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Tephrosia cardiophylla (Fabaceae: Millettieae), a distinctive, new, conservation-listed species from Western Australia's Kimberley sandstones

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SHORT COMMUNICATION

Ongoing taxonomic revisions in *Tephrosia* Pers. (Fabaceae: Millettieae) Australia-wide are continuing to identify putatively new and patently novel taxa, especially from areas in which there have been few, if any, systematic surveys. While some of these taxa are part of difficult complexes containing a number of described and phrase-named taxa as well as variant forms within each, others are readily recognisable and seemingly without close affinity in the Australian flora; the new species described herein is one such distinctive species. The name *T.* sp. Saw Ranges (D. Kabay s.n. PERTH 06720544) was added to Western Australia's vascular plant census in 2011, based on a single fruiting and seeding specimen that could not be matched to any known taxon in Western Australia or the Northern Territory (I. Cowie pers. comm. 2011). Over the past seven years a handful of additional specimens, usually in fruit but occasionally possessing flowers, have been submitted to the Western Australian Herbarium (PERTH) or uncovered at the Northern Territory Herbarium (DNA), validating the distinctness of this species and finally allowing it to be described in full.

Tephrosia cardiophylla R.Butcher, *sp. nov.*

Type: off Gibb River Road [Central Kimberley], Western Australia [precise locality withheld for conservation reasons], 20 May 1993, *I.D. Cowie* 4175 (*holo*: PERTH 08580464!; *iso*: AD!, BRI!, CANB!, DNA D0078767!, K!, L!, LD!, MEL!, MO!, NSW!).

Tephrosia sp. Saw Ranges (D. Kabay s.n. PERTH 06720544), Western Australian Herbarium, in *FloraBase*, https://florabase.dpaw.wa.gov.au/ [accessed 5 February 2019].

Spreading, *low shrub* 0.25–0.6 m tall, 0.2–0.9 m wide. *Branchlets and leaf rachides* with a moderately dense, mixed length, soft, fine, ascending to patent, silvery white indumentum to 1.5 mm long. *Leaves* trifoliolate or pinnate, up to 47 mm long including petiole, leaves and leaflets diminishing in size towards the apices of branches, the number of leaflets per leaf often also decreasing (to 3) towards apices; *stipules* persistent, patent to reflexed, subulate, 1.5–5 mm long, green ageing to yellow-brown, 1(3)-nerved; *petiole* 0.5–10 mm long; *ultrajugal rachis* 0.2–3 mm long; *stipellae* absent; *petiolules* 0.4–0.7 mm long; *leaflets* (3–)7–13, oblanceolate to obovate, V-shaped in T.S., crowded, at least some

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attached in the basal half of the leaf; bases cuneate to rounded; apices rounded to emarginate in the flattened state (with the terminal leaflet distinctly emarginate relative to the laterals), deflexed, with a mucro *c.* 0.5 mm long; *lateral leaflets* to 18 mm long, to 6 mm wide, length 1.68–2.45 × width, usually longest around centre of leaf; *terminal leaflet* 1–1.07 × length of adjacent laterals, to 10.5 mm long, to 7 mm wide, length 1.18–2.19 × width; lamina dull green or bluish green, slightly discolorous with the upper surface a little paler; upper surface indumentum moderately dense, hairs ascending to almost patent, straight, very fine, silvery hyaline, 0.2–0.5 mm long; lower surface indumentum denser than upper, hairs inclined to ascending, straight, fine, silvery hyaline, *c.* 1.5 mm long; secondary veins obscure on lower surface, less obscure on upper and apparently in 6–8 sub-opposite pairs, intersecondary veins obscure, mid-vein narrow, raised on lower surface. *Inflorescence* a 3-flowered, axillary fascicle; *floral bracts* 0.7–1.2 mm long, lanceolate, acuminate, caducous; *bracteoles* absent; *pedicels* 1.5–3.5 mm long (to 5.1 mm on pods). *Calyx* 2.5–4.5 mm long, indumentum moderately dense, ascending to patent, straight, fine, silvery white; tube 1.1–2.5 mm long, 0.67–0.79 × the length of lateral lobes; lower and lateral lobes narrowly deltoid, acuminate; vexillary lobes united a little higher than other three, free for 0.7–0.9 mm (shortly divided to *c.* 1/2 length); lowest lobe 1.5–2.1 mm long, ±equal to or longer than lateral lobes. *Corolla* orange, 4–6 mm long; *standard* 4–5 mm long, 4.8–6.2 mm wide, the claw 1.5–1.8 mm long, the blade suborbicular, not callused at base, apex broadly rounded; *wings* 3.9–6 mm long, 2–3 mm wide, longer than keel, the claw *c.* 1.7 mm long, the blade broadly and obliquely obovate with rounded apex; *keel* 4.4–5 mm long, 2.2–2.6 mm wide, the claw *c.* 1.8 mm long, the blade semicircular, glabrous. *Staminal* tube glabrous, thickened on margins of fenestrae; vexillary filament straight in lower half, glabrous, not callused; anthers 0.45–0.55 mm long, 0.4–0.45 mm wide. *Ovary* densely hairy; ovules 6 seen, presumably also 7 [or more] based on seed number. *Style* flattened, almost uniform to gently tapered, glabrous (hairs at base on vexillary side); stigma penicillate at base, linear. *Pods* linear, curved along length or towards apex, 29–40 mm long, 4–4.5 mm wide, laterally compressed, depressed between seeds, with sinuous margin very slightly indented between seeds, light brown at maturity; indumentum moderately dense, patent with a few or numerous longer, curved hairs, silvery hyaline, also with scattered, very small, shortly stalked, globular-headed hairs underlying the long hairs (visible at ×50 mag.); beak in line with upper suture, straight; white tissue present between seeds. *Seeds* (3–)5–7 per pod, with 4.7–5.3 mm between centres of adjacent seeds, lenticular to obloid-reniform, laterally compressed, tapering to thinner edges, 2.4–2.9 mm long, 2.7–3.7 mm wide, finely mottled tan, brown and black, sometimes also with grey and orange-brown, testa smooth, hilum ±central; rim-aril (with tongue) present, distinct, annular, cream. (Figure 1)

Diagnostic features. *Tephrosia cardiophylla* can be readily distinguished from all other species by the following combination of characters: a low, sprawling, habit; a soft indumentum of white, ±patent hairs; trifoliolate or pinnate leaves with (2–)3–6 pairs of small, crowded, obovate leaflets with rounded to emarginate (the terminal leaflet distinctly emarginate), deflexed apices; small, orange flowers in 3-flowered, axillary clusters; pods that are curved upwards towards apex, slightly sinuous along margin, laterally compressed and depressed between the seeds, with scattered, very small, shortly-stalked, globular-headed hairs under a moderately dense, longer, simple indumentum; seeds that are compressed, lenticular to obloid-reniform and finely mottled, with a distinct, annular, cream rim-aril (with tongue).

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 13 Feb. 2006, *R.L. Barrett & M.D. Barrett* RLB 3061 (PERTH); 13 Apr. 2013, *R.L. Barrett, M.D. Barrett & B. Anderson* RLB 8056 (BRI, MEL, PERTH); 3 May 2018, *R. Butcher, E.M. Joyce & K.R. Thiele* RB 2180 (PERTH); 4 May 2018, *R. Butcher, E.M. Joyce & K.R. Thiele* RB 2190 (MEL, PERTH, UWC); 5 May 2018, *R. Butcher, E.M. Joyce & K.R. Thiele* RB 2193 (PERTH); 16 May 2006, *I.D. Cowie* 11193 (DNA, PERTH); 22–25 Apr. 1998, *D. Kabay s.n.* (PERTH 06720544).

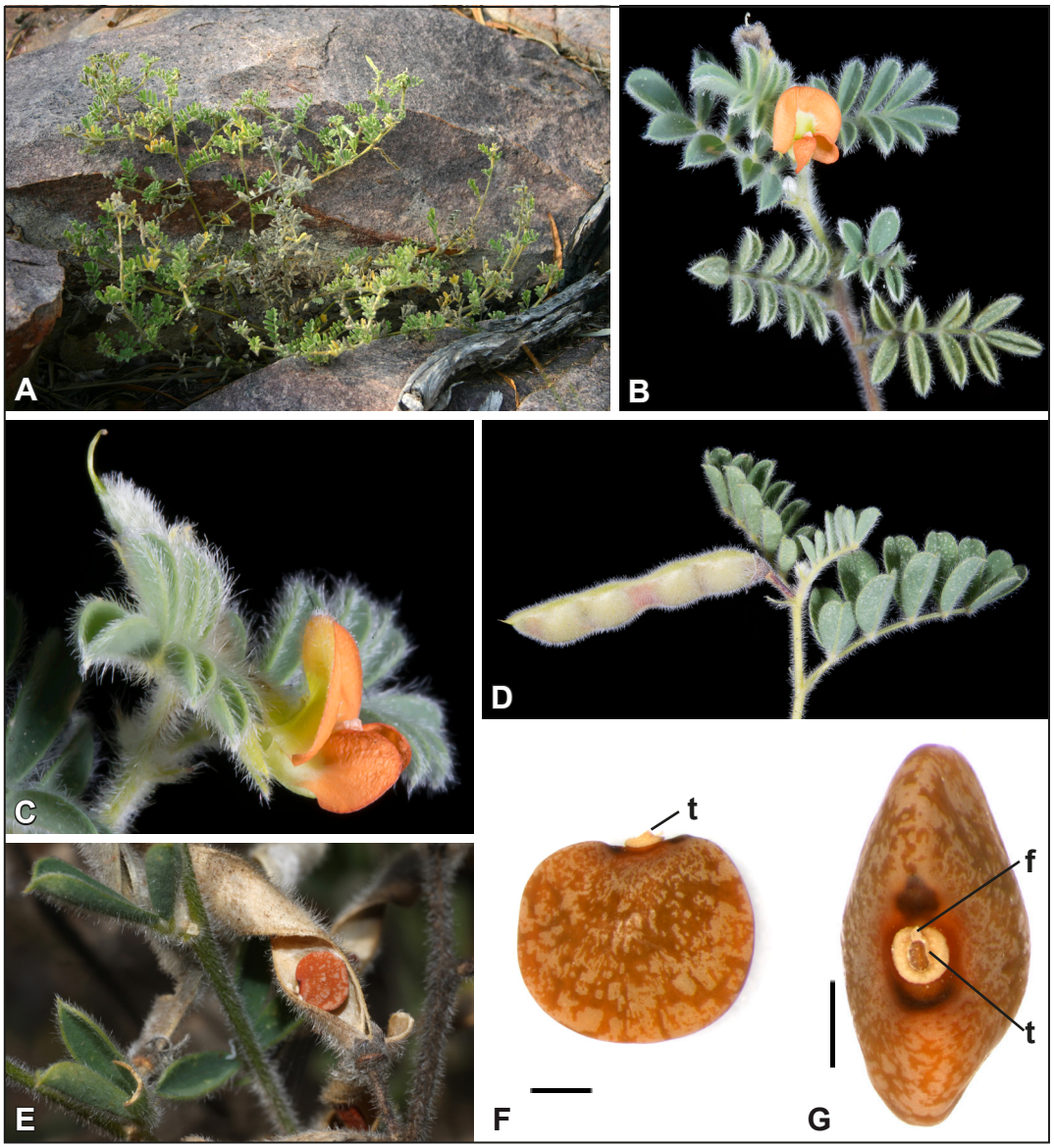

Figure 1. *Tephrosia cardiophylla*. A – fruiting plant growing among sandstone rocks; B – pinnate leaves and axillary flower from front; C – axillary flower from side with developing, densely pubescent pod (with glabrous style) also visible; D – immature pod showing gently sinuous margin; E – dehisced pod showing laterally compressed seed with mottled testa and prominent, annular, rim-aril; F – seed in face view showing mottled testa and rim-aril with triangular tongue (t) on closest edge; G – seed from top showing rim-aril with tongue (t) on right edge and funicle (f) remnant. Scale bar = 1 mm (F, G). Images from *R. Butcher, E.M. Joyce & K. Thiele* RB 2193 (A); *R. Butcher, E.M. Joyce & K. Thiele* RB 2180 (B–D); *R.L. Barrett & M.D. Barrett* RLB 3061 (E–G). Photographs: R. Butcher (A, F, G); K. Thiele (B–D); R.L. Barrett (E).

Phenology. Flowers observed February and May; fruits February to May, with mature seed in late April to late May.

Distribution and habitat. Occurs in the Victoria Bonaparte and Central Kimberley bioregions of Western Australia, where it has been collected from between Wyndham and Kununurra, westward to Barnett River Gorge. Grows in brown loam or red-brown clayey sand among sandstone rocks,

often growing up between rocks in broken sandstone pavement above waterways. Occurs in open low eucalypt woodland with *Corymbia collina* or *Eucalyptus miniata*, often also with *Petalostigma pubescens*, *Grevillea agrifolia*, *Calytrix exstipulata*, *Buchanania obovata*, *Cochlospermum fraseri* and *Acacia* spp., over *Sorghum* and *Triodia*.

Found growing with a range of other *Tephrosia* taxa, in different assemblages, at the three *R. Butcher et al.* 2018 collection sites, namely: *T. subpectinata* Domin, *T.* sp. E Kimberley Flora (C.A. Gardner 9937), *T.* sp. F. Kimberley Flora (B.R. Maslin 5139) (with RB 2180); *T. coriacea* Benth., *T. filipes* Benth. var. *filipes*, *T. simplicifolia* Benth., *T.* sp. Pentecost River (I.D. Cowie 4168), *T.* sp. sparse pinnae (C.R. Michel 2202) (with RB 2190); *T. coriacea*, *T.* sp. Pentecost River (with RB 2193).

Conservation status. Listed as Priority One under Conservation Codes for Western Australian Flora (Smith & Jones 2018), as *T.* sp. Saw Ranges (D. Kabay s.n. PERTH 06720544). This species is very poorly known and requires further survey to determine its true extent and abundance. It was uncommon to occasional at all the sites at which it was observed during field work in 2018.

Etymology. The epithet is from the Greek *kardia* (heart) and *-phyllus* (-leaved). The species is named for the shape of the terminal leaflet, which has a distinctly emarginate apex (in contrast to the lateral leaflets) and is heart-shaped when flattened out.

Vernacular name. Romantic Tephrosia.

Affinities. *Tephrosia cardiophylla* is a distinctive species, readily recognised by the combination of diagnostic characters listed above. It is similar to *T.* sp. F Kimberley Flora (see Wheeler 1992), which also has axillary clusters of orange flowers with glabrous stamens, shortly petiolate 3-foliolate or pinnate leaves, leaflets (all) with emarginate, mucronate apices, and a sinuous margin to the pods. *Tephrosia* sp. F Kimberley Flora can be distinguished by its very long (7–10 mm), subulate and stiffly setaceous stipules, much longer mucros (1.5–2.2 mm long) on leaflets, larger flowers (7.5–10 mm long) with the calyx having longer lobes and the tube *c.* 1/4–1/2 the length of the lateral lobes, oblong pods with a more deeply sinuous margin and a tardily caducous, excentric to central beak, as well as fewer seeds (3 or 4) per pod.

Tephrosia cardiophylla has superficial similarity to some collections of *T.* sp. E Kimberley Flora (see Wheeler 1992), but this taxon has more leaflets per leaf ((9–)19–35), elongate pseudoracemose inflorescences (100–260 mm long), larger flowers (5.5–7.5 mm long) in which the standard petal has an emarginate apex and linear calluses above the claw, more ovules per ovary (8–10), longer and narrower pods ((25–)40–60 mm long, 3–4 mm wide) that have a straight margin and excentric beak, as well as transversely compressed-obloid seeds with the rim-aril absent to scarcely differentiated.

It also has superficial similarity to some specimens at PERTH currently identified as *T.* aff. *remotiflora* Benth., which are atypical in having crowded, hairy leaflets with deflexed apices. Like *T.* sp. E Kimberley Flora, these collections can be readily distinguished from *T. cardiophylla* by their elongate inflorescences, and further distinguished by their pink/purple rather than orange flowers.

Notes. This species is known from few collections over a wide area, with specimens mostly in fruit and with very few flowers. Floral descriptions are therefore based on only two dissected flowers, one from each of two different collections from different localities. Undissected flowers, persistent calyces on pods, and the pods themselves, are comparable in size and dimensions across all specimens seen,

suggesting that measurements from additional flowering material will not greatly inflate the ranges of values given here.

The seeds of *T. cardiophylla* have a prominent, annular, cream, rim-aril (*sensu* Polhill 1976) with a small, triangular peak on one side. This peak is termed the hilar tongue (*sensu* Berg 1979), with the entire structure renamed 'tongue-aril' in Kirkbride *et al.* (2003); here the phrase 'rim-aril (with tongue)' is used. Seed morphology can provide useful characters for the recognition of systematic patterns and the discrimination of taxa in the Leguminosae (Gunn 1981; Lackey 1981; Kirkbride *et al.* 2003) and an international body of work detailing characters of the hilum and testa is emerging for *Tephrosia* (Subba Rao & Shanmukha Rao 1992; Al-Ghamdi & Al-Zahrani 2010; de Queiroz *et al.* 2013); this will be supplemented as study of the Australian taxa continues.

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