lineages within the Papuasian region. From our data, the Australian species are morphologically most similar to the Papuasian species, with the New Caledonian species occurring as morphological outliers. The New Caledonian species tend to have thin, smooth elliptic leaves rather than thicker, rough, ovate leaves as found in the Papuasian species *P. forbesii*, *P. integrifolia*, *P. kamialiensis*, *P. pubescens*, and *P. schulzemenzii*.

With the relatively long geological isolation from the other terrains of the Australian plate (~65–62 Ma; Lafoy et al. 2005) and dynamic history of what is now New Caledonia, it is not surprising that several of the species are morphologically very similar, perhaps having evolved in isolation in a limited number of habitats. Whilst parts of New Caledonia have been submerged in the past, other regions comprising Zealandia were above sea level (Lafoy et al. 2005) and might, subsequently, have acted as refugia and/or sources of ancestral taxa of contemporary New Caledonian *Polyosma*.

Nevertheless, the distinctness of *P. discolor/P. podophylla* from all other New Caledonian species evaluated, with closest morphological similarity to the widespread *P. integrifolia,* may indicate a link between the Malesian-Papuasian-Australian regions. Likewise, the close morphological similarity between *P. leptorhachis* (Papuasia) and *P. brachystachys* (New Caledonia) supports a similar potential linkage. As with most such similarities, however, the process(es) and timing that led to the shared morphological similarities must remain speculative.

The limited availability of morphological characters emphasises the need for targeted field studies, and the collection and analysis of genomic data. The lack of current field-based surveys and collections means that an assessment of the systematics of *Polyosma* in Papuasia based on other data, such as molecular sequence data, is more difficult. Without another independent data source, it is difficult to evaluate the taxonomic integrity of some morphological characters. For example, the morphological variation observed within the geographically widespread *P. integrifolia* suggests that the current circumscription of this species may be taxonomically too broad, as e.g., the Solomon Islands specimens differ from those of more western populations. However, insufficient population-level information is available to fully evaluate this.

The well-sampled, geographically widespread, and relatively well-known Australian species *P. cunninghamii*, comprises two component clusters within a broader circumscription (not presented here). In this species, there is a tendency for the southern populations to have larger, membranous, and smoother leaves (rather than coriaceous/rough), with base subacute (vs cuneate), margin slightly toothed (vs entire), apex acuminate (vs shortly acuminate), and a smaller calyx that is moderately hairy (vs glabrous or sparsely hairy) than more northerly populations. However, some plants in more exposed localities, from the same southern populations, tend to be morphologically more typical of northern populations. Therefore, in our opinion, the observed morphological variation within this species does not appear to be taxonomically informative and is, rather, a plastic response to local environmental variables. A similarly detailed population study of *P. integrifolia* might also indicate that the observed morphological variation within this species is the result of similar factors.

The small number of samples available for some taxa, as used in our analyses, may have limited the capacity for those specimens to form distinct morphological groupings. The morphological characteristics derived from the three available herbarium specimens of ‘Polyosma consimilis’ (sensu Schultze-Menz, ms) are here regarded as being within the morphological circumscription of *P. occulta*. However, these specimens did not group closely with *P. occulta* in the ordination space, being displayed as outliers with long MST links. We conclude that this apparent distant ‘linkage’ of otherwise morphologically similar specimens may indicate insufficient sampling or too much noise in these data (Gower & Ross 1969). Finally, missing data had an undue negative impact on the clustering and ordination of those taxa with few representative specimens.

Our evaluation of the morphological variation within the Australian species of *Polyosma*, recently reviewed by Bean & Forster (2021), confirmed the morphological and taxonomic distinctness of *P. cunninghamii*, *P. globosa*, *P. hirsuta*, *P. rhytophloia*, and *P. rigidiuscula*. However, our study demonstrated that *P. alangiacea* was apparently morphologically diverse and requires further study. Bean & Forster (2021) compared the morphology of *P. alangiacea* with that of *P. cestroides* (from Papua New Guinea). Our SSH-MST analysis (Fig. 2) indicated that *P. alangiacea* was, in fact, morphologically most similar to the Australian species *P. globosa* (also inferred by Bean & Forster’s key to the species) and more distantly similar to the Papuasian species *P. alipensis* (based on our flexible UPGMA analysis, Fig. 1). It is morphologically very dissimilar to *P. cestroides*. *Polyosma globosa* differs morphologically from *P. alangiacea* by having moderately hairy leaves (vs densely hairy in *P. alangiacea*), with leaf apex subacute to acute (vs acuminate in *P. alangiacea*), and a shorter inflorescence (rachis 3.5–9 cm long, vs 9–24.5 cm long in *P. alangiacea*).

Although *P. nigrescens* is apparently morphologically distinguishable from *P. reducta* F.Muell., the status of the former remains uncertain based on our data. Bean & Forster (2021) distinguish *P. reducta* by its persistently hairy branchlets and toothed leaf margin, compared to *P. nigrescens* that has glabrous branchlets (when mature) and leaf margin entire. They suggest that these species are ‘most closely related to’ *P. amygdaloides*. We are unable to comment on possible relatedness based only on our morphological dataset and phenetic analyses, but these two Australian species are, by our determination, morphologically most similar to *P. macrobotrys* (Fig. 1 – UPGMA analysis) or to *P. glaberrima* and *P. macrobotrys* (Fig. 2 – SSH-MST analysis).

Taxonomic accounts of New Caledonian *Polyosma* are provided by Guillaumin (1920, 1939) and Pillon (2018). Our analyses indicate that the New Caledonian species are mostly more similar to each other than to other congeners except for *P. brachystachys* Schltr. that is morphologically more like the Australian species *P. leptorhachis* and *P. rigidiuscula* (Fig. 1, 2). The morphological difference of most New Caledonian *Polyosma* from those of other regions is perhaps not unexpected given the duration of geological isolation of this part of Australasia (Lowry II 1998, Lafoy et al. 2005). The uniqueness of the New Caledonian flora arises from several factors, namely, its former isolation, the multiplicity of geological substrates and the climatic variability due to the island’s relief (Morat 1993). The status of the New Caledonian flora is further complicated because Zealandia, of which New Caledonia and New Zealand are a part, may have been completely submerged at various times (Campbell & Hutching 2007).

Within New Caledonian *Polyosma*, specimens of *P. discolor* and *P. podophylla* clustered together to produce two taxonomically heterogenous clusters. This is congruent with the conclusions of Guillaumin (1920, 1939) and Pillon (2018) that *P. podophylla* should be regarded as a synonym of *P. discolor*, but our results suggest that the current taxonomic circumscription of each taxon may require further evaluation. There are, potentially, two entities worthy of taxonomic recognition. A detailed population study should be undertaken to determine the morphological and genomic diversity within this species group.

Our relatively small sample size precluded a detailed evaluation of the morphological variation within *P. leratii* and so we have accepted the inclusion of *P. leratii* var. *puberula* within the specific concept of *P. leratii* as proposed by Pillon (2018). *Polyosma pancheriana* var. *subintegrifolia* was regarded as a distinct species by Pillon (2018), as *P. subintegrifolia*, but the morphological variation within this taxon and *P. pancheriana* Baill. suggests that further evaluation is necessary to confirm the distinctness of these taxa. The morphological distinctness of *P. kouaouana* is supported by our study but is here regarded as morphologically more similar to *P. leratii* and *P. pancheriana* (including *P. subintegrifolia*) than to *P. discolor*. Although we accept that there are approximately seven species of *Polyosma* in New Caledonia, as concluded by Pillon (2018), detailed population studies are likely to result in the re-circumscription of some taxa and possibly the recognition of *P. podophylla* as distinct from *P. discolor*.

TAXONOMY

Polyosma Blume

Polyosma Blume (1826) 658. — Lectotype (designated by Hutchinson 1967: 31): *Polyosma ilicifolia* Blume.

Shrubs or small to large trees. *Leaves* simple, opposite or subopposite, petiolate, pinnatinerved, with margin entire or variously toothed. *Inflorescence* a raceme, sometimes spicate (flowers rarely solitary), mostly terminal, rarely axillary, usually erect, sometimes pendulous. *Flowers* bisexual, actinomorphic, usually fragrant, sessile or pedicellate; bracteoles free, 3, or connate and single, then 3-fid, inserted at or near base of calyx. *Calyx* tube adnate to ovary (hypanthium) and lobes reduced so calyx 4-dentate, persistent. *Corolla* fused into a long tube with lobes 4, valvate, sometimes splitting almost to base, epigynous, not

persistent. *Stamens* 4, not attached to corolla; filaments hairy; anthers basifixed. *Ovary* inferior, 1-loculate, glabrous; ovules many; style simple, filiform; stigma capitate or truncate. *Fruit* an indehiscent 1-loculate drupe, with sepals persistent distally, usually maturing to bluish or purplish black, 1-seeded.
For a comprehensive generic description, refer to Bean & Forster (2021).

Distribution — It is likely that there are almost 100 species (taxonomic revisions still required), occurring from China (South Central and Southeast), south through Bangladesh (Indian subcontinent), and south-east Asia (Cambodia, Vietnam, Thailand, Myanmar, Assam), Malesia (Malaysia, Singapore, Indonesia, Brunei, Philippines, Timor Leste, Papua New Guinea), and the Solomon Islands, then south to the east coast of Australia (Queensland and New South Wales) and extending east to New Caledonia.

Note — *Polyosma ilicifolia* is included here as it is the type of the genus and as the types of all names included in this species are lectotypified. The species occurs outside the area of interest and is not included in the identification key.

Polyosma ilicifolia Blume — Fig. 3

Polyosma ilicifolia Blume (1826) 658. — Lectotype (designated here): *C.L. Blume s.n.* (lecto L [L 0035086], Indonesia). — Likely syntype: *C.L. Blume s.n.* ([L 0035083]), Indonesia, Java (= Jawa), without date.

Fig. 3 Lectotype of *Polyosma ilicifolia* Blume: *C.L. Blume s.n.*, Java (= Jawa, Indonesia) (lecto L 35086).

Polyosma serrulata Blume (1826) 659 (‘*serrulatum*’). — Lectotype (designated here): *C.L. Blume s.n.* (lecto L [L 0035088], middle left flowering specimen; isolecto L [L 0035088] other, partially fragmented, specimens), Indonesia, Java (= Jawa), without date.

Lectotypification — 1. As listed above, Hutchinson (1967) designated *P. ilicifolia* as type of *Polyosma*. The lectotypification presented here formally confirms the type status of the collections by Carl L. Blume on sheets L 35086 and L 35083 as held at Naturalis Biodiversity Center (L).

2. In the protologue of *P. ilicifolia*, additional habitat information is provided, namely “Crecit: in cacumine montium a torum Javae insulae” that was not included on the collection label. The morphology of the herbarium material (L 0035086) is here regarded as in agreement with the brief description provided by Blume (1826: 659). He noted that this species had a long flowering period (namely “Floret: omni tempore”). The two collections on the L 0035086 are both flowering, and this sheet was annotated (confirmed) by Georg Schulze-Menz in 1967 as ‘lectotype’ material. The lower specimen on L 0035086 is partially fragmented.

3. The other Blume collection of *P. ilicifolia* (L 0035083), incorrectly annotated by an unknown hand as ‘Holotype’, was collected from “Archipel. ins. (printed) Pondok Tenge (handwritten: presumably Pondok Tengah: Middle Hut).” This collection is regarded as a probable syntype and was possibly collected from Taman Nasional Gunung Gede Pangrango, Jawa, Indonesia, as was the synonym *P. serrulata* (see below).

4. In the protologue of *P. serrulata*, Blume (1826: 659) provided additional habitat and locality information, namely “Crecit: in sylvis montium Gede et Pangurango (= Taman Nasional Gunung Gede Pangrango, Jawa, Indonesia).”

5. Blume (1851) circumscribed several varieties within *P. ilicifolia*. However, the taxonomic status of the morphological variation within this species has not been undertaken in this study.

KEY TO THE SPECIES OF POLYOSMA IN PAPUASIA

1\. Leaf margin entire. Although leaf margin usually entire, often with 1 or 2 poorly developed teeth distally 2
1\. Leaf margin toothed 17

2\. Inflorescence pendulous at flowering. . . . . 5. *P. buxea*
2\. Inflorescence erect at flowering 3

3\. Leaves (when mature) with abaxial surface hairy 4
3\. Leaves with abaxial surface glabrous, or with an occasional hair 7

4\. Leaf lamina up to 5 by 1–2 cm, with 4–7 lateral veins on each side of midvein; petiole less than 1 cm long. — Although leaf margin usually entire, often with 1 or 2 poorly developed teeth distally . . . . 20. *P. longebracteolata*
4\. Leaf lamina greater than 7 by 2–8 cm, with at least 10 lateral veins on each side of midvein; petiole usually at least 1 cm long 5

5\. Leaf base rounded; leaves 2–3.5 cm wide; corolla buds brown with green tinge . . . . 28. *P. schulzemenzii*
5\. Leaf base acute; leaves 3.5–8 cm wide; corolla buds white to pale yellow or pinkish green to purplish 6

6\. Leaf lamina elliptic, 9–11 by 3.5–4.5 cm; secondary veins of lamina 10–15 on each side of midrib; petiole 0.8–1.5 cm long . . . . 26. *P. pubescens*
6\. Leaf lamina elliptic to narrowly obovate, 11–25 by (4–)5–8 cm; secondary veins of lamina 17–28 on each side of midrib; petiole 1.5–2(–2.8) cm long . . 18. *P. kamialiensis*

7\. Leaf lamina ± obovate 8
7\. Leaf lamina elliptic or narrowly ovate. 10

8\. Leaf lamina up to 2.7 by 0.5–1.1 cm. — Leaf margin rarely entire, usually shortly serrate, with 1 or 2 teeth per side . . . . 27. *P. rampae*
8\. Leaf lamina at least 4 by 1.3 cm 9

9\. Leaf lamina 5–12 by 3–7 cm; petiole 1.5–3 cm long . . . . 12. *P. glaberrima*
9\. Leaf lamina 4–6 by 1.3–2 cm; petiole 0.7–1 cm long. . . . . 30. *P. stenosiphon*

10\. Venation usually prominent on abaxial surface of lamina 11
10\. Venation usually indistinct on abaxial surface of lamina 13

11\. Leaf apex attenuate; petiole 5–25 cm long. . . . . 6. *P. cestroides*
11\. Leaf apex obtuse to rounded or acuminate; petiole 0.5–3 cm long 12

12\. Leaf apex acuminate; lamina with 13–42 lateral veins on each side of midvein; inflorescence (9–)10–22 cm long; corolla 5–10 mm long . . . . 17. *P. integrifolia*
12\. Leaf apex obtuse or rounded; lamina with c. 10 lateral veins on each side of midvein; inflorescence up to 5 cm long; corolla up to 28 mm long . . . . 24. *P. oligantha*

13\. Leaf lamina with apex long-tapering or attenuate . . . . 3. *P. amygdaloides*
13\. Leaf lamina with apex subacute or acuminate 14

14\. Inflorescence glabrous . . . . 21. *P. macrobotrys*
14\. Inflorescence sparsely hairy 15

15\. Branchlets sparsely hairy; subcanopy tree, up to c. 5 m high . . . . 9. *P. flenleyi*
15\. Branchlets glabrous; canopy or subcanopy tree, c. 10–20 m high. 16

16\. Branchlets with white lenticels; corolla 8–12 mm, green, brownish green, sometimes becoming brownish maroon; leaf blades 4–9 cm long . . . . .1. *P. affinis*
16\. Branchlets with prominent craterous scars; corolla 3–5 mm long, whitish yellow; leaf blades 5.5–11 cm long. . . . . .11. *P. gigantea*

17\. Inflorescence axillary or subterminal (appearing axillary) 18
17\. Inflorescence distinctly terminal 25

18\. Bracteoles and calyx lobes glabrous . . . . 8. *P. finisterrae*
18\. Bracteoles and calyx lobes hairy 19

19\. Leaf lamina with apex mucronate . . . . 23. *P. occulta*
19\. Leaf lamina with apex acuminate or attenuate 20

20\. Venation of abaxial leaf lamina visible but usually not prominent . . . . 16. *P. infernaralis*
20\. Venation of abaxial leaf lamina usually prominent . . . 21

21\. Leaf lamina glabrous . . . . 7. *P. dentata*
21\. Leaf lamina hairy 22

22\. Leaf lamina rhombic-oblong or narrowly obovate . . . . 13. *P. heliciiformis*
22\. Leaf lamina elliptic or broadly elliptic 23

23\. Calyx lobes > 5 mm long; bracteoles > 5 mm long . . . . 10. *P. forbesii*
23\. Calyx lobes < 5 mm long; bracteoles < 5 mm long . . . 24

24\. Leaf lamina densely ferruginous; 6–14 by 3–6 cm. . . . . 4. *P. brassii*
24\. Leaf lamina sparsely hairy; 5–22 by 2–7 cm . . . . 14. *P. helicioides*

25\. Leaf lamina hairy, at least on abaxial surface 26
25\. Leaf lamina glabrous 30

26\. Leaf apex attenuate; lamina broadly elliptic 27
26\. Leaf apex usually obtuse to acuminate; lamina oblong, elliptic, obovate to spathulate 28

27. Subcanopy tree, 10–20 m tall; bracteoles 5–10 mm long . . . . 10. *P. forbesii*
27. Small tree, c. 3 m tall; bracteoles 1–2 mm long . . . . 15. *P. induta*

28. Leaf lamina 0.2–0.5 by 0.5–1.8 cm, oblong, or obovate to spathulate; apex obtuse to subacute; bracteoles (3–4 mm long) as long as calyx. — Leaf margin is usually entire, but often with 1 or 2 poorly developed teeth . . . . 20. *P. longebracteolata*
28. Leaf lamina 13.5–17 by 4–8 cm, obovate or elliptic; apex obtuse or acuminate; bracteoles either shorter than (2–3 mm long) or mostly longer (5–10 mm long) than calyx 29

29. Leaf apex subacute to acute; bracteoles 5–10 mm long (mostly longer than calyx) . . . . 2. *P. alipensis*
29. Leaf apex acuminate; bracteoles 2–3 mm long (shorter than calyx) . . . . 25. *P. pachyrhachis*

30. Venation of abaxial surface of lamina usually prominent 31
30. Venation of abaxial surface of lamina visible but usually not prominent 36

31. Shrub c. 2 m tall; inflorescence with rachis 1.5–2 cm long; leaf lamina up to 2.7 cm long . . . . 27. *P. rampae*
31. Small tree up to 5 m tall, or large tree, 6–20 m tall; inflorescence with rachis at least 4 cm long; leaf lamina at least 3.5 cm long 32

32. Leaf lamina obovate-narrowly ovate or elliptic-narrowly ovate; leaf apex obtuse to apiculate (on distal leaves) . . . . 33. *P. trimeniifolia*
32. Leaf lamina elliptic; leaf apex acuminate 33

33. Leaf margin distinctly serrate throughout; corolla purple with a reddish or greenish tinge . . . . 29. *P. scyphocalyx*
33. Leaf margin with an occasional tooth; corolla buds white or yellow 34

C.S.I.R.O. Phytochemical Survey
PLANTS OF NEW GUINEA
Distributed with the request
that new identifications be notified to:
Herbarium Australiense, C.S.I.R.O., Canberra, Australia.
Saxifragaceae No. T.G.H. 11,816
Polyosma

Tree about 30 ft. X 4 in. in semi-moss forest.
Elev. about 7900 ft.
Summit of Mt. Kaindi - about 6 miles SW of Wau,
Morobe District, T.N.G.
Outer bark reddish brown, rather rough; inner
bark reddish brown; corolla dark brownish
maroon; fruit green.
Preserved flowers.
Thomas G. Hartley May 8, 1963

Fig. 4 Holotype collection of *Polyosma affinis* Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*, showing branchlets with leaves, flowers, and fruits (*T.G. Hartley 11816* [CANB151125.1]).

34. Corolla buds white . . . . 17. *P. integrifolia*
34. Corolla buds whitish yellow, often with green tinge . . . 35
35. Leaf lamina with 13–25 lateral veins on each side of midvein; corolla buds 3–5 mm long; rhachis 8.5–10 cm long . . . . 11. *P. gigantea*
35. Leaf lamina with c. 8 lateral veins on each side of midvein; corolla buds c. 10 mm long; rhachis 5–6 cm long. . . . . 32. *P. torricellensis*
36. Leaf apex acuminate or attenuate . . . .19. *P. leptorhachis*
36. Leaf apex mucronate. 37
37. Shrub up to 1 m tall; corolla green. — Montane forest (at elevation of up to 3500 m) . . . . 22. *P. mucronata*
37. Small tree, 2–5 m tall; corolla greenish brown or purple. — Alpine shrubbery forest (from elevations of at least 3000 m) . . . . 31. *P. subalpina*

1. ***Polyosma affinis*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 4

Etymology. The specific epithet of this new species (*affinis* = 'akin') refers to it being morphologically most like *P. macrobotrys*, but also with similarities to *P. integrifolia* and, to a lesser extent, to *P. amygdaloidea* and *P. glaberrima*.

Polyosma affinis is morphologically most similar to *P. macrobotrys*. Both species have glabrous, elliptic leaves with base of lamina acute and margin entire; however, *P. affinis* usually has smaller leaves (usually 4–9 cm long, and mostly 2–4 mm wide), compared to *P. macrobotrys* that has leaves 12–22 cm long and 4–7.5 cm wide. It also differs by having a brownish maroon corolla and smaller brownish green fruits (4–5 mm long, 3–4 mm diam), compared to a white corolla and larger dark blue fruits (7–10 mm long, 6–8 mm diam) in *P. macrobotrys*. — Type: *T.G. Hartley 11816* (holo CANB [CANB151125]; iso K, L, LAE [LAE 66976]), Papua New Guinea, Morobe, Summit of Mt Kaindi, c. 6 miles SW of Wau, 8 May 1963.

Subcanopy tree, c. 12 m tall, bole c. 5 m tall, c. 12 cm diam. *Branchlets* glabrous, brown, lenticels vertical, white. *Leaves* glabrous; petiole 0.5–1.5 cm long, brown; lamina elliptic, 4–9 by 2–4 cm, coriaceous, drying brown on both surfaces; base acute, margin entire, apex shortly acuminate; secondary veins 10–25 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, not prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered, erect; rachis 1.5–4 cm long, sparsely hairy; flowers loosely arranged and evenly spaced; pedicels 3–5 mm long; bracteoles 1–3 mm long, sparsely hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, 8–12 mm long, green, brownish green, sometimes becoming brownish maroon; corolla moderately hairy, fully split into 4 lobes at anthesis. *Fruits* ovoid, 4–5 by 3–4 mm, sparsely hairy, brownish green.

Distribution — Papua New Guinea (West Sepik, Morobe).

Habitat & Ecology — Occurring in lowland to montane forests at elevations up to 2 550 m.

Conservation status — Probably not of concern.

Additional specimens examined (Paratypes). Papua New Guinea, West Sepik, Mori, Vanimo, *J.S. Womersley NGF 13930* (K, L); ibid., *D. Sayer NGF 19517* (K, NSW); ibid., *D. Sayer NGF 19517A* (L, LAE); Morobe, Garaina, *T.G. Hartley 12772* (K, LAE).

Notes — 1. This species has a widespread altitudinal range, occurring from lowland to montane forest.

2. *Polyosma affinis* is morphologically also like other species with entire leaves, such as *P. integrifolia* and, to a lesser extent, to *P. amygdaloidea* and *P. glaberrima.* It can be distinguished from *P. integrifolia* by the inflorescence rachis being 1.5–4 cm long (vs *P. integrifolia* 9–22 cm long); corolla green (vs *P. integrifolia* white); fruits sparsely hairy, brownish green (vs *P. integrifolia* glabrous and bluish black when mature). It has shorter leaves (4–9 cm long, vs (7–)10–16 cm long in *P. amygdaloidea*), shorter rachis (1.5–4 cm long, vs (3–)5–10 cm long in *P. amygdaloidea*), and green corolla (vs yellowish white in *P. amygdaloidea*). *Polyosma affinis* has brown branchlets with vertical lenticels (vs black branchlets with scattered lenticels in *P. glaberrima*) and leaves elliptic (vs obovate leaves in *P. glaberrima*).

3. Collections of *P. affinis* and *P. alipensis* were often included in a broadly circumscribed *P. forbesii.* These two new species are readily distinguished by several morphological characteristics, namely, *P. alipensis* is usually a larger tree (12–24 m high), with larger leaves (petioles 2.5–4 cm long; lamina 13–17 by 4–8 cm) compared with *P. affinis* which is a smaller tree about 12 m high, with petioles 0.5–1.5 cm long, and lamina 4–9 by 2–4 cm. Furthermore, the leaf margin of *P. alipensis* is serrate (like *P. forbesii*) compared to *P. affinis* that is entire. *Polyosma forbesii* has leaves with the apex attenuate whereas *P. alipensis* has subacute to acute leaves.

2. ***Polyosma alipensis*** B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 5

Etymology. The specific epithet ('*alipensis*') refers to the village Alipe, in the Western Highlands, where this species was collected. It is only known from this location.

Polyosma alipensis is morphologically similar to *P. globosa*, but differs from the latter by having larger leaves (petiole 2.5–4 mm long; lamina 13–17 by 4–8 mm vs petiole 1.5–2 mm long; lamina 8–12 by 3–6 mm in *P. globosa*), leaf margin serrate (vs entire in *P. globosa*), and lamina apex subacute to acute (vs acuminate in *P. globosa*). — Type: *N. Bowers 524* (holo LAE [LAE 105558]; iso AK357464), Papua New Guinea, Western Highlands, Kaugel Valley, (Alipe), 11 June 1969.

Tree, 12–24 m tall, bole up to 4 m, 4–10 cm diam. *Branchlets* glabrous, dark brown, pustules brown, scattered, prominent scars by fallen petioles. *Leaves* pubescent; petiole 2.5–4 cm long; lamina elliptic, 13–17 by 4–8 cm, thickly coriaceous, drying both surfaces dark brown; base cuneate, margin serrate, apex subacute to acute; secondary veins 13–23 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, hairy, prominent on abaxial surface. *Inflorescence* racemose, terminal, > 30-flowered; rachis 3.5–9 cm long, hairy, with flowers densely clustered along rachis; pedicels (2–)5–7 mm long (fruiting pedicels 8–10 mm long); bracteoles 5–10 mm long, hairy. *Calyx* distinctly cup-shaped; calyx lobes 4–6 mm long. *Corolla buds* tubular, (6–)9–10 mm long, greenish yellow to white, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 13–15 by 10–13 mm, glabrous, green turning bluish purple.

Distribution — Papua New Guinea (Western Highlands).

Habitat & Ecology — Occurring in lower montane forest from elevations of 2 000–2 500 m.

Conservation status — This species is here regarded as threatened because of the clearance of the forest by the local people for gardening and the use of the timber of this species for constructing homes.

Additional specimens examined (Paratypes). Papua New Guinea, Western Highlands, Alipe Village, *N. Bowers 433* (LAE); ibid., *N. Bowers 674* (AK, LAE); ibid., *J.S. Womersley NGF 43508* (LAE); Tambul, *J.S. Womersley NGF 14250* (LAE).

3. ***Polyosma amygdaloides*** Reeder

Polyosma amygdaloides Reeder (1946) 283. — Type: *L.J. Brass 13335* (holo A [A42992] (see Typification below); iso BM [BM624948], BO, BRI [BRI-AQ0342397], L [L 0035069], LAE), Indonesia Papua, Snow Mountains, Bernhard Camp, 4 km SW of Idenburg River, Mar. 1939.

Typification. Reeder (1946: 275) states that "In the absence of parenthetical letters indicating the place of deposit [of specimens], cited specimens are to be found only at the Arnold Arboretum [A]." Since Reeder cited the

Fig. 5 Isotype collection of *Polyosma alipensis* B.J.Conn & O.K.Paul (*N. Bowers 524*, AK) showing branchlet with leaves and fruits. a. Insert of *N. Bowers 674* [AK357463] showing base of leaves and immature developing inflorescence.

type of *P. amygdaloides* as "*Brass 13335* (TYPE)" (protologue, p. 283), by inference, held at A, we accept that this specimen is the intended holotype of this species. Based on this assumption, lectotypification is here regarded as unnecessary.

Tree, 10–15 m tall, or shrub up to 5 m tall. *Branchlets* glabrous, brown, pustules scattered. *Leaves* glabrous; petiole 0.5–2 cm long; lamina narrowly ovate, (7–)10–16 by 2–4.5 cm, slightly coriaceous, drying brown on both surfaces; base acute, margin entire, apex attenuate; secondary veins 13–27 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, not prominent but visible on abaxial surface. *Inflorescence* racemose, axillary, > 30-flowered; rachis (3–)5–10 cm long, glabrous; flowers clustered tightly together; pedicel 2–3 mm long; bracteoles 1–2 mm long, sparsely hairy. *Calyx* glabrous; calyx lobes 1–3 mm long. *Corolla buds* tubular, (7–)10–15 mm long, yellowish white; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 7–10 by 4–6 mm, glabrous, green to drying blackish brown.

Distribution — Indonesia (Papua, Papua Barat) and Papua New Guinea (Eastern Highlands).

Habitat & Ecology — Occurring in lower montane forest at elevations from 900 to 1 540 m.

Conservation status — Not known.

Additional specimens examined. INDONESIA, Papua Barat, Fak Fak, Kowap, N from FakFak, *W. Vink BW 12204* (L). – PAPUA NEW GUINEA, Sepik, s.loc., *C.L. Ledermann 9910* (L); Eastern Highlands, Plot 1200C, Mt Wilhelm, *J. Munzinger 6937, J.-F. Molino, K. Molem, J.-C. Pintaud* (Binatang-RC, K, LAE, MPU, NSW, P); Marafunga, *H. Streimann NGF 27671* (LAE, NSW); Crater Mountain Wildlife Management Area, *W. Takeuchi 12073* (L, LAE).

Note — The calyx of this species is glabrous, whereas other species have a sparsely or densely hairy calyx. *Polyosma amygdaloides* is morphologically most similar to *P. gigantea* but differs in several features: leaves with lamina narrowly ovate (vs elliptic in *P. gigantea*); leaf apex attenuate (vs acuminate); inflorescence axillary (vs terminal); and large corolla (7–)10–15 mm long (vs 3–5 mm long).

4. ***Polyosma brassii*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 6

Etymology. The specific epithet acknowledges the Australian botanical collector Leonard J. Brass (Perry 1971), who collected extensively throughout New Guinea and discovered this new species.

Polyosma brassii is morphologically most like *P. induta* and *P. helicioides*. Even though all three species have elliptic leaves, being broadly elliptic in *P. induta*, it differs from the latter two species by having an acuminate leaf apex (vs attenuate in *P. induta* and *P. helicioides*) and flowers with corolla brown (vs greenish white or yellow for the latter two species). — Type: *L.J. Brass 29597* (holo LAE [LAE 34056]); iso L [L 0035074]), Papua New Guinea, Morobe, Mt Kaindi, 15 May 1959.

Tree, 8–15 m tall. *Branchlets* densely hairy, brown, moderately angular or ridged. *Leaves* densely hairy; petiole 1–5 cm long, brown; lamina elliptic, 6–14 by 3–6 cm, coriaceous, drying dark brown on both surfaces; base acute to cuneate, margin serrate, apex acuminate; secondary veins 12–19 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, pubescent, prominent on abaxial surface. *Inflorescence* racemose, axillary, 20–30-flowered; rachis 6–8 cm long, densely hairy; flowers loosely and evenly arranged (not clustered); pedicels 8–12 mm long; bracteoles 1–2 mm long, densely hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (10–)12–20 mm long, brown, with yellowish tinge; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 9–13 by 5–8 mm, hairy, green.

Fig. 6 Isotype collection of *Polyosma brassii* Schulze-Menz ex B.J.Conn & O.K.Paul (*L.J. Brass 29597* [L 0035074]).

Distribution — Papua New Guinea (Morobe Prov.: Wau, Mt Kaindi).

Habitat & Ecology — Occurring in mid montane *Nothofagus* forest (*Nothofagaceae*) between elevations of 1 800–2 200 m.

Conservation status — This species is only known from Mt Kaindi in the Morobe Province. This is an area that is continuing to be adversely affected by clearing and other anthropogenic disturbances. Therefore, it is suspected that this species is endangered.

Additional specimens examined (Paratypes). Papua New Guinea, Morobe Province, Mt Kaindi, Wau, *T.G. Hartley 11739* (K, L); ibid., *J.L.C.H. van Valkenburg 764* (seedling) (L).

Notes — 1. *Polyosma brassii* and *P. helicioides* are morphologically similar by having axillary inflorescences (vs terminal in *P. induta*). *Polyosma brassii* and *P. induta* have hairy branchlets, leaves and fruits, whereas *P. helicioides* has glabrous or slightly hairy branchlets and leaves, with fruits glabrous.

2. The branchlets and leaves of *P. brassii*, *P. forbesii*, and *P. schulzemenzii* are densely ferruginous with dark rusty brown hairs; however, this species differs from *P. forbesii* with its acuminate leaf apex (vs attenuate in *P. forbesii*); bracteoles usually shorter (1–2 mm long vs 1–10 mm long in *P. forbesii*); and brown corolla (vs yellowish green in *P. forbesii*). *Polyosma brassii* has elliptic leaves and hence differs from the narrowly obovate leaves of *P. schulzemenzii*.

5. ***Polyosma buxea*** Mattf.

Polyosma buxea Mattf. (1938) 274. — Type: *J. Clemens & M.S. Clemens 3908* (holo B, destroyed), Papua New Guinea, Morobe, Yunzaing, 18 Aug. 1936. — Neotype (designated here): *J. Clemens & M.S. Clemens 3526* (G [G388955]), Papua New Guinea, Morobe, Yunzaing, 2 July 1936.

Typification. Johannes Mattfeld cites two collections by *J. Clemens & M.S. Clemens*, namely, *3526* and *3908* (Mattfeld 1938: 274), with the latter being designated as the type of this species. However, neither of these *Clemens* collections have been located at B and both are believed to have been destroyed during the Second World War. Furthermore, no duplicates of *J. Clemens & M.S. Clemens 3908* have been located. Since *J. Clemens & M.S. Clemens 3526*, was regarded as conspecific by Mattfeld, a sheet held at G [G388955] is here selected as the neotype of *P. buxea* to replace the lost type.

Subcanopy tree 8–15 m tall. *Branchlets* glabrous, brown, pustular, with lenticels scattered, greyish white. *Leaves* glabrous; petiole 1–3.5 cm long; lamina narrowly elliptic to slightly narrowly ovate, 4–20 by 2–6 cm, black membranous, drying thinly papery to slightly coriaceous, glabrous, drying brown on both surfaces; base acute, margin entire, apex acuminate; secondary veins 10–28 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next lateral vein; tertiary veins weakly percurrent, glabrous, prominent on abaxial surface. *Inflorescences* racemose, terminal, pendulous, > 30-flowered; rachis 20–35 cm long, glabrous, with flowers tightly clustered; pedicels 4–6 mm long; bracteoles 1–2 mm long, glabrous. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, 8–12(–20) mm long, white; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* not seen.

Distribution — Indonesia (Papua Barat) and Papua New Guinea (West Sepik, Morobe, Eastern Highlands, Milne Bay).

Habitat & Ecology — Occurring in lowland forest dominated by *Castanopsis* (D.Don) Spach (*Fagaceae*) at elevations of 1 000–1 800 m.

Conservation Status — Not known. This species is endemic to the island of New Guinea.

Additional specimens examined. Indonesia, Papua Barat, Vogelkop, Kebar Valley, *P. van Royen 3990* (L). – Papua New Guinea, West Sepik, Telefomin, *R.J. Johns 194* (LAE); Morobe, Wau, *T.K. Pratt 79-1143* (LAE); Eastern Highlands, Arau, *L.J. Brass 32235* (K, L, LAE); Aiyura, *J.S. Womersley NGF 4429* (L, LAE); Milne Bay, Goodenough Island, *L.J. Brass 24726* (K, LAE); Mt Dayman, *L.J. Brass 23299* (K, LAE); Raba Raba, *P. Woods, N. Cruttwell & M. Galore NGF 17590* (K, L, LAE); Mt Riu, Sudest Island, *L.J. Brass 27897* (L, LAE).

Note — This is the only species with pendulous inflorescences. It is morphologically most like *P. integrifolia* (for details, see notes under the latter species).

6. ***Polyosma cestroides*** Schltr.

Polyosma cestroides Schltr. (1915) 129; P.Royen (1983) 2523, f. 736. — Type: *C. Ledermann 12566* (holo B [B10-0296088]), Papua New Guinea, West Sepik, '*Felsspitze*', (= vicinity of Sepik River, near August River) (Veldkamp et al. 1988), 3 Aug. 1913.

Polyosma tubulosa Schltr. (1915) 130. — Type: *C. Ledermann 12210* (holo B [B_10_0296089]), Papua New Guinea, Madang, 'Schraderberg' (= Schrader Mountains), 12 June 1913.

Subcanopy to sometimes canopy tree, 5–20 m high, bole 4–16 m, 10–13 cm diam. *Branchlets* glabrous, dark brown, smooth with no lenticels. *Leaves* glabrous; petiole 0.5–2.5 cm long; lamina elliptic, 4–15 by 2–6 cm, coriaceous; discolours in dried material to dark brown to black adaxially, very dark brown abaxially; base acute to cuneate, margin entire, apex attenuate or long tapering; secondary veins 8–21 on each side and at an angle greater than 45° from midrib, regularly looping near margin on to the next secondary vein; tertiary vein weakly percurrent, glabrous and very prominent on abaxial surface. *Inflorescence* racemose, terminal, 20–30-flowered; rachis 1.5–9 cm long, densely hairy; flowers loosely and evenly arranged towards distal end of rachis; pedicels (2.5–)3–5 mm long, narrow; bracteoles 1–3 mm long, hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (5–)10–25 mm long, light brownish green; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 5–13 by 4–9 mm, slightly hairy, green to purple.

Distribution — Papua New Guinea (West Sepik, East Sepik, Madang, Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Gulf, Milne Bay).

Habitat & Ecology — Occurring in mid- to upper montane mossy forests from elevations of (600–)2 000–3 300 m.

Conservation status — Not regarded as of concern.

Additional specimens examined. Indonesia, Indonesia Papua, Snow Mountains, Idenburg River, 15 km SW of Bernhard Camp; *L.J. Brass 12285* (BRI, L, LAE). – Papua New Guinea, West Sepik, Bewani Mountains, *J. Waikabu et al. LAE 50546* (L, LAE); East Sepik, Mt Hunstein, *R. Hoogland 10983* (L, LAE); Victor Emmanuel Range, *P. van Royen 11318* (LAE); ibid., *P. van Royen 11332* (L, LAE); ibid., *P. van Royen 11334* (L, LAE); Madang, near Kaironk Village, *G. Weiblen 1029, M. Evans, B. Isua & S. Majneb* (L, LAE); Morobe, Aseki, *L.A. Craven 1153 & R. Schodde* (L, LAE); ibid., *L.A. Craven 1246 & R. Schodde* (L, LAE); Mt Wasaunon-Kabum, *K. Fazang LAE 78746* (LAE); ibid., *K. Fazang LAE 78747* (LAE); ibid., *K. Fazang LAE 78866* (LAE, NSW); Lake Trist, *E.E. Henty NGF 29019* (K, LAE); Salamaua, *A.N. Millar NGF 228157* (K, L, LAE); Wau, *T.K. Pratt 1006 & 1118* (LAE); Eddie Creek, *C.D. Sayers NGF 19964* (K, L, LAE); Mt Kaindi, *L.J. Brass 29725* (L, LAE); Mt Missim, *J.L. Gressitt BMF310* (LAE); Kuper Range, *W. Takeuchi 403* (LAE); Mt Kurunkurungun, *A. Vinas LAE 59855* (L, LAE); Western Highlands, Mt Kaiap, *H. Tagawa 212* (LAE); Wabag, *J.R. Flenley ANU 2682* (K, LAE); Yaki River, *R.D. Hoogland 6966 & R. Schodde* (BRI, L, LAE); Eastern Highlands, Mt Wilhelm, *L.J. Brass 30560* (L, LAE); Okapa, *L.J. Brass 31813* (L, LAE); Mt Michael, *L.J. Brass 31306* (L, LAE); Southern Highlands, Mt Giluwe, *N.M.U. Clunie & G. Larivita LAE 63219* (L, LAE); Gulf, Tauri River, *R. Pullen 6585* (L, LAE); Milne Bay, Mt Dayman, *L.J. Brass 23207* (K, L, LAE).

Notes — Widespread, high-elevation species that differs from *P. occulta* with its entire margin and long tapering apex. It is morphologically most like *P. dentata*, differing from the latter species by being a taller tree (5–20 m high, vs 4–6.8 m high in *P. dentata*), with base of leaf acute to cuneate (vs *P. dentata* acute), leaf margin entire (vs serrate for *P. dentata*), and leaf apex attenuate to long-tapering (vs acuminate in *P. dentata*).

Reeder (1946) regarded this species (as *P. tubulosa*), as occurring in Indonesia (Papua), based on *Brass 12285*.

7. ***Polyosma dentata*** Schltr.

Polyosma dentata Schltr. (1915) 132, f. 5F–K. — Type: *C.L. Ledermann 12785* (B, lost), Papua New Guinea, East Sepik, 'Im Gebirgsbuschwalde bei dem Lager 'Felsspitze' (= Camp 'Felsspitze') im mittleren Sepik-Gebiet', Aug. 1913. — Neotype (designated here): *A. Vinas & J. Waikabu LAE 59527* (neo LAE; isoneo CNS, L), Papua New Guinea, West Sepik, Telefomin.

Typification. Since most of Ledermann's collections were at B, and were subsequently destroyed with few duplicates distributed elsewhere (Veldkamp et al. 1988, Fosberg & Oliver 1991), a neotype is chosen here based on Schlechter (1915: 10, f. 5F–K) because this illustration was based on the only collection available to Schlechter (namely, *C.L. Ledermann 12785*). Furthermore, the illustration is sufficiently detailed to be in full agreement with the protologue.

Tree 4–6.8 m tall, bole c. 5 m, to 10 cm diam. *Branchlets* glabrous, brown with scattered pustules. *Leaves* glabrous; petiole (0.5–)1–2.5 cm long; lamina broadly elliptic, 5.5–11.5 by 3–5 cm; base acute, margin serrate, apex acuminate; secondary veins 13–19 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, prominent on abaxial surface. *Inflorescence* racemose, axillary, < 20(–25)-flowered; rachis (2–)4–6 cm long, sparsely hairy, with flowers loosely and evenly arranged; pedicels 3–5 mm long; bracteoles 1–3 mm long, sparsely hairy. *Calyx lobes* 1–4 mm long. *Corolla buds* tubular, 15–20 mm long, purplish yellow; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 10–15 by 5–7 mm, glabrous, green to drying blackish brown.

Distribution — Papua New Guinea (West Sepik, East Sepik, Western Highlands, Eastern Highlands).

Habitat & Ecology — Occurring in mid montane forest from elevations of 1350–2300(–4400) m.

Conservation status — This widespread species is inadequately sampled to evaluate confidently its conservation status.

Additional specimens examined. Papua New Guinea, West Sepik, Telefomin, *A. Vinas LAE 59527* (L, LAE); East Sepik, Eastern ridge of Sumset (Mt Hunstein), *R. Hoogland 10954 & L.A. Craven* (BRI, K, L, LAE); Western Highlands, Mt Hagen, *J.M. Wheeler ANU 6255* (LAE); Mt Kaiap, *H. Tagawa 72* (LAE); Eastern Highlands, South Karius, *W. Takeuchi 22429* (LAE).

8. ***Polyosma finisterrae*** Schltr.

Polyosma finisterrae Schltr. (1915) 131, f. 5A–E. — Type: *R. Schlechter 19050* (B, lost), Papua New Guinea, Madang, 'In den Wäldern des Finisterre-Gebirges (= Finisterre Ranges)'. — Neotype (designated here): *D.B. Foreman & A. Vinas LAE 60114* (neo LAE; isoneo BRI), Papua New Guinea, Central, Boridi.

Typification. Rudolph Schlechter (1915: 9) based his concept of *P. finisterrae* solely on a single collection (*R. Schlechter 19050*) from the Madang Province of Papua New Guinea. The neotype is here based on the botanical illustration (Protologue, f. 5A–E, p. 10) of this collection since the herbarium specimen has not been found at B. Furthermore, no other material that he may have examined has been located.

Tree, 2–10 m tall. *Branchlets* glabrous, brown with grey pustules. *Leaves* glabrous; petiole 0.5–1.5 cm long; lamina elliptic, 3.5–10 by 1–5 cm, coriaceous, drying both surfaces dark brownish black; base acute, margin serrate, sometimes sparsely toothed, apex acuminate; secondary veins 9–20 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, not prominent on abaxial surface. *Inflorescence* racemose, axillary, 20–30-flowered; rachis 2.5–4 cm long, glabrous, with flowers loosely and evenly arranged; pedicels 2–5 mm long; bracteoles 1–3 mm long, glabrous. *Calyx lobes* 1–4 mm long. *Corolla buds* tubular, (4–)5–14 mm long, white; corolla moderately hairy, fully split into 4 lobes at anthesis. *Fruits* ovoid, 5–8 by 4–6 mm, slightly hairy, green to purplish blue, drying black.

Distribution — Papua New Guinea (Morobe, Central, New Ireland).

Habitat & Ecology — Occurring in natural hill forest on ultrabasic soils from elevations of 457–1300 m.

Conservation status — Like many of the other species of *Polyosma* occurring in New Guinea, the distribution of this species is inadequately known. However, this species is probably not of concern.

Additional specimens examined. Papua New Guinea, Morobe, Kamiali Wildlife Management Area, *O. Paul & S.A. James SAJ100* (BISH, LAE); ibid., *W. Takeuchi 21049 & 21051* (LAE); Central, Boridi, *D.B. Foreman & A. Vinas LAE 60114* (LAE); New Ireland, Mt Agil, *J. Regalado 1543* (L, LAE).

Notes — 1. Schlechter described the petioles ('Stielchen') as 'ca. 1.5 mm long' (Schlechter 1915: 128 – in the identification key) is regarded as a typographical error that should be corrected to 'c. 1.5 cm long.'

2. The young leaves of this species are purplish and whitish. The new species *P. infernaralis* was previously included in a broad circumscription of *P. finisterrae*; however, these species are readily distinguished by several morphological features (see diagnosis of *P. infernaralis*).

9. ***Polyosma flenleyi*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 7

*Etymology.*The specific epithet of this new species commemorates the collector of the type material, palaeo-ecologist Dr John Roger Flenley (15 July 1936–22 June 2018), who collected extensively throughout the Western Highlands district of Papua New Guinea, particularly in the Wabag area, during 1964–1965 (Van Steenis-Krusemann 1977).

Polyosma flenleyi is morphologically like *P. torricellensis* (not included in our morphometric analyses), but it differs by it being a smaller subcanopy tree (c. 5 m tall), with similar shaped leaves that are smaller (3–6 cm long, 1.5–3 cm wide), whereas *P. torricellensis* is a canopy tree (10–20 m tall), with leaf lamina (9–15 cm long, 1.5–3.5 cm wide). — Type: *J.R. Flenley ANU 2584* (holo CANB [CANB157388.1]; iso K, L [L1868132], LAE [LAE 77341]), Papua New Guinea, Western Highlands, Wabag, 5 Mar. 1965.

Tree, c. 5 m tall, c. 4 cm diam. *Branchlets* sparsely hairy, brownish on young, glabrous when mature, lenticels scattered, brown. *Leaves* glabrous; petiole 0.5–1.5 cm long, brown; lamina narrowly elliptic-ovate, 3–6 by 1.5–3 cm, coriaceous, drying brown on both surfaces; base acute, margin shortly dentate, sometimes appearing entire (in error), apex acuminate; secondary veins 14–20, on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary vein weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 5–6 cm long, sparsely hairy; flowers loosely and evenly arranged; pedicels 2–3 mm long, narrow; bracteoles 1–2 mm long, sparsely hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (5–)8–10 mm long, green, often with yellowish tinge; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 3–4 by 2–3 mm, sparsely hairy, purple.

Distribution — Papua New Guinea (Western Highlands), only known from the type collection.

Habitat & Ecology — Recorded as occurring in mid montane forest at an elevation of 2670 m.

Conservation status — Not known.

Notes — 1. Although the leaves of *P. flenleyi* and *P. torricellensis* sometimes appear entire, the leaf margin of both is shortly dentate. The leaves of *P. flenleyi* have 14–20 secondary veins on each side of the midrib (*P. torricellensis* has c. 8). In

FLORA OF NEW GUINEA.

Distributed by the
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with the request to be notified of new identifications.

Coll. J. R. Flenley
No. ANU 2584 Date 5 March 1965

5°26'S – 143°39'E.

Loc. Ecological site no. 33, c. 4 miles W. of Wabag, W. Highlands District. Alt. 8900 ft.

Hab. Lower montane rain forest. Slope 24°. Aspect S. Drainage good. Shade heavy. Brown forest soil, pH 3.6 to 5.8.

Notes Tree, height 5 m. DBH 4 cm. Grey-green bark. Fruits purple when ripe. Wood light brown. Only 2 seen.

Native name: Minj (Enga language).

Dups. (6) to: LAE,L,K,A,BRI,US.

Fig. 7 Holotype collection of *Polyosma flenleyi* Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov*., showing leaves, flowers, and fruits (*J.R. Flenleyi ANU 2584* [CANB157388.1]).

the analysis presented in this paper, *P. flenleyi* is morphologically similar to *P. gigantea*, albeit somewhat distant. *Polyosma flenleyi* has leaves with lamina narrowly elliptic-ovate and are mostly shorter (3–6 cm long), with longer corollas (5–10 mm long), compared to *P. gigantea* that has elliptic leaves (5.5–11 cm long) and short corollas (3–5 mm long).

2. The juvenile leaves of *P. flenleyi* are purplish green.

10. *Polyosma forbesii* Valeton ex Lauterb.

Polyosma forbesii Valeton ex Lauterb. (1912) 821. — Lectotype (designated here): *H.O. Forbes 700* (lecto BM [BM611313]; isolecto BO [BO1887896], LAE [LAE 87220], MEL [MEL578183], P [P423765]), Papua New Guinea, Central, Southeast New Guinea, Sogeri, anno 1885.

Tree, 10–20 m tall. *Branchlets* densely hairy, brown, smooth. *Leaves* densely hairy; petiole 0.5–3.5 cm long, brown; lamina broadly elliptic, (3–)10–24 by (2–)5–9.5 cm, coriaceous, drying brown on both surfaces; base acute, margin serrate, apex attenuate; secondary veins 10–27 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, pubescent, prominent on abaxial surface. *Inflorescence* racemose, usually axillary, or possibly terminal, 20–30-flowered; rachis 5–12 cm long, densely hairy; pedicels 5–10 mm long; bracteoles 5–10 mm long, densely hairy. *Calyx lobes* 1–7 mm long, hairy. *Corolla buds* tubular, (5–)11–35 mm long, yellowish green to greenish white; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 5–15 by 3–7 mm, sparsely hairy, purplish black.

Distribution — Indonesia (Vogelkop), Papua New Guinea (West Sepik, East Sepik, Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Western, Central, Milne Bay, New Britain).

Habitat & Ecology — Occurring in lowland to mossy forest from elevations of 20–3 000 m.

Conservation status — Not of concern.

Additional specimens examined. Indonesia, Papua Barat, Vogelkop, Ewai, *C. Versteegh BW 7437* (L). – Papua New Guinea, West Sepik, near Folongonom, *W.R. Barker et al. LAE 67506* (L, LAE); Telefomin, *E.E. Henty NGF 20858* (K, L, LAE); Morobe, Pindu, *B.B. Bau LAE 84262* (L, LAE); Kabum, *K.M. Fazang, R. Jansen & S.B. Sennart LAE 78748* (LAE); Gumi Logging Area, *M. Heads 456* (LAE); Bulolo, *J.J. Havel & A. Kairo NGF 9125* (K, LAE); Wau, *G.H. Thomas 11535* (K, LAE); Kuali Creek, c. 5 miles S of Wau, *T.G. Hartley 11535* (L, LAE); Western Highlands, Mt Hagen, *J.R. Croft & O. Akakavara LAE 68137* (L, LAE); Eastern Highlands, Okapa, *T.G. Hartley 12145* (K, LAE); Kainantu, *H. West NGF 5654* (LAE); *P. Katik LAE 74940* (LAE); Crater Mountain, *W. Takeuchi 11841* & *11249* (L, LAE); Southern Highlands, Mt Bosavi, Tari, *M. Jacobs 9054* (LAE); *P. Katik LAE 77989* (LAE); Western, Morehead, *R. Pullen 7233* (L, LAE); Makapa, *P. Oliver LAE 87618* (LAE); Bensbach, *M. Galore & C.E. Ridsdale NGF 33739* (K, LAE); Oriomo River, *K.J. White & E. Gray NGF 10402* (K, L, LAE); Central, Koitaki, *C.E. Carr 12644*, *12780* (L, NY); Sogeri, *H.O. Forbes 315* (L); *G.H. Thomas 10725* (K, LAE); Milne Bay, Mt Suckling, *P.F. Stevens & J.-F. Veldkamp LAE 54111* (L, LAE); New Britain, Whiteman Range, *S.A. James 133* (LAE, NSW); Gasmata, *D. Sayers NGF 24173* (K, LAE).

Notes — A reassessment of this species has resulted in it being more widespread than suggested by Conn & Damas (2019). However, the broad species concept applied by Conn & Damas (2019) appeared not taxonomically useful since it included the distinct new species *P. kamialiensis*. *Polyosma forbesii* (s.str.) has leaves with margin serrate and 10–27 secondary veins on each side of midvein, whereas *P. kamialiensis* has entire leaves with 8–10 secondary veins on each side of midvein.

The inflorescence of this species is usually axillary, although the inflorescence of *Forbes 315* (L) is terminal. In *Carr 12644* (L), the inflorescences are axillary but are restricted to the one or two distal nodes. In *Forbes 500* (MEL578183, one of the isolectotypes) the position of the inflorescence is unclear because most are detached from the specimen, but probably axillary, whereas the inflorescences of the lectotype (BM611313) are mostly axillary in the distal nodes (vs *Carr 12644*), but with one rachis appearing to be terminal (vs *Forbes 315*).

Schlechter (1915) proposed that *Ledermann 12010* (not seen) represented a possible new species. However, based on the brief description provided by him, it is here regarded as *P. forbesii*.

11. ***Polyosma gigantea*** Baker f.

Polyosma gigantea Baker f. (1923) 13. — Lectotype (designated here): *H.O. Forbes 716* (lecto BM [BM611314]; isolecto L [L 0035081], MEL [MEL578184]), Papua New Guinea, Central, Sogeri, “Mt. Wori-wori, 5000 ft, 716”, 1885–1886.

Typification. Since E.G. Baker did not assign a holotype, the specimen (*H.O. Forbes 716*) held at BM is here designated as the lectotype of the species.

Canopy tree c. 15 m tall. *Branchlets* glabrous, brown, craterous scars prominent, left behind by petiole of fallen leaves. *Leaves* glabrous; petiole 1–2 cm long, brown; lamina elliptic, 5.5–11 by 2–3 cm, coriaceous, drying brown on both surfaces; base acute, margin with an occasional small tooth, rarely entire, apex acuminate; secondary veins 13–25 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, not prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 8.5–10 cm long, sparsely hairy; pedicels 6–7 mm long; bracteoles 1–5 mm long, sparsely hairy. *Calyx lobes* 2–5 mm long. *Corolla buds* tubular, 3–5 mm long, whitish yellow, often with greenish tinge; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* not seen.

Distribution — Papua New Guinea (Central, Milne Bay).

Habitat & Ecology — Occurring in lowland forest at an elevation of 1500 m.

Conservation status — Since this species is taxonomically not well known, its conservation status cannot be evaluated.

Additional specimen examined. Papua New Guinea, Milne Bay, Misima, *P. Katik et al. LAE 70862* (L, LAE).

12. ***Polyosma glaberrima*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 8

Etymology. The specific epithet (‘*glaberrima*’) refers to the glabrous branchlets, leaves and fruits that characterize this species.

Polyosma glaberrima is morphologically most similar to *P. gigantea* with both having glabrous, acuminate leaves; however, *P. glaberrima* has an entire leaf margin, whereas *P. gigantea* has a leaf margin with an occasional small tooth, rarely entire. — Type: *L.J. Brass 25739* (holo K; iso L [L 1871121]), Papua New Guinea, Milne Bay, Normanby Island, Mt Pabinama, 5 May 1956.

Subcanopy tree c. 12 m tall, bole c. 2.5 cm diam. *Branchlets* glabrous, black with scattered lenticels. *Leaves* glabrous; petiole 1.5–3 cm long, light brown; lamina obovate, 5–12 by 3–7 cm, thickly coriaceous, discolours in dried materials, yellowish brown adaxially, brown abaxially; base acute, margin entire, apex acuminate; secondary veins 8–18 on each side of midrib and at an angle greater than 45° from midrib, looping near margin onto the next secondary vein; tertiary veins weakly percurrent, not prominent on abaxial surface. Flowers not seen. *Infructescence* racemose, terminal, with fruits loosely and evenly arranged; fruiting rachis c. 6 mm long, with < 20 fruits per rachis, glabrous; fruiting pedicels 7–10 mm long. *Fruits* ovoid, 6–13 by 4–8 mm, glabrous, green (immature).

Distribution — Papua New Guinea (Western Highlands, Central and Milne Bay).

Habitat & Ecology — Recorded from tall moss-forest at an elevation of 850 m.

Conservation status — Not known.

Additional specimens examined (Paratypes). Papua New Guinea, Western Highlands, Tambul, *M. Coode NGF 40023* (LAE); Central, Lake Myola, *J.R. Croft & Y. Lelan NGF 34819* (L, LAE); Milne Bay, Normanby Island, *M.A. Benjamin LAE 67860* (L, LAE).

Notes — 1. *Polyosma glaberrima* also differs from *P. gigantea* by having obovate, broader leaves (3–7 cm wide vs leaves elliptic and 2–3 cm wide in *P. gigantea*).

2. *Polyosma glaberrima* is also morphologically like *P. mucronata* and *P. stenosiphon*, with all three species having a glabrous abaxial leaf surface (or with only an occasional hair). It differs from *P. mucronata* by having variously obovate leaves, with petiole much shorter than lamina length (both characteristics shared with *P. stenosiphon*), whereas *P. mucronata* has elliptic or narrowly ovate leaves, with petiole almost as long as the lamina. *Polyosma glaberrima* is readily distinguished from *P. stenosiphon* by the former species having mostly larger leaves (5–12 cm long, 3–7 cm wide) and longer petioles (1.5–3 cm long), whereas *P. stenosiphon* has leaves 4–6 cm long, 1.3–2(–3) cm wide, and petiole 0.7–1 cm long.

13. ***Polyosma heliciiformis*** Kaneh. & Hatus.

Polyosma heliciiformis Kaneh. & Hatus. (1942) 305, f. 2 (‘*heliciaeformis*’). — Type: *R. Kanehira & S. Hatusima 12333* (holo FU, n.v.; probable iso A [A42993]), Indonesia Papua, Geelvink Bay, Patema, “40 km inward from Nabire” (Kanehira & Hatusima 1942: 307), ‘5 Mar. 1940’ and ‘5 May 1940’ (respectively).

Typification. The collection date of the replicate type material, as held at A (‘May 5, 1940’) is here regarded as a probable labelling error.

Shrub to 3 m tall. *Branchlets* tomentose with brown hairs. *Leaves* sparsely hairy abaxially, glabrous adaxially; petiole 1–2 cm long; lamina rhombic-oblong or narrowly obovate, 10–20 by 3–6 cm; base attenuate to narrowly cuneate, margin remotely crenulate-denticulate, apex acuminate; secondary veins 7–11 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein;

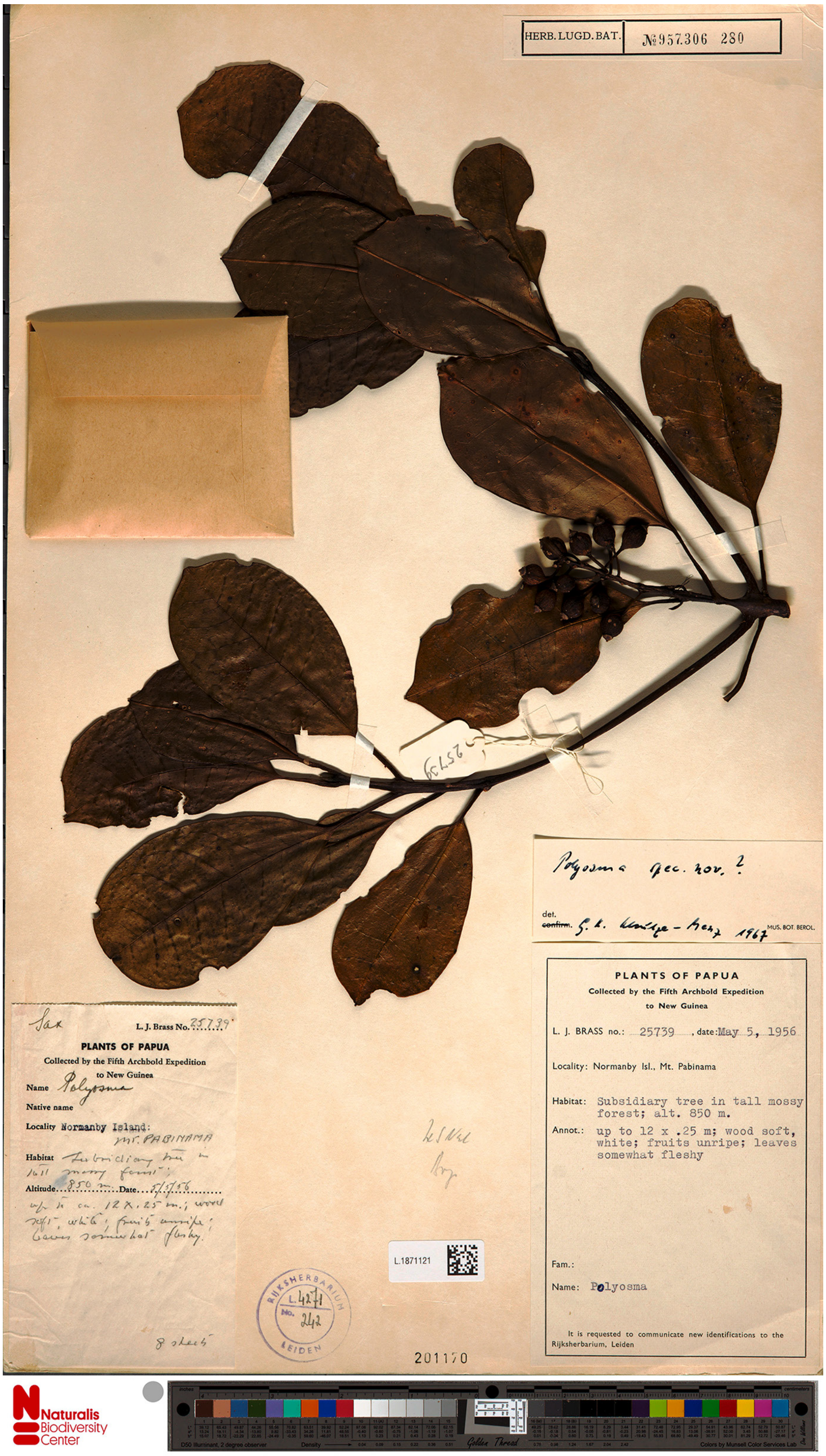


Fig. 8 Isotype of *Polyosma glaberrima* Schulze-Menz ex B.J.Conn & O.K.Paul (*Brass 25739* [L.1871121]).

tertiary veins weakly percurrent, glabrous, prominent on abaxial surface. *Inflorescence* racemose, subterminal, rachis 4–5 cm long, hairy; bracteoles hairy. *Calyx lobes* c. 1.7 mm long. *Corolla buds* tubular, c. 12 mm long, white, with dense greyish hairs. *Fruits* ovoid, 13–15 by 5–7 mm, glabrous, blackish purple.

Distribution — Only known from the type material collected in West New Guinea (Indonesia Papua).

Habitat & Ecology — Recorded from 'rain-forests at about 400 m altitude' (Kanehira & Hatusima 1942: 307), but the (probable) isotype, *Kanehira & Hatusima 12333*, as held at A, records the elevation as 'Altitude above sea level 300 m'.

Conservation status — The conservation status of this species is unknown.

Nomenclature — The specific epithet provided by Kanehira & Hatusima (1942) ('*heliciaeformis*') consisted of two elements that were not combined correctly (Turland et al. 2018: Art. 60.10), and is corrected to '*heliciiformis*'.

Notes — Kanehira & Hatusima (1942: 307, f. 2) described and illustrated the inflorescence of this species as 'subterminal'. Their illustration suggests that the rachis arises laterally from a terminal inflorescence axis. Since additional specimens of this species are not known, the structure of the inflorescence cannot be investigated further.

This species is morphologically similar to *P. dentata* and *P. helicioides*; however, it differs by being a shrub c. 3 m tall (vs tree 4–6.8 m tall in *P. dentata*; tree 6–10 m tall in *P. helicioides*); branchlets tomentose with brown hairs, without pustules (vs branchlets glabrous, brown with scattered pustules in *P. dentata*; branchlets glabrous to slightly hairy, brown, with pustules in *P. helicioides*); leaves sparsely hairy (like *P. helicioides*) (vs glabrous in *P. dentata*); lamina rhombic-oblong or oblanceolate, 10–20 cm long (vs lamina broadly elliptic, 5.5–11.5 cm long in *P. dentata*; lamina elliptic, 5–22 cm long in *P. helicioides*); secondary veins 7–11 on each side (vs secondary veins 13–19 on each side in *P. dentata*; secondary veins 11–25 on each side in *P. helicioides*); and inflorescence subterminal (vs axillary in both other species).

14. ***Polyosma helicioides*** F.Muell.

Polyosma helicioides F.Muell. (1885) 8. — Type: *G. Belford s.n.* (MEL, not located), Papua New Guinea, Central, “On Astrolabe-Range” (Von Mueller 1885 – protologue), without date. — Neotype (designated here): *J. Chalmers s.n.* (MEL [MEL568430]), Papua New Guinea, ‘SE New Guinea (= Central Prov.)’, *anno* 1885 (see Typification below).

Typification. The type collection (*Belford s.n.*) cited in the protologue (Von Mueller 1885) has not been located at MEL. Therefore, the *Chalmers s.n.* collection has been selected as the neotype because Mueller regarded this material as belonging to this species and the label and notes are in Mueller’s hand (pers. comm. by H. Barnes, 10 Nov. 2022).

Tree, 6–10 m tall, bole to 8 m, c. 10 cm diam. *Branchlets* glabrous to slightly hairy, brown, pustules. *Leaves* sparsely hairy; petiole 0.5–2 cm long; lamina elliptic, 5–22 by 2–7 cm, coriaceous, drying both surfaces brown; base acute, margin serrate, apex attenuate; secondary veins 11–25 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, sparsely hairy, prominent on abaxial surface. *Inflorescence* racemose, axillary, > 30-flowered; rachis 6–19 cm long, sparsely hairy, with flowers loosely and evenly arranged; pedicels 6–9 mm long; bracteoles 1–5 mm long, sparsely hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (5–)8–10 mm long, white, often with greenish tinge; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 5–15 by 3–8 mm, glabrous, green to bluish purple, drying brownish black.

Distribution — Indonesia (Papua Barat) and Papua New Guinea (Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Western, Central, Northern, Milne Bay, New Britain).

Habitat & Ecology — Occurring from lowland to high montane mossy forest from elevations of 20–2 500 m.

Conservation status — This widespread species is not regarded as endangered.

Additional specimens examined. Indonesia, Papua Barat, Vogelkop, Sorong, Roefei River, *P. van Royen 3147* (L). – Papua New Guinea, West Sepik, S of Nerenavip village, *D. Frodin NGF 32186* (L); Morobe, Wagau, *O.K. Paul, B.J. Conn & T.K. Kuria LAE 87519* (LAE, NSW); *M.J. Lovave 36* (L, LAE); Sattelberg, *M.S. Clemens 5085* (L); Finschhafen, *P. Katik & J.R. Croft LAE 70757* (L, LAE); Mt Jasop, above Musum, *K. Damas & P. Katik LAE 74639* (L); *K. Damas LAE 74636* (LAE); Oomsis, *E.E. Henty NGF 14302* (L, LAE); *P. van Royen NGF 16329* (K, L, LAE); Lake Trist, *E.E. Henty NGF 29104* (K, L, LAE); Western Highlands, Wabag, *J.R. Flenley ANU 2602* (K, L, LAE); Eastern Highlands: near Lake Aunde, Mt Wilhelm, *R. Hoogland 5675 & R. Pullen* (L); c. 0.5 miles S of Tomba, *J.C. Saunders 665* (L); Daulo, *J.C. Saunders 888*, *889*, *903* (L, LAE); Mt Gahavesuka Park, *K. Kerenga & N. Cruttwell LAE 56695 & LAE 56696* (L, LAE); Marafunga, *J.S. Womersley NGF 24567* (K, LAE, NSW); Southern Highlands, Mt Bosavi, *M. Jacobs 8752* (L, LAE); Western, Oriomo River, *J. White & E. Gray NGF 10402* (LAE); Central, Aloga, *C.E. Carr 13621* (L); Alolo, *C.E. Carr 14171* (L); Mt Kuriva, *P. Katik 605* (LAE); Sirinumu, *R. Pullen 2867* (LAE); Northern, Siurane, *R. Pullen 5465* (LAE); Milne Bay, Goodenough Islands, *L.J. Brass 25109* (K, L, LAE); New Britain, Lackit, *P. Katik & C. Ridsdale NGF 38049* (K, L, LAE); Whiteman Range, *O.K. Paul SAJ201* (BISH, NSW).

Note — Mueller compared this species with *P. ilicifolia* (handwritten notes in upper right corner of neotype). Although the handwriting is faint and almost indecipherable, it appears to read: “Diff[ers] fr[om] *P. ilicif*[*olia*], but only in short leaf_stalks (= petiole) and more abundant fl[owers] fruit unknown. [Otherwise,] It agrees with Java specimens.” Although differences in petiole length and flower abundance may not consistently distinguish these two species, *P. helicioides* has sparsely hairy leaves, whereas those of *P. ilicifolia* are glabrous.

15. ***Polyosma induta*** Reeder

Polyosma induta Reeder (1946) 284, 285. — Type: *L.J. Brass 11482* (holo A [A42994] (see Typification below); iso BM [BM600392], BO, BRI [BRI-AQ342401], L [L 0035089]), Indonesia Papua, Snow Mountains, Bele River, 18 km NE of Lake Habbema, Nov. 1938.

Polyosma vochysioides Reeder (1946) 285. — Type: *L.J. Brass 12090* (holo A [A42999] (see Typification below); iso BO, BRI [BRI-AQ342413], L [L 0035120]), Indonesia Papua, Snow Mountains, Bernhard Camp, Idenburg River, Jan. 1939.

Typification. Reeder (1946: 275) states that “In the absence of parenthetical letters indicating the place of deposit [of specimens], cited specimens are to be found only at the Arnold Arboretum [A].” Since Reeder cited the type of *P. induta* as “*Brass 118483* (TYPE)” and that of *P. vochysioides* as “*Brass 12090* (TYPE)” (protologue, pages 284 & 285, respectively), by inference, held at A, we accept that these specimens are the intended holotypes of these taxa as now understood. Based on this assumption, lectotypification is here regarded as unnecessary.

Small tree, c. 3 m tall. *Branchlets* densely hairy, brown, smooth. *Leaves* densely pilose; petiole 2–3.5 cm long, brown; lamina broadly elliptic, 11–18 by 4–7 cm, coriaceous, dried materials brown on both surfaces; base acute, margin serrate, apex attenuate; secondary veins 14–27 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary vein weakly percurrent, hairy, prominent on abaxial surface. *Inflorescence* racemose, terminal,< 20-flowered; rachis 13–14 cm long, densely hairy; pedicels 3–4 mm long; bracteoles 1–2 mm long, densely hairy. *Calyx lobes* c. 2 mm long. *Corolla buds* tubular, 10–15 mm long, yellow or greenish white; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, c. 15 by 7 mm, densely hairy, pilose, light green.

Distribution — Indonesia (Indonesia Papua: Snow Mountains) and Papua New Guinea (West Sepik, East Sepik, Morobe, Southern Highlands, Western, Central, Milne Bay, New Britain).

Habitat & Ecology — Occurring in *Castanopsis*-dominated forest at elevations of about 1 300 m.

Conservation status — This inadequately known species is widespread and is not regarded as threatened.

Additional specimens examined. Indonesia, Papua, Snow Mountains, Eipomek-Tol, *P. Hiepko 1398 & W. Schultze-Motel* (L); Bele River 18 km NE of Lake Habbema, *L.J. Brass 11483* (BRI, L, LAE); 15 km SW of Bernhard Camp, Idenburg River, *L.J. Brass 12090* (BRI, LAE). – Papua New Guinea, West Sepik, Bulindup, W of Oksapmin, *E.E. Henty, R. Isgar & M. Galore & NGF 41627* (L); Telefomin, *E.E. Henty, R. Isgar & M. Galore NGF 41690* (L, LAE); *K. Kerenga LAE 73993* (L, LAE); East Sepik, Hunstein Range, *W. Takeuchi 6296* (L, LAE); Morobe, Manki Trig, Bulolo, *A. Kairo 778* (L, LAE); Southern Highlands, Mt Ambua, Tari, *W. Vink 16833* (L, LAE); Tari, *J.S. Womersley NGF 39926* (K); Onim Hill, Mt Giluwe, *J.R. Croft LAE 60903* (L, LAE); Western, Muller Range, *W. Takeuchi 24626 & 24628, D. Ama & B. Gamui* (L, LAE); Oriomo River, *J.J. Havel NGF 17241* (L, LAE); Central, Kuriwa, *A. Vinas UPNG 3237* (LAE); Milne Bay, Misima, *T.B. Croat 52922* (LAE); Mt Gerebu, *S.A. James 1341* (LAE); New Britain, Gasmata, *J.R. Croft NGF 15543* (LAE).

Notes — 1. The taxonomic status of this species is very inadequately known, but it is regarded as morphologically most similar to *P. forbesii*. *Polyosma induta* is a small tree (c. 3 m tall), compared to *P. forbesii* which is a large tree 10–20 m tall. It also differs from *P. forbesii* by having a terminal inflorescence (vs axillary in *P. forbesii*).

2. Reeder (1946: 284) proposed that this species and *P. vochysioides* were "very similar in foliage but differ markedly in characters pertaining to the inflorescence were distinct". The inflorescence of *P. induta* is terminal, whereas Reeder records the inflorescence of *P. vochysioides* as terminal or axillary. Reeder suggests that the latter taxon is more floriferous than *P. induta* but this difference is not supported. The additional collections now available for study support *P. vochysioides* being regarded as a synonym of *P. induta.*

16. ***Polyosma infernaralis*** **B.J.Conn & O.K.Paul**, *sp. nov.* — Fig. 9

Etymology. The specific epithet (*infernaralis*) of this new species refers to position of the inflorescences on the lower (*infernus*) leaf axils (*-aralis*).

Polyosma infernaralis is morphologically most like *P. finisterrae*, with both species having serrate leaves, but it differs by tending to have longer petioles (0.5–3 cm long; 0.5–1.5 cm long in *P. finisterrae*); leaf lamina narrowly ovate (vs elliptic in *P. finisterrae*), with apex attenuate (vs acuminate); brown or yellowish green corolla (vs white in *P. finisterrae*); and although both species have axillary inflorescences, those of *P. infernaralis* tend to occur in the lower axils of the leaves. — Type: *L.J. Brass 30567* (holo LAE [LAE 36134]; iso L [L 0035098]), Papua New Guinea, Eastern Highlands, Mt Wilhelm, 17 July 1959.

Tree, 2–12 m tall. *Branchlets* glabrous, brown, smooth. *Leaves* glabrous; petiole 0.5–3 cm long, brown; lamina narrowly ovate, 3.5–8 by 1–3 cm, thinly coriaceous, drying brown on both surfaces; base acute, margin serrate, apex attenuate; secondary veins 10–23, on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, in axils of lower leaves, < 20-flowered, rachis 2–4 cm long, sparsely hairy, light brown; flowers loosely and evenly arranged (not crowded together) near distal end of rachis; pedicels 3–4 mm long; bracteoles 0.5–1 mm long, sparsely hairy. *Calyx lobes* 0.5–3 mm long. *Corolla buds* tubular, 10–20 mm long, yellowish green, turning brownish. *Fruits* ovoid, 7–15 by 5–8 mm, glabrous, green to bluish black, drying brownish black.

Distribution — Papua New Guinea (West Sepik, Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Milne Bay).

Habitat & Ecology — Occurring in montane forest from elevations of 2610–2790 m.

Conservation status — Although this species appears to be widespread, its conservation status is unknown.

Additional specimens examined (Paratypes). Papua New Guinea, West Sepik, Busilmin, *A. Vinas LAE 59438* (LAE); Telefomin, *J.R. Croft & Y. Lelean LAE 65759* (L, LAE); Morobe, Mt Wasaunon, *K. Fazang LAE 78745* (LAE); *K. Fazang LAE 78853* (LAE, NSW); Western Highlands, Jimi, *J. Waikabu et al. LAE 73440* (L, LAE); Wabag, *J.R. Flenley ANU 2847* (K, L, LAE); Eastern Highlands, Marafuga, *P.J. Grubb 256 & P.J. Edwards* (L, LAE); track to Mt Michael, *A. Kairo 448* (L, LAE); *S. Sohmer LAE 75423* (L, LAE); Goroka, *K. Kerenga & C. Baker LAE 56926* (L, LAE); Mt Wilhelm, *G. Robins 674* (L, LAE); *A.I. Gentry 67527* (LAE); Southern Highlands, Mt Giluwe, *J.R. Croft LAE 65319* (LAE, NSW); Onim, *K. Rau 131* (LAE); Ialibu, *N.M.U. Clunie & G. Larivita LAE 63225* (L, LAE); Anga Valley, *R. Schodde 1548* (L, LAE); Milne Bay, Mt Dayman, *L.J. Brass 22714* (L, LAE).

17. ***Polyosma integrifolia*** **Blume**

Polyosma integrifolia Blume (1826) 659. — Lectotype (designated here): *C.L. Blume s.n.* (L [L 0035091]; isolecto A), Indonesia, Java (Jawa Barat), '*in sylvis altioribus montis Burangrang* (= Gunung Burangrang)' (Blume 1826), without date (see Typification 1 below).

Polyosma brachyantha Merr. (1916) 273. — Lectotype (designated here): *C.B. Robinson 1816* (lecto US [US1293396]), Indonesia, Maluku, 'Amboina' (= Ambon), Nov. 1913. Possible syntypes: *Robinson 1814*, *1815* (US) (see Typification 2 below).

Typification. 1. The collection from Java (= Jawa) by C.L. Blume (L 0035091) consists of several samples. Some are fragmented, although the central specimen, mounted with leaves directed toward the bottom and side of the herbarium sheet, is morphologically in agreement with the concept applied by most authors and is in agreement with the very brief protologue (Blume 1826). Georg Schulze-Menz had already annotated L 0035091 (in 1967) as suitable 'lectotype' material.

2. The protologue (Merrill 1916: 274) listed the specimens examined as "*Rel.*[iquiae] *Robins.*[onianae] *1814, 1815, 1816 type.*" It is unclear if Merrill regarded all three collections as syntypes or if he intended *Robinson 1816* to be the type, hence holotype. Since it is possible that he intended that only the latter specimen was to be the type, this specimen has been here designated as the lectotype.

Subcanopy to canopy tree, 6–20 m tall, bole 8–10 m long, 8–30 cm diam. *Branchlets* glabrous, pustules grey. *Leaves* glabrous; petiole 0.5–3 cm long; lamina elliptic, 5–19 by 2–6 cm, coriaceous, drying both surfaces light brown; base acute, margin entire, infrequently with an occasional tooth (possibly correlated with juvenile leaves), apex acuminate; secondary veins 13–42 on each side of midrib and at an angle greater than 45° from midrib, looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, slightly prominent on abaxial surface. *Inflorescence* racemose, terminal, > 30-flowered; rachis 9–22 cm long, hairy; pedicels (3–)4–9 mm long; bracteoles 1–2 mm long, hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (5–)7–10 mm long, white, often with pinkish tinge; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 4–10 by 2–8 mm, glabrous, green maturing to bluish black.

Distribution — Andaman Islands, Myanmar, Thailand, Cambodia, Vietnam, Philippines, Indonesia (Jawa, Bali, Nusa Tenggara Barat, Nusa Tenggara Timur, Sulawesi, Maluku), Timor Leste, and widespread throughout New Guinea to the Solomon Islands (Anonymous 2020; POWO continuously updated).

Habitat & Ecology — Occurring in lowland forest, from elevations up to 1500(–2000) m.

Conservation status — Widespread species that is not considered to be at risk.

Additional specimens examined. Brunei, *Tjiboebas 43* (WAG1930306). – Indonesia, Sumatera, *Korthals s.n.*, without date (L [L1867290]); Jawa, Madioen [Madiun], Ngebel, *S.H. Koorders* 29395B (U); Sulawesi, Sulawesi Tengah, Mt Roroka Timbu, c. 80 km SSE of Palu, *E.F. de Vogel 5439* (L); Bali, Gunung Batu Kau, *A. Dilmy 985* (L); Nusa Tenggara Timur (Kl. Soenda Eil[and]), Flores, *E. Schumtz 1109* (L); Maluku, Amboina [Palau Ambon], *B. Robinson 1816* (A, BM, L, US); Papua Barat, Geelvink Bay, Seroei, Eil[and] Japen, *L.J. van Dijk Netherlands Indies Forest Service bb30450* (L); Wapoga River Area, *J.P. Mogea 7030* (L); Wondiwoi Mountains, Wandammen Peninsula, *F.A.W. Schram BW 13466 & BW 13467* (L). – Malaysia, Sabah, Kg. [Kampong] Monsok, *Joseph, Lideh, Donggop & Gambio SAN110060* (L). – Papua New Guinea, West Sepik, Torricelli Mountains, *P.J. Darbyshire 231* (L, LAE); Mekil Research Station, Mt Stolle, *R. Kiapranis KP465* (L); East Sepik, Mt Hunstein, *W. Takeuchi 6303* (K, LAE); Morobe, Markham Point, *P. Garrett-Jones 21144* (LAE); *Henty NGF 11970* (LAE); Oomsis, *T.G. Hartley 10483* (K, L, LAE); Buso, *D.B. Foreman LAE 52337* (L, LAE); Allen Allison Track, W of Araro 1 River, W of Lababia, *B.J. Conn 5805, K.Q. Damas, K.M. Fazang & O. Paul* (LAE, NSW); Kamiali, *W. Takeuchi 21173*, *T. Jisaka, A. Towati & D. Ama* (L, LAE); Bubuu Valley, *S. James 336* (NSW); Mt Missim, *J.L.C.H. van Valkenburg 700* (LAE); Southern Highlands, Hides, *W. Takeuchi 19036, A. Towati & T. Jisaka* (L, LAE); Western, Eastern side of Bianglopmik (Lake Vivian), N of Biang Bluff, southern slopes of Star Mountains, *B.J. Conn 5990*, *K.D.Q. Damas, D.J. Damas & P. Homot* (LAE, NSW); Oriomo River, *J.S. Womersley & J. Havel NGF 17713* (K, LAE); Central, Sogeri, *H.O. Forbes 692* (K, L, LAE); Milne Bay, Woodlark Islands, *L.J. Brass 28599* (LAE); Misima Islands, *L.J. Brass 27482* (LAE); New Britain, Kandrian, *D. Sayers NGF 21975* (K, L, LAE); New Ireland, New Hanover, *J.R. Croft LAE 65500* (L, LAE); Namatanai, *M. Coode & M.J.S. Sands NGF 57180* (LAE); *O. Gideon LAE 57180* (L, LAE); Manus, Derimbat, *D.B. Foreman LAE 52356* (BRI, L, LAE); Buyang, *K. Kerenga & J.R. Croft LAE*

Fig. 9 Image of isotype specimen of *Polyosma infernaralis* B.J.Conn & O.K.Paul (*L.J. Brass 30567* [L 0035098]).

77334 (L, LAE); near Buyang II village, *M.J.S. Sands 2605, G.A. Pattison & J.J. Woods* (LAE); Derimbat, *D.B. Foreman LAE 52356* (LAE, NSW); Peil Kaw, *K. Kerenga et al. LAE 77547* (K, L, LAE); Dage, *N.E.G.C. Cruttwell 1773* (K, LAE); Mt Dremsel, *B.C. Stone & H. Streimann LAE 53662* (L, LAE); Bougainville, Paguna, *R. Berena 217* (LAE); Siwai, *J.H.L. Waterhouse 625-B* (L). – Solomon Islands, Choiseul, *I.H. Gafui & collectors BSIP17415* (L); New Georgia, NW Kolombangara, Rei Area, *R. Mauriasi & collectors BSIP11638* (L); Gatukai Islands, *C.T. Whitmore BSIP1254* (LAE); Santa Isabel, Binusa, *W.W. Beer's collectors BSIP6618* (L); Barora Ite islands, Madagha bay Area, *R. Mauriasi BSIP16199* (LAE); Guadalcanal, Makina Area, *R. Mauriasi & collectors BSIP11282* (L); ridge top Duidui Area, *R. Mauriasi & collectors BSIP12064* (L); Malaita, Lataanihato Area (Wairokai), *I.H. Gafui & collectors BSIP10265* (L); West Coast Kiu, *Z. Lipaqeto BSIP3556* (LAE); San Cristobal, Tetera, *I.H. Gafui & collectors BSIP12518* (L); Wairaha River, *C.T Whitmore BSIP4375* (LAE).

Notes — This species is morphologically most like *P. buxea*, with both species having glabrous leaves and white corollas. However, the leaves of *P. integrifolia* are elliptic with margin entire or occasionally with a small tooth, whereas *P. buxea* has narrowly elliptic to slightly narrowly ovate leaves with margin always entire.

Polyosma integrifolia has many morphological similarities to *P. induta*, but the latter species has serrate leaves whereas *P. integrifolia* has entire leaves. Reeder (1946) suggested that *P. brachyantha*, originally described as a species from Maluku (Indonesia), occurred in Papua New Guinea, based on two collections that he cited (*Brass 3899* and *Kajewski 1647*). Unfortunately, these specimens were not available for study, so we were unable to determine their identity with certainty. However, this taxon is here regarded as a synonym of *P. integrifolia* based on its protologue.

As currently recognized, *P. integrifolia* is a very widespread, broadly circumscribed species. Blume (1851) circumscribed several varieties within *P. integrifolia*. Although a more detailed evaluation of the morphological variation within this species is required, the broad species concept applied here appears to summarize adequately the taxonomy of this taxon. Plants of this species occurring at higher elevations in Papua New Guinea tend to have shorter petioles and smaller leaf laminas than those growing at lower elevations.

18. ***Polyosma kamialiensis*** B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 10, 11

Etymology. The specific epithet of this new species (*kamialiensis*), refers to the Kamiali area, near the village of Lababia (Papua New Guinea, Morobe Province) where this species is known to occur.

Polyosma kamialiensis is morphologically similar to *P. pubescens* but differs from the latter by having leaves with lamina elliptic to slightly obovate, 11–25 by (4–)5–8 cm, with 17–28 secondary veins on each side of the midrib (vs *P. pubescens* that has elliptic leaves, 9–11 by 3.5–4.5 mm, with 10–15 secondary veins). — Type: *B.J. Conn 5232*, *O.K. Paul, D.J. Damas & S.B. Sennart* (holo NSW [NSW772015]; iso LAE [LAE 209120]), Papua New Guinea, Morobe, Kamiali Wildlife Management Area, S of Kamiali Guest House, 21 May 2009.

Polyosma forbesii auct. non Valeton ex Lauterb.: Conn & Damas (2019) f. 416.

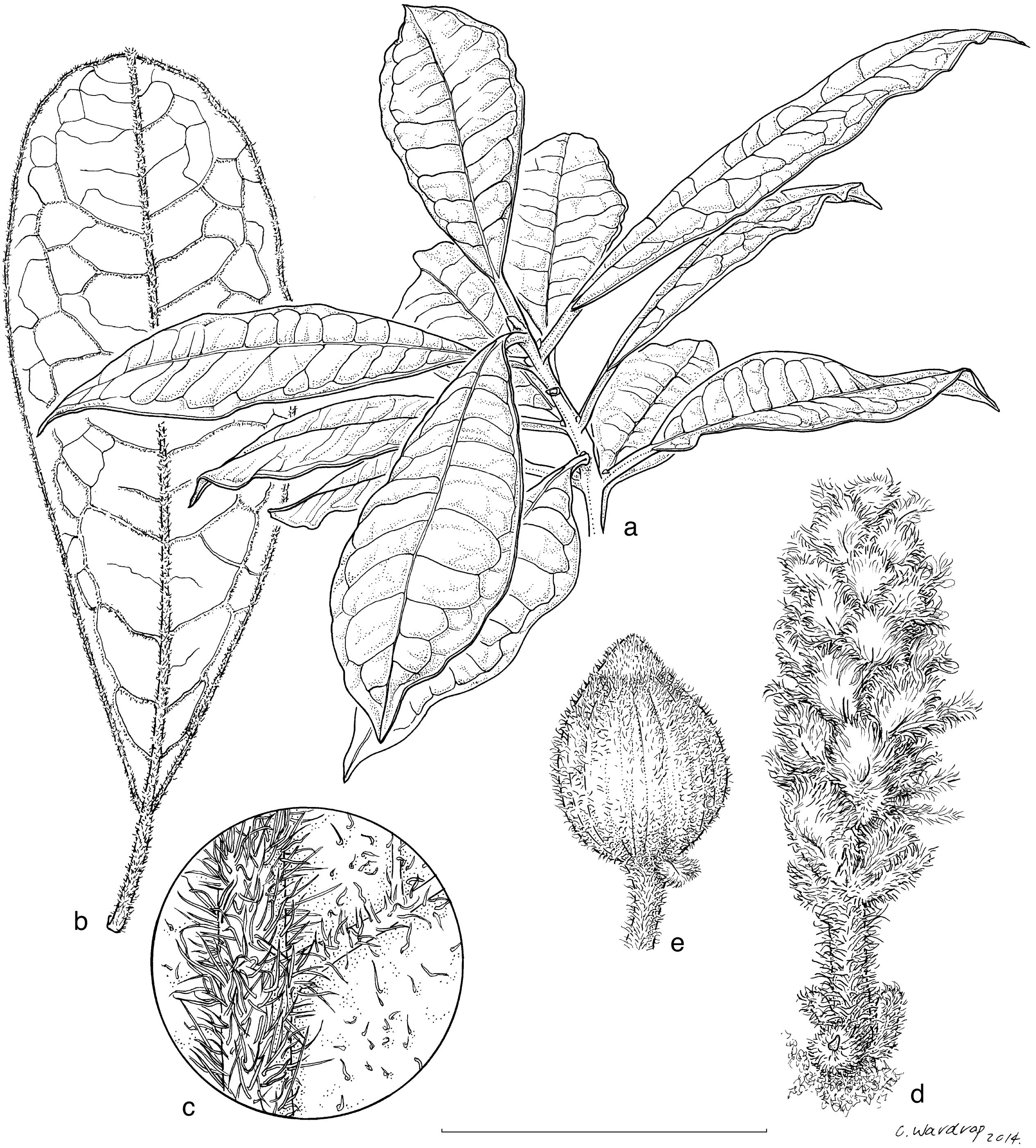
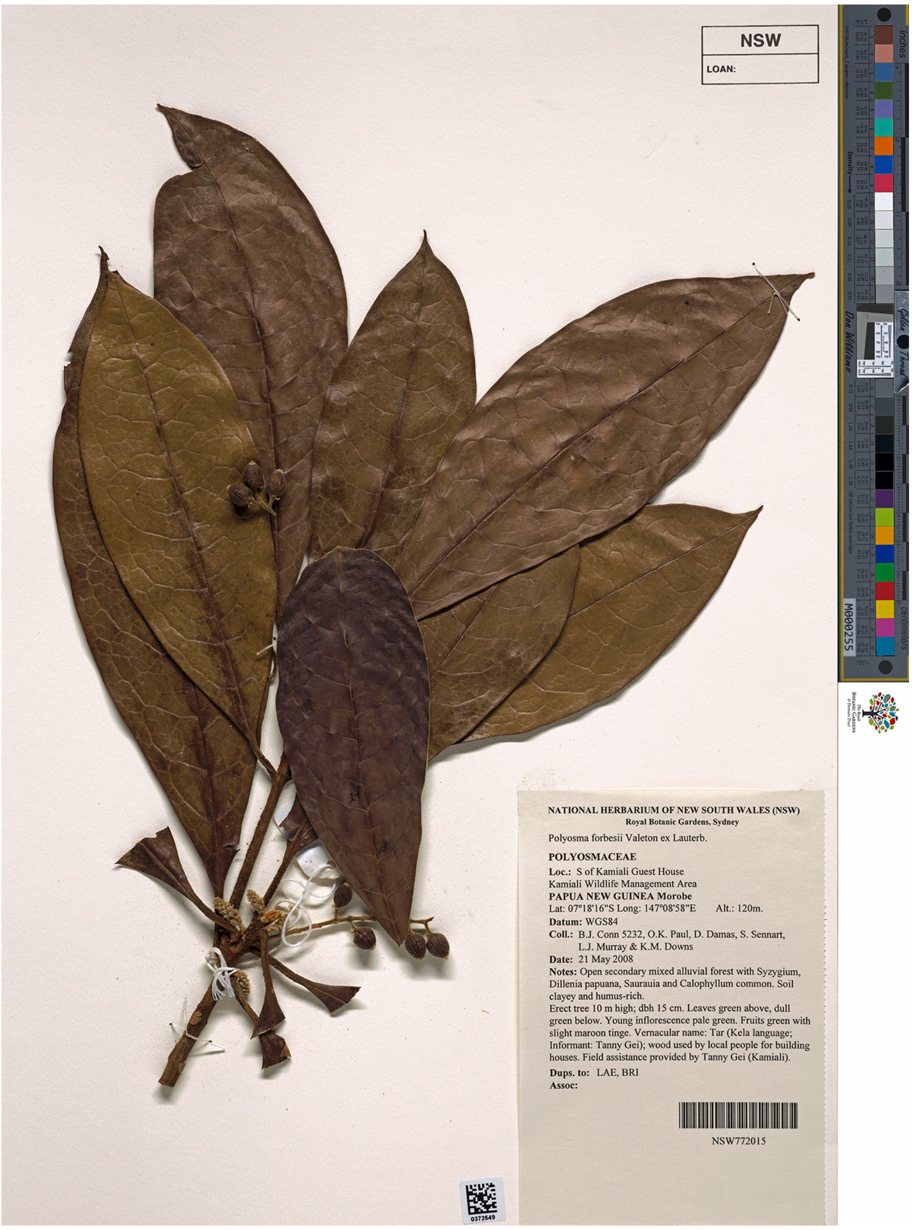


Fig. 10 *Polyosma kamialiensis* B.J.Conn & O.K.Paul, *sp. nov.* a. Distal end of leafy branchlet showing adaxial leaf surface; b. leaf showing indumentum on petiole, and on midvein and secondary veins of abaxial surface; c. detail of abaxial surface of leaf showing distinct indumentum on midvein and secondary veins, with scattered hairs on lamina surface; d. developing inflorescence with flowers in bud, showing hairy bracteoles and calyces; e. developing (immature) fruit densely covered in hairs. — Scale bar (for each of the labeled illustrations): a = 120 mm; b = 60 mm; c = 4 mm; d = 9 mm; e = 15 mm (all: *B.J. Conn 5232, O.K. Paul, D.J. Damas, S.B. Sennart, L.J. Murray & K.M. Downs* [NSW772015]). — Drawing by Catherine Wardrop (NSW).



NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)
Royal Botanic Gardens, Sydney

Polyosma forbesii Valeton ex Lauterb.

POLYOSMACEAE

Loc.: S of Kamiali Guest House
Kamiali Wildlife Management Area
PAPUA NEW GUINEA Morobe
Lat: 07°18'16"S Long: 147°08'58"E Alt.: 120m.
Datum: WGS84
Coll.: B.J. Conn 5232, O.K. Paul, D. Damas, S. Sennart, L.J. Murray & K.M. Downs
Date: 21 May 2008
Notes: Open secondary mixed alluvial forest with Syzygium, Dillenia papuana, Saurauia and Calophyllum common. Soil clayey and humus-rich.
Erect tree 10 m high; dbh 15 cm. Leaves green above, dull green below. Young inflorescence pale green. Fruits green with slight maroon tinge. Vernacular name: Tar (Kela language; Informant: Tanny Gei); wood used by local people for building houses. Field assistance provided by Tanny Gei (Kamiali).
Dups. to: LAE, BRI
Assoc:

NSW772015

Fig. 11 Holotype collection of *Polyosma kamialiensis* B.J.Conn & O.K.Paul, *sp. nov.*, showing branchlet with leaves and developing fruits (*B.J. Conn 5232, O.K. Paul, D.J. Damas, S.B. Sennart, L.J. Murray & K.M. Downs* [NSW772015]).

Erect subcanopy tree, 10–15 m tall; trunk cylindrical, dbh 15–17 cm; bole straight, up to 5–10 m long, moderately to coarsely ridged, fluted at base or buttresses-like, with buttressing up to 40 cm high; outer bark brown, rough, slightly fissured, pustular, with lenticels irregular; subrhytidome red; bark 5–10 mm thick; inner bark 1-layered, strongly aromatic, unpleasant; pale to dark red, with stripes (sometimes indistinct), fibrous; exudate colourless, not readily flowing, colour not changing and not sticky. *Branchlets* hairy, pale brown, with spreading off-white hairs. *Leaves*: petiole 1.5–2(–2.8) cm long, densely hairy, like branchlets; lamina elliptic to slightly obovate, 11–25 by (4–)5–8 cm, subglossy, dull pale green abaxially, green to dark green adaxially, coriaceous, rough, densely hairy on abaxial surface and along midvein on adaxial surface; base acute, margin entire, apex ± attenuate; secondary veins dull yellow-green, 8–10 on each side of midrib and at an angle greater than 45° from midrib, regularly looping near margin onto the next lateral vein; tertiary veins weakly percurrent, densely hairy, prominent on abaxial surface. *Inflorescence* racemose, axillary, erect (young inflorescence pale green), > 30-flowered; rachis (5–)7–13(–18) cm long, hairy; flowers clustered together; pedicels (3–)4–8 mm long; bracteoles (1–)2–6.8 mm long, hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, 10–20 mm long, white to pale yellow, often with greenish tinge; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid or globular, 5–10 by 4–8 mm, smooth, green with slight maroon tinge (when immature), maturing to blackish purple, moderately hairy, with hairs antrorse.

Distribution — Endemic to the Kamiali area of Morobe Province of Papua New Guinea.

Habitat & Ecology — Occurring in open secondary mixed alluvial, lowland to lower montane forest. Growing on rich humic clayey soils.

Conservation status — Although this species is restricted to a small area, since it is included in the Kamiali Conservation Management Area, it is afforded some protection.

Vernacular name — Tar (Kela language; Informant: Tanny Gei).

Uses — Wood used by local people for building houses.

Additional specimens examined (Paratypes). Papua New Guinea, Morobe, Kamiali Conservation Area, Baudu, near Alalo 2 Creek, *B.J. Conn 5571, K.Q. Damas, D.J. Damas & B.G. Sule* (LAE, NSW); Allen Allison Track, c. 100 m W of Araro 1 River, 1.7 km W of Lababia Village, *B.J. Conn 5804, K.Q. Damas, K.M. Fazang & O.K. Paul* (LAE, NSW); trail to Cliffside from

Kamiali Guest House, *O.K Paul & S.A. James SAJ133* (NSW); *O.K. Paul & S.A. James LAE 87544* (L); Bulili ridge near Lababia, *W. Takeuchi 14329, 15090* (LAE); ridge to Cape Roon, slopes above Ariwiri river, Lababia, *W. Takeuchi 14884, 14894 & A. Towati* (CANB, L, LAE); near Tabare (Tabali) river, Lababia, *W. Takeuchi 15413*, *D. Ama & A. Towati* (LAE); ridge to Blue Mountain, near the Nembebah bivouac, *W. Takeuchi 21047* (LAE).

Notes — 1. *Polyosma kamialiensis* shares several morphological similarities with *P. pubescens* and *P. schulzemenzii* (all Papuasian species), all having hairy leaves with margin entire, and apex attenuate. Apart from the differences mentioned in the diagnosis (above), *P. kamialiensis* has leaves and rachis that are densely hairy, with hairs retrorse to reflexed compared to *P. pubescens* that has leaves and rachis sparsely hairy with spreading hairs. The white to pale yellow corolla of *P. kamialiensis* also differs from the pinkish green corollas of *P. pubescens*.

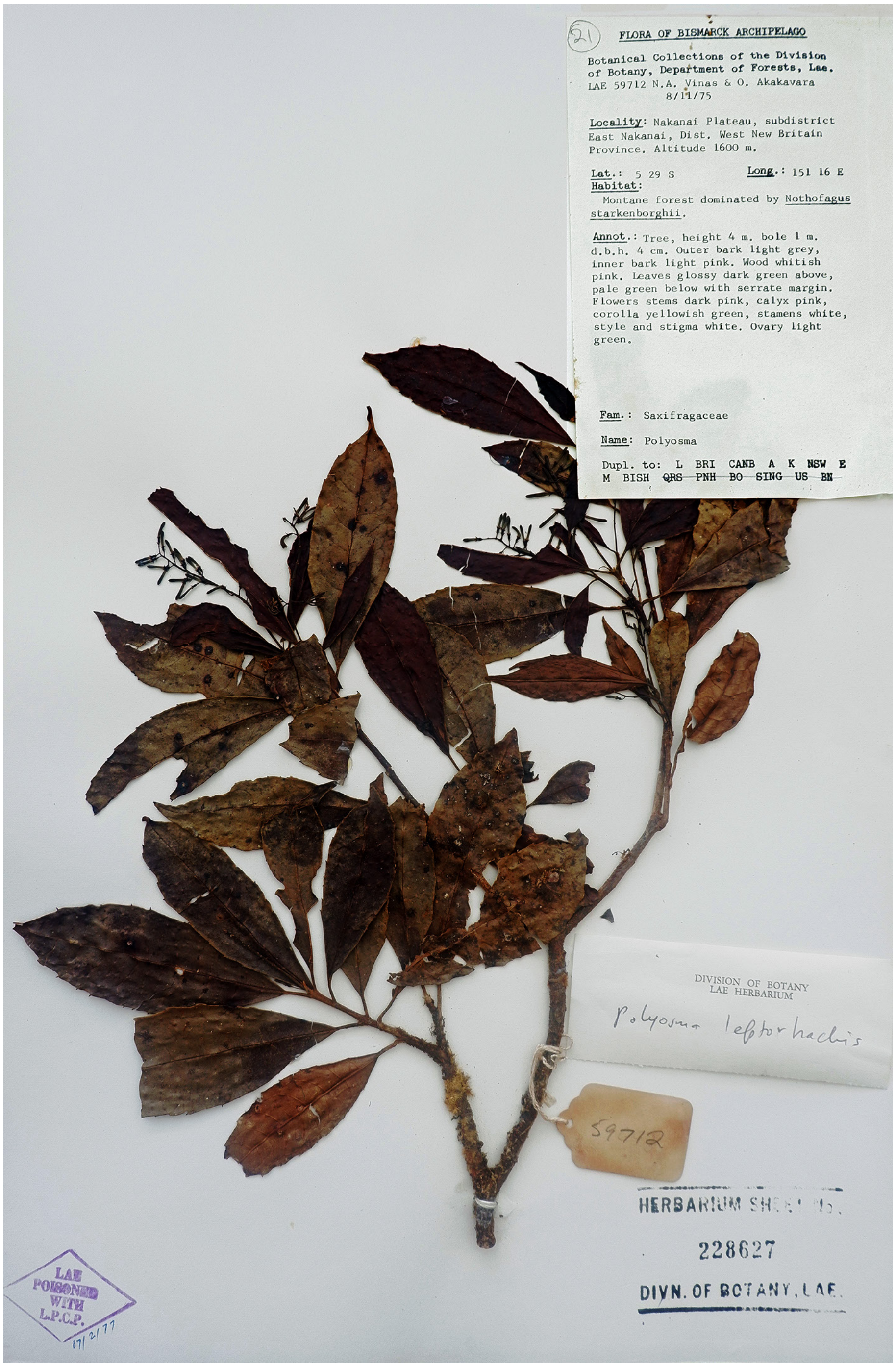
2. The morphological differences that readily distinguish this new species from *P. schulzemenzii* include bracteole length (*P. kamialiensis* usually 2–6.8 mm long vs 5–10 mm long in *P. schulzemenzii*), white to pale yellow corollas (vs greenish brown in *P. schulzemenzii*), and leaf lamina with base acute (vs rounded in *P. schulzemenzii*).

19. ***Polyosma leptorhachis*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 12

Etymology.The specific epithet (*leptorhachis*) of this new species refers to the slender, narrow (*lepto-*) axis (*-rhachis*) of the inflorescences.

Polyosma leptorhachis is morphologically similar to *P. rigidiuscula* (from Australia) with both being shrubby to small trees, but it differs by having a shorter petiole (1–1.5 cm long) and smaller lamina (3.5–8 by 1.5–2 cm), compared to *P. rigidiuscula* which has a longer petiole (3–8 cm long) and larger lamina (usually 8–15.8 by 2.1–5 cm). — Type: *N.A. Vinas & O. Akakavara LAE 59712* (holo LAE [LAE 228627]; iso A, BISH, BRI [BRI-AQ352765], CANB, E, K, L, M, NSW [NSW2396705]), Papua New Guinea, New Britain, East Nakanai Plateau, 8 Nov. 1975.

Small tree, up to c. 5 m tall. *Branchlets* glabrous, with scattered white lenticels. *Leaves* glabrous; petiole 1–1.5 cm long,



21

FLORA OF BISMARCK ARCHIPELAGO

Botanical Collections of the Division
of Botany, Department of Forests, Lae.
LAE 59712 N.A. Vinas & O. Akakavara
8/11/75

Locality: Nakanai Plateau, subdistrict East Nakanai, Dist. West New Britain Province. Altitude 1600 m.

Lat.: 5 29 S Long.: 151 16 E

Habitat: Montane forest dominated by Nothofagus starkenborghii.

Annot.: Tree, height 4 m. bole 1 m. d.b.h. 4 cm. Outer bark light grey, inner bark light pink. Wood whitish pink. Leaves glossy dark green above, pale green below with serrate margin. Flowers stems dark pink, calyx pink, corolla yellowish green, stamens white, style and stigma white. Ovary light green.

Fam.: Saxifragaceae

Name: Polyosma

Dupl. to: L BRI CANB A K NSW E
M BISH ~~QRS PNH BO SING US BN~~

DIVISION OF BOTANY
LAE HERBARIUM

Polyosma leptorhachis

59712

HERBARIUM SHEET No.
228627
DIVN. OF BOTANY, LAE.

LAE
POISONED
WITH
L.P.C.P.
17/2/77

Fig. 12 Holotype collection of *Polyosma leptorhachis* Schulze-Menze ex B.J.Conn & O.K.Paul (*N.A. Vinas & O. Akakavara LAE 59712*; LAE).

brown; lamina elliptic, 3.5–8 by 1.5–2.5 cm, coriaceous, drying brown on both surfaces; base cuneate, margin serrate, apex acuminate or attenuate; secondary veins 15–22 on each side and an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary vein weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 2.5–3 cm long, glabrous; flowers loosely and evenly arranged; pedicels 2–3 mm long, narrow; bracteoles 1–3 mm long, sparsely hairy. *Calyx lobes* 1–2 mm long. *Corolla buds* tubular, 10–15 mm long, green with yellow tinge, turning brown; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, c. 8 by 5 mm, glabrous, green.

Distribution — Papua New Guinea (Eastern Highlands, Southern Highlands, Western, Central, Milne Bay, New Britain).

Habitat & Ecology — Occurring in montane Beech forests, often on limestone derived soils, at elevations from 2040–2610 m.

Conservation status — Not endangered.

Additional specimens examined (Paratypes). Papua New Guinea, Morobe, Siboma, *S.A. James 804 & 805* (LAE, NSW); Buso Mountains, *K. Rau 611* (LAE); Lake Trist, *E.E. Henty NGF 29104* (BRI, LAE); Western Highlands, Mt Oibo, *W. Takeuchi 10677* (K, L, LAE); Eastern Highlands, Okapa, *T.G. Hartley 12157* (LAE); Daulo Pass, *K. Kerenga 154* (LAE); Mt Otto, *D.B. Foreman, Farley, Short & Hynes NGF 48050* (L, LAE); Southern Highlands, Mt Ne, Habono, *D. Frodin NGF 28355* (K, L); 0.75 miles SE of Lei Camp on track to Ibiwara, *D. Frodin NGF 28356* (L); *D. Frodin NGF 28485* (L); Ibiwara, *D. Frodin NGF 28448* (K, L); Onim, Mt Giluwe, *J. Ash ANU 20473* (LAE); Kiburu, *R. Schodde 1437* (L, LAE); Hides, *W. Takeuchi 19179* (LAE); Western, Juha South, *W. Takeuchi 23115, A. Gambia & T. Jisaka* (LAE); Central, [Main Range] Above the Gap, 2439 m, *C.E. Carr 13758* (L); Main Range NW of the Gap, *C.E. Carr 15223* (L); Varirata National Park, *D.G. Frodin 8052* (LAE); Milne Bay, Goodenough Island, *L.J. Brass 25109* (LAE); New Britain, Lower slopes of Mt Lululua, *P.F. Stevens & Y. Lelean LAE 58215* (BRI, L, LAE).

Notes — 1. *Polyosma leptorhachis* is also morphologically like *P. brachystachys* (from New Caledonia) which is also small, being shrubby to a small tree. *Polyosma leptorhachis*, *P. rigidiuscula* and *P. brachystachys* can be readily distinguished by *P. leptorhachis* having shorter inflorescences (rachis 2.5–3 cm long), whereas the other two species have longer inflorescences (*P. rigidiuscula* – rachis 3–11 cm long, and *P. brachystachys* – c. 5 cm long).

2. *Polyosma leptorhachis* is also morphologically similar to *P. mucronata* and *P. subalpina*. It is a small tree up to 5 m tall, like *P. subalpina* (vs shrub up to 1 m tall for *P. mucronata*); it occurs at lower elevations, up to 2600 m (vs *P. mucronata* which extends to high elevations, up to 3500 m and *P. subalpina* at elevations of at least 3000 m). It can also be distinguished by its elliptic leaf lamina (vs obovate for *P. acuminata*), leaf base cuneate (vs acute for *P. mucronata* and *P. subalpina*), and apex acuminate or attenuate (vs the apices are mucronate in *P. mucronata* and *P. subalpina*). The lamina of *P. leptorhachis* has 15–22 secondary veins on each side of the midrib (vs 7–13 in *P. mucronata* and 9–15 in *P. subalpina*). The inflorescence rachis is usually shorter than the other two species (2.5–3 cm long) and glabrous, whereas the rachis in the other two species is hairy and 5.5–6 cm long (*P. mucronata*) and 1.5–9.5 cm long (*P. subalpina*).

3. Schulze-Menz annotated the collection *Carr 13758* (L) as a new species, but this collection is regarded as *P. leptorhachis* as circumscribed here.

20. ***Polyosma longebracteolata*** O.C.Schmidt

Polyosma longebracteolata O.C.Schmidt (1924) 149, f. 734; P.Royen (1983) 2518, f. 736. — Lectotype (designated here): *H.J. Lam 1771* (lecto B [B10_0296082]; isolecto BO (n.v.), L [L 0035101]) (Van Royen 1983)), Indonesia Papua, Jayapura, Nova Guinea neerlandica in reg. flum. Mamberamo (= Sungai Mamberamo), in monte 'Doormantop (= Doorman Peak, Wonabunggame)' (Van Royen 1983), 27 Oct. 1920 (see Typification below).

Typification — Since Schmidt (1924) did not assign a holotype, *H.J. Lam 1771* (as held at B) is here designated as the lectotype.

Subalpine shrub. *Branchlets* densely hairy, hairs pale yellow, glabrescent. *Leaves*: petiole 0.4–0.8 cm long, glabrous; lamina oblong or obovate to spathulate, (1–)2–5 by (0.6–)1–1.8 cm, coriaceous, with abaxial surface sparsely hairy with hairs pilose and adpressed on midrib and sometimes on lateral veins, adaxial surface glabrous; base narrowly cuneate, margin subrevolute, usually entire, but often with 1 or 2 poorly developed teeth distally, apex obtuse to subacute; secondary veins 4–7 on each side and an angle greater than 45° from midrib, regularly looping or irregularly arching near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, prominent on abaxial surface. *Inflorescence* racemose, terminal, rachis 3–3.5 cm long (8–14-flowered), densely hairy with hairs golden yellow; flowers loosely arranged along rachis; pedicels 1–3 mm long; bracteoles 3–5 mm long, hairy. *Calyx lobes* 1–1.5 mm long. *Corolla buds* tubular, 10–15 mm long, yellowish; corolla remaining tubular at anthesis, with 4 small ovate lobes. *Fruits* not seen.

Distribution — Only known from two collections by H.J. Lam (*Lam 1675* and *1771*) from Doorman Peak (= Ngga Sembanggela) (Indonesia Papua, Tolikara Regency).

Habitat & Ecology — Presumably occurring in subalpine shrubberies, at elevation between 3200–3260 m.

Conservation status — Since this species is only known from a single location (Doorman Peak, Wonabunggame), it is possible that it is endangered.

Orthography — Without contradictory evidence, the prefix ('longe') of the specific epithet (Schmidt 1924) is regarded as an adverb preceding an adjectival epithet ('bracteolata' – 'bracteola' with the verbal suffix '-ate'), two words in apposition, and so does not need to be corrected (Turland et al. 2018: Art. 60).

Additional specimen examined. Indonesia, Papua, Jayapura, 'monte Doormantop (= Doorman Peak, Wonabunggame)', *Lam 1675* (L).

Note — Although this species is very inadequately known and has only been recorded from Indonesia Papua, it is likely to also occur in Papua New Guinea.

21. ***Polyosma macrobotrys*** Mattf.

Polyosma macrobotrys Mattf. (1938) 273. — Lectotype (designated here): *J. Clemens & M.S. Clemens 1414*[*a*] (lecto B [B_10.0296075]; isolecto L [L 0035103], NSW), Papua New Guinea, Morobe, Wareo, Cart Road, 'margin jungle' ['an einem Fahrweg im Walde' (Mattfeld 1938: 274)], 25 Dec. 1935 (see Typification below).

Typification — The type of *P. macrobotrys* (*J. Clemens & M.S. Clemens 1414*) as held at B, consists of several samples. However, the collecting number of this collection does not have the suffix 'a'. The upper left specimen is a flowering specimen that matches the detailed description of the inflorescence and flowers provided by Mattfeld (1938) in the protologue.

Tree, c. 9 m tall, c. 10 cm diam. *Branchlets* initially sparsely hairy, soon glabrous, pustules grey-brown. *Leaves*: petiole 1–3.5 cm long, sparsely hairy, soon becoming glabrous; lamina elliptic, (4–)12–22 by (2–)4–7.5 cm, coriaceous to papery (when dry), glabrous, drying brown to pale brown on both surfaces; base acute, margin entire, apex acuminate; secondary veins 13–23 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, usually terminal, or axillary, > 30-flowered; rachis (3–)9–21 cm long, hairy, soon becoming glabrous; pedicels c. 2 mm long; bracteoles 1–2 mm long, hairy. *Calyx lobes* 1–3 mm long. *Corolla buds* tubular, (5–)9–10 mm long, white; *corolla* moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 7–10 by 6–8 mm, glabrous, green to dark blue, drying black.

Distribution — Indonesia (Papua Barat), Papua New Guinea (Western, Morobe, New Britain, Bougainville), and Solomon Islands.

Habitat & Ecology — Occurring in lowland rainforests on slopes between elevations of 60–900 m.

Conservation status — Not known.

Additional specimens examined. Indonesia, Papua Barat, Geelvink Bay, Wondiwoi, Wandammen Peninsula, *C. Koster BW 13654* (L); Mimika, Baliem Valley, *A.J.G.H. Kostermans 700 & Soegeng* (L). – Papua New Guinea, Morobe, Oomsis Creek, *T.G. Hartley 10483* (LAE); Sattleberg, *M.S. Clemens 966* (L); Quembung Mission, *M.S. Clemens 2138* (Conn 1990) (BRI); Western, Oriomo River, *G. McVeagh NGF 8279* (L, LAE); New Britain, Kirigo, Maisua, *J.H.L. Waterhouse 736-B* (L); Bougainville, Paguna Ridge, *G. Argent NGF 1225* (LAE). – Solomon Islands, Guadalcanal, Vulolo, Tutuve, *S.F. Kajewski 2556* (BISH, BRI, LAE); Santa Isabel, Tiratona, *L.J. Brass 3211* (BISH, BRI, L, LAE).

Notes — 1. *Polyosma macrobotrys* is a species with either terminal (usually), or axillary inflorescences.

2. Although unpublished, Schulze-Menz regarded '*P. mutabilis* Blume', based on the herbarium collection *Clemens 1414a* (the type of *P. macrobotrys*) as a variant of *P. integrifolia*. However, the varietal concept applied by Schulze-Menz included plants with ovoid fruits, not distinctly sulcate or truncate at base, and so does not refer to the re-circumscription of *P. mutabilis* as lectotypified by Esser & Saw (2015), and later reduced to the synonymy *P. fragrans* (Wall.) Benn. (Saw 2020a). Irrespective of Schulze-Menz' opinion, *Clemens 1414a* is the type of *P. macrobotrys* and is morphologically distinct from *P. integrifolia*.

22. ***Polyosma mucronata*** Reeder

Polyosma mucronata Reeder (1946) 282; P.Royen (1983) 2516, f. 733. — Type: *L.J. Brass 4310* (holo A [A42995] (see Typification below); iso BRI [BRI-AQ342403], NY), Papua New Guinea, Central, Mt Albert Edward, May-July 1933.

Typification — Reeder (1946: 275) cited the type of *P. mucronata* as '*Brass 4310* (A, TYPE, NY)'. Therefore, we accept that Reeder designated the holotype as the specimen held at A, with an isotype at NY.

Shrub, c. 1 m tall. *Branchlets* glabrous, brown, slightly rough and ridged. *Leaves* glabrous; petiole 1–2 cm long, brown; lamina obovate, 2–5 by 1.2–3 cm, coriaceous, dried materials brown on both surfaces; base acute, margin serrate, apex mucronate; secondary veins 7–13 on each side and an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary vein weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 5.5–6 cm long, densely pubescent, pilose; flowers loosely arranged along rachis; pedicels 1.5–5 mm long, narrow; bracteoles 1–5 mm long, densely hairy. *Calyx lobes* 2–4 mm long. *Corolla buds* tubular, 10–15 mm long, green, often with purple tinge; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, c. 10 by 5 mm, glabrous, green.

Distribution — Papua New Guinea (Western Highlands, Eastern Highlands, Central, Milne Bay).

Habitat & Ecology — Occurring in montane forest from elevations of 3300–3450 m.

Conservation status — Although there are no recent collections of this species, it is regarded as probably not endangered.

Additional specimens examined. Papua New Guinea, Western Highlands, Minj-Nona Divide, Kubor Range, *R. Pullen 5060* (BRI, L, LAE); Mt As, Kubor Range, *R. Pullen 5103* (BRI, L, LAE); Eastern Highlands, Mt Kerigomna, *R.D. Hoogland 5627 & R. Pullen* (L, LAE); Mt Wilhelm, *R.D. Hoogland 6575* (LAE); Central, Mt Dickson, Goilala, *T.G. Hartley 12912* (K, L, LAE); Mt Albert Edward, *H. Kanai 75318* (LAE); *L.A. Craven 2788* (L, LAE); Milne Bay, Mt Suckling, *J.-F. Veldkamp 5893* & *P.F. Stevens* (LAE); Mt Suckling, Tantam Plateau Scarp above Mayu River, *P.F. Stevens LAE 55638* (BRI, L, LAE).

Note — This species is readily distinguished from other Papuasian species because of the obovate lamina with a mucronate apex.

23. ***Polyosma occulta*** Reeder

Polyosma occulta Reeder (1946) 285. — Lectotype (designated here): *L.J. Brass 4524* (lecto A; isolecto BRI [BRI-AQ342405], NY) (see Typification below), Papua New Guinea, Central, Wharton Range, Murray Pass, June–Sept. 1933.

Typification — Reeder (1946: 286) cited the type of *P. occulta* as '*Brass 4524* (A, NY, TYPE)'. Since Reeder did not designate a holotype, the A and NY specimens are here treated as syntypes. Therefore, we designated the lectotype as the *Brass 4524* specimen held at A.

Tree, 3–5 m tall, bole c. 2 m high, 7–10 cm diam. *Branchlets* densely hairy, brown, pustules scattered. *Leaves*: petiole 1–2 cm long, sparsely hairy; lamina oblong – broadly elliptic, 3–7 by 1.5–4 cm, coriaceous, hairy, drying both surfaces light brown; base obtuse, margin serrate, apex mucronate; secondary veins 9–18 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, hairy, prominent on abaxial surface. *Inflorescence* racemose, axillary or subterminal, < 20-flowered; rachis 4–10 cm long, hairy; pedicels 2–3 mm long; bracteoles 5–10 mm long, densely hairy. *Calyx* lobes 1–7 mm long. *Corolla buds* tubular, (7–)9–13 mm long, white; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 6–10 by 5–6 mm, slightly hairy, purplish black, drying black.

Distribution — Papua New Guinea (Central).

Habitat & Ecology — Occurring in montane forest from elevations of 2610–2835 m.

Conservation status — Not known.

Additional specimens examined. Papua New Guinea, Central, track from Avios to Samarei, near Woitape, *P. van. Royen NGF 20483* (L, LAE); Murray Pass, *C.E. Ridsdale NGF 36833* (BRI, L, LAE).

Note — *Polyosma occulta* differs from *P. cestroides* by having leaves with margin serrate. *Polyosma occulta* is distinctive because the large bracteoles tend to cover the calyx.

24. ***Polyosma oligantha*** Reeder

Polyosma oligantha Reeder (1946) 286. — Type: *L.J. Brass 12502 & C. Versteegh* (holo A; iso BRI [BRI-AQ342407], L [L 0035109], LAE [LAE 2827]) (see Typification below), Indonesia, Papua, Snow Mountains, 18 km SW of Bernhard Camp, Idenburg River, alt. 2000 m, Feb. 1939.

Typification — Reeder (1946: 275) states that "In the absence of parenthetical letters indicating the place of deposit [of specimens], cited specimens are to be found only at the Arnold Arboretum [A]." Reeder (1946: 287) cited the type of *P. mucronata* as "*Brass 12502* (TYPE)". Therefore, we accept that he designated the holotype as the specimen held at A and so, lectotypification is unnecessary.

Subcanopy to sometimes canopy tree, up to 25 m high, c. 71 cm diam; bark black, rough. *Branchlets* glabrous, dark brown. *Leaves* with petiole 1–2.3 cm long; lamina elliptic, 6–10 by 3.5–5.5 cm, coriaceous, glabrous, discolors in dried material to dark brown to black adaxially, very dark brown abaxially; base obtuse or cuneate, margin entire, apex obtuse to rounded, emarginate; secondary veins c. 10 on each side and at an angle greater than 45° from midrib, regularly looping near margin on to the next secondary vein; tertiary vein weakly percurrent, glabrous and very prominent on abaxial surface. *Inflorescence* racemose, axillary or terminal, up to 7 cm long, sparsely hairy, 5–8-flowered; bracteoles, 2–3 mm long. *Calyx lobes* c. 2 mm long. *Corolla buds* tubular, up to 28 mm long, brownish green. *Fruits* seen young, ovoid, c. 13 by 11 mm, mature fruit not known.

Distribution — Indonesia (Papua; Snow Mountains).

Note — The taxonomic status of this species is inadequately known because it is only known by the type collection. It was not included in our morphometric analyses. *Polyosma oligantha* shares many morphological similarities with *P. cestroides* and *P. integrifolia*. It has a long corolla (up to 28 mm long vs *P. cestroides* 5–25 mm long, *P. integrifolia* 5–10 mm long), similar large fruits (c. 13 mm long vs *P. cestroides* 5–13 mm long, *P. integrifolia* 5–13 mm long), short petiole (1–2.3 cm long, like *P. integrifolia* 0.5–3 cm long vs *P. cestroides* 5–25 cm long).

25. ***Polyosma pachyrhachis*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 13

Etymology. The specific epithet (*pachyrhachis*) refers to the thick, stout (*pachy-*) axis of the inflorescence axis (*-rhachis*) characteristic of this species.

Polyosma pachyrhachis is morphologically most similar to *P. ilicifolia*, but differs by having slightly larger obovate, sometimes elliptic leaves (13.5–16 by 5–7 cm vs oblong to narrowly elliptic leaves 9–11 by 3–4 cm for *P. ilicifolia*), and the mature corolla remains tubular at anthesis, with 4 small ovate lobes in *P. pachyrhachis* (vs *P. ilicifolia* has mature corolla fully split into 4 petals). — Type: *L.J. Brass 32162* (holo LAE [LAE 33906]; iso L [L 0035110]), Papua New Guinea, Eastern Highlands, Mt Elandora, 18 Oct. 1959.

Tree, c. 6 m tall. *Branchlets* hairy, pustules grey, scattered. *Leaves* sparsely hairy; petiole 2–2.5 cm long; lamina obovate, sometimes elliptic, 13.5–16 by 5–7 cm, coriaceous, upper surface drying brown, glaucous on abaxial surface; base acute, margin serrate, apex acuminate; secondary veins 20–28 on each side and at an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, pubescent, prominent on abaxial surface. *Inflorescence* racemose, terminal, 20–30-flowered; rachis 5–19 cm long, densely hairy; flowers clustered along rachis; pedicels c. 3 mm long, thick; bracteoles 2–3 mm long, hairy. *Calyx lobes* 3–5 mm long. *Corolla buds* tubular,

Fig. 13 Isotype collection of *Polyosma pachyrhachis* Schulze-Menz ex B.J.Conn & O.K.Paul (*L.J. Brass 32162* [L 0035110]).

10–20(–30) mm long, green with yellowish tinge, rarely yellow; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* not seen.

Distribution — Indonesia (Papua Barat) and Papua New Guinea (Western Highlands, Eastern Highlands, Southern Highlands).

Habitat & Ecology — Occurring in montane forest at elevations of about 2400 m.

Conservation status — Unknown.

Additional specimens examined (Paratypes). Indonesia, Papua Barat, Vogelkop, Anggi Gita Lake, *H.O. Sleumer & W. Vink BW 14051* & *BW 14115* (L). – Papua New Guinea, Western Highlands, Ambun, *J.R. Flenley ANU 266* (LAE); Sirunke, *J.S. Womersley NGF 14275* (L); Southern Highlands, Mt Giluwe, *J.R. Croft LAE 60628* (L, LAE); *J.R. Croft LAE 60920* (LAE, NSW); Kiburu, *R. Schodde 14437* (LAE).

Notes — 1. Other morphological differences between *P. pachyrhachis* and *P. ilicifolia* include: *P. pachyrhachis* has bracteoles (2–3 mm long), calyx lobes (3–5 mm long) and corolla (10–20 mm long) that tend to be longer than in *P. ilicifolia* (vs bracteoles c. 2 mm long, calyx lobes c. 2 mm long, and corolla c. 10 mm long).

2. *Polyosma pachyrhachis* is also morphologically similar to a few other species, namely *P. induta*, *P. longebracteolata*, and *P. schulzemenzii*, but differs from them by having leaves with an acuminate apex (vs apex obtuse to subacute in *P. longebracteolata* and attenuate in the other two species); and it differs from *P. longebracteolata* by having larger leaves (13.5–16 cm long, 5–7 cm wide, vs 0.2–0.5 cm long, 0.5–1.8 cm wide in *P. longebracteolata*). Furthermore, the bracteoles of *P. pachyrhachis* are shorter than the calyx, whereas they are as long as the calyx in *P. longebracteolata*.

26. ***Polyosma pubescens*** Ridl.

Polyosma pubescens Ridl. (1916) 38. — Lectotype (designated here): *C. Boden Kloss s.n.* (lecto BM [BM600388]; isolecto K), Indonesia, Papua, Mimika, Camp I (c. 4.5 miles from Setakwa River, eastern tributary of the Utakwa River (Boden Kloss in Ridley 1916, Ballard 2001), (18–20 Sept. 1912 (Ridley 1916)) (see Typification below).

Typification — The only type information provided by Ridley (1916) was the locality information 'Camp I, 500 ft.' Therefore, the *Boden Kloss s.n.* collection as held at BM [BM600388], is here designated as the lectotype because it was collected from 'Camp I', with the isolectotype held at K.

Subcanopy tree, 6–10 m tall. *Branchlets* pubescent, smooth, brown. *Leaves* sparsely hairy; petiole 0.8–1.5 cm long, pale brown; lamina elliptic, 9–11 by 3.5–4.5 cm, coriaceous, drying brown on both surfaces; base acute, margin entire, apex attenuate; secondary veins 10–15 on each side of midrib and at an angle greater than 45° from midrib, looping near margin onto the next secondary vein; tertiary vein weakly percurrent, prominent on abaxial surface, sparsely hairy. *Inflorescence* racemose, either axillary or terminal, > 30-flowered; rachis 10–10.5 cm long, sparsely pubescent; pedicels 3–4 mm long; bracteoles 2–5 mm long, sparsely hairy. *Calyx lobes* 1–2 mm long. *Corolla buds* tubular, 10–15 mm long, pinkish green to purplish; corolla densely hairy, fully split at anthesis. *Fruits* not seen.

Distribution — Indonesia (Papua) and Papua New Guinea (Milne Bay). The distribution of this species is very inadequately known. It is most unlikely that it only occurs in two localities that are at opposite ends of the island of New Guinea.

Habitat & Ecology — Occurring in lower montane forest at elevations of about 1350 m, recorded from *Araucaria-Lithocarpus* ridge forest in Milne Bay (*Stevens LAE 55753*).

Conservation status — Not known: this species is under-collected, and hence, its distribution and habitat preferences are inadequately known.

Additional specimen examined. Papua New Guinea, Milne Bay, Raba Raba, Mt Suckling, *P.F. Stevens & J.-F. Veldkamp LAE 55753* (L, LAE, NSW).

Notes — 1. This species is similar to *P. induta*, but *P. pubescens* has leaves with an entire margin, whereas the leaf margin of *P. induta* is serrate.

2. *Polyosma induta* is morphologically most like *P. forbesii*, which also has a serrate leaf margin. Many features of *P. pubescens* are also like *P. forbesii*, apart from the leaf margin. However, *P. pubescens* is a small tree (6–10 m tall vs *P. forbesii* 10–20 m tall) and is sparsely hairy, whereas *P. forbesii* is densely hairy. This suggests that the taxonomic importance of the presence or absence of marginal teeth, on the leaf margin, requires further evaluation.

3. Although *P. pubescens* is morphologically like *P. schulzemenzii*, they were consistently distinguished from each other in our cluster analysis (Fig. 1) and in the SSH-MST analysis (Fig. 2). Therefore, they are maintained as two distinct species. *Polyosma pubescens* has smooth branchlets and leaves with petiole 0.8–1.5 cm long (whereas *P. schulzemenzii* has ridged branchlets and leaves with mostly longer petioles, 1–2 cm long); *P. pubescens* has a broader elliptic lamina, 3.5–4.5 cm wide, with base acute, and secondary veins 10–15 on each side of midrib (vs *P. schulzemenzii* has narrowly obovate leaves, 2–3.5 cm wide, with base rounded, and secondary veins 17–19 on each side of midrib); the inflorescences of *P. pubescens* are either axillary or terminal, with the rachis sparsely pubescent (vs *P. schulzemenzii* has only terminal inflorescences and the rachis densely hairy); *P. pubescens* has shorter bracteoles (2–5 mm long); and smaller flowers (calyx lobes 1–2 mm long; corolla 5–10 mm long), compared to *P. schulzemenzii* that has bracteoles 5–10 mm long, calyx lobes 5–10 mm long, and corolla 10–20 mm long.

27. ***Polyosma rampae*** W.N.Takeuchi

Polyosma rampae W.N.Takeuchi (2007) 159, f. 1. — Type: *W.N. Takeuchi 20148, A. Towati & D. Ama* (holo LAE [LAE 288549]; iso A, L [L 2070838]), Papua New Guinea, Western Highlands, Kaijende Highlands, Waile Creek, 4 Nov. 2005.

Shrub, c. 2 m tall. *Branchlets* glabrous, dull black to becoming brown, ± smooth, without pustules. *Leaves* opposite or subopposite (appearing spiral), glabrous; petiole 0.4–1.2 cm long, black; lamina narrowly obovate, (1.2–)1.5–2.7 by 0.5–1.1 cm, fleshy, thin-textured when dried; base cuneate, margin shortly serrate, with 1 or 2 teeth per side (rarely absent), black, apex acute and mucronate; secondary veins 4–10 on each side and diverging 55–75° from midrib, closing by inframarginal looping veins; tertiary veins glabrous, prominent on abaxial surface. *Inflorescence* racemose, terminal, erect, rachis 1.5–2 cm long, concealed by bracts except at anthesis, axial surfaces glabrous, black; peduncle 0.4–1.1 cm long. *Bracteoles* foliaceous, linear-elliptic, with central bracteole (10–)13–18 mm long, and lateral bracteoles 8–12 mm long, glabrous, entire, persistent. *Calyx lobes* c. 1.2 mm long. *Corolla buds* tubular, 11–13 mm long, pale purple. *Fruits* ellipsoid-ovoid, (5–)6–7 mm long, black, hairy.

Distribution — Papua New Guinea, only known from the type locality, near the Porgera gold mine (Western Highlands).

Habitat & Ecology — Occurring on the margin of mossy montane forest and along subalpine streams, at about 3000 m elevation.

Conservation status — This species is regarded as not endangered (Takeuchi 2007).

Note — The leafy bracteoles are morphologically like those of *P. occulta*, but the bracteoles of *P. rampae* are much larger, such that the entire raceme is obscured, with the flowers becoming clearly visible only near anthesis. The enlarged bracteoles of *P. occulta* cover only the calyx.

28. ***Polyosma schulzemenzii*** B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 14

Etymology. The specific epithet of this new species commemorates Dr. Georg K. Schulze-Menz, a former director of the Botanical Garden and Botanical Museum Berlin-Dahlem (B), whose revision of the *Polyosma* in the Indonesian-Melanesian-Australian region was not completed because of his sudden death in 1978 (Potztal 1979). Unfortunately, his manuscript of the genus *Polyosma* was not publishable. Although Schulze-Menz recognised this entity as a new species (by the unpublished manuscript name '*Polyosma perlongibracteolata*'), we decided that the similarity of his proposed specific epithet with that of *P. longebracteolata* could have resulted in nomenclatural confusion. Furthermore, we wished to acknowledge Schulze-Menz's extensive research into the taxonomy of this genus by naming this species after him.

Polyosma schulzemenzii is morphologically most similar to *P. pubescens*, but it differs by its obovate leaf lamina which has a rounded base (vs elliptic leaves with acute base for *P. pubescens*). It has larger flowers (corolla 10–20 mm long, greenish brown) than those of *P. pubescens* (vs corolla 5–10 mm long, pinkish green). — Type: *L.J. Brass 31168* (holo L [L 0035111]; iso K, LAE [LAE 40014]), Papua New Guinea, Eastern Highlands, western slopes of Mt Michael, 27 Aug. 1959.

Subcanopy tree, c. 12 m tall. *Branchlets* hairy, brown, ridged. *Leaves*: petiole 1–2 cm long, hairy, brown; lamina narrowly obovate, 7–12 by 2–3.5 cm, coriaceous, densely hairy, abaxial surface ferruginous, drying brown on both surfaces; base rounded, margin entire, apex attenuate; secondary veins 17–19 on each side of midrib and at an angle greater than 45° from midrib, looping near margin onto the next secondary vein;

Fig. 14 Holotype collection of *Polyosma schulzemenzii* B.J.Conn & O.K.Paul (*L.J. Brass 31168* [L 0035111]).

tertiary veins weakly percurrent, prominent on abaxial surface, pubescent. *Inflorescence* racemose, terminal, 20–30-flowered; rachis 5–13 cm long, densely hairy; flowers loosely and evenly scattered along length of rachis; pedicels 2–4 mm long; bracteoles 5–10 mm long, hairy. *Calyx lobes* 5–10 mm long. *Corolla buds* tubular, (10–)14–20 mm long, brown, with greenish tinge; corolla densely hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* not seen.

Distribution — Papua New Guinea (West Sepik, Morobe, Eastern Highlands).

Habitat & Ecology — Occurring in lowland montane forest dominated by *Castanopsis* (D.Don) Spach (*Fagaceae*) species at elevations of about 1 890 m.

Conservation status — This species is inadequately sampled. Therefore, even though it appears to be widespread, its conservation status is not known.

Additional specimens examined (Paratypes). PAPUA NEW GUINEA, West Sepik, Amanab-Green River Road, *H. Streimann & N. Martin LAE 52850* (BRI, L, LAE); Morobe, Edie Creek, Wau, *T.G. Hartley 11739* (LAE).

Notes — 1. The mature open corolla of *P. schulzemenzii* remains tubular with only a small opening apically, whereas the mature corolla of *P. pubescens* splits to the base so that there is no remaining colour tube (style clearly exposed).

2. *Polyosma schulzemenzii* has leaves that are densely hairy and ferruginous on the abaxial surface, similar to those of *P. brassii*. However, the leaf lamina of this new species is narrowly obovate whereas those of *P. brassii* are elliptic. Like *P. longebracteolata*, this new species has bracteoles that are as long as the calyx; however, *P. schulzemenzii* is readily distinguished by its petioles 1–2 cm long, leaf lamina 7–12 cm long, and inflorescences 5–13 cm long (vs *P. longebracteolata* with petiole 0.4–0.8 cm long, leaf lamina (1–)2–5 cm long, and inflorescences 3–3.5 cm long).

FLORA OF NEW GUINEA.
Distributed by the
HERBARIUM AUSTRALIENSE, C.S.I.R.O., CANBERRA, A.C.T.
with the request to be notified of new identifications.
Coll. R.D. Hoogland & R. Schodde
No. 7414 Date 12 Aug. 1960
fam. Escalloniaceae.
Polyosma
Loc. near Kepilam village, Lagaip valley, Laiagam subdistrict, Western Highlands, Terr. of New Guinea.
Hab. in mixed montane forest; alt. c. 8500 feet.
Notes Tree, c. 8.5 m tall, 4.5 m bole, 14 cm diam.
Flowers pale purple-brown.
Local name: Keh (Enga language, Kepilam).
13 duplicates to LAE, L, A, BM, E, NSW, BH, BISH, US, SING, BO, Z, B.

Fig. 15 Isotype collection of *Polyosma scyphocalyx* Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.*, showing leaves and flowers (*R. Hoogland 7414* [CANB85688.1]). a. Insert showing closeup of leaves and fruits [CANB85689.1]).

29. ***Polyosma scyphocalyx*** Schulze-Menz ex B.J.Conn & O.K.Paul, *sp. nov.* — Fig. 15

Etymology. The specific epithet (*scyphocalyx*) of this new species refers to the cup-like (*scypho*-) calyx (-*calyx*) of this species.

Polyosma scyphocalyx is morphologically most similar to *P. dentata*, but it differs by its elliptic leaves (vs broadly elliptic for *P. dentata*); glabrous, terminal inflorescence (vs sparsely hairy and axillary in *P. dentata*); and by being a larger tree (6–15 m high) compared to *P. dentata* (4–6.8 m high). — Type: *R. Hoogland 7414 & R. Schodde* (holo LAE [LAE 38504]; iso CANB [CANB85688.1, CANB85689.1], L [L 0035112], Papua New Guinea, Western Highlands, Lagaip Valley, 12 Aug. 1960.

Tree, 6–15 m tall, bole up to 4.5 m, 6–14 cm diam. *Branchlets* glabrous, brown, pustules grey, scattered. *Leaves* glabrous; petiole 1–3 cm long; lamina elliptic, 3.5–10 by 1.5–4 cm, coriaceous, both surfaces drying light brown; base acute, margin serrate, apex acuminate; secondary veins 9–22 on each side and an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, prominent on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 4–10 cm long, glabrous; flowers loosely and evenly clustered on distal half of rachis; pedicels 5–7 mm long; bracteoles 1–3 mm long, hairy. *Calyx* distinctly cup-shaped; calyx lobes 1–5 mm long. *Corolla buds* tubular, (5–)13–25 mm long, reddish purple or greenish purple; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 9–13 by 5–9 mm, glabrous, green turning purplish blue or brown.

Distribution — Papua New Guinea (Madang, Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Central, Milne Bay, Bougainville).

Habitat & Ecology — Occurring in montane forest from elevations of 2400–3150 m.

Conservation status — This widespread species is not regarded as endangered.

Additional specimens examined (Paratypes). Papua New Guinea, Madang, Kaironk Village, *G. Weiblen 991, M. Evans, B. Isua & S. Majneb* (LAE); *G. Weiblen 1052* (LAE); Morobe, Kabum, *K.A. McElhanon 69* (LAE); Near Arigenang, Finschhafen Sub-District, *D.B. Foreman NGF 48121* (L, LAE); Lake Trist, *E.E. Henty NGF 29019* (L, LAE); Meri Creek, *C.E. Ridsdale NGF 30326* (LAE); Western Highlands, Sirunki, *D. Walker ANU 7419* (L [incorrectly labelled *ANU 749*], LAE); Lagaip, *R. Hoogland 7652 & R. Schodde* (L, LAE); Mt Giluwe, *M. Coode & P. Waring NGF 32508* (K, L, LAE); Tambul, *M. Coode & P. Katik NGF 32953* (K, LAE); Kubor Range, *R. Pullen 5233* & *5293* (L, LAE); Tomba, *J.-F. Veldkamp 5447 & P.F Stevens* (L, LAE); Eastern Highlands, Mt Wilhelm, *J.C. Saunders 787* (L, LAE); Okapa, *T.G. Hartley 13087* (LAE); Marafunga, *P.F. Stevens LAE 51004* (L, LAE); Kassam Pass, *E.E. Henty & J. Vandenberg NGF 29319* (L, LAE); Southern Highlands, Mt Bosavi, *K. Damas LAE 58879* (BRI, CBG, L, LAE); Tari, *C. Kalkman 4886* (K, L, LAE); Mt Ne, *C. Kalkman 4918* (L); Tari, *C. Kalkman 5159* & *5174* (K, LAE), *A. Gillison NGF 25135* (K, LAE); *A. Gillison NGF 25138* (K, L, LAE); *D. Frodin NGF 28128* (K, L, LAE); Ibiwara, *D. Frodin NGF 28356* (LAE); Kagaba-Mendi, *J. Vandenberg, P. Katik & A. Kairo NGF 40095* (K, L, LAE); Mt Ambua, *W. Vink 17229* & *17463* (L, LAE); Central, Woitape, *A.N. Millar 1232* (L, LAE); Mt Gerebu, *S.A James 1438* (LAE); Northern, Kokoda, *J.R. Croft LAE 65009* (L, LAE); Milne Bay, Mt Suckling, *P.F. Stevens & J.-F. Veldkamp LAE 54965* (L, LAE); Baniara, *A. Kanis 1230* (L, LAE); Fergusson Island, *J.R. Croft LAE 71075* (L, LAE); Bougainville: Pavariri, *C.E. Ridsdale & P. Lavarack NGF 31018* (L, LAE).

Notes — 1. Although *P. scyphocalyx* is morphologically also like *P. rampae*, it is readily distinct from the latter shrubby species (*P. rampae* c. 2 m tall). When compared with *P. rampae* (not included in morphometric analyses), *P. scyphocalyx* has elliptic leaves, with petiole 1–3 cm long, lamina 3.5–10 cm long, and apex acuminate, distinguishing it from *P. rampae* that has narrowly obovate smaller leaves (petiole 0.4–1.2 cm long, lamina up to 2.7 cm long), and apex acute and mucronate. The inflorescence rachis is longer in *P. scyphocalyx* (4–10 cm long, vs 1.5–2 cm long in *P. rampae*).

2. Furthermore, the cup-shaped calyx readily distinguishes *P. scyphocalyx* from the tubular calyces of both *P. dentata* and *P. rampae*.

30. ***Polyosma stenosiphon*** Schltr.

Polyosma stenosiphon Schltr. (1915) 128. — Type: *C.L. Ledermann 12085* (holo B [B10_0278226]), Papua New Guinea, West Sepik, 'Kaiserin-Augusta-Fluss (= August River)-Expedition', 1 Aug. 1913.

Polyosma crassifolia Kaneh. & Hatus. (1942: 304). — Type: *R. Kanehira & S. Hatusima 13662* (FU, n.v.), Indonesia, Papua Barat, Vogelkop, Angi, near Lake Giji, Arfak Mountains, 6 Apr. 1940.

Subcanopy to canopy tree, (5–)15–20 m tall. *Branchlets* glabrous, pustulate. *Leaves* glabrous; petiole 0.7–1(–1.5) cm long; lamina slightly obovate, 4–6(–10) by 1.3–2.5(–4.5) cm, drying both surfaces light brown; base cuneate, margin entire, apex obtuse to rounded to shortly acuminate; secondary veins 9–10 on each side of midrib and at an angle greater than 45° from midrib, indistinctly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, indistinct to slightly prominent on abaxial surface. *Inflorescence* racemose, axillary, erect; rachis 10–18-flowered, (2–)4–6 cm long, hairy; bracteoles 2–3 mm long, hairy. *Calyx lobes* 1–2 mm long, hairy. *Corolla buds* tubular, 10–14 mm long, white. *Fruits* recorded as ellipsoid, c. 10 by 7 mm (Kanehira & Hatusima 1942).

Distribution — This species is only known from Indonesia Papua Barat of Indonesia (type collection of *P. crassifolia*) and from the type collection of *P. stenosiphon*, from the West Sepik region of Papua New Guinea.

Conservation status — The conservation status of this species is unknown.

Notes — Although the taxonomic status of this species is inadequately known, it is here recognized as a distinct species. Clearly, further research into this species is required. Most importantly, additional collections, population studies and DNA analysis are needed to evaluate the morphological variation within this species and its relationship with other species of *Polyosma*.

Although taxonomically also inadequately known, *P. crassifolia* is here regarded as a synonym of *P. stenosiphon*, being a slightly larger leafed variant (as suggested by Kanehira & Hatusima 1942).

Attempts to contact FU to examine the type material of *P. crassifolia* were unsuccessful.

31. ***Polyosma subalpina*** Schulze-Menz ex P.Royen

Polyosma subalpina Schulze-Menz ex P.Royen (1983) 2520, f. 735. — Type: *L.J. Brass 29839* (holo L [L 0035118]; iso LAE [LAE 34128], US [US288786]), Papua New Guinea, Eastern Highlands, Mt Wilhelm, 12 June 1959.

Small tree, 2–5 m tall. *Branchlets* glabrous (once recorded as hairy, see notes below), pustules brownish grey, scattered. *Leaves* glabrous; petiole 0.5–2 cm long; lamina obovate, 1.5–5.5 by 1–3 cm, coriaceous, drying both surfaces light brown; base acute, margin serrate, apex mucronate; secondary veins 9–15 on each side and an angle greater than 45° from midrib, regularly looping near margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, not prominent but visible on abaxial surface. *Inflorescence* racemose, terminal, < 20-flowered; rachis 1.5–9.5 cm long, hairy; flowers loosely and evenly arranged towards distal end of rachis; pedicels (1–)2–6 mm long, narrow; bracteoles 1–3 mm long, hairy. *Calyx lobes* 1–5 mm long. *Corolla buds* tubular, 10–20 mm long, greenish brown or purple; corolla moderately hairy, remaining tubular at anthesis, except opening with 4 small lobes distally. *Fruits* ovoid, 6–12 by 3–7 mm, hairy, green turning purple.

Distribution — Papua New Guinea (West Sepik, Morobe, Western Highlands, Eastern Highlands, Southern Highlands, Central).

Habitat & Ecology — Occurring in alpine and subalpine shrubbery vegetation between elevations of 2 500–3 500 m.

Conservation status — This species is regarded as not endangered.

Additional specimens examined. Papua New Guinea, West Sepik, Star Mountains, 3 200 m, *J.R. Croft LAE 65946* (K, L, LAE); Morobe, Mt Sarawaget, *T.G. Hartley 11291* (LAE); Mount Amungwiwa, *J.S. Womersley NGF 17951* & *NGF 17987* (L, LAE); Western Highlands, Mt Hagen, *A. Vinas & J.-F. Veldkamp LAE 59821* (L, LAE); Mt Giluwe, *J.R. Croft et al. LAE 60917* & *LAE 60937* (L, LAE); Mt Oibo, *W.N. Takeuchi 10555* (K, L, LAE); Eastern Highlands, Mt Wilhelm, *M.M.J. van Balgooy 258*, *478*, *753* & *837* (K, L, LAE); *E. Borgmann 51* (B, L); *L.J. Brass 30066* (K, L, LAE); *B. Ernst 51* & *184* (K, LAE); *A. Kairo & H. Streimann NGF 35753* (K, L, LAE); *D.W. McLean & L.K. Wade ANU 7148* (K, L, LAE); *W.R. Philipson 3454 & M.N. Philipson* (L); *G. Robbins 717* (K, L, LAE); *P. van Royen NGF 16011* (K, L, LAE); *J. Smith ANU 15020* (K, LAE); *H. Stauffer 5629* (K, L, LAE); *J. Vandenberg NGF 35040* (K, L, LAE); *K. Wade ANU 7351* (K, LAE); *D. Walker ANU 5096* (K, L, LAE); *J.S. Womersley NGF 8864A* (K, LAE); Mt Otto, *L.J. Brass 31020 & J.D. Collins* (K, L, LAE); *J.-F. Veldkamp 8614 & S. Obedi* (K, L, LAE); Mt Keringomna, *P.F. Stevens & P.J. Grubb LAE 54613* (K, L, LAE); Southern Highlands, Mt Giluwe, *M. Coode NGF 32508* (K, LAE); Mt Kum, *J.S. Womersley NGF 6461* (K, LAE); Mt Ambua, *D. Frodin NGF 28245* (K, L, LAE); *W. Vink 17459* (L, LAE); *W. Vink 17485* (L, LAE); Central, Mt Strong, *P.F. Stevens & M. Coode LAE 51368* (K, L, LAE); Mt Albert Edward, *D.B. Foreman & P. Wardle NGF 45537* (K, L, LAE); *J.R. Croft & A. Vinas LAE 61435* (K, L, LAE); Mt Victoria, *J.R. Croft LAE 61714* (K, L, LAE); Mt Yule, *J.-F. Veldkamp 8518 & M. Kuduk* (K, L, LAE, NSW), *S.A. James 1280* (NSW); Northern, Oro Province, Kokoda, *J.R. Croft et al. LAE 65051* (K, L, LAE).

Note — One collection from Mount Yule, W of Telikom repeater station (*S.A. James 1280* [NSW934170]) has leaves that are hairy rather than glabrous, with the latter appearing to be the normal condition.

32. ***Polyosma torricellensis*** Schltr.

Polyosma torricellensis Schltr. (1915) 130. — Lectotype (designated here): *R. Schlechter 20319* (lecto LY [LY218962]), Papua New Guinea, West Sepik, 'Torricelli-Geb[irges]', 12 Sept. 1909.

Polyosma torricellensis Schltr. var. *pittosporoides* Schltr. (1915) 131, *syn. nov.* — Lectotype (designated here): *R. Schlechter 20166* (lecto P [P709677]; isolecto LY [LY218963, LY218964]), Papua New Guinea, West Sepik, 'Torricelli-Geb[irges]', 12 Sept. 1909 (see Typification below).

Typification — The type collections of *P. torricellensis* and *P. torricellensis* var. *pittosporoides* held at B are here regarded as destroyed (Merrill 1943, Hiepko 1978, 1987). Therefore, lectotypes are here selected for both taxa. Although type material of *P. torricellensis* (*R. Schlechter 20319*) was expected to be held at P, none were located. Therefore, material held at LY, based on photographs, was selected. Type material of *P. torricellensis* var. *pittosporoides* held at P was selected as the lectotype of this variety. The photograph of *R. Schlechter 20319* (*P. torricellensis*) and the herbarium material of *R. Schlechter 20166* (*P. torricellensis* var. *pittosporoides*) are in full agreement with the protologue of each respective taxon.

Canopy tree, 10–20 m tall. *Branchlets* minutely pubescent when young, soon glabrous, brown. *Leaves* glabrous; petiole unknown (see notes below); lamina elliptic to narrowly elliptic, 9–15 by 1.5–3.5 cm, drying brown on both surfaces; base cuneate, margin distally shortly dentate, apex acuminate; secondary veins c. 8 on each side and at an angle greater than 45° (initially almost at 90°) from midrib, looping some distance from margin onto the next secondary vein; tertiary veins weakly percurrent, glabrous, not prominent on abaxial surface. *Inflorescence* racemose, terminal, suberect, 5–6 cm long, 6–20-flowered (indumentum not known); bracteoles not known. *Calyx* tooth-like, small. *Corolla* buds tubular, c. 10 mm long, yellow. *Fruits* not seen.

Distribution — Only known by type collections (*Schlechter 20166* & *20319*), West Sepik, Papua New Guinea.

Habitat & Ecology — Recorded as occurring in lowland forest at an elevation of '800 m' (Schlechter 1915).

Conservation status — Since the taxonomic status of this species is not well known, it is not possible to evaluate its conservation status.

Notes — 1. Since the *Schlechter 20319* (Type) was not available for study, we have relied on the protologue and the type specimen of *P. torricellensis* var. *pittosporoides* (*Schlechter 20166*) to understand Schlechter's species concept. Schlechter described the petioles ('Stielchen') of *P. torricellensis* as 4 mm long (Schlechter 1915: 128 – in the identification key). Since the lamina of the leaves on *Schlechter 20166* (P) are broken, there are no petioles available for measurement. Our lack of understanding of the morphological variation within this species and, hence, its taxonomic status, results from the lack of known populations and herbarium specimens.

2. Although *P. torricellensis* var. *pittosporoides* is recorded as having slightly wider leaves than the typical variety (up to 4.5 cm wide vs 1.5–3 cm wide, respectively), it is here regarded as not sufficiently different to warrant taxonomic recognition, being a higher elevation broader-leaved variant of lower elevation plants of the nominant species.

33. ***Polyosma trimeniifolia*** Kaneh. & Hatus.

Polyosma trimeniifolia Kaneh. & Hatus. (1942) 307, f. 3 ('*trimeniaefolia*'). — Type: *R. Kanehira & S. Hatusima 14099* (holo FU, n.v.; probable iso A [A42998], sterile), Indonesia, Papua Barat, Vogelkop, Iray, Lake (= Anggi) Giji, '8 Apr. 1940' and 'April 5, 1940' (respectively).

Small tree to 5 m tall, densely branched. *Branchlets* glabrous. *Leaves* glabrous; petiole 0.5–1 cm long; lamina obovate-narrowly ovate or elliptic-narrowly ovate, usually c. 5 by 1.8–2.5 cm, base narrowly cuneate, margin distantly serrate, apex obtuse to apiculate on upper leaves; secondary veins 9–10 on each side and diverging 60–80° from midrib, closing by inframarginal looping veins; prominent (raised) on abaxial surface. *Inflorescence* racemose, terminal, erect, rachis 4–5 cm long, 10–15-flowered; peduncles and pedicels sparsely hairy; bracteoles not recorded. *Calyx lobes* c. 0.5 mm long. *Corolla* not recorded. *Fruits* not recorded, presumably densely hairy.

Distribution — Only known from the type material collected in Indonesia (Papua Barat: Vogelkop).

Habitat & Ecology — Recorded from "mossy forests ... at about 2,000 m altitude" (Kanehira & Hatusima 1942: 308). The probable isotype (as held at A) records the habitat as "On the open spinneys (*sic*) on the rigde [ridge] running to Lake Gita."

Conservation status — The taxonomic, and hence conservation status of this species is unknown.

Nomenclature — The specific epithet provided by Kanehira & Hatusima (1942) (namely 'trimeniaefolia') consisted of two elements that were not combined correctly (Turland et al. 2018: Art. 60.10), and so is corrected to 'trimeniifolia.'

Although the replicate sheet of the type collection, as held at A, has a different collection date to that of the holotype (at FU), it is here regarded as a probable labelling error.

Note — Although *P. trimeniifolia* is taxonomically inadequately known, it is morphologically similar to *P. dentata* and *P. rampae*. It is a small tree up to 5 m tall, similar to *P. dentata* (4–6.8 m tall, vs *P. rampae* which is a shrub, c. 2 m tall); lamina obovate-narrowly ovate or elliptic-narrowly ovate, like *P. rampae* with lamina narrowly obovate (vs lamina broadly elliptic in *P. dentata*); lamina usually c. 5 by 1.8–2.5 cm (vs (1.2–)1.5–2.7 by 0.5–1.1 cm in *P. rampae*; 5.5–11.5 by 3–5 cm in *P. dentata*); leaf apex obtuse to apiculate (on upper leaves) (vs acute or mucronate in *P. rampae*; acuminate in *P. dentata*); inflorescence terminal for both *P. trimeniifolia* and *P. rampae* (vs axillary for *P. dentata*); inflorescence rachis 4–5 cm long (vs 1.5–2 cm long in *P. rampae*; (2–)4–6 cm long in *P. dentata*); rachis for both *P. trimeniifolia* and *P. dentata* hairy (vs glabrous in *P. rampae*); calyx lobes c. 0.5 mm long (vs c. 1.2 mm long in *P. rampae*; 1–4 mm long in *P. dentata*).

COLLECTIONS OF UNCERTAIN STATUS

Schlechter (1915) informally suggested that there were possibly five additional new species in New Guinea based on the following collections (unavailable for our study): *Ledermann 8897*, *9151*, *11339*, *11655*, and *12010* (L) – based on photographs are here regarded as *P. forbesii,* plus *Schlechter 17041 + 17148* (K) – description inadequate, but these collections are here regarded as probably within the morphological variation of *P. helicioides*. Overall, the taxonomic status of these collections remains unresolved.

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