

***Enekbatus*, a new Western Australian genus of Myrtaceae with a multi-locular indehiscent fruit**

Malcolm. E. Trudgen & Barbara L. Rye

Western Australian Herbarium, Department of Environment and Conservation,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Trudgen, M.E. & Rye, B.L. *Enekbatus*, a new Western Australian genus of Myrtaceae with a multi-locular indehiscent fruit. *Nuytsia* 20: 229–259 (2010). A new myrtaceous genus endemic to south-western Australia is described as *Enekbatus* Trudgen & Rye. It is related to *Rinzia* Schauer and several other genera, all of which have an unmodified anther type, a multi-locular ovary and reniform seeds. However, the indehiscent fruit of the new genus separates it from the other members of this group. Ten species are recognised here; of these seven are newly described as *Enekbatus bounites* Trudgen & Rye, *E. cristatus*, *E. dualis*, *E. eremaeus*, *E. longistylus*, *E. planifolius* and *E. sessilis*. The new combinations *Enekbatus cryptandroides* (F.Muell.) Trudgen & Rye, *E. clavifolius* (S.Moore) Trudgen & Rye and *E. stowardii* (S.Moore) Trudgen & Rye, are made for three species that were previously included in *Baeckea* L. s. lat. This revision includes a key to the species, distribution maps and illustrations.

Introduction

A new myrtaceous genus, *Enekbatus*, is described here to recognise the morphological isolation of a group of species that are all endemic to the south-west of Western Australia. The distribution of the new genus extends from north of Geraldton to south of Merredin and inland to the western part of the Great Victoria Desert.

Enekbatus belongs to the tribe Chamelaucieae *sensu* Wilson *et al.* (2005), in a group of genera including *Rinzia* Schauer that have multi-locular fruits containing unfacetted seeds of a more or less reniform shape. Unlike all other members of the reniform-seeded group, *Enekbatus* has a toughly fibrous to ossified, indehiscent fruit. So unusual is this fruit in comparison with those of most other genera of the Chamelaucieae, that it has sometimes been mistaken for a gall.

Two early publications that had a major impact on the development of generic concepts for Australian Myrtaceae, Schauer (1843) and Bentham (1867), did not cite material of any of the species now referred to *Enekbatus* as the earliest collection of this species group was apparently made in 1875. Had he seen good material, Schauer would probably have recognised the need for a separate genus, as he carefully delimited genera, including some that are certainly less morphologically isolated than *Enekbatus*.

Unlike Schauer, Bentham (1867) presented a very broad concept of *Baeckea* L. and used simple but sometimes superficial characters for distinguishing it from the few related genera he recognised. While this was a practical approach suited to the limited time available for writing a large flora, it does not

cope with the overall variation and the many more species we now know exists. For example, using Bentham's generic key, those species of *Enekbatus* with superposed ovules would fall into *Scholtzia* Schauer and those with collateral ovules into *Baeckea*.

Accepting Bentham's generic delimitations, Mueller (1876) named one of the taxa now considered to belong in *Enekbatus* as *Baeckea cryptandroides* and Moore (1920) named two more as *B. clavifolia* and *B. stowardii* respectively. A fourth species has been known by two of C.A. Gardner's manuscript names and was briefly described, as *Baeckea* aff. *cryptandroides*, in *Flora of Central Australia* (George & Trudgen 1981).

Materials and methods

This study was based on the gross morphology of dry herbarium material, supplemented with field observations, including measurements of the diameter of fully opened flowers. Branchlet measurements were taken from unbranched flowering branchlets and did not include the length of the flowers. The number of oil glands per row in the leaf was recorded by counting the glands in the two most prominent rows (these are adjacent to the midrib, one on each side) on the abaxial surface. Bracteole widths were measured with the bracteoles flattened. Hypanthium length was taken after anthesis but prior to its enlargement in fruit. Measurements of petals and other floral organs were taken only from very well pressed flowers.

Distribution maps were based on those of *FloraBase* (Western Australian Herbarium 1998–). Codes used for the biogeographic regions are those defined by Thackway & Creswell (1995). Holotypes of the new taxa have been lodged at PERTH.

Morphology

Fruit and seed characters are particularly variable in *Enekbatus* and are of major importance in distinguishing the species. Most of the diagnostic characters of the genus are illustrated in Figures 1–3.

Habit

The species placed in *Enekbatus* genus are relatively uniform in habit, being low-growing shrubs 0.2–1.3 m high (Figure 1B), all or most of them with a marked tendency to produce adventitious roots from horizontal radiating branches when the opportunity arises. However, sometimes all branches are separated from the soil, for example by rock or surrounding plants, and unable to produce such roots. The lateral branchlets tend to have a dense terminal cluster of leaves and a bare basal portion with densely packed prominent nodes, and, when in flower, usually have a solitary, terminal or subterminal flower. Occasionally they are two- or three-flowered.

Bracts and flowers

The flowers are sessile or almost so, although in *Enekbatus planifolius* they usually have a small anthopodium (up to 0.5 mm long). There are usually 1–3 small bracts that combine with a pair of

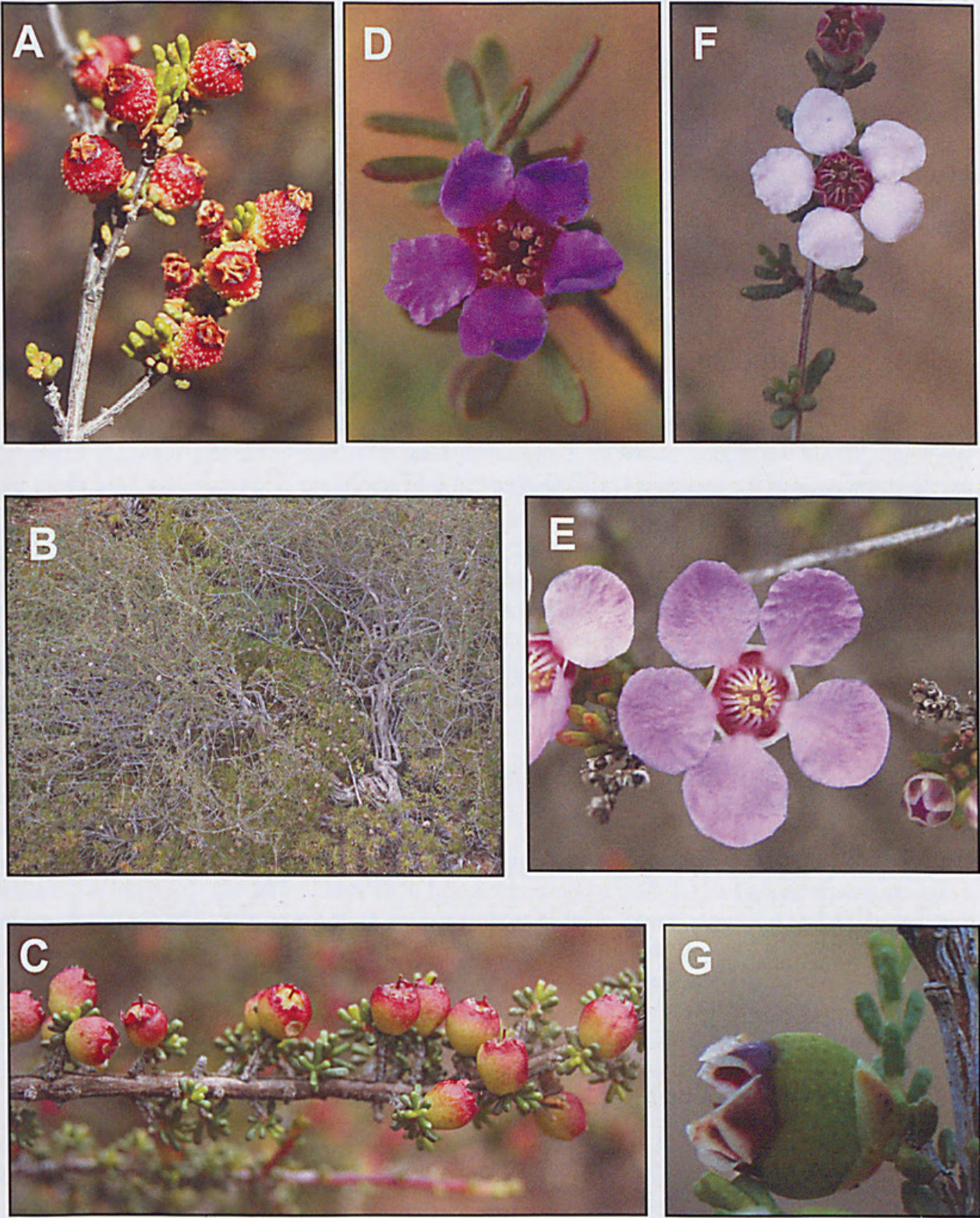


Figure 1. Images of *Enekbatus* species, taken by B.L.Rye. A – fruiting branch of *E. clavifolius* (B.L. Rye 231082 & M.E. Trudgen); B – partially prostrate shrub of *E. dualis* (B.L. Rye 239051 & M.E. Trudgen), growing with *Borya* on a granite outcrop; C – fruiting branch of *E. dualis* (B.L. Rye 239052 & M.E. Trudgen), with a cavity in one fruit probably as a result of insect attack; D – flower and compressed leaves of *E. planifolius* (B.L. Rye 231003 & M.E. Trudgen); E – flower, bud and leaves of *E. sessilis* (M.E. Trudgen 22066 & B.L. Rye); F – flower, bud and leaves of *E. stowardii* (B.L. Rye 231034 & M.E. Trudgen); G – fruit of *E. stowardii* (B.L. Rye 231034 & M.E. Trudgen).

large bracteoles to form an involucre subtending each flower. Except in *E. dualis*, the bracteoles are very broad (broader than long) and at least cover the base of the hypanthium (e.g. Figure 2K & N) and in some cases (e.g. Figure 2D) are large enough to enclose the entire hypanthium. In *E. dualis*, the two bracteoles are longer than they are broad and too small to obscure even the base of the hypanthium from view (Figure 3J). In all the other species, the bracteoles enclosing the young buds and the hypanthium of the flower and young fruit presumably offer protection from desiccation, and also from attack by phytophagous insects. Evidence of such attack on a mature fruit is visible near the centre of Figure 1C.

Hypanthium, petals and stamens

The hypanthium is adnate to the ovary for at least the lower half of its length, with a free tube above the fused section. The petals are uniformly coloured (Figure 1), varying from very pale to deep pink. Occasionally they have been recorded as white, but they normally have some pink colouring at least when they first open. Antipetalous processes (as defined in Trudgen 1986) are absent in most specimens but are sometimes present in a rudimentary form at the base of the petal claw. For example, the flowers on one of the specimens (A.S. George 7989) of *Enekbatus cryptandroides* have about six minute processes, mostly less than 0.1 mm long, opposite each petal.

In *Enekbatus clavifolius* (Figure 3A), and often also in *E. cryptandroides*, there are ten stamens, with the antipetalous ones distinctly longer than the antisepalous ones. Other species have more numerous stamens occupying all positions around the circumference of the flower (e.g. Figure 2E), the maximum number recorded being 25. Each stamen has a slender filament and a versatile, dorsifixed anther. The anthers have two parallel cells which are longitudinally dehiscent, and on the connective there is a free, more or less globular, connective gland.

Gynoecium

Although ovule number in *Enekbatus* is almost constant at two per loculus, the species fall into two main groups on the basis of their ovule arrangement. Four species (Table 1) have the two ovules superposed, so that the upper one is attached to the placenta at its lower end while the lower one is attached at its upper end (in relation to the loculus). In these taxa each loculus usually becomes divided into two compartments by a horizontal partition before the fruit matures (Figure 3M). The remaining species (Table 2) have two collateral ovules in each loculus (see Figures 2O and 3C), although *E. stowardii* does very occasionally produce an additional one or two ovules below the two collateral ones, so that the number of ovules per loculus ranges from two to four. The species with superposed ovules tend to have more loculi than those with collateral ovules.

Fruit

All species of *Enekbatus* have a multi-locular, indehiscent fruit; however, there is significant variation between species in fruit shape and surface ornamentation. The shape varies from depressed globular to obovoid, while the surface can be smooth, pitted or tuberculate. Some of this variation is shown in Figures 1–3.

Paralleling the range of fruit shape, there is great variation in the degree of thickening of the fruit and in which tissues are most modified. At one extreme the fruit of *E. planifolius* and *E. stowardii*

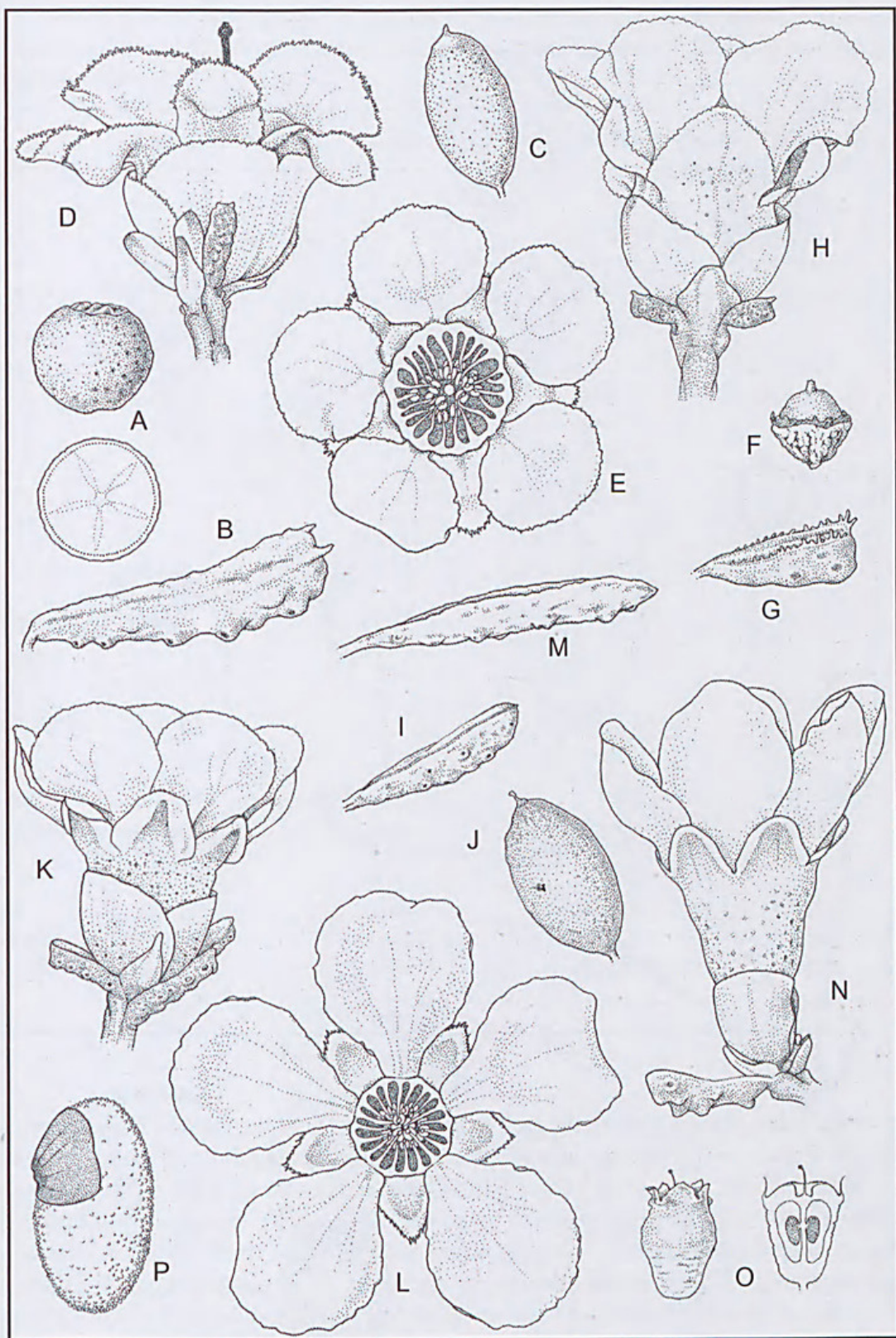


Figure 2. A – *Enekbatus bounites*, fruit, side view and TS ($\times 5$); B–F. *E. eremaeus*. B – leaf ($\times 15$), C – gall ($\times 5$), D – side view of flower ($\times 7$), E – top view of flower ($\times 6$), F – fruit ($\times 5$); G,H. *E. longistylus*. G – leaf ($\times 12$), H – side view of flower ($\times 8$); I–L. *E. sessilis*. I – leaf ($\times 12$), J – gall ($\times 5$), K – side view of flower ($\times 10$), L – top view of flower ($\times 8$); M–P. *E. stowardii*. M – leaf ($\times 12$), N – side view of flower ($\times 8$), O – fruit with style, side view and LS ($\times 4$), P – seed ($\times 20$). Drawn from PERTH specimens A.S. George 14870 (A), J.S. Beard 6542 (B, C), P.G. Wilson 7356 (D, E), J.D. Pearson 2935 (F), J.S. Beard 6699 (G, H), M.E. Trudgen 1416 (I–K), M. Hislop 496B (L), L.A. Craven, F.A. Zich & A.M. Lyne 8903 (M,O,P) and F. Keast L6D 245 (N).

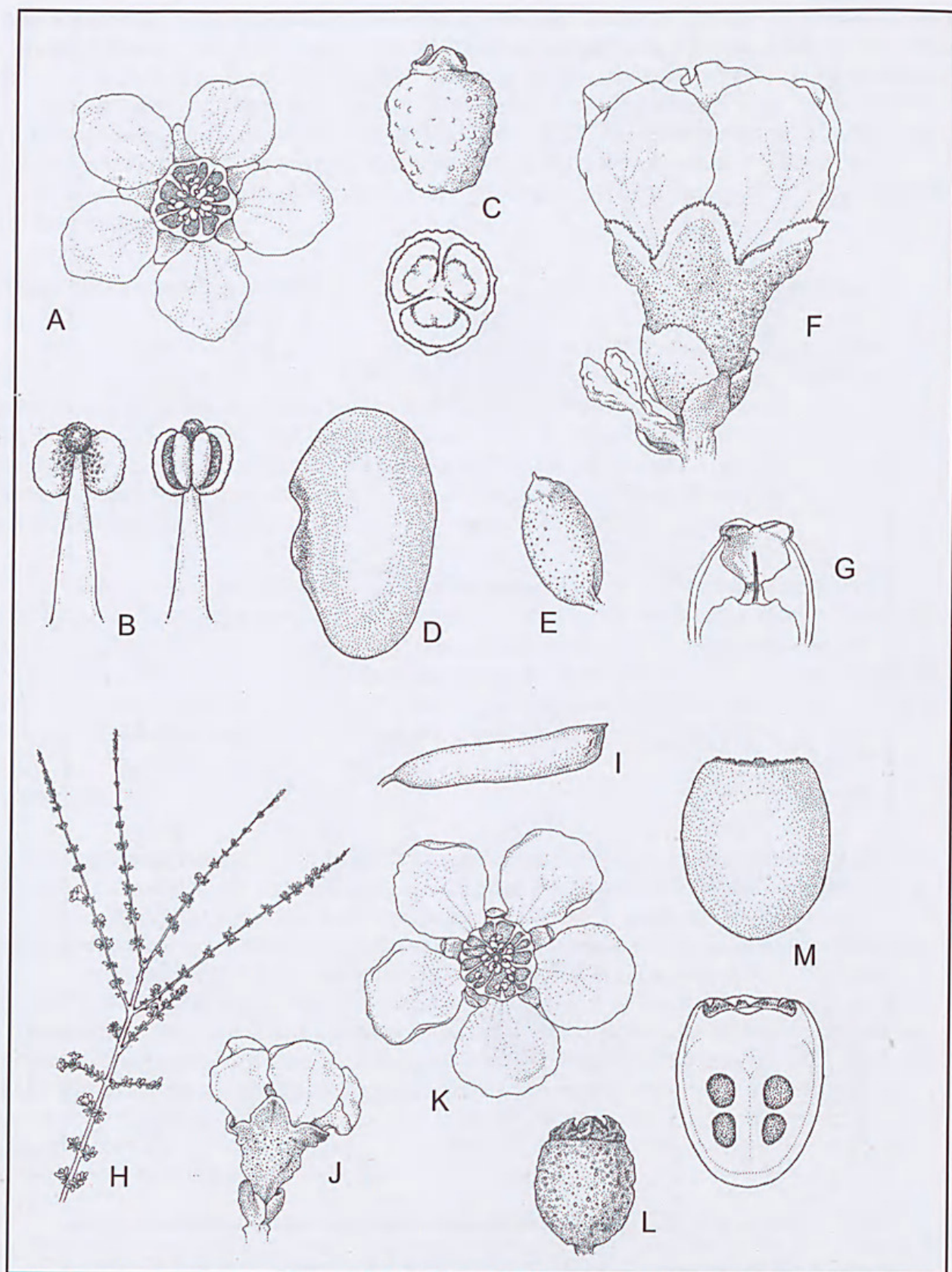


Figure 3. A–D. *E. clavifolius*. A – top view of flower ($\times 10$), B – two views of stamen ($\times 50$), C – fruit, side view and TS ($\times 6$), D – seed ($\times 20$); E–G. *E. cryptandroides*; E – gall ($\times 5$), F – side view of flower ($\times 8$), G – LS of top of fruit, with base of style ($\times 5$); H–M. *Enekbatus dualis*. H – flowering branch ($\times 1$), I – leaf ($\times 20$), J – side view of flower ($\times 8$), K – top view of flower ($\times 8$), L – young fruit with pustules ($\times 8$), M – old fruit, side view and LS ($\times 8.5$). Drawn from MEL specimen M. Koch 2943 (D) and from PERTH specimens B.C. Haberley 304 (A, B), M. Koch 2791 (C), L. Sweedman 2269 (E, G), R.D. Royce 10476 (F), J.S. Beard 4969 (H,K), A.L. Payne 3787 (I,J) and M.E. Phillips WA/68 1380 (L, M).

Table 1. Comparison of the morphology of the species of *Enekbatus* with superposed ovules. All measurements are in mm. *proportion of length of hypanthium enclosed in flowering stage. ** keel very prominent (++), or moderately prominent (+)

	<i>Enekbatus bounites</i>	<i>Enekbatus cristatus</i>	<i>Enekbatus dualis</i>	<i>Enekbatus sessilis</i>
leaves				
length	2.5–3.5	3.5–5	0.8–2.3	1.0–3.5
width	0.3–0.5	0.3–0.5	0.3–0.5	0.4–0.6
thickness	0.3–0.5	0.3–0.4	0.3–0.4	0.3–0.4
bracteoles				
length	c. 1.5	1.2–1.6	0.6–1.2	1.3–2.2
width	c. 2.5	1.4–2	0.4–1	1.6–3
cover*	c. 1/2	c. 3/4	none	2/3–whole
sepals				
length	1–1.3	c. 1.5	0.4–0.7	0.8–1.5
keel**	+	++	+	+ or ++
petal length	4–4.5	2.5–3.3	2.2–2.7	2.5–4.5
stamens	c. 22	20–25	12–15	16–25
gynoecium				
loculi	4,5	4,5	3	4,5
style length	1.3–1.5	c. 1.6	1–1.5	1–1.6
fruit				
l/w ratio	0.7–0.8	0.9?	1–1.3	0.7–0.8
hypanthium	pitted	pitted	smooth	pitted
seeds				
length	1.3–1.5	unknown	1.2–1.5	1.1–1.4
adherent layer	rugose	rugose	none	rugose
testa cells	raised	raised	distinctly raised	raised

has the hypanthium fibrous and tough, but not much thickened or greatly expanded in comparison with the shape of the hypanthium in flower. These species also have the tissue of the ovary wall well developed, that is the ovary becomes somewhat similar to the valves of the dehiscent fruits found in related genera such as *Rinzia*. This includes the ovary having a definite bubbly texture on the inner surface similar to that of *Rinzia* and some other related genera. At the other extreme are species such as *E. bounites* (and other species with the ovules superposed) which have the fruit much expanded and its texture much changed. In this species, the hypanthium is also somewhat thickened, but most of the expansion of the fruit is due to tissue inside the hypanthium. It is not clear if this tissue originates from the ovary tissue becoming less specialised (parenchyma-like) than in related dehiscent genera, or if the ovary wall is much reduced and the tissue is from the inside layer of the hypanthium. What is clear is that this tissue becomes ossified as the fruit matures and completely encases the seeds.

Table 2. Comparison of the morphology of the species of *Enekbatus* with collateral ovules. All measurements are in mm. *proportion of length of hypanthium enclosed in flowering stage. ** keel very prominent (++) , moderately prominent (+) or not prominent, the sepals fully scarious (-).

	<i>Enekbatus clavifolius</i>	<i>Enekbatus cryptandroides</i>	<i>Enekbatus eremaeus</i>	<i>Enekbatus longistylus</i>	<i>Enekbatus planifolius</i>	<i>Enekbatus stowardii</i>
leaves						
length	1.5-3.5	2-3.5	1.3-3.7	0.8-1.5	3.5-4.5	1.7-4
width	0.5-0.8	0.5-0.8	0.5-1.1	0.3-1.3	1.1-1.4	0.5-1.2
thickness	0.4-0.6	0.5-0.7	0.4-0.5	0.2-0.4	0.1-0.3	0.35-0.6
processes	absent	absent	apical	marginal	absent	absent
bracteoles						
length	1.3-1.6	1-2	2.1-3.5	1.8-2.5	1.2-1.5	1.3-1.5
cover*	c. 3/4	c. 1/2	all	all	c. 1/4	1/4-1/3
sepals						
length	0.6-1	0.8-2	1.5-2.6	1.2-2.1	0.7-1.2	0.6-1.1
keel**	+	+	-	-	+	+
petal length	2-2.5	3-4.5	3-4	3-5	2-3	2-4
stamens	10	9-14	17-22	19-24	13-15	13-19
gynoecium						
loculi	3	3	3	3	2, 3	3, 4
style length	0.6-1.2	1.3-2.2	1.6-2.5	2.8-3.6	1.3-1.5	1-2
fruit						
l/w ratio	1-1.3	1-2	c. 0.7	c. 0.7	c. 1.5	c. 1.5
hypanthium	tuberculate	tuberculate	half rugose	smooth	pitted	pitted
petals	absent	absent	present	present	absent	absent
seeds						
length	1.4-1.8	unknown	1.4-1.6	unknown	1.3-1.4	1.3-1.6
adherent layer	scurfy	scurfy	none	unknown	none	none
testa cells	level	level	level	unknown	raised & patterned	raised & patterned

Seeds

Fruits of most *Enekbatus* species tend to be single-seeded or less commonly two-seeded. However, in *E. clavifolius* the fruits commonly have two or more seeds, quite often with two seeds produced in a single loculus; this may also be the case in *E. cryptandroides*. The unfertilised ovules or early-aborted seeds are very compressed, commonly about 0.6 mm long, and dark brown or red-brown. At maturity, the seeds are up to 1.8 mm long and have quite variable shape (Figures 2P and 3D), but are usually not reniform like the seeds of related genera. Their soft, white embryo is enclosed in a pale brown-translucent to white membrane inside a thin or moderately thick, crustaceous testa. The testa is usually medium brown or orange-brown. Several species have the seed partially covered by an irregular layer of scurfy or rugose material formed from part of the wall of the loculus adhering to the testa. This layer covers a greater proportion of the testa in taxa which have superposed ovules than in those with collateral ovules (Figure 3C), as in the latter case one side of the seed is adjacent either to a second seed or to a piece of chaff. In most species, the testa is smooth or colliculate but *Enekbatus dualis* is unusual in having a deeply colliculate or shallowly tuberculate testa.

Species groups within *Enekbatus*

In addition to the two main groups of species mentioned earlier that are distinguished primarily by whether the ovules are superposed or collateral in each loculus, the following subgroups can be readily distinguished within *Enekbatus*:

1. *Enekbatus clavifolius* and *E. cryptandroides* – distinguished by their tendency to have only 10 stamens arranged opposite the sepals and petals, their tuberculate, often multi-seeded fruit, and their smooth seeds that are partially covered by a scurfy adherent layer
2. *Enekbatus eremaeus* and *E. longistylus* – distinguished by the hyaline processes on their leaves, their long bracteoles and usually long style, their smooth or partially smooth, short fruit with persistent petals (seed morphology scarcely known).
3. *Enekbatus planifolius* and *E. stowardii* – distinguished by their apparently smooth but actually minutely pitted fruit, and their minutely colliculate seeds that have a large-scale pattern of shallow circular depressions.
4. *Enekbatus bounites*, *E. cristatus* and *E. sessilis* – distinguished by their 4- or 5-locular, pitted fruit, and colliculate seeds that are almost fully covered by a rugose adherent layer.
5. *Enekbatus dualis* – distinguished by its relatively small narrow bracteoles, its small sepals, and its often more or less reniform seeds with a prominently colliculate to shortly tuberculate testa.

Affinities and distinction of *Enekbatus*

Within the tribe Chamelaucieae, *Enekbatus* can be distinguished quite simply by the combination of its multi-locular indehiscent fruit and its versatile anther (see Figure 3B) with dorsifixed cells opening in parallel slits and with a free connective gland. This unmodified anther type is considered to be primitive (Johnson & Briggs 1984) as it is very widespread and common in the Myrtaceae as

a whole. Many kinds of modified anther types also occur in the family, these modifications being particularly varied within the tribe Chamelaucieae. Other characters found in *Enekbatus*, such as the low habit with layering branches and more or less sessile, pink flowers usually subtended by an involucre that includes large persistent bracteoles, combine with the fruit and anther characters to characterise a very distinct entity.

Enekbatus has a number of the traits that characterise the 'reniform-seeded lineage' that was first recognised and described by Trudgen (1986). Apart from *Enekbatus*, the genera now considered to belong to this group are *Astus* Trudgen & Rye, *Euryomyrtus* Schauer, *Ochrosperma* Trudgen, *Rinzia* Schauer, *Triplarina* Raf. and several small genera that have yet to be described. Benthams (1867) placed all but one of the reniform-seeded species known at that time either in *Baeckea* sect. *Rinzia* or in *Baeckea* sect. *Euryomyrtus* (Schauer) Benth., the exception being the single species of *Triplarina*, because it did not have any stamens opposite the petals. Moore (1920) similarly placed the two species of *Enekbatus* he described in sect. *Euryomyrtus*, which was reinstated as a distinct genus by Trudgen (2001).

Many of the character states found in species of *Enekbatus* are shared with species in some or all of the other genera in the reniform-seeded group. In common with *Enekbatus* these genera have a free connective gland, dorsifixed anthers opening by longitudinal slits, a multi-locular ovary and the base of the style inserted in a depression or short tube. The uniform pink colour of the petals¹ in *Enekbatus* is also found in most of the other reniform-seeded genera, although usually in a smaller proportion of the species. More importantly, *Enekbatus* species have seeds that appear to have been derived from the typical reniform seed, but modified as a result of the indehiscent fruit of all species in the genus. Certainly the seeds are of a similar size to those of most of the other reniform-seeded genera, and the chaff is of the same kind as in those genera. Although the development of an indehiscent fruit has resulted in some species of *Enekbatus* having a thin testa with a smooth surface, other species have retained a thicker testa with a colliculate to shallowly tuberculate surface similar to that found in *Rinzia* and several other reniform-seeded genera.

The other genera in the reniform-seeded group can easily be distinguished from *Enekbatus* as they all have a dehiscent fruit (Table 3). Each of them can also be distinguished from *Enekbatus* by several other characters. For example, *Euryomyrtus* and *Rinzia* both differ from *Enekbatus* in having distinctly stalked flowers and in having an aril in most species; the former also differs in having parallel venation visible on the adaxial surface of its leaves and (usually) well developed processes opposite the petals, while the latter also differs in its broad, flattened filaments.

Molecular data including a single species of *Enekbatus* (Wilson *et al.* 2004) have confirmed the placement of the genus in the Chamelaucieae. Subsequent unpublished data (Peter Wilson pers. comm. 2010) sampling seven species from all species groups in the genus have indicated that *Enekbatus* is related to reniform-seeded genera such as *Rinzia*. An analysis using the nuclear ETS region gave fairly good support for the genus being monophyletic.

¹ This is a relatively unusual character among other species groups that Benthams (1867) included in *Baeckea* s. lat., most of which have uniformly white petals or white petals with the outermost one, i.e. the one exposed in the bud, blotched on the outside with red or pink.

Table 3. Morphological characters of significance in distinguishing *Enekbatus* from other genera in the reniform-seeded group.

<i>Enekbatus</i>	Other reniform-seeded genera
Most species known to produce adventitious roots from horizontal branches	Lacking adventitious roots (except in some species of <i>Rinzia</i>)
Flowers more or less sessile	Flowers usually with a well developed peduncle and/or anthopodium
Bracteoles usually large and combined with bracts in an involucre	Bracteoles usually small and separated from bracts (if present) by a peduncle
Fruit 2–5-locular, indehiscent, thick-walled, toughly fibrous to ossified.	Fruit 2- or 3-locular, dehiscent, thin-walled to crustaceous (not ossified)
Seeds irregularly obovoid to ellipsoid or reniform; testa often thin, sometimes partially or largely enclosed by a scurfy or rugose adherent layer of the loculus wall; aril absent	Seeds reniform or sub-reniform; testa thick, never with loculus wall adherent; aril often present
Ovules 2 per loculus (very rarely 3 or 4), superposed in some species and collateral in others	Ovules 2–14 per loculus, collateral, in an arch or radial, never superposed

Distribution and phenology

Enekbatus is endemic to Western Australia, occurring in the northern parts of the South West Botanical Province and extending well inland from there into the Eremaean Botanical Province. In the former province it occurs in the Geraldton Sandplains Bioregion and the northern to central parts of the Avon Wheatbelt Bioregion. In the latter province it occurs in the northern part of the Yalgoo Bioregion, the eastern two-thirds of the Murchison Bioregion, the western part of the Great Victoria Desert, and has one record in the northern part of the Coolgardie Bioregion (Figure 4).

An unusual feature of the distribution of *Enekbatus*, is the apparent disjunction of at least 200 km between the eight taxa that occur fully or partly within the South West Botanical Province and the two far-inland species of the Eremaean Botanical Province. While the distribution of the genus is predominantly well inland, *Enekbatus bounites* and *E. cristatus* occur close to the west coast.

The flowering period recorded for the genus as a whole extends from June to October, with a peak in August. There was no evidence of any significant differences in flowering time between those species whose ranges overlap. However, no species have been observed co-existing at any of the locations visited during the current study, suggesting that habitat differences may be the primary factor keeping those species reproductively isolated.

Insect associations

Floral galls containing a single wasp larva are fairly common on most species but have not been seen on *Enekbatus dualis*. Several of these galls are illustrated (Figures 2C & J and 3E). They are 2.5–6 mm long, fusiform to ellipsoid, and commonly have a rounded apical mucro formed apparently

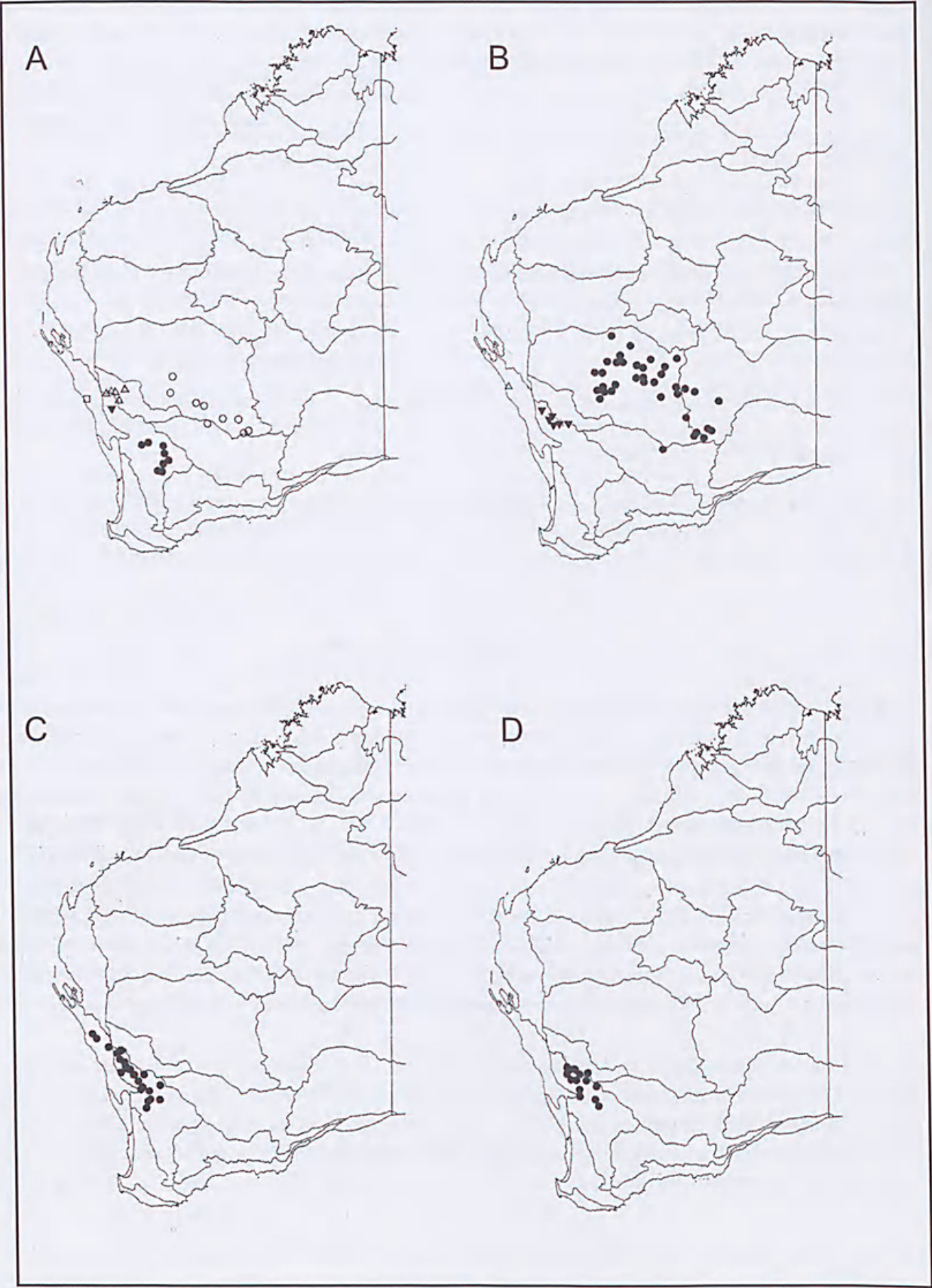


Figure 4. Distribution maps. A – *Enekbatus bounites* □, *E. clavifolius* ●, *E. cryptandroides* ○, *E. dualis* △ and *E. planifolius* ▼; B – *E. cristatus* △, *E. eremaeus* ● and *E. longistylus* ▼; C – *E. sessilis*; D – *E. stowardii*.

from the base of the style. Their base is often subtended by small bracts. Occasionally, an exoskeleton may be left protruding from the summit of the gall by an emerged insect, as found on the *R. Meissner* & *Y. Caruso* 297 specimen of *Enekbatus stowardii*.

Stem galls are occasionally present on the branchlets. These are fusiform to globular, with leaves attached or axils clearly visible.

Many species of native bees have been reported (Houston 2000) visiting the flowers of a species identified as *Baeckeastowardii*, presumably a species of *Enekbatus* although not necessarily *E. stowardii*. The apparently unspecialised, open flowers of *Enekbatus* probably attract a wide variety of insects rather than showing any great pollinator-specificity.

Taxonomy

Enekbatus Trudgen & Rye, *gen. nov.*

Frutices glabri. Folia opposita, decussata, parvula, crassa. Flores sessiles vel subsessiles, per bracteolas 2–5 subtenti. Hypanthium per bracteolas ex parte vel omnino occultum, per saltem dimidio longitudino ad ovarium adnatum. Sepala 5, in fructu persistentia. Petala 5, ungue basali brevi. Stamina 10–25 in unum verticillum dispositis; filamenta filiformia, antipetalina longissima; antherae dorsifixae, versatiles, cellulis parallelibus longitudinaliter dehiscentibus, connectivum glande plus minusve globulari. Cellulae ovarii plerumque 2-ovulatae; placentae axiales, versus apicem vel centrum ovarii positae. Styli basis in depressione inserta. Fructus indehiscens, 2–5-locularis, durus, pariete crasso. Semina obovoidea vel reniformia; arillus carens.

Typus: Enekbatus cryptandroides (F. Muell.) Trudgen & Rye.

Shrubs low and spreading (0.2–1.3 m high), single-stemmed at the base but usually soon developing widely spreading decumbent or prostrate branches at ground level and frequently producing adventitious roots from these main branches, glabrous; upper stems with very short lateral branchlets in an opposite-decussate arrangement. *Leaves* opposite, decussate, tending to be densely crowded into clusters on minute lateral branchlets, the distal leaves of each cluster erect and the basal leaves somewhat to widely antrorse, but tending to be distant on flush growth, shortly petiolate; blade very small (up to 5 mm long), thick in most taxa (often semi-circular to almost rectangular in TS with the adaxial surface more or less flat and abaxial surface deeply rounded and often with a central longitudinal groove), concolorous, usually with several prominent oil glands in 2 or more rows often giving a tuberculate appearance to the abaxial surface, less prominently gland-dotted adaxially. *Inflorescence* of 1 or 2 flowers terminal or subterminal on each short branchlet or rarely in several axils on a branchlet, with the arrangement of flowers on a number of adjacent branchlets along the stems often resembling an interrupted spike or raceme; peduncles virtually absent or very reduced (less than 0.5 mm between stem and bracteoles), the flowers solitary and more or less sessile in the leaf axils. *Bracts and bracteoles* 2–5, opposite-decussate apart from an often solitary basal bract opposed to the subtending leaf, persistent, sessile; bracts (when present) smaller than the two bracteoles; bracteoles overlapping in most taxa to form a tight cup obscuring at least the base of the hypanthium, not or scarcely separated from the bracts below. *Hypanthium* adnate to ovary for at least half of its length, free and somewhat to distinctly flared above, often with a deep reddish tinge. *Sepals* 5, erect or slightly spreading, much smaller than petals, either scarious throughout or with the central basal portion herbaceous, persistent and closing inwards in fruit. *Petals* 5, spreading, distinctly but shortly clawed at base and broadly elliptic to

obovoid or circular above, pale pink to deep pink or purplish pink, sometimes almost white, entire or minutely lacinate, sometimes persistent in fruit. *Antipetalous processes* absent or very inconspicuous. *Androecium* of (9)10–25 stamens in a single whorl, when 10 then one opposite each sepal and petal, when more than 10 then one opposite each petal claw and the others fairly uniformly arranged in between, separated at the base or contiguous on an extremely short staminophore that dips opposite the sepals. *Filaments* filiform with a slightly to distinctly expanded base and tapering to apex, terete, the 5 antipetalous ones largest, often pink. *Anthers* dorsifixed, versatile, about as broad as long, the dorsal (abaxial) surface of the connective terminated by a gland; cells parallel but tilted away from one another so as to be semi-latrose, broad, elliptic, opening in longitudinal slits, pale yellowish; connective gland prominent, more or less globular, *c.* half as long as the cells at first, *c.* 1/3 as long as the cells after contents released. *Disc* convex or with central portion convex and with a distinct to almost obsolete central depression, pink, smooth or pustulate, becoming thickened and hard in fruit. *Ovary* 2–5-locular, inferior; placentas axile, small; ovules 2 per loculus (rarely 3 or 4 per loculus in *E. stowardii*), collateral or superposed (rarely both). *Style* terete, base inserted in the depression in disc; stigma very depressed-ovoid to disc-like, pale yellowish. *Fruit* indehiscent, inferior to about half inferior, obovoid to depressed-ellipsoid, toughly fibrous to ossified, 1-seeded or with 1 or 2 seeds per loculus, with the exposed part tending to become red distally or throughout or (in two species) apparently fully enclosed. *Seeds* of varied and somewhat irregular shape, usually obovoid, ellipsoid or broadly reniform, 1.1–1.8 mm long, without an aril, the hilum small; testa crustaceous but often very thin, smooth to shallowly tuberculate, often orange-brown, in some species partially or almost fully covered by a scurfy or rugose layer; hilum towards one end of seed (when ovules superposed) or more or less central on inner surface.

Etymology. From the Greek *enekbatos* – without outlet, referring to the indehiscent fruit.

Key to the species of *Enekbatus*

- 1. Ovary 3–5-locular; ovules superposed in each loculus. Fruit very thick-walled between the loculi and tending to become divided transversely across the loculi as well
 - 2. Bracteoles 0.6–1.2 × 0.4–1 mm, somewhat folded-keeled, not encircling the hypanthium. Ovary 3-locular. (Mullewa to Wurarga to Mellenbye Station) ***E. dualis***
 - 2: Bracteoles 1.2–2.2 × 1.4–3 mm, curved, encircling and concealing at least the base of hypanthium. Ovary 4- or 5-locular
 - 3. Leaves mostly 1–2 mm long (rarely also with some leaves 2.5–3.5 mm long), with 3–6 main glands in the rows closest to the midvein. Occurring in sandy habitats, commonly in yellow sand, usually well inland. (Murchison River to Wongan Hills and Burakin) ***E. sessilis***
 - 3: Leaves 2.5–5 long, with 7–12 main glands in the rows closest to the midvein. Occurring in sandstone habitats and possibly also in lateritic habitats not far inland
 - 4. Outer sepals somewhat to prominently keeled. Hypanthium usually largely exposed in flower, not becoming tuberculate. (Moresby Range) ***E. bounites***
 - 4: Outer sepals very prominently keeled. Hypanthium usually largely covered in flower, often tuberculate in young fruit. (Kalbarri National Park) ***E. cristatus***
- 1: Ovary 2–4-locular; ovules collateral in each loculus. Fruit not particularly thick-walled between the loculi, without transverse divisions

5. Bracteoles opaque, entire, only enclosing base of hypanthium. Hypanthium pitted.
Ovary 2–4-locular
6. Leaves 1.1–1.4 mm wide, 0.1–0.3 mm thick. Ovary 2- or 3-locular, all specimens with 2-locular flowers common. (North of Morawa) **E. planifolius**
6. Leaves 0.5–0.8 mm wide, 0.35–0.6 mm thick. Ovary 3- or 4-locular. (Morawa to Cowcowing) **E. stowardii**
5. Bracteoles with scarious hyaline edges, sometimes minutely laciniate, enclosing at least half of the hypanthium in flower (hypanthium may be largely exposed in fruit). Hypanthium tuberculate or smooth. Ovary 3-locular
7. Leaves with small hyaline processes near apex or along margins. Sepals scarious throughout. Petals persistent in fruit. Stamens 17–24
8. Leaves with small hyaline processes near apex only. Style 1.6–2.5 mm long. (Meekatharra to western edge of Victoria Desert) **E. eremaeus**
8. Leaves with small hyaline processes extending along margins. Style 2.8–3.6 mm long. (Tardun to Perenjori) **E. longistylus**
7. Leaves entire. Sepals with a somewhat herbaceous central portion. Petals deciduous. Stamens up to 14 (usually 10–12)
9. Bracteoles covering c. 1/2 of hypanthium in newly opened flowers. Petals 3–4.5 mm long. (Sandstone to Comet Vale) **E. cryptandroides**
9. Bracteoles covering c. 3/4 of hypanthium in newly opened flowers. Petals 2–2.5 mm long. (Koorda to Bruce Rock) **E. clavifolius**

Enekbatus bounites* Trudgen & Rye, *sp. nov.

Differt ab *Enekbato sessili* foliis et hypanthio pleurumque longioribus, fructu foveolis plus numerosis.

Typus: Howatharra area, Western Australia [precise locality withheld for conservation reasons], 27 August 1977, *N. McFarland s.n.* (*holo*: PERTH 05830192; *iso*: CANB, K, MEL).

Shrub low and spreading, 0.2–0.3 m high; lateral branchlets mostly 5–15 mm long; flower galls not observed. *Petioles* 0.1–0.3 mm long. *Leaf blades* narrowly oblong to linear in outline, 2.5–3.5 mm long, 0.35–0.5 mm wide, 0.3–0.5 mm thick, obtuse, entire; abaxial surface with midline groove, with 7–10 prominent oil glands per row. *Bracts* 1 or 2, similar to bracteoles but somewhat more leaf-like. *Bracteoles* overlapping to form a tight cup round lower half of hypanthium, almost semi-circular, c. 1.5 mm long, c. 2.5 mm wide, thin, green with a red-tinged keel, margins entire. *Flowers* 1–3 (usually 1) terminating each branchlet, 10–11 mm diam. *Hypanthium* c. 2.5 mm long; adnate portion broadly cupped-obconic, green, with numerous small pits; free portion flared to c. 2.5 mm diam., apparently reddish or purple-tinged. *Sepals* very broadly to depressed ovate, 1–1.3 mm long, 1.2–2.5 mm wide, the outer ones distinctly keeled; keel herbaceous, probably reddish; margins broad, whitish, scarious, minutely laciniate. *Petals* 4–4.5 mm long, pink, entire or crenulate, deciduous in fruit. *Androecium* of c. 22 stamens; antipetalous filaments c. 1.5 mm long, probably pink; anthers c. 0.35 mm long. *Ovary* 4- or 5-locular; placentas attached half way up loculus; ovules 2 per loculus, superposed. *Style* 1.3–1.5 mm long; stigma c. 0.2 mm diam. *Fruit* depressed obovoid or globular, 3–4 mm long, 3.5–4.5 mm diam., very hard (ossified), commonly 1- or 2-seeded; hypanthium with numerous small

pits. *Seeds* broadly obovoid, 1.3–1.5 mm long, 0.8–1.2 mm wide, 0.6–0.9 mm thick; testa moderately thick, orange-brown, very densely and minutely colliculate, covered by an adherent rugose layer that is rather soft. (Figure 2A)

Other specimens examined. WESTERN AUSTRALIA: Howatharra area [precise localities withheld] 13 Sep. 1977, *A.S. George* 14870 (PERTH); Howatharra area, 7 July 1974, *D. & N. Mcfarland s.n.* (PERTH).

Distribution and habitat. Known only in Moresby Range, near Howatharra (north of Geraldton), in the South West Botanical Province: GS. Recorded in clayey soil over sandstone in low heath, at least one record from a hilltop. (Figure 4A)

Phenology. Flowers recorded in early July and fruits recorded from late August to mid September. Seeds measured from *A.S. George* 14870 and *N. Mcfarland s.n.* 27 Aug. 1977.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. Known from only three collections from a very small area.

Etymology. From the Greek *bounites* – dweller in the hills, as this species appears to be restricted to a range of hills.

Affinities. Very closely related to *Enekbatus cristatus* and *E. sessilis*, differing from both in its longer hypanthium that is less fully covered in flower, also differing from the former in its lack of tubercles on the hypanthium and less prominently keeled sepals and from the latter in its lower habit and longer leaves, and usually more numerous pits on the fruit.

Notes. Only one of the specimens examined was in flower but two were in mature fruit. The flowering specimen had flowers that were as large as the largest recorded in *E. sessilis*, suggesting that it usually would have larger flowers than that species. More material is needed to confirm the status of this taxon but it appears to be distinct at least at the subspecific level.

In the relatively small sample of fruits opened in this study, all were either few-seeded or failed to produce a seed, and none had more than 1 fully developed seed in a single loculus although one loculus contained a viable seed and a late-aborted one. In fertile loculi, the seed was sometimes produced by the upper and sometimes by the lower ovule.

Enekbatus clavifolius* (S. Moore) Trudgen & Rye, *comb. nov.

Baeckea clavifolia S. Moore, *J. Linn. Soc. Bot.* 45: 176 (1920). *Type:* Belka [north of Bruce Rock], Western Australia, 1916, *F. Stoward* 305 (*holo:* BM 000603461; *iso:* MEL 72572).

Illustrations. Blackall & Grieve (1980: 77) [as *Baeckea clavifolia*]; drawings on *C.A. Gardner s.n.* Sept. 1932.

Shrub 0.4–1 m high; lateral branchlets mostly 3–12 mm long; flower galls often present. *Petioles* 0.1–0.4 mm long. *Leaf blades* obovate to broadly ovate in outline, 1.5–2.5(3.5) mm long, 0.5–0.8 mm

wide, 0.4–0.6 mm thick, obtuse, entire; abaxial surface usually with 2–5 prominent oil glands in each row; adaxial surface flat to slightly concave. *Bracts* 1 or 2, ovate or broadly ovate, 0.8–1.3 mm long, 0.5–1 mm wide, entire, with a prominent keel. *Bracteoles* depressed ovate, 1.3–1.6 mm long, 1.6–2 mm wide, overlapping to form a cup covering c. 3/4 of the hypanthium, thin, rather petaline, sometimes shiny, entire. *Flowers* 1(2) and terminal on the branchlets, usually 6–7 mm diam. *Hypanthium* 1.3–1.7 mm long; adnate portion more or less obconic, pustulate; free portion flared to 2–2.5 mm diam., sometimes sparsely pustulate. *Sepals* triangular to semi-elliptic, 0.6–1 mm long, 0.8–1.2 mm wide; keel herbaceous, thickened, red-brown; margins whitish-translucent, entire or minutely lacinate, closing inwards in fruit. *Petals* 2–2.5 mm long, medium pink to deep purplish pink, more or less entire, deciduous in fruit. *Androecium* of 10 stamens; antipetalous filaments 0.6–0.8 mm long; anthers 0.25–0.3 mm long. *Ovary* 3-locular; placentas near top of loculi; ovules 2 per loculus, collateral. *Style* 0.6–1.2 mm long; stigma 0.1–0.15 mm wide. *Fruit* broadly ovoid to almost globular with its apex sunken well below the top of the free tube of the hypanthium, 3.3–4.5 mm long, 3–4 mm diam., with base very thick and ossified but walls enclosing the seeds only moderately thickened, each loculus with a whitish scurfy layer apparently derived from the ovary wall enclosing both ovules or seeds; hypanthium tuberculate. *Seeds* 1 or 2 per loculus but often only 1 per fruit, irregularly obovoid (if two seeds present then tending to be flattened on surface where they abut one another), 1.4–1.8 mm long, 0.7–0.9 mm thick and not quite as wide as thick; testa thin, orange-brown, smooth, shiny, minutely areolate, partially covered by a whitish or brown scurfy layer, which adheres to the testa. (Figures 1A & 3A–D)

Selected specimens examined. WESTERN AUSTRALIA: Bruce Rock, 17 July 1970, *J.S. Beard* 5900 (PERTH); Merredin, 18 Sep. 1958, *W.H. Butler s.n.* (PERTH); Muntagin–Merredin, 15 Sep. 1963, *A.J. Cough* 129A (PERTH); Merredin, 31 Aug. 1926, *J.B. Cleland s.n.* [mixed material of three species] (AD); 6 km SE of Merredin and 4 km S of Callgar Rd, 31 Aug. 1985, *R.J. Cranfield* 5283 (PERTH); near Chandler Rd, 20 km NE of Merredin, Oct. 2002, *R. Davis* 10418 (PERTH); sources of Swan River, 1889, *M. Eaton s.n.* (MEL); Bullfinch–Mukinbudin road, 30 km from Mukinbudin, 28 Sep. 1997, *B.A. Fuhrer* 97/55 (PERTH); sandplains E of Bruce Rock, Sep. 1932, *C.A. Gardner s.n.* (PERTH); 13.7 km W of Bruce Rock towards Kellerberrin, 11 Sep. 1976, *B.C. Haberley* 304 (PERTH); 100 m along track on S boundary of Reserve 24125 off Chandler–Merredin road, c. 35 km SSW of Chandler, 29 Sep. 1997 & 24 Aug. 1999, *G.J. Keighery & N. Gibson* 2920 & 2923 (PERTH); Merredin, 29 Sep. 1923, *M. Koch* 2791 *p.p.* (MEL, NSW, PERTH); Merredin, 20 Nov. 1923, *M. Koch* 2791 *p.p.* (MEL, PERTH); Merredin, 8 Feb. 1923, *M. Koch* 2943 (MEL); between Cadoux and Koorda, 12 Sep. 1961, *R.D. Royce* 6649 (PERTH); 19.25 km SW of Chandler and 6.1 km from Brown Rd on Chandler–Merredin road, 15 Oct. 2003, *B.L. Rye* 231082 & *M.E. Trudgen* (AD, CANB, BRI, PERTH); Narkal Reserve, Koorda Shire, 11 Sep. 1998, *R. Storer* 191 (PERTH).

Distribution and habitat. Distributed in the inland part of the South West Botanical Province, from near Koorda east to near Champion and south-south-east to Bruce Rock: AW. Recorded in yellow or brown fine sand, in sandheath, open woodland and shrubland. One recent record is from yellow sandy soil over lateritic gravel, in *Allocasuarina acutivalvis*–*Melalaeuca uncinata* scrub over *Acacia longispinea*. A few of the earlier records suggest that the same genera may be important components of the vegetation at other localities, with *Eucalyptus* also noted for one locality. (Figure 4A)

Phenology. Flowers: mainly late August to late September, also one record in mid July. Fruits: recorded in October, November and February.

Conservation status. Not currently listed as a priority for conservation. It is possibly at risk because of its distribution in the largely cleared wheatbelt, its known range extending c. 135 km. However, it was reported to be common along the boundary of one reserve that was sampled in 1999 and was also common at one of the localities visited in the current study.

Affinities. Closely related to *Enekbatus cryptandroides*, but distinguished by the shorter hypanthium, which is more fully covered by the bracteoles, shorter petals, stamens and style, and narrower stigma. Most specimens of *E. clavifolius* have very small leaves, but occasionally the leaves are as large as those found in most specimens of *E. cryptandroides*. From the few fruiting specimens examined, it appears that the fruit of *E. clavifolius* is shorter and more densely and prominently tuberculate than that of *E. cryptandroides*, but both species are variable in the size of the tubercles on the hypanthium in flower. The former species also tends to be a taller shrub, to have shorter leaves with fewer and less prominent oil glands and to have more deeply coloured petals, but these characters overlap considerably. *Enekbatus clavifolius* is unusual in the genus in having a constant stamen number of ten, with one stamen opposite each sepal and petal. Ten is also the most common stamen number in *E. cryptandroides* but that species sometimes has up to 14 stamens.

The disjunction between the known ranges of the two species is in excess of 350 km. Consequently, the habitat of *E. cryptandroides*, which occurs much further inland, is much drier than that of *E. clavifolius*.

Notes. In fruit, the stamens tend to persist under the incurved sepals. Fruits are not particularly woody in this species, in comparison with other members of the genus, and damage by insects or other organisms is sometimes apparent.

***Enekbatus cristatus* Trudgen & Rye, sp. nov.**

Differt ab *Enekbato sessili* et *E. bounites* foliis longioribus, sepalis plus cristatis, petalis brevioribus, fructu tuberculatis.

Typus: Kalbarri National Park, Western Australia [precise locality withheld for conservation reasons], 13 August 1988, D.R. & B. Bellairs 911A (*holo:* PERTH 05830176).

Illustration. Drawings on C.A. Gardner 13271.

Shrub low and spreading, commonly 0.2–0.3 m high and c. 0.4 m wide but up to 1.2 m high; lateral branchlets mostly 1–10 mm long; flower galls often present. *Petioles* 0.1–0.3 mm long. *Leaf blades* narrowly oblong to linear in outline, 4–5 mm long, 0.3–0.4 mm wide, 0.3–0.4 mm thick, obtuse, entire; abaxial surface with midline groove, with 9–12 prominent oil glands per row. *Bracts* 1 or 2, narrowly ovate or ovate, shorter and more leaf-like than bracteoles. *Bracteoles* overlapping to form a tight cup round more than half to the whole of hypanthium, depressed ovate, 1.2–1.6 mm long, 1.4–2 mm wide, green or coloured on keel, broad scarious margins entire or laciniate. *Flowers* 1 or 2 terminating each branchlet, 7–9 mm diam. *Hypanthium* c. 1.5 mm long; adnate portion broadly hemispheric to broadly obconic, green, pitted; free portion flared to c. 3 mm diam., often reddish or purple-tinged. *Sepals* broadly to depressed ovate, 1–1.3 mm long, up to c. 2 mm wide; keel herbaceous, very prominent, reddish; margins whitish, scarious, minutely laciniate. *Petals* 2.5–3.3 mm long, pink, entire or crenulate, deciduous in fruit. *Androecium* of usually 20–25 stamens; antipetalous filaments 1.3–1.9 mm long; anthers 0.25–0.35 mm long. *Ovary* 4- or 5-locular; ovules 2 per loculus, superposed. *Style* c. 1.6 mm long; stigma 0.1–0.2 mm wide. *Fruit* depressed obovoid, not seen at maturity but apparently becoming very hard (ossified), the largest examined 2.2–2.4 mm long, c. 2.7–3 mm diam., partially reddish; hypanthium with numerous tubercles and small pits or just with pits. *Seeds* not seen.

Other specimens examined. WESTERN AUSTRALIA [precise localities withheld]: Kalbarri National Park, Aug. 1982, D.R. & B. Bellairs 1653A (PERTH); Kalbarri National Park, 13 Aug. 1988, D.R. & B. Bellairs 911A (PERTH); Kalbarri National Park, 21 Sep. 2001, D.R. & B. Bellairs 6204 (PERTH); lower Muchison River [Kalbarri], 21 Aug. 1961, C.A. Gardner 13271 (PERTH).

Distribution and habitat. Known only from Kalbarri National Park, in the north of the South West Botanical Province: GS. Recorded in yellow sand over sandstone in dense heath and in sand with gravel on sandplain. (Figure 4B)

Phenology. Flowers recorded mid August to late September, with young fruits in late September. Fruits measured on D.R. & B. Bellairs 6204.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. Apparently very restricted in distribution, but appears to be adequately protected as the few known populations occur in a large national park. Several recent attempts to relocate this species have failed, however, and further survey is required to determine its range.

Etymology. From the Latin *cristatus* – crested or ridged, referring to the prominently ridged sepals.

Affinities. Very closely related to *Enekbatus bounites* and *E. sessilis* but distinguished by its longer leaves and shorter petals and possibly tending also to have denser and more tuberculate patterning on the hypanthium in fruit.

Notes. This taxon occurs at the extreme north-west end of the range of the genus. It has more prominently keeled sepals than usual in the genus, and has the longest leaves so far recorded. The most mature fruits examined were prominently rugose, being tuberculate as well as pitted, but a smaller fruit examined was just pitted. More fruits are needed to investigate this further and obtain mature seeds to check the taxonomic status of this taxon, which appears from the few available specimens to be a distinct species.

A collection by C.A. Gardner 13271 includes an illustration above which an attached separate piece of paper records the ovule number as six per loculus and the stamen number as about 18. As the ovule number on this specimen is two per loculus and the stamen number for two flowers has been recorded as 23 and 25 respectively, perhaps the small attached piece should have been placed on a different specimen. The illustration does appear to match the specimen.

Enekbatus cryptandroides (F.Muell.) Trudgen & Rye, *comb. nov.*

Baeckea cryptandroides F.Muell., *Fragm.* 10, 29–30 (1876). *Type citation:* between Victoria Spring and Ularung, Young. *Type:* near Ularung [Ularring, Western Australia], 10–15 October 1875, J. Young s.n. (*holo:* MEL 72683; *iso:* MEL 72679).

Illustrations. Blackall & Grieve (1980: 80) [as *Baeckea cryptandroides*]; drawings on C.A. Gardner 2085.

Shrub 0.2–0.7 m high, often dense; lateral branchlets mostly 1–5 mm long; flower galls often present. *Petioles* 0.1–0.4 mm. *Leaf blades* narrowly obovate to oblong in outline, 2–3.5 mm long, 0.5–0.8 mm wide, 0.5–0.7 mm thick, obtuse, entire; abaxial surface with 4–7 oil glands in each row,

the oil glands very prominent in most specimens; adaxial surface flat to slightly concave. *Bracts* 1 or 2, ovate, 0.8–1.3 mm long, 0.5–2 mm wide, acuminate. *Bracteoles* semi-circular, 1–2 mm long, 1.3–2.5 mm wide, overlapping to form a cup covering *c.* 1/2 of the hypanthium, thin, petaline, sometimes shiny, edges entire to shallowly lacinate. *Flowers* 1(2) and terminal on the branchlets, 7–10 mm diam. *Hypanthium* 1.5–2.5 mm long, dark greenish red to red-purple or red-brown, the free portion sometimes more reddish than the adnate portion; adnate portion broadly to narrowly semi-ellipsoid or obconic, longer than free portion, minutely or distinctly tuberculate; free portion flared to 1.7–3.2 mm diam. *Sepals* semi-circular to semi-elliptic, 0.8–2 mm long, 1–2.4 mm wide; keel herbaceous, red-brown and sometimes with prominent glands; margins scarious, white, sometimes shallowly lacinate, closing inwards in fruit. *Petals* 3–4.5 mm long, often fairly deep pink in bud, usually pale pink at maturity, possibly sometimes white, margin crenate or crenulate, deciduous in fruit. *Androecium* of usually 10–12 stamens but up to 14; antipetalous filaments 0.9–1.5 mm long; anthers 0.3–0.5 mm long. *Ovary* 3-locular; placentas near top of loculus; ovules 2 per loculus, collateral. *Style* 1.3–2.2 mm long; stigma 0.2–0.3 mm wide. *Fruit* more or less obovoid with apex sunken well below the top of the free tube of the hypanthium, 5–8 mm long, *c.* 4 mm diam.; hypanthium tuberculate. *Seeds* not seen at maturity, but immature seeds apparently with a brownish scurfy layer adherent to their outer surface as in *E. clavifolius*. (Figure 3E–G)

Specimens examined (north-western area). WESTERN AUSTRALIA: 5 miles [8 km] N of Youanmi Downs Homestead, 8 Sep. 1973, *J.S. Beard* 6474 (NSW, PERTH); 19 miles [30 km] W of Sandstone, 12 Sep. 1966, *A.S. George* 7989 (PERTH); 14 miles [21 km] W of Sandstone, 17 Oct. 1972, *R.D. Royce* 10476 (PERTH).

Other specimens examined (south-eastern area). WESTERN AUSTRALIA: between Callion and Musson's Soak, W of Goongarrie, 10 Sep. 1970, *J.S. Beard* 6252 (NSW, PERTH); 24.5 km SSE of Sunday Bore, Perrinvale Station, 7 Sep. 1988, *R.J. Cranfield* 7136 (PERTH); 12 km SSW of Sunday Bore, Perrinvale Station, 7 Sep. 1988, *R.J. Cranfield* 7144 (PERTH); 13 km SSE of Perrinvale Homestead, 8 Sep. 1988, *R.J. Cranfield* 7173 (PERTH); Comet Vale, 9 Sep. 1927, *C.A. Gardner* 2085 (PERTH); proposed extension of Goongarrie National Park, 13 Sep. 1991, *D. McMillan & A. Chapman* 38/92 (PERTH); 3 km NE of Comet Vale townsite and 1.5 km NW of the edge of Lake Goongarrie, 10 Oct. 1980, *A.V. Milewski* 1060 (PERTH); Kurnalpi, Oct. 1980, *A.V. Milewski s.n.* (PERTH); 49 km on the roads between Pinjin and Bulong, 30°29'S, 122°24'E, 14 Oct. 1992, *L. Sweedman* S 2269 (PERTH).

Distribution and habitat. Occurs in the Eremaean Botanical Province, extending from near Sandstone south-east to Kurnalpi (east of Kalgoorlie): MUR. Recorded in yellow or brown clayey sand or red sand, in sandheath, open woodland and scrub. (Figure 4A)

Phenology. Flowers: early September to October. Fruits recorded in mid October.

Conservation status. This taxon has a fairly wide distribution and is not considered to be at risk.

Affinities. The morphological differences between this species and its close relative *Enekbatus clavifolius* are listed under the latter.

Notes. *Enekbatus cryptandroides* has a large geographic range and is quite variable, with north-western specimens tending to have larger leaves and flowers and more stamens than the south-eastern ones. The hypanthium may be minutely or fairly coarsely tuberculate. A specimen from the Callion area (*J.S. Beard* 6252) seems unusual in its very papillose disc.

No good fruiting material has been seen for this species but it appears that the bracteoles may occasionally be shed before the fruit reaches maturity. According to the protologue, there are one or two seeds per loculus, as in *Enekbatus clavifolius*. The fruits of *E. cryptandroides* appear, from the little material available, to be the largest in the genus and its leaves tend to be the thickest in the genus.

Enekbatus dualis* Trudgen & Rye, *sp. nov.

Differt ab *Enekbato sessili* staminibus paucioribus, petalis brevioribus, ovario 3-loculari, ab *E. stowardii* hypanthio pustulato ovulis superpositis, ab ambobus in bracteolis tantum 2 ornato.

Typus: east of Mullewa, Western Australia [precise locality withheld for conservation reasons], 4 July 1976, M.E. Trudgen 1688 (*holo*: PERTH 06229735; *iso*: AD, CANB, K, MEL, NSW).

Enekbatus roseus Trudgen & Rye ms.

Low dense *shrub*, 0.3–0.75 m high, commonly 0.8–2 m diam.; lateral branchlets mostly 0.5–3 mm long; flower galls absent. *Petioles* 0.1–0.3 mm long. *Leaf blades* slightly incurved, narrowly obovate to more or less oblong in outline, 0.8–2.3 mm long, 0.3–0.5 mm wide, 0.3–0.4 mm thick, obtuse (the broadly obtuse apex sometimes with a minute mucro), entire, medium green throughout to largely reddish, the red colouration most pronounced on apex and often along abaxial surface; abaxial surface usually with 2–6 prominent oil glands in each row. *Bracts* absent. *Bracteoles* not encircling hypanthium, ovate to very broadly ovate and somewhat folded, 0.6–1.2 mm long, 0.4–1 mm wide, usually obtuse, with a thickened reddish incurved keel and thin clear-hyaline border that is much broader at the base than around the apex, entire, persistent on young fruit but shed before fruit reaches maturity. *Flowers* commonly either 2 opposite and subterminal or solitary on the branchlets, 5.5–7.5 mm diam. *Hypanthium* c. 1.5 mm long; adnate portion obconic, dark green to deep red-purple, pustulate, the pustules often much paler but sometimes dark; free portion flared to 1.5–2.2 mm diam., often partially or fully coloured deep red-purple. *Sepals* broadly to shallowly triangular, 0.4–0.7 mm long, 0.6–1.1 mm wide, acute, closing inwards in fruit; keel herbaceous, reddish, thickened, incurved; margins petaloid, entire. *Petals* 2.2–2.7 mm long, deep pink or pink-purple, crenulate to entire, deciduous in fruit. *Androecium* of 12–15 stamens; antipetalous filaments 1–1.5 mm long; anthers c. 0.3 mm long. *Ovary* 3-locular; placentas about half way up loculus; ovules 2 per loculus, superposed. *Style* 1–1.5 mm long; stigma up to 0.2 mm wide. *Fruit* very broadly or depressed obovoid, 2.2–3.5 mm long, 2.5–3.2 mm diam., very hard (ossified) and with the loculi partially divided transversely by a hard septum into 2 compartments one above the other, 1- or 2-seeded as far as known; hypanthium somewhat irregularly tuberculate at first but becoming smooth. *Seeds* broadly reniform to broadly obovoid, 1.2–1.5 mm long, 0.8–1.1 mm thick and almost as wide; testa thicker than in other members of the genus, deeply colliculate or shallowly tuberculate, pale to golden brown, with no adherent layer. (Figures 1B, C & 3H–M)

Selected specimens examined. WESTERNAUSTRALIA [precise localities withheld]: Pindar, 29 Aug. 1964, A.M. Ashby 1059 (AD, PERTH); Pindar, 16 Aug. 1967, A.M. Ashby 2229 (AD, PERTH); Pindar, 10 Aug. 1967, J.S. Beard 4969 (KPBG); between Mullewa and Geraldton, June 1963, Y. Chadwick 1713 (PERTH); on the Mullewa to Yalgoo road, 6 Aug. 1969, H. Demarz D1456 (KPBG); Mullewa, 18 Aug. 2005, J. Docherty 352 (PERTH); no locality or date, C.A. Gardner 13345 (PERTH); Pindar, 25 Aug. 1957, J.W. Green 1578 (PERTH); Ninghan Station, 2 Aug. 2000, M. Hislop 2084 (PERTH); ESE of Mullewa, 13 Aug. 1999, G.J. Keighery & N. Gibson 2919 (PERTH); E of Pindar, 21 July 1994, S. Patrick 1905 (PERTH); E of Mullewa, 6 Aug. 1994, S. Patrick 1943 (PERTH); Pindar, 6 Oct. 1994,

S. Patrick 2058 (PERTH); E of Mullewa, 7 July 1995, *S. Patrick* 2329 (PERTH); Mellenbye Station, 17 Aug. 1993, *A.L. Payne* 3787 (PERTH); Pindar, 20 Sep. 1968, *M.E. Phillips* WA/68 1380 (CBG, NSW, PERTH); E of Pinjar, 9 Sep. 2003, *B.L. Rye* 239052 & *M.E. Trudgen* (CANB, K, PERTH).

Distribution and habitat. Occurs mainly in the Eremaean Botanical Province but extends into the South West Botanical Province, occurring from near Mullewa east to near Wurarga and south to Mellenbye Station: AW, YAL. Occurs in soil pockes in granite or laterite and in deeper soils of varied kinds, commonly recorded with *Acacia*, sometimes also with mallee eucalypts or *Melaleuca uncinata*. (Figure 4A)

Phenology. Flowers: June to late August. Fruits: recorded in September and October. From the few mature fruits examined it appears that the fruits are commonly 1- or 2-seeded; when they are 2-seeded the seeds may be produced in the same loculus or in different loculi.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Recorded probably from more than five localities extending over a range of at least 70 km. The species appears to be locally common (*S. Patrick* pers. comm.), with at least one population recorded as having 1000 plants.

Etymology. From the Latin *dualis* – of two, referring to the presence of only two small bracteoles subtending each flower in this species and also the common occurrence of two flowers together on a branchlet.

Affinities. The affinities of this very distinctive species are not clear. *Enekbatus sessilis* is similar to it in having small narrow leaves, a pitted hypanthium and superposed ovules, but can readily be distinguished by the presence of one or more small bracts, its larger bracteoles and its 4- or 5-locular ovary.

Notes. *Enekbatus dualis* has the narrowest leaves and smallest flowers in the genus and the greatest tendency for divaricate branching. It appears that populations growing in soil pockets on exposed rock tend to be divaricately branched and non-layering while those on deeper soil tend to be more acutely branched and layering, but more observations are needed to confirm this.

Having bracteoles that tend to be longer than wide and do not encircle the hypanthium differentiates this species from all other members of the genus and, in this respect *Enekbatus dualis* is similar to most members of other genera in the reniform-seeded group. It also shows the greatest similarity to those genera in its seed shape and the presence of a somewhat thicker, deeply colliculate or shallowly tuberculate testa, with no adherent layer, suggesting that *E. dualis* has retained some of the primitive characters for its genus.

It is also unusual in that flower galls, which are fairly common in other members of the genus, have never been observed at any of the populations sampled, although stem galls are occasionally present (e.g. *M.E. Phillips* WA/68 1380). The stem galls are almost globular, but with prominent projecting parts, and 2–4 mm in diameter.

All of these unusual characters suggest that *Enekbatus dualis* is the most genetically isolated member of the genus.

Enekbatus eremaeus* Trudgen & Rye, *sp. nov.

Differt ab *Enekbato cryptandroide* hypanthio intra bracteolas plene incluso, textura sepalorum uniformi, petalis persistentibus, staminibus plus numerosis, fructu depresso-globulari ad apicem convexo.

Typus: 13 miles [21 km] north-east of Wiluna, Western Australia, 28 July 1963, *A.S. George* 5607 (*holo*: PERTH 06229727; *iso*: AD, CANB, K, MEL, NSW).

Baeckea eremaea C.A. Gardner ms. *Proposed type*: between Anketell and Sandstone, Western Australia, 17 August 1931, *C.A. Gardner* 2498 (PERTH).

Baeckea eremophila C.A. Gardner ms. *Proposed type*: between Wilson's Patch and Lake Darlot, Western Australia, 15 September 1927, *C.A. Gardner* 2166 (PERTH).

Baeckea aff. cryptandroides in J.P. Jessop, *Fl. Central Australia* 257 (1986).

Illustrations. Drawings on *C.A. Gardner* 2498 and *D.J. Pearson* 131.

Shrub 0.4–1 m high, 0.4–1 m diam.; lateral branchlets 1–8 mm long; flower galls often present. *Petioles* 0.2–0.6 mm long. *Leaf blades* narrowly oblong to obovate in outline, 1.3–3.7 mm long, 0.5–0.8(1.1) mm wide, 0.4–0.5 mm thick, apex obtuse to truncate, with small hyaline processes (present on at least some of the leaves) near apex, often 1 on each side of apex resembling small horns with or without smaller ones present, sometimes 3 or more similar-sized ones present; abaxial surface semiterete with a midline groove, with 4–6 prominent oil glands per row; adaxial surface flat to slightly concave. *Bracts* 2, obovate to obcordate, 1.3–1.6 mm long, 1–2.2 mm wide, with a very narrowly ovate herbaceous centre that often extends past the broad lacinate petaloid edges. *Bracteoles* semi-circular, 2.1–3.5 mm long, 2.8–4.5 mm wide, overlapping to form a tight cup obscuring the hypanthium, petaloid, white, often shiny, entire. *Flowers* 1(2) and terminal on the branchlets, 7.5–10.5 mm diam. *Hypanthium* 1.6–3 mm long; adnate portion broadly hemispheric; free portion flared to 2.5–3.5 mm diam. *Sepals* semi-circular, 1.5–2.6 mm long, 1.5–2.8 mm wide, not obviously keeled, delicate and somewhat scarious, white-translucent, lacinate, fairly erect in fruit. *Petals* 3–4 mm long, medium to deep pink, crenulate, persistent in fruit. *Androecium* of 17–22 stamens; antipetalous filaments 1.3–2.2 mm long; anthers 0.35–0.4 mm long. *Ovary* 3-locular; placentas near the top of loculus; ovules 2 per loculus, collateral. *Style* 1.6–2.5 mm long; stigma 0.2–0.3 mm wide. *Fruit* hidden within the bracteoles and covering of persistent floral parts (sepals, petals, stamens and style), depressed globular, *c.* 2 mm long, *c.* 2.5 mm diam., hard, 1-seeded as far as known; hypanthium covering the basal half, paler than top half (disc) and protruding laterally beyond it where the two halves join, often whitish, prominently rugose with an irregular patterning of densely packed tubercles tending to form longitudinal ribs; upper half with numerous small pits. *Seeds* almost ellipsoid with a flattened margin adjacent to the collateral abortive seed or unfertilised ovule, 1.4–1.6 mm long, 0.8–1.2 mm wide and thick; testa orange-brown to medium brown, somewhat shiny, minutely colliculate or areolate. (Figure 2B–F)

Selected specimens examined. WESTERN AUSTRALIA: Anketell which is E of Mount Magnet on the Sandstone road, 13 Sep. 1968, *A.M. Ashby* 2595A (AD, PERTH); 11 miles [18 km] NW of Wonganoo Station, 13 Sep. 1973, *J.S. Beard* 6542 (NSW, PERTH); 40 km S of Doolgunna Homestead on the Diamond Well–Mooloogool road, 10 July 2007, *G. Byrne* 2742 (PERTH); Boulder, 1900, *W.D. Campbell s.n.* (PERTH); 10 km N of Sandstone, Black Range Station on southern boundary fence,

14 Sept. 2005, *V. Clarke* VTC BR 10 (PERTH); 76 km from Cue on the Cue to Cogla road, 16 Aug. 1985, *H. Demarz* 10639 (PERTH); 42.5 km S of Sandstone, 14 Aug. 2000, *M. Hancock* 859 (NSW, PERTH); Victoria Desert Camp 57 [30° 06' S, 123° 54' E], Elder Exploring Expedition, 20 Sep. 1891, *R. Helms s.n.* (AD, MEL, NSW); 30 km W of Yeelirrie Homestead, 14 Aug. 1982, *A.A. Mitchell* 1011 (PERTH); 3.2 km E of Brealya Well, N of Cogla Downs Station on Nallan–Sandstone road, 22 June 1995, *S. Patrick* 2277 (PERTH); 7.5 km NW of Streich Mound, Queen Victoria Spring Nature Reserve, 28 Oct. 1992, *J.D. Pearson* 2935 (PERTH); 14 miles [21 km] SE of Murchison Downs Station, along the Rabbit Proof Fence, 28 Aug. 1958, *N.H. Speck* 1310 (AD, CANB, NSW, PERTH); 25 km S of the Agnew turnoff on the Leonora to Leinster road, 10 Oct. 1984, *C. I. Stacey* 757 (PERTH); Erliston Station, Laverton, 18 Aug. 1995, *D. True* OS 92 (PERTH); 40 km NE of Bandyu Homestead which is 100 km N of Laverton, 27 Aug. 1968, *Paul G. Wilson* 7356 (AD, PERTH).

Distribution and habitat. Distributed in the south-western part of the Eremaean Botanical Province and in the South-western Interzone: COO, GVD, MUR. Recorded from Diamond Well Station south to Boulder and from near Meekatharra east to Rason Lake. The Boulder record is based on a single old collection and might either be a vague locality or an outlier as there have been no other collections from that vicinity. *Enekbatus eremaeus* is most commonly found on red sand in spinifex sandplain but also occurs in low open woodland with *Eucalyptus gongylocarpa* and spinifex and amongst herbs on yellow sand in dune swales. (Figure 4B)

Phenology. Flowers: July to October. Mature fruits: late October to late November. Mature fruits observed on *J.D. Pearson* 131 (1 only) and *J.D. Pearson* 2935 (many fruits).

Conservation status. This species is the most common and widely distributed member of the genus.

Etymology. The specific epithet alludes to the occurrence of this species in the Eremaean. It extends inland almost to the centre of the State.

Affinities. *Enekbatus eremaeus*, and apparently also its closest relative *E. longistylus*, differ from other members of the genus in having petals persistent as well as sepals at the summit of the mature fruit, which is completely hidden from view. The other species lose the petals and tend to also lose the stamens and/or style later.

Enekbatus longistylus occurs in a less arid region and differs in its shorter, broader leaves with hyaline processes extending along the margins, longer stamens in comparison with the sepal and petal length, and longer style.

Notes. This is one of the two species of *Enekbatus* with an entirely Eremaean distribution and it extends much further inland than the other species. Gardner apparently first intended to name this new species *Baeckea eremophila* based on one of his specimens collected in 1927, but in the 1930s he opted for a different name with a similar meaning, *Baeckea eremaea*. In choosing an epithet for this species, we have adopted the latter of Gardner's names since this was used for several specimens. A brief description of the species was given in *Flora of Central Australia* (George & Trudgen 1981) as *Baeckea aff. cryptandroides*.

The fruits of this species and its closest relative, *Enekbatus longistylus*, appear to be smaller than in other members of the genus, with thin walls between the loculi, but are still very hard at maturity and are more difficult to cut open than those of *E. clavifolius*, perhaps partly because of their more

spherical shape. Their complete covering by the glossy bracteoles and persistent floral parts may also play a role in protecting the seeds from insect attack. Despite the large number of collections of this species, mature fruits are scarcely known and more fruiting material is certainly needed.

Enekbatus longistylus* Trudgen & Rye, *sp. nov.

A *Enekbato eremaeo* affinis sed foliis latioribus atque brevioribus marginibus magis fimbriatis, staminibus et stylo longioribus differt.

Typus: Perenjori area, Western Australia [precise locality withheld for conservation reasons], 11 September 2003, B.L. Rye 239083 & M.E. Trudgen (holo: PERTH 06764487; iso: CANB, K, MEL, NSW).

Shrub 0.2–1 m high, commonly 0.8–1 m across; lateral branchlets mostly 0.5–4 mm long; flower galls often present. *Petioles* 0.1–0.3 mm long. *Leaf blades* obovate or oblong to almost circular in outline, 0.8–1.5 mm long, 0.6–1.3 mm wide, 0.2–0.4 mm thick, truncate, the keel often forming a prominent subterminal abaxial swelling, the margins with small hyaline rim and shortly fringed with slender hyaline processes; abaxial surface with prominent oil glands usually 3 or 4 per row. Bracts 2, more or less entire, broadly to depressed ovate, 1.1–2 mm long, 1.3–2.5 mm wide, with thick brown keel sometimes/often extending beyond the broad petaloid edges. *Bracteoles* depressed ovate, 1.8–2.5 mm long, 3.6–4.6 mm wide (when flattened), greatly overlapping to form a tight cup obscuring the hypanthium, petaloid, white, shiny. *Flowers* 1(2) and terminal on the branchlets, 7–10.5 mm diam. *Hypanthium* 1.4–2.2 mm long; adnate portion broadly obconic to shallowly cup-shaped; free portion flared to 2–3.5 mm diam. *Sepals* broadly or very broadly ovate, 1.2–2.1 mm long, 1.5–2.5 mm wide, scarious, not obviously keeled, shiny white as for bracteoles, more or less entire. *Petals* 3–5 mm long, pale to medium pink, crenate, closing to erect in older flowers, apparently persistent in fruit. *Androecium* of 19–24 stamens; antipetalous filaments 2.5–3 mm long; anthers *c.* 0.4 mm long. *Ovary* 3-locular; placentas near top of loculus; ovules 2 per loculus, collateral. *Style* 2.8–3.6 mm long; stigma 0.15–0.2 mm diam. *Fruit* hidden within the bracteoles and covering of persistent floral parts (sepals, petals, stamens and style), not seen at maturity, the largest seen depressed ovoid and *c.* 1.6 x 2.3 mm, hard, apparently 1-seeded; hypanthium apparently shorter than upper part (disc) but protruding laterally beyond it where the two parts join, both parts fairly smooth. (Figure 2G,H)

—44—

Selected specimens examined. WESTERN AUSTRALIA [precise localities withheld]: E of Perenjori, Sep. 1934, E.M. Barker 30 (PERTH); E of Tardun, 27 Sep. 1973, J.S. Beard 6699 (NSW, PERTH); Koolanooka, 19 Sep. 1931, C.A. Gardner 2681 (NSW, PERTH); Perenjori, Nov. 1953, C.A. Gardner 12157 (AD, PERTH); S of Morawa, 2 Oct. 1962, F. Lullfitz L1615 (PERTH); S of Morawa, 2 Oct. 1962, M.E. Phillips WA/62 1720 (CBG, NSW, PERTH); E of Perenjori, 11 Sep. 2003, B.L. Rye 231014 & M.E. Trudgen (CANB, K, PERTH); E of Perenjori, 11 Sep. 2003, B.L. Rye 231015 & M.E. Trudgen (AD, PERTH).

Distribution and habitat. Endemic to the South West Botanical Province, extending from near Tardun south-east to the Perenjori area: AW. Most commonly found in sandplain, often on yellow sand in *Acacia*- and *Melaleuca*-dominated vegetation. The type locality had dull brownish yellow silty fine sand, with *Acacia* high open scrub to high shrubland over *Melaleuca* high shrubland over *Ecdeiocolea* open sedgeland over *Borya* open herbland and annual Asteraceae. (Figure 4B)

Phenology. Flowers September to October. Immature fruits recorded in early October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Recorded from at least five localities over a range of c. 100 km. Not known from any conservation reserves.

Etymology. The specific epithet, derived from two Latin words, refers to the long style of this species.

Affinities. See notes under its closest relative, *Enekbatus eremaeus*.

Notes. This is a very distinctive species that can be identified by its leaves alone. It has longer stamens and a longer style than all other members of the genus. Good fruiting material is still needed. Leafy galls are sometimes present on the specimens; these are bright red at first, becoming dark grey with age.

Enekbatus planifolius* Trudgen & Rye, *sp. nov.

Ab *Enekbato stowardii* affinis sed foliis latioribus et planioribus et ovario 2- vel 3-loculari differt.

Typus: north of Morawa, Western Australia [precise locality withheld for conservation reasons], 9 September 2003, *B.L. Rye* 239042 & *M.E. Trudgen* (holo: PERTH 07536798; iso: MEL, NSW).

Shrub 0.4–1.1 m high, commonly 0.8–1.2 m diam., with multiple branches from the base; lateral branchlets mostly 1–8 mm long; flower galls often present. *Petioles* 0.3–0.6 mm long. *Leaf blades* narrowly obovate, 3.5–4.5 mm long, 1.1–1.4 mm wide, 0.1–0.3 mm thick, obtuse, entire; abaxial surface with usually 3–5 prominent oil glands per row. *Bracts* usually solitary, broadly ovate, shorter and more keeled than the bracteoles. *Bracteoles* 2, entire, often partially reddish especially on the keel, overlapping to form a cup concealing the anthopodium but only c. 1/4 of the hypanthium, very broadly or depressed ovate, 1.2–1.5 mm long, up to 1.6 mm wide, rather prominently keeled, margins pale yellow-green, firm (not scarious), entire. *Flowers* 1 or 2 terminating each branchlet or in each axil, 7–8 mm diam. *Anthopodium* often visible, up to 0.5 mm long. *Hypanthium* c. 2.5 mm long; adnate portion obconic, pitted, green; free portion flared to 2–2.5 mm diam., deep red-purple. *Sepals* very broadly or depressed ovate, 0.7–1.2 mm long, usually 1–1.3 mm wide; keel reddish; margins whitish, entire. *Petals* 2–3 mm long, medium to deep pink or purplish pink, deciduous in fruit. *Androecium* of 13–15 stamens; antipetalous filaments c. 1.3 mm long, darker pink and much broader at the base than the other filaments; anthers c. 0.25 mm long, dull yellow-green with a pale green gland. *Ovary* 2- or 3-locular; ovules 2 per loculus, collateral. *Style* 1.3–1.5 mm long, pink; stigma c. 0.15 mm wide, yellowish. *Fruit* obovoid, 2–2.5 mm long, 1.5–1.8 mm wide, summit convex, toughly fibrous, 1- or 2-seeded; hypanthium appearing smooth but with numerous minute pits. *Seeds* irregularly obovoid, 1.3–1.5 mm long, 0.7–0.9 mm wide, often not as thick as wide; testa becoming orange-brown, minutely colliculate and with a much larger pattern of shallow circular depressions superimposed on the very numerous colliculae, with no adherent layer. (Figure 1D)

Other specimens examined. WESTERN AUSTRALIA [precise localities withheld]: type locality, 13 Oct. 2003, *B.L. Rye* 231002 & *M.E. Trudgen* (CANB, K, PERTH); type locality, 13 Oct. 2003, *B.L. Rye* 231001 & 231003 & *M.E. Trudgen* (PERTH); SE of type locality, 13 Oct. 2003, *B.L. Rye* 231004 & *M.E. Trudgen* (PERTH); W of type locality, 13 Oct. 2003, *B.L. Rye* 231009 & *M.E. Trudgen* (AD, BRI, PERTH).

Distribution and habitat. Occurs in the South West Botanical Province, known from a very small area north of Morawa: AW. Occurs mainly in brown silty fine sand, possibly over lateritic gravel, in *Acacia-Melaleuca* open scrub, also recorded in a more saline area with mallees. (Figure 4A)

Phenology. Flowers recorded from early September to early October, with mature fruits in October.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. This species appears to be very geographically restricted and is known from one large population estimated to contain several thousand plants and another nearby population that is much smaller.

Etymology. From the Latin *planus* – flat and *folium* – leaf, this species having flatter leaves than any other member of the genus.

Affinities. Very closely related to *Enekbatus stowardii*, being similar particularly in its bracteoles, hypanthium and seed testa, but that species can be distinguished by its narrower leaves, and its 3- or 4-locular ovary. The two taxa are geographically distinct, with *E. planifolius* occurring just north-west of the range of *E. stowardii*.

Notes. In this recently discovered taxon, all or a good proportion of the flowers have a 2-locular ovary, and there is an anthopodium up to 0.5 mm long. Other members of the genus have a 3–5-locular ovary and their flowers are fully sessile or on an anthopodium up to 0.35 mm long. The reduced number of loculi in *E. planifolius* may be responsible for its seeds tending to be broader than thick rather than thicker than broad.

Enekbatus sessilis* Trudgen & Rye, *sp. nov.

Bracteolae pro parte maxima hypanthii occultae. Corolla in fructu descidua. Stamina 16–25. Ovarium 4- vel 5-loculare; ovula 2 per loculum, superposita. Fructus depresso-obovoideus, lignosus, foveolatus. Semina testa subcrustacea, colliculata, brunnea.

Typus: Great Northern Hwy, 14.1 km N of Wubin, Western Australia, 30 August 1975, M.E. Trudgen 1416 (*holo:* PERTH 06229743; *iso:* AD, CANB, K, MEL_{nat}, NSW).

Illustration. Drawings on W.E. Blackall 2795.

Shrub often low or domed, 0.3–0.6(1.2) m high, commonly 0.5–1.2 m diam.; lateral branchlets 0.5–1.5 mm long; flower galls often present. *Petioles* 0.1–0.2 mm long. *Leaf blades* narrowly oblong to almost ovate in outline, mostly 1–2 mm long (rarely with some longer leaves up to 3.5 mm present as well), 0.4–0.6 mm wide, 0.3–0.4 mm thick, obtuse, entire; abaxial surface with midline groove, mostly with 3–6 prominent oil glands per row. *Bracts* 1 or 2, narrowly ovate to ovate with acuminate apex or more leaf-like, commonly 0.5–2 mm long, 0.8–2 mm wide. *Bracteoles* overlapping to form a tight cup round 2/3 to the whole (usually *c.* 3/4) of hypanthium, semi-circular, 1.3–2.2 mm long, 1.6–3 mm wide, thin, green or white, margins entire or minutely lacinate. *Flowers* 1(2) and terminal on the branchlets, 8–11 mm diam. *Hypanthium* 1–2 mm long; adnate portion broadly hemispheric to broadly obconic, green, pitted; free portion flared to 2–3 mm diam., often reddish or purple-tinged. *Sepals* broadly to depressed ovate, 0.8–1.5 mm long, 1.2–3 mm wide; keel herbaceous, pink to maroon or red-brown and pitted at base; margins white, scarious, entire or minutely lacinate. *Petals* 2.5–4.5 mm long, very pale to medium pink or purplish pink, entire or crenulate, deciduous in fruit. *Androecium*

of 16–25 stamens, usually 20 or 21; antipetalous filaments 1.1–1.6 mm long, white with pink base; anthers 0.25–0.35 mm long. *Ovary* 4- or 5-locular; placentas attached half way up loculus; ovules 2 per loculus, superposed. *Style* 1–1.6 mm long; stigma 0.1–0.2 mm wide. *Fruit* depressed obovoid or globular, 2.5–4 mm long, 3–4 mm diam., very hard (ossified), commonly 1- or 2-seeded; hypanthium with widely spaced to moderately dense, small pits. *Seeds* broadly obovoid or of other compact shapes, often thicker than broad, 1.1–1.4 mm long, 0.7–1.2 mm thick; testa thin, golden brown, very densely and minutely colliculate, largely covered by an adherent rugose layer. (Figures 1E & 2I–L)

Selected specimens examined. WESTERN AUSTRALIA: Yuna, Sep. 1930, *E. Ashby* 2608 (ADW, NSW); 6.5 km SSW of Oxley Hill along Drew Rd, which is NE of Arrino, 25 Sep. 1990, *R.J. Cranfield* & *P.J. Spencer* 7845 (PERTH); Wilroy railway siding, which is 18.3 km SE of Mullewa, 19 Sep. 1985, *J. D'Alonzo* 307 (PERTH); 10 km NE of Wubin, c. 0.3 km along Richards Rd from Great Northern Highway, 26 Aug. 1998, *R. Davis* 6495 (PERTH); 214 km from Mount Magnet on Geraldton road, 26 Oct. 1963, *D.W. Goodall* 1710 (PERTH); N of Peterson Rd, c. 12 km S of Wubin, 13 Sep. 1996, *M. Hislop* 496A,B (PERTH); Bunjie Siding, 26.3 km S of Perenjori, *N. Hoyle* 280 (PERTH); Canna, 3 Sep. 1926, *E.H. Ising s.n.* (AD); Wongan Hills, 14 Aug. 1982, *G.J. Keighery* 5997 (PERTH); near Moora, Aug. 1959, *F.R. Morrison s.n.* (NSW, PERTH); Ajana, 20 July 1967, *E.B.J. Smith s.n.* (PERTH); on Yammapool Rd, 6.25 km S of Catto Rd and 0.4 km N of Neates Rd, 29°16'S, 115°48'E, 8 Sep. 2003, *B.L. Rye* 239026–239028 & *M.E. Trudgen* (PERTH); 9 km E of Burakin, 31 Aug. 1975, *M.E. Trudgen* 1431 (PERTH); 2.7 km N of Wubin, 0.5 km S of Stewart Rd on Midlands Rd, 14 Oct. 2003, *B.L. Rye* 231042 & *M.E. Trudgen* (CANB, MEL, PERTH).

Distribution and habitat. Occurs mainly in the South West Botanical Province, extending slightly into the Eremaean Botanical Province: AW, GS, YAL. Extends from just north of the Murchison River south-east to Wongan Hills and to just east of Burakin. Found on yellow to orange-brown fine sand, sometimes over laterite or with gravel. It occurs in a variety of vegetation types including *Eucalyptus* open mallee or low woodland, and scrub of *Acacia*, *Allocasuarina* and/or *Melaleuca*, also recorded in low heath at disturbed sites. (Figure 4C)

Phenology. Flowers: late July to September, the northern populations beginning flowering earlier than the southern ones. Fruits recorded from mid September to October. Seeds measured from *D.W. Goodall* 1710 and *B.L. Rye* 293107 & *M.E. Trudgen*.

Conservation status. This species appears to be relatively common.

Etymology. From the Latin *sessilis* – sitting, used in the botanical sense for lacking a stalk, in reference to the sessile flowers.

Affinities. Very closely related to *Enekbatus bounites* and *E. cristatus*, differing as noted under those two taxa, which possibly should be regarded as subspecies of *E. sessilis*.

Enekbatus sessilis mostly has shorter leaves less than 2 mm long and only 3–6 main oil glands in the rows closest to the midvein whereas the other two taxa have longer leaves with 7–12 main oil glands.

Notes. A fairly widespread and variable species. A particularly variable population was sampled from west of Perenjori (*M.E. Trudgen* 2243A–E). To illustrate the degree of variation, specimen C had large leaves up to c. 3.5 mm long with up to 8 oil glands and large flowers with petals 4.5 mm long, whereas

specimen A had smaller leaves with fewer oil glands and small flowers with petals only 2.5 mm long, also differing in its sepals being more distinctly keeled. Despite their differences in size, all flowers sampled from both specimens were 5-locular, with the loculi located opposite the sepals.

In this species the bracteoles cover most or all of the hypanthium in flower but only a small proportion of the mature fruit. The small bracts below are usually well defined but are sometimes scarcely differentiated from the leaves, differing from the leaves directly below only in having the base somewhat broadened and flattened. While there are many specimens with immature fruits, mature fruits have very rarely been collected.

Enekbatus stowardii (S.Moore) Trudgen & Rye, *comb. nov.*

Baeckea stowardii S.Moore, *J. Linn. Soc.* 45: 176 (1920). *Type*: Cowcowing, Western Australia, 1916, F. Stoward 316 (*holo*: BM 000603462; *iso*: MEL 73053).

Illustrations. Blackall & Grieve (1980: 80) [as *Baeckea stowardii*]; drawings on W.E. Blackall 2847 and C.A. Gardner 2706.

Shrub (0.3)0.6–1.3 m high, commonly 0.6–1.2 m wide, sometimes tangled; lateral branchlets 1–5(12) mm long; flower galls often present. *Petioles* 0.1–0.3 mm long. *Leaf blades* oblong to obovate in outline, 1.7–4 mm long, 0.5–0.8 mm wide, 0.35–0.6 mm thick, obtuse, entire; abaxial surface with usually 3–5 very prominent tuberculate oil glands per row. *Bracts* usually solitary, ovate or broadly ovate, 0.6–1.3 mm long, up to 1 mm wide, prominently keeled. *Bracteoles* entire, often partially reddish especially on the keel, more or less semi-circular, 1.3–1.5 mm long, 1.5–2.5 mm wide, overlapping to form a cup covering 1/4–1/3 of the hypanthium, firm (not scarious). *Flowers* 1(2) and terminal on the branchlets, 6–13 mm diam. *Hypanthium* 1.5–3 mm long; adnate portion obconic, pitted, grey-green; free portion flared to 2–3 mm diam., deep red-purple. *Sepals* depressed ovate or very depressed, 0.6–1.1 mm long, 1.3–2.2 mm wide; keel herbaceous, reddish, not prominent; margins scarious, white, lacinate. *Petals* 2–4 mm long, very pale to medium pink, crenulate, deciduous in fruit. *Androecium* of 13–19 stamens; antipetalous filaments 0.9–1.5 mm long; anthers 0.25–0.35 mm long. *Ovary* 3- or 4-locular; ovules usually 2 per loculus, collateral, rarely with 1(2) additional ovules superposed. *Style* 1–2 mm long; stigma 0.15–0.2 mm wide. *Fruit* obovoid, 2.3–4 mm long, 2–2.5 mm diam., toughly fibrous, commonly 1- or 2-seeded; hypanthium appearing smooth but with numerous minute pits. *Seeds* irregularly obovoid or broadly so to almost reniform, 1.3–1.6 mm long, 0.7–0.8 mm wide, 0.75–0.9 mm thick; testa thicker than most other species, golden brown, minutely colliculate and with a much larger pattern of shallow circular depressions superimposed on the very numerous colliculae, with no adherent layer. (Figures 1F,G & 2M–P)

Selected specimens examined. WESTERN AUSTRALIA: NE of Perenjori, 24 Aug. 1971, T.E.H. Aplin 4844 (PERTH); 80 km S of Wubin, 9 Aug. 1963, J.S. Beard 2584 (PERTH); 8 km NE of Mt Gibson turnoff on Wubin–Paynes Find road, 29 Aug. 1976, R. Coveny 7906 & B.R. Maslin (NSW, PERTH); Karara Station, W of shearing shed, 29° 11' S, 116° 41' E, 25 Oct. 1992, L.A. Craven, F.A. Zich & A.M. Lyne 8903 (PERTH); c. 70.7 km NE of Wubin on the Great Northern Highway, 22 Sep. 1985, J. D'Alonzo 486 (PERTH); Wubin, 5 Sep. 1959, S. de la Hunty (PERTH); Koorda, 24 Sep. C.A. Gardner 2738 (PERTH); 217 mile peg on the Paynes Find road, 20 Aug. 1973, H. Demarz 4351 (PERTH); 12 km ESE of Latham, 14 Aug. 1997, F. Keast L6D 245 (PERTH); 19.5 km SE of Spencer Rd on Rabbit Proof Fence Rd, c. 54 km SE of Perenjori, 28 July 1996, T.R. Lally 1105 & B.J. Lepschi (PERTH); Wubin, 24 Sep. 1963, J. Landy s.n. (MEL); Taylor Rd, 3 km W of Old Well Rd and 0.2 km

E of Benton Rd, E of Latham, 13 Oct. 2003, *B.L. Rye* 231028 & *M.E. Trudgen* (AD, BRI, CANB, PERTH); 1.0 km W of Martin Rd on Chisholm Rd, 29°51'S, 116°38'E, 11 Sep. 2003, *B.L. Rye* 239103 & *M.E. Trudgen* (HO, MEL, NSW, PERTH).

Distribution and habitat. Occurs mainly in the South West Botanical Province, extending slightly into the Eremaean Botanical Province: AW, YAL. Extends from the Perenjori area south-east to Cowcowing. Recorded mainly in gravelly or lateritic soils with some clay, in shrublands, often including *Acacia* and *Melaleuca* species, and in mallee woodlands. (Figure D)

Phenology. Flowers: mainly July to September. Fruits: recorded late October. Mature fruits have been observed on *Craven, Zich & Lyne* 9803.

Conservation status. The range of this species is about 200 km long and many populations have been recorded.

Affinities. See notes under *Enekbatus planifolius*, which is the closest relative of *E. stowardii*. Geographically, *E. stowardii* overlaps considerably with *E. sessilis* but can readily be distinguished from that species in having the ovules collateral rather than superposed.

Notes. The illustration of this species in Blackall & Grieve (1980: 80) shows the bracteoles covering more than normal of the hypanthium although the remainder of the illustration and the notes are accurate for *Enekbatus stowardii*. Perhaps the flower illustrated was still in bud or perhaps that part of the illustration was actually of *E. sessilis*.

Flower size is extremely variable in *E. stowardii*, with flowers ranging from 8 to 13 mm diameter observed in a single population east of Perenjori (*B.L. Rye* 23102 & *M.E. Trudgen*, *B.L. Rye* 23103 & *M.E. Trudgen*). Variation in stamen number is not as great in *E. stowardii* as in some of the other species, with most specimens having 15–17 stamens. However, this species is perhaps the most variable in its gynoecium, with 3- and 4-locular ovaries both common and in very rare instances with superposed as well as collateral ovules.

Acknowledgements

Commencement of work on this plant group was made possible by financial support from the Australian Biological Resources Study during the early 1980s; preliminary descriptions were prepared by Sandra Maley at that time for some members of the new genus revised here. Completion of this work has been supported by recent ABRS funding. We are very grateful to Peter Wilson for keeping us informed of the progress of the molecular studies of *Enekbatus* and related genera, to Paul Wilson for translating the diagnoses into Latin, to Annemarie Wilson for the illustrations, to Skye Coffey for scanning the illustrations, and to the directors and staff of AD, BM, BRI, CANB, CBG, MEL and NSW for the loan of specimens. We are also grateful to Terry Macfarlane and a referee for their helpful comments on drafts of this paper.

References

- Bentham, G. (1867). *Flora Australiensis*. Vol. 3. (L. Reeve: London.)
- Blackall, W.E. & Grieve, B.J. (1980). *How to know Western Australian wildflowers*. Part 3A. Revised 2nd ed. by B.J. Grieve. (University of Western Australia Press: Nedlands, WA.)
- George, A.S. & Trudgen, M.E. (1981). *Baeckea* L. In: Jessop, J. (ed.) *Flora of central Australia*. (Reed Books: Sydney.)
- Houston, T.F. (2000). *Native bees on wildflowers in Western Australia*. Special Publication no. 2 (Western Australian Insect Study Society: Perth.)
- Johnson, L.A.S. & Briggs, B.G. (1984). Myrtales and Myrtaceae – a phylogenetic analysis. *Annals of the Missouri Botanical Garden* 71: 700–756.
- Moore, S. le M. (1920). A contribution to the flora of Australia. *Journal of the Linnean Society* 45: 159–220.
- Mueller, F. (1876). Myrtaceae. In: *Fragmenta phytographiae Australiae*. Vol. 10, pp. 22–31. (Auctoritate Guberni Coloniae Victoriac: Melbourne.)
- Schauer, J.C. (1843). Genera Myrtacearum nova vel denuo recognita. *Linnaea* 17: 235–244.
- Thackway, R. & Cresswell, I.D. (eds) (1995). *An Interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program. Version 4*. (Australian Nature Conservation Agency: Canberra.)
- Trudgen, M.E. (1986). Reinstatement and revision of *Rinzia* Schauer (Myrtaceae, Leptospermeae, Baeckeinaceae). *Nuytsia* 5(3): 415–439.
- Trudgen, M.E. (2001). Reinstatement and revision of *Euryomyrtus* (Myrtaceae). *Nuytsia* 13(3): 543–566.
- Western Australian Herbarium (1998–). *FloraBase – The Western Australian flora*. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/> [accessed July 2010]
- Wilson, P.G., Heslewood, M., Lam, N. & Quinn, C. (2004). Progress towards a phylogeny of the *Chamelaucium* alliance (Myrtaceae). *Australian Biologist* 17: 28–33.
- Wilson, P.G., O'Brien, M.M., Heslewood, M.M. & Quinn, C.J. (2005). Relationships within Myrtaceae *sensu lato* based on a *matK* phylogeny. *Plant Systematics and Evolution* 251: 3–19.



Trudgen, M. E. and Rye, B L. 2010. "Enekbatus, a new Western Australian genus of Myrtaceae with a multi-locular indehiscent fruit." *Nuytsia: journal of the Western Australian Herbarium* 20, 229–259.

<https://doi.org/10.58828/nuy00416>.

View This Item Online: <https://www.biodiversitylibrary.org/item/313771>

DOI: <https://doi.org/10.58828/nuy00416>

Permalink: <https://www.biodiversitylibrary.org/partpdf/349976>

Holding Institution

Royal Botanic Gardens Victoria

Sponsored by

Atlas of Living Australia

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Western Australian Herbarium

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <http://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.