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Contents

A taxonomic revision of *Anisomeles* R.Br. (Lamiaceae)

A.R. Bean

Summary

Bean, A.R. (2015). A taxonomic revision of *Anisomeles* R.Br. (Lamiaceae). ***Austrobaileya* 9(3): 321–381.** The genus *Anisomeles* R.Br., naturally occurring from southern Asia to northern Australia, is taxonomically revised, and its phylogenetic placement is discussed. 26 species are recognised, of which 18 species are newly described (*A. antrorsa* A.R.Bean, *A. brevipilosa* A.R.Bean, *A. bundeyensis* A.R.Bean, *A. carpentarica* A.R.Bean, *A. dallachyi* A.R.Bean, *A. eriodes* A.R.Bean, *A. farinacea* A.R.Bean, *A. grandibractea* A.R.Bean, *A. languida* A.R.Bean, *A. lappa* A.R.Bean, *A. leucotricha* A.R.Bean, *A. macdonaldii* A.R.Bean, *A. ornans* A.R.Bean, *A. papuana* A.R.Bean, *A. principis* A.R.Bean, *A. viscidula* A.R.Bean, *A. vulpina* A.R.Bean, *A. xerophila* A.R.Bean), and one, *A. ajugacea* (F.M.Bailey & F.Muell.) A.R.Bean, is a new combination. Diagnostic morphological characters are discussed, and a comprehensive identification key to the species and four regional keys are provided. A summary of the chemical properties and cytology of two common Asian species is presented. Illustrations, images and detailed distribution maps are provided for all species, and their ecology and phytogeography are discussed. Lectotypes are chosen for *Anisomeles candicans* Benth., *A. cuneata* J.Jacq. ex Fenzl, *A. heyneana* Benth., *A. inodora* R.Br., *A. moschata* R.Br. and *A. salviifolia* R.Br.

Key Words: Lamiaceae, *Anisomeles*, *Anisomeles ajugacea*, *Anisomeles antrorsa*, *Anisomeles brevipilosa*, *Anisomeles bundeyensis*, *Anisomeles carpentarica*, *Anisomeles dallachyi*, *Anisomeles eriodes*, *Anisomeles farinacea*, *Anisomeles grandibractea*, *Anisomeles languida*, *Anisomeles lappa*, *Anisomeles leucotricha*, *Anisomeles macdonaldii*, *Anisomeles ornans*, *Anisomeles papuana*, *Anisomeles principis*, *Anisomeles viscidula*, *Anisomeles vulpina*, *Anisomeles xerophila*, *Epimeredi*, Asia flora, Australia flora, Malesia flora, nomenclature, new species, indumentum, morphology, identification keys, distribution maps, conservation status

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Introduction

Anisomeles R.Br. is a genus belonging to Lamiaceae subfamily Lamioideae (Harley *et al.* 2004). Its species are short-lived perennial shrubs distributed in northern Australia, Malesia and southern Asia. The genus was described by Robert Brown (Brown 1810), with three species, *A. salviifolia* R.Br., *A. moschata* R.Br. and *A. inodora* R.Br., based on specimens that he himself collected from northern Australia, and a specimen collected earlier by Banks and Solander. Soon afterwards, it was realised that two species named by Linnaeus from India (*Nepeta indica* L. and *Nepeta malabarica* L.) were referable to *Anisomeles* (Sims 1819).

Bentham (1848) provided a comprehensive taxonomic treatment of *Anisomeles*, where he enumerated eight species – the three species of Brown from Australia, and five from India and south-east Asia. Later, Bentham (1870) recognised only one species (*A. salviifolia*) for Australia, but at the same time documented four 'forms', with Brown's three species associated with two of these forms. He commented, "with the very large number [of specimens] from various localities now before me, I am unable to assign any positive limits to any of the following [forms]". Bentham's taxonomy was subsequently followed, and hence *A. salviifolia* was applied to all Australian populations of *Anisomeles* for many years. Domin (1928) maintained *A. salviifolia* as the sole Australian species, but erected several varieties based partly on the

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differing indumentum patterns. None of these varieties was accepted by Australian botanists of the time.

Keng (1969) used the name *Anisomeles salviifolia* for some Malesian material, but later he (Keng 1978) considered that even *A. salviifolia* could not be maintained, reducing it to a synonym of *A. malabarica* (L.) R.Br. On this basis, the name *A. malabarica* was subsequently adopted by all Australian herbaria for nearly all Australian *Anisomeles* specimens, and this has been mainly the *status quo* until this revision. Bhatti & Ingrouille (1996) used the name *A. salviifolia* for specimens originating in Australia and New Guinea, although this was partly based on the erroneous belief that all four anthers in *A. salviifolia* are dithecous. In fact, all *Anisomeles* species have the same pattern of two dithecous anthers and two monothecous anthers in each flower.

Harley *et al.* (2004) accepted three species for the genus, but did not name them. Govaerts *et al.* (2013) have accepted five *Anisomeles* species, with four occurring in southern Asia and Malesia (*A. candicans* Benth., *A. heyneana* Benth., *A. indica* (L.) Kuntze, *A. malabarica*), and two occurring in Australia (*A. malabarica, A. salviifolia*). In the current paper, the four Asian/Malesian species accepted by Govaerts *et al.* (2013) are maintained, and two are added; *A. principis* A.R.Bean (found in Timor) and *A. papuana* A.R.Bean (found in New Guinea, the Moluccas and Torres Strait, Queensland). For Australia, 23 species are recognised, being *A. salviifolia* and 22 other species, including 18 species newly named. The present study clearly demonstrates that *A. malabarica* does not occur in Australia. The taxonomic 'lumping' currently applied to Australian *Anisomeles* is a legacy of the statements of Bentham (1870), reinforced by Keng (1978), to the effect that *Anisomeles* is a diffuse genus, where intergradation is rife and there are no discrete taxa. The current author has found that this is not the case. While there is certainly evidence of intergradation between some species, many are eminently discrete and separable from each other by discontinuities in readily observable morphological characters. The differences are often subtle, but they are at least as robust as differences used to separate species in other genera of Lamiaceae, and in other related families.

Rothmaler (1944) maintained that the generic name *Epimeredi* Adans. is synonymous with *Anisomeles*, and that the former should replace the latter. As a consequence, *Epimeredi* was taken up for a time by some Australian herbaria. An unsuccessful proposal to conserve *Anisomeles* against *Epimeredi* was made by Subramanyam & Henry (1969). In the meantime, Backer and Backhuisen van den Brink (1965) had decided that Adanson's original material of *Epimeredi* probably did not include any specimen referable to *Anisomeles*, and so they maintained *Anisomeles* as the accepted generic name. Parkinson (1987) considered that none of Adanson's unconserved generic names were validly published. However, this conclusion was refuted by Wilbur (1989), and the current consensus amongst the botanical community is that Adanson's genera are validly published.

I have examined high quality images of the four Lamiaceae specimens in the Adanson Herbarium (P-Ad.) that have *Epimeredi* written on the label; these four specimens comprise three different species. Only one of these specimens (P00680377) can be linked to the protologue, as one of its labels includes the notation "h. Reg Par 1754". This is a reference to the *Hortus Regius Parisiensis*, cited in the protologue. The date 1754 precedes the publication date for *Epimeredi*, and the specimen is therefore original material. This specimen is readily identifiable as *Anisomeles malabarica*. The inevitable conclusion is that *Epimeredi* Adans. (1763) and *Anisomeles* R.Br. (1810) are congeneric. A proposal to conserve *Anisomeles* against *Epimeredi* is currently under consideration by the Nomenclature Committee for Vascular Plants (Bean 2015).

Materials and methods

This revision is based mainly on a morphological examination of 1300 herbarium

specimens, including 370 specimens held at BRI. Specimen loans were obtained from A, BKF, BM, CANB, DNA, E, G, GH, K, L, MEL, NT, NY, P, PERTH, PR and SING. Specimen images from E, K, MH, P and W have either been received or viewed on the internet. In most cases, the delicate corolla has been examined after reconstitution in boiling water, although spirit material and photographic images were available for several species, especially those from Queensland. Close-up photographic images of flowers have assisted in assessing corolla characters. The author has made limited field studies in Queensland and Northern Territory.

Data on 72 morphological characters for the 26 species were entered into a matrix using the Delta editor (Dallwitz *et al.* 1999 onwards). INTKEY software (Dallwitz *et al.* 1995 onwards) facilitated the development of an interactive key, and the retrieval of diagnostic characters for each taxon. Natural language descriptions were also derived from the data stored in Delta format. Where sequential measurements are given as e.g. 5–7.5 or 8.3–10 this means that the 5 or 10 is equivalent to 5.0 or 10.0 respectively.

The distribution maps were compiled using DIVA-GIS Version 7.5.0, using localities or geocodes given on the labels of specimens and specimen images from the herbaria listed above.

Commonly used abbreviations in the specimen citations are HS (Homestead), NP (National Park), Mt (Mount or Mountain; some place or locality names are correctly Mountain in terms of official names [Geoscience Australia 2015]) and SF (State Forest). Species treatments are arranged alphabetically.

Conservation assessments are made using the IUCN (2012) criteria but are only recommendations as they have not been enacted into Legislation.

Phylogenetic relationships

Cantino (1992) hypothesised a close relationship between *Anisomeles* and *Pogostemon* Desf. based on the shared presence of minute leaf epidermal glands with a unicellular cap, 'bearded' staminal filaments and a lustrous pericarp. This close relationship was further supported by the pollen study of Abu-Asab & Cantino (1994), with both genera shown to have very similar pollen grains, with regular polygonal lumina and large perforations.

Phylogenetic reconstruction using molecular data has determined that *Anisomeles* belongs in the subfamily Lamioideae, tribe *Pogostemoneae* Briq. (Scheen *et al.* 2010; Bendiksby *et al.* 2011), and is sister to *Pogostemon*. Other genera in the 'Pogostemoneae a' clade are *Colebrookea* Sm., *Craniotome* Reichb. and *Microtoena* Prain; these three genera are endemic to south-east Asia. *Pogostemon* has a similar distribution to *Anisomeles*, but with its species diversity centred in India.

Uses and chemical properties

Indian people have used both *Anisomeles malabarica* (Malabar catmint) and *A. indica* (Indian catmint) as medicinal herbs for centuries. *A. malabarica* has been traditionally used to treat amentia, anoxeria, fevers, halitosis, intestinal worms, swellings and rheumatism (Chopra *et al.* 1956; Warrier *et al.* 1994). In recent years, chemical investigations have sought to discover the reasons for the perceived efficacy of *Anisomeles* spp. Jeyachandran *et al.* (2007) claimed that an extract from *A. malabarica* has anti-cancer properties based on a study of liver disease in mice. Kavitha *et al.* (2012) reported that ethanolic extracts and diethyl ether extracts of *A. malabarica* had a statistically significant inhibitory effect against a range of bacteria, including *Staphylococcus aureus* and *Escherischia coli*. Similarly, Mohanraj *et al.* (2012) found an inhibitory effect against four pathogenic bacteria, using a methanol extract from *A. malabarica*.

Baranwal *et al.* (2012) stated that *A. indica* is a source of medically active compounds having various positive pharmacological effects. They made reference to more than a dozen scientific papers that document the bioactivity of *A. indica*, as an analgesic, a

natural herbicide, an antioxidant, an anti-microbial agent, an anti-inflammatory, an inhibitor of the HIV virus, and an inhibitor of tumour cell proliferation.

Chemical analysis of *Anisomeles indica* has revealed the presence of numerous terpenoid compounds, including Anisomelic Acid (Arisawa *et al.* 1986), and 15 essential oil constituents (Yadava & Barsainya 1998). *Anisomeles malabarica* has been shown to possess Anisomelic Acid, as well as Anisomelolide, Malabaric Acid, 2-Acetoxymalabaric Acid, Anisomelyl Acetate and Anisomelol (Preethy *et al.* 2013), and essential oils.

Surprisingly, the available literature on Australian Aboriginal ethnobotany makes no mention of *Anisomeles* spp. Nor have there been any chemical analyses performed on Australian *Anisomeles* spp.

Ecology and phytogeography

All *Anisomeles* species are short-lived perennial shrubs. In areas where the climate is mesic, there may be continual growth for some years. In places that are very dry for part of the year, the leaves abscise and the stems die back to ground level, then new stems sprout from a woody rootstock upon the arrival of the wet season. The same response occurs after a fire. *Anisomeles* spp. do not seem to be pioneer plants that colonise newly burnt ground, but they are certainly fire-adapted.

The present author was unable to germinate any *Anisomeles* seeds. I tried fresh field-collected seeds, as well as seeds extracted from recently collected herbarium specimens. A few seeds from each seedlot were dissected to confirm the presence of a plump embryo. Seedlots were variously untreated, hot-water treated, or scarified. All seeds were placed in petri dishes on blotting paper and kept moist for five weeks, with temperatures ranging from 17° to 27° C. No germination was recorded for any treatment or seedlot. Aluri (1992) similarly reported failure in germinating seeds of *A. indica*, using different unspecified treatments in a greenhouse, and he concluded that there are unknown barriers for breaking dormancy and subsequent germination. In contrast, Fryer (2006) recorded that *Anisomeles* seeds germinated at Kings Park, Perth, in 9–42 days with no special treatment.

Anisomeles species inhabit a wide range of soil types, from sands to clays, but in all cases freely draining. In some instances, the soil is skeletal in rocky gorges and escarpments. The parent material can be sandstone, granite, limestone or basalt. The distribution of some species extends into littoral areas including continental islands, but they usually occur away from the direct influence of salt-laden winds.

Aluri (1992) reported that *Anisomeles malabarica* and *A. indica* are pollinated mainly by sunbirds (*Nectarinia* sp.) and carpenter bees (*Xylocopa* spp.). The bees land on the lower corolla lip and insert their proboscis into the base of the flower, and in so doing the stigma brushes against the back of its head and its thorax. The sunbird lands on the inflorescence rachis and probes several flowers in the vicinity, contacting the stigma with its pollen-laden bill and forehead.

No hybrids between *Anisomeles* spp. have been reported in Australian literature, nor indicated on specimen labels, nor observed by the current author. However, Aluri (1992) has reported the existence of a single individual with morphological characteristics intermediate between *A. malabarica* and *A. indica*, naturally occurring at Turimella, India. Aluri & Subba Reddi (1989) bagged unmanipulated flowers of *A. malabarica* and *A. indica*, and found that the plants were self- and cross-compatible and self- and cross-pollinating. Fruit and seed production was higher in cross-pollinated plants, but plants can produce limited seed in the absence of pollinators.

Anisomeles is distributed in northern Australia, Malesia and southern Asia. It extends west as far as Pakistan, north to the Himalayan Range, and east to the Ryukyu Islands of Japan. It is widespread in India and south-east Asia, and occurs, somewhat sporadically, in the islands of Malesia. It

is found in Australia as far south as the Queensland-New South Wales border. Most members of the genus are confined to the tropics; only *A. moschata* extends south of the Tropic of Capricorn, while only *A. indica* extends north of the Tropic of Cancer. The species diversity is greatest in tropical Australia, especially the 'Top End' of Northern Territory and in northern Queensland. The genus has not been recorded on any of the islands of the southern Pacific Ocean, except as a naturalised alien.

Ctyology

Krishnappa & Basavaraj (1982) reported $2n = 34$ for *Anisomeles indica*, and several other studies have confirmed this. The same authors reported $2n = 34$ for *A. malabarica*; this is supported by most other studies, but Thoppil & Jose (1998) recorded $2n = 32$. No chromosome counts have been published for Australian *Anisomeles* spp.

Discussion of morphological characters

1. Habit

Anisomeles species may be prostrate (**Fig. 1B**) or may reach three metres in height, according to labels of specimens from both Asia and Australia, but more usually they are in the height range 0.6–1.5 m (**Fig. 1C**). Upright plants may become top-heavy and lean over with large stems resting on the ground, but continuing to grow; such plants have here been termed procumbent.

2. Stem indumentum

Anisomeles species display a range of hair types, and the structure, direction, density and size of hairs are all diagnostic. The three common hair types are 1. the hispid hair (**Fig. 2A**). This hair type is erect (± perpendicular to the stem), relatively straight, eglandular, multicellular and longer than 1 mm. The presence of this hair type is partly related to ontogeny. Most species have dense hispid hairs throughout the stem on young plants, but as the plant ages these are usually lost, at least from the upper portions of the plant. From the small proportion of herbarium specimens that include the entire plant, it is evident that in the majority of species, hispid hairs persist at the basal part of the stem on mature plants. They are apparently absent in *A. farinacea* and *A. ornans*. In this study, comparisons between taxa involving this hair type were made only from the upper stems, 1–3 nodes below the most proximal verticil. 2. the short, curved, eglandular hair (**Fig. 2B**). This type is found on the majority of taxa, and varies in density from very sparse to dense, though on any given taxon, the density is relatively uniform. On the stems of a few species, these hairs are antrorse; but in most species the hairs are retrorse. In some taxa with very densely tomentose stems, the hairs are somewhat variable in direction. 3. the stalked glandular hair (**Fig. 2C**). These are 0.1–0.3 mm long and erect. They are frequently present on the calyx and rachis, but on the stems they are usually (depending on the taxon) either abundant or absent.

The hair types present, in combination with their density, allows the partial identification of many species from sterile material.

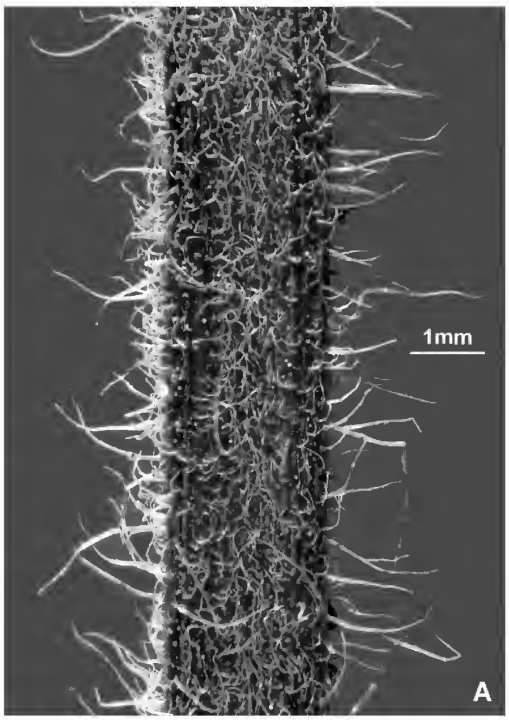
3. Leaf morphology and indumentum

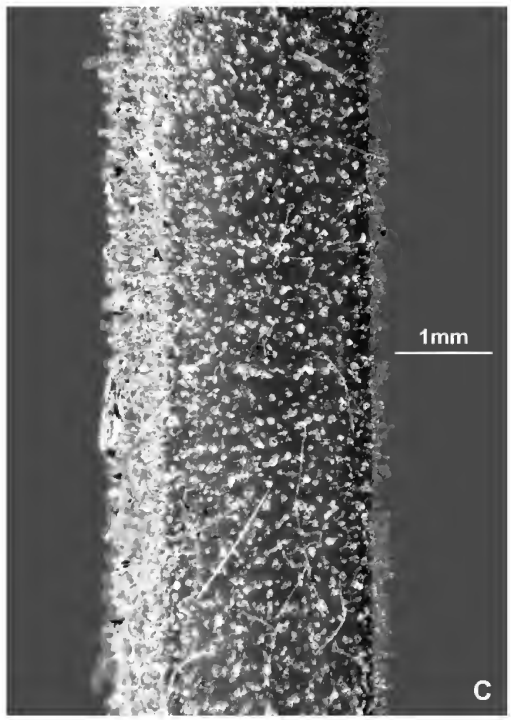
Leaf shape is more or less consistent for any given taxon, and the leaf base may be attenuate, narrowly cuneate, broadly cuneate or obtuse (**Figs. 3, 4, 5**). The leaves of all species are lobed, with the margins being crenate, dentate or serrate. The shape, number and the depth of the lobes are diagnostic for some species. At the peak of each lobe is a prominent gland. The length of the petiole relative to the lamina is also a useful measure that discriminates some taxa.

For the purposes of this paper, the 'cauline leaves' are defined as those that are three or more nodes below the most proximal verticil. The 'upper leaves', i.e. those adjacent to or 1 or 2 nodes below the most proximal verticil, have been measured only when cauline leaves are not available. The 'leaves' or 'bracts' subtending a verticil (except the most proximal) are referred to as 'floral bracts'.

The indumentum types present on the leaves are often the same as on the stems, but the direction is never retrorse – they are either antrorse, erect, or flexuose with no fixed direction. The difference in density between

Fig. 1. ***Anisomeles*** spp. photographed in the wild. A. flower of ***A. languida***. B. habit of ***A. languida***. C. flowering plant of ***A. carpentarica***. D. flower of ***A. macdonaldii***. A & B from *McDonald KRM14297* (BRI); C from *Cowie 10489* (DNA); D from *McDonald KRM14083 & Guymer* (BRI).





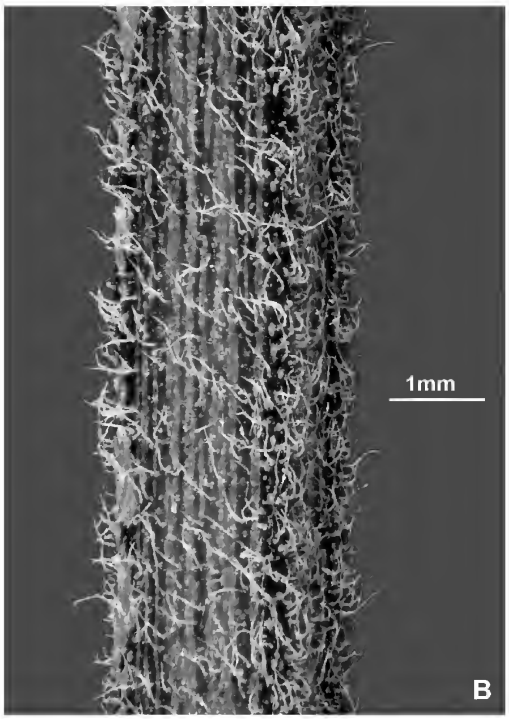


Fig. 2. Indumentum types of ***Anisomeles*** spp. A. stem of ***A. languida*** with hispid hairs and short curved eglandular hairs B. stem of ***A. moschata*** with short curved eglandular hairs only. C. stems of ***A. viscidula*** with stalked glandular hairs only. A from *McDonald KRM14297* (BRI), B from *Batianoff 940683 & Price* (BRI), C from *Egan 5038* (DNA).

the upper and lower surfaces is sometimes diagnostic, as is the length of the hairs on both surfaces.

4. Inflorescence structure

In all species, the inflorescence comprises few to many verticils arranged in a spike-like structure at the end of each branch. Each verticil comprises two cymose inflorescences on opposite sides of the stem. There is much variation in the branching pattern of the cymes, the number of flowers per cyme, and the distance between the individual flowers or fruits. The leaves or bracts subtending the verticil (except the lowest one) are referred to as 'floral bracts'. All other leaf-like structures within the cymes are termed 'bracteoles'. There are three cyme types (**Fig. 6**): 1. entirely monochasial, where every flower is borne on

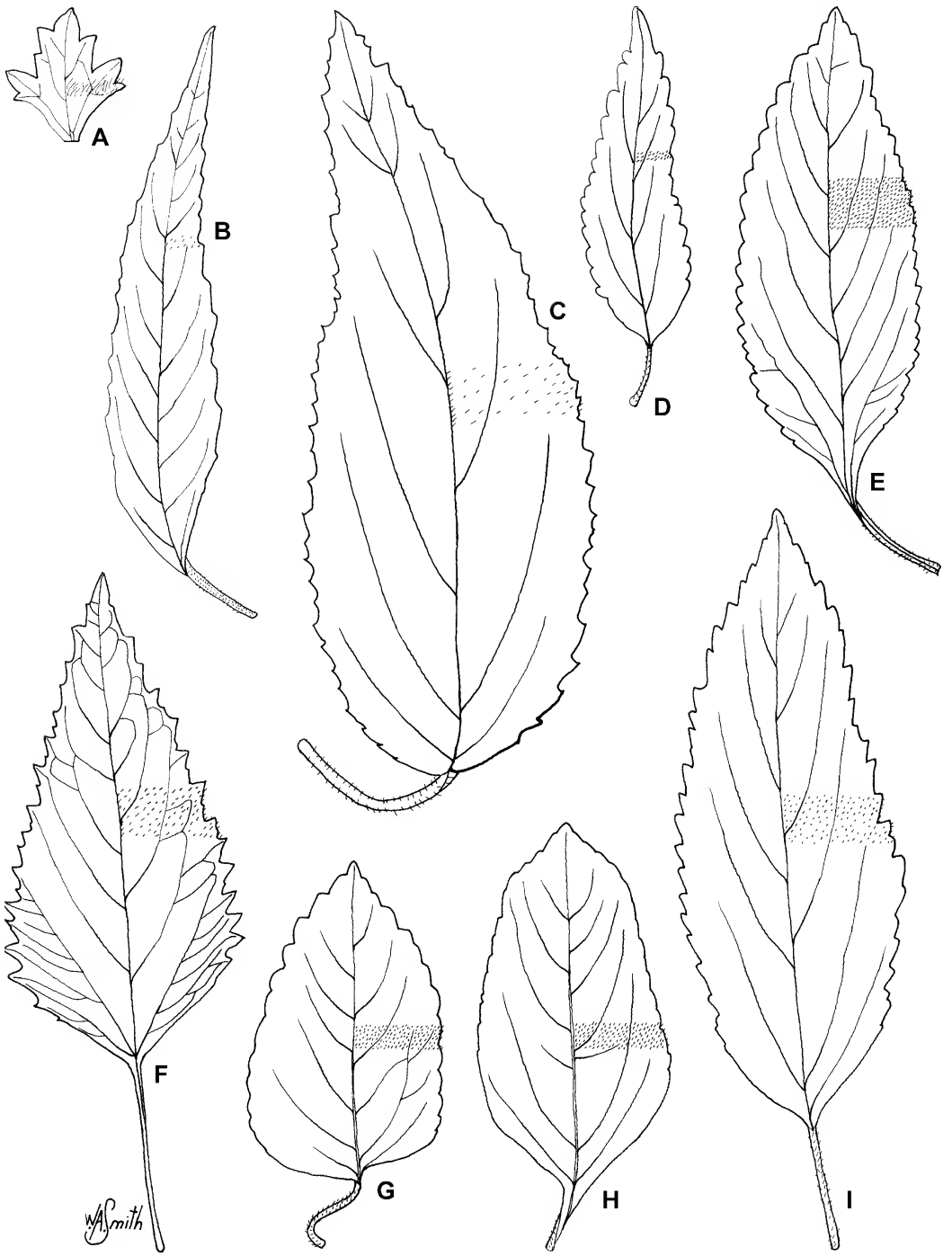


Fig. 3. Cauline leaves of ***Anisomeles*** spp. (all ×0.8): A. ***A. ajugacea*** (*Wannan 3568 & Verdec*, BRI). B. ***A. brevipilosa*** (*O'Neill 72*, DNA). C. ***A. bundeyensis*** (*Fensham 559*, DNA). D. ***A. candicans*** (*Mokim 586*, G). E. ***A. carpentarica*** (*Russell-Smith 2866 & Lucas*, DNA). F. ***A. dallachyi*** (*Dallachy s.n.*, MEL 1551746). G. ***A. grandibractea*** (*Dunlop 4438*, DNA). H. ***A. eriodes*** (*Forster PIF32572 & McDonald*, BRI). I. ***A. farinacea*** (*Edinger 496*, PERTH). Del. W. Smith.

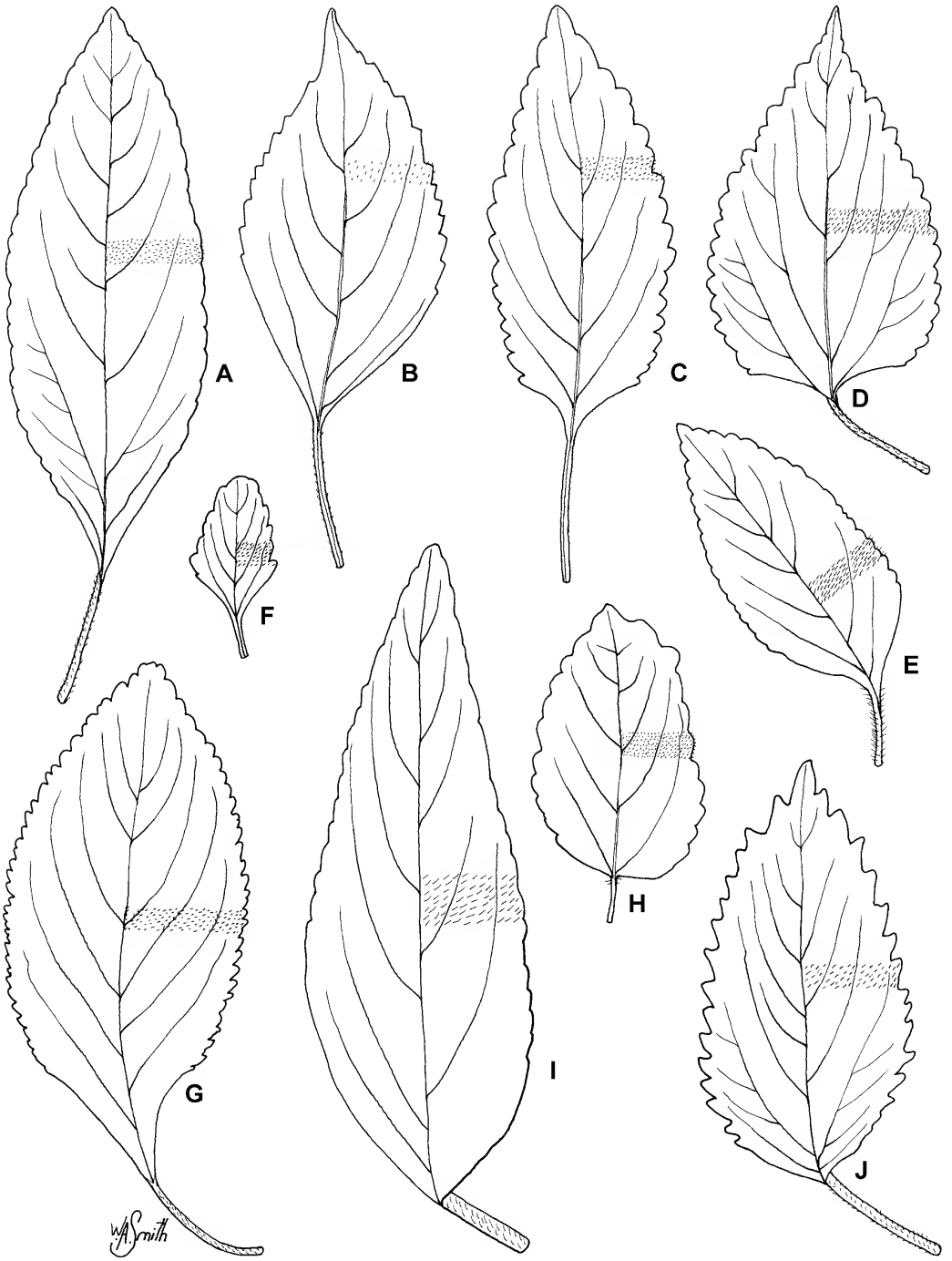


Fig. 4. Cauline leaves of ***Anisomeles*** spp. (all ×0.8): A. ***A. grandibractea*** (*Lazarides 9106*, DNA). B. ***A. heyneana*** (*Sinclair 4562*, E). C. ***A. inodora*** (*Forster PIF32933*, BRI). D. ***A. indica*** (*Lei 110*, NY). E. ***A. languida*** (*McDonald KRM14297*, BRI). F. ***A. lappa*** (*Forster PIF12777 & Bean*, BRI). G. ***A. leucotricha*** (*Michell & Risler 1520*, DNA). H. ***A. macdonaldii*** (*McDonald KRM3899 & Little*, BRI). I. ***A. malabarica*** (*Wight 2173*, NY). J. ***A. moschata*** (*Bean 26462*, BRI). Del. W. Smith.

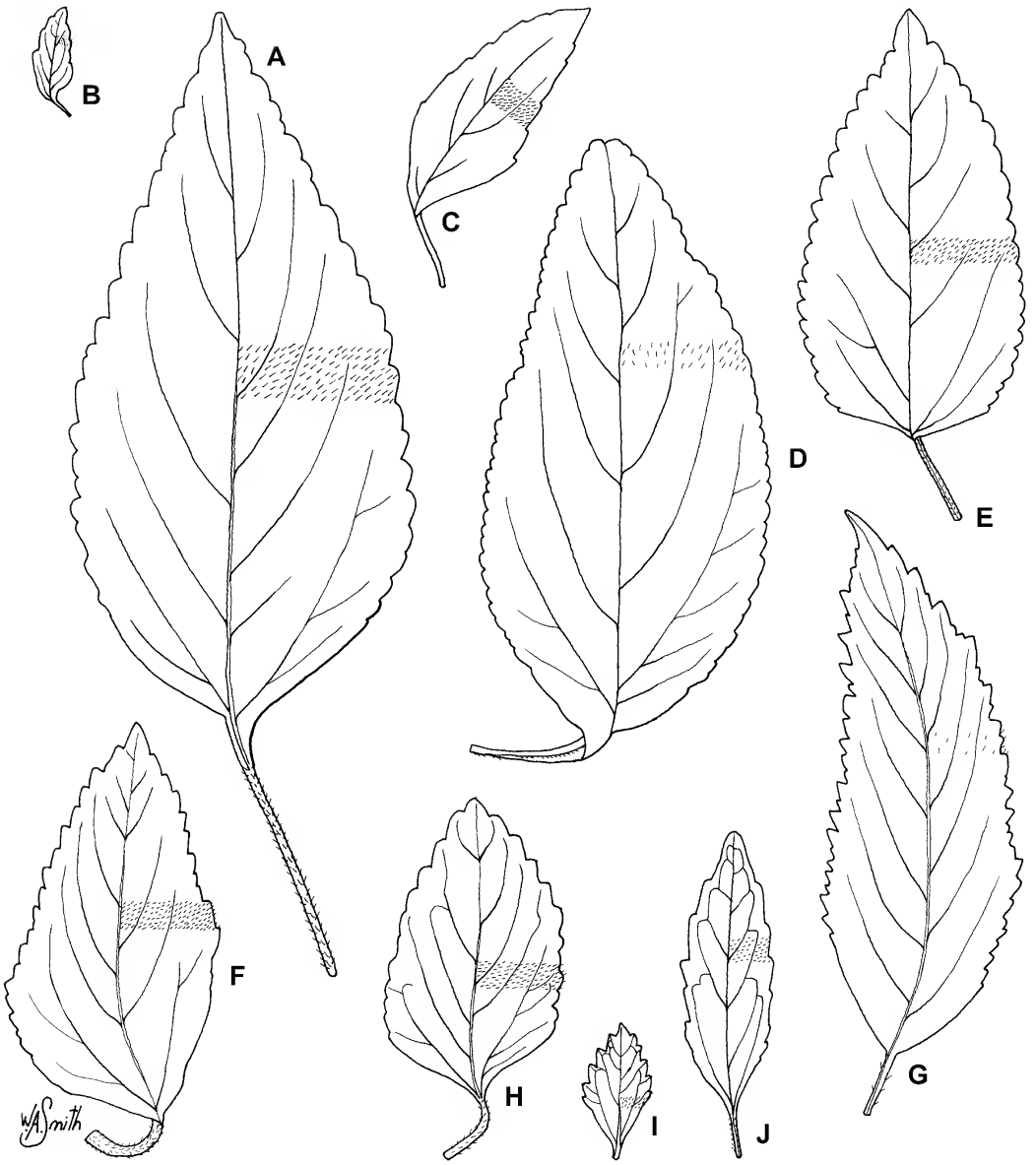


Fig. 5. Cauline leaves of ***Anisomeles*** spp. (all ×0.8): A. ***A. moschata*** (*McDonald KRM938*, BRI). B. ***A. moschata*** (*Fensham 5361 & Butler*, BRI). C. ***A. ornans*** (*Hubbard & Winders 7710*, BRI). D. ***A. papuana*** (*Pullen 7199*, BRI). E. ***A. principis*** (*Kenneally 8922*, PERTH). F. ***A. salviifolia*** (*Randell 821*, DNA). G. ***A. viscidula*** (*Eichler 22501*, DNA). **H.** ***A. vulpina*** (*Jensen 3350 & Kemp*, BRI). I. ***A. antrorsa*** (*Bean 13601*, BRI). J. ***A. xerophila*** (*Albrecht 7633 & Latz*, NT). Del. W. Smith.

a single zig-zag rachis (i.e. two monochasia per verticil); 2. once-dichasial, where the first branch of the cyme is dichasial, and thereafter monochasial (i.e. four monochasia per verticil); and 3. twice-dichasial, where the first two basal branches of the cyme are dichasial, and thereafter monochasial (i.e. eight monochasia per verticil). The cyme type has a direct influence on the overall shape of the verticil. The 'entirely monochasial'

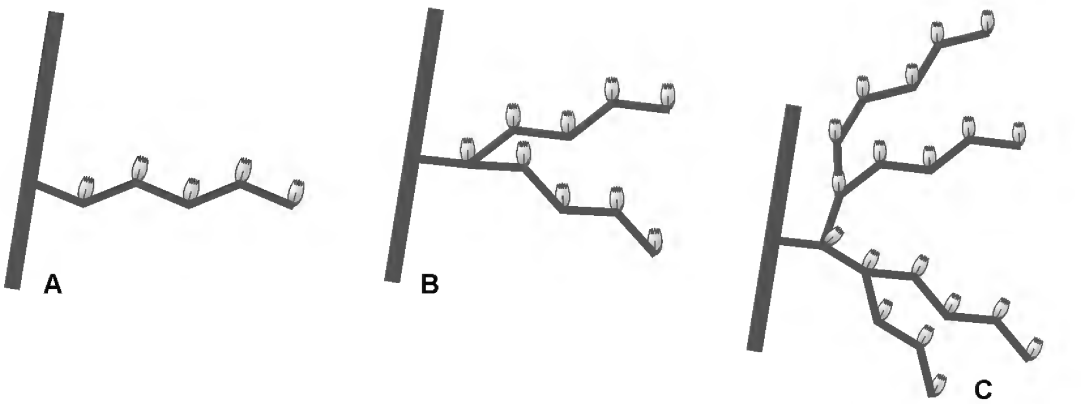


Fig. 6. Diagrams of infloresence types in ***Anisomeles***. A. entirely monochasial. B. once dichasial at base. C. twice dichasial at base.

cyme results in a lax slender inflorescence where each flower or fruit is clearly visible. The 'twice-dichasial' cyme results in a compact sub-globose inflorescence where the branching pattern is difficult to see and many of the flowers or fruits are obscured. The 'once-dichasial' cyme is of an intermediate form. Inflorescence characters have been assessed using fruiting material, where the internodes are fully expanded, and it is easier to detect the patterns involved. The number of flowers per monochasium is typically quite variable within species, but is of some diagnostic value. The distance between the individual flowers or fruits (it is the fruiting distance that is measured in this paper) is diagnostic for some species. Adjacent fruits can be as much as 12 mm apart, giving rise to a very lax cyme, or as little as 0.7 mm apart, resulting in a congested cyme.

5. Corolla colour, shape and indumentum (Figs. 1A, 1D, 7A–C).

The corolla is predominantly pink or mauve to purple for most species with areas of white usually present. In *Anisomeles heyneana*, the corolla is often pure white. The descriptions of flower colour given on herbarium labels are so varied or generalised that it makes any analysis of the character quite pointless. The corolla shape is remarkably consistent throughout the genus; it consists of a small entire upper lip, adjacent to or in contact with the stamens; and a large lower lip, generally somewhat recurved. The two terminal lobes are obtuse and mostly fused, with an emarginate apex indicating their fusion; the lateral lobes are similarly obtuse and scarcely extend past the base of the lateral lobes. Between the lateral lobes is an area here dubbed the 'platform', a roughly rectangular area bounded by the lateral lobes, terminal lobes, and the throat. The platform is sometimes flat, but often somewhat raised or puckered, and in some species, it bears relatively long stiff hairs. The number of these hairs is of diagnostic value. Within the corolla tube is the annulus, which is surmounted by many tiny stiff erect hairs.

6. Fruiting calyx morphology

The calyx in *Anisomeles* grows in size from the budding stage to anthesis and through to fruiting, and measurements of the calyx near anthesis will vary greatly depending on the exact stage of floral development. All of the features of the flowering calyx are also present on the fruiting calyx, and are more easily seen and assessed on the latter, and measurements are more reliable as the calyx has by then stopped growing.

The fruiting calyx offers a number of very diagnostic morphological characters, which have been assessed and measured from dried pressed material at the fruiting stage, where the nutlets (**Fig. 7H**) are mature or nearly so.

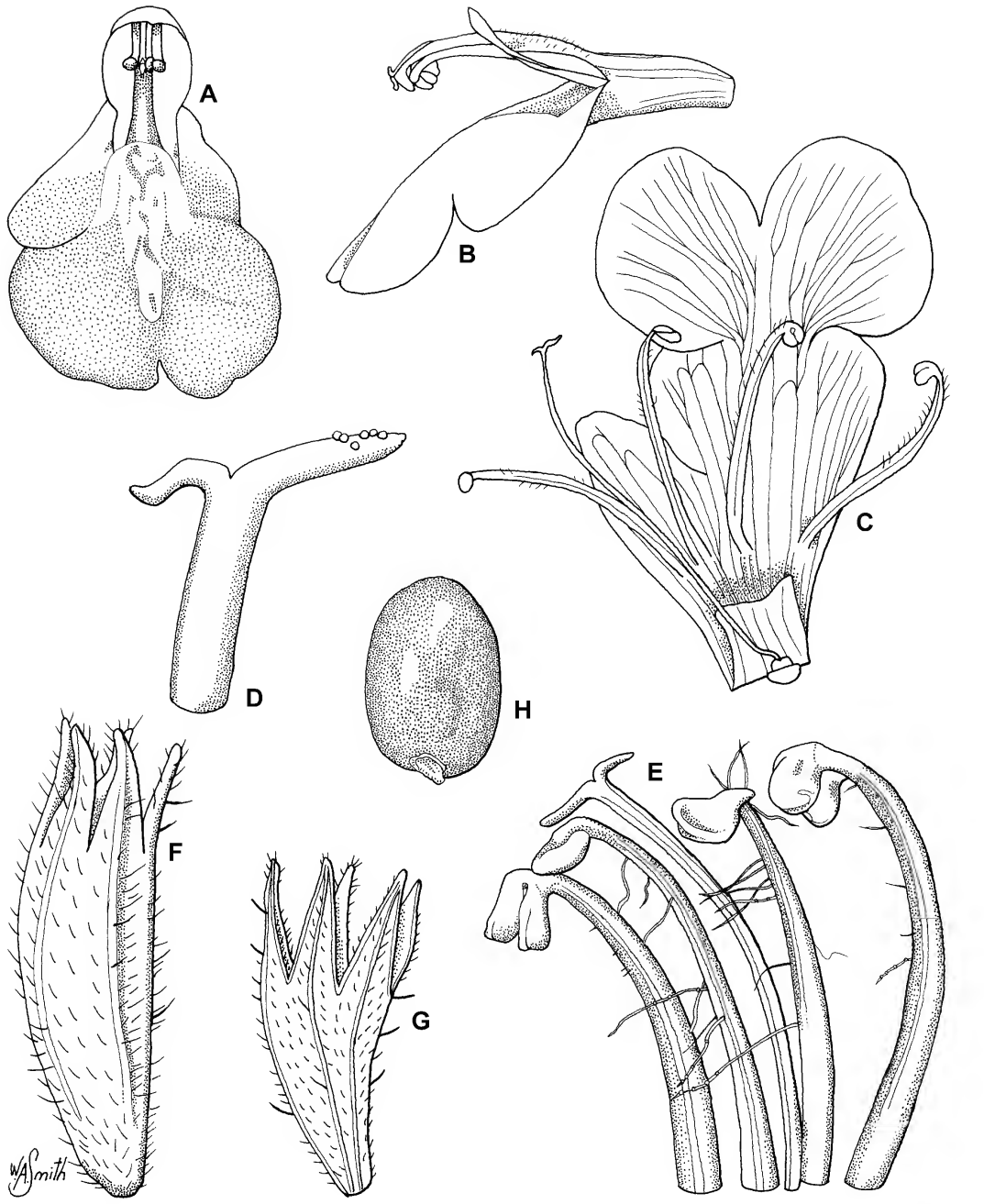


Fig. 7. ***Anisomeles*** floral morphology. A. face-on view of corolla, showing lateral and terminal lobes of the lower lip, the corolla platform (dappled light and dark area) and the upper lip enclosing the stamens ×4. B. lateral view of the corolla and stamens ×4. C. opened out flower showing the corolla lobes, the annulus (near base of stamens) and the hairy filaments ×8. D. stigma, showing unequal lobes ×40. E. upper part of stamens and style showing hairy filaments, monothecous anthers and dithecous anthers ×12. F. cylindrical calyx ×8. G. obconical calyx ×4. H. nutlet ×16. A–D from ***A. moschata*** (*Forster PIF28444*, BRI); E from ***A. lappa*** (*Forster PIF12777*, BRI); F from ***A. moschata*** (*Elsol 9*, BRI); G from ***A. indica*** (*Newman et al. LAO486*, E); H from ***A. moschata*** (*Stanley 592*, BRI). Del. W. Smith.

The overall shape of the fruiting calyx is very often cylindrical (**Fig. 7F**), or at times narrowly campanulate, but in the Asian species, *A. indica*, it is obconical (**Fig. 7G**). The shape may be quantified by using the ratio of the length versus the width (measured as the maximum distance across calyx lobe apices on dried material). The external surface of the calyx is more or less smooth, apart from the 5 or 10 rather faint longitudinal ribs, and the external indumentum tends to reflect that of the stems and leaves, and is often diagnostic. The inner surface of the calyx is often glabrous, but there is frequently a zone of long dense hairs distal from the nutlets.

The calyx lobes are very often acute i.e. tapering evenly to the apex, but in a few species, most notably *A. malabarica*, they are acuminate to attenuate, and the lobes have a long and slender apex. The inner surface of the calyx lobes is notable for the network of anastomosing raised veins, including an intramarginal vein that runs close to the margin but not confluent with it. Between the margin and this intramarginal vein are found the calyx 'fringe' hairs; densely clustered erect eglandular multicellular hairs. The fringe hairs are highly diagnostic, because they are, with very few exceptions, consistent in length and pattern for any given species (**Figs. 8, 9, 10, 11**). In some species the length of the fringe hairs is ± constant from calyx lobe sinus to calyx lobe apex, while in other species the hair length decreases from sinus to apex.

Taxonomy

Anisomeles R.Br., *Prodr.* 503 (1810), *nom. cons. prop.*; Bean (2015). **Lectotype:** *A. moschata* R.Br., chosen by Subramanyam & Henry (1969).

Epimeredi Adans., *Fam. Pl. (Adanson)* 192 (1763), *nom. cons. rej.* **Lectotype:** *E. malabaricus* (R.Br.) Rothm., chosen by Subramanyam & Henry (1969).

Perennial herbs or shrubs, with erect, procumbent or prostrate stems arising from a woody rootstock, usually aromatic. Sessile glands present on nearly all plant parts. Stems square in cross-section; indumentum of unbranched multicellular, eglandular hairs (short or long, curved or straight) and/or short erect unicellular gland-tipped hairs. Leaves petiolate, opposite, decussate, margins crenate to dentate; the cauline leaves transforming abruptly or gradually to the floral bracts of the verticil. Inflorescences terminal, spicate, indeterminate, of several verticils at the apex of each branch; lowest verticil borne in axil of cauline leaves, all other verticils subtended by floral bracts. Verticils few to many flowered, congested or lax; branching of cymes initially often dichasial, then monochasial, with a single flower at each node, bracteoles persistent. Flowers bisexual. Calyx gamosepalous, symmetric, lengthening after anthesis, then somewhat swollen at the proximal end; tube obconical to narrowly campanulate or cylindrical, outer surface with 5 or 10 longitudinal ribs, inner surface frequently with dense multicellular hairs on medial section; lobes 5, acute, acuminate or attenuate, equal; outer surface more or less smooth, inner surface with several raised anastomosing veins, including an intramarginal vein, and with a fringe of straight multicellular hairs between the intramarginal vein and the inner margin. Corolla zygomorphic, 2-lipped, upper lip entire, hooded, white; lower lip 3-lobed, median lobe large, reflexed, broadening distally and usually emarginate or bipartite. Stamens 4, all fertile; staminal filaments raised, adjacent to upper corolla lip, coherent near apex, with many spreading multicellular hairs distally or medially. Anterior anthers transversely 2-celled, cells parallel; posterior anthers transversely 1-celled. Style gynobasic, glabrous; stigma branches 2, unequal. Nutlets brown to black, smooth, glossy, with a small basal scar.

26 species in southern Asia, Malesia and Australia, 23 species occurring in Australia (20 endemic).

Etymology

From the Greek *anisos* meaning unequal, and *melos* meaning 'a limb, or a part', presumably in reference to the corolla, in which the upper lip is far smaller than the lower lip.

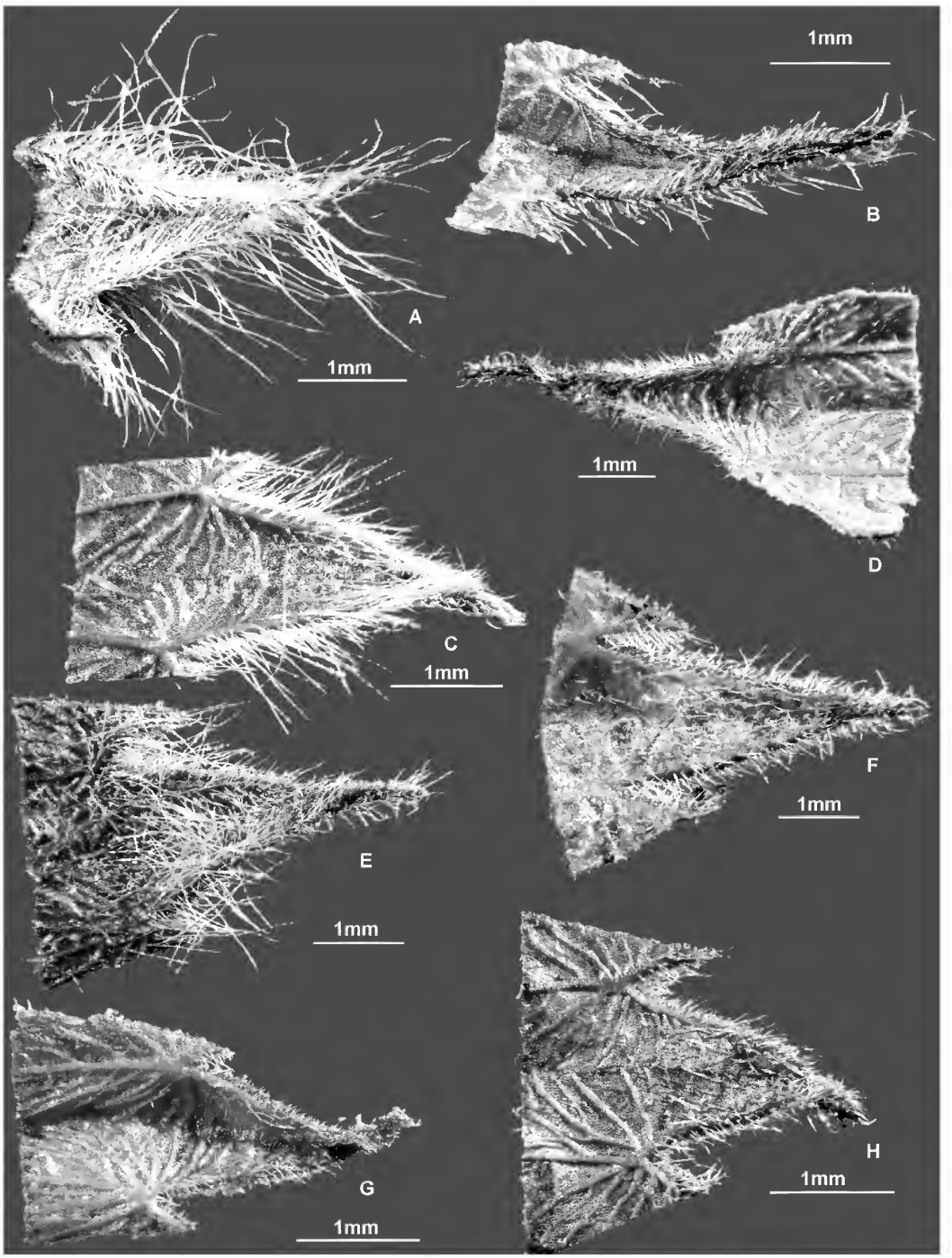


Fig. 8. Inner surface of fruiting calyx lobes, showing fringe hairs. A. ***A. ajugacea*** (*Wannan 3568 & Verdec*, BRI). B. ***A. antrorsa*** (*Bean 13601*, BRI). C. ***A. brevipilosa*** (*O'Neill 72*, DNA). D. ***A. bundeyensis*** (*Fensham 559*, DNA). E. ***A. candicans*** (*Mokim 586*, G). F. ***A. carpentarica*** (*Russell-Smith 2866 & Lucas*, DNA). G. ***A. dallachyi*** (*Dallachy s.n.*, MEL 684770). H. ***A. grandibractea*** (*Dunlop 4438*, DNA).

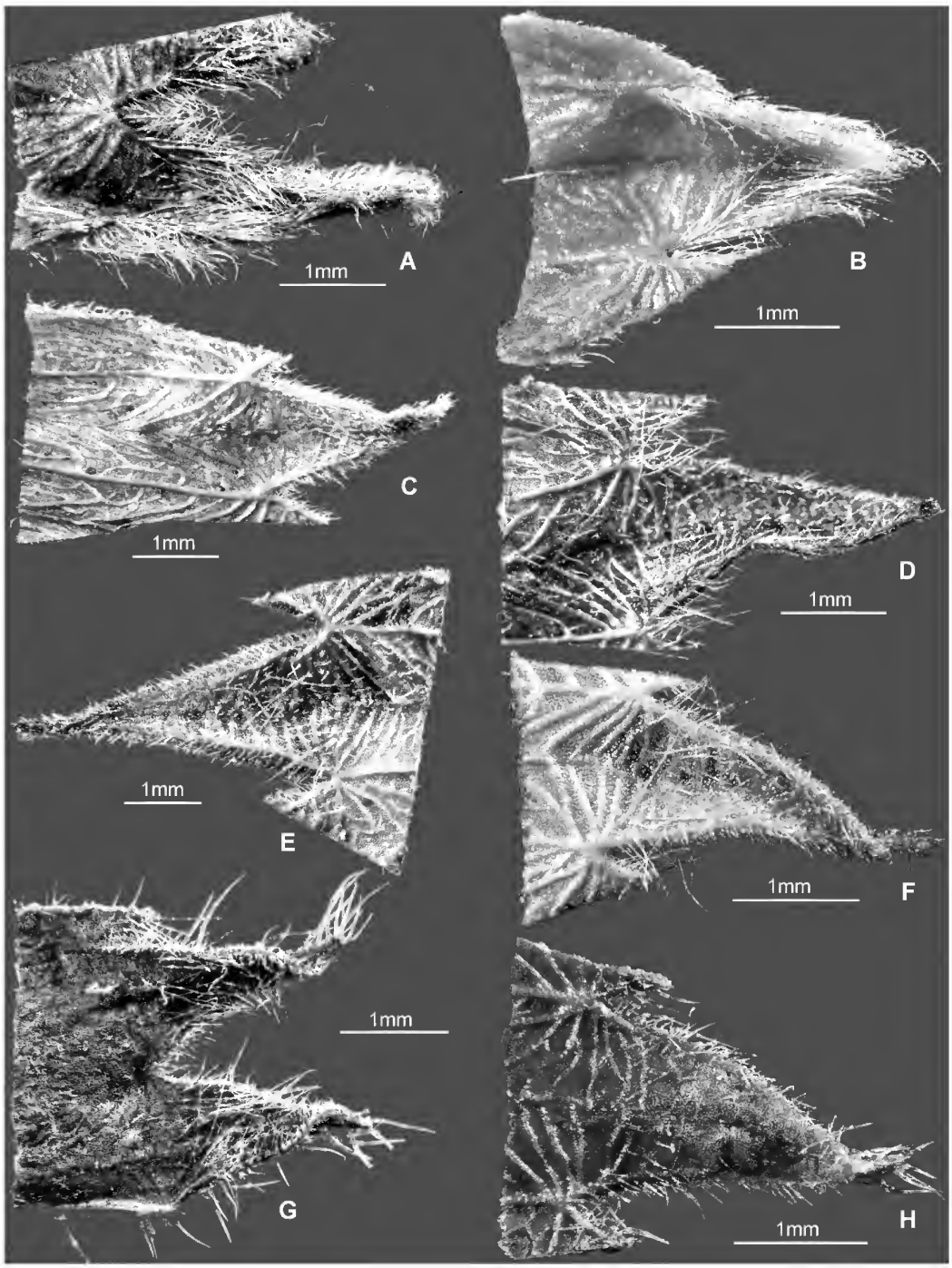


Fig. 9. Inner surface of fruiting calyx lobes, showing fringe hairs. A. ***A. eriodes*** (*Forster PIF32572 & McDonald*, BRI). B. ***A. farinacea*** (*Edinger 496*, PERTH). C. ***A. grandibractea*** (*Lazarides 9106*, DNA). D. ***A. heyneana*** (*Sinclair 4562*, E). E. ***A. indica*** (*Singh 287*, NY). F. ***A. inodora*** (*Forster PIF32933*, BRI). G. ***A. languida*** (*McDonald KRM14297*, BRI). H. ***A. lappa*** (*Forster PIF30742 & McDonald*, BRI).

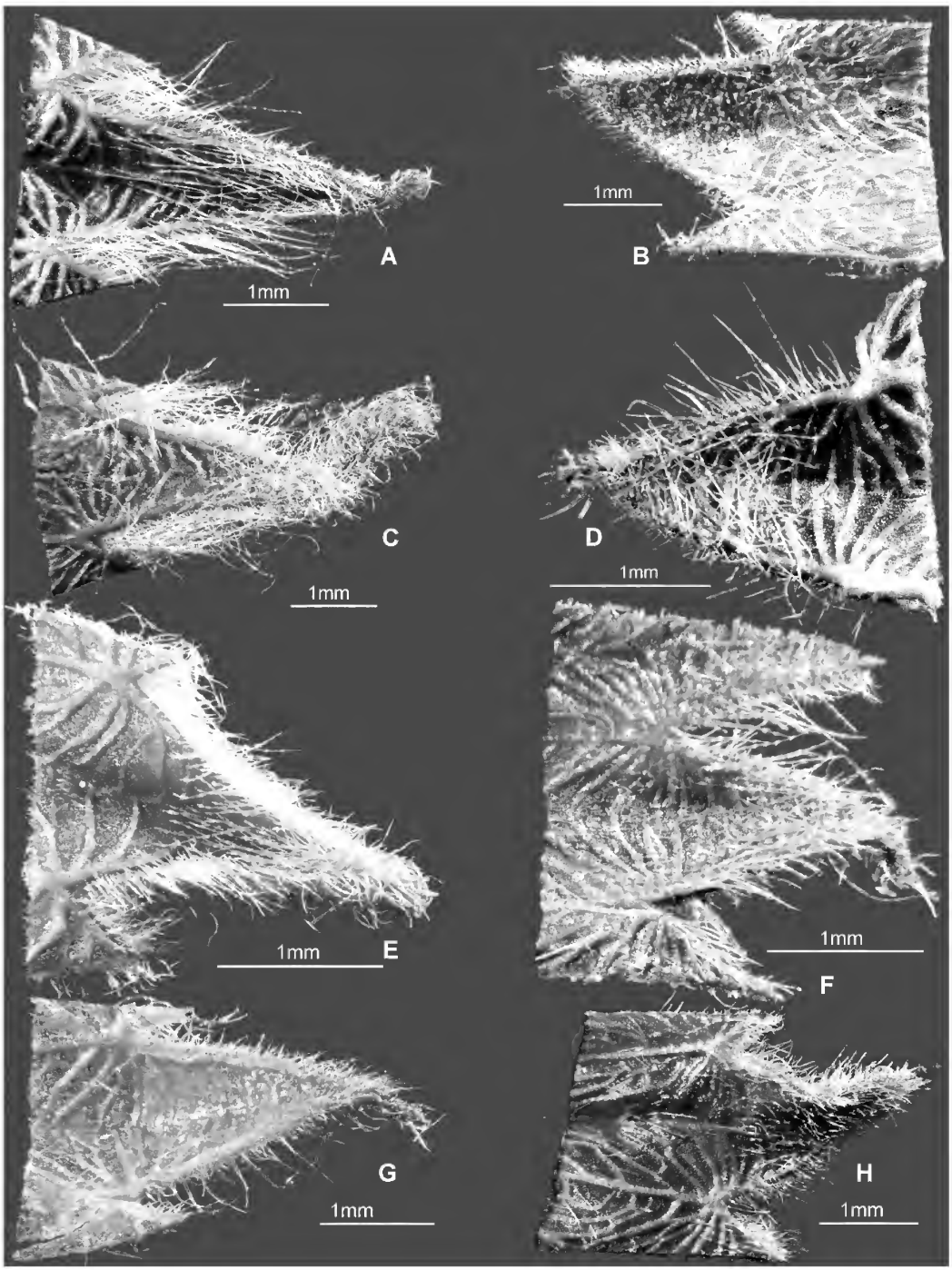


Fig. 10. Inner surface of fruiting calyx lobes, showing fringe hairs. A. ***A. leucotricha*** (*Michell & Risler 1520*, DNA). B. ***A. macdonaldii*** (*McDonald KRM3899 & Little*, BRI). C. ***A. malabarica*** (*Wight 2173*, NY). D. ***A. moschata*** (*Bean 26462*, BRI). E. ***A. ornans*** (*Bean 18853*, BRI). F. ***A. papuana*** (*Pullen 7199*, BRI). G. ***A. principis*** (*Kenneally 8922*, PERTH). H. ***A. salviifolia*** (*Randell 821*, DNA).

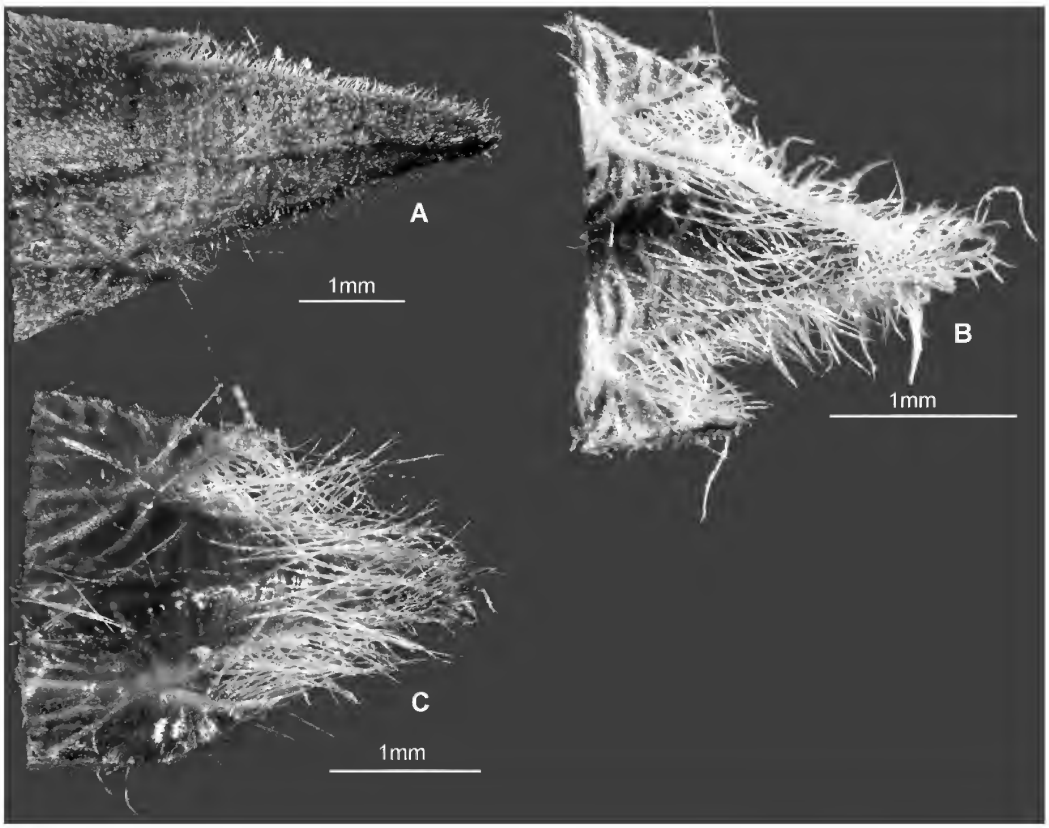


Fig. 11. Inner surface of fruiting calyx lobes, showing fringe hairs. A. ***A. viscidula*** (*Eichler 22501*, DNA). B. ***A. vulpina*** (*Jensen 3350 & Kemp*, BRI). C. ***A. xerophila*** (*Albrecht 7633 & Latz*, NT).

Key to species of *Anisomeles*

1 Upper stems white, indumentum very dense, hairs completely obscuring stem at ×40 magnification **2**
1. Upper stems not white, indumentum very sparse to dense, stem surface visible at ×40 magnification **7**

2 Leaf and stem indumentum appressed, retrorse, hairs 0.05–0.2 mm long **3**
2. Leaf and stem indumentum woolly, hairs without fixed direction, 0.4–1.2 mm long **4**

3 External calyx hairs moderately dense to dense, spreading, 0.3–0.8 mm long; style 12–13 mm long; leaves often narrow (3–6.6 times longer than wide). . . . . **3. A. brevipilosa**
3. External calyx hairs very dense, appressed, 0.15–0.25 mm long; style 9.5–10.5 mm long; leaves often broader (2.8–3.5 times longer than wide). . . . . **9. A. farinacea**

4 Fruiting calyx lobes attenuate, 3.1–5.3 mm long; external calyx hairs 1.2–1.5 mm long . . . . . **18. A. malabarica**
4. Fruiting calyx lobes acute, 1.8–3.3 mm long; external calyx hairs 0.5–1 mm long **5**

5 Cauline leaves with 7–14 pairs of marginal lobes; low shrub 30 to 60 cm; verticils widely separated . . . . . **20. A. ornans**
5. Cauline leaves with 12–20 pairs of marginal lobes; shrub (40–) 60–200 cm; verticils not widely separated, sometimes overlapping **6**

6 Bracteoles 0.3–0.8 mm wide; corolla platform glabrous; calyx fringe hairs 0.2–0.35 mm long at apical end . . . . . **8. A. eriodes**
6. Bracteoles 0.9–1.2 mm wide; corolla platform with 20–100 hairs; calyx fringe hairs 0.5–1 mm long at apical end . . . . . **23. A. salviifolia**

7 Erect glandular hairs (0.1–0.3 mm long) frequent to abundant on upper stems and inflorescence rachis **8**
7. Erect glandular hairs absent from upper stems and rachises, although sessile glands usually present **11**

8 Patent hispid hairs absent from upper stems; cymes twice dichasial at base; cauline leaves 120–150 mm long; bracteoles 6.4–11 mm long . . . **4. A. bundeyensis**

8. Patent hispid hairs present (often frequent) on upper stems; cymes monochasial or once dichasial at base; cauline leaves 51–110 mm long; bracteoles 2.5–7.5 mm long **9**

9 Cauline leaves 1.2–1.9 times longer than wide, base obtuse; corolla upper lip 5.8–6.7 mm long . . . . . **17. A. macdonaldii**
9. Cauline leaves 2–3.8 times longer than wide, base cuneate; corolla upper lip 3.5–5.7 mm long **10**

10 Glandular hairs not extending to lower stems; hairs sparse on upper leaf surface; corolla platform glabrous; nutlets 1.7–1.9 mm long . . . . . **7. A. dallachyi**
10. Glandular hairs extending to lower stems; hairs moderately dense to dense on upper leaf surface; corolla platform with 1–20 hairs; nutlets 1.9–2.2 mm long . . . . . **24. A. viscidula**

11 All calyx fringe hairs < 0.4 mm long **12**
11. Calyx fringe hairs > 0.4 mm long, at least at the sinus end **19**

12 Floral bracts consistently longer than verticils **13**
12. Floral bracts not consistently longer than verticils **14**

13 Hispid hairs frequent on upper stems; 4–10 pairs of marginal lobes on cauline leaves; plants prostrate or procumbent; Qld . . . . . **15. A. lappa**
13. Hispid hairs absent from upper stems; 12–27 pairs of marginal lobes on cauline leaves; plants erect; N.T. . . . . **10. A. grandibractea**

14 Fruiting calyces obconical, 5–7.5 mm wide at lobe apices; corolla platform with > 100 hairs . . . . . **12. A. indica**
14. Fruiting calyces cylindrical to narrowly campanulate, 2–5 mm wide at lobe apices; corolla platform glabrous or with many fewer than 100 hairs **15**

15 Petioles 0–3 mm long; plants prostrate **16**
15. Petioles 3.5–31 mm long; plants erect **17**

16 Marginal lobes of cauline leaves 2.5–5.1 mm deep; longest leaf hairs 1–2.5 mm long; corolla annulus hairs 0.4–0.5 mm long; corolla platform glabrous . . . . . **1. A. ajugacea**
16. Marginal lobes of cauline leaves 0.8–1.7 mm deep; longest leaf hairs 0.6–0.9 mm long; corolla annulus hairs 0.15–0.2 mm long; corolla platform with 1–20 hairs . . . . . **2. A. antrorsa**

17 Hairs on upper leaf surface 0.9–1.3 mm long; leaves 27–50 mm long; peduncles on lowermost verticil 0–1 mm long . . . . . **25. A. vulpina**
17. Hairs on upper leaf surface 0.2–0.8 mm long; leaves 44–152 mm long; peduncles on lowermost verticil (0–)1–15 mm long **18**

18 Corolla platform with 20–100 hairs; style 10–12 mm long; fruiting calyces 7–8.9 mm long. . . . . **6. A. carpentarica**
18. Corolla platform with 1–20 hairs; style 12–14 mm long; fruiting calyces 8.2–11.0 mm long . . . . . **22. A. principis**

19 Longest hairs on the upper leaf surface 0.1–0.25 mm long. **20**
19. Longest hairs on the upper leaf surface 0.25–2 mm long **22**

20 Leaves and stems green, indumentum sparse to moderately dense; corolla platform glabrous . . . . . **13. A. inodora**
20. Leaves and stems grey or grey-green, indumentum moderately dense to dense; corolla platform with at least some hairs **21**

21 Marginal lobes of cauline leaves 4–16 pairs, lobes serrate; calyx fringe hairs 0.15–0.3 mm long at apical end. . . . . **3. A. brevipilosa**
21. Marginal lobes of cauline leaves 15–37 pairs, lobes crenate; calyx fringe hairs 0.7–1.4 mm long at apical end. . . . . **16. A. leucotricha**

22 Longest hairs on leaves 0.9–2 mm long. **23**
22. Longest hairs on leaves 0.25–0.7 mm long **24**

23 Stems with patent hispid hairs; plants procumbent; external hairs on fruiting calyx 1.1–2.4 mm long . . . . . **14. A. languida**
23. Stems without patent hispid hairs; plants erect; external hairs on fruiting calyx 0.6–1 mm long . . . . . **25. A. vulpina**

24 Lower leaf surface glabrous or with sparse hairs (> 0.2 mm apart); outside of fruiting calyx with a mix of glandular and eglandular hairs . . . . . **11. A. heyneana**
24. Lower leaf surface with moderately dense to dense hairs (< 0.2 mm apart); outside of fruiting calyx with eglandular hairs only **25**

25 Nutlets 1.5–1.7 mm long; cauline leaves with 19–33 pairs of marginal lobes . . . . . **21. A. papuana**
25. Nutlets 1.8–2.2 mm long; cauline leaves with 3–18 pairs of marginal lobes. **26**

26 Fruiting calyces 8.9–10.2 mm long; fruiting calyx lobes 3–3.5 mm long . . **5. A. candicans**
26. Fruiting calyces 5.8–8.6 mm long; fruiting calyx lobes 1.5–2.5 mm long **27**

27 Corolla platform glabrous; petioles 21–38% of lamina length . . . . . **19. A. moschata**
27. Corolla platform with 20–100 hairs; petioles 13–22% of lamina length . . **26. A. xerophila**

Key to the Asian and Malesian species of *Anisomeles*

1 Upper stems white, indumentum very dense, hairs completely obscuring stem at ×40 magnification . . . . . **18. A. malabarica**
1. Upper stems not white, indumentum very sparse to dense, stem surface visible at ×40 magnification **2**

2 All calyx fringe-hairs < 0.4 mm long **3**
2. Calyx fringe-hairs > 0.4 mm long, at least at the sinus end **4**

3 Fruiting calyces obconical, 5–7.5 mm wide at lobe apices; corolla platform with more than 100 hairs . . . . . **12. A. indica**
3. Fruiting calyces cylindrical to narrowly campanulate, 2.0–5 mm wide at lobe apices; corolla platform glabrous or with fewer than 20 hairs . . . . **22. A. principis**

4 Lower leaf surface glabrous or with sparse hairs (> 0.2 mm apart); outside of fruiting calyx with a mix of glandular and eglandular hairs . . **11. A. heyneana**
4. Lower leaf surface with moderately dense to dense hairs (< 0.2 mm apart); outside of fruiting calyx with eglandular hairs only **5**

5 Nutlets 1.5–1.7 mm long; fruiting calyx 6.2–8.3 mm long; cauline leaves with 19–33 pairs of marginal lobes . . . . . **21. A. papuana**
5. Nutlets 1.8–2.2 mm long; fruiting calyx 8.9–10.2 mm long; cauline leaves with 3–18 pairs of marginal lobes . . . . . **5. A. candicans**

Key to the Western Australian species of *Anisomeles*

1 Upper stems white, indumentum very dense, hairs completely obscuring stem at ×40 magnification **2**
1. Upper stems not white, indumentum very sparse to dense, stem surface visible at ×40 magnification **3**

2 External calyx hairs moderately dense to dense, spreading, 0.3–0.8 mm long; style 12–13 mm long; leaves often narrow (3–6.6 times longer than wide). . . . . **3. A. brevipilosa**
2. External calyx hairs very dense, appressed, 0.15–0.25 mm long; style 9.5–10.5 mm long; leaves often broader (2.8–3.5 times longer than wide). . . . . **9. A. farinacea**

3 Erect glandular hairs (0.1–0.3 mm long) frequent to abundant on upper stems and inflorescence rachis . . . . . **24. A. viscidula**
3. Erect glandular hairs absent from upper stems and rachises, although sessile glands usually present. **4**

4 Corolla platform with 1–20 hairs; hairs on the leaves 0.25–0.8 mm long . . **22. A. principis**
4. Corolla platform glabrous; hairs on the leaves 0.15–0.25 mm long . . . . . **13. A. inodora**

Key to the Northern Territory species of *Anisomeles*

1 Upper stems white, indumentum very dense, hairs completely obscuring stem at ×40 magnification **2**
1. Upper stems not white, indumentum very sparse to dense, stem surface visible at ×40 magnification **4**

2 Leaf and stem indumentum appressed, retrorse, hairs 0.05–0.2 mm long **3**
2. Leaf and stem indumentum woolly, hairs without fixed direction, 0.4–1.2 mm long . . . . . **23. A. salviifolia**

3 External calyx hairs moderately dense to dense, spreading, 0.3–0.8 mm long; style 12–13 mm long; leaves often narrow (3–6.6 times longer than wide). . . . . **3. A. brevipilosa**
3. External calyx hairs very dense, appressed, 0.15–0.25 mm long; style 9.5–10.5 mm long; leaves often broader (2.8–3.5 times longer than wide). . . . . **9. A. farinacea**

4 Erect glandular hairs (0.1–0.3 mm long) frequent to abundant on upper stems and inflorescence rachis **5**
4. Erect glandular hairs absent from upper stems and rachises, although sessile glands usually present. **6**

5 Patent hispid hairs absent from upper stems; cymes twice dichasial at base; cauline leaves 120–150 mm long; bracteoles 6.4–11 mm long. . . **4. A. bundeyensis**
5. Patent hispid hairs present (often frequent) on upper stems; cymes monochasial or once dichasial at base; cauline leaves 51–110 mm long; bracteoles 2.5–7.5 mm long. . . . . **24. A. viscidula**

6 Fruiting calyx fringe-hairs < 0.4 mm long **7**
6. Fruiting calyx fringe-hairs > 0.4 mm long, at least at the sinus end **8**

7 Floral bracts consistently longer than verticils; fruiting calyx 8.7–11 mm long . . . . . **10. A. grandibractea**
7. Floral bracts not consistently longer than verticils; fruiting calyx 7–8.9 mm long . . . . . **6. A. carpentarica**

8 Longest hairs on the upper leaf surface 0.25–0.4 mm long . . . . . **26. A. xerophila**
8. Longest hairs on the upper leaf surface 0.1–0.25 mm long. **9**

9 Leaves and stems green, indumentum sparse to moderately dense; corolla platform glabrous . . . . . **13. A. inodora**
9. Leaves and stems grey or grey-green, indumentum moderately dense to dense; corolla platform with at least some hairs **10**

10 Marginal lobes of cauline leaves 4–16 pairs, lobes serrate; fruiting calyx fringe hairs 0.15–0.3 mm long at apical end . . . . . **3. A. brevipilosa**
10. Marginal lobes of cauline leaves 15–37 pairs, lobes crenate; fruiting calyx fringe hairs 0.7–1.4 mm long at apical end. . . . . **16. A. leucotricha**

Key to the Queensland species of *Anisomeles*

1 Upper stems white, indumentum very dense, hairs completely obscuring stem at ×40 magnification **2**
1. Upper stems not white, indumentum very sparse to dense, stem surface visible at ×40 magnification **3**

2 Cauline leaves with 7–14 pairs of marginal lobes; low shrub 30 to 60 cm tall; verticils widely separated . . . . . **20. A. ornans**
2. Cauline leaves with 12–20 pairs of marginal lobes; shrub (40–) 60–200 cm tall; verticils not widely separated, sometimes overlapping . . . . . **8. A. eriodes**

3 Erect glandular hairs (0.1–0.3 mm long) frequent to abundant on upper stems and inflorescence rachis **4**
3. Erect glandular hairs absent from upper stems and rachises, although sessile glands usually present **5**

4 Cauline leaves 1.2–1.9 times longer than wide, base obtuse; corolla upper lip 5.8–6.7 mm long; glandular hairs extending to lower stems . . . . **17. A. macdonaldii**
4. Cauline leaves 2.4–3.8 times longer than wide, base cuneate; corolla upper li 3.8–5.7 mm long; glandular hairs not extending to lower stems . . . . **7. A. dallachyi**

5 Fruiting calyx fringe-hairs < 0.4 mm long **6**
5. Fruiting calyx fringe-hairs > 0.4 mm long, at least at the sinus end **10**

6 Floral bracts consistently longer than verticils . . . . . **15. A. lappa**
6. Floral bracts not consistently longer than verticils **7**

7 Petioles 0–3 mm long; plants prostrate **8**
7. Petioles 3.5–31 mm long; plants erect **9**

8 Marginal lobes of cauline leaves 2.5–5.1 mm deep; longest leaf hairs 1–2.5 mm long; corolla annulus hairs 0.4–0.5 mm long; corolla platform glabrous . . . . . **1. A. ajugacea**
8. Marginal lobes of cauline leaves 0.8–1.7 mm deep; longest leaf hairs 0.6–0.9 mm long; corolla annulus hairs 0.15–0.2 mm long; corolla platform with 1–20 hairs . . . . . **2. A. antrorsa**

9 Hairs on upper leaf surface 0.9–1.3 mm long; leaves 27–50 mm long; peduncles on lowermost verticil 0–1 mm long . . . . . **25. A. vulpina**
9. Hairs on upper leaf surface 0.2–0.8 mm long; leaves 44–152 mm long; peduncles on lowermost verticil (0–)1–15 mm long . . . . . **6. A. carpentarica**

10 Longest hairs on the upper leaf surface 0.1–0.25 mm long **11**
10. Longest hairs on the upper leaf surface 0.25–2.0 mm long **12**

11 Leaves and stems green, indumentum sparse to moderately dense; corolla platform glabrous . . . . . **13. A. inodora**
11. Leaves and stems grey or grey-green, indumentum moderately dense to dense; corolla platform with at least some hairs . . . . . **3. A. brevipilosa**

12 Longest hairs on leaves 0.9–2 mm long **13**
12. Longest hairs on leaves 0.25–0.7 mm long **14**

13 Stems with patent hispid hairs; plants procumbent; external hairs on fruiting calyx 1.1–2.4 mm long . . . . . **14. A. languida**
13. Stems without patent hispid hairs; plants erect; external hairs on fruiting calyx 0.6–1 mm long . . . . . **25. A. vulpina**

14 Nutlets 1.5–1.7 mm long; cauline leaves with 19–33 pairs of marginal lobes **21. A. papuana**
14. Nutlets 1.8–2.2 mm long; cauline leaves with 3–18 pairs of marginal lobes **15**

15 Corolla platform glabrous; petioles 21–38% of lamina length . . . . . **19. A. moschata**
15. Corolla platform with 20–100 hairs; petioles 13–22% of lamina length . . **26. A. xerophila**

1. Anisomeles ajugacea (F.M.Bailey & F.Muell.) A.R.Bean **comb. nov.**; *Teucrium ajugaceum* F.M.Bailey & F.Muell., *Synop. Queensl. Fl. Second Suppl.* 48 (1888). **Type:** Australia: Queensland. Cook District: Musgrave Electric Telegraph Station, undated, *T. Barclay-Millar s.n.* (holo: BRI [AQ340432], 2 sheets).

Anisomeles sp. (Big Coleman River J.R.Clarkson+ 7119); Henderson (2002).

Procumbent shrub, 0.05–0.2 m high. Upper stems and rachises with patent hispid hairs; short curved hairs absent or retrorse, sparse; stalked glandular hairs absent; sessile glands 8–32 mm². Cauline leaves 16–29 mm long, 14–24 mm wide, 1.1–1.4 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate, irregular or regular, 2–4 on each side, acute, 2.5–5.1 mm deep; petioles 0–3 mm long, 0–13% of lamina length. Lamina upper surface indumentum appressed, eglandular, 1–2.2 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–112 mm²; lower surface indumentum appressed, eglandular, 1–2.5 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–96 mm²; transition from leaves to floral bracts gradual. Floral bracts ovate or broadly ovate, 5–13 mm long, 3–7 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial, with 3–5 flowers per monochasium, peduncles 0–3 mm long on lowermost cluster; bracteoles obovate or spathulate, 5–10 mm long, 1–3 mm wide. Corolla tube same length as calyx; annulus 3.3–5 mm from base of corolla, annulus hairs 0.4–0.5 mm long; upper lip elliptical, 4–6.6 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface; lower lip pink, 5.6–6.7 mm long to end of lateral lobes, 9.8–11.3 mm long overall, glabrous on platform. Longest stamens 12–14 mm long from base of corolla tube; filament hairs 0.35–0.5 mm long, mainly along middle part or mainly at distal end. Style 12.7–15.5 mm long; longer stigma lobe 0.85–1.2 mm long, shorter stigma lobe 0.4–0.65 mm long. Fruiting calyces 2–5 mm apart on rachilla; fruiting calyx narrowly campanulate, 7–8 mm long, 3.4–5 mm wide at lobe apices, 1.5–2.1 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 1.5–2.1 mm long, sessile glands 48–128 mm²; lobes acute, 2.6–3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.2–0.35 mm long at apical end, 0.1–0.25 mm long at sinus end, sinus hairs absent, inner surface of tube glabrous. Nutlets 2.3–2.6 mm long. **Figs. 3A, 8A.**

***Additional selected specimens examined*: Australia: Queensland.** Cook District: Near Little Laura River, SSW of Laura, Jul 1990, *Bean 1906* (BRI); 28.3 km from the Kennedy River on the Jedda Creek track to King River Station, Jun 1981, *Clarkson 3717* (BRI, K, MO, PERTH); 2 km S of the Big Coleman River on the Coen to Musgrave Road, May 1987, *Clarkson 7119 & Simon* (BRI, NSW); 3.5 km N of South Five Mile Creek on the Peninsula Developmental Road, Apr 1991, *Clarkson 8929 & Neldner* (BRI, K); 27 km N of Musgrave, Cape York Peninsula, Jun 2004, *Foley s.n.* (BRI [AQ610577]); 21.4 km E of Musgrave, May 2004, *Gray 8910* (BRI, CANB, CNS, NSW); Musgrave Electric Telegraph Station, May 1891, *Jacobson s.n.* (BRI [AQ161262]); 25 km by road towards Jowalbinna from Peninsula Development Road, Jul 2007, *McDonald KRM6826 & Johnson* (BRI); 6.7 km along Pormpuraaw Road from Gulf Development Road junction near Musgrave, May 2010, *McDonald KRM9188* (BRI, CNS); N of Musgrave on Cape York Development Road, just S of Red Blanket Creek, May 2004, *Wannan BSW3496 & Graham* (BRI);

S of Musgrave, May 2004, *Wannan 3564 & Verdec* (BRI); N of Musgrave, May 2004, *Wannan 3568 & Verdec* (BRI); W of Musgrave, Jun 2004, *Wannan 3598* (BRI); 0.5 km S of Bamboo Creek, 6 km SW of Spion Kop, Jun 2005, *Wannan 4018 & Beasley* (BRI); Telegraph Track, 'Bamboo', Cape York Peninsula, Jun 2008, *Wannan 5223* (BRI).

Distribution and habitat: *Anisomeles ajugacea* is endemic to Queensland. Most records are within a 40 km radius of Musgrave, Cape York Peninsula, and there are a couple of records further south near Laura (**Map 1**). It inhabits low rises or flats in woodland of *Eucalyptus tetrodonta* F.Muell. and *Corymbia* spp. on white sandy soils.

Phenology: Flowers are recorded from April to July; fruits between May and August.

Notes: *Anisomeles ajugacea* is a highly distinctive species because of its short truncate leaves with just 2–4 pairs of lobes, the petioles 0–3 mm long, the exterior calyx hairs to 2.0 mm long, and the abundant antrorse to erect hispid hairs on the stems and leaves. It can produce prostrate stems up to 3 metres long (*Wannan 3564 & Verdec*).

This species was placed in the genus *Teucrium* by F.M. Bailey and F. Mueller, but it clearly belongs in *Anisomeles*, due to its gynobasic style, 2-lipped corolla, 2-celled anterior anthers, and the nutlets with a very small, basal areole.

Conservation status: **Least Concern**.

2. Anisomeles antrorsa A.R.Bean **sp. nov.** habitu prostrato serpente, pilis antrorsis insidentibus cauli, foliis parvis, cymis perfecte monochasialibus et nuculis 2.5–2.7 mm longis distinguitur. **Typus:** Australia: Queensland. Cook District: 13.7 km along New Pennefather River Road, N of Weipa, 11 July 1998, *A.R. Bean 13601* (holo: BRI).

Prostrate shrub, 0.1–0.4 m high. Upper stems and rachises without patent hispid hairs, or with patent hispid hairs; short curved hairs antrorse, moderately dense or dense; stalked glandular hairs absent. Cauline leaves 17–33 mm long, 9–21 mm wide, 1.4–2.4 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate, regular, 3–8 on each side, acute or obtuse, 0.8–1.7 mm deep; petioles 1.5–4 mm long, 5–15% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.6–0.9 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 64–80 mm²; lower surface indumentum erect or curved, eglandular, 0.6–0.8 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 48–112 mm²; transition from leaves to floral bracts gradual. Floral bracts ovate or broadly ovate, 6–25 mm long, 5–18 mm wide, not consistently exceeding verticils or consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial, with 3–7 flowers per monochasium, peduncles 0–4 mm long on lowermost cluster; bracteoles spathulate or linear, 4–5.8 mm long, 0.4–1.1 mm wide. Corolla tube same length as calyx; annulus 1.9–2.5 mm from base of corolla, annulus hairs 0.15–0.2 mm long; upper lip ovate or elliptical, 5–5.6 mm long, with eglandular hairs on outer surface; lower lip 4.5–5.5 mm long to end of lateral lobes, 9–10 mm long overall, with 1–20 eglandular hairs on platform. Longest stamens 11.5–12 mm long from base of corolla tube; filament hairs 0.7–1.1 mm long, mainly at distal end. Style 11.5–12.5 mm long; longer stigma lobe 0.65–0.75 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 2–3.5 mm apart on rachilla; fruiting calyx cylindrical, 7–7.3 mm long, 2–3.3 mm wide at lobe apices, 2–3 times longer than wide, exterior surface with hairs of different sizes or types or with all hairs same size and type, hairs glandular or hairs eglandular, 0.7–1.3 mm long, sessile glands 80–192 mm²; lobes acute, 2.3–3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.4 mm long at apical end, 0.15–0.4 mm long at sinus end, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 2.5–2.7 mm long. **Figs. 5I, 8B**.

Additional specimens examined: **Australia: Queensland.** Cook District: 4.3 km NW of Beagle North Camp, *c.* 41 km NNE of Aurukun, May 1982, *Clarkson 4331* (BRI); Red Beach, Weipa area, in 1980, *Herrman s.n.* (CANB); Andoom, E of Botchitt Swamp, 17.5 km NW of Lorim Point, Jan 1981, *Morton AM1021*

(BRI); Community orchard and garden, Mapoon (Old Mapoon), Mar 2005, *Waterhouse BMW7207* (BRI, CANB); Mapoon, near dump, Jun 2008, *Wannan 5283 & Graham* (BRI, NSW).

***Distribution and habitat*:** *Anisomeles antrorsa* is endemic to Queensland. It is confined to the western coast of Cape York Peninsula between Old Mapoon and North Camp, over a distance of *c.* 120 km (**Map 2**). It grows in sandy soil in open forest dominated by *Eucalyptus tetrodonta* and *Corymbia nesophila* (Blakely) K.D.Hill & L.A.S.Johnson.

***Phenology*:** Flowers are recorded from January to July; fruits from May to July.

***Notes*:** *Anisomeles antrorsa* is distinguished by the antrorse hairs on the stems, the small leaves with short petioles, the prostrate trailing habit, the long nutlets (2.5–2.7 mm), and the short calyx fringe hairs. It is most closely related to *A. ajugacea*, but differs by the shallower leaf marginal lobes, the shorter hairs on the leaves and the exterior of the calyx, the corolla platform with 1–20 hairs (versus glabrous) and the hairs of the corolla tube annulus only 0.15–0.2 mm long (versus 0.4–0.5 mm long).

***Conservation status*: Least Concern**.

***Etymology*:** From the Latin *antrorsus*, meaning 'forward pointing', and given in reference to the antrorsely directed hairs on the stems in this species.

3. Anisomeles brevipilosa A.R.Bean **sp. nov.** pilis cauli et paginae inferiori foliorum insidentibus longitudine minus quam 0.2 mm, pilis exterioribus calycis fructificantis 0.3–0.7 mm longis, pedunculis longis cymarum imarum et foliis crebro lanceolatis distinguitur. **Typus:** Australia: Northern Territory. Limmen National Park, *c.* 1 km N of southern lost city turnoff, southern park boundary, 22 April 2008, *D.L. Lewis 733* (holo: DNA; iso: MO).

Erect or spreading shrub, 0.6–2 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, dense or very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent; sessile glands 96–192 mm². Cauline leaves 57–93 mm long, 13–23 mm wide, 3–6.6 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes serrate, irregular or regular, 4–16 on each side, obtuse, 0.2–2 mm deep; petioles 8–20 mm long, 9–35% of lamina length. Lamina upper surface indumentum erect or curved, eglandular or appressed, eglandular 0.1–0.2 mm long, sparse (hairs > 0.2 mm apart), moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–112 mm²; lower surface indumentum erect or curved, eglandular or appressed, eglandular 0.1–0.2 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart) or very dense, obscuring surface at ×40 magnification, sessile glands 48–256 mm²; transition from leaves to floral bracts abrupt. Floral bracts linear or lanceolate, 4–28 mm long, 1–6 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes entirely monochasial, or once dichasial at base then monochasial, or twice dichasial (±globose), with 3–12 flowers per monochasium, peduncles 1–20 mm long on lowermost cluster; bracteoles spathulate or linear, 2.5–7.5 mm long, 0.3–1 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 3.5–3.8 mm from base of corolla, annulus hairs 0.2–0.25 mm long; upper lip elliptical, 4.5–5.2 mm long, with glandular hairs on outer surface; lower lip 5.5–6.8 mm long to end of lateral lobes, 11.7–13.1 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 12–13 mm long from base of corolla tube; filament hairs 0.7–1.2 mm long, mainly at distal end. Style 12–13 mm long; longer stigma lobe 0.6–0.7 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 0.9–3 mm apart on rachilla; fruiting calyx cylindrical, 6.6–10 mm long, 2.9–4.2 mm wide at lobe apices, 2.3–2.8 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.3–0.8 mm long, moderately dense to dense, sessile glands 96–176 mm²; lobes acute, 1.7–3.9 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.15–0.3 mm long at apical end, 0.7–1.2 mm long at

sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section. Nutlets 2–2.3 mm long. **Figs. 3B, 8C.**

***Additional specimens examined*: Australia: Western Australia.** Nimbing Range, NNW of Kununurra, May 1996, *Keighery 15255* (PERTH); banks of Packsaddle Creek, near Kununurra, Aug 1974, *Kenneally 1938* (CANB, PERTH); The Gorge, Station Creek, 35 km NNE of Carlton Hill HS, Mar 1978, *Lazarides 8475* (CANB, PERTH); *c.* 97 km N of Kununurra on road to coast N of Ningbing, Jul 1995, *Mitchell 4005* (CANB, PERTH); Summit of Poompangala Hill, *c.* 8 km W of Kalumburu, Apr 1991, *Willing 265* (PERTH). **Northern Territory.** near Caranbirini Waterhole, SW of Borroloola, Jun 1999, *Bean 15048* (BRI); 33 km N of Victoria River Downs HS, Jun 2005, *Bean 24129* (BRI, DNA, MEL); 25 miles [41.7 km] E of Timber Creek, May 1968, *Byrnes NB743* (BRI); 35 miles [56 km] SW of Borroloola, Mar 1959, *Chippendale 5553* (BRI, CANB, L, MEL, PERTH); *c.* 1.9 km NNE of Pungalina HS on Calvert River Road, Pungalina Wildlife Sanctuary, Jun 2011, *Jensen 2375* (BRI, DNA); 17 km SW of Kalkarindji, May 2010, *Latz 25553* (DNA, NT); Nicholson River area, Jun 1974, *Maconochie* 1992 (AD, BRI, CANB, K, MO, NT); Site 141, Kidman Springs Research Station, Aug 1990, *Manning V627* (DNA); 50 km SW of Borroloola, Jun 1977, *Must 1551* (BRI, CANB, DNA, NT); 7.5 km S of Timber Creek racecourse, Jul 1977, *Must 1564* (DNA, CANB, NT); Gregory NP, beside tributary of Bullock Paddock Creek, Apr 1996, *O'Neill 72* (DNA, MO); 4 miles [6 km] SSE of Coolibah Station, Jun 1952, *Perry 2865* (BRI, CANB, NT); 14 km from Settlement Creek on road to Calvert Hills, 1 km E of jump-up, May 1978, *Simon 3124 & Farrell* (BRI); Daly River Aboriginal Reserve, *c.* 95 km SE from Port Keats Mission, May 1994, *Walsh 3727* (DNA, MEL); 5 km W of Robinson River, Gulf of Carpentaria, May 1985, *Wightman 1886 & Leach* (BRI, CANB, DNA, K, PERTH); Fish River station, Apr 2012, *Wirf 710* (CANB, DNA). **Queensland.** Burke District: Settlement Creek, 25 miles [40 km] from coast, Gulf of Carpentaria, Jun 1948, *Perry 1201* (BRI, CANB, PERTH); Gregory River crossing near Riversleigh Station, Jun 1989, *Purdie 3585* (CANB); Bowthorn Station, 33.5 km NNW of HS, Jun 2006, *Thompson WES796 & Morgan* (BRI, NSW); 100 km WSW of Burketown, May 2008, *Thompson WES1484 & Wilson* (BRI, DNA).

***Distribution and habitat*:** *Anisomeles brevipilosa* is widespread in the Northern Territory, and extends to near Kununurra in Western Australia, and the extreme north-west of Queensland (**Map 3**). It grows in dry watercourses or on sandy colluvium, over sandstone or limestone substrates.

***Phenology*:** Flowers are recorded from March to June; fruits from April to June.

***Notes*:** *Anisomeles brevipilosa* can often be distinguished solely by its narrow leaves, up to 6.6 times longer than broad. However, populations from the Victoria River Downs area have broader leaves than usual, i.e. 3–4 times longer than broad. Very often, the stem indumentum is extremely dense, obscuring the stem surface at ×40 magnification, but in some localities the stem indumentum is dense or moderately dense.

Anisomeles brevipilosa is closely allied to *A. farinacea*; they both have extremely short hairs (< 0.2 mm) on their leaves and upper stems. *A. brevipilosa* is distinguished from *A. farinacea* by the presence of hispid hairs at the base of the plant, hairs 0.3–0.8 mm long on the outside of the calyx (versus 0.15–0.25 mm long), and not obscuring the calyx surface (surface obscured in *A. farinacea*), the lower corolla lip 11.7–13.1 mm long (versus 6.4–10 mm long), and style 12–13 mm long (versus 9.5–10.5 mm long).

***Conservation status*: Least Concern**.

***Etymology*:** From the Latin *brevis* meaning short and *pilosus* hairy. This is in reference to the very short hairs on the stems and leaves of this species.

4. Anisomeles bundeyensis A.R.Bean **sp. nov.** pilis glandularibus abundantibus caulibus insidentibus, foliis basalibus 125–145 mm longis, bracteolis longissimis, cymis bis dichasialibus in verticillis et calycibus fructificantibus 11.4–12.6 mm longitudine distinguitur. **Typus:** Australia: Northern Territory. Mt Bundey East, 14 May 1987, *R. Fensham 559* (holo: DNA).

Erect or spreading shrub, 1–1.5 m high. Upper stems and rachises without patent hispid hairs; short curved hairs absent; stalked glandular hairs abundant; glandular hairs extending to lower stems; sessile glands 8–48 mm². Cauline leaves 120–150 mm long, 55–67 mm wide, 2–2.4 times longer than wide, base obtuse or broadly cuneate (> 60°); marginal lobes dentate or serrate, regular, 26–35 on each side, acute, 1.5–2.2 mm deep; petioles 23–30 mm long, 18–21% of lamina length. Lamina upper surface indumentum of erect glandular hairs and curved eglandular hairs

0.25–0.3 mm long, moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum of erect glandular hairs 0.25–0.3 mm long, moderately dense (hairs 0.1–0.2 mm apart), sessile glands 32–80 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical or ovate, 5–15 mm long, 2–4.5 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex, cymes twice dichasial (± globose), with 4–7 flowers per monochasium, peduncles 0–1 mm long on lowermost cluster; bracteoles spathulate or linear, 6.4–11 mm long, 0.8–1.6 mm wide. Corolla tube shorter than calyx; annulus 3.4–4 mm from base of corolla, annulus hairs 0.25–0.35 mm long; upper lip ovate or elliptical, 4.5–4.8 mm long, with glandular hairs on outer surface; lower lip 7–7.2 mm long to end of lateral lobes, 12–13.4 mm long overall, with more than 100 eglandular hairs on platform. Longest stamens 12–13 mm long from base of corolla tube; filament hairs 1.2–1.3 mm long, mainly at distal end. Style 12.5–13.5 mm long; longer stigma lobe 0.65–0.75 mm long, shorter stigma lobe 0.55–0.7 mm long. Fruiting calyces 0.7–1.1 mm apart on rachilla; fruiting calyx cylindrical, 11.4–12.6 mm long, 3.2–4 mm wide at lobe apices, 3.1–3.6 times longer than wide, exterior surface with all hairs same size and type, hairs glandular, 0.25–0.35 mm long, sessile glands 8–32 mm²; lobes acute, 3.3–4.4 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.25 mm long at apical end, 0.15–0.25 mm long at sinus end, sinus hairs absent, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 2.3–2.4 mm long. **Figs. 3C, 8D**.

***Additional specimens examined*: Australia: Northern Territory.** Mt Bundey, Arnhem Highway, Mar 1987, *Dunlop 6884 & Wightman* (DNA).

***Distribution and habitat*:** *Anisomeles bundeyensis* is endemic to the Northern Territory. It is known only from Mt Bundey and nearby Mt Bundey East, SE of Darwin (**Map 2**). It grows on granite outcrops.

***Phenology*:** Flowers are recorded for March and May; fruits recorded in May.

***Notes*:** *Anisomeles bundeyensis* is distinguished by the abundant glandular hairs on the stems, the very long bracteoles, the twice-dichasial cymes on the verticils, and the long fruiting calyces. It is closely related to *A. viscidula*, but differs by the lack of retrorse eglandular hairs and hispid hairs on the stems, the considerably larger corolla, the twice-dischasially branched cymes and the fruiting calyces only 1–1.5 mm apart.

***Conservation status*:** This species has a very restricted Area of Occupancy (<20 km²), and is known from just two locations. A status of **Vulnerable**, criterion D2, is recommended.

***Etymology*:** Named for the location of Mount Bundey.

5. Anisomeles candicans Benth. in Wall., *Pl. Asiat. Rar.* 1: 59 (1830); *Epimeredi candicans* (Benth.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type citation:** Yenangheun, ripae Irawaddi. **Type:** Burma. Yenanghuen [Yenangyaung], ripae Irawaddi, in 1826, *[Wallich Cat. No. 2038]* (lecto [here designated]: K 000846316, image!).

Anisomeles malabarica var. *nigrescens* Benth. in Wall., *Pl. Asiat. Rar.* 1: 59 (1830). **Type citation:** ad ripas Irawaddi. **Types:** Burma. Prome, in 1826, *[Wallich Cat. No. 2037]* (syn: K); Irawaddi River, [1826], *[Wallich Cat. No. 2037/4]* (syn: K; syn: BM 000984304).

Shrub, height unknown. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, moderately dense; stalked glandular hairs absent; sessile glands 8–32 mm². Cauline leaves 65–91 mm long, 15–32 mm wide, 2.6–4.3 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate, irregular or regular, 11–18 on each side, acute or obtuse, 0.6–2.1 mm deep; petioles 9–17 mm long, 13–20% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.3–0.4 mm long, moderately dense (hairs 0.1–0.2 mm apart), sessile glands 48–80 mm²; lower surface indumentum erect or curved, eglandular, 0.4–0.6 mm long, dense (hairs < 0.1 mm apart), sessile glands 8–32 mm²; transition from leaves to floral bracts abrupt. Floral bracts lanceolate or elliptical, 6–45

mm long, 2–16 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial, with 6–9 flowers per monochasium, peduncles 4–24 mm long on lowermost cluster; bracteoles spathulate or linear, 3.8–8.5 mm long, 0.4–1.3 mm wide. Corolla unknown. Fruiting calyces 1.5–1.8 mm apart on rachilla; fruiting calyx narrowly campanulate or cylindrical, 8.9–10.2 mm long, 3.6–5 mm wide at lobe apices, 1.9–2.5 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.4–0.6 mm long, sessile glands 48–96 mm²; lobes acute, 3–3.5 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.2–0.5 mm long at apical end, 1–1.4 mm long at sinus end, sinus hairs present, inner surface of tube with dense ring of long hairs in medial section. Nutlets 2–2.1 mm long. **Figs. 3D, 8E.**

***Additional specimens examined*: Burma.** Shingaung road, Minbu, Nov 1902, *Mokim 575* (G); Minbu district, Nov 1902, *Mokim 586* (G).

***Distribution and habitat*:** The only specimens or specimen images I have seen are from central Burma, all close to the Irrawaddy River (**Map 4**). Murata (1971) recorded this species from Thailand, citing several specimens held at TI or KYO, but I have not had the opportunity to view these. The habitat is unknown.

***Phenology*:** Unknown.

***Notes*:** *Anisomeles candicans* is probably most closely related to *A. malabarica*, but differs from the latter by the stem indumentum being only moderately dense; the shorter hairs on the leaves and outside of the calyx; the calyx fringe hairs 1–1.4 mm long at the sinus end (0.5–0.7 mm for *A. malabarica*); the lower verticils with long peduncles; and the leaves more deeply toothed. Wallich's specimen from Prome has shorter petioles than the other specimens, but is otherwise typical.

***Conservation status*: Data Deficient**.

6. Anisomeles carpentarica A.R.Bean **sp. nov.** affinis *A. moschatae* sed foliis angustioribus, pilis marginalibus loborum calycis brevioribus, numero maximo pilorum labio inferiori corollae insidentibus differens. **Typus:** Australia: Northern Territory. Gray's Bay, in Caledon Bay, 21 June 1972, *D.E. Symon 7804* (holo: BRI; iso: AD, DNA, NT).

Erect or spreading shrub, 0.45–2.5 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, sparse to dense; stalked glandular hairs absent; sessile glands 8–128 mm². Cauline leaves 44–152 mm long, 20–53 mm wide, 1.6–4.1 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or serrate, irregular or regular, 12–30 on each side, acute or obtuse, 0.5–1.5 mm deep; petioles 10–31 mm long, 15–31% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.2–0.5 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–112 mm²; lower surface indumentum erect or curved, eglandular, 0.2–0.5 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–128 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical or ovate, 6–13 mm long, 2.5–7 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial or twice dichasial (± globose), with 4–12 flowers per monochasium, peduncles 1–12 mm long on lowermost cluster; bracteoles spathulate or linear, 3.5–6.5 mm long, 0.3–1.2 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 3.3–3.6 mm from base of corolla, annulus hairs 0.15–0.2 mm long; upper lip ovate or elliptical, 2.6–4.4 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface; lower lip 4–5.5 mm long to end of lateral lobes, 8.5–11.7 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 10–11.5 mm long from base of corolla tube; filament hairs 0.7–1.2 mm long, mainly at distal end. Style 10–12 mm long; longer stigma lobe 0.5–0.65 mm long, shorter stigma lobe 0.3–0.4 mm long. Fruiting calyces 1–2.3 mm apart on rachilla; fruiting calyx cylindrical, 7–8.9 mm long, 3.3–3.8 mm wide at lobe apices, 2.1–2.4

times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.2–0.6 mm long, sessile glands 32–160 mm²; lobes acute, 1.9–2.8 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.35 mm long at apical end, 0.15–0.35 mm long at sinus end, sinus hairs absent or present, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.9–2.2 mm long. **Figs. 1C, 3E, 8F.**

***Additional specimens examined*: Australia: Northern Territory.** Groote Eylandt, 6.5 km SSE of Alyangula, Apr 1992, *Cowie 2557* (CANB, DNA); Arnhem Bay, mouth of Cato River, May 1992, *Cowie 2879* (DNA); South Bay, Bickerton Island, Apr 1993, *Cowie 3883 & Leach* (DNA); Stevens Island, southern end, Apr 1996, *Cowie 6769* (DNA, MEL); Groote Eylandt, near Malkiyangwa Beach, Mar 2005, *Cowie 10489* (DNA, L); Walker River, May 1993, *Dunlop 9531 & Leach* (DNA); Cape Arnhem, Sep 1993, *Dunlop 9734 & Wightman* (DNA); N of Nhulunbuy, Oct 1993, *Egan 2719* (DNA); track to Cape Arnhem, Oct 1993, *Egan 2772* (DNA); Wessel Island, Sep 1972, *Latz 3283* (CANB, DNA); Wigram Island, English Company Islands, Jul 1992, *Leach 3061* (DNA, NT); South side of Rimbija Island, Wessel Islands, Nov 2007, *Roberts 1026* (BRI, CANB); 4 Mile Jungle, Umbakumba, Groote Eylandt, Jul 1987, *Russell-Smith 2866 & Lucas* (DNA); 10 km N of Harris Creek, Blue Mud Bay, Sep 1987, *Russell-Smith 3116 & Lucas* (BRI, DNA); Warangaya, Elcho Island, Sep 1987, *Russell-Smith 3278 & Lucas* (DNA, PERTH); Hemple Bay, Groote Eylandt, Apr 1948, *Specht 276* (BRI, CANB, L, MEL, PERTH); Port Bradshaw, Jul 1948, *Specht 781* (BRI); 63 miles [101 km] west of Giddy River crossing, Jun 1972, *Symon 7748* (DNA, NT); mouth of Bing Bong Creek, Bing Bong Station, May 1984, *Thomson 643* (DNA, NT). **Queensland.** Burke District. North Bountiful Island, South Wellesley Group, Nov 2002, *Thomas BOI37 & Pedley* (BRI); 178 km NW of Burketown on Wollogorang Station (Gulf site 392), May 2008, *Thompson MORN058 & Wilson* (BRI); Karumba, Jul 1960, *Trapnell 186* (BRI); Bountiful Islands, Wellesley Island Group, Mar 2008, *Waterhouse BMW7648* (BRI, CANB).

***Distribution and habitat*:** *Anisomeles carpentarica* is distributed from Karumba in Queensland to Elcho Island in the Northern Territory (**Map 5**). It mainly occurs in littoral areas on old beach dunes, but it does occasionally grow further inland on sandy substrate.

***Phenology*:** Flowers are recorded from February to November; fruits are recorded from April to November.

***Notes*:** *Anisomeles carpentarica* is close to *A. moschata*, but differs by the narrower leaves (L/B ratio 2.7–4.1 times, compared to 2.1–2.8 times for *A. moschata*), the longer bracteoles, the calyx fringe hairs of uniform length throughout, 0.15–0.35 mm long (longer towards the sinus in *A. moschata*; 0.5–1 mm long), and the numerous (20–100) trichomes on the platform of the corolla (glabrous or < 20 hairs for *A. moschata*).

***Conservation status*: Least Concern.**

***Etymology*:** The epithet refers to the distribution of this species which predominantly fringes the Gulf of Carpentaria.

7. Anisomeles dallachyi A.R.Bean **sp. nov.** pilis glandularibus abundantibus rachibus calycibus insidentibus, foliis indumento sparso in pagina superiore praeditis, pilis marginalibus brevissimis loborum calycis et nuculis 1.7–1.9 mm longis distinguitur. **Typus:** Queensland. [North Kennedy District]: Rockingham Bay, 27 April 1866, *J. Dallachy s.n.* (holo: MEL 684769; iso: MEL 684766, MEL 684768, MEL 684770, MEL 684773, MEL 684774, MEL 684775, MEL 684776, MEL 684777, MEL 684778, MEL 684788).

Anisomeles salviifolia var. *subtomentosa* Domin, *Biblioth. Bot.* 89: 567 (1928), *pro parte*. **Type:** Queensland. [North Kennedy District]: Rockingham Bay, undated, *J. Dallachy s.n.* (syn: K).

Erect or spreading shrub, height unknown. Upper stems and rachises without patent hispid hairs, or with patent hispid hairs; short curved hairs retrorse, sparse or moderately dense; stalked glandular hairs abundant; sessile glands 16–80 mm². Cauline leaves 46–96 mm long, 16–44 mm wide, 2–3.3 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate, irregular or regular, 14–23 on each side, acute or obtuse, 0.5–2.4 mm deep; petioles 12–33 mm long, 26–45% of lamina length. Lamina upper surface indumentum of erect or appressed, curved eglandular hairs, 0.2–0.55 mm long, sparse (hairs > 0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum of erect or curved,

eglandular hairs, 0.15–0.3 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 48–96 mm²; transition from leaves to floral bracts abrupt or gradual. Floral bracts lanceolate or elliptical, 4–27 mm long, 1.5–8 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 4–7 flowers per monochasium, peduncles 0–11 mm long on lowermost cluster; bracteoles linear, 3.2–4.5 mm long, 0.3–0.6 mm wide. Corolla tube same length as calyx; annulus 3.8–4.2 mm from base of corolla, annulus hairs 0.25–0.3 mm long; upper lip elliptical, 3.5–4.7 mm long, with eglandular hairs on outer surface or glabrous; lower lip 5.5–6.5 mm long to end of lateral lobes, 12–14 mm long overall, glabrous on platform. Longest stamens 13–13.5 mm long from base of corolla tube; filament hairs 0.3–1.5 mm long, mainly at distal end. Style 13.5–14 mm long; longer stigma lobe 0.8–0.9 mm long, shorter stigma lobe 0.4–0.6 mm long. Fruiting calyces 1.8–4 mm apart on rachilla; fruiting calyx cylindrical, 7.1–9 mm long, 2.7–3.8 mm wide at lobe apices, 1.9–2.8 times longer than wide, exterior surface with hairs all glandular, or with some curved eglandular hairs 0.2–0.4 mm long also present, sessile glands 32–96 mm²; lobes acute, 2.2–3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.1–0.15 mm long at apical end, 0.1–0.2 mm long at sinus end, sinus hairs absent, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 1.7–1.9 mm long. **Figs. 3F, 8G.**

***Additional specimens examined*: Australia: Queensland.** North Kennedy District. Beside Old Dalrymple Track near Cardwell, May 1975, *Andrews 158 & Simon* (BRI); Rockingham Bay, in 1870, *Dallachy s.n.* (MEL 1551746, MEL 1551726).

***Distribution and habitat*:** *Anisomeles dallachyi* is endemic to Queensland. It is known only from the Cardwell area on the north-eastern coast (**Map 1**). It inhabits eucalypt forest on sandy soils.

***Phenology*:** Flowers and fruits have been recorded in April and May.

***Typification*:** There are 13 sheets of this species at MEL that were collected by J. Dallachy from Rockingham Bay. A close examination of the 13 sheets of *A. dallachyi* reveals that they are separable into two "groups", based on details of their morphology and overall similarity. One group of 11 sheets has plant material so similar that I regard it as originating from a single gathering; one of the sheets has an original Dallachy label giving the date of collection as 27th April 1866; this sheet is selected as the holotype, and the other 10 sheets are regarded as isotypes. The labels of all 11 sheets have a "B" written on the corner indicating that they were seen by Bentham for *Flora Australiensis*.

The second group of two sheets has material closely matching, but different in leaf shape and indumentum to the first group; one of these sheets has the date '1870' on the label, and neither sheet has a "B" on the corner of its label.

The syntypes of *Anisomeles salviifolia* var. *subtomentosa* at K comprise a mixture of *A. moschata* and *A. dallachyi*. It is the K specimens that Domin examined before describing that variety (Orchard 1999); he did not see material at MEL or P.

***Notes*:** The location of Dallachy's type collection can be inferred. On the 26th April 1866, he collected *Ficus copiosa* Steud. at Meunga Creek (a few km north of Cardwell) (AVH 2015). On the 27th April 1866, he collected *Cyperus decompositus* (R.Br.) F.Muell. (AVH 2015). This species is known to occur on sand-ridges at the southern end of Edmund Kennedy NP, about 2 km north of Meunga Creek (specimen at BRI, *Bean 3893*). This is a likely place for Dallachy's collection of the *Anisomeles*.

Anisomeles dallachyi is probably most closely related to *A. viscidula*, but *A. dallachyi* differs by the lack of glandular hairs on the lower stems, the sparse hairs of the upper leaf surface, the glabrous corolla platform, the mostly shorter calyx fringe hairs, and the shorter nutlets. The only other *Anisomeles* species in the Cardwell area is *A. moschata*; *A. dallachyi* is distinguished from *A. moschata*

by the stalked glandular hairs on the upper stems, rachises and calyces; the sparsely hairy leaves; and the much shorter calyx fringe hairs.

***Conservation status*:** A status of **Vulnerable**, criterion D2, is recommended (IUCN 2012).

***Etymology*:** Named for John Dallachy (1808?–1871), collector of the type specimen. Dallachy was a very well-known botanical collector in Victoria, New South Wales and Queensland. In the latter state, most of his collections are from near Rockingham Bay (Cardwell), where he lived from 1864 until his death in 1871.

8. Anisomeles eriodes A.R.Bean **sp. nov.** indumentis densissimis in caulibus superioribus, folii indumentis lanatis intricatis, tubo corollae quam calyce breviore, labio inferiore corollae glabro et calycibus fructificantibus 8.3–9.7 mm longitudine distinguitur. **Typus:** Australia: Queensland. Cook District: Olive River Environmental Reserve, 0.5 km W by road of Bromley Homestead, 14 June 2007, *P.I. Forster PIF32572 & K.R. McDonald* (holo: BRI; iso: MEL, NSW).

Anisomeles sp. (Agnew J.R.Clarkson 4993); Bostock & Holland (2010, 2014).

Procumbent shrub, or erect or spreading shrub, 0.4–1 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse or no fixed direction, very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent. Cauline leaves 50–100 mm long, 21–40 mm wide, 1.9–3.2 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate or serrate, regular, 15–20 on each side, acute or obtuse, 0.3–1.7 mm deep; petioles 8–14 mm long, 13–19% of lamina length. Lamina upper surface indumentum lanate, tangled, 0.4–0.7 mm long, dense (hairs < 0.1 mm apart) or very dense (obscuring surface at ×40 magnification), sessile glands 32–96 mm^2; lower surface indumentum lanate, tangled, 0.4–0.7 mm long, dense (hairs < 0.1 mm apart) or very dense, obscuring surface at ×40 magnification; transition from leaves to floral bracts abrupt, or gradual. Floral bracts elliptical, 8–34 mm long, 4–13 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 6–13 flowers per monochasium, peduncles 0–3 mm long on lowermost cluster; bracteoles spathulate or linear, 3.5–6.1 mm long, 0.3–0.8 mm wide. Corolla tube shorter than calyx; annulus 2.4–3 mm from base of corolla, annulus hairs 0.15–0.25 mm long; upper lip elliptical, 4.5–5.5 mm long, with glandular hairs on outer surface; lower lip pink or white, 5.6–7.3 mm long to end of lateral lobes, 10.6–12.5 mm long overall, glabrous on platform. Longest stamens 11–12.5 mm long from base of corolla tube; filament hairs 0.5–0.9 mm long, mainly at distal end. Style 11–13 mm long; longer stigma lobe 0.7–0.9 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 1–1.6 mm apart on rachilla; fruiting calyx narrowly campanulate or cylindrical, 8.3–9.7 mm long, 4–4.9 mm wide at lobe apices, 1.7–2.4 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.6–1 mm long; lobes acute, 2.5–3.3 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.2–0.35 mm long at apical end, 0.8–1.1 mm long at sinus end, sinus hairs absent, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 2–2.4 mm long. **Figs. 3H, 9A**.

***Additional selected specimens examined*: Australia: Queensland.** Cook District: 23.2 km from Peninsula Development Road, towards Iron Range, Jul 1998, *Bean 13618* (BRI); Archer River, Wenlock – Coen Road, Aug 1948, *Brass 19773* (BRI, CANB, K); *c.* 60 km directly NE of Weipa, Jun 2008, *Byrd CA31* (BRI); 1 km N of Batavia Landing on the Weipa – Mapoon Road, Aug 1983, *Clarkson 4934* (BRI, CNS, K, MEL); Batavia Downs, Shilling paddock, *c.* 0.5 km W of HS, Apr 1990, *Clarkson 8574 & Neldner* (AD, BRI, DNA, L); 10.8 km east of Agnew airstrip on the track to Bertihaugh Station, Aug 1983, *Clarkson 4993* (BRI, PERTH); Merapah Holding, corridor between Rokeby and Archer Bend NP, 25 km NW of Ranger Station, Aug 1990, *Fell DF2154* (BRI); 2 km E of Mt Gibson, 16 km SSE of Lakeland Downs, West Normanby River catchment, May 1993, *Fell DGF3295 & Daunt* (BRI); slope of St George granites, 9.3 km E of Maitland Downs HS, Jul 2003, *Fox IDF2090* (BRI); Archer Bend NP, May 1988, *Godwin C3854* (BRI); 31.3 km along Pormpuraaw Road from Peninsula Development Road, Aug 2008, *McDonald KRM7879* (BRI); Oyala Thumotang NP, 23

km by road W of Peninsula Development Road, Geike Range, May 2013, *McDonald KRM14197 & Winter* (BRI, DNA, HO); Running Creek Nature Refuge, Jun 2013, *McDonald KRM14489* (BRI); Lama Lama NP, between Goose and Bull Lagoons, Jun 2013, *McDonald KRM14578* (BRI, MEL); 50 km N of Weipa airport, Little Scrub Creek, Feb 2009, *Mitchell 6-190 & Massey* (BRI, MEL, PERTH); E of Falls Creek crossing on Kennedy Road, Jun 1982, *Morton AM1732* (BRI); Nichol Creek, Kaanju nation, central Cape York, Aug 2007, *Smith 5236 & Nelson* (BRI, NSW); 30 km ESE of Weipa Mission, Sampling Point 19, Jul 1974, *Specht W377 & Salt* (BRI); E of Weipa on the Peninsula Development road, Feb 2000, *Wannan 1608 & Jago* (BRI); East of Musgrave, Jun 2004, *Wannan 3593* (BRI, CANB); Telegraph track, 'Bamboo', Cape York Peninsula, Jun 2008, *Wannan 5219 & Graham* (BRI).

***Distribution and habitat*:** *Anisomeles eriodes* is endemic to Queensland. It is widely distributed on Cape York Peninsula from NE of Weipa to Maitland Downs (**Map 5**). It commonly grows in woodland with *Eucalyptus tetrodonta*, *E. cullenii* or *Corymbia nesophila* on hillsides or low pebbly rises. The soil is sandy, often reddish in colour.

***Phenology*:** Flowers are recorded from February to August; fruits from June to August.

***Notes*:** Two poor quality specimens from hilly terrain south-west of Cooktown (*Fell DGF3295 & Daunt*; *Fox IDF2090*; cited above) are disjunct from the main area of *A. eriodes*, and are somewhat atypical in appearance, but are included here with it. *A. eriodes* is most likely to be confused with *A. ornans*. See notes under that species.

***Conservation status*: Least Concern**.

***Etymology*:** The epithet is from the Greek word *eriodes*, meaning 'like wool, woolly' (Brown 1956). It refers to the woolly tomentum of the leaves and stems in this species.

9. Anisomeles farinacea A.R.Bean **sp. nov.** tomento densissimo caulibus et paginae inferiori foliorum insidente, pilis 0.05–0.15 mm in paginae inferiori foliorum et pilis 20–100 labio inferiori corollae insidentibus distinguitur. **Typus:** Australia: Western Australia. Flint Creek Gorge, 9 km NW of homestead, 28 June 1987, *D.J. Edinger 496* (holo: BRI; iso: DNA, PERTH).

Erect or spreading shrub, 1–2 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent; sessile glands 96–240 mm². Cauline leaves 52–111 mm long, 15–42 mm wide, 2.8–3.5 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate or serrate, irregular or regular, 8–24 on each side, acute or obtuse, 0.6–2 mm deep; petioles 13–23 mm long, 12–21% of lamina length. Lamina upper surface indumentum appressed, eglandular, 0.05–0.2 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 16–96 mm²; lower surface indumentum erect or curved, eglandular or appressed, eglandular 0.05–0.15 mm long, dense (hairs < 0.1 mm apart), sessile glands 48–192 mm²; transition from leaves to floral bracts abrupt. Floral bracts linear or lanceolate, 7–24 mm long, 1–5 mm wide, not consistently exceeding verticils or consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 2–9 flowers per monochasium, peduncles 2–7 mm long on lowermost cluster; bracteoles linear, 4–7.5 mm long, 0.35–0.6 mm wide. Corolla tube longer than calyx; annulus 2.5–3.2 mm from base of corolla, annulus hairs 0.2–0.25 mm long; upper lip ovate or elliptical, 2–3.6 mm long, with glandular and eglandular hairs on outer surface; lower lip 3–6.5 mm long to end of lateral lobes, 6.4–10 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 9.5–10 mm long from base of corolla tube; filament hairs 0.5–0.8 mm long, mainly at distal end. Style 9.5–10.5 mm long; longer stigma lobe 0.8–0.9 mm long, shorter stigma lobe 0.5–0.6 mm long. Fruiting calyces 1–2 mm apart on rachilla; fruiting calyx cylindrical, 8.2–9 mm long, 2.7–4.4 mm wide at lobe apices, 1.9–3 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.15–0.25 mm long, very dense, sessile glands 8–128 mm²; lobes acute, 2–3.1 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.2–0.3 mm long at apical

end, 0.8–1.1 mm long at sinus end, sinus hairs absent, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 2–2.2 mm long. **Figs. 3I, 9B.**

***Additional specimens examined*: Australia: Western Australia.** King Leopold Range, Gibb River road, 42.7 km SW of turnoff to Mt House Station, May 1985, *Aplin 1020 et al.* (NSW, PERTH); near headwaters of King Creek, SSW of Mt Humbert, Yampi Peninsula, Yampi Sound Defence Training Area, Mar 2001, *Barrett RLB 2135* (PERTH); 13 miles [21 km] S of Halls Creek, Jul 1968, *Beard 5533* (PERTH); between Silent Grove and the Bell Gorge parking area, Aug 2005, *Byrne 1610* (PERTH); S side of Cockburn Range, *c.* 6.5 km W of King River, Jul 1974, *Carr 3359 & Beauglehole 47138* (MEL, NSW, PERTH); 1 km NNW of Barker River Gorge, Napier Range, Apr 1988, *Cranfield 6466* (CANB, K, PERTH); Fern Creek, King Leopold Range, Apr 1988, *Dunlop 7773 & Simon* (BRI, DNA, PERTH); Devil's Pass, Napier Range, May 1905, *Fitzgerald 606* (PERTH); near Mt Eliza, May 1905, *Fitzgerald 734* (PERTH); Silver Gull Creek at spring, *c.* 14 km SE of Cockatoo Island, Apr 1983, *Fryxell & Craven 3877* (CANB, MEL, PERTH); between McDonald Range and Glenelg River, Jul 1950, *Gardner 9583* (NSW, PERTH); Fossil Downs, Apr 1951, *Gardner 10074* (PERTH); Lower western slopes of Mt Bell, King Leopold Ranges, May 1988, *Goble-Garratt 617* (PERTH); Near Ord River, in 1884, *Johnston s.n.* (MEL); 14 km SE of Mt Kitchener, Jun 1987, *Kenneally 10549 & Hyland* (PERTH); Wulwuldji Spring, Bungle Bungle NP, Nov 1989, *Menkhorst 907* (DNA, PERTH); Windjana Gorge NP, in immediate vicinity of Carpenters Gap rockshelter, Jul 1997, *Wallis LW97A/13* (PERTH); Napier Range, south side, Windjana Gorge NP, Jun 1988, *Wilson 12799* (BRI, PERTH); March Fly Creek, 85 km NE of Lennard River crossing, Jun 1988, *Wilson 12895* (PERTH). **Northern Territory.** Gregory NP, tributary of Upper East Baines River, 50 km from Bullita Outstation, Apr 1996, *Walsh 4502 & Jones* (DNA).

***Distribution and habitat*:** *Anisomeles farinacea* is widespread in the Kimberley region of Western Australia, from Cockatoo Island in the west to south-east of Kununnurra, and is known from a single collection in the Northern Territory (**Map 2**). It frequently inhabits watercourses or creek-banks, with genera such as *Pandanus*, *Terminalia* and *Livistona*, but it also grows on limestone hills or on sandstone (or even granite) scree slopes with closed-forest species or woodland species. Soil varies from sandy loam to black clay.

***Phenology*:** Flowers are recorded from March to August; fruits are recorded from April to October.

***Notes*:** The colour of the corolla has been variously described on herbarium labels as mauve, purple, purple and white, blue, or violet.

Anisomeles farinacea is closely related to *A. brevipilosa*. Distinguishing features are given under that species.

***Conservation status*: Least Concern.**

***Etymology*:** The epithet is from the Latin *farina*, meaning flour, given in reference to the very pale colour of the stems and lower leaf surfaces.

10. Anisomeles grandibractea A.R.Bean **sp. nov.** bracteis floralibus maximis, pilis brevibus in pagina superiore, monochasiis paucifloris et pilis marginalibus brevibus insidentibus lobis calycis distinguitur. **Typus:** Australia: Northern Territory. Deaf Adder Gorge, 23 February 1977, *C.R. Dunlop 4438* (holo: DNA; iso: MEL).

Erect or spreading shrub, 0.5–1.5 m high. Upper stems and rachises without patent hispid hairs, or with patent hispid hairs; short curved hairs retrorse or antrorse, sparse or moderately dense; stalked glandular hairs absent; sessile glands 8–96 mm². Cauline leaves 44–116 mm long, 27–62 mm wide, 1.5–3.5 times longer than wide, base obtuse, broadly cuneate or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate, dentate or serrate, regular, 12–27 on each side, acute or obtuse, 0.3–2.2 mm deep; petioles 12–31 mm long, 16–40% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.2–0.7 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum erect or curved, eglandular, 0.3–0.6 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–112 mm²; transition from leaves to floral bracts gradual. Floral bracts elliptical, ovate or broadly-ovate, 12–78 mm long, 9–30 mm wide, consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial, or twice dichasial, with 2–8 flowers per monochasium, peduncles 0–7 mm long on lowermost cluster;

bracteoles spathulate or linear, 4.3–9.5 mm long, 0.5–1.3 mm wide. Corolla tube longer than calyx or the same length as calyx; annulus 3.1–4 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip elliptical, 3.7–5.9 mm long, with eglandular hairs on outer surface; lower lip 4.8–7.6 mm long to end of lateral lobes, 8.5–14.5 mm long overall, platform glabrous or with 1–20 eglandular hairs. Longest stamens 12.5–14.5 mm long from base of corolla tube; filament hairs 0.5–1.4 mm long, mainly at distal end. Style 13–15 mm long; longer stigma lobe 0.4–0.7 mm long, shorter stigma lobe 0.3–0.55 mm long. Fruiting calyces 1–1.5 mm apart on rachilla; fruiting calyx cylindrical, 8.7–11 mm long, 2.8–4.3 mm wide at lobe apices, 2.3–3.7 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, longest ones 0.25–0.6 mm long, sessile glands 8–112 mm²; lobes acute, 1.8–3.3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.35 mm long at apical end, 0.15–0.4 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.8–2.1 mm long. **Figs. 3G, 4A, 8H, 9C**.

***Additional specimens examined*: Australia: Northern Territory.** Koolpin Gorge, Mar 1990, *Brennan Bre190* (DNA); 20 km SE of Twin Falls, May 1980, *Craven 5880* (CANB); Mt Brockman, Feb 1973, *Dunlop 3323* (BRI, CANB, DNA, NT); SE of Mt Howship, Arnhem land, Feb 1984, *Dunlop 6628 & Russell-Smith* (DNA); Nourlangie Rock, along path to lookout, Feb 1987, *Gartrell & Cunliffe UNSW19974* (BRI, CANB, DNA); 14.5 km WNW of Twin Falls, May 1980, *Lazarides 9106* (DNA, CANB, DNA); walking trail, Obiri Rocks, Apr 1987, *Purdie 3175* (CANB); top of Twin Falls, Kakadu NP, Jun 1983, *Russell-Smith 711* (DNA); 5 km E of Winwuyurr Creek crossing, Kakadu NP, Feb 1984, *Russell-Smith 1102* (DNA); 6 km S of Oenpelli, Jul 1983, *Russell-Smith 1167* (DNA); 10 km SW of Oenpelli Aboriginal Settlement, May 1988, *Weber 9890* (AD, BRI, DNA).

***Distribution and habitat*:** *Anisomeles grandibractea* is endemic to the Northern Territory. It is confined to the eastern parts of Kakadu NP, and the Oenpelli area of Arnhem Land (**Map 7**). It inhabits sandstone plateaux and gorges, in eucalypt woodland or Acacia scrub, and is often recorded from the margins of monsoon vine forest in sandstone gorges, with at least some sites dominated by *Allosyncarpia ternata* S.T.Blake. Soils are skeletal or sandy.

***Phenology*:** Flowers are recorded between February and July; fruits from March to July.

***Notes*:** This species is characterised by seemingly axillary inflorescences, due to the floral bracts greatly exceeding the verticils. One collection (*Lazarides 9106*) has antrorse stem hairs, while other specimens have retrorse hairs on the stem.

Anisomeles grandibractea has two forms. The typical form has relatively shorter and broad floral bracts, often brown tomentum on new growth, long hairs (0.45–0.7 mm long) on the upper leaf surface, long petioles (27–40% of lamina length), and obtuse or broadly cuneate leaf bases. The other form (represented by e.g. *Lazarides 9106*, *Dunlop 6628 & Russell-Smith*) has very long floral bracts, no brownish tomentum, short hairs (0.2–0.35 mm long) on the upper leaf surface, shorter petioles (16–28% of lamina length), and narrowly cuneate leaf bases. Further study may reveal these forms to be separate species.

***Conservation status*: Least Concern**.

***Etymology*:** The epithet alludes to the floral bracts of this species, which consistently exceed the verticils.

11. Anisomeles heyneana Benth. in N.Wallich, *Pl. Asiat. Rar.* 1: 59 (1830); *Anisomeles secunda* O.Kuntze, *Revis. Gen. Pl.* 2: 512 (1891), *nom. illeg.*; *Epimeredi secundus* Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944), *nom. illeg.* **Type:** India, undated, *B. Heyne s.n. [Wallich Cat. No. 2028]* (lecto [here designated]: K 001057386, image!).

Teucrium secundum Heyne, In *Numer. List [Wallich]* n. 2028 (1829), *nom. nud.*

Erect or spreading shrub, 1.2–3 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, sparse; stalked glandular hairs absent; sessile glands 8–16 mm². Cauline leaves 72–116 mm long, 30–38 mm wide, 2.4–3.1 times longer

than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate or serrate, irregular or regular, 12–22 on each side, acute, 0.5–2.3 mm deep; petioles 17–43 mm long, 24–37% of lamina length. Lamina upper surface indumentum appressed, eglandular, 0.6–0.7 mm long, sparse (hairs > 0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum erect or curved, eglandular, 0.6–0.8 mm long, confined to veins or sparse (hairs > 0.2 mm apart), sessile glands 48–128 mm²; transition from leaves to floral bracts abrupt. Floral bracts ovate, 3.5–14 mm long, 1.5–7.5 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial, with 4–8 flowers per monochasium, peduncles 8–39 mm long on lowermost cluster; bracteoles spathulate or linear, 2.5–4.8 mm long, 0.3–1.2 mm wide. Corolla tube same length as calyx; annulus 2.5–3.5 mm from base of corolla, annulus hairs 0.1–0.15 mm long; upper lip elliptical, 4.1–4.9 mm long, with eglandular hairs on outer surface; lower lip 5–5.5 mm long to end of lateral lobes, 9–10 mm long overall, glabrous on platform or with 1–20 eglandular hairs on platform. Longest stamens 11–12 mm long from base of corolla tube; filament hairs 0.7–1.1 mm long, mainly along middle part. Style 12–13 mm long; longer stigma lobe 0.6–0.8 mm long, shorter stigma lobe 0.15–0.5 mm long. Fruiting calyces 1.3–3 mm apart on rachilla; fruiting calyx cylindrical, 8–9.1 mm long, 3.7–4.5 mm wide at lobe apices, 1.9–2.2 times longer than wide, exterior surface with hairs of different sizes or types, hairs glandular and hairs eglandular, 0.4–0.9 mm long, sessile glands 48–112 mm²; lobes acute, 2.5–3 mm long. Fruiting calyx fringe hairs about the same length throughout or longer at sinus end than at apical end, 0.2–0.3 mm long at apical end, 0.2–0.8 mm long at sinus end, sinus hairs absent or present, inner surface of tube with sparse long hairs in medial section. Nutlets 1.8–2.1 mm long. **Figs. 4B, 9D.** *Western Hill catmint.*

***Additional specimens examined*: India.** Karjat, North Konkan, Jan 1949, *Fernandes 26* (A); near Dudh Sagor, Nov 1949, *Fernandes 5430* (K); Londa, Bombay Presidency, Jan 1950, *Fernandes 1012* (K); Nil-Gherries, 1857–58, *Perrottet* (G); Hosangadi, Karnataka State, Jan 1939, *Raja 6340* (MH); below Phonda Ghat, Jan 1853, *Ritchie 540* (E); near Kanheri Caves [between Thane & Borivali], Bombay presidency, Oct 1945, *Sinclair 4562* (E); Concan [Konkan], undated, *Stocks s.n.* (BRI, G, L, MH, NY, P).

***Distribution and habitat*:** *Anisomeles heyneana* is endemic to India. It occurs close to the west coast (Western Ghats), from Hosangadi to Mumbai (**Map 6**). None of the specimen labels include information on habitat; however, Efloraofindia (2007–2015) gives its habitat as "near forest clearing on hills and slopes".

***Phenology*:** Flowers are recorded for January, October, and November; fruits in January.

***Notes*:** Bentham, in the protologue, distinguished *Anisomeles heyneana* by the secund (one-sided) pedunculate inflorescences, the long ascending branches and the small leaves. It is true that in *A. heyneana*, one of the cymes at each verticil sometimes does not develop forming a secund inflorescence, but this is not a reliable difference.

Anisomeles heyneana is most likely to be confused with the sympatric *A. indica*, from which it differs by the narrower and often smaller leaves, the verticils all separated along the rachis, the long peduncle of the lower verticils, the white corolla, and the glabrous or sparsely hairy corolla platform.

***Conservation status*: Data Deficient**.

12. Anisomeles indica (L.) Kuntze, *Revis. Gen. Pl.* 2: 512 (1891); *Nepeta indica* L., *Sp. Pl.* 2: 571 (1753); *Epimeredi indicus* (L.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type:** Habitat in India (lecto: LINN 726.28, *fide* Cramer 1981).

Ballota disticha L., *Mant. Pl.* 1: 83 (1767); *Ajuga disticha* (L.) Roxb., *Hort. Bengal.* 44 (1814); *Anisomeles disticha* (L.) B.Heyne ex Roth, *Nov. Pl. Sp.*: 254 (1821); *Nepeta disticha* (L.) Blume, *Bijdr.* 823 (1826). **Type:** Habitat in India (lecto: LINN 737.7, *fide* Cramer 1981).

Monarda zeylanica Burm.f., *Fl. Ind. (N.L.Burman)* 12 (1768). **Type citation:** Habitat in Zeylona. **Types:** Ceylon, 1672–1677, *P. Hermann* (syn: BM 000621817); t. 71, J. Burman, *Thesaurus Zeylanica* (syn: the illustration).

Marrubium indicum Burm.f., *Fl. Ind. (N.L.Burman)* 127 (1768). **Type citation:** Habitat in Zeylona & Java. **Types:** Ceylon, 1672–1677, *P. Hermann* (syn: BM 000621817); t. 71, J. Burman, *Thesaurus Zeylanica* (syn: the illustration).

Nepeta amboinica L.f., *Suppl. Pl.* 273 (1782). **Type citation:** Habitat in Amboina. **Types:** Nepeta indica rotundiore folio, *Pl. Hist. Univ.*, pt. 3, p. 415 (1699) (syn: the illustration, *n.v.*).

Lamium garganicum Lour., *Fl. Cochinch.* 365 (1790), *nom. illeg.*, *non* L. (1763). **Type citation:** incultum in Cochinchina & China.

Ballota mauritiana Pers., *Syn. Pl. [Persoon]* 2: 126 (1806). **Type:** Isle de France, *P. Commerson s.n.* (syn: P, image!).

Anisomeles ovata R.Br. in W.T.Aiton, *Hortus Kew.* ed. 2, 3: 364 (1811), *nom. illeg.* [*Ballota disticha* L. cited in synonymy]. **Type:** probably a cultivated plant, *n.v.*

Anisomeles ovata var. *glabrata* Benth. in Wall., *Pl. Asiat. Rar.* 1: 59 (1830). **Types:** Nepal. Hetaundah, 13 December 1826, *N. Wallich s.n. [Wallich Cat. No. 2041]* (syn: K 000674248); India. Goalpara, 14 November 1808, *F. Buchanan-Hamilton s.n. [Wallich Cat. No. 2041]* (syn: K 000674247).

Anisomeles ovata var. *mollissima* Benth. in Wall., *Pl. Asiat. Rar.* 1: 59 (1830); *A. indica* var. *mollissima* (Benth.) Backer, *Fl. Java* 2: 624 (1965). **Type citation:** "Prome, Taong Dong et Sillet". **Type:** Bangladesh. Sylhet, *N. Wallich s.n. [Wallich Cat. No. 2039]* (syn: K [3 specimens]).

Phlomis alba Blanco, *Fl. Filip.* 474 (1837), *nom. illeg.*, *non* Forrsk. (1775).

Anisomeles cuneata J.Jacq. ex Fenzl, *Ecl. Pl. Rar.* 2: no. 27, t. 127 (1844). **Type:** the illustration, t. 127 (lectotype [here designated]).

Anisomeles malabarica var. *albiflora* Hassk., *Pl. Jav. Rar.:* 485 (1848); *Anisomeles albiflora* (Hassk.) Miq., *Fl. Ned. Ind.* 2: 976 (1859); *A. indica* var. *albiflora* (Hassk.) Backer, *Fl. Java* 2: 624 (1965). **Type:** not cited.

Anisomeles ovata var. *serratifolia* Miq., *Fl. Ind. Bat.* 2: 975 (1859). **Type:** Java, *C.L. Blume* (syn: ?L, *n.v.*); Borneo, *P.W. Korthals* (syn: ?L, *n.v.*).

Lophanthus argyi H.Lev., *Repert. Spec. Nov. Regni Veg.* 12: 181 (1913). **Type:** China. Kiang-sou [Jiangsu Sheng]: Zou-se, Vous-sie, Sou-Tcheou, undated, *P.C. d'Argy s.n.* (holo: E, fruiting material only).

Anisomeles tonkinensis Gand., *Bull. Soc. Bot. France* 65: 65 (1918). **Type:** Vietnam. Tonkin, ad Hanoi, August 1908, *A.C. D'Alleizette 184* (syn: P 04443001).

Erect or spreading shrub, 0.8–2 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, sparse to dense; stalked glandular hairs absent; sessile glands 8–64 mm². Cauline leaves 55–123 mm long, 27–76 mm wide, 1.3–2 times longer than wide, base obtuse or broadly cuneate (> 60°); marginal lobes crenate or dentate or serrate, irregular or regular, 11–22 on each side, acute or obtuse, 0.8–4 mm deep; petioles 12–40 mm long, 22–35% of lamina length. Lamina upper surface indumentum erect or curved, eglandular or appressed, eglandular 0.6–1.2 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–32 mm²; lower surface indumentum erect or curved, eglandular or appressed, eglandular 0.5–1.4 mm long, confined to veins or sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs <0.1 mm apart), sessile glands 8–64 mm²; transition from leaves to floral bracts abrupt or gradual. Floral bracts ovate, 7–15 mm long, 3–10 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all overlapping, forming continuous terminal inflorescence or overlapping near apex, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 3–5 flowers per monochasium, peduncles 0–10 mm long

on lowermost cluster; bracteoles spathulate or linear, 2.7–4.2 mm long, 0.2–0.5 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 3–4 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip elliptical, 4.9–6.4 mm long, with eglandular hairs on outer surface or glabrous; lower lip 4.4–7.5 mm long to end of lateral lobes, 10.2–11.8 mm long overall, with more than 100 eglandular hairs on platform. Longest stamens 13.5–17 mm long from base of corolla tube; filament hairs 0.9–1.5 mm long, mainly along middle part. Style 14–18 mm long; longer stigma lobe 0.6–0.9 mm long, shorter stigma lobe 0.4–0.8 mm long. Fruiting calyces 1–2 mm apart on rachilla; fruiting calyx obconical, 7.2–10.8 mm long, 5–7.5 mm wide at lobe apices, 1.3–2 times longer than wide, exterior surface with hairs of different sizes or types or with all hairs same size and type, hairs glandular or hairs eglandular, 0.6–2 mm long, sessile glands 16–96 mm^2; lobes attenuate or acute, 3–5 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.3 mm long at apical end, 0.15–0.3 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.7–1.9 mm long. **Figs. 4D, 7G, 9E.**

***Additional selected specimens examined*: Caribbean.** Seamens Valley, Portland, Jamaica, Feb 1920, *Maxon & Killip 72* (A). **Mauritius.** Ile de France, undated, *Commerson 263* (L). **Pakistan.** below the Lowari Pass, Sep 1895, *Gatacre 17411* (BM). **India.** Mawryngkneng, Khasi Hills, Assam, Oct 1951, *Chand 5035* (L); Dehra Dun and vicinity, Nov 1927, *Singh 287* (NY). **Sri Lanka.** Pitiduwa, Galle district, Oct 1971, *Cramer 3423* (L). **Maldives.** Hitaddu Islet, Sep 1964, *Sigee 116* (BM). **Nepal.** SE of Thagaon, above Bhotekoshi Nadi, Sep 2011, *Watson EKSIN14 et al.* (E). **Thailand.** Huay Bankau, Nov 1971, *Beusekom 3559 et al.* (L); Ban Bing Khong, Chiang Mai province, Oct 1987, *Maxwell 87-1309* (L). **Laos.** Along path to Ban Silia, Khammouan, Oct 2005, *Newman et al. LAO486* (E). **China.** Pak Shik Ling and vicinity, Oct 1932, *Lei 110* (NY); Dinghu Mountains, Oct 1963, *Ting & Shih 1078* (L). **Japan.** Miyako Island, Ryukyus, Jan 1940, *Naiko s.n.* (L). **Philippines.** MINDANAO: Zamboanga, Feb 1904, *Hallier 4619* (L). **Fiji.** Levuka, May 1923, *Greenwood 583* (BRI). **Indonesia.** JAVA: Buitenzorg, Oct 1922, *Bakhuizen van den Brink 1939* (L). SULAWESI: Minanga, Dec 1895, *Koorders 17361B* (L). LESSER SUNDA ISLANDS: Kada, Timor, Jul 1970, *Kooy 751* (L); Komodo Island, Jun 1982, *Verheijen 4921* (L). PAPUA: N of Andjai village, Kebar Valley, Nov 1954, *van Royen 5023* (L). **Australia.** Christmas Island, Stubbings Point, W side of South Point, Jun 1984, *Mitchell 32* (AD, CANB).

***Distribution and habitat*:** *Anisomeles indica* is a widespread and common species. It is indigenous in southern Asia, including Pakistan, India, Sri Lanka, Maldives, Nepal, Bhutan, Bangladesh, Burma, Thailand, Laos, Malaysia, Vietnam, China, Taiwan, Japan, Philippines and Indonesia (including Papua). From its eastern extent, the Ryukyu Islands of southern Japan, it extends west to Pakistan, north to the foothills of the Himalayas, and south to Java and Christmas Island, the latter being an external territory of Australia (**Map 4**). It grows on a wide range of habitats from steep mountain slopes to alluvial flats, and on sandy or clayey soils.

The African Plants Database (APD 2013) states that *A. indica* is naturalized in Madagascar. Hedge (1998) cited two specimens for Madagascar, commenting that "Perhaps *A. indica* is present in Madagascar, but this has never been confirmed, even as an introduced species". Baker (1877) stated that the occurrences of *A. ovata* (=*A. indica*) on nearby Mauritius were naturalisations. Naturalised populations also occur at Fiji, Samoa, Trinidad and Jamaica.

***Phenology*:** Flowers and fruits have been recorded from every month of the year.

***Nomenclature*:** Govaerts *et al.* (2013) have listed *Anisomeles cuneata* as a synonym of *A. malabarica*. However, the very good illustration in the protologue undoubtedly depicts *A. indica*. The protologue states that the plant originated in India, and seeds (sent from England) were raised at Vienna botanical garden. No specimen matching the protologue is present at W (A. Löckher, pers. comm. July 2013). In the absence of a specimen, the illustration in the protologue is considered the type of the name. Fenzl's name appears after the descriptive paragraph, indicating that he wrote the validating description, though he credits Jacquin with the species epithet.

The Rheede syntype of *Nepeta amboinica* is referable to *Anisochilus carnosus* (L.f.) Wall. (Suddee & Paton 2009).

***Notes*:** *Anisomeles indica* is a very widespread species and is accordingly very variable. It is most readily recognised by its obconical fruiting calyces, which are usually considerably less than twice as long as they are wide. All other species have fruiting calyces that are cylindrical or at most narrowly campanulate. The calyx fringe hairs of *A. indica* are very short throughout, in contrast to all other Asian species.

The syntypes of *A. indica* var. *mollissima* possess a much denser indumentum and more numerous leaf lobes than the type of *A. indica*, and on that basis it is tempting to recognise it as a distinct species, but it is possible to find *A. indica* specimens with a range of indumentum densities and leaf lobe numbers, so that recognition even at varietal rank seems unwise. Furthermore, the tomentose specimens seem to have no 'core' distribution; they occur in Nepal, eastern India and Sumatra.

From my study of herbarium specimens, I conclude that the variation in fruiting calyx size, leaf size and shape, flower size, and indumentum density for *A. indica* appears to be continuous, and hence no infraspecific taxa are proposed. However, a careful field-based study may yet find that distinct taxa exist.

***Conservation status*: Least Concern**.

13. Anisomeles inodora R.Br., *Prodr. Fl. Nov. Holl.* 503 (1810); *Anisomeles salviifolia* var. *denudata* Domin, *Repert. Spec. Nov. Regni Veg.* 12: 98 (1913), *nom. illeg.*; *A. salviifolia* var. *inodora* (R.Br.) Domin, *Biblioth. Bot.* 89: 567 (1928); *Epimeredi inodorus* (R.Br.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type:** [Australia: Northern Territory]. Arnhem North Bay [Melville Bay], 14 February 1803, *R. Brown s.n. [Bennett Number 2356]* (lecto: BM 001041066 [here designated]; isolecto: BM 001041067, E 00649578).

Procumbent or erect to spreading shrub, 0.6–2 m high. Upper stems and rachises without patent hispid hairs, or rarely with patent hispid hairs; short curved hairs retrorse, sparse or moderately dense; stalked glandular hairs absent; sessile glands 48–112 mm². Cauline leaves 38–115 mm long, 12–43 mm wide, 1.9–3.4 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or serrate, irregular or regular, 7–24 on each side, obtuse, 0.5–3 mm deep; petioles 7–42 mm long, 20–60% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.15–0.25 mm long, confined to midrib or sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum erect or curved, eglandular, 0.15–0.25 mm long, confined to veins or sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 80–144 mm²; transition from leaves to floral bracts abrupt. Floral bracts lanceolate or elliptical, 9–31 mm long, 3–11 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 3–14 flowers per monochasium, peduncles 0–19 mm long on lowermost cluster; bracteoles spathulate or linear, 2.7–5.8 mm long, 0.3–1.1 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 2.3–3.3 mm from base of corolla, annulus hairs 0.25–0.3 mm long; upper lip elliptical, 4.8–5.8 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface; lower lip purple or pink, 6.3–7.6 mm long to end of lateral lobes, 11.7–13.6 mm long overall, glabrous on platform. Longest stamens 11.5–12.5 mm long from base of corolla tube; filament hairs 0.8–1.5 mm long, mainly at distal end. Style 12.5–13.5 mm long; longer stigma lobe 0.7–0.8 mm long, shorter stigma lobe 0.45–0.55 mm long. Fruiting calyces 1.3–3.8(–12) mm apart on rachilla; fruiting calyx cylindrical, 7–9.3 mm long, 3.1–3.5 mm wide at lobe apices, 2.1–2.9 times longer than wide, exterior surface with hairs of different sizes or types or with all hairs same size and type, hairs glandular or hairs eglandular, 0.1–0.9 mm long, sessile glands 112–208 mm²; lobes acute, 1.5–2.8 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.15–0.3 mm long at apical end, 0.6–1.1 mm long at sinus end, sinus hairs absent, inner

surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.8–2.2 mm long. **Figs. 4C, 9F.**

***Additional selected specimens examined*: Australia: Western Australia**. Mitchell Plateau, N of mining camp, Aug 1978, *Beauglehole 59057 & Errey* (PERTH); Mt Barnett, Jun 1905, *Fitzgerald 1093* (PERTH); 17 km from camp towards Pt Warrender, Mitchell Plateau, Apr 1982, *Keighery 4824* (PERTH); Camp Creek, near bauxite crusher, Mitchell Plateau, Jan 1982, *Kenneally 7987* (PERTH); N end of Bougainville Peninsula separating Admiralty Gulf and Vansittart Bay, Apr 1982, *Kenneally 8091* (AD, K, PERTH); 21 km N of mining camp, Mitchell Plateau, May 1982, *Kenneally 8194* (PERTH); Cape Anjo, Jul 1973, *Wilson 11296* (PERTH). **Northern Territory**. Nhulunbuy, Gove Peninsula, Jun 1982, *Hinz 134* (DNA); Cape Arnhem, Mar 1995, *Barritt 1729* (DNA, MEL); 5 km NNE of Gwapilina Point, Port Bradshaw, Feb 1994, *Brennan 2478* (DNA); Truant Island, English Company Islands, Jul 1992, *Leach 3012* (BRI, DNA); Black Point, Cobourg Peninsula, May 1983, *Wightman 402* (BRI, CANB, DNA, MEL); Latram River, NE Arnhem Land, Feb 1988, *Wightman 4163* (BRI, DNA, MEL); Giddy River crossing, Nhulunbuy area, May 1989, *Wightman 4706* (BRI, DNA). **Queensland**. Cook District: near Little Laura River, SSW of Laura, Jul 1990, *Bean 1681* (BRI); Newcastle Bay, 2.5 miles [4 km] S of Somerset, May 1948, *Brass 18756* (A, BRI, L); 10.2 km S of Batavia Downs on the Peninsula Development Road, Apr 1990, *Clarkson 8432 & Neldner* (BRI); Cape Melville NP, 8 km SSW of Cape Melville, Jul 1993, *Fell DGF3364 & Stanton* (BRI, CANB); 102 km NW of Coen, boundary of Archer Bend NP and Merluna Holding, Jun 1994, *Fell DGF4413 & Buck* (BRI); Batavia Downs, 7.2 km W by road of Bromley HS, towards Moreton Telegraph Station, Jun 2007, *Forster PIF32757 & McDonald* (BRI, NSW); Normanby Holding, Duffers Creek catchment, N of Battle Camp Road, Jun 2007, *Forster PIF32933* (BRI); Snake Creek, Gulf of Carpentaria, 35 km NNW of Delta Downs HS, Jun 2003, *Fox IDF1791* (BRI); Hammond Island, Jul 1974, *Heatwole 207 & Cameron* (BRI); *c.* 18 km W of Cholmondeley Creek crossing, on Telegraph Line road, Mar 1992, *Johnson 5162* (BRI, NSW); Middle Creek ridge, Errk Oykangand NP, Jun 2010, *McDonald KRM9440 & Little* (BRI); Running Creek Nature Refuge. Scrubby Lagoon, Jun 2013, *McDonald KRM14501* (AD, BRI); Pormpuraaw, Chapman Point camping ground, 1.9 km S of township, May 2009, *McKenna SGM512* (BRI, CANB, CNS); Weipa, edge of Lake Patricia vine scrub, Mar 1980, *Morton AM680* (BRI); Chuula Outstation, Kaanju Nation, central Cape York, May 2005, *Smith 4862 & Claudie* (BRI); Roberts Creek, Squatter camp, Weipa, Apr 2008, *Stephensen KFS38* (BRI, CANB); Rutland Plains, near mouth of Mitchell River, Jun 1943, *Whitehouse s.n.* (BRI [AQ160159]).

***Distribution and habitat*:** *Anisomeles inodora* occurs in the northern Kimberley area of Western Australia, in coastal parts of the 'Top End', Northern Territory, and throughout Cape York Peninsula in Queensland (**Map 7**). It inhabits sandy soils in open eucalypt woodland and forest, and occasionally on sandstone outcrops.

***Phenology*:** Flowers from February to October; fruits from April to October.

***Notes*:** This species is allied to *Anisomeles moschata*, but differs by the shorter leaf hairs, the sparser indumentum on the lower leaf surface, the longer lower lip of the corolla, the glabrescent stems and calyces glabrous or with a few hairs along the ribs.

Specimens from the Laura region of Queensland have particularly widely spaced flowers and fruits and quite narrow leaves, but from herbarium study, I am unsure whether there is a discontinuity between this form and typical *A. inodora*. Specimens from the Kimberley region of Western Australia also have widely spaced flowers and fruits and narrow leaves, and they have shorter calyx fringe-hairs than the typical form. Further study may reveal that a taxonomic distinction is warranted for these populations.

***Conservation status*: Least Concern**.

14. Anisomeles languida A.R.Bean **sp. nov.** habitu prostrato, praesentia pilorum hispidorum patentium in caulibus superioribus, pilis 1–2.4 mm longitudine foliis calycibusque insidentibus, in pagina superiore folii appressis, calycibus fructificantibus late dispositis et labio inferiore corollae glabro distinguitur. **Typus:** Australia: Queensland. Cook District: Isabella Falls, Battlecamp Road, NW of Cooktown, 7 June 2013, *K.R. McDonald KRM14297* (holo: BRI; iso: MEL, NSW).

Prostrate shrub, 0.1–0.2 m high. Upper stems and rachises with patent hispid hairs; short curved hairs retrorse, sparse or moderately dense; stalked glandular hairs absent; sessile glands 8–64 mm². Cauline leaves 55–78 mm long, 27–37 mm wide, 1.9–2.4 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate, irregular or regular, 12–16 on each side, acute or obtuse, 0.6–1.8

mm deep; petioles 11–30 mm long, 18–45% of lamina length. Lamina upper surface indumentum appressed, eglandular, 1–2 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 32–96 mm²; lower surface indumentum erect or curved, eglandular or appressed, eglandular 1–1.6 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 64–128 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical or ovate, 6–27 mm long, 2.5–10 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 4–9 flowers per monochasium, peduncles 0–5.5 mm long on lowermost cluster; bracteoles spathulate, 2.5–6.7 mm long, 0.3–0.8 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 2.5–3.2 mm from base of corolla, annulus hairs 0.15–0.2 mm long; upper lip elliptical, 4–5.1 mm long, with eglandular hairs on outer surface; lower lip purple or pink, 5.6–6.9 mm long to end of lateral lobes, 11–14.5 mm long overall, glabrous on platform. Longest stamens 11.5–13.5 mm long from base of corolla tube; filament hairs 1.1–1.5 mm long, mainly along middle part or mainly at distal end. Style 11.5–14 mm long; longer stigma lobe 0.6–0.8 mm long, shorter stigma lobe 0.4–0.45 mm long. Fruiting calyces 1.7–4.4 mm apart on rachilla; fruiting calyx narrowly campanulate or cylindrical, 6.9–9 mm long, 3.2–4.3 mm wide at lobe apices, 2.1–2.4 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 1.1–2.4 mm long, sessile glands 16–96 mm²; lobes acute, 1.8–3.1 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.25 mm long at apical end, 0.15–0.4 mm long at sinus end, sinus hairs absent, inner surface of tube with sparse long hairs in medial section or glabrous. Nutlets 2.1–2.4 mm long. **Figs. 1A, 1B, 2A, 4E, 9G**.

***Additional specimens examined*: Australia: Queensland.** Cook District: Isabella Falls, near Cooktown, May 1970, *Blake 23444* (BRI, CANB, L, MEL, PERTH); Lockerbie, 10 miles [16 km] WSW of Somerset, Apr 1948, *Brass 18404* (BRI, CANB, L); Bridge Creek Holding (proposed NP), upper Bridge Creek catchment, NW of Cooktown, Apr 2010, *Forster PIF36462 & Thomas* (BRI); Bridge Creek Holding (proposed NP), S of Battle Camp road, NW of Cooktown, May 2010, *Forster PIF36860 & Thomas* (BRI); Cape Melville NP, Nookai Creek, May 2014, *McDonald KRM15738* (BRI, NSW); Big Fish Camp waterhole, Silver Plains station, Jun 2014, *McDonald KRM16018* (BRI, DNA, MEL).

***Distribution and habitat*:** *Anisomeles languida* is endemic to Queensland. It occurs in four disjunct areas of Cape York Peninsula, viz. Battle Camp road near Cooktown, Cape Melville, Silver Plains, and Lockerbie (**Map 2**). It grows in riparian woodland, or its margin with *Eucalyptus* woodland on sandstone or granite hillslopes.

***Phenology*:** Flowers have been recorded from April to June; fruits in May and June.

***Notes*:** *Anisomeles languida* is distinguished by the prostrate habit, the presence of patent hispid hairs on the upper stems, the hairs 1–2.4 mm long on leaves and calyces, the hairs appressed on the upper leaf surface, the widely spaced fruiting calyces, and the glabrous platform of the corolla.

***Conservation status*: Least Concern**.

***Etymology*:** From the Latin *languidus*, meaning listless or weary. This is an oblique reference to the prostrate habit of the plant; it seems too weary to battle against gravity.

15. Anisomeles lappa A.R.Bean **sp. nov.** habitu prostrato vel procumbente, pilis hispidis crebris caulibus insidentibus, foliis basalibus paribus 4–10 loborum marginalium praeditis, monochasiis paucifloris et bracteis floralibus longitudine verticillos superantibus distinguitur. **Typus:** Australia: Queensland. Cook District: 1 km S of Lappa on Mt Garnet Road, 12 April 2005, *P.I. Forster PIF30742 & K.R. McDonald* (holo: BRI; iso: MEL, NSW).

Anisomeles salviifolia var. *tomentoso-hirsuta* Domin, *Biblioth. Bot.* 89: 567 (1928). **Type:** Australia: Queensland. Cook District: Walsh River near Chillagoe, February 1910, *K. Domin s.n.* (holo: PR 530817).

Prostrate or procumbent shrub, 0.15–0.5 m high. Upper stems and rachises with

patent hispid hairs; short curved hairs retrorse, moderately dense or dense; stalked glandular hairs absent; sessile glands 8–80 mm². Cauline leaves 26–49 mm long, 12–25 mm wide, 2–3.3 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate or serrate, irregular or regular, 4–10 on each side, acute or obtuse, 0.9–1.5 mm deep; petioles 4–13 mm long, 11–33% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.4–1 mm long, sparse (hairs < 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–64 mm²; lower surface indumentum erect or curved, eglandular, 0.4–0.7 mm long, confined to veins or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 64–112 mm²; transition from leaves to floral bracts gradual. Floral bracts 16–46 mm long, 8–17 mm wide, consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial, with 3–7 flowers per monochasium, peduncles 1–6 mm long on lowermost cluster; bracteoles obovate or spathulate, 4–13 mm long, 0.7–5 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 2.2–3 mm from base of corolla, annulus hairs 0.1–0.3 mm long; upper lip ovate or elliptical, 4.1–6.2 mm long, with glandular hairs on outer surface; lower lip 6.2–7.7 mm long to end of lateral lobes, 14–15.5 mm long overall, glabrous or with 1–20 eglandular hairs on platform. Longest stamens 13–15 mm long from base of corolla tube; filament hairs 0.9–1.3 mm long, mainly at distal end. Style 13–15 mm long; longer stigma lobe 0.65–0.8 mm long, shorter stigma lobe 0.45–0.5 mm long. Fruiting calyces 1–2 mm apart on rachilla; fruiting calyx cylindrical, 7–10 mm long, 4.3–5.5 mm wide at lobe apices, 1.7–2.5 times longer than wide, exterior surface with hairs of different sizes or types or with all hairs same size and type, hairs eglandular, 0.4–1.9 mm long, sessile glands 32–96 mm²; lobes acute, 2–3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.3 mm long at apical end, 0.15–0.25 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 2.1–2.5 mm long. **Figs. 4F, 7E, 9H.**

***Additional selected specimens examined*: Australia: Queensland.** Cook District: Alma-den, undated, *Bick 176* (BRI); Springmount Station, *c.* 13 km from the Mareeba – Dimbulah Road, on the road to Collins Weir, Apr 1983, *Clarkson 4664* (BRI, CNS, DNA, K, MEL, MO, PERTH); 10 km from Alma-den on road to Mt Surprise, Jan 1992, *Forster PIF9593* (BRI); 16 km from Mt Garnet on road to Lappa, 1 km past Mt Cardwell turnoff, Jan 1993, *Forster PIF12777 & Bean* (BRI, CNS, MEL); Pannikin Springs area, 29 km W of Mungana, Jan 1993, *Forster PIF13013 & Bean* (BRI, DNA); Copperfield River, Kidston Goldmine water supply dam, Gilbert Range, Feb 1994, *Forster PIF14902 & Bean* (BRI, CNS, MEL); Donkey Spring Creek, Bulleringa NP, 80 km NW of Mt Surprise, Apr 1998, *Forster PIF22414 & Booth* (BRI); Stannary Hills, 11 km S of Mutchilba, Portion 603, May 2006, *Forster PIF31593 & McDonald* (BRI); Chillagoe, Jan 1931, *Hubbard 6815 & Winders* (BRI); Kent Holdings, W of road from Mt Garnet to Minnamoolka, May 1999, *Jago 5239 & Wannan* (BRI); 1 km from Walsh River crossing, N of Chillagoe, Mar 2000, *McDonald KRM329* (BRI); near Barwidgi Road turnoff, S of Mt Garnet, Apr 2004, *McDonald KRM2176 & Covacevich* (BRI); 51 km along Alma-den road from junction with Gulf Development Road, near Mt Surprise, May 2004, *McDonald KRM2596* (BRI); Undara NP, 5.1 km along northern boundary firebreak with St Ronan's station, Dec 2006, *McDonald KRM6032* (BRI); Gorge Creek, Mareeba, Apr 1962, *McKee 9257* (CANB); Pinnacle Springs Road, 4 km W from Kennedy Highway, Apr 2004, *Purdie 5924* (BRI, CANB); 2 km downstream of junction of Graves and Fulford Creeks, Burlington Station, N of Mt Surprise, Jun 1999, *Thompson SLT2467 & Newton* (BRI); 100 mile swamps, 'Rosella Plains', Jul 1981, *Williams 81134* (BRI). North Kennedy District: 12 km along Deadmans Road, off Silver Valley Road, Feb 1996, *Forster PIF18415 & Ryan* (BRI, CNS, NSW); *c.* 1.2 km ESE of Hidden Valley township, Paluma Road, Feb 2000, *Pollock ABP853 & Edginton* (BRI).

***Distribution and habitat*:** *Anisomeles lappa* is endemic to Queensland. It is found in the north-east of the state, including the western parts of the Atherton Tableland, Bulleringa NP, Alma-den, and Undara NP (**Map 2**). It grows in eucalypt woodland. Almost all records are from granite hills or sandy soils adjacent to granite outcrops.

***Phenology*:** Flowers and fruits are recorded from December to July inclusive.

***Notes*:** *Anisomeles lappa* can be distinguished by the prostrate or procumbent habit, the abundant patent hispid hairs on flowering stems, the short cauline leaves, and the long

lower lip of the corolla. It may be distinguished from the geographically close species *A. moschata* by the prostrate to procumbent habit, the floral bracts exceeding the verticils, and the calyx fringe hairs only 0.15–0.25 mm long at sinus end.

***Conservation status*: Least Concern**.

***Etymology*:** The epithet refers to the locality of Lappa, a railway siding near the township of Petford, near where the type was collected. It is used as a noun in apposition.

16. Anisomeles leucotricha A.R.Bean **sp. nov.** foliis ellipticis praeditis tomento brevi albo, verticillis omnino vel partim superpositis, pilis marginalibus longis loborum calycis, pilis 1–20 labio inferiori corollae insidentibus et bracteis floralibus parvis distinguitur. **Typus:** Australia: Northern Territory. 3.4 km S of Goodparla airstrip (abandoned), Kakadu National Park, 29 April 1990, *A.V. Slee & L.A. Craven 3034* (holo: DNA; iso: CANB).

Erect or spreading shrub, 0.7–1.5 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, sparse or moderately dense; stalked glandular hairs absent; sessile glands 16–112 mm². Cauline leaves 48–97 mm long, 13–43 mm wide, 2.2–3.7 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes crenate, regular, 15–37 on each side, obtuse, 0.6–1.5 mm deep; petioles 10–26 mm long, 12–29% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.15–0.3 mm long, sparse (hairs > 0.2 mm apart), sessile glands 8–32 mm²; lower surface indumentum erect or curved, eglandular, 0.2–0.3 mm long, dense (hairs < 0.1 mm apart), sessile glands 64–112 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical, 3.5–25 mm long, 1–9 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all overlapping, forming continuous terminal inflorescence or overlapping near apex, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 2–9 flowers per monochasium, peduncles 0–12 mm long on lowermost cluster; bracteoles linear, 2.8–4.5 mm long, 0.2–0.4 mm wide. Corolla tube longer than calyx, or same length as calyx, or shorter than calyx; annulus 2.5–3.2 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip elliptical, 3.9–5.2 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface or glabrous; lower lip 5.6–6.5 mm long to end of lateral lobes, 8.8–12.3 mm long overall, with 1–20 eglandular hairs on platform. Longest stamens 11–12 mm long from base of corolla tube; filament hairs 0.9–1.5 mm long, mainly at distal end. Style 11–12 mm long; longer stigma lobe 0.75–0.85 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 0.8–1.2 mm apart on rachilla; fruiting calyx cylindrical, 7.2–9.3 mm long, 3.1–3.6 mm wide at lobe apices, 2.1–2.9 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.25–0.5 mm long, sessile glands 80–128 mm²; lobes acute, 2.5–3.7 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.7–1.4 mm long at apical end, 1–1.5 mm long at sinus end, sinus hairs present, inner surface of tube glabrous. Nutlets 1.9–2.3 mm long. **Figs. 4G, 10A**.

***Additional selected specimens examined*: Australia: Northern Territory**. Bukbuk Hill, near Arnhem Highway, 4–5 km E of Kapalga turnoff, Feb 1991, *Brennan Bre995* (DNA); Kakadu NP, fire plot 202, Jabiluka Outlier, Mar 1999, *Brennan 3752* (DNA); Litchfield Road, 2 miles [3 km] from HS, Apr 1967, *Byrnes N237* (DNA, NT); 3 miles [5 km] W of, and 8 miles [13 km] S of, Adelaide River township, Jan 1972, *Byrnes & McKean B259* (DNA); Kakadu Highway, Nellie Creek Range, Mar 1987, *Clark 882* (CANB, DNA); Tipperary Station, Jun 1990, *Clark 2347* (DNA); 13 miles [21 km] SE of Darwin, May 1958, *Chippendale 4443* (BRI, DNA); 13 miles [21 km] W of Burrundie, Mar 1961, *Chippendale 7629* (DNA, MEL); Port Essington, S of Wangewanga Cove, Apr 1993, *Cowie 3356* (DNA); Port Essington, in 1819, *Cunningham 270* (MEL); Melville Island, SE coast, Apr 1992, *Fensham 1280* (DNA); Shoal Bay, 34 km NE of Darwin, Apr 1992, *Halford Q1101* (BRI, DNA); Port Darwin, undated, *Holtze 54* (MEL); Mary River Station, Mar 2001, *Liddle 2605* (DNA); Bathurst Island, Nguiu Forestry Suburb, May 1998, *Michell & Risler 1520* (DNA); 0.5 miles [0.8 km] N of CSIRO block, Tipperary, May 1963, *Muspratt SSO610* (DNA); 2.5 miles [4.0 km] W of Mud Spring, May 1963, *Muspratt SSO542* (DNA); 10 miles [16 km] out from Daly River, Feb 1964, *Robinson R79* (DNA, NT); Koolpinyah Station, 1 km S of Banka's Jungle, Mar 1990, *Taylor SMT12* (DNA); Jindare Station, Stray Creek catchment, Jun 2010, *Westaway 3251* (B, DNA, MO); White Cliffs beach, west of airstrip, Croker Island, Mar

2013, *Westaway JOW4142* (BRI, CANB, DNA); Bynoe Harbour, *c.* 200 m from MacKenzie Arm boat ramp off Barramundi Drive, Mar 2006, *Wirf 247* (DNA).

***Distribution and habitat*:** *Anisomeles leucotricha* is endemic to the Northern Territory, from Melville Island to Kakadu NP and Litchfield NP (**Map 3**). It grows on a variety of habitats, including vine thicket on foreshore, open woodland with *Corymbia foelscheana* (F.Muell.) K.D.Hill & L.A.S.Johnson and/or *Erythrophleum chlorostachys* (F.Muell.) Baill. on hills. Substrate is quaternary sand or sandstone.

***Phenology*:** Flowers are recorded from January to July; fruits between April and July.

***Notes*:** *Anisomeles leucotricha* is distinguished by the elliptical leaves with an attenuate base and a short even indumentum, the exceptionally long calyx fringe hairs, the closely arranged fruiting calyces (0.8–1.2 mm apart), the adjacent verticils sometimes overlapping to form a dense cluster, and the tiny floral bracts. The leaves have many crenate lobes. The lower leaf surfaces have short antrorse hairs, very often conspicuously white, especially along the veins.

This species possibly intergrades with *A. brevipilosa* to the east of (and west of) Katherine, as some specimens from these areas are difficult to allocate to either species.

***Conservation status*:** Least Concern (IUCN 2012).

***Etymology*:** The epithet is from the Greek *leucos* – white, and *trichos* – hair or trichome. In this species, the hairs on the underside of the leaf are frequently conspicuously white, especially along the veins.

17. Anisomeles macdonaldii A.R.Bean **sp. nov.** abundantia pilorum glandularium et absentia pilorum eglandularium retrorsorum caulibus insidentibus, foliis basalibus latis basi obtusa et petiolo longo (longitudine 32–54% laminae aequante) praeditis distinguitur. **Typus:** Australia: Queensland. Cook District: *c.* 8 km by road E of Chillagoe, 21 April 2013, *K.R. McDonald KRM14083 & G.P. Guymer* (holo: BRI; iso: MEL, *distribuendi*).

Anisomeles salviifolia var. *hispida* Domin, *Biblioth. Bot.* 89: 567 (1928). **Type:** Australia: Queensland. Cook District: Smelling Bluff near Chillagoe, February 1910, *K. Domin s.n.* (syn: PR 530815); limestone hill near Chillagoe, February 1910, *K. Domin s.n.* (syn: PR 530816).

Erect or spreading shrub, 0.4–2 m high. Upper stems and rachises with patent hispid hairs; short curved hairs absent or retrorse, sparse to moderately dense; stalked glandular hairs abundant; glandular hairs extending to lower stems; sessile glands 8–80 mm². Cauline leaves 51–91 mm long, 32–63 mm wide, 1.2–1.9 times longer than wide, base obtuse or broadly cuneate (> 60°); marginal lobes crenate or dentate, regular, 10–18 on each side, acute or obtuse, 0.9–2.4 mm deep; petioles 19–40 mm long, 32–54% of lamina length. Lamina upper surface indumentum of erect glandular and curved eglandular hairs, 0.15–1.3 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–48 mm²; lower surface indumentum of erect glandular and curved eglandular hairs, 0.15–1.3 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–80 mm²; transition from leaves to floral bracts gradual. Floral bracts ovate or broadly ovate, 14–47 mm long, 11–28 mm wide, not consistently exceeding verticils or consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 4–11 flowers per monochasium, peduncles 2–28 mm long on lowermost cluster; bracteoles spathulate or linear, 2.5–5.5 mm long, 0.4–1.1 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 3–3.4 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip ovate or elliptical, 5.8–6.7 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface; lower lip pink, 8.2–9 mm long to end of lateral lobes, 14–16.5 mm long overall, with 1–20 or 20–100 eglandular hairs on platform. Longest stamens 12.8–13.5 mm long from base of corolla tube; filament hairs 1.3–1.6 mm long, mainly at distal end. Style 12.8–14

mm long; longer stigma lobe 0.65–0.75 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 1–7 mm apart on rachilla; fruiting calyx cylindrical, 7.4–10 mm long, 3–4.8 mm wide at lobe apices, 2.1–2.7 times longer than wide, exterior surface with hairs of different sizes or types, hairs glandular and eglandular, 0.8–1.3 mm long, sessile glands 8–48 mm²; lobes acute, 1.8–3.2 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.25 mm long at apical end, 0.15–0.3 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.8–2.3 mm long. **Figs. 1D, 4H, 10B.**

***Additional specimens examined*: Australia: Queensland.** Cook District: McDonald Creek area, 42 km from Mt Surprise township, Mt Surprise Gemfield, Apr 1985, *Champion 135* (BRI); Mt Mulligan, between the abandoned mine site and the falls on Richards Creek along the water supply pipeline, Apr 1984, *Clarkson 5272* (BRI, MEL); Royal Arch Tower, *c.* 5 km SW of Chillagoe, Mar 1987, *Clarkson 6832 & McDonald* (BRI, DNA, L, NSW, PERTH); Near Royal Arch Cave, Chillagoe, Jun 1992, *Fensham 243* (BRI); on Chillagoe Road, 14 km from Almaden, Mar 1990, *Forster PIF6524* (BRI, CNS, DNA); Mt Pinnacle, SSW of Dimbulah, Jan 1993, *Forster PIF12952 & Bean* (BRI); Bridle Logging Area, SF 607 Dinden, Jul 1995, *Forster PIF17353 et al.* (BRI); NE slopes of Hann Tableland above the Southedge HS, Jul 2002, *Fox IDF1648* (BRI); on a bench alongside the water-supply pipeline between Ngarrabullgan and the Mt Mulligan HS, Jul 2003, *Fox IDF2072* (BRI); Mungana, Aug 1995, *Hyland 15355* (BRI); *c.* 1.9 km ENE of Mt Carbine, *c.* 1.7 km along Mt Spurgeon road, Apr 2013, *Jensen 2801 & Kemp* (BRI, CANB); Pinchgut Hill, NE of Chillagoe, Mar 2005, *McDonald KRM3899 & Little* (BRI); Chillagoe, Jan 1918, *Michael 289* (BRI); Mt Mulligan, 40 km NW of Dimbulah, Apr 1989, *Neldner 2758* (BRI). North Kennedy District: NW of Pear Rock, Mt Stewart Range, 'Allandale', May 1995, *Forster PIF16624 & Figg* (BRI); 9.5 km W of Homestead, 83 km SW of Charters Towers, Aug 1992, *Thompson CHA196 & Sharpe* (BRI).

***Distribution and habitat*:** *Anisomeles macdonaldii* is endemic to Queensland. It is found in several disjunct populations from Mt Carbine to Chillagoe, with disjunct occurrences near Mt Surprise and Pentland. It appears to be especially prevalent around limestone outcrops near Chillagoe (**Map 1**). It grows in low eucalypt woodland or on the margins of vine thicket. The substrate can be granite, limestone or sandstone.

***Phenology*:** Flowers and fruits are recorded from January to August inclusive.

***Notes*:** *Anisomeles macdonaldii* is distinguished by the broad cauline leaves, the abundant stalked glandular hairs on the stems, and the abundant patent hispid hairs on the stems.

***Conservation status*: Least Concern**.

***Etymology*:** Named for Keith Raymond McDonald (b. 1950), an expert on the taxonomy and identification of many faunal groups, especially frogs, and for the last 15 years, an avid plant collector. He has increased our knowledge of Queensland plant species considerably through his many high-quality specimens, and has discovered or rediscovered a number of species.

18. Anisomeles malabarica (L.) R.Br. in Sims, *Bot. Mag.* 46: t. 2071 (1819); *Nepeta malabarica* L., *Mant. Pl. Altera* 566 (1771); *Ajuga fruticosa* Roxb., *Hort. Bengal.* 44 (1814), *nom. illeg.*; *Epimeredi malabaricus* (L.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type:** Herb. Linn. no. 726.26 (lecto: LINN, *fide* Cramer 1981).

Nepeta pallida Salisb., *Prodr. Stirp. Chap. Allerton* 78 (1796), *nom. illeg.* (*Nepeta malabarica* L. cited in synonymy).

Stachys mauritianus Pers., *Syn. Pl. [Persoon]* 2(1): 123 (1806); *Craniotome mauritianum* (Pers.) Bojer, *Hortus Maurit.* 249 (1837). **Types:** Isle de France, undated [June 1769], *P. Commerson s.n.* (syn: P 00541421; P 00541422; P 04359606).

Erect or spreading shrub, 0.9–1.5 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent. Cauline leaves 47–90 mm long, 13.5–32 mm wide, 2.8–3.6 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes serrate, regular, 14–29 on each side, acute or obtuse, 0.2–0.9 mm deep; petioles 9–13 mm long, 14–21% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.4–1.2 mm long, moderately dense (hairs 0.1–0.2 mm apart) or

dense (hairs < 0.1 mm apart), sessile glands 8–48 mm²; lower surface indumentum lanate, tangled or erect or curved, eglandular, 0.9–1.2 mm long, very dense, obscuring surface at ×40 magnification; transition from leaves to floral bracts abrupt. Floral bracts lanceolate or elliptical, 6–17 mm long, 2–5 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all overlapping, forming continuous terminal inflorescence or overlapping near apex, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 5–14 flowers per monochasium, peduncles 0–1 mm long on lowermost cluster; bracteoles linear, 4.2–6.5 mm long, 0.3–0.5 mm wide. Corolla tube shorter than calyx; annulus 3.5–4.2 mm from base of corolla, annulus hairs 0.1–0.15 mm long; upper lip elliptical, 4.5–5.2 mm long, with eglandular hairs on outer surface; lower lip 5–5.4 mm long to end of lateral lobes, 8.5–10.7 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 13–14 mm long from base of corolla tube; filament hairs 0.4–0.6 mm long, mainly along middle part. Style 13–13.5 mm long; longer stigma lobe 0.7–1 mm long, shorter stigma lobe 0.3–0.5 mm long. Fruiting calyces 1.5–2.2 mm apart on rachilla; fruiting calyx cylindrical, 8–12.2 mm long, 2.8–3.7 mm wide at lobe apices, 3–4.3 times longer than wide, exterior surface with hairs of different sizes or types, hairs glandular and eglandular, 1.2–1.5 mm long, sessile glands 8–16 mm²; lobes attenuate, 3.1–5.3 mm long. Fruiting calyx fringe hairs about the same length throughout or longer at sinus end than at apical end, 0.3–0.6 mm long at apical end, 0.5–0.7 mm long at sinus end, sinus hairs present, inner surface of tube with dense ring of long hairs in medial section. Nutlets 1.9–2.2 mm long. **Figs. 4I, 10C.** *Malabar catmint.*

***Additional specimens examined*: India.** San Thome, in 1856, *Cleghorn s.n.* (E); Kulasegaram, S. Travancore, Feb 1934, *Erlanson 5378* (NY); Pondicherry, May 1837, *Gaudichaud s.n.* (P); Cuddalore, Nov 1959, *Govindarajalu 3699* (L); Bounds of Vedanthangal Sanctuary, Tamil Nadu, Jan 1976, *Henry 47027* (MH); Tiruchi, Nov 1978, *Matthew et al. RHT19392* (L); Banavar – Arsikere road, Jan 1970, *Saldanha 16079* (E); Kanjamalai, Apr 1944, *Sinclair 3464* (E); Papanasam project area, Madras State, Jun 1964, *Subramanian 1653* (L); Perur, Noyal riverbank, Jun 1956, *Subramanyam 45* (MH); way to Pachakumatchi, Jun 1959, *Subramanyam 8259* (L); Susindram, Tamil Nadu, Dec 1980, *Swaminathan 68985* (MH); Walayar Dam, outlet canal, Kerala State, May 1964, *Vajravelu 19064* (MH); Peninsula Ind. orientalis, undated, *Wight 2173* (NY); Pulicat, Madras, Mar 1837, *Wight 2173* (E). **Sri Lanka.** Kaddaikadu, Mar 1973, *Bernardi 14265* (L); beside Trincomalee – Kinniya Road, Sep 1974, *Cramer 4325* (E); Palaiyutta, Mar 1994, *Cramer 6960 et al.* (E); 9 miles [14 km] NNE of Jaffa, along road to Palai, Dec 1974, *Davidse 9090 & Sumithraarachchi* (K, L); Trincomalee, Oct 1976, *Fosberg 56390* (E, NY, P); Foul Point, Trincomalee district, Feb 1972, *Jayasuriya 651 et al.* (E); Talankuda, Batticaloa district, Apr 1973, *Stone 11188* (L); Just N of Trincomalee, Mar 1973, *Townsend 73/245* (E); Kinniyai, Trincomalee district, Sep 1974, *Waas & Tirvengadum 809* (L, NY). **Malaysia.** Penang, in 1822, *Wallich 2037/2* (NY). **Western Indian Ocean**. Mauritius, undated, *Sieber s.n.* (NY).

***Distribution and habitat*:** *Anisomeles malabarica* is native to Sri Lanka and southern India (**Map 6**). In addition, it is (or was) naturalised on Penang Island, Malaysia, and on the island of Mauritius. It inhabits open sunny areas; sandy flats on dunes near the coast, stream banks, and "waste ground".

***Phenology*:** Flowers are recorded for every month of the year; fruits are recorded in January, April, September and December.

***Nomenclature*:** The authorship for *Anisomeles malabarica* has often been given as "(L.) R.Br. ex Sims", but the notation 'Brown mss' after the description in the protologue indicates that the author was Brown and not Sims. Hence the correct authorship is "(L.) R.Br. in Sims" or, where the plant name stands alone, just "(L.) R.Br.".

Notes: *Anisomeles malabarica* is a very distinctive species because of its very densely tomentose stems, relatively narrow leaves, long attenuate calyx lobes and long hairs on the external surface of the calyx.

Baker (1877) accepted *A. malabarica* as being native on Mauritius, but it seems far more likely that it was transported there by man, as specimens of the Mauritian plant are identical to those from India, and the species has no means of long-range seed dispersal.

***Conservation status*: Least Concern**.

19. Anisomeles moschata R.Br., *Prodr. Fl. Nov. Holl.* 503 (1810); *Anisomeles salviifolia* var. *moschata* (R.Br.) Domin, *Biblioth. Bot.* 89: 567 (1928); *Epimeredi moschatus* (R.Br.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type:** [Australia: Queensland. PORT CURTIS DISTRICT:] Keppel Bay, 9 August 1802, *R. Brown [Bennett Number 2357]* (lecto: BM 001041069 [here designated]; isolecto: CANB 278977, E 00649579, P 04358989).

Anisomeles salviifolia var. *subtomentosa* Domin, *Biblioth. Bot.* 89: 567 (1928), *pro parte*. **Type:** Australia: Queensland. [?NORTH KENNEDY DISTRICT]: Rockingham Bay, undated, *J. Dallachy s.n.* (syn: K).

Procumbent, erect or spreading shrub, 0.3–2.5 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, sparse to dense; stalked glandular hairs absent; sessile glands 8–112 mm². Cauline leaves 11–100 mm long, 6–43 mm wide, 1.7–2.8 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate, dentate or serrate, irregular or regular, 3–18 on each side, acute or obtuse, 0.3–2 mm deep; petioles 4–22 mm long, 21–38% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.25–0.7 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–96 mm²; lower surface indumentum erect or curved, eglandular, 0.25–0.6 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 48–160 mm²; transition from leaves to floral bracts abrupt, or gradual. Floral bracts elliptical or ovate, 8–22 mm long, 3–9 mm wide, not consistently exceeding verticils or consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial or twice dichasial (± globose), with 2–10 flowers per monochasium, peduncles 0–11 mm long on lowermost cluster; bracteoles spathulate or linear, 2.8–4.7 mm long, 0.2–1.1 mm wide. Corolla tube longer than calyx, or same length as calyx, or shorter than calyx; annulus 2.3–3.5 mm from base of corolla, annulus hairs 0.15–0.3 mm long; upper lip ovate or elliptical, 3.6–5.3 mm long, with glandular hairs on outer surface or with eglandular hairs on outer surface; lower lip purple, 4.7–6.6 mm long to end of lateral lobes, 8.6–12 mm long overall, glabrous on platform. Longest stamens 10.5–12.5 mm long from base of corolla tube; filament hairs 1.1–1.9 mm long, mainly at distal end. Style 10.5–14 mm long; longer stigma lobe 0.55–0.7 mm long, shorter stigma lobe 0.3–0.45 mm long. Fruiting calyces 1.2–2.8 mm apart on rachilla; fruiting calyx cylindrical, 6.2–8.6 mm long, 2.5–4.5 mm wide at lobe apices, 1.7–2.7 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.2–0.6 mm long, sessile glands 64–176 mm²; lobes acute, 1.5–2.5 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.2–0.4 mm long at apical end, 0.5–1.1 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.8–2.1 mm long. **Figs. 2B, 4J, 5A, 5B, 7A, 7B, 7C, 7D, 7F, 7H, 10D.**

***Additional selected specimens examined*: Australia: Queensland**. COOK DISTRICT: between Cairns and Kuranda, May 1952, *Everist 5139* (BRI, CANB); Daintree NP, Orania Creek off Little Daintree River head, May 1998, *Forster PIF22858 et al.* (AD, BRI, CNS, MEL); Luster Creek, Aug 1995, *Jago 3571* (BRI, MEL); Cairns, Koombal, Jun 1993, *Lyons 142* (BRI); Mt Misery Road, Turnoff, S of Shiptons Flat, Jul 2001, *McDonald KRM938* (BRI). NORTH KENNEDY DISTRICT: Mt Abbot, 50 km W of Bowen, Aug 1992, *Bean 4833* (BRI); Adjacent to Proserpine Dam, *c.* 25 km W of Proserpine, Jul 2007, *Bean 26462* (BRI); Sinclair Bay, Cape Gloucester, Jul 1992, *Batianoff 9209206* (BRI); NW of Pentland, near 'Lowholm', Jul 1954, *Blake 19380* (BRI, CANB, MEL); SF 605 Koombooloomba, Tully Falls, Mar 2002, *Forster PIF28444* (BRI, K, MEL, NSW). SOUTH KENNEDY DISTRICT: St Bees Island, 38 km NE of Mackay, Mar 1989, *Batianoff 11152* (AD, BRI, PNH); Rabbit Island, 6 km N of Seaforth, Jun 1994, *Batianoff 940683 & Price* (BRI). LEICHHARDT DISTRICT: slopes of Ropers Peak, NE of Capella, May 1987, *Bean 577* (BRI); Ropers Peak, E of Capella, Jan 2006, *Fensham 5361 & Butler* (BRI); eastern slopes of Dilly Pinnacle, 7 km NNE of Springsure, Oct 1998, *Bean 14179* (BRI, NSW); Consuelo Tableland, upper tributary of Rocky Creek, Mar 2006, *Eddie CPE1511* (BRI, NSW). PORT CURTIS DISTRICT: Mt Slopeaway, 5 km from Marlborough, May 1991, *Batianoff MS9105121 & Franks* (BRI); Mt Archer, Rockhampton, Feb 1980, *Stanley 592* (BRI); Middle

Percy Island, 87 miles [140 km] SE of Mackay, Apr 1956, *Lazarides 5604* (BRI, CANB, PERTH); 5 miles [8 km] NE of Tynan HS, Jun 1963, *Lazarides 6889* (BRI, CANB, L). WIDE BAY DISTRICT: Biggenden, May 1931, *White 7716* (BRI). MORETON DISTRICT: SW end of Macleay Island, Jun 1976, *Elsol 9* (BRI); Mt Greville, *c.* 20 km W of Boonah, Apr 1975, *Sharpe 1211 & Saul* (BRI); Wilson's Peak, Apr 1949, *White 13006* (BRI, CANB).

***Distribution and habitat*:** *Anisomeles moschata* is endemic to Queensland where it is widely distributed in eastern areas, from just north of Cooktown to within a few kilometres of the New South Wales border, and extending up to 400 km from the east coast (**Map 3**). It inhabits eucalypt forests and woodlands on wide range of topographies and geologies, where the soils are well drained and frosts are absent or few.

***Phenology*:** Flowers and fruits have been recorded from every month of the year.

***Notes*:** This is a very widespread and variable species. Specimens have been assigned to this species on the basis of their glabrous corolla platform, the calyx fringe hairs longer at the sinus end than at the apical end, the petioles 21–38% of lamina length, and the moderately dense to dense tomentum on the lower leaf surface. Three or four regional forms exist – for instance, many specimens from the Leichhardt pastoral district of Queensland are consistently small-leaved and have verticils with short monochasia; specimens from Cairns and surrounding areas have large leaves with numerous marginal lobes. Because of apparently intergrading forms and lack of data on floral characteristics, I have not erected any new species from *A. moschata sens. lat.* However, it seems highly likely that such a division will be possible if further studies are undertaken.

The syntypes of *Anisomeles salviifolia* var. *subtomentosa* at K comprise a mixture of *A. moschata* and *A. dallachyi*. It is the K specimens that Domin examined before describing that variety (Orchard 1999); he did not see material at MEL or P.

***Conservation status*: Least Concern**.

20. Anisomeles ornans A.R.Bean **sp. nov.** affinis A. eriodi sed foliis praeditis lobis marginalibus paucioribus, floribus paucioribus in monochasiis, praesentia pilorum in labio inferiore corollae et calycibus fructificantibus brevioribus differens. **Typus:** Australia: Queensland. COOK DISTRICT: Simpson's Gully, Agate Creek fossicking area, 30 April 2006, *K.R. McDonald KRM5243* (holo: BRI; iso: CNS, MEL, *distribuendi*).

Erect or spreading shrub, 0.3–0.6 m high. Upper stems and rachises without patent hispid hairs; short curved hairs no fixed direction, very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent. Cauline leaves 29–68 mm long, 11–32 mm wide, 2–3.6 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes dentate or serrate, irregular or regular, 7–14 on each side, acute or obtuse, 0.5–1 mm deep; petioles 6–13 mm long, 16–27 % of lamina length. Lamina upper surface indumentum lanate, tangled, 0.4–0.6 mm long, dense (hairs < 0.1 mm apart), sessile glands 16–48 mm²; lower surface indumentum lanate, tangled, 0.4–0.7 mm long, dense (hairs < 0.1 mm apart) or very dense, obscuring surface at ×40 magnification; transition from leaves to floral bracts abrupt. Floral bracts lanceolate or elliptical, 6–26 mm long, 2–8 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 3–6 flowers per monochasium, peduncles 0–2 mm long on lowermost cluster; bracteoles linear, 2–6.6 mm long, 0.2–0.4 mm wide. Corolla tube same length as calyx; annulus 2–2.5 mm from base of corolla, annulus hairs 0.25–0.4 mm long; upper lip elliptical, 4.3–5 mm long, with glandular hairs on outer surface; lower lip purple or pink, 6.3–7.7 mm long to end of lateral lobes, 11–13.6 mm long overall, with 1–20 or 20–100 eglandular hairs on platform. Longest stamens 10.5–11.5 mm long from base of corolla tube; filament hairs 0.6–0.9 mm long, mainly at distal end. Style 11.5–12 mm long; longer stigma lobe 0.7–0.8 mm long, shorter stigma lobe 0.45–0.55 mm long. Fruiting calyces 1–1.9 mm apart on rachilla; fruiting calyx narrowly campanulate or cylindrical, 6.7–8.1 mm long, 2.4–3.9 mm wide at lobe apices, 2.1–2.8 times longer than

wide, exterior surface with all hairs same size and type, hairs eglandular, 0.5–0.9 mm long; lobes acute, 2–2.5 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.2–0.4 mm long at apical end, 0.7–1.1 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section. Nutlets 2–2.1 mm long. **Figs. 5C, 10E.**

***Additional specimens examined*: Australia: Queensland.** Burke District: The Crater, Blackbraes NP, N of Hughenden, Apr 2002, *Bean 18853* (BRI). Cook District: Cave Creek, Gilbert River, undated, *Daintree s.n.* (MEL 684767); Chadshunt, Gilbert River, May 1954, *Everist 5401* (BRI, MEL); Flat Creek, *c.* 50 km S of Georgetown, May 2011, *Mathieson MTM1076* (BRI, NSW); 5 km along Blacksoil Creek Road, Agate Creek fossicking area, Apr 2006, *McDonald KRM5202* (BRI, NSW); Rungulla Station HS area, S of Georgetown, Sep 2013, *McDonald KRM14725 & Little* (BRI, CANB); Gilbert River Holding, about 300 m along track, Apr 2014, *McDonald KRM15524* (BRI, CANB); Gilbert River, Feb 1922, *White 1425* (BRI). North Kennedy District: *c.* 25 km N of Wando Vale HS, Broken River, Poley Cow Creek, Apr 1988, *Fell DF882* (BRI); Gregory Springs Station, N of Hughenden, Feb 1931, *Hubbard 7710 & Winders* (BRI, K).

***Distribution and habitat*:** *Anisomeles ornans* is endemic to Queensland. It is found from 'Wando Vale' (N of Pentland) to Gilbert River (E of Croydon) (**Map 7**). It grows on sandstone escarpments and basalt hills, with a variety of species including *Eucalyptus chartaboma* D.Nicolle and *Corymbia erythrophloia* (Blakely) K.D.Hill & L.A.S.Johnson. Soils may be clayey, sandy or skeletal.

***Phenology*:** Flowers recorded from February to September; fruits from April to September.

***Notes*:** *Anisomeles ornans* is allied to *A. eriodes*, but differs by the leaves with fewer marginal lobes (7–14), the more widely separated verticils, the fewer flowers (3–6) in the monochasia, the corolla tube the same length as the calyx; the corolla platform with 1–20 hairs, and the shorter fruiting calyces.

***Conservation status*: Least Concern**.

***Etymology*:** Derived from the Latin *ornatus* meaning ornate or embellished. It refers to the pleasing appearance of the silvery stems and leaves in this species.

21. Anisomeles papuana A.R.Bean **sp. nov.** foliis lobis marginalibus praeditis, labio infero breviore corollae, calycibus fructificantibus brevissimis et nuculis tantum 1.5–1.7 mm longis distinguitur. **Typus:** Papua New Guinea. Western Province: Near Morehead Patrol Post, 30 August 1967, *R. Pullen 7199* (holo: BRI; iso: A, CANB, K *n.v.*, L, LAE *n.v.*).

Erect or spreading shrub, 1.2–2 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, moderately dense or dense; stalked glandular hairs absent; sessile glands 8–64 mm². Cauline leaves 62–112 mm long, 26–60 mm wide, 1.8–2.8 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate, irregular or regular, 19–33 on each side, acute or obtuse, 0.7–3.5 mm deep; petioles 8–24 mm long, 13–25% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.3–0.6 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 8–48 mm²; lower surface indumentum erect or curved, eglandular, 0.3–0.6 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 16–144 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical or ovate, 4.5–14 mm long, 3–5 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 5–14 flowers per monochasium, peduncles 0–5 mm long on lowermost cluster; bracteoles spathulate or linear, 1.8–4.2 mm long, 0.15–0.45 mm wide. Corolla tube same length as calyx; annulus 2.1–3 mm from base of corolla, annulus hairs 0.15–0.25 mm long; upper lip elliptical, 4–4.2 mm long, with eglandular hairs on outer surface; lower lip 5–5.9 mm long to end of lateral lobes, 7.5–9.3 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 10.5–11.5 mm long from base of corolla tube; filament hairs 1–1.4 mm long, mainly at distal end. Style 10–12 mm long; longer stigma lobe 0.45–0.7 mm long, shorter stigma lobe 0.25–0.4 mm long. Fruiting

calyces 1–1.6 mm apart on rachilla; fruiting calyx cylindrical, 6.2–8.3 mm long, 3.1–3.5 mm wide at lobe apices, 2.1–2.5 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.2–0.6 mm long, sessile glands 8–160 mm²; lobes acute, 1.4–2.7 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.1–0.25 mm long at apical end, 0.45–1.1 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or glabrous. Nutlets 1.5–1.7 mm long. **Figs. 5D, 10F**.

***Additional specimens examined*: Indonesia**. MOLUCCAS: Yamdena Island, road from Saumlakki to Olilit, Mar 1938, *Buwalda 4043* (L). **Papua New Guinea.** CENTRAL PROVINCE: Baroka, Mekeo district, Apr 1933, *Brass 3715* (BRI); Roger's airstrip, *c.* 8 miles [13 km] W of Kanosia Plantation, Jul 1962, *Darbyshire 653* (BRI, CANB, L); Nebiri Quarry, Port Moresby sub-district, Apr 1970, *Gebo 369* (CANB); near Jackson's Airport, Port Moresby, Aug 1963, *Heyligers 1006* (CANB); Tovobada Hills, 12 miles [19 km] N of Port Moresby, May 1965, *Heyligers 1180* (BRI, CANB, L); S coast near Kwikila, Abau subdistrict, Jun 1969, *Paijmans 767* (CANB); Rubulogo Creek, *c.* 18 miles [29 km] N of Port Moresby, Apr 1967, *Pullen 6689* (CANB); north vicinity of Rigo, Aug 1962, *Schodde 2700* (BRI, CANB); Port Moresby, Jul 1918, *White 61* (BRI). GULF PROVINCE: Near Malalaua, Mar 1966, *Craven & Schodde 904* (CANB); Malalaua, lower Tauri River area, Feb 1966, *Pullen 6528* (CANB). MOROBE PROVINCE: Bulolo, Feb 1950, *Fryar 3948* (BRI, CANB); Bulolo, Wau subdistrict, Jul 1970, *Streimann & Kairo NGF47869* (BRI, CANB). NORTHERN PROVINCE: Between Dabora and Wabubu, Cape Vogel Peninsula, Apr 1953, *Brass 21876* (CANB). WESTERN HIGHLANDS PROVINCE: Baiyer River, Nov 1954, *Floyd & Womersley 6826* (BRI). WESTERN PROVINCE: Near Rouku, Morehead subdistrict, Jul 1973, *Henty NGF49713* (BRI, CANB, L). **Australia: Queensland.** COOK DISTRICT: Thursday Island, Jun 1897, *Bailey s.n.* (BRI [AQ160154]); Darnley Island, Torres Strait, Apr 2005, *Hucks LAH285* (BRI, CANB); Yorke Island, Torres Strait, Oct 1971, *Lawrie s.n.* (BRI [AQ3927]); Mabuyag Island, Torres Strait, Aug 2008, *McKenna SGM222* (BRI, CANB); Gabba island, Torres Strait, Feb 2000, *Waterhouse BMW5655* (BRI, CANB).

Distribution and habitat: *Anisomeles papuana* is widely distributed in lowland New Guinea, also Torres Strait, Queensland, and the southern Moluccas Islands of Indonesia (**Map 5**). It inhabits savannah woodland at altitudes from 0–100 metres and mostly below 30m (except the three specimens mentioned below).

Phenology: Flowers and fruits are recorded from February to November inclusive.

Notes: *Anisomeles papuana* is distinguished by the many lobes per leaf, the relatively short petioles, the consistently short cylindrical calyces and the nutlets only 1.5–1.7 mm long.

Three specimens (*Floyd & Womersley 6826*, *Fryar 3948*, *Streimann & Kairo NGF47869*) are known from relatively high altitude (from 750 to 1150 metres) in Papua New Guinea. These specimens have a more compact infructescence, and the floral bracts exceed the verticils; they may represent an additional undescribed taxon.

***Conservation status*: Least Concern**.

***Etymology*:** The epithet refers to Papua New Guinea, where the great majority of collections have been made.

22. Anisomeles principis A.R.Bean **sp. nov.** pilis antrorsis retrorsisve plusminusve patentibusve, eglandularibus, densis in caulibus, bracteolis latis, pilis 1–20 labio inferiori corollae insidentibus et pilis marginalibus brevibus loborum calycis distinguitur. **Typus:** Australia: Western Australia. South-west Osborne Island, Bonaparte Archipelago, 29 June 1973, *P.G. Wilson 11152* (holo: PERTH).

Erect or spreading shrub, 0.5–1.5 m high. Upper stems and rachises without patent hispid hairs, or with patent hispid hairs; short curved hairs retrorse or antrorse, sparse to dense; stalked glandular hairs absent; sessile glands 16–160 mm². Cauline leaves 63–104 mm long, 24–42 mm wide, 2–2.7 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or serrate, regular, 10–21 on each side, acute or obtuse, 0.9–2.1 mm deep; petioles 16–19 mm long, 18–25% of lamina length. Lamina upper surface indumentum erect, glandular or erect or curved, eglandular, 0.25–0.8 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 16–80 mm²; lower surface indumentum erect, glandular or erect or curved, eglandular, 0.25–0.7 mm long, moderately dense (hairs

0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 48–176 mm²; transition from leaves to floral bracts abrupt, or gradual. Floral bracts elliptical or ovate, 7–30 mm long, 3.5–18 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 5–14 flowers per monochasium, peduncles 0–15 mm long on lowermost cluster; bracteoles obovate or spathulate or linear, 4.8–7.8 mm long, 0.5–2.5 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 2.5–3 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip elliptical, 3.6–4.7 mm long, with eglandular hairs on outer surface; lower lip 4–5.8 mm long to end of lateral lobes, 8–10.5 mm long overall, with 1–20 eglandular hairs on platform. Longest stamens 12–14 mm long from base of corolla tube; filament hairs 0.7–1.2 mm long, mainly at distal end. Style 12–14 mm long; longer stigma lobe 0.65–0.7 mm long, shorter stigma lobe 0.4–0.55 mm long. Fruiting calyces 0.8–1.5 mm apart on rachilla; fruiting calyx cylindrical, 8.2–11 mm long, 3.4–4.8 mm wide at lobe apices, 2–2.6 times longer than wide, exterior surface with hairs of different sizes or types or with all hairs same size and type, hairs glandular or hairs eglandular, 0.4–1 mm long, sessile glands 80–144 mm²; lobes acute, 2.3–3 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.25 mm long at apical end, 0.15–0.25 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or glabrous. Nutlets 1.9–2.3 mm long. **Figs. 5E, 10G**.

***Additional specimens examined*: Indonesia**. Lesser Sunda Islands: Timor, undated, herb. *Drake* (P); Timor, Apr 1821, *Reinwardt s.n.* (L). **Australia: Western Australia.** 8.5 km ENE of Mt Agnes, near headwaters on N side of Prince Regent River, Jan 2001, *Barrett & O'Connor RLB1588* (PERTH); Secure Bay, side arm on W side of bay, Yampi Peninsula, Mar 2001, *Barrett & Handasyde RLB2047* (PERTH); Ellenbrae Station, Jul 2004, *Brennan & Done 6328* (DNA, PERTH); slopes overlooking campsite, Margaret Island, Buccaneer Archipelago, Jun 1982, *Hopkins BA0475* (PERTH); Boongarie Island, 18.3 km NE of Mt Knight, Jun 1988, *Keighery & Alford 1817* (PERTH); E side of Mindjau Creek, Port Warrender, Admiralty Gulf, Jan 1982, *Kenneally 7764* (PERTH); Campsite on unnamed tributary of Prince Regent River, arising 19 km SE of the mouth, north-west Kimberley, Jun 1984, *Kenneally 8922* (MEL, PERTH); unnamed island in Prince Frederick Harbour at entrance to Hunter River, Jun 1984, *Kenneally 8978* (PERTH); junction of unnamed creek and Sale River, 30 km ESE of mouth, May 1986, *Kenneally 9603* (MEL, PERTH); Heywood Island (South island), Naturalist Island, E side, directly opposite 'Ninepin', or the Sentinel, Prince Frederick Harbour, May 1987, *Kenneally 9963* (PERTH); Boomerang Bay, Bigge Island, Jun 1972, *Marchant 72/60* (PERTH); adjacent to creek running out of Koolan townsite, May 1993, *Mitchell 3112* (PERTH); *c.* 5 km SW of Crystal Head on E side of major river and adjacent to W.A. Water Authority gauging station, Mar 1994, *Mitchell 3403* (PERTH); junction of two creeks where G. Grey had his main base camp in 1837, 15° 22' 04"S 124° 45' 19"E, Mar 1994, *Mitchell 3465* (NSW, PERTH); beach on Hanover Bay, north Kimberley, May 1998, *Mitchell 5401* (PERTH); Bachsten Creek, Jul 2001, *Russell-Smith & Handasyde TH01-171* (DNA, PERTH); Mallam Spring, SE side of Augustus Island, Jul 1990, *Willing 187* (PERTH); above Moran River Gorge, Prince Regent Nature Reserve, May 1991, *Willing 420* (PERTH); Bonaparte Archipelago, May 1972, *Wilson 10896* (CANB, PERTH).

***Distribution and habitat*:** *Anisomeles principis* is found in the Kimberley region of Western Australia and on the island of Timor (**Map 5**). In Australia, it reportedly grows on sandstone hills and gullies, in *Triodia* hummock grassland, eucalypt woodland or on the edges of vine thicket. Two specimen labels mention basalt as the substrate.

***Phenology*:** Flowers collected from January to July; fruits from May to July.

***Notes*:** *Anisomeles principis* is variable with regard to indumentum types present on the stems. Several specimens (including *Kenneally 8922, Wilson 10896*) have dense antrorse hairs, and one (*Kenneally 9603*) has abundant spreading hispid hairs. These may prove to be taxonomically distinct. Distinguishing features of the species as currently circumscribed are: monochasial or once-dichasial cymes of the verticils; short petioles (16–19 mm); short calyx fringe hairs, often pedunculate lower verticils; crowded flowers and fruits; and broad bracteoles.

***Conservation status*: Least Concern** (IUCN 2012).

***Etymology*:** From the Latin *principis* – of the prince. This is in reference to the Prince Regent River, where the distribution of this species is centred.

23. Anisomeles salviifolia R.Br., *Prodr. Fl. Nov. Holl.*: 503 (1810); *Anisomeles salviifolia* var. *typica* Domin, *Biblioth. Bot.* 89: 567 (1928), *nom. illeg.*; *Epimeredi salviifolius* (R.Br.) Rothm., *Repert. Spec. Nov. Regni Veg.* 53: 12 (1944). **Type:** [Australia: Northern Territory] Maria Island, Gulf of Carpentaria, 1 January 1803, *R. Brown s.n. [Bennett Number 2355]* (lecto [here designated]: BM 001041064; isolecto: BM 001041065; CANB 278978).

Erect or spreading shrub, 0.8–2 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse or antrorse or no fixed direction, very dense, obscuring stem surface at ×40 magnification; stalked glandular hairs absent. Cauline leaves 39–100 mm long, 11–36 mm wide, 1.7–5.4 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or serrate, irregular or regular, 12–20 on each side, acute or obtuse, 0.3–1.8 mm deep; petioles 9–19 mm long, 14–40% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.3–0.6 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–48 mm²; lower surface indumentum lanate, tangled, 0.5–0.8 mm long, dense (hairs < 0.1 mm apart) or very dense, obscuring surface at ×40 magnification, sessile glands 16–64 mm²; transition from leaves to floral bracts abrupt. Floral bracts elliptical or ovate, 7–25 mm long, 2–12 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 4–7 flowers per monochasium, peduncles 0–12 mm long on lowermost cluster; bracteoles spathulate, 4.8–7.5 mm long, 0.9–1.2 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 3.3–3.4 mm from base of corolla, annulus hairs 0.2–0.3 mm long; upper lip ovate or elliptical, 4.2–4.8 mm long, with glandular or eglandular hairs on outer surface; lower lip 5.1–6.1 mm long to end of lateral lobes, 9.7–11 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 10.5–12 mm long from base of corolla tube; filament hairs 0.9–1.1 mm long, mainly at distal end. Style 10.5–11.5 mm long; longer stigma lobe 0.75–0.9 mm long, shorter stigma lobe 0.4–0.5 mm long. Fruiting calyces 1.5–2 mm apart on rachilla; fruiting calyx cylindrical, 7.2–10.5 mm long, 3.3–4.8 mm wide at lobe apices, 1.6–2.5 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.5–0.7 mm long, sessile glands 16–80 mm²; lobes acute, 1.8–2.9 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.5–1 mm long at apical end (or 0.15–0.3), 0.6–1 mm long at sinus end (or 0.15–0.3), sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section. Nutlets 2–2.4 mm long. **Figs. 5F, 10H**.

***Additional specimens examined*: Australia: Northern Territory.** west side of South West Island, Sir Edward Pellew group, Feb 1976, *Craven 3725* (BRI, CANB, DNA); Maria Island, Jul 1972, *Dunlop 2747* (DNA, NT); Bing Bong Station, Jun 1971, *Henry 94* (BRI, DNA, NSW); 6 km SSE of Lake Eames, Vanderlin Island, Aug 1988, *Latz 11067* (DNA, NT); Buchanan Bay, May 1977, *McKey 125* (DNA, NT); point at the N end of Eagle Bay, Maria Island, Mar 2008, *Mitchell 8789* (CANB, DNA, NSW); northern end, West Island, Jul 1988, *Parsons 63* (DNA, NT); Camp Beach, Centre Island, Jun 2010, *Randell 821* (DNA, K, NT); South West Island, Sir Edward Pellew group, Feb 1976, *Rice 2392* (CANB); Watson Island, Sir Edward Pellew group, Jul 1988, *Thomson 2536* (DNA, NT); South West Island, Sir Edward Pellew group, Jul 1984, *Wightman 1577* (CANB, DNA).

***Distribution and habitat*:** *Anisomeles salviifolia* is endemic to the Northern Territory. It is confined to the south-western Gulf of Carpentaria, including Maria Island, the islands of the Sir Edward Pellew group, and on the mainland at Bing Bong Station (**Map 2**). It grows in dune swales never far from the ocean, usually with grasses and woodland species, but sometimes on the edge of vine thicket. Soils are sandy and infertile.

***Phenology*:** Flowers are recorded from February to August; fruits are recorded from May to August.

***Notes*:** Specimens of *Anisomeles salviifolia* seen from Maria Island differ consistently from those collected in the Sir Edward Pellew islands or Bing Bong station by the narrower leaves. Two collections from Maria Island have long calyx fringe hairs, contrasting with the short calyx fringe hairs in specimens from other locations. However, the type of *A. salviifolia* has short calyx fringe hairs. Because the calyx fringe hairs difference is not consistent and only leaf shape seems consistently different, no taxonomic distinction has been made.

***Conservation status*: Least Concern**.

24. Anisomeles viscidula A.R.Bean **sp. nov.** pilis glandularibus abundantibus et hispidis sparsis usque crebris insidentibus caulibus, foliis comparate angustis et carpis late dispositis in cymis distinguitur. **Typus:** Australia: Western Australia. Cave Spring Gap on Kununurra to Legune road, 26 April 1977, *H. Eichler 22501* (holo: DNA; iso: CANB, L, MEL, MO, PERTH).

Procumbent shrub, or erect or spreading shrub, 0.45–1.5 m high. Upper stems and rachises with patent hispid hairs; short curved hairs absent or retrorse, sparse to moderately dense; stalked glandular hairs abundant, or occasional; glandular hairs extending to lower stems; sessile glands 8–48 mm². Cauline leaves 71–110 mm long, 19–42 mm wide, 2.4–3.8 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes serrate, irregular or regular, 15–30 on each side, acute or obtuse, 0.6–1 mm deep; petioles 14–43 mm long, 19–43% of lamina length. Lamina upper surface indumentum of erect glandular and curved eglandular hairs, 0.1–0.7 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–48 mm²; lower surface indumentum of erect glandular and curved eglandular hairs, 0.25–0.4 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–128 mm²; transition from leaves to floral bracts abrupt or gradual. Floral bracts lanceolate or elliptical, 5–44 mm long, 1–16 mm wide, not consistently exceeding verticils or consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes entirely monochasial or once dichasial at base then monochasial, with 3–11 flowers per monochasium, peduncles 0–13 mm long on lowermost cluster; bracteoles spathulate or linear, 4–7.5 mm long, 0.4–1.2 mm wide. Corolla tube longer than calyx, or same length as calyx; annulus 2.5–3.4 mm from base of corolla, annulus hairs 0.2–0.25 mm long; upper lip elliptical, 3.8–5.7 mm long, with eglandular hairs on outer surface; lower lip 7–9 mm long to end of lateral lobes, 13.5–16 mm long overall, with 1–20 eglandular hairs on platform. Longest stamens 12.5–14 mm long from base of corolla tube; filament hairs 0.6–1.2 mm long, mainly at distal end. Style 11.5–13.5 mm long; longer stigma lobe 0.7–0.85 mm long, shorter stigma lobe 0.5–0.65 mm long. Fruiting calyces 1.5–4.8 mm apart on rachilla; fruiting calyx cylindrical, 8.9–12.5 mm long, 3.5–5.2 mm wide at lobe apices, 1.9–2.6 times longer than wide, exterior surface with hairs of different sizes or types, hairs glandular and eglandular, longest hairs 0.4–1.3 mm long, sessile glands 8–128 mm²; lobes acute, 2.3–3.7 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.15–0.4 mm long at apical end, 0.15–0.4 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section or glabrous. Nutlets 1.9–2.2 mm long. **Figs. 2C, 5G, 11A**.

***Additional specimens examined*: Australia: Western Australia.** SW side of Mt Page, S of Walcott Inlet, Yampi Peninsula, Mar 2001, *Barrett & Start RLB2339* (PERTH); Point Springs, 40 km N of Kununurra, May 1988, *Kenneally 10692* (NSW, PERTH); head of Tin Can Gully, Mornington Peninsula, May 2005, *Legge 976* (PERTH); 2 km E of junction of Charnley and Calder Rivers, Eastern Walcott Inlet, May 1983, *Milewski 205* (PERTH); Foot of Cave Spring Range, 30 km NNE of Kununurra, Mar 1978, *Paijmans 2543* (CANB). **Northern Territory.** 10 km from Jim Jim Falls, Sep 1984, *Brennan 2675* (DNA); Katherine Gorge NP, Apr 1968, *Byrnes NB618* (BRI, DNA); *c.* 450 m from Top Car Park, on track to Upper Falls, Edith Falls, Nitmiluk NP, May 1993, *Conn 3703 & Doust* (DNA, NSW); McArthur River area, near the Glyde River, Jan 1976, *Craven 3567*

(BRI, CANB, DNA); Mt McMinns Station, 11.8 km E of station turnoff on road to Roper Bar, Mar 2002, *Dixon & Harwood 1016* (DNA); Fitzmaurice River basin, May 1994, *Dunlop 9922 & Latz* (DNA, MEL); Keep River NP, Jarrarm area, Jun 1995, *Egan 5038* (DNA); Nitmiluk NP, Feb 1991, *Evans 3639* (BRI, DNA, K); Wearyan River headwaters, Jan 1989, *Latz 11262* (DNA, MEL, NT); 28 km S of Nathan River HS, Sep 1995, *Latz 14580* (DNA, NT); 2.5 km ESE of Katherine Gorge ranger station, May 2009, *Latz 24344 & Quarmby* (DNA, NT); Yamburran Range, 10 km NNE of Mt Millikmonmir, May 1994, *Leach 4555 & Albrecht* (DNA, MEL); Nitmiluk NP, Feb 2001, *Michell 3348* (B, DNA); Hayes Creek, May 1963, *Muspratt SS0603* (DNA); Edith Falls, Katherine Gorge NP, Apr 1983, *Thompson 249* (CANB); Bullo River Station, Mar 2009, *Westaway 2792* (DNA, MO).

***Distribution and habitat*:** *Anisomeles viscidula* is endemic to Australia and is distributed from the north-west Kimberley region of Western Australia, to the north-eastern Northern Territory (**Map 7**). It grows in open woodland dominated by species such as *Erythrophleum chlorostachys*, *Eucalyptus miniata* A.Cunn. ex Schauer or *E. phoenicea* F.Muell. It is apparently confined to quartzose sandstone plateaux and outcrops on sandy or skeletal soil.

***Phenology*:** Flowers are recorded from January to June. There is also a single flowering record from September, but that specimen was collected from a spring with permanent water supply. Fruits are recorded from April to September.

Notes: *Anisomeles viscidula* is characterised by the relatively lax inflorescences exceeded by the floral bracts on the lower verticils, the relatively narrow leaves, and the presence of stalked glandular hairs and hispid hairs on the stems and leaves. Eastern populations (adjacent to the Gulf of Carpentaria) have relatively few glandular hairs, but in all other populations, they are abundant. It differs from *A. macdonaldii* by the narrower cauline leaves with serrate marginal lobes, and the mostly longer fruiting calyces.

***Conservation status*: Least Concern**.

***Etymology*:** From the diminutive form of the Latin word *viscidus* meaning sticky or clammy. This is in reference to the densely glandular leaves and stems of this species.

25. Anisomeles vulpina A.R.Bean **sp. nov.** pilis densis retrorsis in caule, foliis latis basi obtusa, in pagina superiore folii pilis 1.0–1.3 mm longitudine et pilis marginalibus loborum calycis ubique 0.3–0.6 mm longitudine distinguitur. **Typus:** Australia: Queensland. North Kennedy District: *c.* 50 metres from the top of Mt Fox crater, SW of Ingham, 4 October 2014, *R. Jensen 3350 & J.E. Kemp* (holo: BRI; iso: CANB, CNS, E, MEL, NSW, NY, *distribuendi*).

Erect or spreading shrub, 0.3–0.4 m high. Upper stems and rachises without patent hispid hairs; short curved hairs retrorse, moderately dense or dense; stalked glandular hairs absent; sessile glands 8–48 mm². Cauline leaves 27–50 mm long, 16–30 mm wide, 1.6–2.1 times longer than wide, base obtuse or broadly cuneate (> 60°) or narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate or serrate, regular, 9–14 on each side, acute or obtuse, 0.4–1.8 mm deep; petioles 3.5–20 mm long, 13–44% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.9–1.3 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 8–32 mm²; lower surface indumentum lanate, tangled or erect or curved, eglandular, 1–1.2 mm long, dense (hairs < 0.1 mm apart), sessile glands 16–64 mm²; transition from leaves to floral bracts gradual. Floral bracts elliptical or ovate or broadly ovate, 4.5–20 mm long, 3–14 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) overlapping near apex or all separated on rachis, cymes entirely monochasial, with 3–6 flowers per monochasium, peduncles 0–1 mm long on lowermost cluster; bracteoles spathulate or linear, 2.4–3.5 mm long, 0.3–0.5 mm wide. Corolla tube same length as calyx, or shorter than calyx; annulus 2.7–3 mm from base of corolla, annulus hairs 0.25–0.4 mm long; upper lip elliptical, 3.4–4.9 mm long, with eglandular hairs on outer surface; lower lip purple or pink, 5.3–6.4 mm long to end of lateral lobes, 9.5–12.1 mm long overall, glabrous or with 1–20 eglandular hairs on platform. Longest stamens 11.5–12 mm long from base of corolla tube; filament hairs 0.9–1.9 mm long, mainly at distal end. Style

12–13 mm long; longer stigma lobe 0.6–0.65 mm long, shorter stigma lobe 0.4–0.45 mm long. Fruiting calyces 0.9–1.5 mm apart on rachilla; fruiting calyx cylindrical, 7.3–8 mm long, 3.8–4.4 mm wide at lobe apices, 1.7–2.1 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.6–1 mm long, sessile glands 64–112 mm²; lobes acute, 1.8–2.4 mm long. Fruiting calyx fringe hairs about the same length throughout, 0.3–0.5 mm long at apical end, 0.3–0.5 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section or with sparse long hairs in medial section. Nutlets 1.9–2.1 mm long. **Figs. 5H, 11B.**

***Additional specimens examined*: Australia: Queensland.** North Kennedy District: Mt Fox crater, Seaview Range, Apr 1985, *Rodd 4462 & Hardie* (BRI, NSW).

***Distribution and habitat*:** *Anisomeles vulpina* is endemic to Queensland where it is known only from Mt Fox, a volcanic crater south-west of Ingham (**Map 5**). It grows in fertile volcanic soil amongst basalt rocks and boulders, in an open grassland habitat.

***Phenology*:** Flowers are recorded in April and October; fruits in October.

***Notes*:** *Anisomeles vulpina* differs from *A. moschata* by the much longer hairs on both the upper and lower leaf surfaces, and by the shorter calyx fringe hairs.

***Conservation status*:** A status of **Vulnerable**, criteria D1 and D2, is recommended.

***Etymology*:** From the Latin *vulpes*, meaning "fox". This is in reference to the type locality, Mount Fox.

26. Anisomeles xerophila A.R.Bean **sp. nov.** absentia pilorum glandularium, pagina interiore labii inferioris corollae longa, calycibus fructificantibus brevibus (5.2–7.1 mm longitudine) et pilis folii 0.3–0.5 mm longitudine distinguitur. **Typus:** Australia: Northern Territory. North Hayward Creek on Stuart Highway, 58 km N of Tennant Creek, 19 April 1983, *R.M. Barker 186* (holo: DNA; iso: AD).

Erect or spreading shrub, 0.3–1.5 m high. Upper stems and rachises with or without patent hispid hairs; short curved hairs retrorse, moderately dense or dense; stalked glandular hairs absent; sessile glands 48–96 mm². Cauline leaves 24–78 mm long, 9–23 mm wide, 2.1–3.9 times longer than wide, base narrowly cuneate (< 60°) or attenuate; marginal lobes crenate or dentate, irregular or regular, 7–17 on each side, acute or obtuse, 0.4–2.1 mm deep; petioles 3.5–11 mm long, 13–22% of lamina length. Lamina upper surface indumentum erect or curved, eglandular, 0.25–0.4 mm long, sparse (hairs > 0.2 mm apart) or moderately dense (hairs 0.1–0.2 mm apart), sessile glands 32–112 mm²; lower surface indumentum erect or curved, eglandular, 0.25–0.4 mm long, moderately dense (hairs 0.1–0.2 mm apart) or dense (hairs < 0.1 mm apart), sessile glands 16–128 mm²; transition from leaves to floral bracts abrupt. Floral bracts lanceolate or elliptical, 6–27 mm long, 1.5–7 mm wide, not consistently exceeding verticils. Verticils (inflorescence clusters) all separated on rachis, cymes once dichasial at base then monochasial or twice dichasial (± globose), with 3–7 flowers per monochasium, peduncles 0–12 mm long on lowermost cluster; bracteoles spathulate or linear, 2.8–5 mm long, 0.3–0.8 mm wide. Corolla tube same length as calyx; annulus 2.3–3 mm from base of corolla, annulus hairs 0.25–0.3 mm long; upper lip ovate or elliptical, 4–5.1 mm long, with glandular or eglandular hairs on outer surface; lower lip 4–6 mm long to end of lateral lobes, 6.5–10.3 mm long overall, with 20–100 eglandular hairs on platform. Longest stamens 10–12.8 mm long from base of corolla tube; filament hairs 0.7–1.3 mm long, mainly at distal end. Style 10.5–13 mm long; longer stigma lobe 0.65–0.7 mm long, shorter stigma lobe 0.45–0.6 mm long. Fruiting calyces 1.2–2.2 mm apart on rachilla; fruiting calyx cylindrical, 5.8–7.9 mm long, 2.4–3.9 mm wide at lobe apices, 1.8–2.9 times longer than wide, exterior surface with all hairs same size and type, hairs eglandular, 0.3–0.5 mm long, sessile glands 128–160 mm²; lobes acute, 1.7–2.4 mm long. Fruiting calyx fringe hairs longer at sinus end than at apical end, 0.1–0.3 mm long at apical

end, 0.7–1 mm long at sinus end, sinus hairs absent, inner surface of tube with dense ring of long hairs in medial section. Nutlets 2–2.2 mm long. **Figs. 5J, 11C**.

***Additional specimens examined*: Australia: Northern Territory**. 2 miles [3 km] N of Katherine, Apr 1967, *Adams 1755* (CANB, L, NT); Attack Creek, W of Stuart Hwy, *c.* 66 km N of Tennant Creek, May 1996, *Albrecht 7633 & Latz* (NT); 'Nickson's Place', across river from Katherine, Apr 1956, *Burbidge 5111* (BRI, CANB, PERTH); Seven Emu Station, 34.3 km (by road) from junction with main road to Wollogorang, May 1993, *Conn 3767 & Doust* (DNA, NSW); Robinson River Station, May 1983, *Cowen 6* (CANB, DNA); Settlement Creek (below jump-up) on road between Redbank Mine and Wollogorang, May 1984, *Halford 845123* (NT); *c.* 30 miles [48 km] E of Borroloola, Jun 1973, *Henry 836* (NT); Whittington Range, 70 km N of Tennant Creek, Oct 2006, *Latz & Albrecht 22238* (MEL, NT); Wollogorang Station, Branch Creek gorge, Jul 1998, *Michell & Risler 1640* (DNA); Nitmiluk NP, Mar 2001, *Michell 3349 & Deichmann* (DNA); Gibson Creek, 35 miles [56 km] N of Tennant Creek, Jul 1968, *Must 209* (MEL, NT); 15 miles [24 km] S of McArthur River station, Jul 1948, *Perry 1735* (MEL, NT, PERTH); Hayward Creek, W of highway, Phillip Creek Station, Feb 1984, *Strong 45* (NT); Attack Creek, Banka Banka station, Jul 1983, *Thomson 353* (NT). **Queensland.** BURKE DISTRICT: Cloncurry, Nov 1935, *Blake 10133* (BRI); Westmoreland Station, just W of Hells Gate, 15 km SE of HS, May 2005, *Booth 4293* (BRI, NSW); Norfolk Station, on remote station track, Jun 2006, *Booth 4619 & Kelman* (BRI); Cabbage Tree Creek, Little Eva crossing, Apr 1962, *Cole 223 & Provan* (BRI); Westmoreland, Lagoon Creek, off track to Camp Ridgeway, May 1997, *Forster PIF21036 & Booth* (BRI); 49 km from Mt Isa on Duchess road, May 1997, *Forster PIF21172 & Booth* (BRI, DNA, MEL); 12 km S of Mt Isa, on road to Duchess, Jun 1991, *Halford Q519* (BRI); Lawn Hill Station, Jul 1971, *Latz 1607* (CANB, MEL, NSW, NT); 2 miles [3 km] S of Mt Isa township, Mar 1954, *Lazarides 4377* (BRI, CANB, MEL, NT); Mt Isa, Aug 1928, *MacGillivray 2213* (BRI).

***Distribution and habitat*:** *Anisomeles xerophila* is widely distributed from Katherine south to Tennant Creek in the Northern Territory and to Cloncurry in north-western Queensland (**Map 1**). In the more inland areas, it is confined to creek banks, but closer to the coast, it inhabits eucalypt woodland on flats or sandstone scree slopes; occasionally it sometimes grows in limestone areas.

***Phenology*:** Flowers mostly recorded from January to July, but with a single record from November; fruits from January to October.

***Notes*:** *Anisomeles xerophila* is closely related to *A. leucotricha*, but differs by the leaves broadest towards the base, leaves with fewer marginal lobes, the longer hairs of the lower leaf surface, the well separated verticils (verticils overlapping for *A. leucotricha*), and the more widely spaced fruiting calyces. *A. xerophila* is also closely related to *A. brevipilosa*, and possibly intergrades with it in the Wollogorang – Borroloola area, but differs by the mostly broader leaves, the longer hairs on the upper and lower leaf surfaces, and the shorter lower lip of the corolla.

This species usually has verticils that are short and compact, twice dichasially branched, but occasionally (e.g. *Must 209*, *Booth 4293*, *Burbidge 5111*) they are once-dichasial and elongate with a rachis up to 25mm long.

***Conservation status*: Least Concern**.

***Etymology*:** From the Greek *xeros* (dry) and *philus* (loving). This species alone extends to the semi-arid parts of Australia, where the annual rainfall is about 450 mm.

Excluded names

Anisomeles australis Spreng., *Syst. Veg. (ed. 16) [Sprengel] 4(2, Cur. Post.)* 226 (1827). = **Teucrium corymbosum** R.Br.

Anisomeles furcata (Link) Sweet, *Hort. Brit. [Loudon]* 232 (1830). = **Craniotome furcata** (Link) Kuntze.

Anisomeles glabrata Benth. ex Wall., *Numer. List* n. 2041 (1829), *nomen nudum.*

Anisomeles indica f. *albiflora* Kuntze, *Revis. Gen. Pl.* 2: 512 (1891), *nomen nudum.*

Anisomeles indica f. *rubicunda* Kuntze, *Revis. Gen. Pl.* 2: 512 (1891), *nomen nudum.*

Anisomeles intermedia Wight ex Benth., *Labiat. Gen. Spec.* 703 (1835). **Type:** India. Madurai [Madura], undated, *R. Wight 2172/42* (lecto: MH, *fide* Cramer (1981), *n.v.*; isolecto: E, K).

Bentham (1835) speculated that *Anisomeles intermedia* could be a hybrid between *A. ovata* (= *A. indica*) and *A. malabarica*, and I think that this must be the case. Its morphological characteristics are intermediate between *A. indica* and *A. malabarica*, and both

of the original localities (Madura, India and Peradeniya, Sri Lanka) are within the geographical overlap zone of *A. indica* and *A. malabarica*. Of the more than 200 Indian and Sri Lankan *Anisomeles* specimens seen by the present author, none matches the type of *A. intermedia*, further supporting the idea that it is an infrequent hybrid. Aluri (1992) reported the existence of a single plant of a presumed hybrid between these two species, occurring at Turimella, India.

Anisomeles nepalensis Spreng., *Syst. Veg. (ed. 16) [Sprengel]* 2: 706 (1825). = **Craniotome furcata** (Link) Kuntze

Anisomeles secunda f. *albiflora* Kuntze, *Revis. Gen. Pl.* 2: 512 (1891), *nomen nudum.*

Anisomeles secunda f. *rubicunda* Kuntze, *Revis. Gen. Pl.* 2: 512 (1891), *nomen nudum.*

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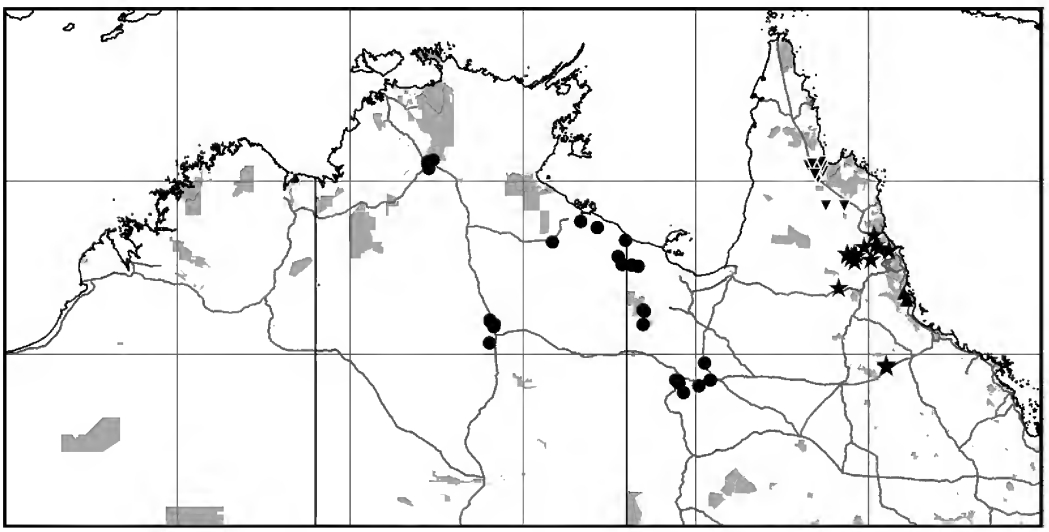
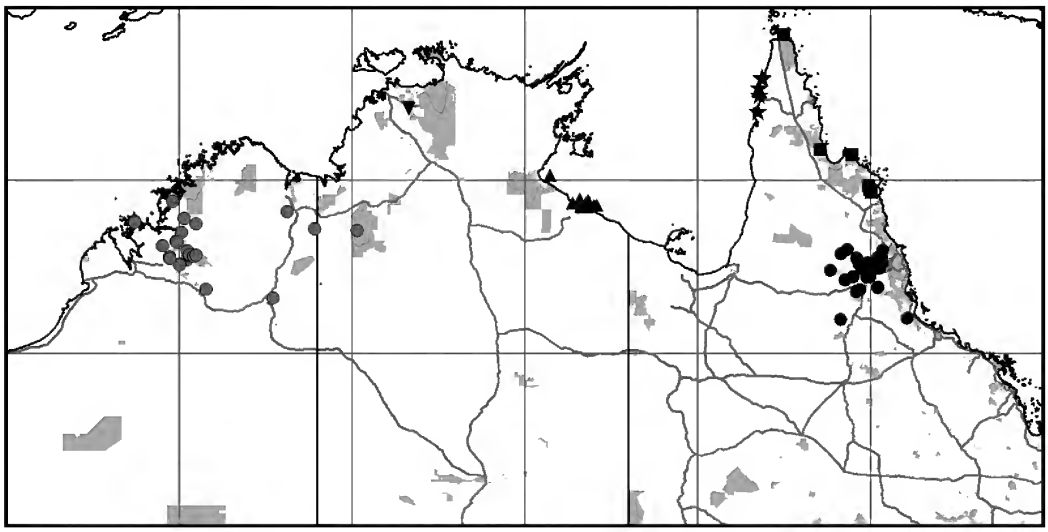
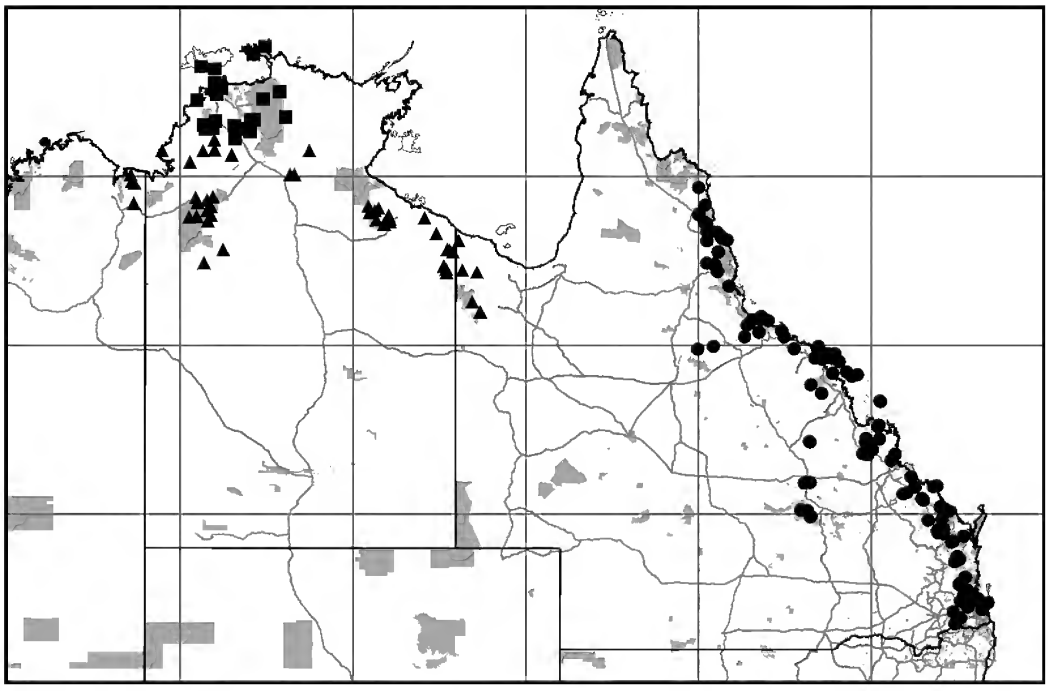


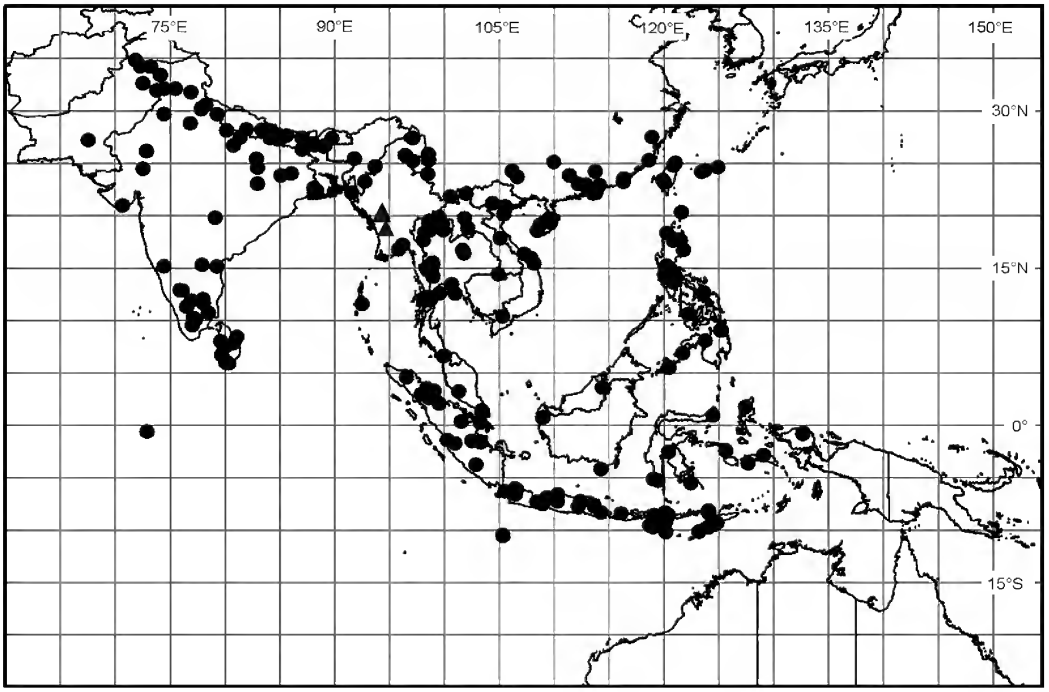
Map 1. Distribution of *Anisomeles* spp. *A. ajugacea* ▼, *A. dallachyi* ▲, *A. macdonaldii* ★, *A. xerophila* ●. National Parks and other conservation reserves in grey.



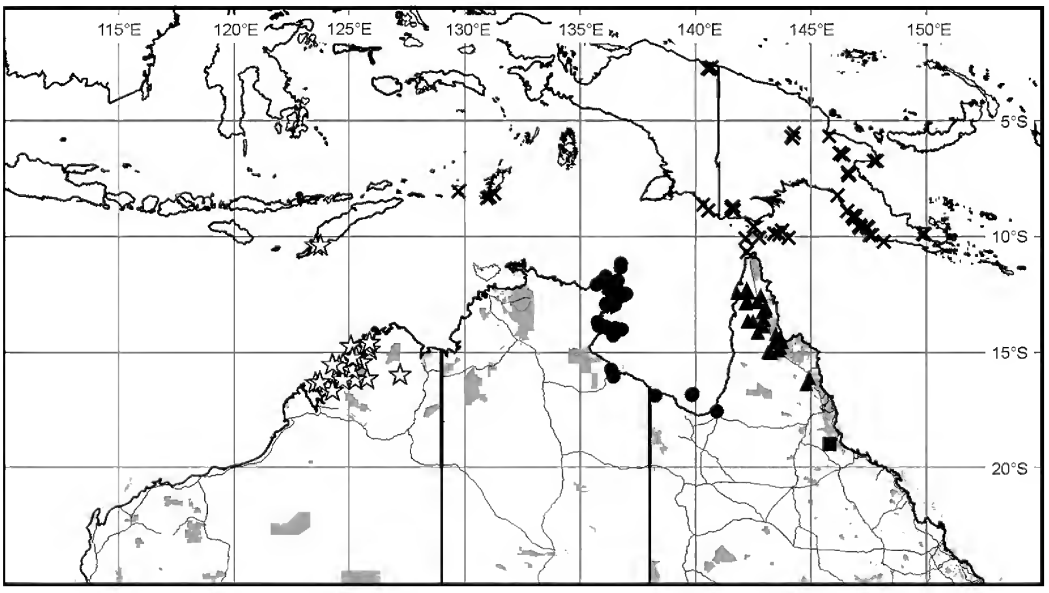
Map 2. Distribution of *Anisomeles* spp. *A. antrorsa* ★, *A. bundeyensis* ▼, *A. farinacea* ●, *A. languida* ■, *A. lappa* ●, *A. salviifolia* ▲. National Parks and other conservation reserves in grey.



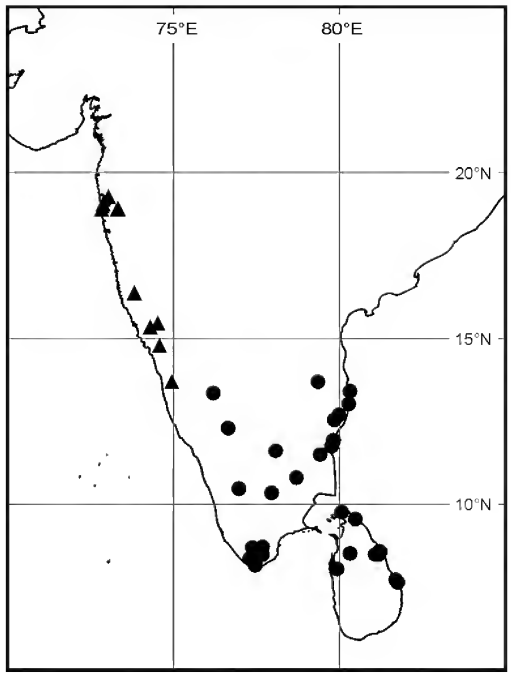
Map 3. Distribution of *Anisomeles* spp. *A. brevipilosa* ▲, *A. leucotricha* ■, *A. moschata* ●. National Parks and other conservation reserves in grey.



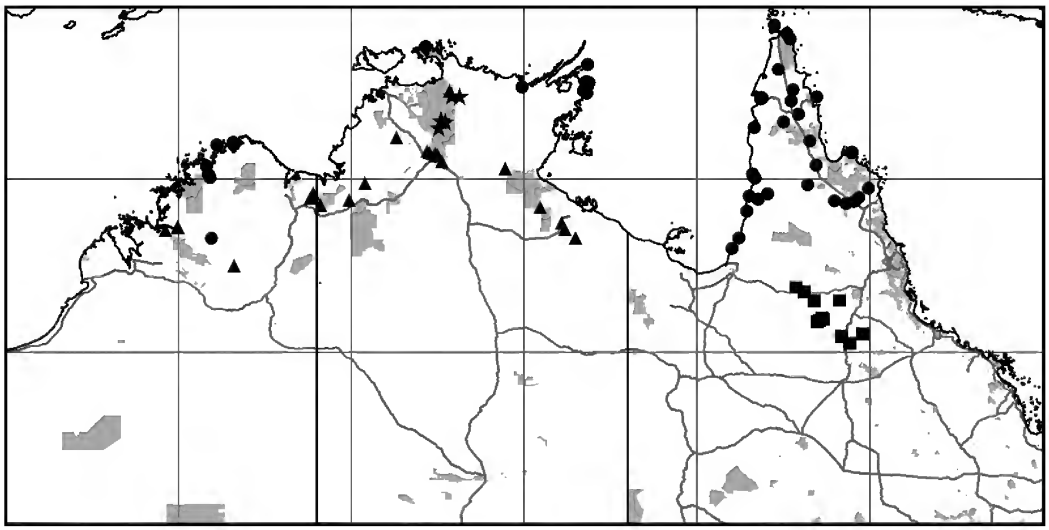
Map 4. Distribution of *Anisomeles* spp. *A. candicans* ▲, *A. indica* ●.



Map 5. Distribution of *Anisomeles* spp. *A. carpentarica* ●, *A. eriodes* ▲, *A. papuana* ✕, *A. principis* ✠, *A. vulpina* ■. National Parks and other conservation reserves in grey.



Map 6. Distribution of *Anisomeles* spp. *A. heyneana* ▲, *A. malabarica* ●.



Map 7. Distribution of *Anisomeles* spp. *A. grandibractea* ★, *A. inodora* ●, *A. ornans* ■, *A. viscidula* ▲. National Parks and other conservation reserves in grey.

Three new species of *Taeniophyllum* Blume (Orchidaceae) from northern Queensland

B. Gray

Summary

Gray, B. (2015). Three new species of *Taeniophyllum* Blume (Orchidaceae) from northern Queensland. ***Austrobaileya* 9(3): 382–392**. Three diminutive, leafless orchids of the genus *Taeniophyllum* are described as new from northern Queensland, increasing the total species enumerated from mainland Australia to eight, namely *T. clementsii* (D.L.Jones & B.Gray) Kocyan & Schuit., *T. confertum* B.Gray & D.L.Jones, *T. epacridicola* B.Gray sp. nov., *T. explanatum* B.Gray sp. nov., *T. lobatum* Dockrill, *T. malianum* Schltr., *T. muelleri* Lindl. ex Benth. and *T. triquetroradix* B.Gray sp. nov. A key to the mainland Australian *Taeniophyllum* species is provided. All inflorescences of the mainland Australian taxa are also illustrated and provided here for comparison purposes and compliment the key. Line drawings, photographs and distribution maps for the three newly described species are given.

Key Words: Orchidaceae, *Taeniophyllum*, *Taeniophyllum epacridicola*, *Taeniophyllum explanatum*, *Taeniophyllum triquetroradix*, Australia flora, Queensland flora, new species, taxonomy, identification key

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Introduction

Taeniophyllum Blume is a diverse group of small, epiphytic orchids with 229 species widely distributed from Africa through India to Japan southwards through the Malay Archipelago to New Guinea, Australia and extending east to New Caledonia and Tahiti, with the centre of distribution in New Guinea (Schlechter 1982; Seidenfaden & Wood 1992; Margońska & Szlachetko 2010). In Australia, six species are enumerated, namely *T. confertum* B.Gray & D.L.Jones, *T. lobatum* Dockrill, *T. malianum* Schltr., *T. muelleri* Lindl. ex Benth., *T. norfolkianum* D.L.Jones, B.Gray & M.A.Clements and *T. pusillum* (Willd.) Seidenf. & Ormerod (formerly *T. obtusum* Blume; see Seidenfaden 1995) (Gray & Jones 1984; Lavarack & Gray 1985; Clements 1989; Dockrill 1992; Ormerod 1994; Jones 2006; Jones *et al.* 2006). However, two of the six species recorded occur on off shore islands, namely *T. norfolkianum* on Norfolk Island (Jones *et al.* 2006) and *T. pusillum* on Christmas Island (Clements 1989) and are not included in this paper.

Based on recent molecular findings, Kocyan & Schuiteman (2014) combined *Microtatorchis* Schltr. with *Taeniophyllum*, and in doing so, *Microtatorchis clementsii* D.L.Jones & B.Gray was transferred to *Taeniophyllum clementsii* (D.L.Jones & B.Gray) Kocyan & Schuit., bringing the number of *Taeniophyllum* species recognised for mainland Australia up to five.

Generally, all the Australian *Taeniophyllum* species are small, leafless or with minute scale like leaves covering the stem. They have diminutive flowers, usually bearing only one, rarely two, at a time on a peduncle. The inflorescence is a raceme, often with continuous growth, producing flowers over a long period.

Observations have been carried out by the author over a period of some years, and have led to the discovery of these three novelties described here as *T. epacridicola* B.Gray sp. nov., *T. explanatum* B.Gray sp. nov. and *T. triquetroradix* B.Gray sp. nov. Two of these,

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namely *T. explanatum* and *T. triquetroradix*, occur within the Wet Tropics of north-eastern Queensland (Townsville to Cooktown), while *T. epacridicola* is known only from far northern Cape York Peninsula. All three new species are known only from a small number of collections.

Materials and methods

This study is based on examination of living plants in the field, cultivated material, and preserved spirit collections deposited in BRI, CANB and CNS (herbaria acronyms follow Thiers (continuously updated)). Measurements and illustrations were made based on living root and stem morphology, whereas inflorescence structure and floral characters were studied from live plants and preserved materials in spirit. Length × width measurements are indicated as measurement × measurement mm.

An illustration depicting the inflorescences of all mainland Australian *Taeniophyllum* taxa, including the three new taxa, is provided here for comparison purposes (**Fig. 1**) and to compliment the key.

Taxonomy

Key to mainland Australian *Taeniophyllum* species

1 Sepals and petals fused near the base forming a tube **2**
1. Sepals and petals free to the base not forming a tube **5**

2 Roots terete in cross section . . . . . **T. muelleri**
2. Roots triangular or flattened in cross section **3**

3 Roots triangular in cross section (having a raised longitudinal ridge) . . **T. triquetroradix**
3. Roots flattened in cross section **4**

4 Roots 1.5–2 mm broad; peduncle filiform, 12–25 mm long; rachis filiform; floral bracts small, alternating, *c.* 0.5 mm apart, all in one plane; flowers *c.* 2.5 mm long . . . . . **T. explanatum**
4. Roots 1 mm or less broad; peduncle filiform, 2–5 mm long; rachis not filiform, fleshy, parallel sided, twice as wide as peduncle; floral bracts alternating, < 0.5 mm apart; flowers < 2 mm long . . . . . **T. clementsii**

5 Roots 2–3 mm broad; peduncle 2–3 mm long; floral bracts overlapping, hiding the rachis . . . . . **T. confertum**
5. Roots 1.5–4 mm broad; peduncle and rachis not as above **6**

6 Peduncle, rachis and ovary sparsely covered with erect short-bristly hairs; flowers green, turning yellow with age . . . . . **T. lobatum**
6. Peduncle, rachis and ovary glabrous **7**

7 Young roots green with rows of white elongate spots; roots 1.5–2.5 mm broad, mostly hanging free from the host, some appressed; peduncle filiform, 20–50(–60) mm long; floral bracts overlapping; flower 7–11 mm wide . . . . . **T. malianum**
7. Young roots green; roots 2–3.5(–4) mm broad, appressed to the host; peduncle and rachis zig-zag from base, not filiform, 5–10 mm long; floral bracts alternating 1–1.5 mm apart; flower 4.5–5 mm wide . . . . . **T. epacridicola**

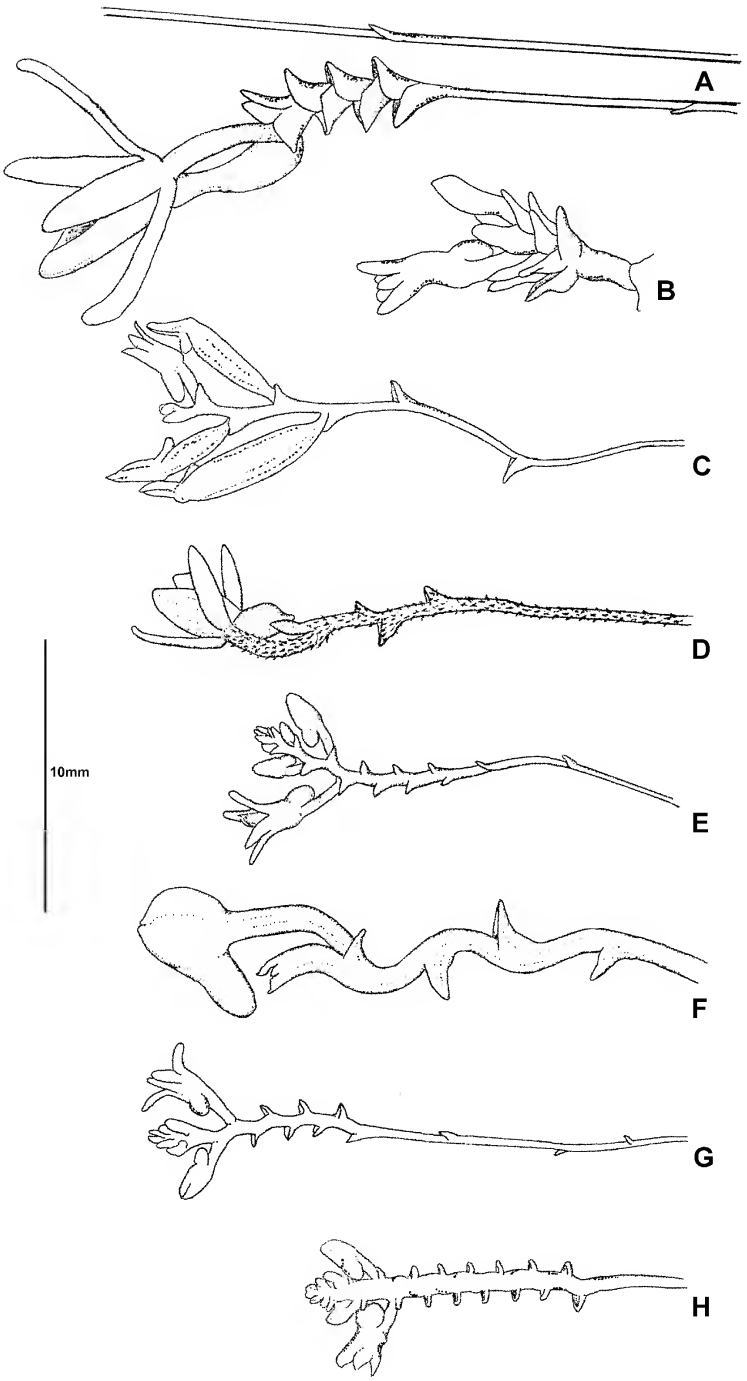

Fig. 1. Lateral views of inflorescences from all mainland Australian ***Taeniophyllum*** species. A. ***T. malianum*** cultivated plant (no voucher). B. ***T. confertum*** from *Walker s.n.* (CNS). C. ***T. muelleri*** from *Gray BG9661* (CNS). D. ***T. lobatum*** from *Gray BG8584* (CNS). E. ***T. triquetroradix*** from *Gray BG4129* (CNS). F. ***T. epacridicola*** from *Gray BG5235* (CNS). G. ***T. explanatum*** from *Gray BG9674* (CNS). H. ***T. clementsii*** from *Gray BG8508* (CNS). Scale as indicated. Del. B. Gray.

1. Taeniophyllum epacridicola B.Gray **sp. nov.** Similar to *T. mangifera* Schltr. but differs in having dorsal sepal and petals clavate, lateral sepals obovate with a sharp apical point and a much larger stigmatic opening. **Typus:** Queensland. Cook District: Atherton, cultivated (*ex situ* from Wasp Creek), 11 September 1990, *B. Gray BG5235* (holo: BRI; iso: CNS).

Plant epiphytic. **Roots** usually several, flattened, creeping, 50–150 mm long, 2–3.5(–4) mm broad, greyish green. **Inflorescences** one to several, scape 4–6 mm long. **Rachis** rough, zig-zag, 5–10 mm long, reddish-green. **Floral bracts** alternating triangular 1–1.5 mm apart, reddish green. **Flowers** lasting one day, 4.5–5 mm across, pale creamy yellow. **Sepals** spreading widely free to the base. **Dorsal sepal** concave, elliptic to obovate, *c.* 2.8 × 1.6–1.8 mm. **Lateral sepals** broadly elliptic, acute at the apex, *c.* 2.6 × 1.6 mm, keeled on the back. **Petals** spathulate, *c.* 2 × 1.4 mm. **Labellum** thick and fleshy, deeply concave with raised sides and obtuse at the apex, *c.* 2.2 × 1.8 mm. **Spur** 1.4–1 mm, in line with the labellum. **Column** short and stout, *c.* 1.2 × 1 mm, purplish towards the front. **Anther cap** *c.* 0.8 × 1 mm, beaked at the front. **Pollinia** 4 in unequal pairs. **Capsule** 19–20 × *c.* 4.5 mm, with slight longitudinal ridges. **Figs. 2–4**.

***Additional specimens examined*: Queensland.** Cook District: Wasp Creek north of Bamaga, Sep 1989, *Gray BG5120* (CNS); Usher Point, Cape York, Jan 2010, *Gray BG9681 & Baume* (CNS).

***Distribution and habitat*:** *Taeniophyllum epacridicola* is endemic to northern Cape York where it is known from a few localities north of the Jardine River (**Map 1**). Specimens examined in the field grow on twigs and small branches primarily in epacrid dominated shrubland at elevations below 100 m. *T. epacridicola* has also been rarely observed in the margin of the rainforest.

***Phenology*:** Flowering and fruiting has been recorded between July and January.

***Notes*:** *Taeniophyllum epacridicola* is in the section *Taeniophyllum* (synonym: section *Trachyrhachis* Schltr.), and this represents the first record of the section for Australia. The first specimen of *T. epacridicola* examined was on a fallen branch in the edge of rainforest near Lockerby homestead north of Bamaga in September 1979. However, efforts to locate more material for detailed examination were unsuccessful until a second collection (sterile) was made at Wasp Creek in September 1989 (*Gray BG5120*), and was successfully flowered in cultivation in September 1990 (*Gray BG5235*). In 2008 another population was located at Usher Point by David Baume. This population was revisited in January of 2010 to enable voucher preparation (*Gray BG9681 & Baume*). A single plant (tentatively identified as this species), has been located close to Punsand Bay; however, no fertile specimen has been available to date.

***Etymology*:** *Taeniophyllum epacridicola* is named for its seeming preference to grow in epacrid dominated shrubland consisting of *Leucopogon ruscifolius* R.Br. and *L. yorkensis* Pedley (Ericaceae).

2. Taeniophyllum explanatum B.Gray **sp. nov.** Similar to *T. muelleri* Lindl. ex Benth. but differs in having roots flattened in cross-section. **Typus:** Queensland. Cook District: Bridle Creek on power line access road, 24 October 2002, *B. Gray BG8339* (holo: BRI; iso: CNS).

Plant epiphytic forming small clumps with 5–30 roots. **Roots** ± flat in cross section, 1.5–2 mm across, up to 10 cm long, dull green. **Inflorescences** filiform, peduncle 12–25 mm × *c.* 0.2 mm with 1–3 bracts. **Rachis** increasing in length as flowering progresses producing 10–30 flowers one at a time; buds, flowers and capsules can be present at the same time. **Floral bracts** acute, alternate, 0.5–0.6 mm long, *c.* 0.5 mm apart and all in one plane. **Flowers** opening singly, *c.* 2.5 mm long including the spur and *c.* 2.5 mm across when open, green. **Sepals** and **petals** connate at the base into a tube *c.* 0.8 mm long, then spreading. **Dorsal sepal** linear to narrowly lanceolate, *c.* 2 × 0.6–0.7 mm, incurved. **Lateral sepals** linear, *c.* 2 × 0.6 mm. **Petals** ovate, *c.* 1.8 × 0.6 mm, incurved, apex acuminate. **Labellum** cymbiform, narrowly triangular, 1.8–2 mm × *c.* 0.5 mm with low erect lobes at the base, apex acute with an inflexed spur *c.* 0.5 mm long. **Spur**

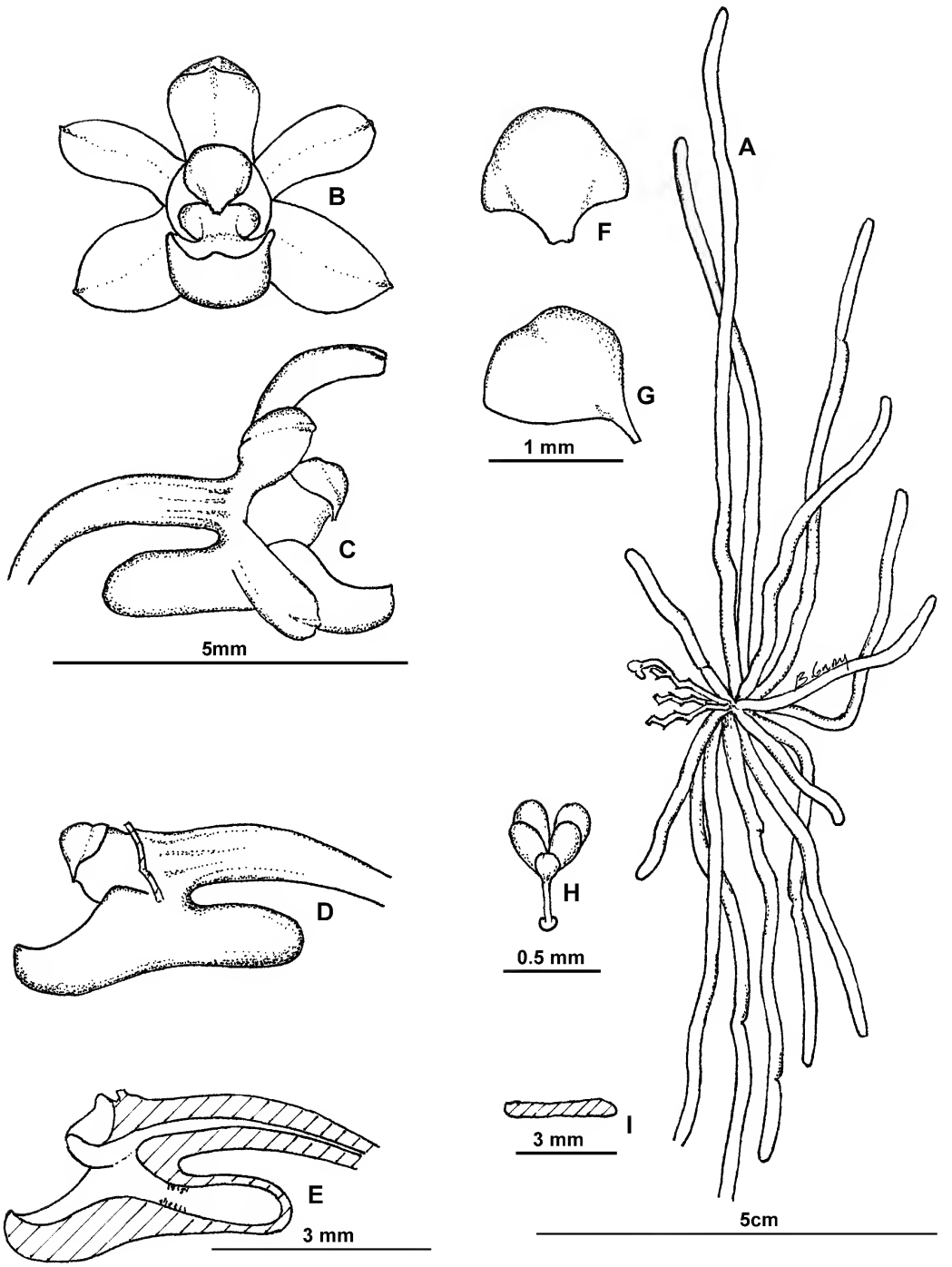

Fig. 2. ***Taeniophyllum epacridicola***. A. habit of a mature flowering plant. B. face view of flower. C. lateral view of flower. D. lateral view of column and labellum. E. longitudinal section of flower. F. face view of anther. G. lateral view of anther. H. pollinia. I. transverse section of mature root. All from *Gray BG5235* (CNS). Scale as indicated. Del. B. Gray.

Fig. 3. ***Taeniophyllum epacridicola***. A fruiting specimen showing flat roots closely appressed to a branch of an understorey tree (*Gray BG9681*, CNS). Photo: B. Gray.

Fig. 4. ***Taeniophyllum epacridicola***. Close-up view of an open flower (*Gray BG5235*, CNS). Photo: B. Gray.

subglobose, *c.* 0.9 × 0.7 mm. **Column** domed, *c.* 0.7 × 0.4 mm, wings forward facing and *c.* 0.3 × 0.1 mm. **Anther cap** *c.* 0.4 × 0.3 mm, with 2 prominent humps. **Pollinia** 4 in two pairs, pale yellow. **Capsule** not seen. **Figs. 5 & 6**.

***Additional specimens examined*: Queensland.** Cook District: Robson Creek, Danbulla NP, Aug 2014, *Ford 6332* (CNS); Bridle Creek on power line access Road, Aug 2009, *Gray BG9312* (CNS); Windsor Tableland NP, Oct 2014, *Gray BG9674, Baume & Walker* (CNS); Mt Windsor Tableland, May 1989, *Jones 4377 & Clements* (CANB).

***Distribution and habitat*:** *Taeniophyllum explanatum* occurs within the Wet Tropics of Queensland from Mount Windsor Tableland south to Innisfail (**Map 2**) at elevations from 500 to 1000 m, in rainforest, usually on small trees and vines.

***Phenology*:** Flowering has been recorded between May and January.

***Notes*:** *Taeniophyllum explanatum* has only been collected on a few occasions possibly

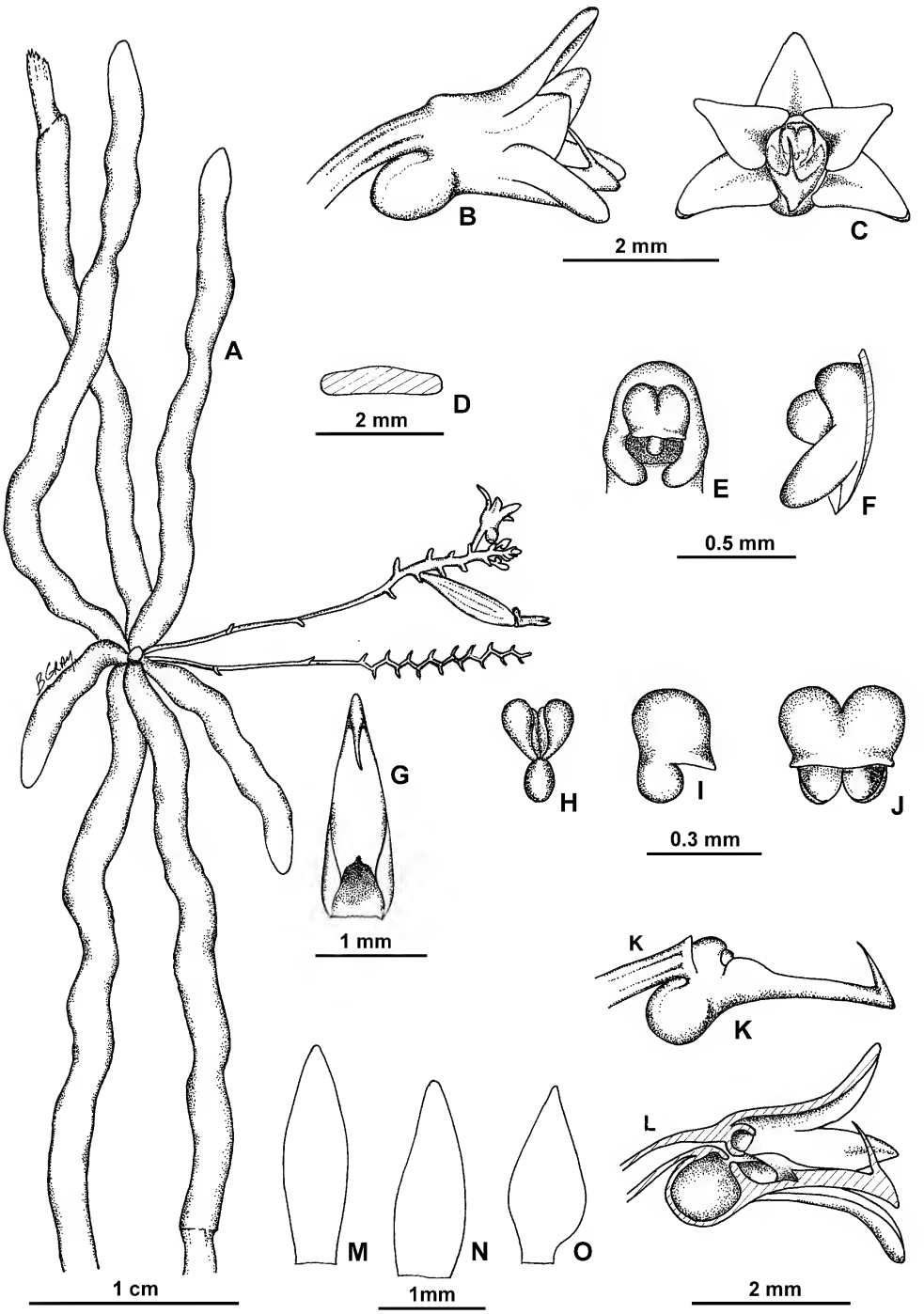

Fig. 5. ***Taeniophyllum explanatum***. A. habit of a mature flowering and fruiting plant. B. lateral view of flower. C. face view of flower. D. transverse section of mature root. E. face view of column. F. lateral view of column. G. face view of labellum. H. pollinia. I. lateral view of anther. J. face view of anther. K. lateral view of labellum and column. L. longitudinal section through flower. M. dorsal sepal. N. lateral sepal. O. petal. All from *Gray BG8339* (CNS). Scale as indicated. Del. B. Gray.

Fig. 6. ***Taeniophyllum explanatum***. Plant showing inflorescences bearing flower buds and open flowers (*Gray BG9674*, CNS). Photo: B. Gray.

because this small species is easily overlooked in the rainforest. Most of the collections made are from the more accessible understorey; however, a single collection (*Ford 6332*) is from the rainforest canopy.

***Etymology*:** The specific epithet refers to the roots being flat.

3. Taeniophyllum triquetroradix B.Gray **sp. nov.** Similar to *Taeniophyllum muelleri* Lindl. ex Benth. but differs in having roots triangular in cross-section. **Typus:** Queensland. Cook District: Ridge above Tinaroo Dam perimeter road, 8 September 1990, *B. Gray BG5238* (holo: BRI; iso: CNS).

Taeniophyllum sp.; Ormerod (1994).

***Illustrations*:** Jones (2006: 454), as *T. confertum* B.Gray & D.L.Jones.

Plants epiphytic, spider like in appearance sometimes proliferating from root tips and forming small colonies. **Roots** 4–10, appressed to the host, ± triangular in cross section, 10–60 mm × 1.5–2 mm, glaucous to greyish green, strongly ridged on the upper surface. **Inflorescences** 1–3(–4); peduncle 5–12 mm long. **Rachis** extending as flowering progresses; 5–20 or more flowered with one or sometimes two open together; buds, flowers and capsules can be present at the same time. **Floral bracts** projecting 0.5–0.6 mm, somewhat fleshy and all in one plane. **Flowers** *c.* 4.5 mm long including the spur and 3 mm in diameter, green, aging to yellowish green. Sepals and petals fused at the base into a tube *c.* 1.4 mm long. **Sepals** spreading, somewhat ovate to narrowly triangular, *c.* 1.5 × 0.9 mm, acute at the apex. **Petals** spreading, ovate, *c.* 1.4 × 0.8–0.9 mm, acute at the apex. **Labellum** fleshy, cymbidiform *c.* 1.9 mm long, obscurely three lobed near the base, lateral lobes *c.* 0.3 mm high, midlobe narrowly triangular, acute at the apex with an inflexed spine *c.* 0.6 mm long at the tip. **Spur** elongate-globose, *c.* 1.9 × 0.9 mm. **Column** domed *c.* 0.7 mm high,

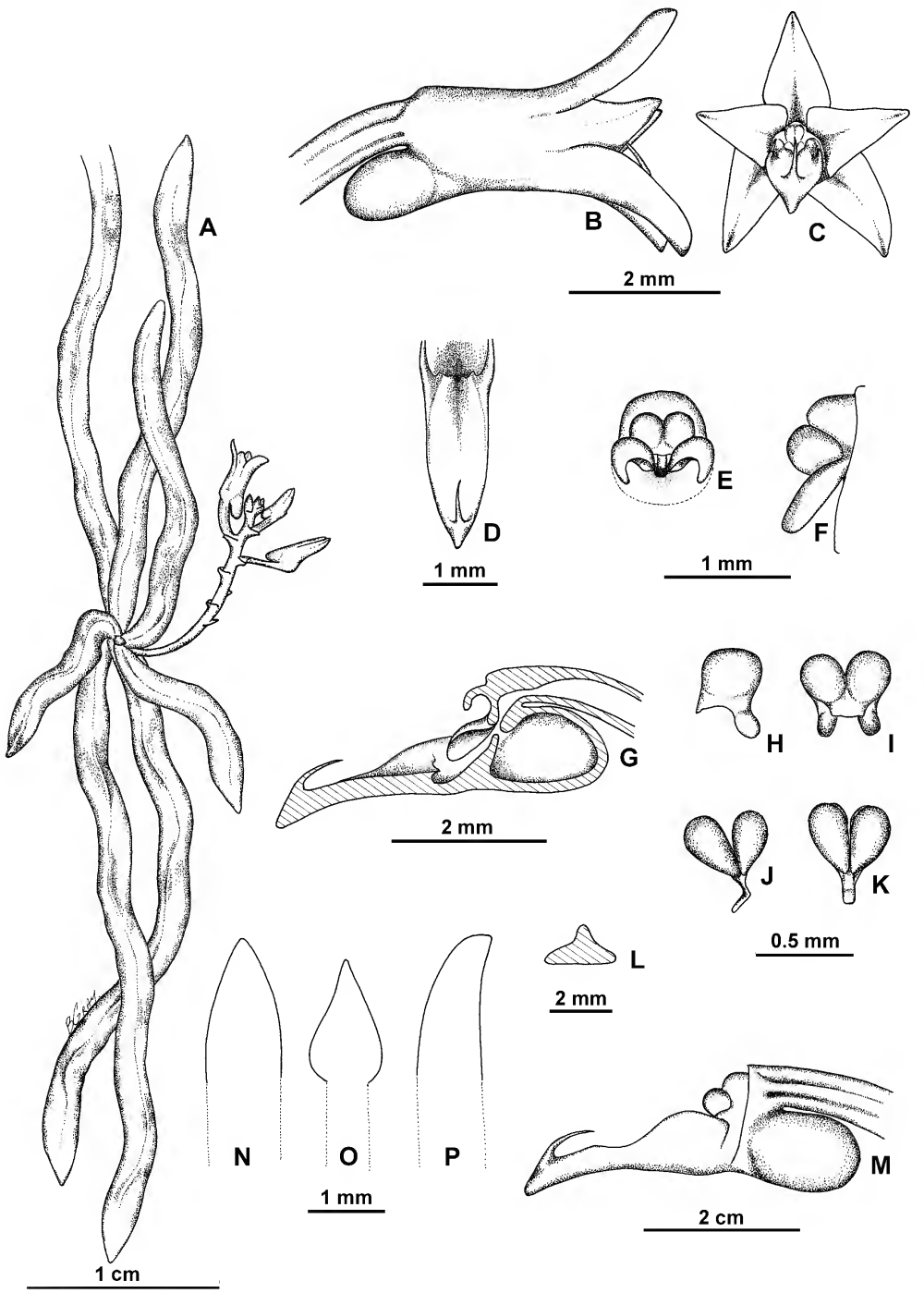

Fig. 7. ***Taeniophyllum triquetroradix***. A. habit of a mature flowering plant. B. lateral view of flower. C. face view of flower. D. face view of labellum. E. face view of column. F. lateral view of column. G. longitudinal section of labellum and column. H. lateral view of anther. I. face view of anther. J. face view of pollinia. K. lateral view of pollinia. L. transverse section of mature root. M. lateral view of labellum and column. N. dorsal sepal. O. petal. P. lateral sepal. All from *Gray BG5238* (BRI). Scale as indicated. Del. B. Gray.

column wings projecting forward, *c.* 0.4 mm long. **Anther Cap** *c.* 0.5 × 0.5 mm, with two distinct humps. **Pollinarium** *c.* 0.5 mm long. **Pollinia** 4, ovoid, in 2 equal sized pairs, yellow. **Capsule** 11.5–12 × 2–3 mm with 5–6 longitudinal ridges. **Figs. 7 & 8**.

***Additional specimens examined*: Queensland.** Cook District: Euluma Creek Road, Julatten, Jan 2003, *Gray BG8424* (CNS); Bushy Creek, Julatten, Aug 1985, *Gray BG4129* (CNS); Cairns Inlet near White Rock, Jul 2013, *Ormerod 008* (CNS).

Fig. 8. ***Taeniophyllum triquetroradix***. Close-up view of a flowering specimen in cultivation showing (i) triangular roots with a clear dorsal median ridge, and (ii) an inflorescence bearing a flower bud and an open flower (*Gray BG8424*, CNS). Photo: B. Gray.

***Distribution and habitat*:** *Taeniophyllum triquetroradix* occurs within the Wet Tropics of Queensland between Mossman and Innisfail (**Map 2**) from sea level to 400 m. Plants have been most commonly found in poorly developed, open rainforest, either in the understorey or the upper canopy based on specimens found on fallen branches; however, it has also been recorded at the edge of mangroves. Some populations have also been observed on trees in open paddocks.

***Phenology*:** Flowers have been observed between July and January.

***Notes*:** *Taeniophyllum triquetroradix* is probably more common than the number of collections indicates because plants are small and often overlooked.

***Etymology*:** The specific epithet refers to the roots which are triangular in cross section.

Acknowledgements

I am grateful to David Baume for his kind help with locating new populations of *Taeniophyllum epacridicola* and *T. explanatum*, and who also assisted me in numerous field trips; James Walker for good company in the field, testing and commenting on the taxonomic key, and his constructive criticism with the manuscript. Special thanks to Yee Wen Low (Singapore Botanic Gardens) and Paul Ormerod (Cairns, Queensland) for help with the initial stage of the manuscript. Professor Darren Crayn and Frank Zich kindly provided me with access to the Australian Tropical Herbarium (CNS) to examine the *Taeniophyllum* collection there; Paul Forster and the curators of the Queensland herbarium (BRI) for making available relevant materials on loan for this study.

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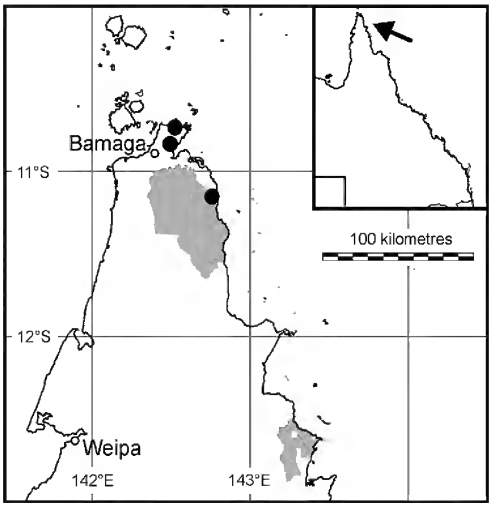
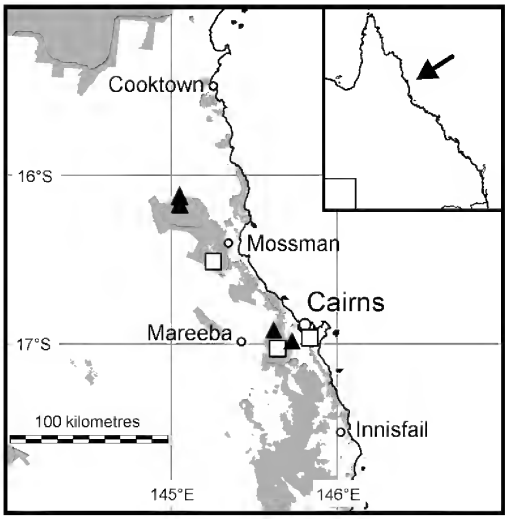


Map 1. Distribution of *Taeniophyllum epacridicola*, grey shaded areas are conservation reserves.



Map 2. Distribution of *Taeniophyllum explanatum* ▲ and *T. triquetroradix* □, grey shaded areas are conservation reserves.

A taxonomic revision of *Cynometra* L. (Fabaceae) in Australia with a new species from the Wet Tropics of Queensland and a range extension to the mainland

W.E.Cooper

Summary

Cooper, W.E. (2015). A taxonomic revision of *Cynometra* L. (Fabaceae) in Australia with a new species from the Wet Tropics of Queensland and a range extension to the mainland. ***Austrobaileya* 9(3): 393–403**. *Cynometra* comprises three species in Australia. In addition to *C. iripa* Kostel., the new species *C. roseiflora* W.E.Cooper is described, illustrated and distinguished from related species. *C. ramiflora* L. is newly recorded as occurring on the Australian mainland in north Queensland. All species are described with notes provided on typification, distribution and habitat. An identification key to the species of *Cynometra* in Australia is presented.

Key Words: Fabaceae, Leguminosae, *Cynometra*, *Cynometra iripa*, *Cynometra ramiflora*, *Cynometra roseiflora*, new species, taxonomy, Australia flora, Queensland flora, identification key

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Introduction

Cynometra L. has been classified in the leguminous tribe *Detarieae* (within the Caesalpiniaceae) that broadly corresponds to the 'Detarieae clade' recovered from multiple genetic sequence data (Bruneau *et al.* 2008). There appears to be a close relationship with *Maniltoa* based on the available genetic evidence; however, taxon sampling has been limited to date (Bruneau *et al.* 2008), hence the traditional circumscription of *Cynometra* based on floral morphology (Knapp-van Meeuwen 1970; Ding Hou 1996) is followed in the current paper.

Cynometra comprises approximately 88 species when so defined (The Plant List 2013) with a pantropical distribution from the African continent, Indian subcontinent (including Indian Ocean Islands, India, Sri Lanka), SE Asia, Malesia, Pacific Islands, Australia to Central America (Mexico), the West Indies and South America (Brazil, Argentina and Chile), occurring in forests from sea level to altitudes of 1300 m. The genus has its greatest diversity on the African continent (Cowan & Polhill 1981: 124) and is present only in small species numbers in Australia and the western Pacific.

Historically, within Australia and in Asia, specimens of *Cynometra iripa* Kostel. (in the sense applied in this paper) have been previously determined as *C. ramiflora* var. *bijuga* (Bentham 1864; Bailey 1900; Knaap-van Meeuwen 1970). Recent consensus has been that true *C. ramiflora* did not occur on mainland Australia (Knapp-van Meeuwen 1970; Tomlinson 1986; Ding Hou 1996); although it has been subsequently recorded from the Australian territory of Christmas Island in the Indian Ocean (Du Puy 1993; Claussen 2005). Despite these published statements, *Cynometra ramiflora* does indeed occur on mainland Australia and was first collected at the Jardine River on Cape York Peninsula in 1978 (*Stirling A1M462* BRI), although this specimen was possibly overlooked by the second and third groups of authors mentioned above. *Cynometra ramiflora* was again collected in 1991 (*Sankowsky 1223* [BRI], this specimen resulting in the phrase name *Cynometra* sp. (Paira Homestead Rd., G. Sankowsky +1223) at BRI) and again at Jardine River in October 2014 (*Cooper, Jensen, Kemp & Zdenek 2265, 2267, 2268* [CNS]).

Accepted for publication 23 July 2015

In 1992, Garry Sankowsky collected a sterile specimen of *Cynometra* at Mossman River. This specimen and further collections were later determined at QRS (now CNS) to be *C. ramiflora,* and as *C. iripa* by the Queensland Herbarium (BRI). Habitat as well as leaf, flower and fruit morphology indicated that these collections were distinct from *C. ramiflora* and *C. iripa* and required investigation.

This morphological and ecological study confirms that three species of *Cynometra* occur in Australia: *C. iripa*, *C.ramiflora* and the newly described *C. roseiflora* known only from the Mossman River. Knaap-Van Meeuwen (1970: 13) stated that all Indo-Pacific species of *Cynometra* grow under ever-wet conditions; however, the three species that occur in Australia grow in tropical climates with a distinct dry season. *C. iripa* and *C. ramiflora* do occur in back mangal (*sensu* Tomlinson 1986) areas, but *C. roseiflora* occurs in rainforest with a distinct dry season on porous granitic soil.

Materials and methods

The study is based upon the examination of selected herbarium material from CNS, BRI, CANB and NSW (herbarium acronyms as per Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff 2015), combined with field observations of all species. All specimens cited have been seen by the author.

Measurements of the floral parts and fruits are based on fresh material as well as material preserved in 70% ethanol.

Taxonomy

Cynometra L., *Sp. Pl.* 1: 382 (1753) & *Gen. Pl.*, 5th edn. 466 (1754). **Type species:** *C. cauliflora* L.

***Cynometra* in Australia:** Monoecious shrubs or trees to 15 m tall, can be multistemmed or buttressed. **Bark** finely fissured, lenticels linear or round; stipules caducous and leaving no visible scar; bracts enclosing new leaves and inflorescences similar to the stipules, several overlap to create a cone-like structure, broadly reniform, semi-circular, broadly ovate, somewhat cupular or oblong-obovate, 0.8–2.5 mm long, rust coloured, minute hairs on dorsal surface, margin ciliate, caducous. **Leaves** coriaceous, alternate, 1–2-jugate, discolorous, new leaves green, pink or bright red; petiole + rachis chanelled on the upperside; petiolules thickened, wrinkled, mostly enclosed by leaflet base; leaflets opposite, asymmetrical, basal pair (if present) are smaller than terminal pair; base oblique; margin entire; venation brochidodromous. **Inflorescences** axillary, terminal or ramiflorous, racemes on a swelling; bracteoles 1 or 2 towards pedicel base, filiform or strap-shaped, 1.5–3.5 mm long, caducous. **Flowers** bisexual; hypanthium inverted cone-shaped; sepals 4, imbricate, unequal in width, margin ciliate at apex, somewhat ragged or entire, acute; petals 5, free, white or pink, margin entire or barely fimbriate at apex, caducous; disk absent; stamens 10; anthers orbicular-cordate, cleft at base, bilocular, introrse, medi-dorsifixed, dehiscing longitudinally; ovary asymmetrically elliptical, stipe short and inserted excentrically; ovules 1 (rarely 2 or 3); style slender, almost directly in line with dorsal margin of ovary or excentric to varying degrees and becoming more excentric post anthesis; stigma capitate. **Fruit** an indehiscent woody nut, asymmetrical with a beak at apex of dorsal suture, rugose, scurfy; seeds 1 (rarely 2 or 3). Germination epigeal.

Key to *Cynometra* species in Australia

1 Petals bright pink, about half as long as sepals; ovary inner wall glabrous but for a tuft of hairs at base; new leaves bright red . . . . . **3. C. roseiflora**

1. Petals white or very pale pink, about same length as sepals; ovary inner wall glabrous to generally hairy (not tufted at base); new leaves green or pink **2**

2 Leaf rachis and petiolules minutely hairy; sepal apices ciliate; ovary inner walls pubescent; fruit laterally compressed and distinctly beaked partway along dorsal side; new leaves green . . . . . **1. C. iripa**

2. Leaf rachis and petiolules glabrous on mainland Australia (minutely hairy or glabrescent on Christmas Island); sepal apices entire or few-toothed; ovary inner walls glabrous or with a few sparse hairs; fruit globose and with a small beak near apex of dorsal side; new leaves pink . . . . . **2. C. ramiflora**

1. Cynometra iripa Kostel., *Allg. Med.-Pharm. Fl.* 4: 1341 (1835). **Type:** Rheede, *Hort. Malab.* 4: t. 31 (1683).

Cynometra ramiflora var. *bijuga auct. non* (Span. ex Miq.) Benth. as to type; Bentham (1864: 296).

Cynometra ramiflora auct. non L.; Bailey (1900: 469).

***Illustrations*:** Parkinson A (1768–71) as *C. ramiflora*; Lear & Turner (1977: 31) as *C. ramiflora*; Wightman (1989: 63); Ross (1998: 168); Tomlinson (1986: 253); Cooper & Cooper (2004: 102); Duke (2006: 136, 137 [upper image], (2013).

In Australia: Shrub or tree to 6 m, sometimes multistemmed. **Bark** finely fissured, lenticels linear or round, pale; new flush foliage green; stipules not seen. **Leaves** 1–2-jugate; petioles 1–4 mm long, minutely pubescent; petiole + rachis 9–30 mm long, channelled on the upperside, puberulent, lenticels pale; petiolules up to 3 mm long, wrinkled, mostly enclosed by leaflet base, puberulent on underside, glabrescent on upperside; leaflets discolorous, asymmetrical, obliquely-elliptical, obliquely-oblong, obliquely-obovate or obliquely-ovate; basal pair 8.5–50 × 5–30 mm; terminal pair 23–85 × 11–50 mm; coriaceous, glabrous; base oblique, cuneate, attenuate or obtuse; apex obtuse and emarginate; margin entire; venation brochidodromous, primary vein raised (more so on under-side); secondary veins 6–10 pairs, slightly raised on both sides of dried specimens but ± flush on fresh leaves, angle of divergence from primary vein 50–70°, forming loops 2–5 mm from margin; tertiary venation reticulate. **Inflorescences** axillary, terminal or ramiflorous, solitary racemes or a fascicle of racemes on a swelling, racemes 3–9-flowered; bracteoles 1 or 2 towards pedicel base, filiform, 1.5–3 mm long, sparsely hairy, caducous. **Flowers** fragrant, erect, 6.5–8.5 × 5.5–8 mm wide; receptacle inverted cone-shaped, *c.* 1.5 × 1.5 mm; sepals 4, unequal in width, lanceolate or oblong-ovate, becoming reflexed and often incurved at apex, 2.5–3 × 0.5–1.7 mm, white or very pale pink; margin at apex ciliate, from mid position to base entire or sparsely ciliate; glabrous or with few sparse hairs on abaxial surface; petals 5, white or very pale pink, lanceolate, 2–3 × 0.5–0.7 mm, glabrous, caducous; stamens 10; filaments terete, 4–7 mm long, straight or curved, glabrous; anthers *c.* 1 × 1 mm, brown; ovary inserted excentrically on a short stipe, *c.* 2.25 × 1.25 mm, pink, white pubescent externally, appressed-pubescent internally; ovules 1 (rarely 2); style slender, almost directly in line with dorsal margin of ovary or excentric to varying degrees, becoming more excentric post anthesis, 2–4 mm long, sparsely hairy from median section to base; stigma capitate. **Fruit** on a 6–10 mm long pedicel, an asymmetrical nut with a distinct beak at apex of dorsal suture and partway along dorsal side, suborbicular, laterally compressed, 30–40 × 30–34 × 17.5–20 mm, deeply rugose, glabrescent, scurfy, brown; seeds 1 (rarely 2), 25–29 × 17–20 mm. *wrinklepod mangrove*. **Figs. 1A, 2A–C**.

***Additional selected specimens* (*from 60 examined*): Australia: Northern Territory.** Ingliss Island, Dec 1987, *Dunlop 7510* (CANB); Arnhem Bay, Probable Island, Oct 2009, *Westaway 3190* (NSW). **Queensland.** Cook District: *c.* 6 km NE of Mapoon community, Sep 2006, *Wharton s.n.* (BRI [AQ783524]); Cape York Peninsula, E of Bramwell Homestead on Olive River, Dec 1987, *Kanis 2047* (CANB); Weipa Concession, Marmoss Creek, Sep 1974, *Dockrill 853* (CNS); near Taylors Landing, Claudie River, Jul 2014, *Cooper 2239, Jensen & Venables* (CNS); Nesbit River, Jun 1995, *Forster PIF17083* (CNS); Annie River, Dec 1978, *Duke AIM877* (BRI); Endeavour River Estuary, May 1991, *Le Cussan 25* (CNS); Cooktown, Keatings Lagoon

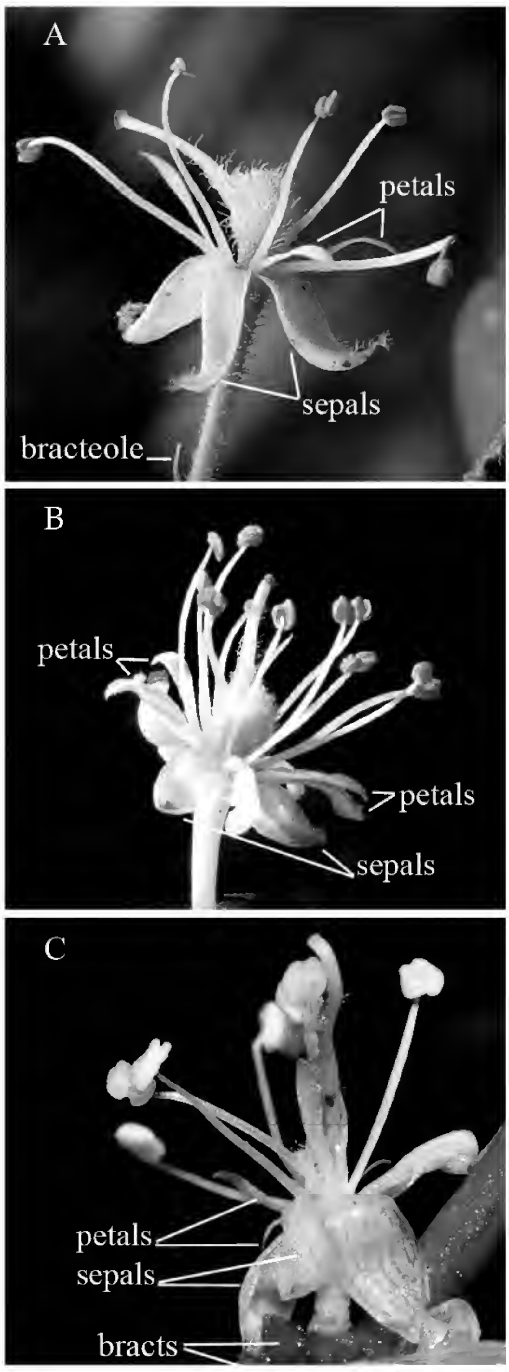

Fig. 1. ***Cynometra*** flowers: A. ***Cynometra iripa*** (*Cooper 2238 et al.* [CNS]), B. ***C. ramiflora*** (*Cooper 2245 et al.* [CNS]), C. ***C. roseiflora*** (*Cooper 2215 et al.* [CNS]). Photos: A & B, W. Cooper; C, T. Hawkes.

Conservation Park, Dec 2008, *Booth 5243 & Lynch* (BRI); 100 m N of Daintree River ferry crossing, Jul 1995, *Gray 6247* (CNS); North bank of Mossman River mouth, Sep 1948, *Smith 3997* (CANB); Redden Island, Machans Beach, Apr 2014, *Cooper 2235, Venables & Cooper* (CNS); Holloways Beach, Jan 2015, *Cooper 2273* (CNS); Holloways Beach, Jul 2014, *Cooper 2238 & Venables* (CNS); Russell River Road, Jul 2004, *Gray 8933* (CNS); Mouth of Maria Creek near Kurramine Beach, Jul 1994, *Waterhouse 3356* (BRI); Deluge Inlet, Hinchinbrook Island, Aug 1976, *Abel AS144* (BRI). North Kennedy District: Hayman Island, Jun 1934, *White 10120* (BRI). South Kennedy District: Mackay, Sep 1968, *Jones s.n.* (BRI [AQ19340]).

***Distribution and habitat*:** *Cynometra iripa* is distributed throughout tropical southern and south-eastern Asia (including India, Bangladesh, Myanmar, Cambodia, Vietnam and Thailand), Malesia (Malaysia, Indonesia, Singapore, the Philippines and New Guinea), Micronesia, Melanesia (Solomon Islands, New Caledonia) and Australia, at altitudes reportedly to 500 m (Ding Hou 1996). Within Australia, *C. iripa* has been recorded in Queensland on the mainland and off shore islands from Cape York to the Mackay area, as well as west to East Arnhem Land in the Northern Territory (**Map 1**); altitude near sea-level to 20 m.

In Australia, *Cynometra iripa* is a plant of back mangal areas, rarely of upstream wetlands (Keatings Lagoon near Cooktown [*Booth 5243 & Lynch*]) or adjoining monsoon forest (Arnhem Land [*Westaway 3190*]). In Queensland it commonly co-occurs with *Acacia polystachya* A.Cunn. ex Benth., *Acrostichum speciosum* Willd., *Aegiceras corniculatum* (L.) Blanco, *Arytera bifoliolata* S.T.Reynolds, *Avicennia marina* (Forssk.) Vierh., *Brownlowia argentata* Kurz, *Bruguiera gymnorhiza* (L.) Savigny, *Clerodendrum inerme* (L.) Gaertn., *Cryptocarya exfoliata* C.K.Allen, *Dalbergia candenatensis* (Dennst.) Prain, *Derris trifoliata* Lour., *Dillenia alata* (R.Br. ex DC.) Martelli, *Dysoxylum acutangulum* subsp. *foveolatum* (Radlk.) Mabb., *Excoecaria agallocha* L., *Ganophyllum falcatum* Blume, *Heritiera littoralis* Dryand., *Lumnitzera littorea* (Jack) F.Voigt, *Melaleuca leucadendra* (L.) L., *Thespesia populneoides* (Roxb.) Kostel., *Terminalia sericocarpa* F.Muell and *Xylocarpus* spp. In the Northern Territory it is

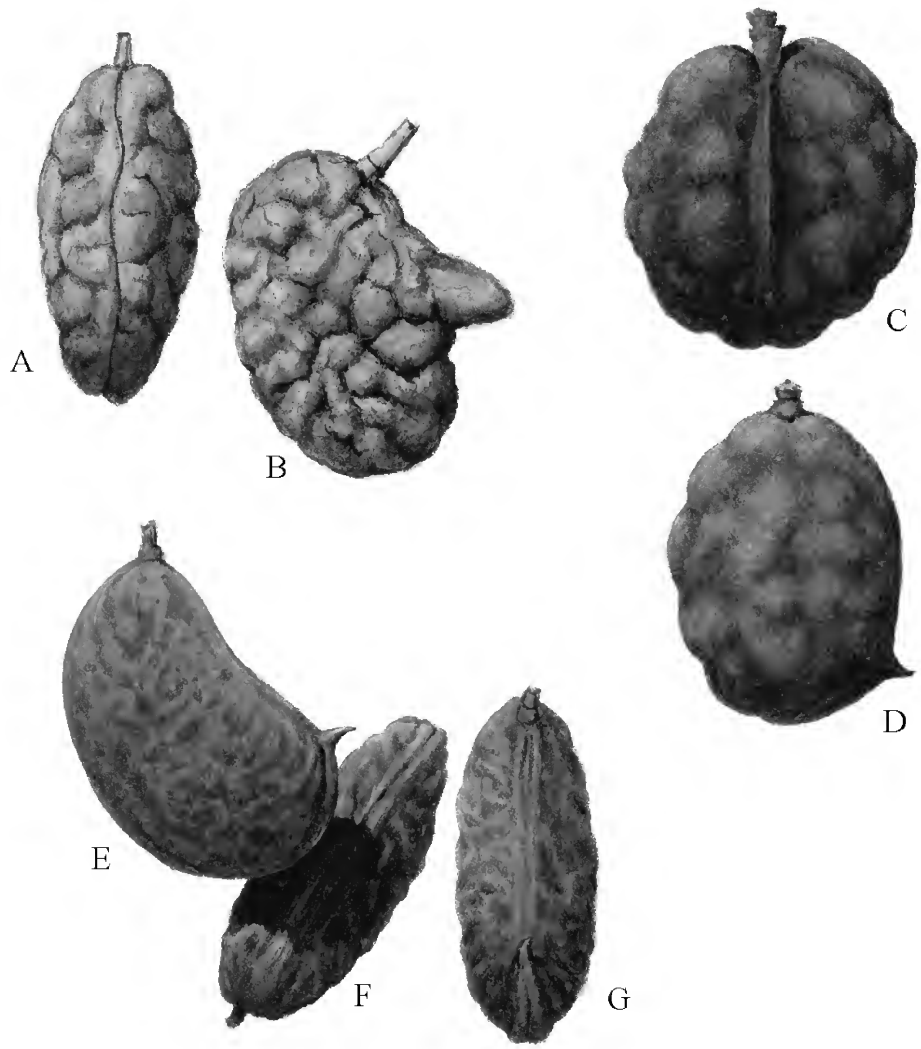

Fig. 2. ***Cynometra*** fruit all natural size: ***C. iripa*** (*Cooper 2273* [CNS]), A. ventral view, B. lateral view showing beak on dorsal side; ***C. ramiflora*** (*Cooper 2265 et al.* [CNS]), C. dorsal view, D. lateral view; ***C. roseiflora*** (*Cooper 2271 et al.* [CNS]), E. lateral view, F. ventral view, G. dorsal view. Del. W.T. Cooper.

known to occur in back mangal communities co-occurring with *Aegiceras corniculatum* (L.) Blanco, *Lumnitzera racemosa* Willd. and *Flacourtia territorialis* Airy Shaw, and in adjoining monsoon forest dominated by *Peltophorum pterocarpum* (DC.) Backer ex K. Heyne.

***Phenology*:** Flowers have been recorded from March to October; fruits have been recorded from January to March, June to September and in November.

***Typification*:** *Cynometra iripa* Kostel. is solely based on Rheede's plate in *Hortus Malabaricus* (Kosteletzky 1835; Knaap-van Meeuwen 1970). This plate was also one of the two elements cited by Linnaeus (1753) in his description of *C. ramiflora* L.; however, this element has now been excluded from

typification of that name (Kosteletzky 1835; Knaap-van Meeuwen 1970). Kosteletzky (1835) quite clearly indicated the single typifying elements for both his name and that of Linnaeus (1753) and provided accounts of both species. Although this does not equate to a formal lectotypification in the modern sense, subsequent authors have followed this citation (e.g. Knaap-van Meeuwen 1970; Ding Hou 1996: 606; Ross 1998: 169). Jarvis (2007) goes so far as to state "Lectotype (Knaap-van Meeuwen in *Blumea* 18: 23 (1970): [icon] "*Cynomorium Silvestre*" in Rumphius, Herb. Amboin. 1: 167, t. 63. 1741", although Kosteletzky (1835) rather than Knaap-van Meeuwen (1970) should probably be regarded as making this decision: neither state "lectotypify" as such.

***Notes*:** *Cynometra iripa* has been described as having a style not in line with the dorsal suture of the ovary (Knaap-van Meeuwen 1970), but Australian material has styles that are often directly in line with the dorsal suture, although during and after anthesis they become excentric to varying degrees. All living specimens seen in the Cairns area, as well as along the Claudie and Olive Rivers, have pink ovaries with a dense covering of white hairs, thus differing from the rust-coloured pubescence described by Ross (1998). Fresh specimens from other areas were not seen for comparison.

Sepals have been described as being rather long-hairy (Knaap-van Meeuwen 1970: 23; Ding Hou *et al.* 1996: 603). Sepals of Australian specimens seen by the author of this revision do not have a hairy surface but do have a ciliate margin especially at the apex.

***Etymology*:** There has been confusion over the etymology of the specific epithet *iripa*. It is clear that Rheede's name for this plant, *Iripa*, was based on an indigenous Malayalam (native language of southern India) name (Rheede's opening statement is 'Iripa Malabarensibus'; Ram (2005) also indicates that Malayalam names were employed by Rheede). This is further confirmed by Nicolson *et al.* (1988), who reported that "Irippa (sic) is still used. It is found [in] mangrove swamps, increasingly scarce in Kerala". Hence the etymology for *iripa* is derived from Irippa, the Malayalam name for the plant.

2. Cynometra ramiflora L., *Sp. Pl.* 382 (1753). **Type:** based on *Cynomorium sylvestre* Rumph., *Herb. Amboin.* 1: 167, t. 63 (1741), *fide* Knaap-van Meeuwen (1970: 23 "excl. syn *Iripa* Rheede").

Cynometra sp. (Paira Homestead Rd G.Sankowsky+ 1223); Pedley (2007: 39, 2010: 34).

***Illustrations*:** Beddome (1869–1874); Pierre (1880–1907); Kirtikar & Basu (1918); Verdcourt (1979: 84); Whitmore (1983: 255); Du Puy (1993: 180 D & E); Corner (1997: 399); Claussen (2005: 21); Duke (2006: 137) as *C. iripa* (lower photo).

In Australia: Tree to 15 m, dbh to 60 cm, buttressed, blaze red. **Bark** with numerous lenticels, these round or elongated and often in vertical lines; twigs with scattered to dense round and linear lenticels; new flush foliage pink to cream; stipules filiform, *c.* 1.5 mm long; tuft of hairs at petiole apex *c.* 0.75 mm long, caducous. **Leaves** 1 (rarely 2)-jugate; petiole (+ rachis when present) 5–33 mm long, shallowly grooved on upper side, glabrous on mainland specimens and glabrescent on Christmas Island specimens; petiolules 2–6 mm long, thickened and mostly enclosed by leaflet base, glabrous on mainland specimens but minutely pubescent on Christmas Island specimens; leaflets discolorous, asymmetrical, obliquely-ovate, obliquely-oblong, obliquely-obovate or broadly elliptical; basal leaflets, if present, 17–82 × 9–46 mm; terminal leaflets 63–210 × 30–98 mm; coriaceous, shiny, glabrous; base oblique, rounded, truncate, attenuate or cuneate; apex acute, shortly acuminate, acuminate or emarginate; margin entire; venation brochidodromous, primary vein raised on upperside, secondary veins in 8–12 pairs (6 –7 pairs on basal leaflets if these present), angle of divergence from primary vein 40°–50°; tertiary venation reticulate. **Inflorescences** axillary, terminal or ramiflorous, solitary or paired (sometimes condensed) racemes, up to 20-flowered; rachis to 20 mm long, glabrous; pedicels 6.5–12.5

mm long, glabrous; bracteoles near pedicel bases boat-shaped and keeled, 3–3.5 × *c.* 1.5 mm, ciliate at apex, dorsal surface with hairs along keel line and some scattered minute hairs may be present, caducous. **Flowers** with an unpleasant odour, erect, 5–9 × *c.* 9 mm; receptacle inverted cone-shaped, *c.* 1.5 × 1.5–2.5 mm; sepals 4, oblong-ovate, *c.* 5 × 2.5 mm, white, apex acute and somewhat ragged or slightly fimbriate, otherwise margin entire, glabrous; petals 5, obovate-lanceolate, 5.5–6 × *c.* 1.5 mm, white, caducous, glabrous, apex acute or mucronate and somewhat ragged or slightly fimbriate, otherwise margin entire; stamens 10; filaments terete, straight or curved, 6–8 mm long, glabrous; anthers *c.* 1.25 mm long, cream to brown; ovary inserted slightly off centre on its stipe, *c.* 1 mm long, yellowish or pink, pubescent externally, internal walls glabrous (or with a few sparse hairs *Cooper 2245*); ovules 1–3; style in line with dorsal suture or frequently excentric, 3–3.5 mm long, sparse hairs towards base; stigma capitate. **Fruit** on a 3–10 mm long pedicel, an asymmetrical, somewhat globose nut, but flattened on the ventral side, 38–52 × 37–42 × 28.5–40 mm, rust brown coloured, woody, rugose, scurfy, minutely and sparsely pubescent, beak short, near apex of dorsal suture, seed solitary. *wrinklepod mangrove*. **Figs. 1B, 2C & D, 3**.

***Additional selected specimens (from 18 examined)*: Malaysia.** Pahang, Kuantan Telok Chempedak Bay, Jul 1992, *Saw FRI37559* (CNS). **Papua New Guinea.** New Britain Province: Cape Roebuck, west of Fullerborn Harbour, May 1973, *Womersley NGF41214* (CNS). Western province: Morehead River, *c.* 8 miles inland, Aug 1967, *Pullen 7057* (CANB), *7074* (CANB); junction of Bensbach & Tarl Rivers, Bensbach sub-district, Aug 1967, *Ridsdale & Galore NGF 33711* (CANB). **Australia. Christmas Island**. SE Ross Hill, Mar 2002, *Holmes CI43 & Holmes* (CANB); Cultivated at National Park Headquarters, Dec 2014, *Cooper 2285 & Maple* (CNS); Cultivated at 21 Central Rehab Field, Dec 2014, *Cooper 2286 & Maple* (CNS). **Queensland.** Cook District: Paira Homestead, Sep 1991, *Sankowsky 1223* (CNS); Old Paira Homestead Road, Cape York, Feb 1992, *Sankowsky 1320* (CNS); Jardine River, Nov 1978, *Stirling AIM462* (BRI); Jardine River, Oct 2014, *Cooper 2267, Jensen, Kemp & Zdenek* (CNS); Jardine River, Oct 2014, *Cooper 2265, Jensen, Kemp & Zdenek* (CNS); Jardine River, Oct 2014, *Cooper 2268, Jensen, Kemp & Zdenek* (CNS); ex Mew River, Muddy Bay, Cape York (cultivated at Tolga), Oct 2005, *Sankowsky 2668 & Sankowsky* (BRI); *ditto loc.*, (cult. by Sankowsky at Tolga), Oct 2014, *Cooper 2258, Cooper & Sankowsky* (CNS); Cairns Botanic Gardens (ex Mew River), May 2014, *Cooper 2275 & Venables* (CNS); Cairns Botanic Gardens (ex Mew River), Aug 2014, *Cooper 2245, Cooper & Roberts* (CNS).

Fig. 3. ***Cynometra ramiflora*** showing pink colouration on pendulous new leaves (*Sankowsky 2668 et al.* [CNS]). Photo: G. Sankowsky.

***Distribution and habitat*:** *Cynometra ramiflora* occurs in India, Sri Lanka, South-east Asia (including Thailand), Malesia (including Indonesia, Malaysia, the Philippines, New Guinea), Melanesia (Solomon Islands, New Caledonia) and Australia.

On mainland Australia, it has been recorded from two locations from north Queensland near Cape York (**Map 1**). One site is along the Jardine River in areas of back mangal on white sand and mangrove mud where it co-occurs with *Acrostichum speciosum* Willd., *Calophyllum inophyllum* L., *Cerbera manghas* L., *Crinum pedunculatum* R.Br., *Heritiera littoralis* Dryand., *Melaleuca quinquenervia* (Cav.) S.T.Blake, *Rhizophora* spp. and *Xylocarpus granatum* K.D.Koenig. The second is near the Mew River on the east coast adjacent to mangroves in swamp forest dominated by *Livistona benthamii* F.M.Bailey.

On Christmas Island, *C. ramiflora* occurs in isolated relict mangroves on an elevated

area at *c.* 300 m altitude where, at no time since the last interglacial has sea level been where mangroves are now found (Woodroffe 1988: 12). Christmas Island has been rapidly uplifted during the Cainozoic pushing tertiary limestone to 361 m above sea level (Woodroffe 1988: 12).

***Phenology*:** Flowers in cultivation have been recorded in August and October; fruit has been recorded from the Jardine River in October and in cultivation in May.

***Typification*:** See previous notes under *Cynometra iripa*.

***Notes*:** Previously *Cynometra ramiflora* was thought not to occur in Australia, but specimens from Cape York and Christmas Island are confirmed to be this species.

In the past, *C. ramiflora* has been distinguished from *C. iripa* by the glabrous inner wall of its ovaries (Knaap-Van Meeuwen 1970: 14; Tomlinson 1986: 253) (those of *C. iripa* are pubescent). However, one collection (*Cooper 2245*) has sparse but distinct pale hairs on the inner wall of some, but not all ovaries.

Sepals have been variously described as being completely hairy, with a few hairs near their tip or glabrous (Knaap-van Meeuwen 1970: 24, Ding Hou *et al.* 1996: 606). Australian material has glabrous sepals with an entire to slightly fimbriate apex margin.

With the exception of a small tuft of caducous hairs at the petiole apex, all specimens seen from the Australian mainland and New Guinea have glabrous petioles, rachises and petiolules (including on tender new growth), whereas material from Christmas Island and SE Asia have glabrescent petioles and rachises, and minutely pubescent petiolules.

***Etymology*:** The specific epithet, *ramiflora*, is derived from the Latin *rami-* (pertaining to branches) and *-florus* (flowered), referring to the ramiflorous inflorescences.

3. Cynometra roseiflora W.E.Cooper sp. nov. Similar to *Cynometra ramiflora* L. but differs in the colour of new flush foliage (red versus pink); petal length (about half as long as sepals versus of similar length); petal colour (bright pink versus white); internal ovary wall (glabrous but for a tuft of hairs at base versus glabrous or sparsely hairy but lacking a tuft of hairs at base); fruit shape (reniform and laterally compressed versus globose and ventrally flattened). **Typus:** Australia: Queensland. Cook District: Mossman Gorge section, Daintree National Park, north side of the river, 10 March 2013, *W. Cooper 2215*, *T. Hawkes*, *R. Jensen*, *J. Kemp & J. Leech* (holo: CNS [2 sheets + spirit]; iso: BRI, CANB, L, K, MO *distribuendi*).

Cynometra iripa (in part) (*sensu* Pedley 2007: 39).

Cynometra ramiflora (in part) (*sensu* Hyland *et al.* 2003, 2010).

Shrub or tree to 15 m. **Bark** with round or elongated lenticels or pustules; twigs zig-zag, with lenticels round and scattered; stipules not seen. **Leaves** 1-jugate; petioles 4–8 mm long, not channelled, mostly enclosed by leaflet base, glabrous; leaflets slightly discolorous, new growth bright red and pendulous; petiolules 1–2.5 mm long, wrinkled, glabrous; leaflets asymmetrically ovate, 70–175 × 20–62 mm, membranaceous-coriaceous, glabrous, upper-side shiny, under-side dull; base oblique, cuneate, attenuate or rounded; apex acuminate or drawn out with a bluntly rounded tip, rarely emarginate; margin entire; venation brochidodromous, primary vein raised on both surfaces; secondary veins 8–15 per leaflet, angle of divergence from primary vein 20–40°; tertiary veins reticulate. **Inflorescence** a ramiflorous, axillary or rarely pseudo-terminal, 1–7-flowered fascicle or pedunculate raceme on a swelling; pedicels 3–4 mm long, glabrous; bracteoles 2 on each pedicel, caducous, not seen but evidenced by scars. **Flowers** not fragrant, erect, *c.* 7 × 6 mm; receptacle shortly cone-shaped *c.* 0.5 mm long and wide; sepals 4, lanceolate or oblong-elliptic, reflexed and strongly incurved at apex, 3–4 × 1–2.5 mm, bright pink, some becoming whitish after anthesis, glabrous, margin at apex often sparsely and minutely ciliate; petals 5, lanceolate or strap-shaped, entire, 1–2 × 0.2–0.7 mm, bright pink,

caducous; stamens 9–10; filaments terete, *c.* 4.5 mm long; anthers *c.* 0.75 × 0.75 mm, white; ovary inserted slightly excentrically on a short stipe or sessile, *c.* 1.5 × 1 mm, pink, pubescent externally, glabrous internally except for a tuft of hairs at base; ovule 1; style slender, elongate, initially in line with dorsal suture, becoming excentric after anthesis, *c.* 4.5 mm long, sparsely hairy from base to apex, stigma minutely capitate. **Fruit** on a 2–5 mm long pedicel, a reniform or oblong and laterally compressed nut, with a small beak at apex of dorsal suture, 28–55 × 19.5–31.5 × 13.5–23.5 mm, rugose, scurfy, sparsely and minutely pubescent, rust brown coloured; seeds 1 per fruit, testa thin and adhering to mesocarp. Germination epigeal. **Figs. 1C, 2E–G, 4**.

***Additional selected specimens* (*from 8 examined*): Queensland.** Cook District: N bank of Mossman River, Mossman, Oct 1992, *Russell s.n.* (BRI [AQ548293]); Mossman Gorge NP, north side of the river, Jul 2013,

Fig. 4. ***Cynometra roseiflora*** showing red new leaves (*Cooper 2215 et al.* [CNS]). Photo: R. Jensen.

Cooper 2223, Jensen, Jago & Russell (CNS); NPR 133, Mossman Gorge, Jul 1995, *Hyland 25906 RFK & Gray* (CNS); NPR 133, Mossman Gorge, Dec 1995, *Hyland 25906 RFK & Gray* (CNS); Mossman River, Silky Oaks Resort, Jul 1992, *Sankowsky 1333* (CNS); Mossman Gorge, Silky Oaks Resort, May 1993, *Sankowsky 1417* (CNS); Cultivated by G & N Sankowsky at Tolga, Nov 2014, *Cooper 2271 & Sankowsky* (CNS).

***Distribution and habitat*:** *Cynometra roseiflora* is endemic to the Wet Tropics bioregion in north-eastern Queensland where it is currently known to occur within a very small area on the northern side of the Mossman River in the Mossman Gorge section of the Daintree National Park and on the neighbouring property of Silky Oaks Lodge (**Map 1**), altitude 20–125 m. It grows in wet lowland rainforests (mesophyll vine forest) on soils derived from granite. Plants that co-occur with *C. roseiflora* include *Alstonia scholaris* (L.) R.Br., *Archidendron ramiflorum* (F.Muell.) Kosterm., *Backhousia bancroftii* F.M.Bailey & F.Muell. ex F.M.Bailey, *B. hughesii* C.T.White, *Calamus australis* Mart., *Calamus moti* F.M.Bailey, *Cardwellia sublimis* F.Muell., *Citronella smythii* (F.Muell.) R.A.Howard, *Dysoxylum arborescens* (Blume) Miq., *D. papuanum* (Merr. & L.M.Perry) Mabb., *D. pumilum* Mabb.; *Lindsayomyrtus racemoides* (Greves) Craven, *Medinilla balls-headleyi* F.Muell., *Mesua larnachiana* (F.Muell.) Kosterm., *Myristica insipida* R.Br. var. *insipida* and *Palaquium galactoxylon* (F.Muell.) H.J.Lam.

***Phenology*:** Flowers have been recorded in March; fruits have been recorded in June–July.

***Etymology*:** The specific epithet, *roseiflora*, is derived from the Latin *roseus* (pink) and *-florus* (flowered).

Acknowledgements

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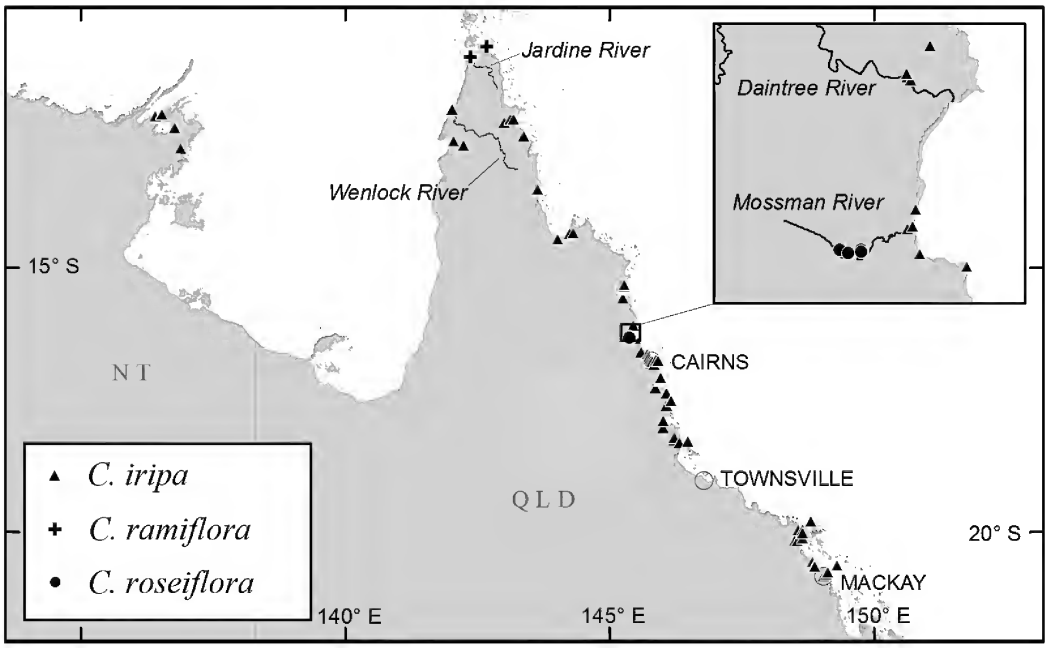

Map 1. Distribution of *Cynometra iripa* ▲(within Australia), *C. ramiflora* ✚ (within mainland Australia), and *C. roseiflora* ●.

Olearia cuneifolia A.R.Bean & M.T.Mathieson (Asteraceae: Astereae), a new species from Queensland

A.R. Bean & M.T. Mathieson

Summary

Bean, A.R. & Mathieson, M.T. (2015). *Olearia cuneifolia* A.R.Bean & M.T.Mathieson (Asteraceae: Astereae), a new species from Queensland. ***Austrobaileya* 9(3): 404–407.** *Olearia cuneifolia* A.R.Bean & M.T.Mathieson is described, illustrated and compared to related taxa. It has a restricted distribution in the Mungallala area of southern Queensland. A conservation status of Endangered is recommended.

Key Words: Asteraceae, *Olearia*, *Olearia cuneifolia*, endangered species, Maranoa, Queensland flora

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Introduction

Olearia Moench with 122 indigenous species is currently Australia's most species diverse Asteraceae genus (APC 2015). The molecular study by Cross *et al.* (2002) showed that *Olearia* is polyphyletic, with some species appearing in clades with species from other genera of the tribe Astereae. They identified two major taxonomic groups for *Olearia*, 'primary clade I' and 'primary clade II', to which all species could be assigned. The study also revealed the presence of eight robust clades within *Olearia*, which they designated A–H. It is possible that the name *Olearia* will, after further study, be confined to Clade A (including the Queensland species *O. ramulosa* (Labill.) Benth., *O. microphylla* (Vent.) Maiden & Betche and *O. nernstii* (F.Muell.) Benth.); otherwise all members of primary clade I will retain the generic name of *Olearia*. Messina *et al.* (2014) have provided a revision of the species included in *Olearia* sect. *Asterotriche* Benth., a monophyletic subset of the Clade A of Cross *et al.* (2002).

Olearia cuneifolia, newly named here, belongs to Clade B of Cross *et al.* (2002) and is related to *O. magniflora* (F.Muell.) Benth., *O. muelleri* (Sond.) Benth. and *O. calcarea* F.Muell. ex Benth.

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Materials and methods

This study is based on the morphological examination of specimens held at BRI, together with field observations. The measurements for floral parts are based on material preserved in 70% alcohol or reconstituted with hot water; other plant parts were measured from dried material.

Taxonomy

Olearia cuneifolia A.R.Bean & M.T.Mathieson **sp. nov.** with affinity to *O. muelleri*, but differing by the cuneate leaves, the much longer involucres, the disc florets with hairs on the corolla tube and corolla lobes, and the two-whorled pappus. **Typus:** Queensland. MARANOA DISTRICT: Nalpa Downs, *c.* 16 km NE of Mungallala, 26 March 2015, *M.T. Mathieson MTM1999* (holo: BRI; iso: CANB, K, MEL, NSW, US, *distribuendi*).

Erect shrub to 2 m high. Branchlets very viscid and with sparse, erect eglandular hairs to 0.15 mm long. Young branchlets distinctly angular due to decurrent leaf-bases, but older branchlets terete. Leaves alternate, sessile, oblanceolate to cuneate, 8–15 × 2–5.2 mm, ± glutinous, ± concolorous, venation not visible, except midrib; glabrous or with short sparse erect eglandular hairs, mainly along margins; apex acute or truncate; base attenuate; margins flat or recurved, entire or with 2 small teeth near apex. Capitula terminal,

solitary, sessile. Involucres ellipsoidal at anthesis, 14–16 mm long, 7–9 mm diameter; campanulate to hemispherical at fruiting stage. Bracts 5–7-seriate; outer bracts 3–4 × 1.8–2.5 mm, elliptical, with ± dense eglandular hairs near distal end; margins irregularly ciliate; inner bracts lanceolate, 6–10 × 1.5–2 mm, inner surface glabrous, outer surface with eglandular hairs near apex; apex obtuse, margin irregularly ciliate near apex. Receptacle slightly to markedly alveolate, 3–3.8 mm diameter. Ray florets 14–21, female; corolla tube linear, 6.2–6.9 mm long, with small antrorse eglandular hairs on apical ¼ of tube; ligule 7.5–9.5 mm long, white; styles exserted, recurved. Disc florets 28–42, bisexual; corolla tube linear, 6.5–7.5 mm long, with antrorse eglandular hairs on medial section; corolla lobes 5, acute, 0.8–1.6 mm long, glabrous except for a cluster of small eglandular hairs near apex; anthers 1.2–1.4 mm long, with sterile tip 0.8–1 mm long, anther tails *c.* 0.1 mm long. Achenes flattened-cylindric, 4–6-ribbed, 3.8–4.2 mm long, densely silky-hairy throughout; pappus bristles barbellate, creamy-white, in two whorls; inner whorl 7.5–8 mm long at fruiting stage, the outer whorl 1–1.5 mm long. **Figs. 1–3**.

***Additional specimens examined*: Queensland.** MARANOA DISTRICT: Lot 23, CP847082 Mitchell 8445 – Morven 8346 [Umberill Station], Sep 2003, *Baumgartner s.n.* (BRI [AQ764458]); Nalpa Downs, WNW of Mitchell, Dec 2013, *Mathieson MTM1599* (BRI); Nalpa Downs, *c.* 40 km NW of Mitchell, Sep 2014, *Mathieson MTM1790* (AD, BRI, HO, NE, NT); Andromeda, Mar 2015, *Mathieson MTM2000* (BRI, NSW); Andromeda, N of Mungallala, May 2008, *Silcock 125* (BRI); Andromeda, *c.* 24 km NNE of Mungallala, Oct 2008, *Wang JW0170* (BRI).

***Distribution and habitat*:** *Olearia cuneifolia* is endemic to Queensland. The species is known from sites north and north-east of Mungallala, between Roma and Charleville. It occurs within the ecotone between open or degraded forests dominated by *Acacia harpophylla* F.Muell. ex Benth. and *Casuarina cristata* Miq. and open sclerophyll woodland dominated by *Eucalyptus crebra* F.Muell. and/or *E. thozetiana* (Maiden) R.T.Baker. The soils are derived from sedimentary rocks and consist of self-mulching cracking clays on flat areas or stony clays on lower slopes of low mesas and rises.

***Phenology*:** Flowers and fruits are recorded in March, May, September and October.

***Affinities*:** *Olearia cuneifolia* is related to *O. muelleri, O. magniflora* and *O. calcarea*. All of these species have solitary and sessile capitula, and the involucres are cylindrical to ellipsoidal at anthesis. All have small resinous leaves.

Olearia cuneifolia differs from *O. muelleri* by the narrower, more cuneate-shaped leaves (broadly-ovate to orbicular in *O. muelleri*), the much larger involucres, the greater number of disc and ray florets, the presence of hairs on the corolla tube and lobes of the disc florets (glabrous in *O. muelleri*), the longer achenes and the pappus with two whorls of bristles (one whorl in *O. muelleri*).

Olearia cuneifolia differs from *O. magniflora* by the leaves without teeth or with only two teeth (at least some leaves with four or more teeth in *O. magniflora*), the shorter rays of the ray florets, the rays white in colour (mauve to purple in *O. magniflora*), and the densely hairy achenes (glabrous in *O. magniflora*).

Olearia cuneifolia is similarly in leaf morphology to *O. calcarea*, but differs from *O. calcarea* by the longer involucres, the greater number of ray florets, the much shorter rays of the ray florets, and the shorter achenes and pappus. *O. calcarea* is often regarded as a hybrid between *O. magniflora* and *O. muelleri* (Walsh & Lander 1999). *O. cuneifolia* is not considered to be a hybrid as other species of *Olearia* in the area (*O. canescens* (Benth.) Hutch., *O. elliptica* DC., *O. gordonii* Lander, *O. subspicata* (Hook.) Benth.) are not related to it.

***Conservation status*:** *Olearia cuneifolia* is only known from three locations in a small area (approximately 19.5 km^2) to the north of Mungallala in south central Queensland. It has not been located elsewhere in the surrounding district despite many surveys in similar

Fig. 1. ***Olearia cuneifolia***. A. flowering branchlet ×1. B. outer involucral bract ×8. C. inner involucral bract ×8. D. mature achene and pappus ×8. E. disc floret ×16. F. ray floret ×8. All from *Mathieson MTM1999* (BRI). Del. W. Smith.

Fig. 2. Lateral view of young flowering capitulum (*Mathieson MTM1999*). Photo: M.T. Mathieson.

habitat. The total population is estimated to be < 250 individuals occupying a total area of less than two hectares. Applying the criteria of the IUCN (IUCN 2012), the recommended conservation status is **Endangered** (D2).

***Etymology*:** The specific epithet is given in reference to the leaf shape.

Acknowledgements

We are grateful to Will Smith (BRI) for the line drawings.

Fig. 3. Disc and ray florets on young flowering capitulum (*Mathieson MTM1999*). Photo: M.T. Mathieson.

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Eremophila woodiae Edginton (Scrophulariaceae), a new species from Queensland

M.A. Edginton

Summary

Edginton, M.A. (2015). *Eremophila woodiae* Edginton (Scrophulariaceae), a new species from Queensland. ***Austrobaileya* 9(3): 408–415.** *Eremophila woodiae* is described and illustrated. Notes on ecology, distribution and conservation status are provided. The known distribution of the new species is restricted to the vicinity of Vergemont Station and Opalton in western central Queensland. A conservation status of Least Concern is recommended.

Key Words: Scrophulariaceae, Myoporaceae, *Eremophila*, *Eremophila woodiae*, new species, taxonomy, conservation status, Vergemont Station, Opalton

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Introduction

Eremophila R.Br. is a genus of 215 species and is endemic to Australia (Chinnock 2007). The genus is widespread throughout the arid areas of the continent (although some species do occur outside arid areas, albeit less commonly) with the majority of species restricted to Western Australia. Until recently, *Eremophila* was considered to be part of the family Myoporaceae, a southern hemisphere family. A review by Tank *et al.* (2006) based on molecular studies supported the inclusion of the traditional Myoporaceae within the Scrophulariaceae, an inclusion which has now been accepted at BRI and elsewhere.

A new species of *Eremophila*, restricted to western central Queensland, is described in this paper. Herbarium material was first collected in 1986 by Neldner and Nicholson, then in 1987 by Mitchell.

Material and methods

This study is based upon the examination of dried herbarium material and label data from the Queensland Herbarium. All existing specimens were examined. No spirit material had been collected, although parts rehydrated to facilitate drawing have subsequently been put into spirit. Unless stated otherwise all photographs were taken by the author.

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Taxonomy

Eremophila woodiae Edginton **sp. nov. Typus:** Queensland. Gregory North District: Vergemont, W of Longreach, 1 September 2013, *R. Fensham 6372* (holo: BRI).

Eremophila sp. (Opalton V.J. Neldner+ 2619); Edginton (2014).

Small shrub to 0.5 metres; **branches** terete, often exhibiting remaining basal portions of leaves, resinous on new growth, becoming non-resinous with age, non-tuberculate, red-brown to yellow, becoming grey with age; indumentum on new branches, leaves, petioles, pedicels and sepals moderately dense with sessile and short spreading colourless glandular hairs 0.1–0.4 mm long, and longer villous glandular and eglandular colourless hairs 0.6 –1.1 mm long, branches glabrescent. **Leaves** spirally arranged, densely crowded towards the branch tips, spreading to ascending, linear-lanceolate, conduplicate in distal three-quarters and flattened below, 12–22 mm long, 1.5–3 mm long, resinous, mid to dark green; margins mainly entire apart from distinct lobing towards apex with 3–5 lobes per margin directed upwards, apex obtuse to sub-acute; base narrowing to a petiole-like

section 0.5–1 mm long formed by the central vein. **Flowers** 1 per axil; pedicels semi-terete, 1–2 mm long, dark red-brown to yellow in dried specimens, becoming grey with age. **Sepals** 5, slightly imbricate, 12–14.5 mm long, resinous, acute; differentiated into 1 posterior, 2 anterior and two inner ones; posterior sepal ovate-lanceolate, 5–6 mm wide; anterior sepals broadly triangular-lanceolate, 3–4 mm wide; inner sepals triangular-lanceolate, 2–3 mm wide. **Corolla** ± zygomorphic, bilabiate, 14–19 mm long, violet to light purple, unspotted; tube 11–14 mm long, bulbous at base, slightly constricted above and then dilating gradually distally; upper lip 4–5 mm long, 2 lobed, lobes obtuse, divided for *c.* 1/10 of length; lower lip 4–5 mm long, 3-lobed, the lobes divided for most of their length, medial one obtuse, slightly longer and broader than the lateral ones which are obtuse to subacute; outer surface of upper tube and lobes sparsely to moderately villous, hairs colourless, eglandular, constriction and lowermost part of tube glabrous; inner surface of lobes glabrous; tube prominently woolly in throat just below lobes of upper lip, otherwise villous in upper part, glabrous in lower part, hairs eglandular. **Stamens** 4; anthers 2–2.5 mm long, lower 2 enclosed, upper two barely exserted from throat, glabrous; filaments sparsely villous with white eglandular hairs near base, glabrous above; **ovary** conical-ovoid, slightly to moderately laterally compressed, 2–3 mm long, 1–1.5 mm wide, glabrous, 4-locular; 3 ovules per locule; style *c.* 10 mm, sparsely villous with white eglandular hairs. **Fruit** (mature) ovate-conical, 5–8 × 3.5–5.5 mm, exocarp papery, whitish, glabrous; endocarp woody, slightly compressed, subreticulately ribbed distally, red-brown; immature fruit enclosed by sepals. **Figs. 1–5**.

***Additional specimens examined*: Queensland.** Gregory North District: 18 km SW of Opalton, Nov 1986, *Neldner 2619 & Nicholson* (BRI). Mitchell District: 25 km SW of Vergemont Station, W of Longreach, Sep 1989, *Mitchell 463* (BRI); Vergemont Station, May 2011, *Fensham 6101 & Silcock* (BRI); Vergemont Station, W of Longreach, Sep 2013, *Fensham 6376* (BRI), *6379* (BRI), *6380* (BRI).

***Distribution and habitat*:** *Eremophila woodiae* is endemic to western central Queensland, in the vicinity of Opalton and Vergemont Stations west of Longreach and south of Winton (**Map 1**).

The species occurs on barren plateaux, especially near the edges, in skeletal soil with sparse, stunted shrubland. There is one record from the base of a jump-up in "boree (*Acacia tephrina*) and spinifex (*Triodia* sp./spp.) flats" (*Neldner 2619 & Nicholson*). Associated species commonly include *Acacia shirleyi* Maiden, *A. catenulata* C.T.White, *A. sibirica* S.Moore, *Corymbia blakei* K.D.Hill & L.A.S.Johnson, *Eremophila latrobei* F.Muell., *Hakea collina* C.T.White, *Triodia longiceps* J.M.Black and *T. pungens* R.Br. (Silcock & Fensham 2014; Queensland Herbarium HERBRECS data 2015).

***Phenology*:** The specimens collected indicate that flowering and fruiting occurs between May to November.

***Affinities*:** *Eremophila woodiae* bears a superficial resemblance to *E. hispida* Chinnock, which has a known distribution which is close to, but does not quite overlap, that of *E. woodiae*. Both taxa are low shrubs with leaves which appear linear when viewed without a microscope, and both species have violet to purple flowers 15–20 mm long. *Eremophila woodiae* has leaves which are linear-lanceolate when viewed microscopically (linear on *E. hispida*); very crowded leaves (not crowded on *E. hispida*), simple hairs only on all parts (simple hairs, with or without some stellate hairs on branchlets, leaves and sepals on *E. hispida*), and the top ¼ to ½ of each leaf has lobes (entire leaves on *E. hispida*). Despite the superficial resemblance, *E. woodiae* and *E. hispida* are unlikely to be close relations.

Eremophila woodiae can be classified in *Eremophila* section *Eremaeae* Chinnock based on the species description (Chinnock pers. comm., July 2015). Chinnock further stated that the corolla was interesting and appeared slightly different (based on the single image of a flower seen) in having two obtuse upper lobes; however, as there can be variation in the size of the flowers and the arrangement of the lower lobes in species of this section more flowers from different

Fig. 1. Holotype of ***Eremophila woodiae*** (*Fensham 6372*, BRI).

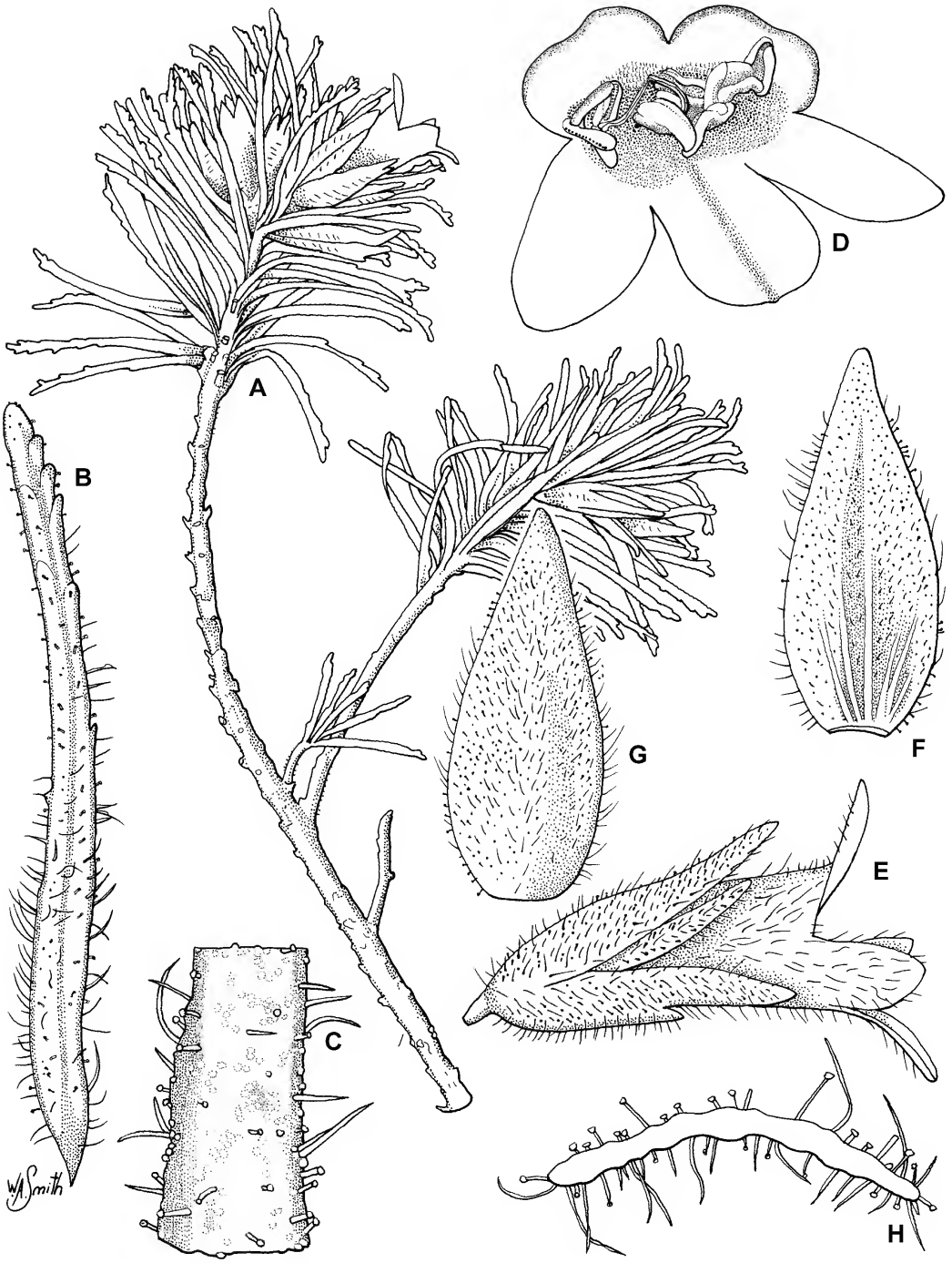

Fig. 2. ***Eremophila woodiae.*** A. branching habit ×2. B. leaf ×8. C. close-up of leaf showing glandular and eglandular hairs ×24. D. front view of corolla ×6. E. side view of calyx and corolla ×4. F & G. inner and outer surfaces of posterior sepal ×4. H. cross-section of posterior sepal showing glandular and eglandular hairs ×16. All from *Fensham 6379* (BRI). Del. W. Smith.

Fig. 3. Flower, branch and leaves of ***Eremophila woodiae*** at Vergemont Station. Photo: R. Fensham.

populations may show greater variation. Otherwise all other aspects of the species fall well within the boundaries of *Eremophila* section *Eremaeae*. It may be related to *E. goodwinii* F.Muell. because of the glandular indumentum, although unlike this species it does not have the banding on the inside lateral walls of the corolla (Chinnock pers. comm., July 2015).

***Notes*:** In one collection of *Eremophila woodiae* (*Mitchell 463*), a flower with 6 sepals was noted (**Fig. 5**). All other flowers examined during this study had 5 sepals so it is presumed that 6 sepals is a rare exception.

None of the fruits observed had completely shed the exocarp – though some had shed most of it; consequently it is possible that none of the fruits were completely mature. Therefore 1 mm was added arbitrarily to the highest measured values for length and width, and these augmented values were used as the high end of the ranges for length and width.

***Conservation status*:** The species known range is very restricted; however, it is locally common in places. A species profile (as *Eremophila* sp. (Opalton V.J. Neldner+ 2619) by Silcock & Fensham (2014) found that this species occurred on 6 of 10 plateaux surveyed in the overall area of distribution. Population sizes on each of these plateaux varied from 1000 to 4000 plants, with a total of about 17000 plants found. Ninety km² of similar plateaux were mapped in its known range, and of this 5 km² was surveyed. It was estimated that the total population based on known occurrences is approximately 300,000 individuals. However, Silcock & Fensham

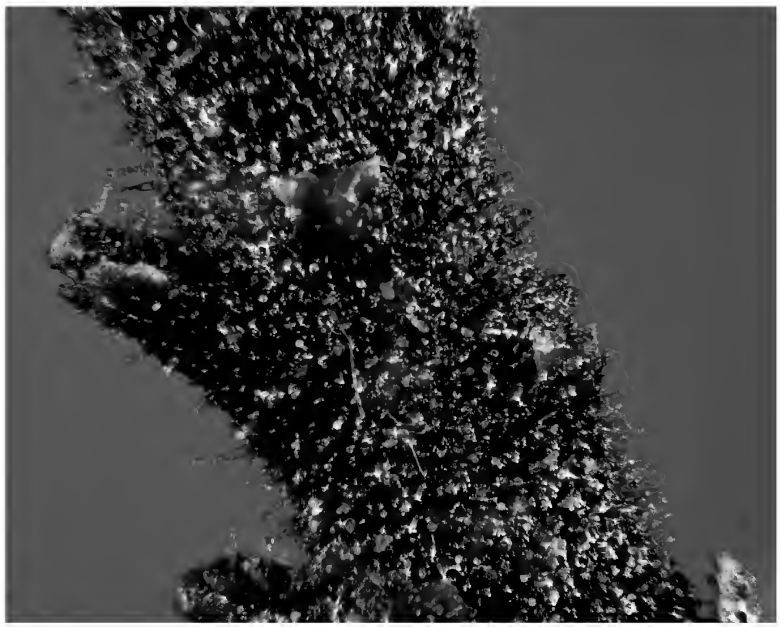

Fig. 4. Branch portion of ***Eremophila woodiae*** showing raised persistent leaf base remnants and glandular and eglandular hairs.

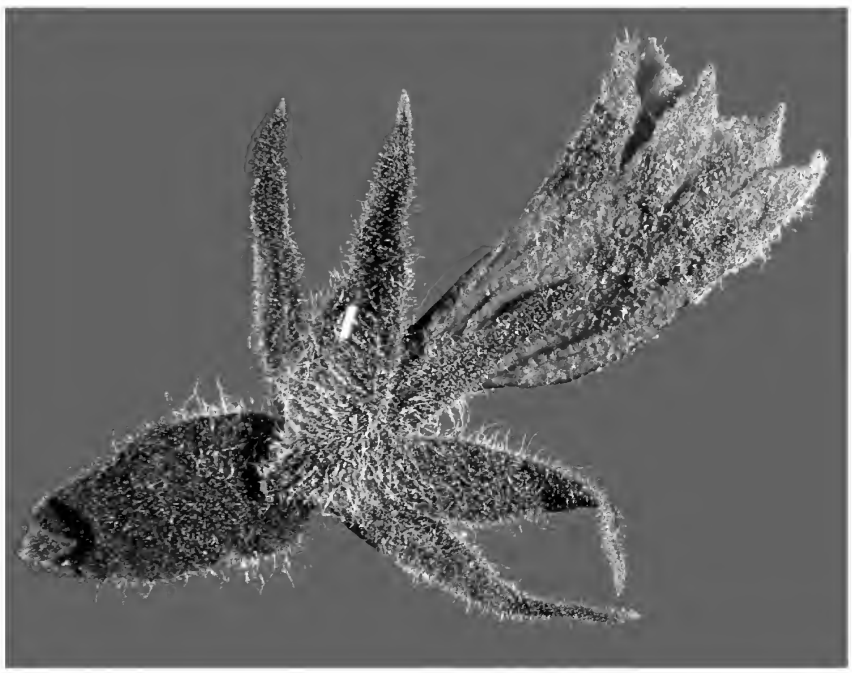

Fig. 5. Six-sepal flower of ***Eremophila woodiae*** (*Mitchell 463*, BRI).

(2014) concluded that there is a lot of suitable habitat to the west and south of its known range, so the total population may be higher than 300,000.

The habitat in which *Eremophila woodiae* occurs is without domestic stock and has low feral goat numbers; conversely grazing by native animals is thought to be very low. No evidence of grazing on the species was observed. Silcock & Fensham (2014) concluded that there are no threats to this species, that it is abundant within its limited range and that there are no observable fluctuations in the number of plants over the short term. They ascertained that the species is not eligible for listing under any IUCN criteria. Therefore a **Least Concern** conservation status under the *Queensland Nature Conservation Act 1992* is recommended.

***Etymology*:** The specific epithet of this species is named for Aileen Wood, a long term staff member at the Queensland Herbarium. Aileen's knowledge of cultivated plants, especially cultivars, is unsurpassed at the Queensland Herbarium and is greatly appreciated by staff.

Acknowledgements

I wish to thank the following staff at the Queensland Herbarium who assisted me in the preparation of this paper: Rod Fensham for collecting material to facilitate description, and for reading an early manuscript draft and making instructive suggestions; Ailsa Holland for reading an early manuscript draft and making instructive suggestions; Tony Bean for the distribution map, methodology advice and for reading a late manuscript draft and making instructive suggestions; Will Smith for the distribution map, drawings and assistance with photographs. I also wish to thank Bob Chinnock for reviewing the manuscript and making useful comments.

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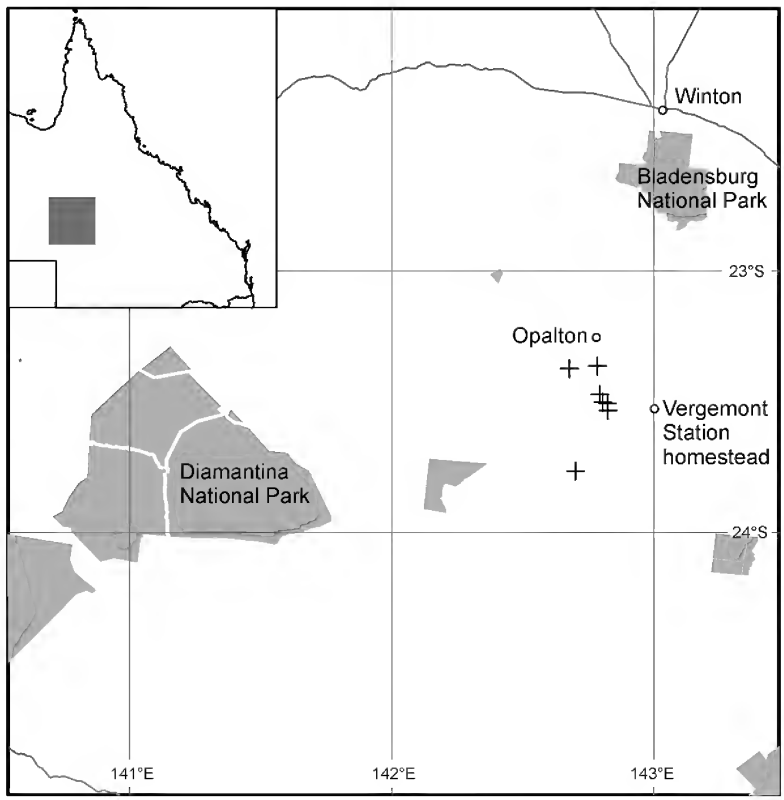

Map 1. Distribution of *Eremophila woodiae*, grey shaded areas are conservation reserves.

Rhynchospora croydonensis R.Booth (Cyperaceae), a new species from northern Queensland

R. Booth

Summary

Booth, R. (2015). *Rhynchospora croydonensis* R.Booth (Cyperaceae), a new species from northern Queensland. ***Austrobaileya* 9(3): 416–420.** A new species, *Rhynchospora croydonensis* R.Booth, is described and illustrated and notes are provided on its distribution and habitat. A key to Queensland species of *Rhynchospora* Vahl. is provided.

Key Words: Cyperaceae, *Rhynchospora*, *Rhynchospora croydonensis,* Australia flora, Queensland flora, new species, taxonomy, identification key

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Introduction

Rhynchospora Vahl. is a large, cosmopolitan genus consisting of more than 300 species, mostly occurring in the tropics and subtropics of the Central and South Americas (Strong 2006). Only a few species are widely distributed, though most of the Australian species also occur in southeast Asia (Kern 1974). Australia has about twenty one species, with fourteen of these occurring in Queensland (Bostock & Holland 2014).

Bentham & Hooker (1883) separated the genus *Rhynchospora* into two informal sections, "*Haplostylae*" and "*Diplostylae*" based on the degree of stylar branching and this was followed by Kükenthal (1949, 1952). Thomas *et al.* (2009) constructed a preliminary molecular phylogeny of the genus that indicated the two informal sections in *Rhynchospora* are artificial. A full phylogenetic study of the genus with greater sampling from Australia and Asia is still needed.

According to the classification of Goetghebeur (1986), *Rhynchospora* may be included within the subfamily *Cyperoideae*, tribe *Rhynchosporeae*. However, Bruhl (1995) indicated that the tribe *Rhynchosporeae* is part of the subfamily *Caricoideae*. Muasya *et al.* (2009) found good molecular support for the recognition of tribe *Rhynchosporeae* in an isolated position near tribe *Cariceae* and *Scirpeae*, with the *Rhynchosporeae* consisting solely of the genus *Rhynchospora* (including *Pleurostachys* Brongn.).

Sharpe (1989) provided a key and descriptions for four species in southeast Queensland, but the most comprehensive set of descriptions remain those provided by Kükenthal (1949, 1952). Due to the extensive field work undertaken in recent years, particularly in north Queensland, more *Rhynchospora* material has become available for study at the Queensland Herbarium. Critical examination of these collections by the present author has now enabled this new species to be formally described and named.

Materials and methods

All herbarium specimens of *Rhynchospora* held at BRI have been examined. Measurements were made from dried material.

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Taxonomy

Rhynchospora croydonensis R.Booth, **sp. nov.** similar to *Rhynchospora pterochaeta* F.Muell. but differs in the achene surface that has scattered hispid hairs (versus densely papillose), and hairs on the hypogynous bristles at the very base of the bristles (versus densely pilose for half their length). **Typus:** Queensland. Burke District: 6.5 km along Coralie Road from Croydon – Claraville Road junction, 22 April 2011, *K.R. McDonald KRM10937* (holo: BRI [AQ759401]; iso: NSW).

Rhynchospora sp. Croydon (S.L.Everist 5384); R.Booth in Bostock & Holland (2014).

Annual or short lived perennial 20–45 cm tall; culms tufted, 3-angled, trigonous, striate, 0.6–1.3 mm wide, glabrous. Lamina flat or conduplicate, 1–3 mm wide with long ciliate hairs when young, glabrescent. Ligule membranous. Involucral bracts ciliate on the margins, longer than the inflorescence. Inflorescence a single dense head, 1.2–1.5 cm long by 2–2.5 cm wide. Spikelets lanceolate or linear-lanceolate, 7.5–10 mm long, pale brown to brown. Perianth present as 6 hypogynous bristles, unequal in length, longer than the nut and style base, antrorsely scabrid, plumose at the base, glabrous above. Glumes distichous, 6–7, narrowly ovate or ovate-lanceolate, 2–10 mm long, 1.2–1.8 mm wide, coloured straw or light brown to brown, glabrous, keeled or with the midrib distinct, not nerved; apex acute; margin glabrous; rachilla wingless. Style deciduous, entire, glabrous. Achene with a persistent style base, not grooved, 2.4–3 mm long, as broad or broader than the achene and longer than, or equalling the achene; margins winged, setulose; stramineous, or yellow-brown. Achene obovoid, biconvex, lenticular, or concave-convex; 2.2–3 mm long, 1.3–1.6 mm wide, not ribbed; surface smooth or with a faint cell pattern, with hispid hairs mainly in the distal half, pilose hairs only at the base of the achene. **Fig. 1**.

***Additional specimens examined*:** Queensland. Burke District: Cothilda Station, May 2001 *Turpin GPT872* (BRI); between Croydon and Gilbert River, May 1954, *Everist 5384* (BRI). Cook District: Staaten River NP, *c.* 35 km W of Bulimba Homestead, 150 km W of Chillagoe, Sep 2013, *Leitch ODA004939* (BRI); Fishermans Waterhole, Walsh River, N of Chillagoe, Mar 2005, *McDonald KRM3936a* (BRI); Bulleringa NP, Jul 2006, *Lovatt TH9249* (BRI); 79 km from Georgetown on Croydon Road, Apr 1996, *Forster PIF19012b & Ryan* (BRI); 23 miles [38.3 km] SE of Croydon township, Jul 1954, *Speck 4719* (CANB).

***Distribution and habitat*:** *Rhynchospora croydonensis* is endemic to northern Queensland where it has been found between Croydon and the Gilbert River in the south, Staaten National Park in the north, and west to Bulleringa National Park (**Map 1**). Plants usually grow in drainage lines in sandy soils often with *Melaleuca viridiflora* Sol. ex Gaertn. var. *viridiflora.*

***Affinities*:** *Rhynchospora croydonensis* is closely related to *R. pterochaeta*, which it differs from most obviously in the achene characters: *R.pterochaeta* being papillose over much of its surface, while *R. croydonensis* has hispid hairs, mainly in the distal part of the achene.

***Conservation status*:** There are only nine collections of *Rhynchospora croydonensis* and its geographic range is not large. This sedge has been found in Bulleringa and Staaten River National Parks and is likely to be widespread in its seasonally ephemeral habitat dominated by annual or geophytic species. It is not considered to be threatened and a **Least Concern** conservation status is recommended.

***Etymology*:** The epithet is from the town of Croydon in the Gulf of Carpentaria near where this species was first collected.

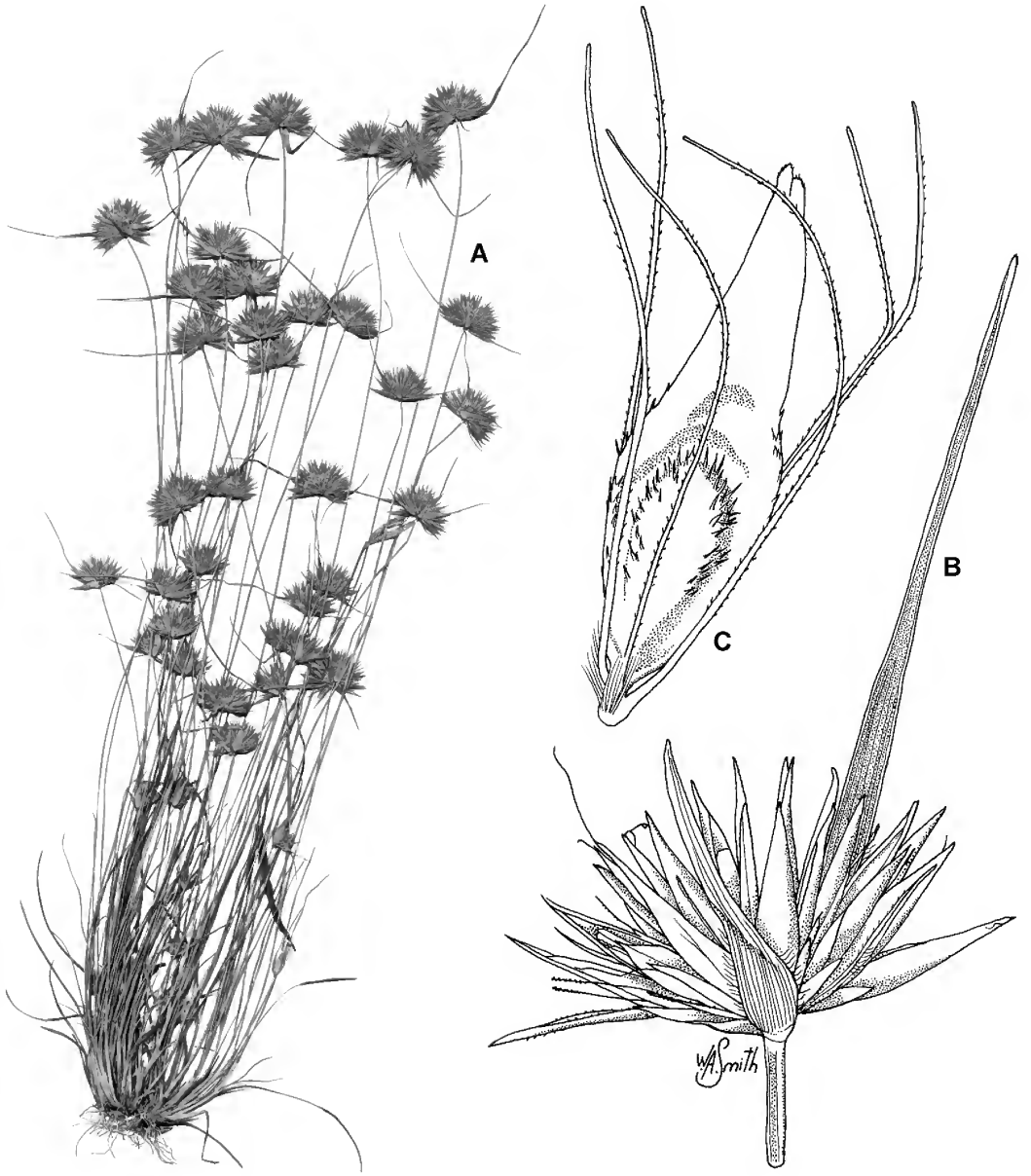

Fig. 1. ***Rhynchospora croydonensis***. A. habit ×0.4. B. inflorescence ×3. C. achene and hypogynous bristles ×12. All from *McDonald KRM10937* (BRI).

Key to the Queensland species of *Rhynchospora*

1 Inflorescence a compound panicle or clustered in loose corymbs **2**
1. Inflorescence a single, dense head **4**

2 Stems filiform, < 1 mm wide . . . . . **R. gracillima**
2. Stems stout, 2–15 mm wide **3**

3 Inflorescence a large, loose, compound panicle; style base furrowed on both sides; stout plants 70–200 cm high . . . . . **R. corymbosa**
3. Inflorescence of several small, irregular corymbs; style base not furrowed; slender plants to 1 m high, usually less . . . . . **R. brownii**

4 Style base 0.4–0.6 mm long; bristles whitish, shorter than the achene . . . . . **R. rubra**
4. Style base > 0.6 mm long; bristles usually > the achene in length **5**

5 Base of the achene and the bristles with no pilose hairs (hispid hairs may be present on the bristles only) **6**
5. Base of the achene or at least bottom part of the bristles with pilose hairs **9**

6 Achene (not including the style base) < 2 mm long . . . . . **R. subtenuifolia**
6. Achene > 2 mm long **7**

7 Spikelets < 6 mm long . . . . . **R. submarginata**
7. Spikelets > 6 mm long **8**

8 Style base furrowed or grooved, achene with broad triangular based hairs at the apex; bristles much longer than the style base . . . . . **R. exserta**
8. Style base not furrowed, achene with rather fine hispid hairs; bristles only just longer than the achene and style base . . . . . **R. heterochaeta**

9 Achene revolute, papillose on the nearly joined margins . . . . . **R. leae**
9. Achene biconvex or convex, not revolute **10**

10 Style base grooved, curved, or winged adjacent to the achene, often setulose on the margins **11**
10. Style base not grooved, curved or winged **13**

11 Style base long-conical with a groove down the middle . . . . . **R. longisetis**
11. Style base as broad or broader than the achene, curved, but not grooved **12**

12 Achene papillose (hairs rounded at the ends) over much of its surface, pilose hairs covering lower half of the achene . . . . . **R. pterochaeata**
12. Achene with hispid hairs (pointed at the ends) mainly in the distal half, pilose hairs only at the base of the achene . . . . . **R. croydonensis**

13 Achene > 3 mm long, style base at least 2 mm long . . . . . **R. longisetis**
13. Achene < 3 mm long, style base < 1.5 mm long **14**

14 Achene papillose over most of its surface, bristles unequal in length . . . . . **R. wightiana**
14. Achene hispid or occasionally papillose, mainly in the distal half, bristles equal in length . . . . . **R. affinis**

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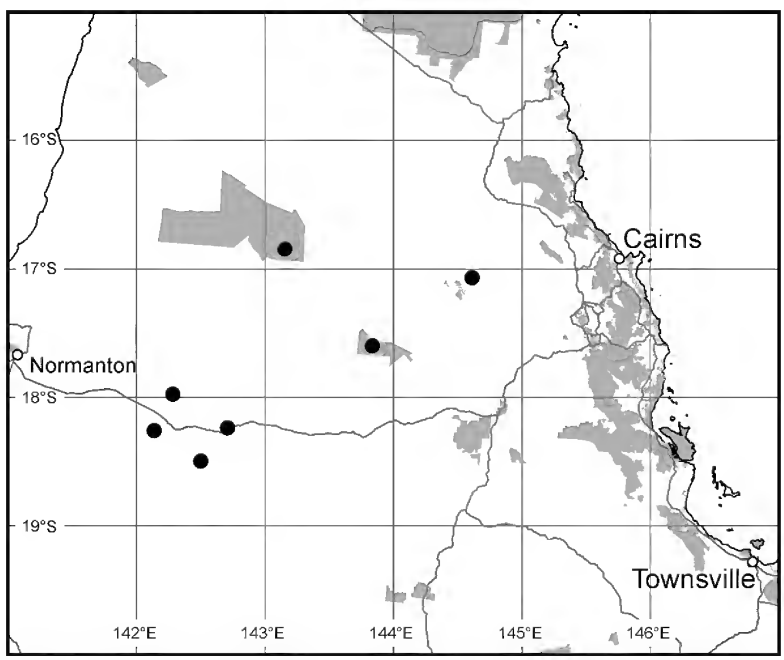

Map 1. Distribution of *Rhynchospora croydonensis*, grey shaded areas are conservation reserves.

First record of the Gnetales in Australia: *Gnetum gnemon* L. (Gnetaceae) on Badu and Mua islands, Torres Strait, Queensland

David G. Fell[1], David J. Stanton, Dick Williams, Frank Loban, Frank Nona, Troy Stow, John Wigness, Erimiah Manas & Guyai Uiduldam

Summary

Fell, D.G., Stanton, D.J., Williams, D., Loban, F., Nona, F., Stow, T., Wigness, J., Manas E., and Uiduldam G. (2015). First record of the Gnetales in Australia: *Gnetum gnemon* L. (Gnetaceae) on Badu and Mua Islands, Torres Strait, Queensland. ***Austrobaileya* 9(3): 421–430**. The gymnosperm order Gnetales is reported for the first time in Australia, from specimens of *Gnetum gnemon* collected on two continental islands in Torres Strait, Queensland. The distribution, habitat, ecology and local conservation status of the species are discussed, and its origins in Torres Strait are considered with reference to biogeographic and anthropogenic factors.

Key Words: Gnetaceae, *Gnetum gnemon*, Australia flora, Queensland flora, Badu Island, Mua Island, Torres Strait

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Introduction

Gnetum L. is the sole genus within the family Gnetaceae and order Gnetales of the gymnosperms. The genus consists of about 40 species with 10 species in South America, one in tropical West Africa, and 20–25 species in tropical and subtropical Asia (Markgraf 1929, 1977; Maheshwari & Vasil 1961; Verheij & Sukendar, 1991; Carlquist 1994, 1996; Price 1996; Wonn & Renner 2006, Hou *et al.* 2015). The origins and evolutionary relationships of the gnetophytes are considered as central toward understanding the origin of flowers and seed plant evolution (Markgraf 1929; Chamberlain 1935; Price 1996; Hansen *et al.* 1999; Winter *et al.* 1999; Manner & Eleivich 2006). Recent genetic studies now recognise that gnetophytes are more closely related to conifers than to angiosperms (Hansen *et al.* 1999; Winter *et al.* 1999; Becker *et al.* 2000), and that the major lineages of *Gnetum* diverged in the Late Cretaceous (Hou *et al.* 2015).

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Gnetum gnemon L. has a wide distribution in Malesia and the Western Pacific and is native to Indonesia, Papua New Guinea, the Solomons, and Vanuatu (Verheij & Sukendar 1991; Manner & Eleivich 2006; Wonn & Renner 2006; Bourke 2010). In Papua New Guinea it occurs in the Morobe, Eastern Highlands, Western Highlands, Central, East Sepik, Sandaun (West Sepik), Manus Island, New Ireland, Western, Bougainville, New Britain, Madang, Milne Bay, and Gulf Provinces (Conn & Damas 2006). It is previously known in Australia only from cultivated trees in the vicinity of Darwin (Atlas of Living Australia, 2012; I. Cowie *pers. comm.*, November 2012).

Gnetum gnemon is a dioecious evergreen tree 15–30 m in height in the canopy or subcanopy with a trunk diameter at breast height to 40 cm (Peekel 1984; Conn & Damas 2006; Manner & Eleivich 2006). The trunk is smooth and cylindrical with prominent raised swollen bands (100–300 mm apart) caused by the growth and fall of the opposite and symmetrical branches (Conn & Damas 2006). Leaves are simple and opposite, elliptic, lanceolate or oblong-oval, 15–25 cm long and 5–9 cm wide (Manner & Eleivich 2006). As a gymnosperm, *Gnetum* does not have true

flowers; the cones or strobili are presented at the tip of a slender stem or axis (Chamberlain 1935; Manner & Eleivich 2006). It has yellow single-seeded fruits which turn purplered or orangered at maturity (Maheshwari & Vasil 1961; Manner & Eleivich 2006), ripening between September and December (Bourke *et al.* 2004).

Across its Asian, Malesian and Western Pacific range the genus *Gnetum* is known from tropical rainforest up to 1,700 m with rainfall of 750–5,000 mm/year (Manner & Eleivich 2006). It occurs in primary and secondary vegetation, with cultivated trees commonly found in home orchards and subsistence gardens.

Wild and cultivated *Gnetum gnemon* is an important natural resource in many parts of Asia, Malesia and the Pacific where it occurs. Documented uses include: food (leaves for wrapping food items, young cones and leaves cooked with meat for flavoring; seeds ground into a flour for fried flat cakes; flowers (stroboli) eaten; young fruits eaten raw or cooked; timber (poles for house construction, tool handles, burned for fuel, and pulped for papermaking); stem bark fibre (string bags, ropes, bowstring on musical instruments, construction of fishing lines and fishnets, assembling arrowheads and arrowshafts); agroforestry and rehabilitation (intercropping for rambutan and breadfruit, trellis for *Dioscorea* yams, improving soil fertility, windbreaks, boundary markers) (Henderson & Hancock 1989; Verheij & Sukendar 1991; Ohtsuksa 1983; Peekel 1984; Salim *et al.* 2002; Walter & Sam 2002; Manner & Eleivich 2006; Quartermain & Tomi 2010). Extracts derived from *Gnetum* are reported useful as health supplements (Kato *et al.* 2009) and the nuts form an important home industry throughout Indonesia (Cadiz & Florido 2001).

In Papua New Guinea it is an important wild and cultivated food plant in many locations (Powell 1976; Bourke 2004) and known in Tok pisin as '*Tulip*' (two leaves) (French 1986). The Gidra people of the Oriomo River area of southwest Papua New Guinea adjacent to Torres Strait, eat the fruits and leaves (Ohtsuka 1983), and the leaves and fruit are identified as a source of protein across the nation (Cordon 1970). Cultivation of trees is achieved by propagating seed and/or from cuttings (French 1986). In the Kiunga area of Western Province the bark is used to make the fibre for string bags and other products and it is also cultivated as a food plant (leaves) in Daru (Western Province) (B. Waterhouse *pers. comm.*, April 2014).

We report on the occurrence of *Gnetum gnemon* on two islands in Torres Strait, Queensland, thus recognizing the gymnosperm order Gnetales for the first time from Australia. The distribution, habitat and ecology of the species at these localities are discussed together with an assessment of its local conservation status. Its origins in Torres Strait are considered with reference to biogeographic and anthropogenic factors.

Materials and methods

A survey of the vegetation of the Torres Strait Islands, Queensland, Australia, was carried out in 2007 (Stanton *et al.* 2009). The survey's primary objective was to map vegetation communities at a scale of 1:25,000 and Regional Ecosystems at a scale of 1:50,000, and was supplemented by floristic inventory and collections of voucher specimens for Australian herbaria. Additional surveys on the Badu and Mua islands between 2009 and 2015 have been carried out as part of a biodiversity management planning program through the Land and Sea Management Unit of the Torres Strait Regional Authority (3D Environmental 2011a, 2011b; Gynther *et al.* 2014; Reis *et al.* 2015).

Collections of *Gnetum gnemon* were made at Badu Island in October 2007 (*Fell 10206 & Stanton*) (**Fig.** 1) and on Mua Island in April 2011 (*Fell 10803 & Stanton*) (**Fig. 2**), with further confirmed observations on Mua in March 2014 and on Badu in May 2015 (Fell pers. obs.). Voucher specimens are lodged with the Queensland Herbarium (BRI) with duplicates to the Australian Tropical Herbarium (CNS).

Fig. 1. Leaves of ***Gnetum gnemon*** on Badu Island (*Fell 10206 & Stanton*). Photo: D.G. Fell.

Results and discussion

Gnetum gnemon in Torres Strait

Badu Island

Badu Island is situated approximately midway between the tip of Cape York Peninsula and mainland New Guinea, and belongs to the Near Western Group of Torres Strait Islands. It is a continental island of 10,467 ha, centred at 10° 07' S, 142° 09' E and located around 92 km south of the Papua New Guinea (PNG) coastline and 70 km NW of Cape York (**Map 1**). The island is the homeland of the Badulgal people with a population of 784 people as at the 2011 census (Australian Bureau of Statistics 2012).

The coarse grained Badu granite dominates the landscape, forming the island's rugged interior of low rocky hillocks with massive granite boulders. Granite basement rock is overlain on its margins by younger unconsolidated deposits including alluvial deposits and extensive dune fields of varying age and geomorphic expression (Willmott & Powell 1977; Garnett & Jackes 1983; 3D Environmental 2011a).

A total of 49 vegetation communities within 20 broad vegetation groups and 32 Regional Ecosystems are recognised across the island, within which 592 plant species have been recorded. The flora comprises 560 native species with 17 ferns, one cycad, one conifer and 572 flowering plants (3D Environmental 2011a).

Mua Island

Mua (also known as Moa) Island lies adjacent and immediately to the east-south east of Badu, being separated by a narrow (2.5 km wide) channel. Situated approximately 55 km

north of the tip of Cape York, Queensland and 94 km south of the New Guinea mainland (**Map 1**), it has a total area of 17,001 ha, and is the second largest island in Torres Strait. There are two Torres Strait Islander communities on the island: at Kubin and St Pauls, which had populations of 163 and 258 respectively as at the 2011 census (Australian Bureau of Statistics 2012).

Mua is formed on continental igneous basement rocks and is topographically diverse, dominated by the high point of Banks Peak in the north-east, rising to 376 m. A rugged east and south facing coastline features rocky coastal headlands, and an expansive coastal plain forms a broad enclave behind the island's north-eastern coastline. Vegetation is diverse with a total of 62 vegetation communities occurring within 23 broad vegetation groups and 44 regional ecosystems. The flora is the richest in the Torres Strait region with 609 native species, comprising 19 ferns, one cycad, two conifers and 654 flowering plants (3D Environmental 2012a).

Fig. 2. Upland habitat of ***Gnetum gnemon*** on Banks Peak, Mua Island. Photo: D.J. Stanton.

Local Habitat & Ecology

In Torres Strait *Gnetum* occurs in poorly drained lowland swamp forest (Badu), lowland riparian rainforest (Mua), and on steep granitic hillslopes in well-developed evergreen vineforest (Mua) (**Fig. 3**).

The Badu occurrence is within a closed (swamp) forest characterised by poorly drained soils which may be seasonally inundated. Typical canopy tree species are *Carallia brachiata* (Lour.) Merr., *Deplanchea tetraphylla* (R.Br.) F.Muell., *Lophostemon suaveolens* (Sol. ex Gaertn.) Peter G.Wilson

Fig. 3. Multi stemmed trunk of ***Gnetum gnemon*** in lowland riparian rainforest on Mua Island. Photo: D.G. Fell.

& J.T.Waterh., *Maranthes corymbosa* Blume, *Melaleuca dealbata* S.T. Blake and *Syzygium angophoroides* (F.Muell.) B.Hyland with a sharp ecotone to the surrounding woodland vegetation.

On Mua, *Gnetum* occurs in upland and lowland situations. Upland habitats are on the steep granite hillslopes and crests of Banks Peak, the highest topographic feature in Torres Strait. *Gnetum* was recorded between approximately 250–350 m altitude in evergreen notophyll vineforest and in wind sheared evergreen vinethicket (**Fig. 2**). The evergreen vineforests are developed on upper sheltered slopes where weathering of the granite has produced a well-drained and relatively fertile sandy loam soil (3D Environmental 2011b). The rainforest type is a unique and newly described ecosystem for Queensland, restricted to only a few mountain top locations in Torres Strait (3D Environmental 2009). The canopy height ranges from 23 m to 35 m with dominants including *Acmenosperma claviflorum* (Roxb.) Kausel., *Anthocarapa nitidula* (Benth.) T.D.Penn. ex Mabb., *Calophyllum sil* Lauterb., *Manilkara kanosiensis* H.J.Lan & B.Meeuse, *Sterculia shillinglawii* F.Muell. subsp. *shillinglawii* and *Syzygium beuttnerianum* (K.Schum.) Nied. *Gnetum* habitat on the steep southern slopes of the peak features a wind sheared canopy of *Acmenosperma claviflorum*, *Calophyllum sil*, *Podocarpus grayae* De Laub. *Licuala ramsayi* var. *tuckeri* Barfod & Dowe and *Pandanus zea* H.St. John. Riparian rainforest on alluvial sands and silts constitute *Gnetum* lowland habitat on Mua. Characteristic canopy species are *Buchanania arborescens* (Blume) Blume, *Horsfieldia australiana* S.T.Blake, *Maranthes corymbosa* Blume, *Syzygium angophoroides* and *S.bamagense* B.Hyland.

No uses are documented or known for *Gnetum gnemon* in the Torres Strait. Specimens were shown to Land and Sea Rangers during our visits to Badu in November 2007, November 2010 and May 2015, and on Mua in March 2011 and March 2014. They did not recognise the plant, and stated that they had no name or use for it (D. Williams *pers. comm*., 2015; T. Stow *pers. comm*., 2007; J. Wigness *pers. comm*., 2011).

Natural or translocated?

Some plants and their populations in Torres Strait are a reflection of natural biogeographic distributions, whereas others are anthropogenic and may indicate the influence of people as dispersal agents (Denham 2008; Denham *et al*. 2009; McNiven 2008).

The accepted hypothesis that the pantropical range of *Gnetum* reflects a Gondwanan history was established by Markgraf (1929). However, Wonn & Renner (2006) consider that its present range follows a more recent radiation in the Malesian region, and therefore is not Gondwanan. Using analysis of fossil-calibrated molecular-clocks, these authors investigated *Gnetum* lineages now found in Africa, South America and Southeast Asia with results suggesting the influence of ancient long-distance dispersal of

seeds across seawater. Further, its distribution throughout Asia is thought to have occurred during radiation through Malesia where opportunities for overland seed dispersal coincided with times of low sea levels (Wonn & Renner 2006).

Torres Strait was formed by rising sea levels in the Holocene (*c.* 8000–6500 years before present) that inundated the Arafura Plain, a low-lying land bridge that connected Australia and New Guinea for much of recent geological history (Jennings 1972; Woodroffe *et al.* 2000). Given the occurrence of *G. gnemon* in neighboring areas of central-southern New Guinea, it is likely the Torres Strait records are refugial populations that reflect its biogeographic distribution across the Malesian region.

However, the potential for the taxon to have been introduced into Torres Strait by human vectors should not be discounted. The species is widely cultivated across its range, including in New Guinea, and hence it is possible that it was translocated to the islands. Movements of human populations and trade between New Guinea and Torres Strait have greatly influenced the distribution patterns of a number of important tropical crop plants and has influenced cultivation practices in the region (Haddon 1935; Barrau 1963; Harris 1977; Barham 2000; Denham 2008; Denham *et al.* 2009; McNiven *et al.* 2006; McNiven 2008). Furthermore, the impact of Torres Strait islanders upon their pre-contact surroundings included the introduction of new plant species from other islands (Shnukal 2004; McNiven 2008), a practice that is ongoing in contemporary culture. The fact that local people do not have a local name or a use for the plant does not mean that it was not used in the past.

Conservation Status

Across the majority of its range *Gnetum gnemon* is a common tree species in the wild that is also widely cultivated throughout Malesia. In Torres Strait, a conservative estimate of its population size on Badu is 500–1000 individuals within an area of available habitat of < 200 ha. Surveys carried out by the authors in 2007, 2009, 2011, 2014 and 2015 assessed the condition of the habitat as good, being free of weeds although diggings by feral pigs (*Sus scrofa*) were observed throughout the habitat. The even age of the canopy and the species composition together with evidence of old charred stumps indicate that the habitat is transitional and subject to past burning. Invasive weeds such as Singapore daisy (*Sphagneticola trilobata* (L.) Pruski), praxelis (*Praxelis clematidea* R.M.King & H.Rob.), annual mission grass (*Pennisetum pedicellatum* Trin. subsp. *pedicellatum*) and leucaena (*Leucaena leucocephala* (Lam.) de Wit) occur on the islands, but are mostly associated with habitation and along roadsides. Singapore daisy has successfully invaded degraded swamp forests within and on the margins of the Badu community and is considered a serious threat to these habitats across the island.

Resilience to fire of *Gnetum gnemon* is not documented; however, its mesic habitat is likely to be sensitive to fire. Fire has been an ongoing influence on the island's vegetation, and fire management is an increasing focus of the Land and Sea Ranger program (3D Environmental 2012a, 2012b). Given the small population size and highly localised occurrence, there is a risk of stochastic extinction of the species on this island.

The upland rainforest habitat of the Mua population is similarly remote and inaccessible, and no known direct threats are evident. Population size is not known; however, the spatial extent of the forest type is mapped as < 477 ha (Stanton *et al.* 2009). While numerous weeds occur on the island they are limited to the margins of the island communities Kubin and St Pauls and along some major tracks and roads. The undisturbed and remote nature of the upland habitat suggests that there would appear to be a very low risk of stochastic extinction of the population. Its lowland occurrence on Mua occupies approximately 20 ha within a linear band of riparian rainforest located three kilometres from the coast. The ecotone to adjacent *Corymbia* and *Melaleuca* grassy woodland vegetation is sharp and controlled

by seasonal burning practices. Weeds such as Brazilian joyweed (*Alternanthera brasiliana* (L.) Kuntze) and leucaena occur nearby. Weed incursions, and inappropriate fire management which erode fire sensitive riparian margins, represent potentially threatening processes to the integrity of the lowland *Gnetum* habitat.

Integration of further ecological and genetic studies are necessary to better understand the conservation and management requirements of *Gnetum gnemon* in Torres Strait. Future assessments on the conservation values of *Gnetum gnemon* in Torres Strait should acknowledge that conservation of peripheral populations is dependent upon the genetic divergence from other conspecific populations, and may be beneficial to the protection of the evolutionary process (Lesica & Allendorf 1995).

It is feasible that additional populations occur on Badu and Mua and further field assessments are required to better understand the species ecology in terms of distribution, population size, phenology, recruitment, and to investigate cultural values. Similar focus is also required for other additions to the Australia flora recently recorded in Torres Strait namely *Cycas papuana* F.Muell. and *Manilkara kanosienisis* H.J.Lan & B.Meeuse (Fell in prep.) as well as other highly disjunct species recorded in the region (Fell & Stanton 2011). Such studies are achievable with the support and involvement of traditional landowners and their representative bodies and the Torres Strait Regional Authority Land and Sea Management Unit.

Acknowledgements

The authors acknowledge all Elders past and present, Traditional Owners and community members of Badu and Mua islands. Access to Badu was provided by the Mura Badulgal (TSI) Corporation Registered Native Title Body Corporation (RNTBC) and to Mua by the Mualgal (Torres Strait Islander) Corporation RNTBC. These bodies administer the native title rights and interests over their respective islands. The field surveys on Badu and Mua were funded and managed by the Land and Sea Management Unit of the Torres Strait Regional Authority. Field assistance on Badu was provided by Badu Island Ranger Keijie Bowie as well as by Mua Ranger Jackson Ware, Warraber Trainee Ranger Young Billy and Mer Trainee Ranger Tauki Passi. On Mua Island, Ranger Mentor Simon Conaty supported field work and his assistance is most appreciated. Thanks to David Gooding who provided GIS support to detailed vegetation mapping over Torres Strait islands. Botanical identifications were provided by the staff of the Queensland Herbarium. Comments on an earlier version of this paper from Garrick Hitchcock, Rob Neal, Paul Forster and Barbara Waterhouse are greatly appreciated.

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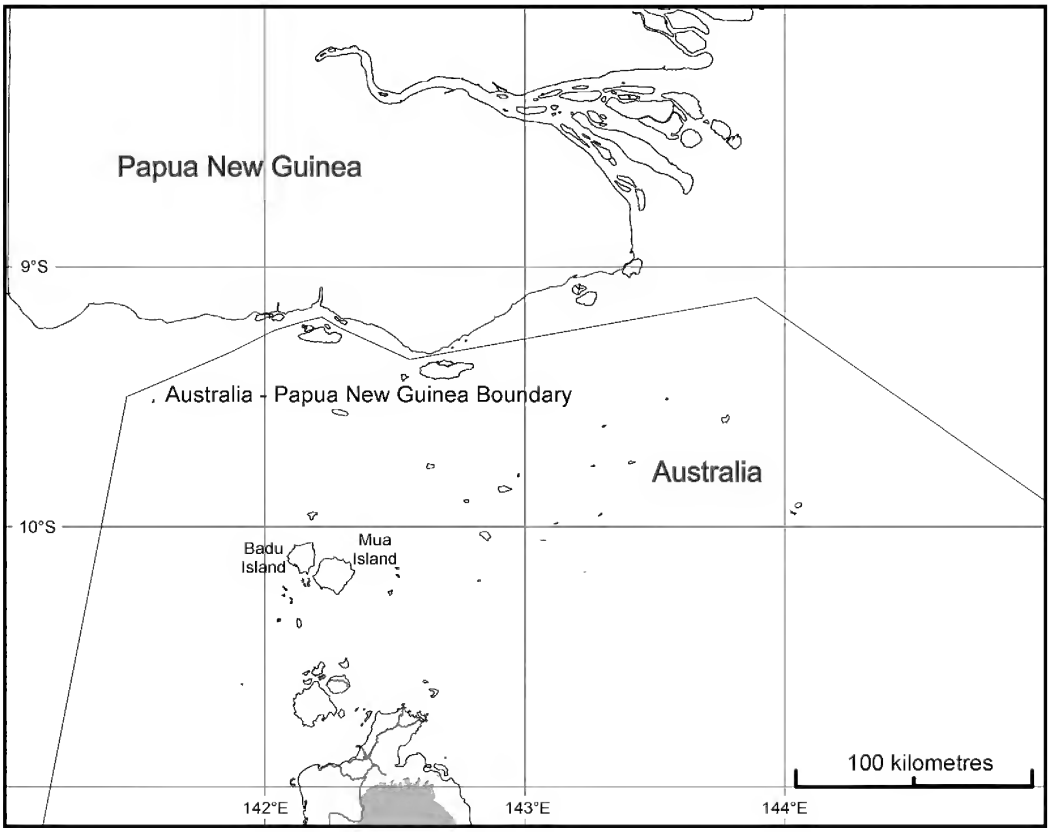

Map 1. Position of Badu and Mua islands in Torres Strait indicating position between Papua New Guinea and mainland Australia.

Plectranthus laetus P.I.Forst. and *P. ventosus* P.I.Forst. (Lamiaceae), new species from Cape York Peninsula, Queensland

Paul I. Forster

Summary

Forster, P.I. (2015). *Plectranthus laetus* P.I.Forst. and *P. ventosus* P.I.Forst. (Lamiaceae), new species from Cape York Peninsula, Queensland. ***Austrobaileya* 9(3): 431–438**. Two new species of *Plectranthus* are described from Cape York Peninsula: *P. laetus* P.I.Forst. from Orchid Creek Station and *P. ventosus* P.I.Forst. from the Melville Range at Cape Melville National Park. Both species occur on granite substrates within or adjacent to rainforests.

Key Words: Lamiaceae, *Plectranthus*, *Plectranthus laetus*, *Plectranthus ventosus*, Australia flora, Queensland flora, Cape Melville, Orchid Creek, new species, taxonomy, distribution maps.

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Introduction

Ongoing botanical exploration of remote areas of Cape York Peninsula continues to reveal vascular plants that are new to science. A further two species of *Plectranthus* L.Hér. are described here, both discovered in previously unsurveyed localities on the tops of mountains or ridges, and in habitats akin to the 'sky island' concept discussed previously Forster (2014). In each case, access to the localities was by helicopter. The description of these new species brings to 15, the number of species of *Plectranthus* now recognised for the Cape York Peninsula bioregion (https: //data.qld.gov.au/dataset/bioegeographic-subregions-queensland). The species previously recognised are *P. apreptus* S.T.Blake, *P. apricus* P.I.Forst., *P. arenicola* P.I.Forst., *P. batianoffii* P.I.Forst., *P. congestus* R.Br., *P. dumicola* P.I.Forst., *P. excelsus* P.I.Forst., *P. foetidus* Benth., *P. megadontus* P.I.Forst., *P. mirus* S.T.Blake, *P. pulchellus* P.I.Forst., *P. scutellarioides* (L.) R.Br. and *P. venustus* P.I.Forst.; ten of the overall total are endemic.

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Materials and methods

Fieldwork was undertaken in north Queensland to procure fresh material for specimens and cultivation enabling observation of variation in morphology and phenology. The subsequent descriptions and observations are based on these recent collections and other earlier collections in the Queensland Herbarium (BRI).

Taxonomy

Plectranthus laetus P.I.Forst., **sp. nov.** with affinity to *P. pulchellus* but differing in the orange sessile glands (versus yellow), the verticillasters with fewer flowers (6–10 versus 12–16), the flowers with corollas that are strikingly blue-purple (versus light purple) and the larger calyces. **Typus:** Queensland. Cook District: Orchid Creek Station, Coffee Scrub; SW of Lockhart River, Cape York Peninsula, 30 April 2014, *P.I. Forster PIF41138 & S.L. Thompson* (holo: BRI; iso: CNS, MEL, NSW *distribuendi*).

Perennial herb, stems erect to 50 cm high; foliage scentless when crushed, not clammy; non-glandular and glandular trichomes uncoloured, non-glandular trichomes without prominent raised bases, sessile glands 8-celled, orange. Roots fibrous, somewhat

fleshy and thickened. Stems square, erect to straggling, fleshy, easily snapped, the lower parts up to 13 mm diameter and not noticeably thickened, pink-purple to pink-green, upper parts with persistent indumentum, non-glandular trichomes sparse to dense, antrorse, 6–10-celled up to 1 mm long, glandular trichomes absent, sessile glands sparse. Leaves discolorous, petiolate; petioles 7–19 × 1.5–2 mm, channelled on top, non-glandular trichomes sparse, antrorse, 4–10-celled up to 0.5 mm long, glandular trichomes absent, sessile glands occasional to sparse; laminae lanceolate-ovate to ovate, fleshy, ±flat to slightly keeled, 30–70 × 26–50 mm, crenate with 8–14 teeth up to 4 mm long on each margin, of similar length along margin, secondary teeth poorly developed; tip acute; base obtuse to rounded; upper surface medium-green and somewhat glossy, veins impressed and often pink-purple, non-glandular trichomes sparse, antrorse, 4–8-celled up to 0.5 mm long, glandular trichomes and sessile glands absent; lower surface pale purple to purple-green and with a light hoary silver frosting from indumentum, veins strongly raised, non-glandular trichomes sparse, antrorse, 4–8-celled up to 0.8 mm long, glandular trichomes absent, sessile glands scattered. Inflorescence up to 350 mm long, usually single or with 1 or 2 side branches; axis square in cross-section, pink-purple, non-glandular trichomes sparse, antrorse, 4–8-celled up to 0.5 mm long, glandular trichomes sparse and minute (< 0.2 mm long), sessile glands absent or occasional; bracts broadly ovate, 1.5–1.8 × 7–8 mm, ecomose, margins somewhat irregularly crenate to crenulate due to slightly enlarged bases of trichomes, non-glandular trichomes sparse, antrorse, 4–6-celled up to 0.4 mm long, glandular trichomes absent, sessile glands occasional to scattered; verticillasters 6–10-flowered, 7–20 mm apart; pedicels 4–5 × *c.* 0.2 mm, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes and sessile glands absent. Flower calyces 2.5–2.8 mm long, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes occasional and very short (< 0.2 mm long), sessile glands sparse. Corolla 9.5–11.5 mm long, blue-purple; tube 5–6 mm long, abruptly curved at 80–90° 2–2.4 mm from the base, slightly inflated upwards, non-glandular trichomes absent or occasional, 2-celled and very short (< 0.2 mm long), glandular trichomes and sessile glands absent; upper lobes suborbicular, erect to weakly reflexed, 1.8–2 × 1.5–1.6 mm, non-glandular trichomes scattered, antrorse, 2–4-celled up to 0.3 mm long, glandular trichomes absent, sessile glands sparse; lateral lobes rounded, *c.* 0.5 × 0.7–0.8 mm, glabrous; lower lobe oblong-ovate, 5–5.2 × 4–4.2 mm, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.3 mm long, glandular trichomes absent, sessile glands sparse; filaments filiform, 7–8 × *c.* 0.2 mm, lilac, fused for 4–5 mm from the base; anthers *c.* 0.4 × 0.3 mm; style filiform, 8–9 × *c.* 0.2 mm, cream, bifid for *c.* 0.5 mm. Fruit calyces 4.5–5 mm long; upper lobe broadly ovate, 2–2.2 × 2–2.2 mm; lateral lobes lanceolate, 1.8–2.2 × 0.7–0.8 mm; lower lobes lanceolate-falcate, 2–2.2 × 0.7–0.8 mm. Nutlets ± circular in outline, compressed flattened globose, 0.8–1 mm wide, 0.4–0.5 mm thick, brown, weakly verrucose. **Fig. 1.**

***Distribution and habitat*:** Thus far, *Plectranthus laetus* has been collected from a single locality on Orchid Creek Station, southwest of Lockhart River on Cape York Peninsula in Queensland. Plants commonly grew in diffuse colonies on granite boulders and slabs in the ecotone between woodland dominated by *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson, *Eucalyptus cullenii* Cambage and *Melaleuca saligna* Schauer and closed forest (semi-deciduous notophyll vineforest) at altitudes between 380 and 400 m. Some plants were also found under the vineforest canopy, but usually in sunny spots or in close proximity to the margin. Other species in close association at the type locality included *Abelmoschus moschatus* subsp. *tuberosus* (Span.) Borss.Waalk., *Cymbopogon queenslandicus* S.T.Blake, *Desmodium tenax* Schindl., *Glycine* sp. (Bolt Head P.I.Forster PIF8948), *Hibiscus normanii* F.Muell., *Setaria oplismenoides* R.A.W.Herrm., *Solanum intonsum* A.R.Bean and *Vernonia*

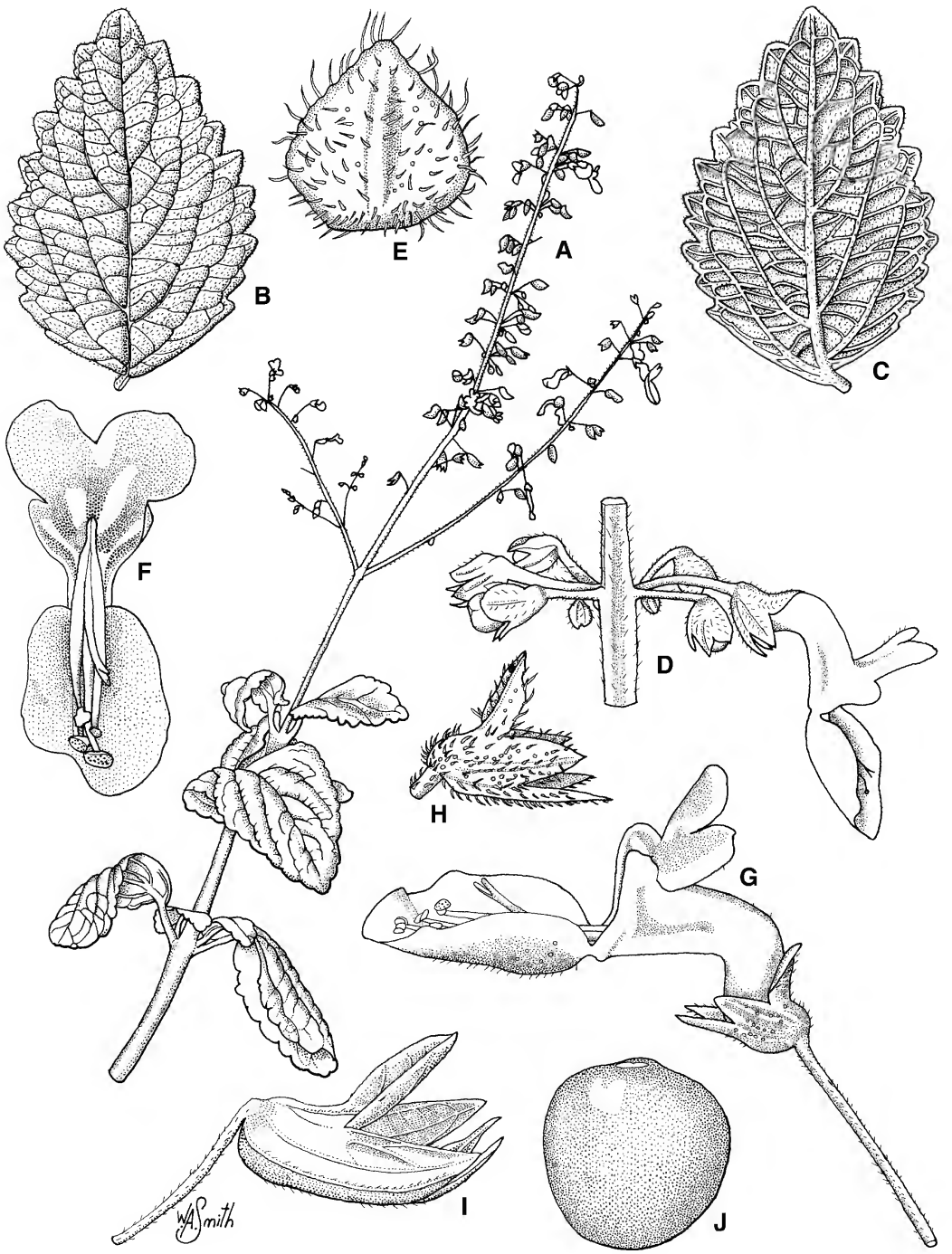
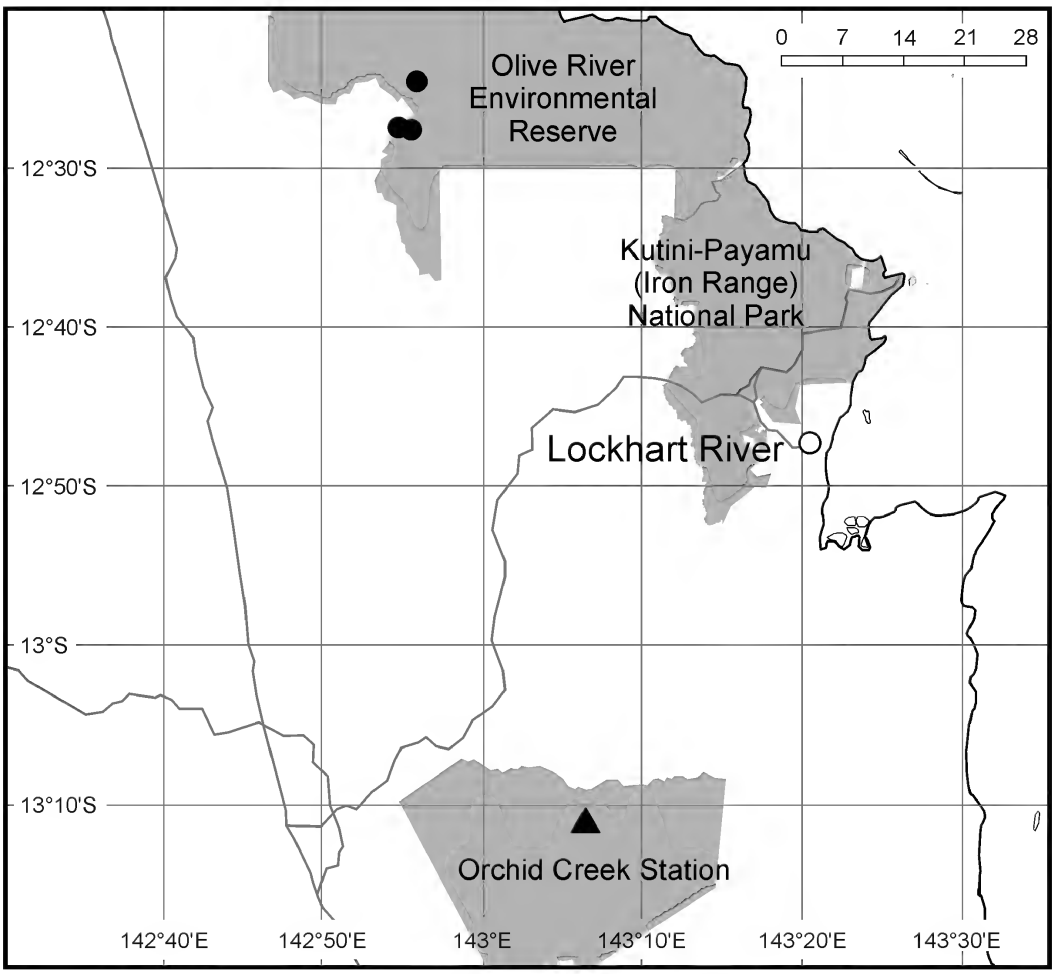


Fig. 1. ***Plectranthus laetus***. A. habit of branchlet with flowering and fruiting inflorescence ×0.6. B. adaxial leaf surface ×1. C. abaxial leaf surface ×1. D. verticillaster with buds and flower ×4. E. floral bract ×12. F. face view of flower ×6. G. lateral view of flower ×6. H. lateral view of flowering calyx ×8. I. lateral view of fruiting calyx ×8. J. seed ×32. All from *Forster PIF41138 & Thompson* (BRI). Del. W. Smith.

junghuhniana J.Kost. This relatively small habitat space is periodically impacted by wildfires undoubtedly resulting in the markedly sharp rainforest margin. Adult plants of the *Plectranthus* are probably killed by these fires, but regenerate *in situ* either from seed or the fleshy rootstocks or *ex situ* by dispersal from adjacent plants within the vineforest canopy.

Notes*: *Plectranthus laetus was first collected in 2014 during a general botanical survey of Orchid Creek Station. The new species appears to be closely related to *P. pulchellus* (Forster 1994) that grows on sandstone substrates (cliff lines) adjacent to spring fed rainforests (evergreen notophyll/mesophyll vineforests) on the Olive River Reserve and from which it is disjunct by *c.* 70 km (**Map 1**).



Map 1. Distribution of *Plectranthus pulchellus* ● and *P. laetus* ▲ on Cape York Peninsula, grey shaded areas are conservation reserves and property boundaries.

Plectranthus pulchellus differs from *P. laetus* mainly in the yellow sessile glands (versus orange) and the verticillasters with a greater number of flowers (12–16 versus 6–10), flowers with corollas that are light purple (versus blue-purple) and with smaller calyces. There are also other minor differences in the combinations of indumentum composition and cover on the foliage and floral parts; however, the speciation hypothesis is that the two are sister taxa.

***Etymology*:** The specific epithet is derived from the Latin word *laetus* (pleasant), an allusion to the appearance of this plant.

Plectranthus ventosus P.I.Forst., **sp. nov.** with affinity to *P. parviflorus* Willd. but differing in lacking a basal stem tuber (versus present), antrorse non-glandular trichomes on the foliage (versus retrorse) and obovate-rhomboid floral bracts (versus ovate to obovate). **Typus:** Queensland. Cook District: ex situ cultivation from Melville Peak, on the ridge between the headwaters of Sweetwater Creek and Temple Creek, Cape Melville National Park, 10 April 2015, *H.B. Hines CM40 & C.J. Hoskin* (holo: BRI).

Perennial herb, stems erect to 15 cm high; foliage scentless when crushed, not clammy; non-glandular and glandular trichomes uncoloured, non-glandular trichomes without prominent raised bases, sessile glands absent. Roots fibrous, somewhat fleshy and thickened. Stems square, erect to straggling, fleshy, easily snapped, the lower parts up to 8 mm diameter and not noticeably thickened, pink-purple to pink-green, upper parts with persistent indumentum, non-glandular trichomes sparse, antrorse, 4–6-celled up to 1 mm long, glandular trichomes sparse, very short with little development of stalks. Leaves discolorous, petiolate; petioles 2–5 × 0.8–1 mm, weakly channelled on top, non-glandular trichomes sparse, antrorse, 4–6-celled up to 1 mm long, glandular trichomes ± stalkless; laminae lanceolate-ovate to ovate, fleshy, ±flat to slightly keeled, 6–25 × 4–20 mm, crenate with 4–6 teeth up to 2 mm long on each margin, of similar length along margin, secondary teeth poorly developed; tip acute; base obtuse to rounded; upper surface medium-green and somewhat glossy, veins impressed, non-glandular trichomes sparse, antrorse, 4–6-celled up to 1 mm long, glandular trichomes absent; lower surface pale green, veins strongly raised, non-glandular trichomes sparse, antrorse, 4–6-celled up to 1 mm long, glandular trichomes sparse and stalked to 0.4 mm long. Inflorescence up to 100 mm long, usually single or with 1 or 2 side branches; axis square in cross-section, pink-purple, non-glandular trichomes occasional, weakly antrorse, 4–6-celled up to 0.2 mm long, glandular trichomes dense and minute (< 0.2 mm long); bracts obovate-rhomboid, strongly cupped, 0.9–1 × 0.8–1 mm, ecomose, margins somewhat irregularly crenate to crenulate due to slightly enlarged bases of trichomes, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.4 mm long, glandular trichomes occasional, ± sessile; verticillasters 6–10-flowered, 4–14 mm apart; pedicels 2–4.5 × *c.* 0.2 mm, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes ± sessile. Flower calyces 1.8–2 mm long, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes sparse and very short (< 0.2 mm long). Corolla either not opening (cleistogamous) or poorly formed, 2.8–3 mm long, white, with some mauve edging; tube 1.8–2 mm long, ± straight, slightly inflated upwards, non-glandular and non-glandular trichomes absent; upper lobes suborbicular, inflexed, *c.* 0.5 × 0.5 mm, non-glandular trichomes scattered, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes scattered < 0.1 mm long; lateral lobes rounded, *c.* 0.2 × 0.2 mm, glabrous; lower lobe oblong-ovate, 0.8–1 × 0.6–0.7 mm, non-glandular trichomes sparse, antrorse, 2–4-celled up to 0.2 mm long, glandular trichomes absent; filaments filiform, 1.8–2 × *c.* 0.1 mm, lilac, fused for 0.8–1 mm from the base; anthers *c.* 0.2 × 0.1 mm; style filiform, *c.* 1.2 × 0.1 mm, cream, bifid for *c.* 0.2 mm. Fruit calyces 4.5–5 mm long; upper lobe broadly ovate, 1–1.2 × 1.6–1.8 mm; lateral lobes lanceolate, 1–1.2 × *c.* 0.8 mm; lower lobes lanceolate-falcate, 1.2–1.3 × 0.4–0.5 mm. Nutlets ± circular in outline, compressed flattened globose, 0.7–0.8 mm wide, 0.4–0.5 mm thick, brown, weakly verrucose. **Figs. 2 & 3**.

Distribution and habitat: *Plectranthus ventosus* is known so far from a single population at Cape Melville where it was collected on a ridge top (*c.* 590 m altitude) growing amongst scattered large boulders in stunted rainforest immediately adjacent to an exposed boulder field. Substrate is coarse sandy loam derived from Cape Melville granite; however, the plants mainly

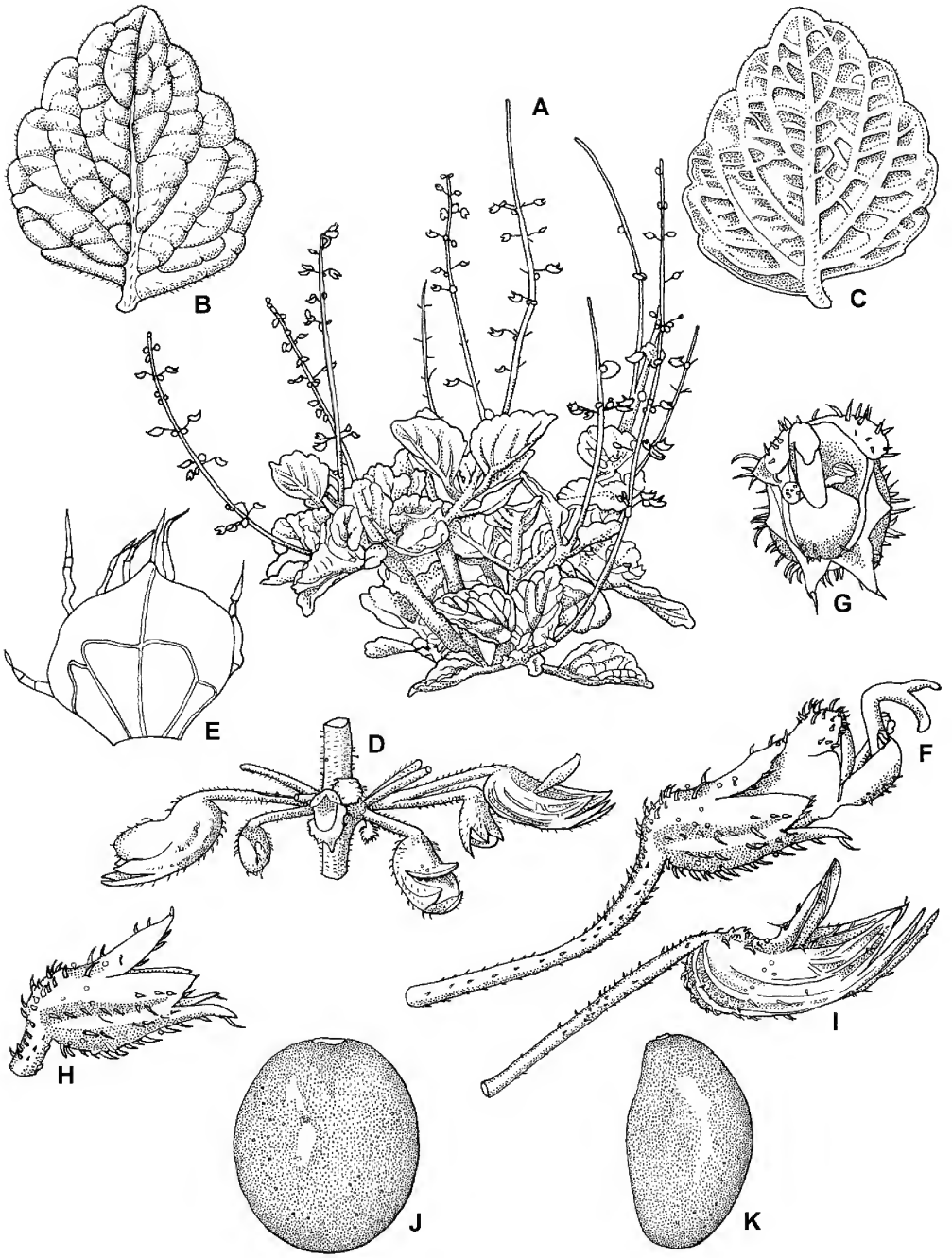


Fig. 2. ***Plectranthus ventosus***. A. habit of whole plant with flowering and fruiting inflorescences ×0.6. B. adaxial leaf surface ×2. C. abaxial leaf surface ×2. D. verticillaster with buds and fruiting calyces ×4. E. floral bract ×32. F. lateral view of cleistogamous flower ×12. G. face view of cleistogamous flower ×12. H. lateral view of flower calyx ×12. I. lateral view of fruiting calyx ×8. J. top view of seed ×32. K. lateral view of seed ×32. All from *Hines CM40 & Hoskin* (BRI). Del. W. Smith.

Fig. 3. *Plectranthus ventosus* in habitat (*Hines CM40 & Hoskin* [BRI]). Photo: H. Hines.

grew lithophytically on top of the boulders in detritus derived from leaf litter **(Fig. 3)**. Two other species of *Plectranthus* occur at Cape Melville, namely *P. dumicola* and *P. megadontus* **(Map 2)**; both tend to be at lower altitudes and in more exposed situations.

Notes*: *Plectranthus ventosus was discovered at Cape Melville by Harry Hines and Conrad Hoskin on 15 December 2013 during surveys for amphibians and reptiles. Live material was forwarded to the author and cultivated in Brisbane.

This species appears to be predominantly cleistogamous based on repeated inspection of cultivated material with normally formed inflorescences, verticillasters and buds. Fully formed seeds are present in most fruiting calyces and although a corolla is formed, it fails to open or appears malformed and dwarfed without proper expansion of the floral organs. Whether this is a case of 'induced cleistogamy' (equivalent to 'pseudocleistogamy' or 'ecological cleistogamy') where floral development is affected by environmental conditions (Culley & Klooster 2007) remains to be seen. All other Australian *Plectranthus* flower normally, although Blake (1971) did observe cleistogamous flowers on *P. parviflorus*. Cleistogamy has not been recorded in the genus in other parts of its extra-Australian range with other Lamiaceae genera recorded as cleistogamous being *Ajuga* L., *Lamium* L., *Salvia* L. and *Scutellaria* L. (Culley & Klooster 2007). Although this *Plectranthus*

occurs in a relatively 'severe' habitat, other species of the genus from similar altitudes and latitudes flower normally when cultivated further south (i.e. Brisbane), hence its floral behavior is probably natural.

Inferred relationships of this species are hypothesized to be with species such as *Plectranthus apreptus*, *P. laetus*, *P. parviflorus* and *P. pulchellus*; however, this remains to be tested with non-morphological methods. *Plectranthus ventosus* differs from all these species by the absence of sessile glands on the foliage and floral parts. It is perhaps most similar to *P. parviflorus*; however, that species differs by the possession of a pronounced basal tuber to the stems (absent), retrorse orientated non-glandular trichomes on the foliage (versus antrorse) and floral bracts that are ovate to obovate (versus obovate-rhomboid).

Plectranthus ventosus is surprisingly only the second vascular plant to be recognised as endemic to the boulder fields of the Melville Range at Cape Melville, the other being the iconic *Wodyetia bifurcata* Irvine. The Melville Range is recognised as a significant local centre of diversity for vertebrates with six endemic to these habitats (Hoskin 2013).

***Etymology*:** The specific epithet is derived from the Latin word *ventosus* (windy), and pertains to the continuous strong winds that buffet and shape the vegetation at Cape Melville Range. These very winds prevented revisitation of this specific locality in 2014 in an attempt to source further material and to ascertain the population extent.

Acknowledgements

I would like to thank Harry Hines (Queensland Parks & Wildlife Service) and Conrad Hoskin (James Cook University – Townsville) for live material and photographs of *Plectranthus ventosus*; Simon Thompson (DATSIMA) for assistance in the field and organization of the fieldwork at Orchid Creek Station (OCS); Keith McDonald for assistance in the field at OCS and Will Smith (BRI) for preparation of the figures and maps.

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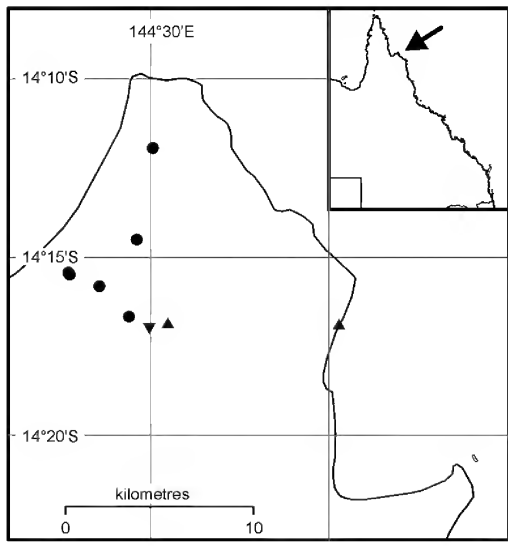

Map 2. Distribution of *Plectranthus* species at Cape Melville, Cape York Peninsula (area entirely within Cape Melville National Park): *P. dumicola* ●, *P. megadontus* ▲ and *P. ventosus* ▼.

Overlooked plant species names associated with the botanical collections of Eugene Fitzalan

John Leslie Dowe

Summary

Dowe, J.L. (2015). Overlooked plant species names associated with the botanical collections of Eugene Fitzalan. ***Austrobaileya* 9(3): 439–444**. Three overlooked species names, related to the botanical collections of Eugene Fitzalan are assessed for their nomenclatural validity. The names were published by Walter Hill: *Erythrina fitzalanii* W.Hill is found to be valid and placed as a synonym of *Erythrina variegata* L.; *Dendrobium luridum* and *Dendrobium fitzalani* are invalid and are therefore names that are to be rejected.

Key Words: Eugene Fitzalan, Fabaceae, Orchidaceae, *Erythrina fitzalanii*, *Erythrina variegata*, *Dendrobium fitzalani*, *Dendrobium luridum*, Queensland, Burdekin Expedition, overlooked species names

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Introduction

Whilst preparing a paper on the botanical collections of Eugene Fitzalan (b.1830; d.1911) who was active in Queensland during the latter decades of the 1800s (Dowe 2015), three apparently overlooked species names were encountered. The names were all introduced in publications written by Walter Hill. Two of the names, *Erythrina fitzalanii* and *Dendrobium luridum*, were cited in relation to the species collected by Eugene Fitzalan during the Burdekin Expedition (Hill 1860a). The third, *Dendrobium fitzalani* was included in the *Catalogue of the Plants in the Queensland Botanic Gardens* (Hill 1875). This paper discusses the names and assesses their nomenclatural validity.

Botanical results of the Burdekin Expedition

The Burdekin Expedition of 1860 was the first botanical expedition to be sanctioned by the then newly formed Queensland Colonial Government. The Expedition departed Brisbane on 22 August 1860 in the Schooner *Spitfire*, under the command of Joshua W. Smith RN in the company of George Elphinstone Dalrymple, Commissioner of Crown Lands for Queensland. The Expedition sailed as far north as Halifax Bay, and returned to Brisbane on 18 October 1860. Fitzalan was under contract to the Victorian Government as a paid collector engaged by Ferdinand Mueller, the Victorian Government Botanist. The intention of the Burdekin Expedition was to locate the mouth of the Burdekin River, and to determine if the river was navigable and suitable as a port (Dalrymple 1860; Smith 1860). About 140 specimens were collected by Fitzalan during the Expedition (Dowe 2015). The specimens were originally examined by Walter Hill (the Queensland Government Botanist) when the Expedition returned to Brisbane. Hill (1860b) provided an annotated species list, but only to the designation of family. The specimens were subsequently sent to Mueller in Melbourne, and he produced a detailed botanical treatment that described and annotated 88 taxa of which 10 were described as novelties (Mueller 1860). Later, based on collections by Fitzalan made during the Expedition, a further 16 new taxa were described in Bentham's *Flora Australiensis*, 11 in Mueller's *Fragmenta Phytographiae Australiae*, and one each in *Adansonia* and the *Journal de Botanique Néerlandaise* (Dowe 2015). In total, about 40 new taxa were described from Fitzalan's specimens collected during the Expedition. Following the Expedition, Fitzalan was to continue

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collecting for Mueller in tropical Queensland, reaching a total of about 2200 specimens, thus placing him as one of the most productive botanical collectors in Queensland of that era (Dowe 2015).

Overlooked species names

Two of the names, *Erythrina fitzalanii* and *Dendrobium luridum*, appeared in a newspaper article summarising the botanical results of the Burdekin Expedition, and were included within a quote that was ascribed to Hill (1860a). The third name, *Dendrobium fitzalani* appeared in a systematically arranged list of plants that were then being cultivated in the Botanic Gardens in Brisbane (Hill 1875). Searches of the APC (2015), APNI (2015), IPNI (2015) and Kew (2015) databases, and other relevant taxonomic citation sources were conducted and the names were not located, thus indicating that the names have not been recorded in the taxonomic literature.

The publication of new species names in non-scientific publications such as newspapers and catalogues has proven to be problematic for botanical nomenclature and taxonomy, particularly with regards to valid publication and typification (Nelson 1990; Ewan 1993; Dowe 2004). New names published in trade catalogues and non-scientific newspapers have been deemed invalid since 1953, but names published prior to that date may be permitted by the code, if the rules of botanical nomenclature are otherwise observed (McNeill *et al*. 2012). Two examples of names validly published in Australian newspapers are *Dendrobium falcorostrum* Fitzg. and *Dendrobium fuscum* Fitzg. (=*D. discolor* Lindl.), both published in the *Sydney Morning Herald* (Fitzgerald 1876, 1879).

Erythrina fitzalanii

The name *Erythrina fitzalanii* was first published in *The Moreton Bay Courier,* Saturday, 27 October 1860: "*Burdekin Expedition – Botanical Research…through the courtesy of Mr. Hill, Superintendent of the Botanical Gardens… Amongst the ornamental plants the Erythrina fitzalanii (W.H.), a scarlet flowering coral tree, twelve feet in height, is the gem of those collected during the expedition. Trees of it in flower were seen by the party six miles distant*" (Hill 1860a). This relates to direct observations made on Long Island by Fitzalan (1860) of a flowering *Erythrina*: "*… we saw in the centre of one of the patches of scrub…a tree of such an intense scarlet that it was visible at a distance of several miles. I made my way to this spot, and found it to be a new Erythrina, completely covered with large scarlet blossoms, but without a single leaf on it. This is the most beautiful tree I have ever seen*". Smith (1860) was similarly impressed with the *Erythrina*: "*Here* [Long Island], *and at every place we visited, geological and botanical specimens were obtained; among the latter, a most beautiful flower of a scarlet color, completely covering the few trees which we saw. Upon close examination it was observed that, at this season, there were no leaves on the tree, which has a whitish bark, and is about 20 ft in height*". Hill (1860b) produced a 'List of Specimens, collected by Mr. Fitzalan' from the Burdekin Expedition designated only to family, in which he included a significant number under Fabaceae. Although not directly relatable to Hill's list, there is one item that may pertain to Fitzalan's collection, it being: "*18. Fabaceae, a handsome tree, beautiful when in flower, wood close grained and firm*". This is the only Fabaceae tree included in Hill's list, the others being described as shrubs or vines.

Fitzalan's collections of *Erythrina* species at MEL include *E. variegata* L. from Port Denison [MEL 0072371], *E. vespertilio* Benth. from both Port Denison and Moreton Bay [MEL 0072399, MEL 0072401, MEL 0072450 and MEL 0072467], and a specimen filed as *Erythrina* sp. [MEL 2113384] from the Cumberland Islands (**Fig. 1**). The Cumberland Islands, as accepted at that time, included the islands between Hayman Island in the north to St Bees Island in the south and thus encompassed Long Island. It is assumed that the latter collection was made at Long Island, as described by both Smith and Fitzalan. An examination of the flower parts in that specimen relates it to *E. variegata*. The only other possible species that it could be, based on known distribution, is *E. vespertilio* Benth. subsp. *vespertilio* but the flower

parts in the MEL specimen are significantly longer and therefore exclude that species. Considering this, the specimen can serve as a type for the name *E. fitzalanii* W.Hill, but with the taxon made synonymous with *E. variegata* L. The description provided in the newspaper article is adequate to identify the plant to *E. variegata*, with gregarious scarlet flowers, habit to about 3-6 m in height, bark whitish and leaves deciduous. An addition to the synonymy of *E. variegata* as presented by Bean (2008) is thus:

Erythrina fitzalanii W.Hill, *The Moreton Bay Courier* [Vol 15, No. 936] 27 Oct. 1860: 2. **Type:** Queensland. South Kennedy. Cumberland Islands [Long Island], 1860, *Fitzalan s.n.* (lectotype: MEL 2113384 [here designated]).

Dendrobium luridum

The second overlooked name was also introduced in the same article in *The Moreton Bay Courier*: "*Two beautiful plants of the Dendrobium luridum, and its variety, with yellow flowers, were also collected on the islands*" (Hill 1860a). This was later spelt as *Dendrobium laridum*, in a re-issue of the article in another newspaper (Hill 1860c). A search of both MELISR and the Mueller Correspondence files at RBG Melbourne failed to locate any specimens or references that relate to this name (A.Vaughan and S.Maroske, *pers. comm.*). As there are contraventions of Articles in the ICBN [Melbourne Code] (McNeill *et al.* 2012), i.e. Article 9 (identity ambiguous); and Article 36 (when it is merely proposed in anticipation of the future acceptance of the taxon concerned), this name is to be rejected. The identity of this species is otherwise not able to be determined: one possibility is that it relates to *Dendrobium discolor* Lindl., but this cannot be established because of the lack of description and the absence of extant specimens.

Dendrobium fitzalani

The third overlooked name was introduced in Hill's *Catalogue of the plants in the Queensland Botanic Gardens*, as verbatim: "*Dendrobium fitzalani* F.M.…Dendron, trees; bio, to live; growing upay, Epi.…Queensland" (Hill 1875). As the name was appended with the authorship of F.M. [i.e. F. Muell.], searches were conducted of Mueller's Correspondence at RBG Melbourne to locate any reference in communications between Hill and Mueller, as well as the MELISR database (A.Vaughan and S.Maroske, *pers. comm.*), and no such name was located. As there are contraventions of Articles in the ICBN [Melbourne Code] (McNeill *et al.* 2012), i.e. Article 9 (identity ambiguous); and Article 36 (when it is merely proposed in anticipation of the future acceptance of the taxon concerned), this name is to be rejected.

Acknowledgements

Nimal Karunajeewa and Alison Vaughan of the National Herbarium of Victoria (MEL) are thanked for assisting with access to MELISR and for the image of the Fitzalan specimen in MEL. Sara Maroske is thanked for undertaking searches of the Mueller Correspondence archives at MEL and Charles Nelson is thanked for comments on the original draft.

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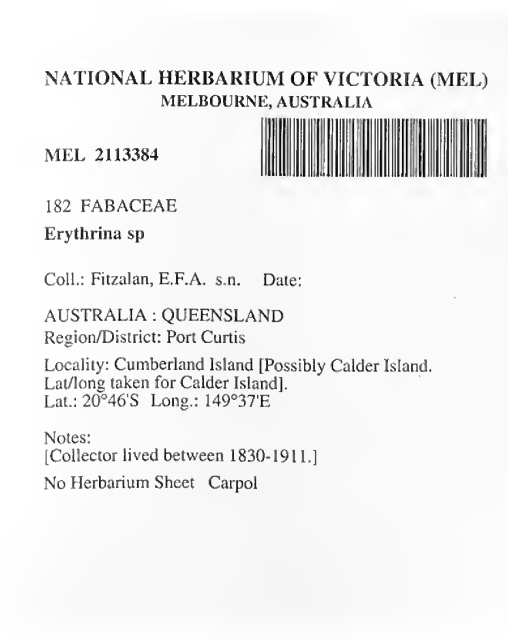
Fig. 1. Lectotype of ***Erythrina fitzalanii*** W.Hill. Original label collected by Eugene Fitzalan from Cumberland Islands [Long Island] during the Burdekin Expedition, 1860, MEL 2113384.


MEL 2113384

NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA

MEL 2113384

182 FABACEAE
Erythrina sp

Coll.: Fitzalan, E.F.A. s.n. Date:

AUSTRALIA : QUEENSLAND
Region/District: Port Curtis

Locality: Cumberland Island [Possibly Calder Island. Lat/long taken for Calder Island].
Lat.: 20°46'S Long.: 149°37'E

Notes:
[Collector lived between 1830-1911.]

No Herbarium Sheet Carpol

Fig. 1 (cont.) Lectotype of ***Erythrina fitzalanii*** W.Hill. The reverse of the label showing the printed herbarium data. Reproduced with permission from the National Herbarium of Victoria (MEL), Royal Botanic Gardens Melbourne.

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A conspectus of *Polyscias* J.R.Forst. & G.Forst. (Araliaceae) in Queensland, Australia

A.R. Bean

Summary

Bean, A.R. (2015). A conspectus of *Polyscias* J.R.Forst. & G.Forst. in Queensland, Australia. ***Austrobaileya* 9(3): 445–456**. The 12 indigenous species of *Polyscias* in Queensland are enumerated, and their nomenclature, distribution and habitat are discussed. Distribution maps and an identification key are provided. Specimen citations of *Polyscias zippeliana* (Miq.) Valeton from Australia are newly given. Lectotypes are selected for *Aralia nodosa* Blume, *Hedera australiana* F.Muell., *Nothopanax macgillivrayi* Seem., *Panax elegans* F.Muell., *Panax mollis* Benth., *Panax murrayi* F.Muell., *Panax zippeliana* Miq. and *Pentapanax willmottii* F.Muell.

Key Words: Araliaceae, *Polyscias*, *Polyscias zippeliana*, taxonomy, Queensland flora, lectotypes, nomenclature, identification key

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Introduction

Polyscias J.R.Forst. & G.Forst. is the second largest genus in Araliaceae, with 159 species (Lowry & Plunkett 2010), and is distributed from tropical Africa to the islands of the eastern Pacific Ocean. Over the last 150 years, *Polyscias* has sometimes been narrowly defined and sometimes broadly circumscribed. The current trend is a broadly defined *Polyscias*, exemplified by the molecular study of Plunkett & Lowry (2010), where *Polyscias* is used in a broad sense, encompassing several previously widely recognised genera including *Arthrophyllum* Blume, *Gastonia* Comm. ex Lam., *Tetraplasandra* A.Gray and *Reynoldsia* A.Gray. These genera have been shown to be polyphyletic or paraphyletic with respect to a narrowly defined *Polyscias*.

This paper presents a summary of the *Polyscias* species occurring in Queensland and adjacent areas, provides a key to their identification, and lectotypifies several names. 12 species of *Polyscias* are recognised here for Queensland, all are indigenous. Bostock & Holland (2014) listed 11 species as indigenous to Queensland. One species from that list, *P. scutellaria* (Burm.f.) Fosberg, is excluded from this account, because both existing records were found to be based on cultivated specimens; while two species are added – *P. spectabilis* (Harms) Lowry & G.M.Plunkett, which has recently been transferred from the genus *Gastonia*, and *P. zippeliana* (Miq.) Valeton, not previously recorded in Australian censuses or databases.

Materials and methods

This paper is based on the study of around 400 *Polyscias* specimens at BRI, and specimen images of types from BM, BR, FI, K, L, M and MEL. Any measurements given here have been made from dried herbarium specimens. Collection dates for historical New Guinean collections were determined using Steenis-Kruseman (2011). Distribution maps have been compiled using DIVA-GIS Version 7.5.0, using label data of specimens from BRI, and of the type specimen of *P. zippeliana* at L. Species treatments are arranged in alphabetical order.

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Common abbreviations used in the specimen citations are HS (homestead), LA (Logging Area), NP (National Park), SF/SFR (State Forest/State Forest Reserve) and TR (Timber Reserve).

Taxonomy

Polyscias J.R.Forst. & G.Forst., *Char. Gen. Pl.* 63 (1775).

Shrubs or trees; leaves alternate, imparipinnate or bipinnate (rarely tripinnate or unifoliolate); petiole with an expanded sheathing base; leaflets in pairs, margins entire, crenate or dentate. Inflorescences terminal, paniculate; flowers in umbels or less commonly in racemes; pedicels often articulated below the ovary. Ovary inferior. Calyx rudimentary, often comprising 5 small teeth. Petals 4-5(-8), valvate. Stamens equal in number to petals. Fruit a spherical or laterally flattened drupe, crowned by persistent styles.

1. Polyscias australiana (F.Muell.) Philipson, *Blumea* 24: 171 (1971); *Hedera australiana* F.Muell., *Fragm.* 4: 120 (1864); *Irvingia australiana* (F.Muell.) F.Muell., *Fragm.* 5: 18 (1865); *Kissodendron australianum* (F.Muell.) Seem., *J. Bot.* 3: 201 (1865); *Kissodendron australianum* (F.Muell.) Seem. var. *australianum*, F.Muell., *Descr. Notes Papuan Pl.* 5: 88 (1877). **Type:** Queensland. Rockingham Bay, 1 March 1864, *J. Dallachy s.n.* (lecto: MEL 1533942 [here designated]; isolecto: BM 000810429; BR 563082; MEL 1533941).

Kissodendron australianum var. *furfuraceum* C.T.White, *Contr. Arnold Arbor.* 4: 83 (1933). **Type:** Queensland. Cook District: Boonjie, 8 October 1929, *S.F. Kajewski 1256* (holo: BRI).

***Illustrations*:** Elliot & Jones (1997: 418); Cooper & Cooper (2004: 65); Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Mossman River, Feb 1932, *Brass 2145* (BRI); SF 310 Gadgarra, Nov 1995, *Forster PIF17970 & Spokes* (BRI, MEL). North Kennedy District: Kirrama Range, Bryce Henry LA, SF 344, Nov 1992, *Fell DF2041* (BRI, CNS, MEL). South Kennedy District: Clarke Range, Eungella NP, Broken River, near bridge on road to Eungella Dam, Apr 1981, *Telford 11182 & Rudd* (BRI, CANB, NSW). Port Curtis District: Waterpark Creek, Byfield, 1983, *McCabe s.n.* (BRI [AQ394772]). Moreton District: Yandina Creek, SF 351 near Eumundi, Oct 1993, *Bean 6813* (BRI).

***Distribution and habitat*:** *Polyscias australiana* is endemic to Queensland. It is mainly distributed in the Wet Tropics bioregion, but extending further south, *viz.* in the Proserpine – Mackay region, the Byfield area near Rockhampton, and in a very limited area near Eumundi, north of Brisbane (**Map 1**). It grows in evergreen notophyll rainforest where rainfall exceeds 1500 mm per annum. In southern and central Queensland, it is found mainly at low altitudes, but at the northern end of its range, it extends to 1200 metres.

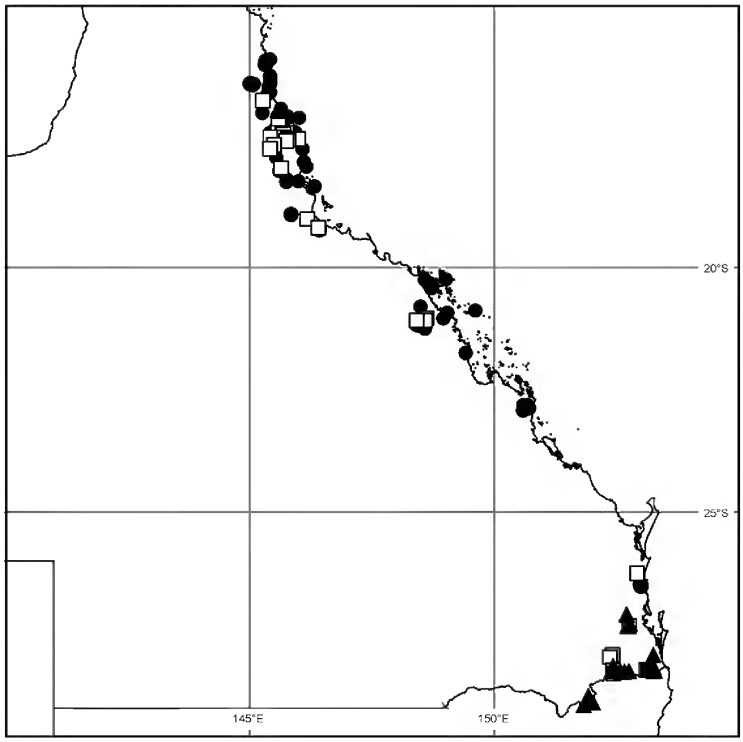
***Notes*:** *Polycias australiana* is distinguished by the pinnate leaves with 7–21 leaflets; the rusty hairs on the developing inflorescences, vegetative shoots and petiole bases; and the primary inflorescence axis bearing many secondary axes in 3 or 4 verticils.

2. Polyscias bellendenkerensis (F.M.Bailey) Philipson, *Austrobaileya* 1: 24 (1977); *Pentapanax bellendenkerensis* F.M.Bailey, *Queensland Agric. J.* 15: 491–492 (1904); *Kissodendron bellendenkerense* (F.M.Bailey) Domin, *Biblioth. Bot.* 89: 484 (1928). **Type:** Queensland. Cook District: Summit of Bellenden-Ker, 20–23 July 1904, *A. Meston 170* (holo: BRI).

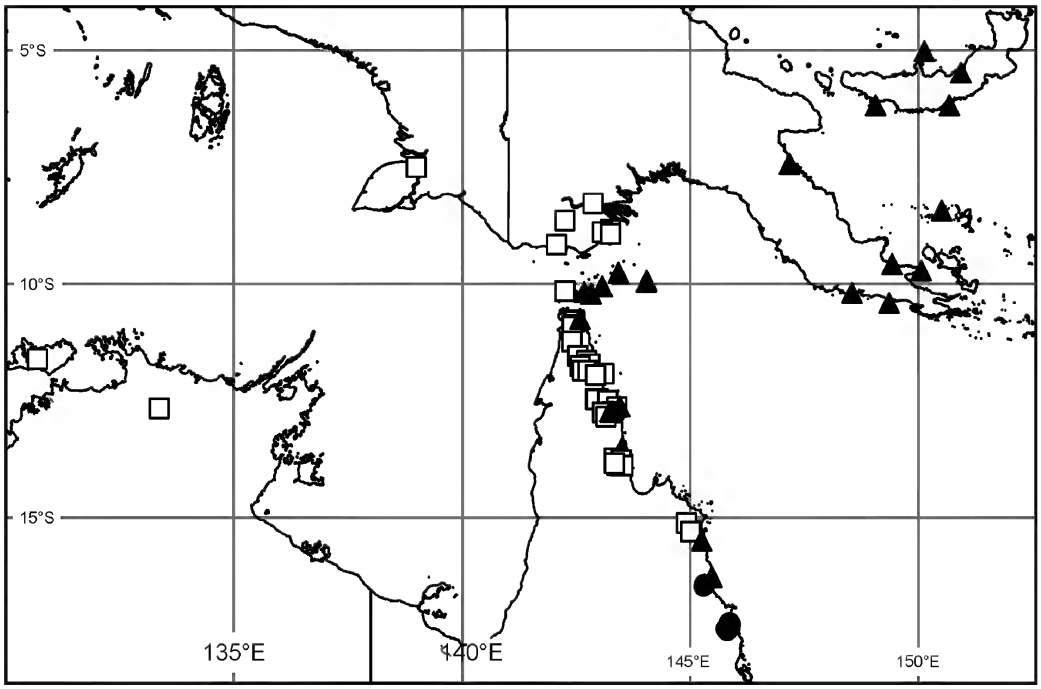
***Illustrations*:** Elliot & Jones (1997: 418); Cooper & Cooper (2004: 65); Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Upper catchment of Mossman River, Mossman Bluff, Jan 1989, *Fell & Baird s.n.* (BRI [AQ457118]); 'Heathland' near helicopter pad on W slope of S peak of Bartle Frere, Wooroonooran NP, Apr 1995, *Hunter JH766* (BRI); Summit of Centre peak, Bellenden Ker, Nov 1972, *Webb & Tracey 11914* (BRI, CANB).

***Distribution and habitat*:** *Polyscias bellendenkerensis* is endemic to Queensland where it is found in two disjunct areas of the Wet Tropics bioregion; on the Mt Bellenden-Ker and Mt Bartle Frere massif, and in the mountains west of Mossman (**Map 2**). It grows in shrubland or elfin 'cloud forest' at altitudes of 1100–1600 metres.



Map 1. Queensland distribution of *Polyscias australiana* ●, *P. murrayi* □, *P. sambucifolia* ▲.



Map 2. Australian and Malesian distribution of *Polyscias bellendenkerensis* ●, *P. macgillivrayi* ▲, *P. zippeliana* □.

***Notes*:** *Polyscias bellendenkerensis* is distinguished by the mostly bipinnate foliage, the flowers borne in umbels, and the styles remaining erect in fruit.

3. Polyscias elegans (C.Moore & F.Muell.) Harms, *Natur. Pflanzen.* III, 8 (111): 45 (1894); *Panax elegans* C.Moore & F.Muell., *Trans. Philos. Inst. Victoria* 2: 68 (1857); *Nothopanax elegans* (C.Moore & F.Muell.) Seem., *Fl. Vit. [Seemann]* 3: 114 (1866); *Tieghemopanax elegans* (C.Moore & F.Muell.) R.Vig., *Bull. Soc. Bot. France* 52: 308 (1905); *Gelibia elegans* (C.Moore & F.Muell.) Hutch., *Gen. Fl. Pl.* 2: 58 (1967). **Type:** Queensland. Moreton Bay, [December 1856], *W. Hill & F. Mueller* (lecto: MEL 672695 [here designated]).

Panax polybotryus F.Muell., *Hooker's J. Bot. Kew Gard. Misc.* 9: 229 (1857). **Type:** Queensland. Moreton Bay, [in 1856] *F. Mueller s.n.* (syn: BM 000810430).

Polyscias branderhorstii Harms, *Nova Guinea* 8: 274 (1909); *Gelibia branderhorstii* (Harms) Hutch., *Gen. Fl. Pl.* 2: 58 (1967). **Type:** New Guinea. South coast at Dorf Gelieb, 3 November 1907, *B. Branderhorst 208* (syn: K 000792854 & K 000792853).

***Illustrations*:** Cooper & Cooper (2004: 65); Hyland *et al.* (2010); Nicholson & Nicholson (2007a: 52).

***Additional selected specimens examined*:** Queensland. Cook District: Thursday Island, Jul 1975, *Stocker 1295* (BRI); The Big Scrub, 2–4 km NE of Mt Surprise turnoff, Mt Garnet – Charters Towers Road, May 1976, *Rodd 3200* (BRI, NSW). South Kennedy District: Carlisle Island, *c.* 1 km W of Turtle Bay and *c.* 35 km N of Mackay, Sep 1986, *Sharpe 4442 & Batianoff* (BRI). Port Curtis District: Stevens Road, S of Pine Mountain, Shoalwater Bay Training Area, Apr 2011, *Bean 30856 & Halford* (BM, BRI, MO). Burnett District: Mt Wooroolin, 4 km WNW of Kingaroy, Apr 1991, *Telford 11036 & Rudd* (BISH, BRI, CANB, NSW). Wide Bay District: Gheerulla Creek, above the falls, W of Mapleton, Apr 1998, *Bean 13199* (BRI). Moreton District: Ithaca Creek, Apr 1876, *Bailey s.n.* (BRI [AQ215503]).

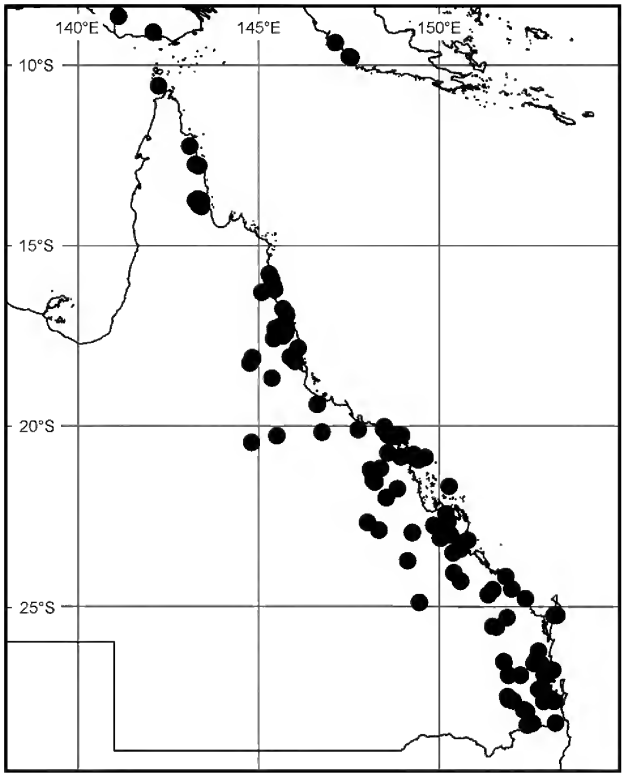
***Distribution and habitat*:** *Polyscias elegans* occurs along the Queensland coast, and extends up to 250 km inland where suitable sheltered habitats exist. It is also found on the Torres Strait islands, and in southern New Guinea (**Map 3**). It also occurs in coastal New South Wales, as far south as Jervis Bay (Floyd 1989). It grows in all types of notophyll rainforest, including those of the littoral zone.

***Notes*:** *Panax polybotryus* was omitted from Govaerts *et al.* (2014), and is treated as a name of uncertain application in APC (2015). In the protologue for *P. polybotryus*, Mueller stated that it has a "racemose, not umbellate inflorescence". *Polyscias elegans* is the only Australian *Polyscias* species that does not have an umbellate inflorescence, a clear indication that the two names are synonymous. This has been confirmed by examination of an image of a type of *P. polybotryus* held at BM. It comprises detached leaflets and a short portion of an infructescence. Both the leaflets and the infructescence are consistent with the species known as *Polyscias elegans*.

Harms (1909) distinguished *Polyscias branderhorstii* from *P. elegans* by the very short pedicels of the fruits and the much "weaker" (sparser?) hairs on the inflorescence. However, these differences are not significant; pedicel length is variable in *P. elegans* throughout its range, as is the density of the inflorescence indumentum.

***Nomenclature*:** *Panax polybotryus* was published in the 9th volume of *Hooker's Journal of Botany and Kew Miscellany*, and p. 229 was published during August 1857 (Stafleu & Cowan 1979). *Panax elegans* was published in the 2nd volume of the *Transactions of the Philosophical Institute of Victoria*, on 30 September 1857 (Chapman 1991); hence in the genus *Panax*, the epithet *polybotryus* has nomenclatural priority over *elegans*. However, *Panax polybotryus* cannot be transferred to *Polyscias*, as the combination *Polyscias polybotrya* is preoccupied for another taxon (*Polyscias polybotrya* Harms, *Notizbl. Königl. Bot. Gart. Berlin 3: 20* (1902)). Therefore *Polyscias elegans* is the correct name for this species.

4. Polyscias macgillivrayi (Seem.) Harms, *Natur. Pflanzen.* III, 8 (111): 45 (1894); *Nothopanax macgillivrayi* Seem., *Fl. Vit. [Seemann]* 3: 114 (1866); *Panax macgillivrayi* (Seem.) Benth., *Fl. Austral.* 3: 382 (1867); *Tieghemopanax macgillivrayi* (Seem.) R.Vig.,



Map 3. Queensland and New Guinea distribution of *Polyscias elegans*.

Bull. Soc. Bot. France 52: 313 (1905). **Type:** Queensland. Cook District: Cape York, October 1848, *J. MacGillivray 431* (lecto: K000792847, here chosen; isolecto: BRI (fragment)).

***Illustrations*:** Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Mount Cook NP, NP 142, 1.5 km WSW of Mt Cook summit, Feb 1993, *Fell DGF2877 & Stanton* (BRI, CNS); Turrel Hill, 10 km WSW of Nesbit River mouth, 51.6 km N of Silver Plains HS, Aug 1993, *Fell DGF3393 et al.* (BRI, CNS); Lamond Hill, Iron Range, Jul 1991, *Forster PIF9016* (BRI); Great Barrier Reef, Restoration Rock, near Cape Weymouth, Portland Roads, Jul 1969, *Heatwole s.n.* (BRI [AQ8116]); Warraber Island, Torres Strait, May 2002, *Waterhouse BMW6410* (BRI, CANB).

***Distribution and habitat*:** *Polyscias macgillivrayi* is found along the east coast of Cape York Peninsula, Queensland, and in coastal parts of mainland Papua New Guinea and New Britain (**Map 2**). It also extends to Micronesia (Philipson 1979). It mainly inhabits the littoral zone almost exclusively, and is frequent on continental islands, but occasionally extends up to 20 km inland.

***Notes*:** Dried specimens of this species are instantly discernible by their strong odour resembling curry powder.

5. Polyscias mollis (Benth.) Harms, *Natur. Pflanzen.* III, 8 (111): 45 (1894); *Panax mollis* Benth., *Fl. Austral.* 3: 382 (1867); *Nothopanax mollis* (Benth.) Seem., *J. Bot.* 4: 295 (1866); *Tieghemopanax mollis* (Benth.) R.Vig., *Bull. Soc. Bot. France* 52: 312 (1905). **Type:** Queensland. Rockingham Bay, undated, *J. Dallachy s.n.* (lecto: MEL 2249865 [here designated]; isolecto: MEL 2249866; MEL 2249858).

Panax macdowallii F.Muell., *Southern Science Record n.s.* 2 (1886); *Aralia macdowallii* (F.Muell.) F.Muell. ex F.M.Bailey, *Syn. Queensland Fl. Suppl.* 2: 31 (1888); *Polyscias macdowallii* (F.Muell.) Domin, *Biblioth. Bot.*

89: 485 (1928). **Type:** Queensland. "Russell's River, Walter Hill", *n.v.*

Illustrations: Cooper & Cooper (2004: 65); Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Palmerston NP, west of Crawford Lookout, Jan 1993, *Bean 5407* (BRI); Westcott Road, Topaz, Mar 2001, *Cooper 1522 & Cooper* (BRI); trail into Stockwellia site near Malanda, Feb 2009, *Costion 1695* (BRI, CNS); Wooroonooran NP, Ghourka Road, Mar 2003, *Forster PIF29260 & Cooper* (BRI, MEL); SFR 755, North Johstone LA, Mar 1976, *Moriarty 1966* (BRI, CNS); Bailey's Creek area, Oct 1963, *Smith 11654* (BRI).

***Distribution and habitat*:** *Polyscias mollis* is endemic to Queensland, and confined to the Wet Tropics bioregion, from Innisfail to Cooktown (**Map 4**), where it grows as an understorey species in complex notophyll rainforest in high rainfall areas.

***Notes*:** *Polyscias mollis* is unique among Australian *Polyscias* species by virtue of its prickly stems. The leaf rachis is sometimes prickly as well. The tiny marginal teeth on the leaflets are also diagnostic. The typical form has numerous short erect hairs on the leaflets, rachises and inflorescences. A glabrous form that was described at species rank (*Panax macdowallii* F.Muell.), is apparently common, and perhaps as widely distributed as the typical form. Govaerts *et al.* (2014) accepted *Polyscias macdowallii* as a distinct species, but apart from the indumentum, it does not differ in any consistent way from *P. mollis sens str.*

***Typification*:** There are six sheets at MEL of *Polyscias mollis* material that were collected by Dallachy from Rockingham Bay. MEL 2249865 is here chosen as the lectotype as the material on the sheet is a good match for the protologue, and the corner of the label has a "B" indicating that it was seen by Bentham for *Flora Australiensis*. One of the sheets (MEL 2249857) was certainly not seen by Bentham as its label includes information about the prickly stems possessed by the species, and that information is missing from the protologue; another sheet (MEL 2249859) is probably not original material as it bears mature fruits, and the protologue stated that fruits were "not seen quite ripe"; another sheet (MEL 2271939) bearing only leaflets, is perhaps a part of the same gathering as MEL 2249857, and if so, it is not original material.

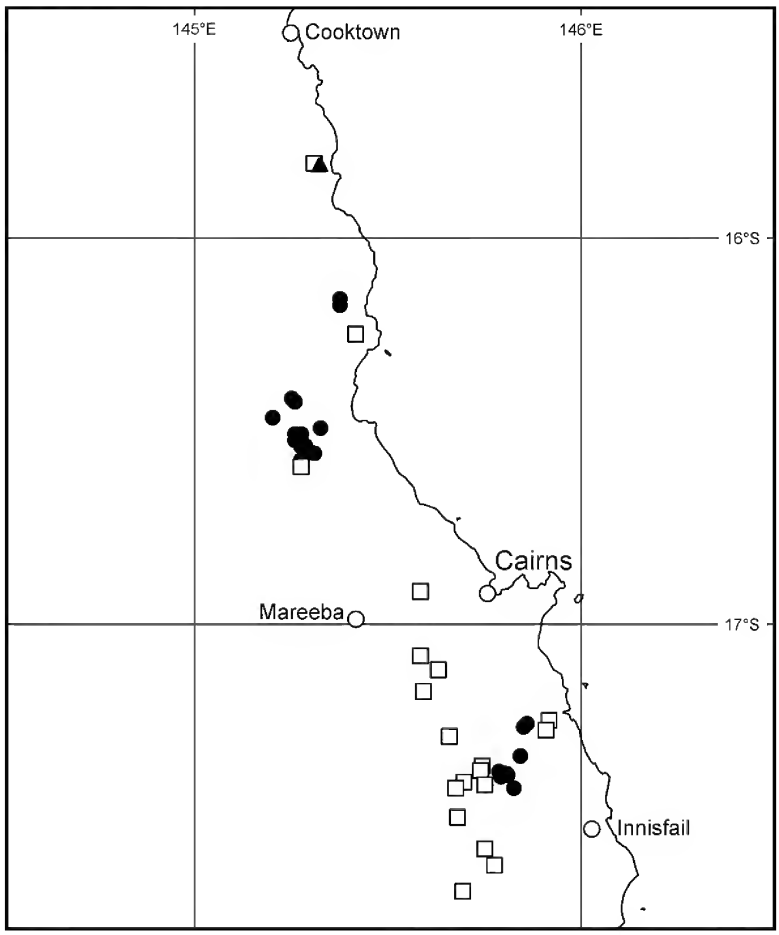
The type of *Panax macdowallii* is not present at MEL, where one would expect it to be (W. Gebert pers. comm. Sep 2014). Bailey (1888) cited Mueller as saying that he had recently received "further specimens collected by Mr Sayer" soon after his original naming. There are numerous Araliaceae specimens at MEL collected by Sayer, but the only one matching the protologue (i.e. having 2 styles and pinnate leaves) is MEL 2249860. This scrappy specimen is quite glabrous, and some prickles are present on the very short section of stem that has been preserved, and the leaflets have tiny marginal teeth, confirming it as the glabrous form of *P. mollis*. Since Mueller considered the Sayer specimen to be the same taxon as his *Panax macdowallii*, it follows that *P. macdowallii* is the glabrous form of *P. mollis*.

6. Polyscias murrayi (F.Muell.) Harms, *Natur. Pflanzen.* III, 8 (111): 45 (1894); *Panax murrayi* F.Muell., *Fragm.* 2: 106 (1860); *Nothopanax murrayi* (F.Muell.) Seem., *J. Bot.* 4: 295 (1866); *Tieghemopanax murrayi* (F.Muell.) R.Vig., *Bull. Soc. Bot. France* 52: 310 (1905). **Type:** New South Wales. Near Twofold Bay, [September 1860], *F. Mueller s.n.* (lecto: MEL 672694 [here designated]; isolecto: BM 000810432; BR 563113; MEL 672693; MEL 672754).

***Illustrations*:** Cooper & Cooper (2004: 66); Hyland *et al.* (2010); Nicholson & Nicholson (2007b: 48).

***Additional selected specimens examined*:** Queensland. Cook District: Mt Haig, Emerald LA, Aug 1976, *Stocker 1527* (BRI). North Kennedy District: Bluewater SF, NW of Townsville, Oct 1992, *Bean 5071* (BRI, MEL). South Kennedy District: 500 m along walking track to Mt Dalrymple, Eungella NP, Jul 1995, *Wiecek 594 et al.* (BRI, CANB, MEL, NSW, SYD). Darling Downs District: W of Moss Gardens, near Killarney, Mar 2004, *Bean 21775* (BRI). Moreton District: The Summit, Mt Glorious, Mar 1999, *Phillips 198* (BRI).

***Distribution and habitat*:** In Queensland, *Polyscias murrayi* occurs mainly in the south-east of the state, but with disjunct occurrences



Map 4. Australian distribution of *Polyscias mollis* □, *P. spectabilis* ▲, *P. willmottii* ●.

around Eungella, west of Mackay, and in the Wet Tropics where it is found as far north as Mt Lewis, near Julatten (**Map 1**). It occurs all along the New South Wales coast and just into Victoria (Floyd 1989). It is a pioneer species, inhabiting roadsides and sunny breaks in notophyll rainforest. In Queensland it is rarely found below 500 metres in altitude.

***Notes*:** The leaflet margins are usually distinctly toothed, but in some collections, the leaflets are entire.

7. Polyscias nodosa (Blume) Seem., *J. Bot.* 3: 181 (1865); *Aralia nodosa* Blume, *Bijdr. Fl. Ned. Ind.* 873 (1826); *Paratropia nodosa* (Blume) DC., *Prodr.* 4: 265 (1830); *Hedera nodosa* (Blume) Hassk., *Tijdschr. Natuurl. Gesch. Physiol.* 10: 131 (1843); *Eupteron nodosum* (Blume) Miq., *Bonplandia* 4: 139 (1856). **Type:** Indonesia. Mt Menara, Java, *s.dat.*, *s.coll.* (lecto: L 0008479 [here designated]).

***Illustrations*:** Cooper & Cooper (2004: 66); Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Iron Range NP, Gordon Creek, Sep 1997, *Gray 7248* (BRI, CNS); Kuranda Range Road, Sep 1987, *Gray 4567* (BRI, CNS); Foot of MacAlister Range, 2.5 km ENE of Saddle Mountain, Oct 1987, *Lyons 49* (BRI, DNA); Base of Mt Isley, Edmonton, S of Cairns, Jan 1997, *Plunkett 1537 et al.* (BRI); Bank of Barratt

Creek, Oct 1992, *Russell s.n.* (BRI [AQ547505]). North Kennedy District: Brandy Creek Road, about 5 km E of Shute Harbour and 13 km NE of Proserpine, Nov 1985, *Sharpe 4149* (BRI).

***Distribution and habitat*:** In Queensland *Polyscias nodosa* is known from Iron Range; at several locations between Cooktown and Tully; and in a limited area near Proserpine (**Map 5**). It also occurs in mainland Papua New Guinea, Bougainville, Java, Lombok, Celebes, Moluccas and the Philippines (Philipson 1979). It is a pioneer species that inhabits disturbed sites in evergreen notophyll rainforest in high rainfall areas.

***Notes*:** Fertile specimens are easily recognisable by their long racemose inflorescences bearing sessile umbels. The leaves may exceed two metres in length. It is cultivated as an ornamental in south-east Asia.

8. Polyscias pupurea C.T.White, *Proc. Roy. Soc. Queensland* 47: 64 (1936), as *Polyscias purpureus*. **Type:** Queensland. Cook District: Mossman River Gorge, 5 February 1932, *L.J. Brass 2072* (holo: BRI; iso: MEL).

***Illustrations*:** Cooper & Cooper (2004: 66); Hyland *et al.* (2010).

***Additional selected specimens examined*:** Queensland. Cook District: Rex Range, NE of Julatten, Jan 1993, *Bean 5676 & Forster* (BRI, DNA); Mt Bartle Frere, Jun 1986, *Bruhl 534* (BRI, CANB); FR 310, Swipers LA, E of Malanda, Aug 1963, *Hyland AFO/2752* (BRI, CNS); McIlwraith Range, Sep 1974, *Hyland 7638* (BRI, CNS); *c.* 0.5 km south of Copperlode Falls Dam, Mar 2009, *Jago 7256* (BRI, L); Gold Hill summit ridge, TR 165, Aug 1986, *Weston 474 et al.* (BRI, CNS, NSW); Kuranda, Feb 1922, *White 1532* (BRI).

***Distribution and habitat*:** *Polyscias purpurea* is endemic to Queensland where it occurs in the McIlwraith Range, and in the Wet Tropics bioregion of Queensland, between Cooktown and Tully (**Map 5**). It is an understorey species in evergreen notophyll rainforest in high rainfall areas.

***Notes*:** It can be distinguished by its complete lack of hairs on all plant parts, and the purple petals.

9. Polyscias sambucifolia (DC.) Harms, *Natur. Pflanzen.* III, 8 (111): 45 (1894); *Panax sambucifolius* DC., *Prodr.* 4: 255 (1830); *Nothopanax sambucifolia* (DC.) K.Koch, *Wochenschr. Gartnerei Pflanzenk.* 2: 77 (1859); *Tieghemopanax sambucifolius* (DC.) R.Vig., *Bull. Soc. Bot. France* 52: 310 (1905). **Types:** New Holland, [in 1823], *F.W. Sieber Fl. Nov. Holl.* n. 256 (syn: BM 000810433; syn: BR 563114; syn: G-DC, microfiche!; syn: M 0172422; syn: M 0172423).

***Additional selected specimens examined*:** Queensland. Moreton District: Near White Swamp road, SSW of Boonah, Feb 1990, *Bean 1365* (BRI, CANB); 6 km W of Mt Glorious, Dec 1995, *Bean 9370* (BRI, NSW); 7 km NW of Springbrook on Ankida Nature Refuge, Jan 2005, *Thompson MOR543* (BRI). Darling Downs District: 1.5 km S of Christie Target, near Wallangarra, Dec 1989, *Bean 1216* (BRI, NSW); South Bald Rock Swamp, E side near South Bald Rock, Girraween NP, Feb 1994, *Grimshaw G422 & Robins* (BRI).

***Distribution and habitat*:** In Queensland *Polyscias sambucifolia* is confined to the south-east corner, south from Mt Mee, above 400 m altitude (**Map 1**). It is widespread in New South Wales, Victoria and Tasmania. It inhabits simple rainforest or wet sclerophyll eucalypt forest on a variety of soil types.

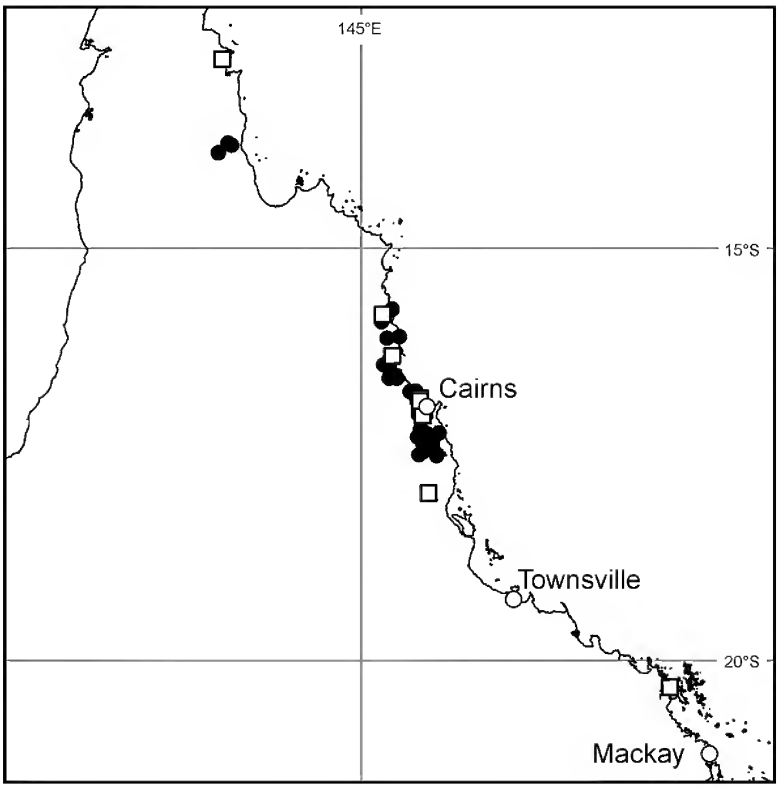
***Notes*:** *Polyscias sambucifolia* is a highly variable species for which a number of putative subspecies have been proposed (APNI 2015). None of these occur in Queensland where the species has relatively uniform morphology.

10. Polyscias spectabilis (Harms) Lowry & G.M.Plunkett, *Pl. Divers. Evol.* 128: 74 (2010); *Peekeliopanax spectabilis* Harms, *Notizbl. Bot. Gart. Berlin-Dahlem* 9: 478 (1926); *Gastonia spectabilis* (Harms) Philipson, *Blumea* 18: 494 (1970). **Type:** Papua New Guinea. New Ireland Province: Lamekot, Lamusong, in 1925, *G. Peekel 1001* (holo: B, destroyed; iso: ?, n.v.).

***Illustrations*:** Cooper & Cooper (2004: 64); Hyland *et al.* (2010), as *Gastonia spectabilis*.

***Selected specimen examined*:** Queensland. Cook District: Cedar Bay NP, Gap Creek area, Jun 2005, *Forster PIF31018 & Jensen* (BRI, L, MEL, NSW).

***Distribution and habitat*:** In Australia, *Polyscias spectabilis* is confined to a single locality in the Gap Creek area near Bloomfield, Queensland (**Map 4**). It is however, widespread in New Guinea and adjacent islands (Philipson 1979). It is a



Map 5. Australian distribution of *Polyscias nodosa* □, *P. purpurea* ●.

pioneer species that inhabits disturbed sites in evergreen notophyll rainforest in high rainfall areas.

***Notes*:** This species reportedly reaches 30 metres in height in Australia, and 40 metres in New Guinea. Philipson (1979) conjectured that it is "possibly the largest araliad known".

11. Polyscias willmottii (F.Muell.) Philipson, *Austrobaileya* 1: 24 (1977); *Pentapanax willmottii* F.Muell., *Austral. J. Pharm.* 2: 125 (1887). **Type:** Queensland. Cook District: Mt Bellenden-Ker, in 1887, *W.A. Sayer & A. Davidson 34* (lecto: MEL 672698 [here designated]; isolecto: MEL 672699).

***Illustrations*:** Cooper & Cooper (2004: 66); Hyland *et al.* (2010); Nicholson & Nicholson (2004: 57).

***Additional selected specimens examined*:** Queensland. Cook District: 27.3 km from the Rex Highway on Mt Lewis Road near Julatten, Nov 1990, *Holland 36* (BRI, NSW); Black Snake Lookout, Wooroonooran NP, Jul 1995, *Hunter JH4624* (BRI); Boulder field, 50 m north of Bower Bird site, just past NW Peak, Bartle Frere, May 2004, *Jensen 1397* (BRI, MEL); summit of Mt Lewis, Nov 1988, *Jessup GJM5134 et al.* (BRI, DNA, NSW); North Mary LA, SF 143, Jul 1994, *Forster PIF15624* (BRI, CNS, MEL, NSW).

***Distribution and habitat*:** *Polyscias willmottii* is endemic to Queensland, and confined to the Wet Tropics bioregion between Mt Bartle Frere and Thornton Peak (**Map 4**). It grows in high-altitude rainforest or 'cloud forest', between 1000–1600 metres.

***Notes*:** *Polyscias willmottii* is distinguished by the glabrous new-growth, the wavy leaflet margins, the relatively long petiolules and the 5-locular fruits.

12. Polyscias zippeliana (Miq.) Valeton, *Bull. Dép. Agric. Indes Néerl.* 10: 42 (1907); *Panax zippelianum* Miq., *Ann. Mus. Bot. Lugduno-Batavi* 1: 15 (1863); *Nothopanax zippelianus (Miq.) Seem., Fl. Vit. [Seemann]* 115 (1866). **Type:** Indonesia. Papua. Near Dourga River, [May 1828], *A. Zippelius* (lecto: L 0008487, [here designated]; isolecto: K 000792850, L 0008488).

Kissodendron australianum var. *dispermum* F.Muell., *Descr. Notes Papuan Pl.* 5: 88 (1877); *Kissodendron dispermum* (F.Muell.) Domin, *Biblioth. Bot.* 89: 484 (1928); *Polyscias australiana* var. *disperma* (F.Muell.) Philipson, *Blumea* 24: 171 (1978); *Polyscias disperma* (F.Muell.) Lowry & Plunkett, *Pl. Divers. Evol.* 128: 68 (2010), *nom. illeg. non* Blanco (1837), ***syn. nov.*** **Type:** Papua New Guinea. Fly River, [December 1875], *L.M. d'Albertis s.n.* (syn: MEL, image!; syn: FI [Beccari Herbarium 4662], image!).

***Additional selected specimens examined*: Queensland.** Cook District: Lockerbie, 10 miles [16 km] WSW of Somerset, Apr 1948, *Brass 18412* (A, BRI); 22.6 km E of Bromley on the track to Carron Valley, Jul 1990, *Clarkson 8878 & Neldner* (BRI, CNS); Head of Pascoe River, 5 km NW of Mt Yangee, 21.2 km WSW of Lockhart River community, Apr 1994, *Fell DGF4274 & Claudie* (BRI, DNA); 3.5 km NNE of Massy Creek Crossing, Silver Plains Station, eastern fall of McIlwraith Range, Jul 1993, *Forster PIF13611 et al.* (BRI, MEL); Richardson Range, 18 km along Middle Peak track to Shelburne Bay, Jun 2008, *Forster PIF33617 & McDonald* (BRI, PE); Bamaga, Cape York, Sep 1963, *Jones 2516* (BRI, CANB); N of Massy Creek, *c.* 13 km NW of Silver Plains, Aug 1978, *Kanis 2019* (BRI, CANB, L); McIlwraith Range (NP proposal), Sep 2004, *McDonald KRM3019* (BRI, DNA); Isabella Falls, off Cooktown – Laura road, *c.* 30 km from Cooktown, Jan 1997, *Plunkett 1550 et al.* (BRI); Isabella Falls, on the Battle Camp road, 31.6 km NW of Cooktown, Nov 2010, *Wilson 685 & Wilson* (BRI, CANB, CNS).

***Distribution and habitat*:** *Polyscias zippeliana* is widespread in far north Queensland on Cape York Peninsula and the islands of Torres Strait. It is also common in the lowlands of southern New Guinea, both in Papua New Guinea and Indonesian Papua, and is found in the far north of the Northern Territory, including Melville Island and Kakadu NP (**Map 2**). It typically grows along watercourses with fringing rainforest in a landscape dominated by *Eucalyptus* and *Melaleuca* woodland.

***Notes*:** *Polyscias zippeliana* is clearly allied to *P. australiana*, but differing by the larger often 2-locular fruits and longer pedicels, by the primary inflorescence axis lacking the 3 or 4 many-branched verticils, and the generally fewer leaflets.

Polyscias zippeliana has previously been recorded as occurring in Australia, without any precise location or specimen citations, by Philipson (1995) and Lowry & Plunkett (2010). Despite this, it was not recorded for Queensland in Bostock & Holland (2014) or for Australia in AVH (2015). The record of *P. australiana* from Northern Territory (Short *et al.* 2011) is referable to *P. zippeliana.*

Philipson (1995) described *P. zippeliana* as having "3 or 4 pairs of leaflets", mimicking the description in the protologue. However, it is unrealistic to suppose that there could be so little variation in the number of leaflets in this species, when every other species has a considerable range of leaflet numbers.

Philipson (1995) also stated that the New Guinean species *Polyscias schultzei* Harms occurs in "Queensland, Australia". As Philipson restricted his view of *P. zippeliana* to specimens bearing 3 or 4 pairs of leaflets, it seems likely that Australian specimens of *P. schultzei sensu* Philipson are in fact *P. zippeliana* with 5 or more pairs of leaflets. It is also quite possible that *P. schultzei* is synonymous with *P. zippeliana*, but that determination requires further study.

Key to the *Polyscias* species of Queensland

1 At least some bipinnate leaves on a given branch **2**
1. All leaves pinnate **3**

2 Leaflets elliptical, 2.3–3.5 times longer than wide; flowers in umbels; styles not recurved in fruit. . . . . **2. P. bellendenkerensis**

2. Leaflets broadly ovate, 1.6–2.3 times longer than wide; flowers solitary, arranged in a raceme along the secondary axes; styles recurved in fruit. . . . . **3. P. elegans**

3 Stems with stout prickles; leaflet margins with many small teeth 0.3–0.5 mm long. . . . . **5. P. mollis**
3. Stems unarmed; leaflet margins entire or with teeth *c.* 1 mm long **4**

4 Undersides of mature leaflets white or grey due to very numerous tiny peltate scales . . . . . **9. P. sambucifolia**
4. Undersides of mature leaflets green, glabrous **5**

5 New vegetative growth, petiole bases and floral bracts hairy **6**
5. New vegetative growth, petiole bases and floral bracts glabrous. **8**

6 Petiolules of lateral leaflets < 5% lamina length; fruits 10-locular; styles recurved in fruit; the hairs white or grey; pedicels not articulated . . . **10. P. spectabilis**
6. Petiolules of lateral leaflets 5–20% of lamina length; fruits 2- or 3-locular; styles erect in fruit; the hairs rusty-coloured; pedicels articulated **7**

7 Dried fruits 3.5–6 mm long, 3 or 4-locular; fruiting pedicels 3–9 mm long . . . . . **1. P. australiana**
7. Dried fruits 6.5–8 mm long, 2 or 3 (–4)-locular; fruiting pedicels 13–23 mm long . . . . . **12. P. zippeliana**

8 Tall trees, often exceeding 15 m; well-developed leaves more than 1.5 m long, leaflets 15–35; petiolules of lateral leaflets < 5% of lamina length **9**
8. Small trees to 6 m high; well-developed leaves 20–50 cm long, leaflets 3–15; petiolules of lateral leaflets 5–45% of lamina length **10**

9 Leaflets narrow, 3.2–5 times longer than wide; fruits 2-locular, flattened, distinctly pedicellate . . . . . **6. P. murrayi**
9. Leaflets broader, 2.1–2.8 times longer than wide; fruits 5-locular, ± globose, sessile . . . . . **7. P. nodosa**

10 Petiolules long, 25–45% of leaflet length; leaflet margins undulate; fruits 5-locular . . . . . **11. P. willmottii**
10. Petiolules shorter, 5–20% of leaflet length; leaflet margins flat; fruits 2-locular. **11**

11 Leaflets ± parallel-sided, abruptly narrowed near apex; dried specimens highly odoriferous; petals white to greenish; dried mature fruits 4–5 mm long, fruiting pedicels 3.5–5 mm long; usually growing in littoral zone . . . . . **4. P. macgillivrayi**
11. Leaflets tapering ± evenly to the apex; dried specimens not odoriferous; petals purple; dried mature fruits 2.5–3.5 mm long, fruiting pedicels 1.5–3 mm long; growing in rainforest away from the coast. . . . . **8. P. purpurea**

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SHORT COMMUNICATION

Triunia kittredgei Olde (Proteaceae): a name to be rejected

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Triunia Lour. is a genus of four species endemic to eastern Australia (Foreman 1995). Two species (*Triunia erythrocarpa* Foreman, *T. montana* (C.T.White) Foreman) occur in the Wet Tropics of northeastern Queensland and two species (*T. robusta* (C.T.White) Foreman, *T. youngiana* (C.Moore & F.Muell. ex F.Muell.) L.A.S.Johnson & B.G.Briggs) occur in southeastern Queensland (SE Qld), with the latter also found in adjacent parts of New South Wales. In this note we examine the typification and application of several of these names; in particular we address what is the correct name to be applied to the iconic threatened species in SE Qld (Forster *et al.* 1990; Shapcott 2002; Powell *et al.* 2005) that is known as *T. robusta* (*cf.* Olde 2015).

Chronology of Events

White (1933) described *Helicia youngiana* var. *robusta* C.T.White (= *Triunia robusta* (C.T.White) Foreman) without nominating a type. He provided a detailed description of the taxon: '2. var. **robusta**, n. var. Leaves mostly entire but sometimes toothed and deeply so towards the top, up to 20 cm. long and 5.5 cm. wide, smooth and very shining above. Racemes up to 10 cm. long; pedicels up to 7 mm. long, hairy but much less so than in the type [var. typica], buds cylindrical 1.5 cm. long, individual bracts up to 1 cm. long and 4 mm. wide. Fruits (in the dried state) subglobose, 2.5 cm. long, 2 cm. diam.'

White cited eight specimen collections from his examination of material at BRI, MEL and NSW but did not indicate the herbaria where the specimens were held. Seven of these specimen collections are from SE Qld and one collection from northeastern Qld, *viz.*

***SE Queensland collections*:**

Maroochy [Maroochie], [July ?1888] *F.M. Bailey s.n.* (BRI [AQ317456], MEL 2277223A *n.v.*): flowering specimen

Maroochy [Maroochie], *s.dat., J. Low s.n.* (BRI [AQ317464], MEL 2277222A *n.v.*): flowering specimen

Eumundi, [Nov 1894], *J.F. Bailey & J.H. Simmonds s.n.* (BRI [AQ317466], MEL 2277221A *n.v.*): flowering specimen

Eumundi, [Nov 1892], *J.H. Simmonds s.n.* (BRI [AQ317462], MEL *n.v.*, NSW *n.v.*): flowering specimen

Eumundi, [Nov 1900], *J.F. Bailey s.n.* (BRI [AQ317470], MEL 2277219A *n.v.*, MEL 2277220A *n.v.*, NSW 169006 *n.v.*): flowering specimen

Eumundi, [May 1892], *J. F. Bailey & J.H. Simmonds s.n.* (BRI [AQ104858]): fruiting specimen

Eumundi, Oct 1911, *J.B. Staer s.n.* (NSW 169005 *n.v.*)

***NE Queensland collection*:**

East Malanda, Atherton Tableland, Sep 1929, *S.F. Kajewski 1219* (BRI, A *n.v.*, K, NY, S): specimen in bud

Discussion

The SE Qld specimens have been classified as *Triunia robusta* and the NE Qld specimen as *T. erythrocarpa* following Foreman (1986, 1987, 1995) until the recent account of Olde (2015).

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Sleumer (1955) in his review of *Helicia* Lour. accepted White's *Helicia youngiana* var. *robusta* and selected as lectotype *Kajewski 1219* at NSW '(lecto-*typus* haud vidi)' but this specimen does not exist at NSW (see Olde 2015). Isolectotypes of *Kajewski 1219* that Sleumer did see are at A, K, NY and S.

Foreman (1986) did not accept Sleumer's earlier lectotypification and selected *Simmonds s.n.* (BRI AQ317462) at BRI as lectotype for *Helicia youngiana* var. *robusta*. Foreman (1986) transferred White's variety to *Triunia* and raised it to species rank as *Triunia robusta*.

Olde (2015) has asserted that Foreman's (1986) lectotypification of *Helicia youngiana* var. *robusta* C.T.White is invalid as it is later than Sleumer's (1955) lectotypification and that Sleumer should be followed. Hence Olde (2015) has assigned *Triunia robusta* to what is known as *T. erythrocarpa* Foreman and provided a new name, *T. kittredgei* Olde, for the species in SE Qld.

We have examined White's (1933) protologue and the characters he used to describe *Helicia youngiana* var. *robusta* and compared them with the specimens from locality records he cited. **Table 1** provides a list of White's characters that he used to describe *Helicia youngiana* var. *robusta* and the presence of these characters for *Simmonds s.n.* [BRI AQ317462] (lectotype selected by Foreman (1986)), the other SE Qld collections and *Kajewski 1219* (lectotype selected by Sleumer (1955)). The character list shows that Sleumer's (1955) lectotypification, *Kajewski 1219*, is in serious conflict with

Table 1. White's characters for *Helicia youngiana* var. *robusta* from his protologue and the characters of the specimens he cited.

White's protologue	*Simmonds s.n.* [AQ317462]	Other SE Qld specimens from localities cited by White	*Kajewski 1219*
Leaves entire or sometimes toothed	Leaves entire	Leaves entire or sometimes toothed	Leaves entire
Leaves to 20 cm long	Leaves 10–20 cm long	Leaves 10–20 cm long	Leaves 7–13 cm long
Leaves to 5.5 cm wide	Leaves 3.5–5.5 cm wide	Leaves 3–5.5 cm wide	Leaves 2.5–4 cm wide
Leaves very shining above	Leaves very shining above	Leaves very shining above	Leaves slightly shining above
Racemes to 10 cm long	Racemes 8–10 cm long	Racemes 8–10 cm long	Racemes 3–4.5 cm long
Pedicels to 7 mm long	Pedicels 5–6 mm long	Pedicels 6–7 mm long	Pedicels 1–3 mm long
Buds 15 mm long	Buds 14–15 mm long	Buds 14–15 mm long	Buds 6–10 mm long
Bracts to 10 mm long and 4 mm wide	Bracts 5–6 mm long and 3 mm wide	Bracts 10–11 mm long and 4 mm wide	Bracts 7–8 mm long and 3–4 mm wide
Fruits subglobose, 2.5 cm long, 2.5 cm diam.	No fruits	Fruits subglobose, 2.5 cm long, 2.5 cm diam.	No fruits

the protologue whereas Foreman's (1986) lectotypification, *Simmonds s.n.* [AQ317462], agrees with the protologue. Therefore, Sleumer's lectotypification is superseded by Foreman's (1986) lectotypification as per Article 9.19(b) of the *International Code of Nomenclature for algae, fungi and plants (Melbourne Code)* (ICN) (McNeill *et al.* 2012). *Triunia robusta* Foreman remains as the correct name to be applied to the SE Queensland species (Foreman 1986, 1995), *T. erythrocarpa* Foreman the correct name for the NE Queensland species (Foreman 1987, 1995), and *T. kittredgei* is a synonym of *T. robusta*. Note that the 'protologue' provided by Olde (2015) for *H. youngiana* var. *robusta* is not the actual protologue from White (1933), but is a short Latin description from Sleumer (1955).

Taxonomy – conspectus of *Triunia* Lour.

1. Triunia erythrocarpa Foreman, *Muelleria* 6: 302, fig. 3 (1987). **Type:** Queensland. Cook District: State Forest Reserve 310, Swipers Logging Area, 8 October 1973, *B. Hyland 6919* (holo: CNS; iso: BRI, CNS, NSW).

Triunia robusta auct. non (C.T.White) Foreman; Olde, *Telopea* 18: 190 (2015).

2. Triunia montana (C.T.White) Foreman, *Muelleria* 6: 195 (1986); *Helicia youngiana* var. *montana* C.T.White, *Contr. Arnold Arbor.* 4: 24 (1933). **Type:** Queensland. Cook District: Palm Camp, Bellenden Ker, 6 July 1889, *F.M. Bailey s.n.* (lectotype: BRI [AQ 317454], *fide* Foreman 1986; isolectotype: MEL *n.v.*).

Olde (2015) assumed that Sleumer (1955) lectotypified *H. youngiana* var. *montana* C.T.White by referring to a non-existent specimen at NSW 'Bellenden Ker, near the summit, *White* (NSW, *typus*, haud vidi)'. Foreman (1986) was the first to lectotypify *H. youngiana* var. *montana* by selecting as lectotype F.M. Bailey's specimen from Palm Camp, Bellenden Ker (BRI [AQ317454]). This specimen agrees with White's protologue and has on the specimen label in C.T. White's handwriting 'Type of variety'. The selection by Foreman (1986) of this specimen as lectotype is in accordance with the Code Article 9 and Rec. 9A.3. Note that Olde (2015) reproduced Sleumer's (1955) Latin description for *H. youngiana* var. *montana* and not White's (1933) protologue.

3. Triunia robusta (C.T.White) Foreman, *Muelleria* 6: 196 (1986); *Helicia youngiana* var. *robusta* C.T. White, *Contr. Arnold Arbor.* 4: 23–24 (1933). **Type:** Queensland. Moreton District: Eumundi, November 1892, *J.H. Simmonds s.n.* (lectotype: BRI [AQ317462], *fide* Foreman 1986; isolectotype: BRI [AQ317462 – 2nd sheet]).

Triunia kittredgei Olde, *Telopea* 18: 192 (2015), **syn. nov. Type:** Queensland. Moreton District: Brolga Park, 6 km W of Woombye, 27 October 1990, *A.R. Bean 2538* (holo: NSW *n.v.*; iso: BRI, MEL *n.v.*).

4. Triunia youngiana (C.Moore &F.Muell. ex F.Muell.) L.A.S.Johnson & B.G.Briggs, *Bot. J. Linn. Soc.* 70: 175 (1975); *Helicia youngiana* C.Moore & F.Muell. ex F.Muell., *Fragm.* 4: 84 (1864); *Macadamia youngiana* (C.Moore & F.Muell. ex F.Muell.) F.Muell. in G.Bentham, *Fl. Austral.* 5: 406 (1870); *H. youngiana* var. *typica* C.T.White, *Contr. Arnold Arbor.* 4: 23 (1933), *nom. inval.* **Type:** New South Wales. Duck Creek, Richmond River, *Richards 4,* in 1863 (holo: MEL 93852A, image!, *fide* Olde 2015).

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SHORT COMMUNICATION

Validating the name *Habenaria vatia* D.L.Jones ex M.T.Mathieson (Orchidaceae) for a threatened orchid species from Queensland

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The name *Habenaria vatia* D.L.Jones (Jones 2002) was invalidly published under Art. 40.2 of the *International Code of Nomenclature for algae, fungi and plants* (Melbourne Code) (McNeill *et al.* 2012) as two collections were indicated as the holotype (APNI 2015). In a subsequent publication attempting to validate the name, Jones & Clements (2004) correctly designated a single collection as the holotype and provided a reference to the original Latin description and diagnosis but cited all page numbers ("516–524") of the article Jones (2002) (APNI 2015). Therefore the reference given by Jones & Clements (2004) does not unambiguously refer to the initial, previously published description or diagnosis of this species as required by ICN Art. 38.13 (McNeill *et al.* 2012).

This species is known only from Mua (Moa) island in the Torres Strait and is listed as **Vulnerable** under the *Queensland Nature Conservation Act 1992*. The name *Habenaria vatia* D.L.Jones ex M.T.Mathieson is here validated.

Habenaria vatia D.L.Jones ex M.T.Mathieson, **sp. nov.** – Validating description and diagnosis: D.L.Jones, *The Orchadian* 13(11): 519 (2002). **Typus:** Queensland. Cook District: cultivated Australian National Botanic Gardens ex *c.* 1 km NE of airport, Kubin, Moa Island, Torres Strait, 24 October 1990, *D.L.Jones 6792* (holo CANB!; iso BRI!).

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