

# A revision of the leafless species of *Templetonia* (Fabaceae: Brongniartieae)

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## Introduction

*Templetonia* R.Br. is a genus of subshrubs and shrubs in tribe Brongniartieae (Fabaceae). It is one of six genera endemic in Australia in a tribe that also includes Central American and South American genera. *Templetonia*, as this study commenced, comprised ten species of which four, *T. egena* (F.Muell.) Benth., *T. battii* F.Muell., *T. sulcata* (Meisn.) Benth. and *T. smithiana* J.H.Ross appear to form a natural group based on several features, the most obvious being an apparent lack of leaves. The latter three actually develop a rudimentary leaf and pair of stipules at each node, while *T. egena* develops a scale. For the most part, these structures wither and fall. The group is also distinguished from leafy species of *Templetonia* by their relatively small flowers, short pedicels, brown-chartaceous bracts and bracteoles, and few-seeded, non-partitioned pods. All are much-branched shrubs growing to more than 1 m high and occur in semi-arid and arid parts of southern Australia, with only *T. egena* extending into northern Australia. The greatest diversity is in Western Australia and South Australia.

*Templetonia* is distinguished from other Australian genera in the Brongniartieae by the absence or sparseness of indumentum, broad bracts and bracteoles, and calyces with lower lobes imbricate in bud and with a tapering upper lip. The abundant reddish glandular material in leaf axils is also distinctive, although species of *Hovea* R.Br. and at least two American genera also develop these glands to some extent. In terms of calyx shape, *Templetonia* is most similar to the American genus *Brongniartia* Kunth. Although morphological data supports the monophyly of *Templetonia*, nuclear DNA data provides no support for a sister relationship between the leafless *T. egena* and a group of four leafy species (Thompson *et al.* 2001). Note that two additional species in the phylogenies presented in Thompson *et al.* (2001) and named as *Templetonia biloba* (Benth.) Polhill and *T. incana* have since been transferred to *Cristonia* J.H.Ross and *Thinicola* J.H.Ross respectively (Ross 2001).

*Taxonomic history of leafless species:* The first species described in the group was *Templetonia sulcata* in 1844, as *Bossiaea sulcata* Meisn. In the 1850s *Templetonia egena* was described; it was placed initially

## Abstract

A revision of the leafless species of *Templetonia* R.Br. (Fabaceae: tribe Brongniartieae) is presented. Two new species are described, *T. incrassata* I.Thomps. and *T. ceracea* I.Thomps. In addition, *Bossiaea rossii* F.Muell. is resurrected and recombined as *Templetonia rossii* (F.Muell.) I.Thomps. Distribution maps and identification keys are presented.

**Keywords:** taxonomy, semi arid regions, Australia.

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in *Daviesia* Sm. and soon after in *Bossiaea* Vent. by Mueller. *Bossiaea rossii* was described in 1862. Bentham, in *Flora Australiensis*, transferred most of these taxa to *Templetonia*, but *Bossiaea rossii* F.Muell. was instead treated as a synonym of *Templetonia sulcata*. In 1887 *Templetonia battii* was described. Much later, a revision by Ross (1982) maintained the long-standing recognition of three species. However, soon after, Ross (1984) described *T. smithiana*, an entity he segregated from *T. sulcata*.

The need for a revision of the leafless species of *Templetonia* was identified while reviewing the tribe Brongniartieae for the *Flora of Australia* project. The pattern of morphological variation elucidated by the author in this study called for the number of leafless species of *Templetonia* to be increased from four to seven.

## Methods

The pattern of morphological variation in the leafless group in *Templetonia*, as reflected in the taxonomy presented below, was determined through examination of herbarium material with the aid of a dissecting microscope. Assessment of floral morphology was aided by the reconstitution of dried flowers in hot water with added detergent. Specimens from AD, BRI, CANB, DNA, MEL and PERTH were examined.

Taxonomically useful characters recognised in this study include: the thickness, spinescence, degree of divergence, surface texture, waxiness, and depth of grooves of branches; the degree of development and persistence of rudimentary leaves; the presence of stipules; the length of pedicels; the scaliness and apical morphology of the bracteoles; the ovule number and length and stoutness of the style; the size and glandularity of pods; the size of seeds; and the size, lobation and dissection of the aril.

## Taxonomy

### *Templetonia* R.Br., in W.T.Aiton, *Hortus Kew.*, 4: 269 (1812)

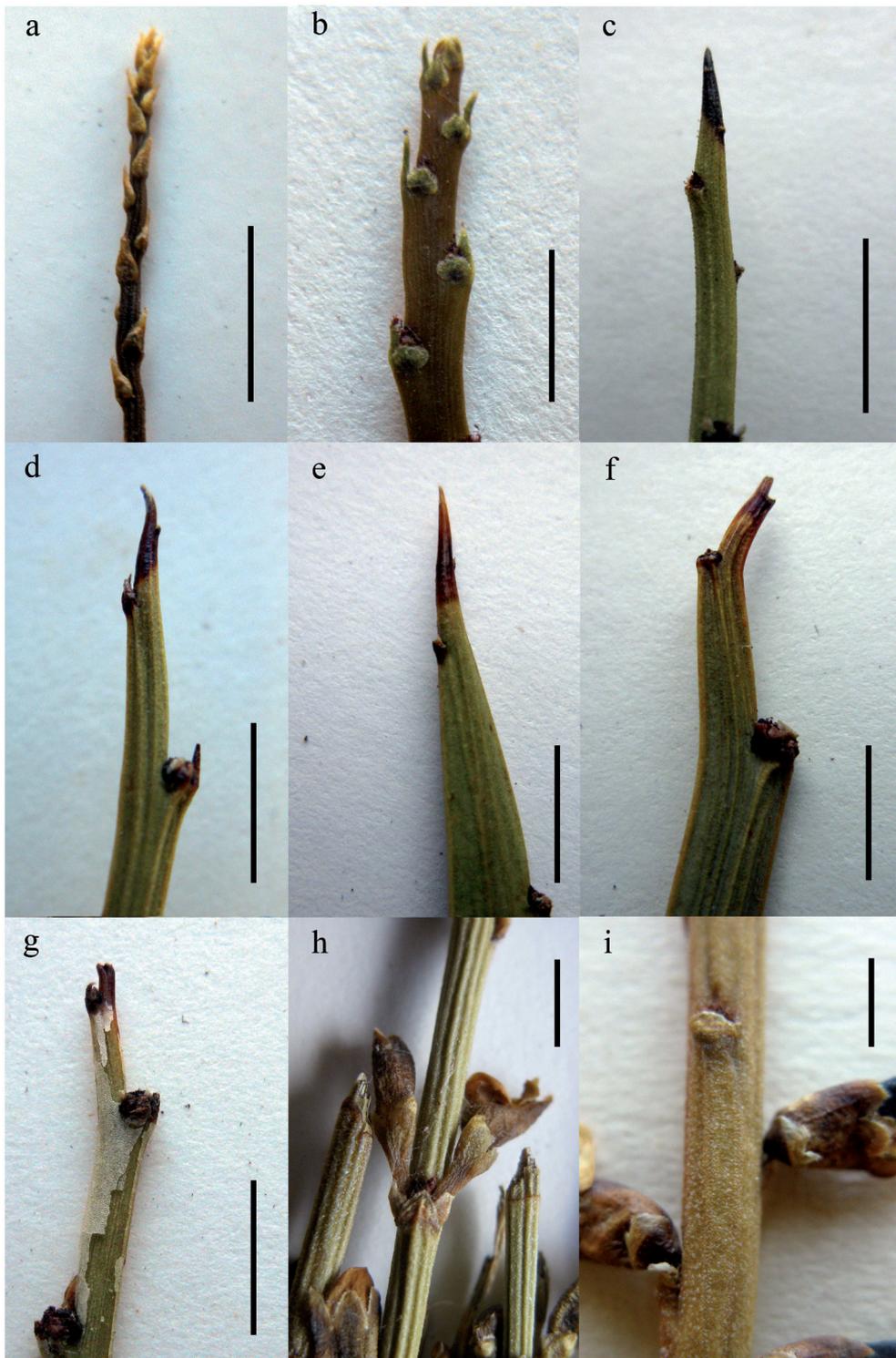
**Type:** *Templetonia retusa* (Vent.) R.Br.

The six leafy species of *Templetonia* develop either petiolate simple leaves with a green lamina more than 5 mm long and more than 1 mm wide, or they develop

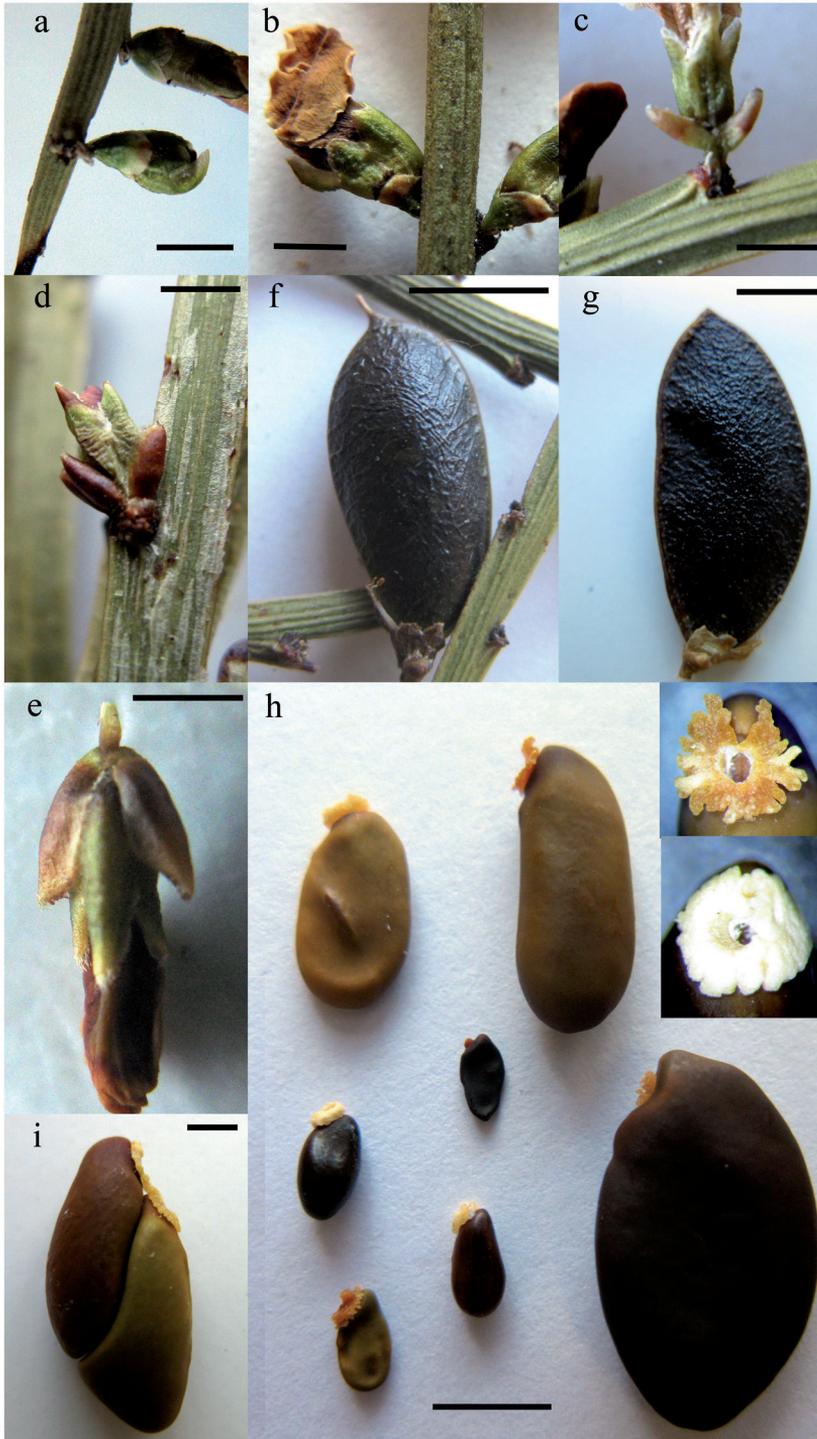
compound leaves with leaflets > 5 mm long. Other features which distinguish them from the leafless taxa include the longer flowers and pedicels, and the parallel-sided, more numerous-seeded, and mostly internally partitioned pods. *Templetonia aculeata* (F.Muell.) Benth. occasionally loses all of its leaves, but is recognised as a species in the leafy group by the features described above and by its conspicuous pungent stipules and its hairiness.

### A circumscription of the leafless species of *Templetonia*

*Shrubs* to c. 3 m high, mostly as wide as or wider than high, generally much-branched, glabrous apart from ciliolate margins on bracts, bracteoles and calyces. *Branches* longitudinally ridged or angular, terete or flattened, sometimes slightly flexuose, sometimes tapering terminally and then sometimes spine-like; axils containing abundant reddish glandular material. *Leaves* rudimentary, developed at most nodes, most often withering and falling; stipules triangular, to c. 1 mm long, variably chartaceous, typically eroding to their base; a scale sometimes developed instead of a leaf and stipules. *Inflorescences* axillary, with flowering branches bearing flowers at several to numerous consecutive nodes, with 1 or 2 flowers per node, flowers opening  $\pm$ simultaneously; bract basal, commonly brown, chartaceous; bracteoles inserted near base of calyx, often shortly connate, overlapping calyx tube, broad-ovate, orbicular or oblate, convex abaxially, herbaceous basally abruptly transitional to a chartaceous portion of varying extent, and which is predominantly brown but transparent distally. *Calyx* with tube equal to or longer than lobes; upper lip tapering; lower medial lobe the longest, straight or incurved, sometimes chartaceous distally; standard slightly longer than wings and keel, limb mostly cuneate, yellow with an inner purple-brown zone encircling a pale throat, wings with various proportions of purple-brown and yellow; keel pale throughout or purplish distally; stamens monadelphous, anthers dimorphic with dorsifixed anthers alternating with the longer basifixed anthers; ovary glabrous, 2–7-ovulate; style 2–4 mm long; stigma capitate. *Pods* almost spreading or more often suberect, short-stipitate, elliptic to oblong-elliptic in profile, 7–28 mm long, slightly to moderately



**Figure 1. Branches. a–b. New growth. a.** *Templetonia egena* (J.G. Luehmann, 1890 MEL); **b.** *T. rossii* (B.Hadlow 565 CANB). **c–g. Branch termini c.** *T. battii* (W.R. Archer 1009951 MEL); **d.** *T. sulcata* (H. Eichler 15913 AD); **e.** *T. smithiana* (A. Webb & B. Muir 272 PERTH); **f.** *T. rossii* (E.N.S. Jackson 755 AD); **g.** *T. ceracea* (M. Phillips CANB 035493). **h–i. Ridging. h.** *T. egena* (R.D. Royce 6588 PERTH); **i.** *T. incrassata* (A.S. George 2718 PERTH). Scale bars: a–g = 5 mm; h–i = 2 mm.



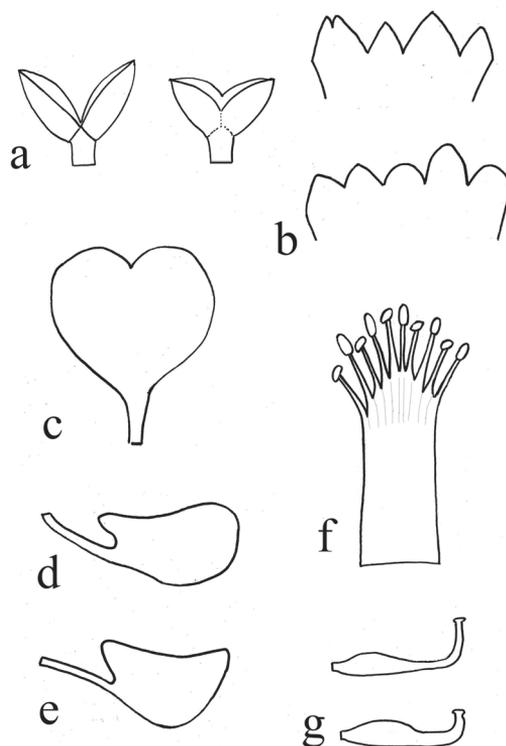
**Figure 2. Flowers, fruit and seeds. a–e. Flowers. a.** *Templetonia battii*, bud (W.R. Archer 1009951 MEL); **b.** *T. battii* (M. Hislop 2269 PERTH); **c.** *T. sulcata*, view from below (H. Eichler 15913 AD); **d.** *T. ceracea*, bud, corolla just emerging (T.R. Lally 1122 AD); **e.** *T. rossii*, view from above (M.D. Crisp 986 PERTH). **f–g. Pods. f.** *T. sulcata* (M.G. Corrick 11466 CANB); **g.** *T. incrassata* (P.S. Short 2308 & L. Haegi AD). **h–i. Seeds** (all more or less full size but immature seeds partly collapsed). **h.** Comparison of species, from **l to r: top row:** *T. egena* (Browning AD), *T. incrassata* (D.E. Symon 1115 AD; upper inset showing aril); **middle row:** *T. sulcata* (B. Smith s.n. PERTH; lower inset showing aril), *T. ceracea* (Koch MEL); **bottom row:** *T. battii* (Ashby 39 AD), *T. rossii* (B. Archer 485 PERTH), *T. smithiana* (C. Chapman, 25.xi.1972 PERTH); **i.** *T. egena*, seeds from one pod (K.D. Rohrlach 697 AD). Scale bars: **a–e, i = 2 mm; f–h = 5 mm.**

compressed, not partitioned, 1- or 2(or 3)-seeded; valves sometimes dotted with glands. *Seeds* ellipsoid to oblong-ellipsoid, plump to somewhat compressed, 4–16 mm long, brown; hilum subapical; aril annular, c. circular or elliptic, wall variously thick, often with frilly lateral outgrowths, mostly cleft at summit; vertical lobe mostly present, arising apico-laterally; orifice 0.2–0.5 mm wide.

**Notes on morphology:** BRANCHES (Fig. 1): Branches of all species have conspicuous prominences at nodes which are made more conspicuous by the presence of dark glandular material. The compressed branches seen in some species are reminiscent of those of the leafless *Bossiaea* species such as *B. walkeri*, but the *Templetonia* species are more prominently longitudinally ridged and they are more uniformly compressed. The leafless *Bossiaea* species also do not have glandular material in axils.

LEAVES AND STIPULES (Fig. 1): In most species linear leaf rudiments c. 0.5 mm wide are present on new growth, and these sometimes persist beyond the initial growth phase. Often the rudiments are only 1–2 mm long, but may be as long as 4 mm. Leaves do not have a discernible petiole but on close inspection the blade is seen to be strongly concave. Associated with each leaf is a pair of small, erect, triangular stipules. Best development of leaves occurs beyond the first four or five nodes and examination of fully grown branches for persistent rudimentary leaves should be directed at these nodes. Occasionally the lowermost node or two has a scale only and this is equivalent to the normal situation in *T. egena* and *T. incrassata* (described below). Figure 1b shows the progression of development of leaves and stipules along a branch. More basal stipules are often brown and chartaceous distally but further along a branch are entirely pale green. Over time leaves and stipules wither and become eroded so that often only the base of the structure remains as a ridge (coloured brown in Fig. 2c). The pale branch-margins in species with flattened branches are continuous with leaf rudiments, whereas the ridges on the faces trace to stipule bases and become more prominent nearer this termination (Fig. 2c).

In *T. egena* and *T. incrassata*, two of the three species with terete branches, a single scale is developed instead of a rudimentary leaf and paired stipules (Fig. 1a). The shape of these scales is more or less constant along a



**Figure 3. Flower parts (semi-diagrammatic, generalised).** a. bracteoles, free and connate; b. calyx lobes (*Templetonia rossii* & *T. ceracea* type at top); c. standard; d. wing; e. keel; f. androecium, opened out; g. pistil (*T. battii* bottom). Scale (approximate) a–e.  $\times 5$ ; f.  $\times 6$ ; g.  $\times 4$ .

branch. Scales also gradually become eroded with age.

BRACT AND BRACTEOLES (Figs 2 & 3): Bracts occupy a similar position to stipules and when two flowers arise from a node the two bracts can resemble a pair of stipules. They can be distinguished on close inspection as they will be inserted inner to a ridge which is the basal remnant of a stipule. Bracteoles are important in discriminating species. All species have bracteoles inserted more or less immediately below the receptacle and they extend over the calyx tube at anthesis. In some species they are connate while in others they are more or less free (Fig. 2a–d, 3a). They are green and often somewhat fleshy proximally, then abruptly change to chartaceous and brown. This brown zone less abruptly changes to a more or less clear zone distally and sometimes laterally. The apex and margins are generally ciliolate, and they develop splits to different extents depending on the species. The relative proportions of the green, brown and clear zones vary between species but are fairly constant

Key to species of *Templetonia*

Note: Branch widths or diameters are measured mid-internode. All measurements given in the key and descriptions are based on dried material.

- 1 Branches erect to suberect, terete, blunt at terminus; a triangular scale developed at nodes.....**2**
- 1: Branches moderately divergent, flattened, or if ever terete then also tapering into a spine-like terminus; a pair of triangular stipules and a leaf rudiment developed at nodes (often only obvious on new growth).....**3**
- 2 Flowering-branch diameter mostly < 1.5 mm, with ridges well-defined; pedicels > 1 mm long at flowering; standard-limb 3–4 times length of claw; pods commonly < 18 mm long.....**1. *T. egena***
- 2: Flowering-branch diameter mostly > 1.5 mm, with ridges generally poorly defined; pedicels < 1 mm long at flowering; standard-limb c. 2 times length of claw; pods mostly > 18 mm long.....**2. *T. incrassata***
- 3 Branches terete; bracteole usually with a tuft of glandular material at apex; style c. 2 mm long.....**3. *T. battii***
- 3: Branches flattened; bracteoles with glandular material absent or in minute amounts; style c. 3 mm long.....**4**
- 4 Branches spine-like (tapering and becoming terete, c. 0.1–0.2 mm wide at tip); bracteoles brown and chartaceous in distal 2/3 only; lower medial calyx lobe incurved not brown-chartaceous; flower buds rounded at apex.....**5**
- 4: Branches not spine-like (tapering but flattened and at least 0.5 mm wide at tip); bracteoles almost entirely brown and chartaceous; lower medial calyx lobe straight, brown-chartaceous distally, flower buds acute at apex.....**6**
- 5 Pods 5–6 mm wide, 10–13 mm long; seeds 3.5–4.5 mm long; flowering branches 1.5–3.5(–4.5) mm wide, sometimes minutely papillose.....**4. *T. sulcata***
- 5: Pods 9–12 mm wide, 15–28 mm long; seeds 9–16 mm long; flowering branches 3–8 mm wide, smooth.....**5. *T. smithiana***
- 6 Branches not encrusted with epicuticular wax; flowering branches 2–7 mm wide; ovaries 2- or 3-ovulate; aril > 1 mm wide, frilly.....**6. *T. rossii***
- 6: Branches encrusted with epicuticular wax that lifts in sheets; flowering branches 1–3(–4) mm wide; ovaries 4-ovulate; aril < 1 mm wide, entire.....**7. *T. ceracea***

within a species. Minute amounts of reddish or dark glandular material may be detectable amongst the ciliolate apex in most species; however, in *T. battii* there is substantially more and it commonly forms a distinct tuft at the apex (Figs 2a–d).

FLOWERS (Fig. 2a–e & Fig. 3): The calyx is entirely or mostly green. It is sometimes somewhat fleshy and then tends to dry dark. The lower medial lobe of the calyx is brown and chartaceous apically and straight in *T. rossii* and *T. ceracea* at and before anthesis, but in other species it is green except for the clear margin and is distinctly incurved. This is particularly obvious in the flower bud where it covers other lobes of the calyx (Fig. 2a). The calyces of *T. rossii* and *T. ceracea* are also different in the structure of the upper lip. The two lobes are either completely fused or the apices of the two lobes are only slightly divergent and because of obscuring hairs, appear to be completely fused (Fig. 2e). Figure 3b shows the two fundamental types of calyx lobe morphology.

The standard in all species is arched upwards when viewed from the side prior to anthesis, and this is similar to the upwards curvature of both wings and keel. Anther dimorphism is conspicuous, with basifixed anthers approximately twice the length of the basifixed anthers (Fig. 3f). In *T. incrassata* the ratio is slightly greater than 2. As appears to be typical of the Brongniartieae, one stamen tends to become free from the sheath markedly more proximally than the other stamens; however, no free vexillary stamen has been recorded in this group. The sheath apex (with sheath opened out and flattened) is gently rounded except in *T. egena* in which it is commonly nearly truncate or even slightly emarginate.

PODS AND SEEDS: A feature of this group is the relatively high ratio of ovules to seeds. In many instances, less than half the ovules of an ovary are fertilised. Careful opening of semi-mature pods reveals the remnant ovules.

There is considerable variation in seed size in this

group. The outgrowths from the aril margin that give it a frilly appearance is seen in four of the species and is unique within the Brongniartieae. In two species the margin is crenate, while in *T. ceracea* the aril wall is entire. There appears to be some variability in extent of frilliness within species. The aril's vertical lobe is conspicuous in most species, but is indistinct in *T. egena* and apparently absent in *T. incrassata*.

Several of the species are illustrated in Ross (1982). For *T. sulcata* (Ross 1982, figure 13), illustrations a–i are drawn from *T. rossii*, and the presentation of anther size is inaccurate. The seed of *T. smithiana* is illustrated in Ross 1982, figure 15a–d as *T. sulcata*.

### 1. *Templetonia egena* (F.Muell.) Benth., *Fl. Austral.* 2: 170 (1864)

*Daviesia egena* F.Muell., *Trans. & Proc. Victorian Inst. Advancem. Sci.* 1854–55: 118 (1855); *Bossiaea egena* (F.Muell.) F.Muell., in W.J.Hooker, *Hooker's J. Bot. Kew Gard. Misc.* 8: 43 (1856).

**Type:** South Australia. Murray scrub towards Morundam, *F. Mueller*, ii.1851, lecto: MEL20345, *fide* J.H. Ross, *Muelleria* 5: 18 (1982).

*Shrubs* to c. 3 m high, sometimes with branches weeping; flowering branches  $\pm$ erect, straight, 0.8–1.5 mm in diameter, terete, mostly with well-defined ridges, not glaucous, not tapering terminally; new growth 0.5–0.8 mm in diameter. *Scale* present at nodes instead of leaf rudiments and stipules, triangular-ovate, 1–1.5 mm long. *Pedicels* 1–3 mm long; bract c. 1 mm long; bracteoles 1–1.5 mm long, shortly connate, chartaceous in distal half to third. *Flower buds* with apex rounded; calyx 2.5–4 mm long, tube 2–2.5 mm long, sinus of upper lip 0.5–1 mm deep with apices separated; median lower lobe moderately to much longer than other lobes, not chartaceous or brown; standard 5.5–9 mm long, limb c. as wide as long, claw 1–1.8 mm long; wings 5–8 mm long, 1.5 mm wide, claw c. 1.8 mm long; keel 5–7 mm long, 2 mm wide, pale greenish or tinged purple distally, claw c. 1.5 mm long; stamen-sheath c. 1.5 mm wide flattened-out; ovary 5- to 8-ovulate; style 2.5–4 mm long. *Pods* c. elliptic in profile, (11–) 13–18(–22) mm long, 5–11 mm wide, 1- or occasionally 2-seeded; valves dotted with minute glands. *Seeds* compressed-ellipsoid, 7–9(–11) mm long, 3.5–5 mm

wide, brown; aril 1.5–3.5 mm in diameter, with fine lateral outgrowths, cleft at summit distinct, vertical lobe not or only obscurely evident.

**Selected specimens of c. 300 examined:** **WESTERN AUSTRALIA.** 1 km SE of Mindi Springs, Hamersley Range National Park, *M.E. Trudgen* 7241, 15.x.1990 (PERTH); 14.9 km NNE of Bullen Hill, Little Sandy Desert, *S. van Leeuwen* 5124, 5.ix.2002 (CANB, PERTH); c. 101 km S of Munjina Roadhouse on Northern Hwy, *A.A. Mitchell* PRP1004, 3.xi.1995 (PERTH); Tom Price mine site, *K. Atkins*, 10.ix.1980 (PERTH). **NORTHERN TERRITORY.** 9 km W of Idracowra – Palmer Valley boundary, *J.R. Maconochie* 2432, 14.ix.1978 (AD, BRI, CANB, DNA, MEL 2000125); 2 km SE of Princes Bore, Alcoota Station, *B. Strong*, 20.xi.1979 (DNA); 8 km S of Yuendumu, *T.S. Henshall* 2822, 5.xii.1979 (CANB, DNA, MEL 567854). **SOUTH AUSTRALIA.** 32 km S of Yunta, *N.N. Donner* 3715, 2.x.1971 (AD, BRI); Willochra, c. 20 km NE of Quorn, *R. Hill* 1401 (AD, CANB); 'Gluepot' station, c. 12 km NE of homestead, c. 103 km NW of Renmark, *I. Crawford* 4439 (AD, CANB, MEL 2270988, NSW); Kunatjara, Tomkinson Ranges, *A. Kalotas* 1433, 15.xi.1982 (AD, DNA). **QUEENSLAND.** c. 24 km SSE of Blackwater township, *M. Lazarides & R. Story* 56, 6.ix.1961 (BRI, CANB, MEL 1507638). **NEW SOUTH WALES.** Broken Hill, *A. Morris* 62, 28.xi.1919 (MEL 564728); Boppy Mount area, Cobar, *J.B. Cleland*, 14.ix.1911 (AD, MEL 564727); c. 12 km E of Balranald on road to Hay, *M.E. Phillips*, 31.viii.1962 (CANB, DNA); Kimberley Station, c. 80 km SE of Cockburn, *E.F. Constable*, 25.vii.1955 (DNA, NSW); Harvey Ranges, *J.L. Boorman*, xi.1905 (BRI, NSW). **VICTORIA.** Redcliffs, N of town between railway line and road, *M.G. Corrick* 7463 (AD, MEL 592031); Meringur Bushland Reserve, 15 km E of Mortlake, *A.C. Beaglehole* 57011, 31.x.1977 (MEL); Swan Hill, *J.G. Luehmann*, 1890 (MEL); Mildura, *H.B. Williamson*, 9.xii year unknown (MEL); Wemen, Robinvale District, *A.R. Begg*, viii.1960 (MEL).

**Distribution and habitat:** Occurs in southern, central and north-eastern Western Australia, southern Northern Territory, South Australia, central-eastern Queensland, western and central New South Wales, and north-western Victoria (Fig. 4). Grows in sandy soils in woodland, grassland and shrubland.

**Flowering period:** Flowers late winter to summer.

**Notes:** The upper calyx lobes of *T. egena* are similar to the lateral lobes but slightly more triangular and are fused in the proximal third to half. Occasional 2-seeded pods have been seen in which the seeds are abnormally shaped due to a lack of room for normal expansion (Fig. 2i). The aril in *T. egena* is highly variable in diameter and the degree of dissection of the margin. Based on a

small survey of flowers, the stamen sheath of *T. egena* differs slightly from the other leafless species in the shape of the apex of the stamen sheath and the free filament portion is relatively long. In other species of *Templetonia* the sheath apex is rounded (Fig. 3f). *Templetonia egena* is one of two species to have a scale at nodes, *T. incrassata* being the other. These two species are further distinguished from other leafless species of *Templetonia* by the bead-like appearance of the epidermis (seen under magnification), their relatively erect branches, their pod valves with glands more conspicuous at maturity, and the relatively small or absent aril lobe.

## 2. *Templetonia incrassata* I.Thomps., sp. nov.

*A. T. egena* (F.Muell.) Benth. *ramis crassioribus sulcis non profundis plerumque glaucis, pedicellis brevioribus, leguminibus longioribus, seminibus longioribus differt.*

**Type:** SOUTH AUSTRALIA. 22 km south of Mount Christie Corner, Mobella Station, 30°31'11"S, 133°30'03"E, F.J. Badman 8257, 3.ix.1995; holo: AD 99647245; iso: AD 99644643.

*Erect shrubs* to c. 2.5 m high; flowering branches suberect, straight, 1.5–2.5 mm in diameter, terete, with generally poorly defined ridges, often glaucous, not tapering terminally; new growth c. 1 mm in diameter. *Scale* present at nodes instead of leaf rudiments and stipules, triangular-ovate, 0.6–1.2 mm long. *Pedicels* 0.3–1 mm long; bract c. 1 mm long; bracteoles 1.5–2.2 mm long, shortly connate, chartaceous in distal third. *Flower buds* with apex rounded; calyx 3–4.5 mm long, tube 2–3.2 mm long, sinus of upper lip c. 0.5 mm deep with apices separated; median lower lobe slightly to much longer than other lobes, not chartaceous or brown; standard 5.5–8 mm long, limb slightly wider than long, claw 2–2.5 mm long; wings 5–7 mm long, 2 mm wide, claw 2.5 mm long; keel 5–6.5 mm long, 2.2 mm wide, generally dark purple distally, claw 2 mm long; stamen sheath c. 1.8 mm wide flattened-out; ovary 6-ovulate; style 2.5–3.5 mm long, slender distally. *Pods* obliquely; oblong-elliptic in profile, mostly 16–25 mm long, 7–10 mm wide, 1(or 2)-seeded; valves dotted with minute glands. *Seeds* oblong-ellipsoid, 9–14 mm long, 4–5 mm wide, brown; aril 1.5–3 mm in diameter, with wall crenate to deeply lobate, vertical lobe not evident.

**Selected specimens of c. 40 examined:** WESTERN AUSTRALIA. c. 12 km S of Menzies, A.S. *George* 2718, 21.viii.1961 (PERTH); c. 38 km E of the intersection of the Mt Jackson–Diemals road and the Diemals–Menzies Rd, P.S. *Short* 2308 & L. *Haegi*, 5.xi.1983 (AD, MEL 1524851, PERTH); Goddard Creek, along Transcontinental Rly, R.D. *Royce* 5567, 3.x.1956 (CANB); 32 km from Coolgardie towards Kalgoorlie, E.M. *Canning*, 7.ix.1968 (CANB); 26 km ENE of Cosmo Newbury Mission, N. *Forde* 1385, 14.x.1960 (CANB); 500 m E of Lake Raeside, Kirgella Rocks Station, H. *Pringle* 2402, 13.vii.1989 (CANB, PERTH); Victoria Desert, Camp 54, R. *Helms*, 11.ix.1891 (MEL 564626); Mt Elvire Station, B.H. *Smith s.n.*, 23.viii.1981 (MEL 590013). SOUTH AUSTRALIA. Yellabinna Regional Reserve, F.J. *Badman* 11575, 18.viii.2005 (AD); SW corner of Commonwealth Hill Station, c. 40 km NW of Wynbring railway station, D.E. *Symon* 1115, 2.xii.1960 (AD, DNA); c. 6 km N of Red Lake along roadside, J.Z. *Weber* 8218, 22.x.1983 (AD); Nundroo Well, R.H. *Ashby*, 15.xi.1975 (AD); c. 46 km S of Ooldea, P. *Wilson* 1830, 23.ix.1960 (AD); SW of Anthony Lake, Commonwealth Hill Station, c. 90 km NNW of Tarcoola, B. *Lay* 64, 3.ix.1970 (AD); c. 6 km N of Red Lake along roadside, J.Z. *Weber* 8218, 22.x.1983 (AD).

**Distribution and habitat:** Occurs in central-western Western Australia and central-western South Australia (Fig. 4). Grows in various soils including sands and calcareous sands, often near lake margins, in woodland, shrubland and grassland.

**Flowering period:** Flowers winter to early spring.

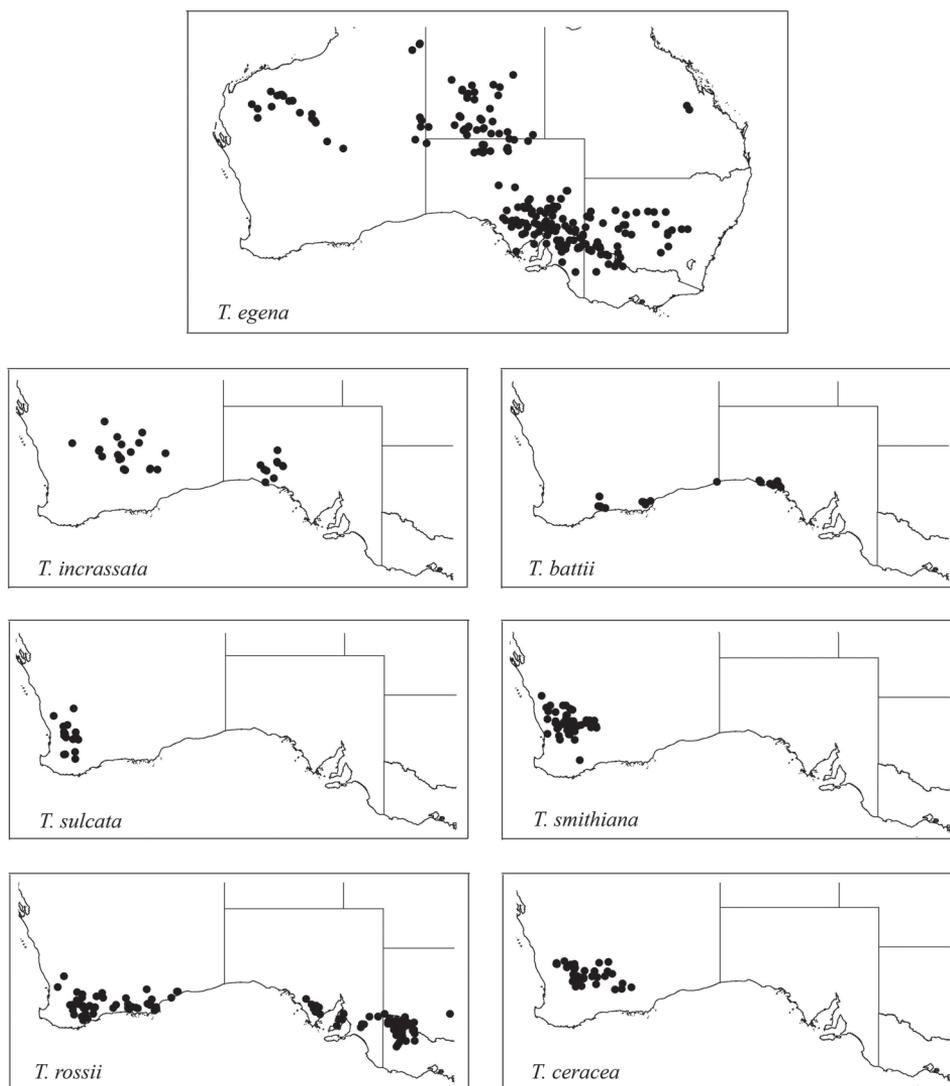
**Etymology:** The epithet refers to the relatively thick branches when compared to *T. egena* (L: *incrassatus*, thickened).

**Notes:** Apart from the distinctions given in the key, *T. incrassata* is more often glaucous than *T. egena*, has a plumper calyx, a standard petal with a longer claw, broader wings and a keel that is usually more purple. Further floral distinctions based on a limited survey of specimens include greater anther dimorphism, a stamen sheath that is more prolonged centrally, and filaments shorter beyond the sheath.

## 3. *Templetonia battii* F.Muell., *Australas. Chem. Druggist* 2(2): 31 (1887)

*Bossiaea battii* (F.Muell.) Tate, *Handb. Fl. Extratrop. S. Australia* 65 (1890).

**Type:** Western Australia. Eucla, J.D. *Batt*; syn: MEL 564735; Western Australia. Eucla, J.D. *Batt*; syn: MEL 564736.



**Figure 4.** Distributions of *Templetonia egena*, *T. incrassata*, *T. battii*, *T. sulcata*, *T. smithiana*, *T. rossii* and *T. ceracea*.

*Erect shrubs* to c. 1.5 m high; flowering branches divergent, often slightly flexuose, 1–2 mm in diameter mid-internode, terete, mildly ridged, sometimes minutely and finely papillose, tapering terminally to form a dark, spine-like apex 0.1–0.2 mm wide at tip; new growth c. 0.5 mm wide. *Leaf rudiments and stipules* developed at nodes; leaf rudiments to c. 1 mm long, sometimes scale-like basally. *Pedicels* 0.5–1.5 mm long; bract c. 0.5 mm long; bracteoles 1.5–2 mm long, connate for up to half of length, chartaceous in distal third to quarter, apex generally remaining intact, usually with a tuft of red glandular material.

*Flower buds* with apex rounded; calyx 2–3.5 mm long, tube 1.5–2 mm long, sinus of upper lip 0.5–1 mm deep with apices separated, lower median lobe much longer than other lobes, not chartaceous or brown, arching strongly inwards; standard 5.5–6 mm long, limb wider than long, 6–7 mm wide, claw 0.5–1.5 mm long; wings 4–5 mm long, 2 mm wide, claw c. 1.5 mm long; keel 3.5–4.5 mm long, 1.5 mm wide, dark purple distally, claw c. 1.5 mm long; stamen sheath 1.5 mm wide flattened out; ovary 6-ovulate, style c. 2 mm long, rather stout. *Pods* elliptic in profile, 8–15 mm long, 4–7 mm wide, 1- or 2-seeded; valves not gland-dotted. *Seeds* ellipsoid,

4.5–5 mm long; aril 1.5–2 mm in diameter, wall frilly, with long outgrowths, vertical lobe c. 0.5 mm high.

**Selected specimens of c. 30 examined:** **WESTERN AUSTRALIA.** 1 Martin St., Ravensthorpe, *M. Hislop* 2269, 12.viii.2001 (PERTH); c. 20 km WSW of Ponier Rock, c. 78 km S of Balladonia Motel, Eyre Hwy, *K. Newbey* 7360, 14.ix.1980 (PERTH); 10 km E of Buraminy, 143 km NE of Esperance, *W.R. Archer* 1009951 (MEL 2035026, PERTH). **SOUTH AUSTRALIA.** 14 km NW of Penong towards Bookabie, *J. Taylor* 1510 & *P. Ollerenshaw* (AD, CANB, MEL 653023); 16 km from Penong to Ceduna, c. 1 km along small side road, *H.R. Toelken* 7750, 25.x.1983 (AD); Yumburra Conservation Park, S side of plain near Maningilla rock holes, *R.H. Ashby* 39, xii.1985 (AD).

**Distribution and habitat:** Occurs in far south-central Western Australia, east of Lake King, and south-western South Australia as far east as Denial Bay (Fig. 4). Grows in sandy and loamy soils, usually on limestone in shrubland and woodland.

**Flowering period:** Flowers winter to spring.

**Notes:** The large convex and curved medial lower lobe of the calyx is responsible for the rounded apex of the bud. Although this feature is also seen in four other species in the leafless group, it is particularly apparent in *T. battii*. Of all the leafless species, *T. battii* is the only one with conspicuous development of glandular material at the apex of the bracteoles. In other species minute amounts of glandular material are sometimes evident. *Templetonia battii* also has the shortest, stoutest style in the group and the keel and wing auricles are relatively weakly developed. Microscopically the surface of branches is often minutely and finely papillose; *T. sulcata* is similar in this respect. The leaf and stipule development in *T. battii* occasionally shows some intermediacy between the scale formation of *T. egena* and *T. incassata* and the linear leaf rudiments developed in *T. sulcata*, *T. smithiana*, *T. rossii* and *T. ceracea* as leaf rudiments are sometimes relatively broad.

#### **4. *Templetonia sulcata* (Meisn.) Benth., Fl. Austral. 2: 171 (1864)**

*Bossiaea sulcata* Meisn., in J.G.C. Lehmann, *Pl. Preiss.* 1: 81 (1844).

**Type:** Western Australia. Avon River, York, *J.A.L. Preiss* 1028; holotype: *K n.v.*, photo MEL 584229.

**Erect shrubs** to c. 1.5 m high; flowering branches

moderately to strongly divergent, straight, 2–3 mm wide, moderately compressed, sharply ridged, smooth or minutely and finely papillose, tapering terminally to form a dark spine-like apex, with tip 0.1–0.2 mm wide; new growth 1–1.4 mm wide. *Leaf rudiments and stipules* developed at nodes; leaf rudiments to c. 4 mm long, tending to persist on longer branches. *Pedicels* 0.5–1 mm long; bract c. 0.5 mm long; bracteoles 0.8–1.5 mm long, free or nearly so, chartaceous in distal half to two-thirds, apex often splitting and/or becoming ragged. *Flower buds* with apex rounded; calyx 2.5–3.5 mm long, sinus of upper lip c. 0.5 mm deep with apices separated, lower medial lobe slightly longer than other lobes, not chartaceous or brown; standard 5–6 mm long, limb c. as wide as long, 4–5 mm wide, claw 1–1.5 mm long; wings 5 mm long, 1.5 mm wide, claw c. 2 mm long; keel 5 mm long, 2 mm wide, dark purple distally, claw 1.5–2 mm long; stamen sheath 1.2–1.5 mm wide flattened out; ovary 5- or 6-ovulate, style 2.5–3 mm long. *Pods* narrow-elliptic in profile, 9–14 mm long, 5–6 mm wide, 1–4-seeded; valves not gland-dotted. *Seeds* ellipsoid, 4–4.5 mm long; aril 1.5–1.8 mm in diameter, wall crenate, vertical lobe c. 0.3 mm high.

**Selected specimens of c. 80 examined:** **WESTERN AUSTRALIA.** Near Mortlock River, 9 km SW of Goomalling, A.S. *George* 15740, 1.ix.1979 (PERTH); Avon region, c. 1.5 km SW of Manmanning, *B.H. Smith* 1604, 3.viii.1992 (CANB, PERTH); c. 40 km E of Wongan Hills on Avon 24861 on Phillip's farm, Landeny, *L.A. Phillips* 29, 27.viii.2006 (PERTH); Beverley Airfield reserve, c. 1 km S of Beverley, *M. Ochtman & D. Lynch* 22, 18.ix.2000 (PERTH); Gwambygine, near York, *J. Seabrook s.n.*, 7.ix.1980 (PERTH); c. 6 km W of Dumblebung to Wagin, *B.R. Maslin* 652, 2.viii.1970 (PERTH); Mt Hardy, c. 10 km E of York, *B. Smith* 206, 18.xii.1982 (CANB, MEL 626709, PERTH); c. 19 km from Broomehill towards Growanjerup, *J.W. Wrigley*, 21.x.1968 (CANB); Along road and railway line between Katanning and Tambellup, c. 7 km S of Broomehill, *H. Eichler* 15913, 31.viii.1959 (AD).

**Distribution and habitat:** Occurs in south-western Western Australia between 30° and 34°S and between 116° and 117°40'E (Fig. 4), largely overlapping the distribution of *T. smithiana*. Grows in sands and loams in shrubland and woodland.

**Flowering period:** Flowers winter to spring.

**Notes:** Similar to *T. smithiana* in bracteole, calyx and branch-tip morphology, but with very different pod and seed morphology. Also, *T. sulcata* does not

grow as large as *T. smithiana*, its branches are generally narrower, and the rudimentary leaves are often better developed and more persistent. The branch surface is sometimes minutely papillose unlike the consistently smooth surface in *T. smithiana*. Bracteoles of *T. sulcata* and *T. smithiana* have a distinctive tricolour appearance, with bands green proximally, light brown centrally, and whitish-translucent distally. The distal portion tends to become quite ragged through splitting.

*Templetonia sulcata* can be distinguished from *T. rossii* by branch-tip and bracteole features, as given in the key, and by its plumper seeds with an aril crenate rather than frilly and with a lower, broader lobe, and by the pods which are narrower but deeper and have a longer beak.

Chromosome numbers given in Sands (1975) under *T. sulcata* are all referable to other species (see *T. ceracea*, *T. smithiana* and *T. rossii*).

### 5. *Templetonia smithiana* J.H.Ross, *Muelleria* 5: 278 (1984)

**Type:** Western Australia. Doodarding, No. 2 Rabbit fence, 0.25 mile (c. 0.4 km) N of gate 44, 31°01'S, 117°12' E, *B.H. Smith 204*, 13.xii.1982; holo: MEL 626707; iso: K, PERTH, both *n.v.*

*Erect shrubs* to c. 1.5 m high; flowering branches moderately divergent to almost spreading, often flexuose, 3–6(–7) mm wide, strongly compressed, with ridges often sharply defined, smooth, tapering terminally to form a dark, spine-like apex, with tip 0.1–0.2 mm wide; new growth 2.5–3 mm wide. *Leaf rudiments and stipules* developed at nodes; leaf rudiments to 3 mm long. *Pedicels* 1–1.5 mm long; bract c. 0.5 mm long; bracteoles 1–1.5 mm long, free or nearly so, chartaceous in distal half to two-thirds, apex often splitting and or becoming ragged. *Flower buds* with apex rounded; calyx 3–4 mm long, tube 2–3 mm long, sinus of upper lip c. 0.5 mm deep, with apices separated; lower medial lobe moderately longer than other lobes, not chartaceous; standard 6–8 mm long, limb c. as wide as long, 5–7 mm wide, claw 1.5 mm long; wings 1.8 mm wide, claw 2.3 mm long; keel 1.5 mm wide, with claw c. 2 mm long, dark purple distally; stamen sheath 1.8 mm wide flattened out; ovary 5-ovulate, style 3–4 mm long. *Pods* elliptic in profile, 15–28 mm long, 9–12 mm wide, 1-seeded; valves with glands sometimes faintly

detectable. *Seeds* compressed ellipsoid, 9–16 mm long; aril 1 mm in diameter, wall entire or slightly crenate, vertical lobe c. 0.4 mm high.

**Selected specimens of c. 60 examined:** WESTERN AUSTRALIA. Mt Hardy, 11 km from York on road to Quairading, *J.H. Ross 2773* (CANB, MEL 626714); Doodarding, c. 0.4 km N of 44 gate, no. 2 rabbit fence, *B.H. Smith 1346* (BRI, MEL 1587441, PERTH); 28 km N of Bullfinch on Bullfinch–Evanston Rd, *L.A. Craven 4555* & *B.J. Lepschi*, 6.xi.2000 (CANB, PERTH); c. 11 km E of Winchester, *C. Chapman*, 25.xi.1972 (PERTH); Mt Gibson Station, *S. van Vreeswyk 3858*, 27.viii.1993 (PERTH).

**Distribution and habitat:** Occurs in far south-western Western Australia mostly north of 32°15'S (Fig. 4). Grows on sandy-loam rises, often near salt lakes.

**Chromosome number:**  $2n = 16$  (Sands 1975; collection no. 637.4.1 PERTH 02900556, as *T. sulcata*).

**Flowering period:** Flowers August to October.

**Notes:** Closely related to *T. sulcata*, with which it is partly sympatric, having more or less identical floral and bracteole morphology and in having similarly spinescent branches, but markedly different in branch width and in dimensions of fruits and seeds. Branches are similar to those of *T. rossii* in terms of width and colour (at least when dry). However, branches of *T. rossii* are not spiny and the surface of branches are generally minutely granular (most easily detected along the hyaline edge of the branch at  $\times 10$ – $\times 20$ ). In *T. smithiana* more so than other species, there is a tendency for the funicle and placenta to detach with the seed.

A collection from Koorda NW of Merredin (*Blackall* PERTH 02900610) has relatively short internodes and shows evidence of being atypically succulent.

### 6. *Templetonia rossii* (F.Muell.) I.Thomps., *comb. nov.*

*Bossiaea rossii* F.Muell., *Fragm.* 3: 94 (1862).

**Type:** Victoria. Avoca River, ?*F. Mueller*; lecto: MEL 20342, *fide* J.H. Ross, *Muelleria* 5: 27 (1982).

*Erect shrubs* to c. 1.5 m high; flowering branches moderately divergent,  $\pm$ straight, 2–7 mm wide, moderately compressed, mildly ridged, smooth or more often minutely granular, sometimes glaucous, tapering terminally but not spine-like and not becoming terete (apex c. 0.5 mm wide); new growth 2–3 mm wide. *Leaf rudiments and stipules* developed

at nodes; leaf rudiments to c. 2 mm long. *Pedicels* 0.5–1.5 mm long; bract c. 1 mm long; bracteoles 1–3 mm long, almost entirely chartaceous, apex tending to remain intact. *Flower buds* with apex acute; calyx 2.5–3.5 mm long, sinus of upper lip hardly developed or to c. 0.5 mm deep, with apices hardly separated, lower medial lobe moderately longer than other lobes, chartaceous distally; standard c. 6 mm long, limb 5.5 mm wide, claw 1–1.5 mm long; wings 5 mm long, 2 mm wide, claw c. 1.5 mm long; keel c. 4.5 mm long, c. 2 mm wide, pale or purple distally, claws 1.5 mm long; stamen sheath 1.2–1.4 mm wide flattened out; ovary 2- or 3-ovulate, style c. 3 mm long. *Pods* elliptic or oblong-elliptic in profile, 8–12(–16) mm long, 6–7 mm wide, without basal projection, 1 or 2 (or 3)-seeded; valves not gland-dotted. *Seeds* 3.5–5 mm long; aril 1.5–2 mm in diameter, wall frilly, with numerous short lateral outgrowths, vertical lobe c. 0.5 mm high.

**Selected specimens of c. 200 examined:** **WESTERN AUSTRALIA.** 14.9 km E of Wagin on road to Dumbleyung, *T.R. Lally 1253 & B.J. Lepschi*, 22.ix.1996 (CANB, MEL 2095147, PERTH); 37 km N of Katanning on road to Dumbleyung, 15 km S of Dumbleyung, *G.J. Keighery 6340*, 26.viii.1983 (PERTH); 26 km S of Deralinya Ruins on Parmango Rd, 89 km NE of Condingup, *B. Archer 485*, 12.xii.1986 (CANB, MEL 2036768, PERTH). **SOUTH AUSTRALIA.** 5.5 km S of Wharminnda on road to Tumby, *D.J. Duval 553* (AD); Blue Range, Hincks National Park, c. 1 km S of Oak Amphitheatre, *C.R. Alcock 2273*, 8.x.1968 (AD); hundred of Wiltunga, Yorke Peninsula, c. 140 km NNW of Adelaide, *B. Copley 621*, 16.ix.1966 (AD); c. 5 km S of Bute, *B. Copley 874*, 8.xi.1966 (AD). **NEW SOUTH WALES.** Sturt Hwy, c. 29 km from Euston towards Buronga, *R.G. Coveny 18762* (AD, BRI, CANB, MEL 2105426); 20 km W of Balranald, *W.E. Mulham 1222* (CANB). **VICTORIA.** c. 22 km N of Birthday Tank, Sunset Country, *R. Filson 7428*, 24.ix.1965 (AD, MEL 645657); 1 km E of Nyah West on Nyah West to Murray Valley Hwy Rd, *B. Hadlow 640*, 7.ix.1991 (CANB, MEL 290510); 54.3 km E of the North-South Settlement Rd and Pheeny's Track junction, on Pheeny's track, Murray Sunset National Park, *J. McAuliffe 562*, 2.ix.2003 (CANB).

**Distribution and habitat:** Occurs in southern Western Australia, south-eastern South Australia, north-western Victoria and south-western New South Wales (Fig. 4). Grows in sands and loams in shrubland and woodland.

**Chromosome number:**  $2n = 16$  (Sands 1975; collection no. 638.15.10, PERTH 02900432, as *T. sulcata*).

**Flowering period:** Flowers September to October.

**Notes:** Branches are mostly minutely roughened and apparently they exude a sticky substance as a smattering of fine debris is commonly seen in pressed specimens. The slight elevations of branch surfaces are less prominent than the papillae often seen in *T. sulcata* and *T. battii*. *Templetonia rossii* and *T. ceracea* are closely related based on bracteole and calyx morphology; however, aril morphology is quite different. The bracteoles of *T. rossii* and *T. ceracea*, as well as being more extensively chartaceous and brown than in other species, tend to be more convex abaxially and a groove is often present at the boundary of brown-chartaceous and herbaceous portions.

### 7. *Templetonia ceracea* I.Thomps., sp. nov.

*AT. sulcata* (Meisn.) Benth. *ramis ceraceis angustioribus minus compressis, bracteolis fere omnino chartaceis, margine arillorum integro differt; a T. rossii* (F.Muell.) I.Thomps. *ramis ceraceis angustioribus minus compressis, floribus magnioribus, margine arillorum integro differt.*

**Type:** Western Australia. 87.7 km west of Coolgardie Post Office, *B. Archer 1152*, 6.x.1998; holotype: MEL 2068186; iso: CANB, PERTH.

*Erect shrubs* to c. 1.5 m high; flowering branches moderately divergent,  $\pm$ straight, 1.5–2 mm wide, slightly to moderately compressed, mildly ridged, smooth beneath sheets of epicuticular wax; tapering terminally but not spine-like and not becoming terete (apex c. 0.5 mm wide); new growth 1.5–2 mm wide. *Leaf rudiments and stipules* developed at nodes; leaf rudiments to c. 3 mm long. *Pedicels* 0.5–1.5 mm long; bract c. 1 mm long; bracteoles 1–2.5 mm long, almost entirely chartaceous, apex tending to remain intact. *Flower buds* with apex acute; calyx 3–4.5 mm long, tube 2–3.5 mm long, sinus of upper lip hardly developed or to 0.5 mm deep, with apices not or only slightly separated; lower medial lobe moderately longer than other lobes, chartaceous distally; lateral lobes sometimes chartaceous distally; standard c. 7 mm long, limb c. as wide as long, c. 6 mm wide, claw 1–1.5 mm long; wings c. 6 mm long, 2.5 mm wide, claw c. 2 mm long; keel c. 5 mm long, c. 2 mm wide, light purple distally, claws c. 2 mm long; stamen sheath c. 1.5 mm wide flattened out; ovary 4-ovulate, style c. 3 mm long. *Pods* elliptic or oblong-elliptic in profile,

7–10 mm long, 4–7 mm wide, 1- or 2-seeded; valve not gland-dotted. *Seeds* c. 4 mm long; aril 0.7 mm in diameter, wall entire, not cleft at summit, vertical lobe c. 0.5 mm high.

**Selected specimens of c. 60 examined: WESTERN AUSTRALIA.** Nungarin, C.A. Gardner, 24.viii.1920 (PERTH); 57 km E of Norseman on Eyre Hwy, R.J. Cranfield 10026, 16.viii.1995 (PERTH); 87.7 km W of Coolgardie PO, 5.8 km E of Boorabbin Microwave Tower, B. Archer 1152, 6.x.1998 (CANB, MEL 2068186, PERTH); c. 32 km S of Coolgardie, R.D. Royce 3463, 8.viii.1951 (PERTH); 16 km SSE of Jaurdi Homestead, c. 63 km E of Koolyanobbing, K. Newbey 8952, 18.ix.1981 (PERTH); Southern Cross, W. Middleton, 1.xii.1962 (MEL 593423); 1.2 km NW of Bruce Rock South Rd turnoff on Bruce Rock–Narabeen Rd, 3 km SE of Bruce Rock, T.R. Lally 1122 & B.J. Lepschi, 10.viii.1996 (AD, HO, CANB, MEL 271045, NSW); Merredin, M. Koch, 10.ix.1923 (MEL).

**Distribution and habitat:** Occurs in south-western Western Australia (Fig. 4). Grows in red-brown clay loams, and sandy loams in low woodland.

**Chromosome number:**  $2n = 16$  (Sands 1975; collection no. 637.3.2 PERTH 02899256, as *T. sulcata*; however, recorded as  $2n = 14$  on herbarium label and in Sands 1966).

**Flowering period:** Flowers winter to spring.

**Etymology:** The epithet refers to the epicuticular wax coating the surface of branches (L. *ceraceus*, waxy).

**Notes:** A loose, crusty epicuticular wax lifting from the surface of branches of *T. ceracea* is unique in the genus. *Templetonia rossii* is likely to be its closest relative based on calyx lobe and bracteole morphology. In these characters they are virtually indistinguishable; however, the bracteoles of *T. ceracea* tend to have a broader clear zone, the lower medial lobe of the calyx generally often has a more sharply demarcated chartaceous apex and the lateral lobes are more often chartaceous at the tips. Small differences are evident in the the petals, and fertile parts; those of *T. ceracea* are on average c. 1 mm longer than in *T. rossii* and the stamen sheath is markedly broader. The aril of seeds of *T. ceracea*, based on very few seeds seen, are distinctive for their small size and entire margin. Pods are the smallest in the group but only slightly smaller than in *T. rossii* and *T. battii*, and based on a small sampling are always 4-ovulate with all ovules attach to the same valve. Pods of collections from Southern Cross

(W.Middleton MEL) and Merredin (*M.Koch* MEL) have a slight protuberance of the suture adjacent to the stipe; this has not been seen in pods of other species.

One specimen from the Hunt Range on Jaurdi Station, (L.W.Sage 1591 PERTH) entirely lacks encrustations but appears, based on branch width and degree of compression, to be *T. ceracea*. The branches of this specimen have an unusual varnished appearance which may represent aberrant development.

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