

## ANETHOLEA ANISATA TRANSFERRED TO, AND TWO NEW AUSTRALIAN TAXA OF, SYZYGIUM (MYRTACEAE)

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### SUMMARY

The distinction between *Anetholea* and *Syzygium* is lessened due to the occurrence of epigeal germination and dry fruitedness in the latter genus also and it is concluded that *Anetholea* is better placed within *Syzygium*. Analysis of sequence data from nuclear ribosomal DNA and the chloroplast genome support this conclusion. The sole species of *Anetholea*, *A. anisata*, is transferred to *Syzygium* and the new combination, *S. anisatum* (Vickery) Craven & Biffin, made. *Syzygium wilsonii* subsp. *cryptophlebium* is reinstated at species rank, necessitating the new combination, *S. cryptophlebium* (F. Muell.) Craven & Biffin. Two new taxa of *Syzygium* are described from Australia, *S. wilsonii* subsp. *epigaeum* Craven & Biffin and *S. maraca* Craven & Biffin.

**Key words:** *Anetholea*, *Syzygium*, Myrtaceae, cpDNA, nrDNA.

### INTRODUCTION

*Backhousia anisata* Vickery recently was found to be an anomalous member of *Backhousia* Hook. & Harv. and moved to the new genus *Anetholea* Peter G. Wilson as its sole species (Wilson et al., 2000). The lack of any indumentum and possession of certain wood anatomical features were more consistent with a relationship with *Syzygium* Gaertn. and its allies than with the remaining species of *Backhousia* (Wilson et al., 2000). Because *B. anisata* possesses a dry fruit, leafy cotyledons and has epigeal germination, Wilson et al. (2000) concluded that it did not belong to an existing syzygioid genus and erected *Anetholea* to accommodate it. Our studies of the *Syzygium* generic complex in the Indo-Pacific have necessitated consideration of *Anetholea anisata* relative to the other species of the complex. Of the three features considered by Wilson et al. (2000) to be diagnostic at the generic level, our observations are that two of them, a dry fruit and epigeal germination, occur also in species of *Syzygium*. A dry fruit occurs in *S. glenum* Craven (Craven, 2003), albeit the tissues comprising the pericarp in *S. glenum* may not be homologous with those in *A. anisata*, the fruit wall of which is chartaceous in the dried state. Other species of *Syzygium* have somewhat dryish, at least not fleshy or succulent, fruit also. Hyland (1983) has recorded several species with non-fleshy fruit as follows: *S. boonjee* B. Hyland, fruits are “somewhat spongy”; *S. bungadinnia* (F.M. Bailey) B. Hyland, fruits are firm; *S. crebrinerve* (C.T. White) L.A.S. Johnson, pericarp more or less mealy; *S. gustavioides* (F.M. Bailey) B. Hyland, fruits have

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a leathery pericarp; *S. hodgkinsoniae* (F. Muell.) L.A.S. Johnson, pericarp is firm; *S. kuranda* (F.M. Bailey) B. Hyland, pericarp is firm, somewhat brittle and granular in texture. Notwithstanding the apparent histological diversity in the tissues comprising the fruit wall in *Syzygium* species, the taxonomic significance of which is yet to be investigated, it seems that dryness per se may not be a character of significance for higher level classification. Epigeal germination has been recorded as occurring in several *Syzygium* species by Henderson (1949), Hyland & Whiffin (1993) and Hyland et al. (2003), i.e. *S. attenuatum* (Miq.) Merr. & Perry (as *Eugenia attenuata* Miq.), *S. branderhorstii* Lauterb., *S. campanulatum* Korth. (as *E. oleina* Wight), *S. conglomeratum* (Duthie) I.M. Turner (as *E. conglomerata* Duthie), *S. erythrocalyx* (C.T. White) B. Hyland, *S. luehmannii* (F. Muell.) L.A.S. Johnson, *S. nervosum* DC., *S. pustulatum* (Duthie) Merr. (as *E. pustulata* Duthie) and *S. trachyphloium* (C.T. White) B. Hyland, and is a feature of a new taxon, *S. wilsonii* subsp. *epigaeum* Craven & Biffin, that is described below. On present knowledge, the possession of leafy, obvolvate cotyledons appears to be the only distinction between *A. anisata* and the other syzygioid species. Wilson et al. (2000) state that there “is some evidence, however, that the embryo of *Syzygium* has developed from an ancestor with leafy, obvolvate cotyledons; it is apparent, in some species at least, that the thick cotyledons are interlocked in an obvolvate fashion (e.g. Hyland, 1983: figs 2.35, 4.2)”. This is in accordance with our own observations of fruits of *Syzygium*; rarely are the two opposing faces of the cotyledons more or less flat and a tendency towards being obvolvate is not uncommon.

Analysis of DNA sequence data from comprehensive samples of species of the *Syzygium* generic complex suggest that *Anetholea* belongs within a broadened circumscription of *Syzygium*. Harrington & Gadek (2004), in an analysis of sequence data from internal transcribed spacer (ITS) and external transcribed spacer (ETS) regions of the nuclear ribosomal DNA repeat from 66 syzygioid taxa, found that *Anetholea* nested within the ingroup taxa, consisting of species of *Acmena* DC., *Acmenosperma* Kausel, *Syzygium* and *Waterhousea* B. Hyland as these four genera were defined by Hyland (1983). In a combined analysis of ITS and ETS data, the relationship of *A. anisata* was unresolved within a polytomy of eight clades (containing most of the *Syzygium* taxa and all of *Acmena*, *Acmenosperma* and *Waterhousea*) that was sister to a well-supported clade of six *Syzygium* taxa (Harrington & Gadek, 2004). Harrington & Gadek’s results are reinforced by analysis of three cpDNA data sets (*matK*, *ndhF*, *rpl16*) in which the position of *Anetholea* is consistently resolved amongst ingroup taxa, including *Syzygium*, *Acmena*, *Acmenosperma* and *Waterhousea* species (Biffin, unpublished data). Consideration of the morphological evidence, together with that obtained from molecular data, has led us to conclude that *Anetholea* falls within the circumscription of *Syzygium* and that *A. anisata* should be transferred to the latter genus.

Ongoing studies into Australian species of *Syzygium* have resulted in the recognition of a new species allied to *S. alluiligneum* B. Hyland, and a new subspecies within *S. wilsonii* (F. Muell.) B. Hyland. These are described below. The status of *S. wilsonii* subsp. *cryptophlebium* (F. Muell.) B. Hyland was considered and, in view of the several differences from *S. wilsonii* subsp. *wilsonii*, its elevation to species rank is warranted and is effected below.

**1. *Syzygium anisatum* (Vickery) Craven & Biffin, *comb. nov.***

*Backhousia anisata* Vickery (1941) 129. — *Anetholea anisata* (Vickery) Peter G. Wilson in Wilson et al. (2000) 434. — Type: *Rickerby s.n.* (holo NSW n.v.), New South Wales, Bellingen, 26 October 1939.

**2. *Syzygium cryptophlebium* (F. Muell.) Craven & Biffin, *comb. nov.***

*Eugenia cryptophlebia* F. Muell. (1875) 144. — *Syzygium wilsonii* subsp. *cryptophlebium* (F. Muell.) B. Hyland (1983) 135. — Type: *Dallachy s.n.* (holo MEL; iso MEL, NSW), Queensland, Rockingham Bay.

*Eugenia sordida* F.M. Bailey (1892) 15. — Type: *Bailey s.n.* (holo BRI n.v.; iso MEL), Queensland, Mt Bellenden Ker, alt. about 1430 m.

*Eugenia macoorai* F.M. Bailey (1892) 15. — Type: *Bailey s.n.* (holo BRI n.v.; iso MEL), Queensland, near the summit of the S peak of Bellenden Ker.

*Eugenia rhadinantha* S. Moore (1917) 303. — Type: *Gibbs 6350* (holo BM n.v.; iso NSW), Queensland, Kuranda.

Note — Hyland (1983) treated *Eugenia cryptophlebia* as a subspecies of *Syzygium wilsonii*. Although the two taxa are clearly related, the differences are such that separate recognition at species rank is warranted. *Syzygium cryptophlebium* forms a tree to 30 m tall, has persistent, non-peeling branchlet bark, white or cream staminal filaments and mauve or purple fruit at maturity. In contrast, *S. wilsonii* is a shrub or tree to 9 m tall, has peeling branchlet bark, staminal filaments that are red, purple or pink and fruit that are white or cream at maturity.

**3. *Syzygium wilsonii* subsp. *epigaeum* Craven & Biffin, *subspec. nov.***

A *S. wilsonii* (F. Muell.) B. Hyland subsp. *wilsonii* filamentis staminalibus roseis, sepalis exterioribus longioribus (1.5–2 mm longis), disco staminali declinato, et germinatione epigaea differt. — Typus: *Ford 4359* (holo BRI; iso A, CANB, K, L, MEL, NSW, P, QRS n.v.), Australia, Queensland, National Park Reserve 904, Wooroonooran, Coolamon Creek, c. 700 m S of Towalla Mine, c. 18 km SE of Malanda, 15 July 2004.

*Tree* or *shrub* to 9 m tall, to 5 cm dbh. *Branchlets* terete, compressed or quadrangular, winged or not, 1.2–2.5 mm in diameter; bark dull, smooth or slightly striate, peeling. *Leaf lamina* narrowly ovate or narrowly elliptic (occasionally oblong, rarely ovate), 7–19.4 by 2–6 cm, 2–5.4 times as long as wide, base cordate, rounded or obtuse, apex acuminate to narrowly acute, primary and secondary venation distinctly different with secondaries relatively little developed and not joining the intramarginal vein, primary veins 16–29 on each side of the midrib, divergence angle more or less uniform, in the median part of the lamina at an angle of 65–75° and 4–11 mm apart, intramarginal vein present and 1.6–4.2 mm from the leaf margin, secondary intramarginal vein present or absent, oil dots not visible to the unaided eye in transmitted light, the dots small, sparse. *Petiole* 2–7 by 0.9–2 mm, stipules and/or axillary enations present or absent. *Reproductive seasonal growth unit* with a reproductive zone only. *Inflorescence* leafless, among the leaves (rarely below the leaves), terminal, distal axillary or lateral, few- to many-flowered, paniculate, the main axis straight and rigid and 1.5–2 mm thick at the mid point, 2.5–6 by 4–6 cm; bracteate, the bracts deciduous; bracteoles subtending each flower or subtending the lateral flowers of a triad with the terminal flower ebracteolate, deciduous. *Flowers* pink (calyx recorded by collectors as creamy

pink or pink, corolla as creamy pink, creamy white or white, filaments as bright pink or pink, and anthers as white or pink), not calyptrate. *Hypanthium* dull, visibly gland dotted, stipitate or not (and then tapering evenly to the base or truncate or rounded), narrowly obconic or stipitately very narrowly obconic, 8–9 by 3.5–4 mm, stipe 0–2 mm long. *Sepals* 4, inner sepals larger than outer sepals or the sepals uniform in size, transversely-semicircular or semielliptic, persistent, not accrescent, 1.5–2.5 mm long when all are uniform in length, outer pair 1.5–2 mm long, inner pair 2–2.5 mm long. *Petals* 4, deciduous, not coherent, clawed or not (if clawed, shortly so), 2.5–3.5 by 2.5–3.5 mm, the margin lacerate or entire. *Staminal disc* descending. *Stamens* all fertile, outermost stamens 10–18 mm long, the filaments inflexed in bud; anther sacs parallel, narrowly-elliptic or narrowly oblong; anthers 0.6–0.8 by 0.3–0.4 mm, dehiscing by longitudinal slits; connective glands small or absent. *Style* 12–19 mm long at anthesis. *Placentation* axile-median, placenta very narrowly V-shaped, with the 2 apical arms well distinct, peltate despite its more or less linear shape. *Ovules* 16–22 per locule, spreading, arranged in two longitudinal rows. *Mature fruit* white or cream, obovoid and flat at the top or ellipsoid (obovoid in vivo), 13–20 by 9–16 mm, with the calyx rim not appreciably expanding in fruit, the ovary apex domed, pericarp thick relative to the size of the seed and adhering to the seed without peg-like intrusions into it; germination epigeal. *Seed* 1, ellipsoidal, 8 mm in diameter, testa present, uniembryonic; embryo with the cotyledons readily separable and no interlocking funicular tissue present, equal in size or nearly so.

Distribution — Australia (Queensland, the Danbulla to Topaz region).

Habitat — Rain forest; 610–720 m altitude.

Notes — 1. Flowers have been recorded from May to October. Fruits recorded in October and January.

2. As the differences between this taxon and *S. wilsonii* subsp. *wilsonii* are relatively minor other than the mode of germination, inclusion within *S. wilsonii* at the rank of subspecies is deemed appropriate.

3. The subspecific epithet is derived from the Greek *epi*, over, on and *ge*, earth, in reference to the epigeal mode of germination.

Specimens studied:

*Connors* 139; *Cooper & Cooper* 1730; *Ford* 4359 (type); *Gray* 2268, 2633, 5322, 5777, 7749, 7912; *Irvine* 1640; *Jones* 18767; *Sankowsky & Sankowsky* 1608.

#### 4. *Syzygium maraca* Craven & Biffin, *spec. nov.*

*A S. alliligneo* B. Hyland inflorescentia 1–4-flora, stylo longiore (40–41 mm longo), fructu pyriformi longioreque (55–110 mm longo), et semine subreniformi differt. — *Typus*: *Irvine* 771 (holo CANB; iso QRS), Australia, Queensland, Timber Reserve 1230, Boonjje Logging Area, c. 17 km ESE of Malanda (off Gourka Road), 12 March 1974.

*Tree* to 24 m tall, to 70 cm dbh. *Bark* brown to red-brown, papery, flaky. *Branchlets* terete or compressed, rounded, angled or winged, 1.5–2 mm in diameter; bark dull to glossy, smooth or slightly striate, persistent. *Leaf lamina* elliptic or narrowly elliptic or obovate, 4–13 by 2.3–6 cm, 1.7–2.5 times as long as wide, base symmetrical or oblique, cuneate or attenuate, apex short to long acuminate, primary and secondary venation distinctly different with the secondaries relatively little developed and not joining the intramarginal vein, the primary veins 8–16 on each side of the midrib, the

divergence angle more or less uniform, in the median part of the lamina at an angle of 50–70° and 3–8 mm apart, intramarginal vein present and 1.5–3 mm from the margin, secondary intramarginal vein present, oil dots visible to the unaided eye in transmitted light, the dots small, sparse to dense. *Petiole* 5–20 by 1–2 mm, stipules and/or axillary enations not seen. *Reproductive seasonal growth unit* with a reproductive zone only. *Inflorescence* leafless, among the leaves, terminal or distal axillary, 1–4-flowered, cymose, 2.5–6 by 1–5 cm, main axis straight and rigid and 0.75–1.5 mm thick at the mid point, bracteate, bracts deciduous, bracteoles subtending each flower or subtending the lateral flowers of a triad and with the terminal flower ebracteolate, deciduous. *Flowers* not calyprate, white or cream. *Hypanthium* dull (or glossy due to an exudate from the outer hypanthium wall), not visibly gland dotted, stipitate-campanulate or narrowly so, 9–22 by 5–6 mm, stipe 1–10 mm long. *Sepals* 4, inner pair larger than the outer, subcircular, persistent, not accrescent, outer pair of sepals 3.3–6 mm long, inner pair 5–7.7 mm long. *Petals* 4, early deciduous, not coherent, 8–16 by 7.5–12 mm, the margin entire. *Staminal disc* lipped. *Stamens* all fertile, outermost stamens 22–33 mm long, filaments inflexed in bud, anther sacs parallel, narrowly-elliptic or narrowly-oblong, 1.5–2 by 0.7–0.9 mm, dehiscing by longitudinal slits, connective glands absent. *Style* 40–41 mm long. *Placentation* axile-median, placenta an hemi-ellipsoid cushion. *Ovules* 15–30 per locule, ascending, arranged irregularly. *Mature fruit* red or glossy dark red, pyriform (often curvedly so, the stipitate portion short or long), 55–110 by 28–55 mm, with the calyx rim not appreciably expanding in fruit, the pericarp thin relative to the size of the seed, relatively fleshy, distinctly free from the seed and without peg-like intrusions into the seed. *Seed* 1, subreniform, 30–35 mm across, testa present, uniembryonic; embryo with the cotyledons readily separable and no interlocking funicular tissue present, equal in size or nearly so.

*Distribution* — Australia (Queensland, Daintree and Topaz regions).

*Habitat* — Rain forest; 15–720 m altitude.

*Notes* — 1. Flowers have been recorded in February, March and July. Fruits have been recorded in June, September to November, and January.

2. Hyland (1983) assigned flowering and sterile specimens of *S. maraca* to *S. alliligneum* although he apparently suspected then that they might prove to represent a distinct species (B. Gray, pers. comm.). With the more recent collection of fruiting specimens, it is clear that two quite different species are involved. The pyriform fruit and much reduced inflorescence readily distinguish this species from *S. alliligneum*. Sterile herbarium material can also be named as the leaves of *S. maraca* feel soapy to the touch, in some cases sticky, whereas the leaves of *S. alliligneum* lack any such tactile qualities.

3. The specific epithet is a noun in apposition. Well-developed fruit of this species are extremely similar in shape to the musical instrument, maraca. In addition, the pericarp separates from the seed at maturity thus enabling the seed to rattle within the cavity when the fruit is shaken.

4. The ability of *S. maraca* to produce large fruits which, fide G. Sankowsky (pers. comm.), are extremely palatable indicates that this species is worth investigation with a view to its development as a commercial fruit crop.

*Specimens studied:*

*Cooper & Cooper* 1605; *Gray* 2634, 4912; *Irvine* 31, 769, 771 (type), 1211, 1378; *Jensen* 480; *Sankowsky* 1438; *Sankowsky & Sankowsky* 1592, 1623; *Telford & Donaldson* 12194.

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