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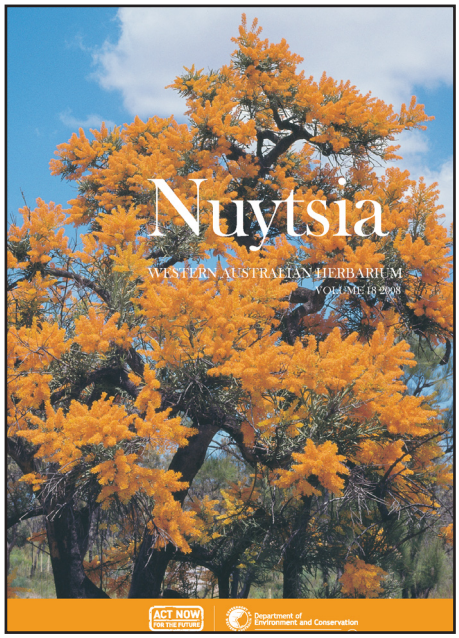

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Rediscovery of *Tetratheca nuda* var. *spartea* (Elaeocarpaceae) in south-west Western Australia and elevation to specific rank as *Tetratheca spartea*

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Abstract

Butcher, R. Rediscovery of *Tetratheca nuda* var. *spartea* (Elaeocarpaceae) in south-west Western Australia and elevation to specific rank as *Tetratheca spartea*. *Nuytsia* 18: 39–47 (2008). *Tetratheca nuda* Lindl. var. *spartea* Planch. ex Benth. was named by Bentham in 1863 from material collected from an unspecified locality by Drummond in 1843. Mueller placed the name in synonymy under *T. virgata* Steetz in 1882, but Thompson recognised and lectotypified the name in 1976, reiterating the close affinity with *T. nuda* but querying the status of the taxon. The taxon was known only from the type material until a 2005 collection from near Toodyay was confirmed as comparable with the type. Additional collections have since confirmed its distinctness from *T. nuda*. This taxon is described in full herein as *T. spartea* (Benth.) R.Butcher. Images of the new species and a distribution map are provided, as is an amended taxonomic key to the species of 'leafless' *Tetratheca* in Western Australia.

Introduction

Tetratheca nuda Lindl. var. *spartea* Planch. ex Benth. was named by George Bentham in 1863, following its recognition by Jules Émile Planchon in William Jackson Hooker's herbarium at the Royal Botanic Gardens, Kew. Based on *Drummond,* Coll. 1843, n. 101 and 104, Bentham's description of *T. nuda* var. *spartea* was 'Tubular process of the anthers nearly as long as the cells.' (1863: 133). Ferdinand von Mueller (1882: 5) later included *T. nuda* var. *spartea* in the superficially similar *T. virgata* Steetz, presumably due to the length of the anther tube, but a number of characters (discussed below) serve to easily distinguish the two taxa. In her revision of *Tetratheca* Sm., Joy Thompson (1976: 165) referred to *T. nuda* var. *spartea* under *T. nuda*, and designated *Drummond* 101 herb. Hook., 1843 (K) as the lectotype, with MEL 1008122 cited as an isolectotype. Thompson did not resolve the status of this taxon, but regarded the long anther tube and a dark patch at the base of each petal as significant differences from typical *T. nuda*.

Examination of all typical *T. nuda* specimens at PERTH, MEL and NSW confirms that the anther tube is consistently short (0.35–0.5 mm long) in this species, but that the dark patch at the base of the petals is commonplace. Although Thompson (1976: 139) reported that hybridisation is extremely rare in *Tetratheca* (it has not been observed among the Western Australian species, T.D. Macfarlane pers. comm.), she suggested that *T. nuda* var. *spartea* might represent an hybrid between *T. nuda* and, possibly, *T. hirsuta* Lindl., a species characterised by its extremely long anther tubes and large, black

spot at the base of each petal. Thompson's annotation on the isolectotype of *T. nuda* var. *spartea* (Figure 1) in 1974 states '*T.* sp. aff. *nuda* or *T. nuda* × ? (*hirsuta*?)', highlighting that she thought the taxon may be a distinct species, but reflecting a reluctance to recognise it at a different rank in the absence of further collections.

A 2005 collection of *Tetratheca* from an area of the Julimar State Forest north-west of Toodyay (*F. Hort* 2895), is comparable to the isolectotype of *T. nuda* var. *spartea*. Corresponding closely with *T. nuda* in habit and floral form, this collection differs from typical *T. nuda* and is identical to *Drummond* 101 in stamen morphology, in having only large-headed glandular hairs on the ovary, and in its slightly thicker stems with minute glandular hairs. Thompson's hypothesised hybrid status for *T. nuda* var. *spartea* can now be discounted, as the closest known population of typical *T. nuda* is *c.* 30 km to the south-west, in the Avon Valley National Park. *Tetratheca hirsuta* does not co-occur with *T. nuda* var. *spartea*, although it has been collected from other areas of the Julimar State Forest (e.g. *M. Hislop* 2330; *F. & J. Hort* 2893; *C.L. Wilson* 834). The only other *Tetratheca* species occurring with *T. nuda* var. *spartea* is the distinctly different *T. pilifera* Lindl. (e.g. *R. Butcher, F. Hort & J. Hort* RB 1178; *F. & J. Hort* 2898, 2899). Nearly 500 flowering individuals of *T. nuda* var. *spartea* have been recorded at its rediscovery site. Plants are morphologically consistent across the population, as well as consistently different from *T. nuda*. Consequently, *T. nuda* var. *spartea* is recognised here at an elevated taxonomic rank as the new species *T. spartea* (Benth.) R.Butcher.

Drummond 101 is without locality information. However, the recent collections of *T. spartea* from the Julimar State Forest are *c.* 20 km away from James Drummond's property 'Hawthornden', near Toodyay. The Toodyay–Bolgart area was extensively sampled during Drummond's second, third and supplemental collections between 1843–1844 (Erickson 1969; Barker 2005; Maslin & George 2005) and Erickson (1969: 87) recounts that '[a]fter a year of almost constant field work and exploration during 1842 James Drummond spent most of 1843 at 'Hawthornden''. It appears highly likely, therefore, that *T. spartea* was originally collected in close proximity to Drummond's home, and the 162 year gap in its collection history suggests that it is a rare species, geographically restricted to this immediate area.

Methods

All *Tetratheca* specimens at PERTH were examined as well as material of Western Australian species, including types, on loan from MEL and NSW. Herbarium acronyms follow Holmgren and Holmgren (1998–). Stem width and foliage measurements were taken from both herbarium specimens and material preserved in 70% ethanol. Where values differed under different treatments, this has been noted. Floral measurements were taken from rehydrated flowers and material preserved in 70% ethanol. The distribution map was prepared using DIVA-GIS freeware Version 5.0.2.0. (http://www.diva-gis.org), from PERTH specimen data, and shows *IBRA (Interim Biogeographical Regionalisation for Australia) Version 6.1* boundaries.

A taxonomic key to the 'leafless' species of *Tetratheca* in Western Australia was published by Butcher (2007: 140–141). However, due to the length of its anther tube, *T. spartea* cannot be neatly inserted under lead 7. of that key and included in the same group as *T. angulata* R.Butcher, *T. applanata* R.Butcher and *T. nuda*, taxa with which it shares the greatest morphological similarity. An amended key is therefore presented here.

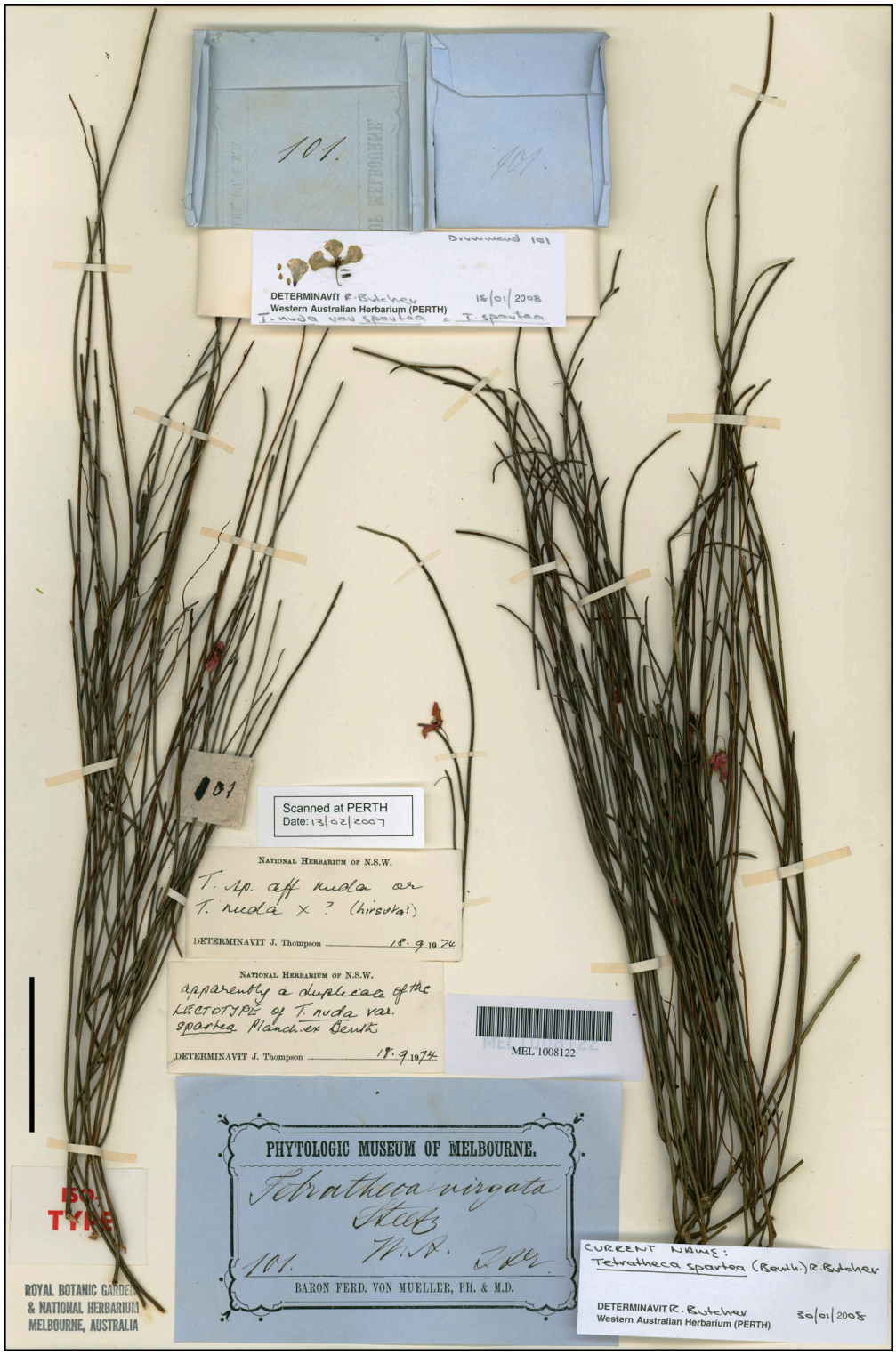

Figure 1. Isolectotype of *Tetratheca nuda* var. *spartea* (MEL 1008122). Additional flowers and fragments are contained within Mueller's packets. Scale = 5 cm.

Taxonomy

Tetratheca spartea (Benth.) R.Butcher, *stat. nov.*

Tetratheca nuda Lindl. var. *spartea* Planch. ex. Benth., *Fl. Austral*. 1: 133 (1863). *Type*: *Drummond,* Coll. 1843, n. 101 (*lecto*: K *n.v.*; *isolecto*: MEL 1008122!; *fide* Thompson 1976). Excluded syntype: *Drummond,* Coll. 1843, n. 104. NSW 125190! = *T. paucifolia* Joy Thomps.

Clumped *sub-shrub*, 0.45–0.6 m high, 0.15–0.3 m wide. *Stems* numerous from base, alternate, slender, mostly leafless, terete, straight but often curved in upper part, apices determinate, senescing into short silver-black points, 0.7–1.2 mm wide in flowering region, younger stems light green, striate, older stems mid-green, drying dull light olive-green, rugulose to irregularly striate, papillose with sparse, minute, red-tipped glandular hairs (to 0.1 mm long), these concentrated near stem bases and towards apices of younger stems and usually caducous. *Leaves* alternate, caducous, sparse, ascending with apex incurved; petiole applanate and concave in TS, persistent and appressed to stem after blade falls, 0.6–1.2 mm long, cream-pink, glabrous or with occasional small, red-tipped glandular hairs, not glaucous; blade ±linear to elliptic, 0.8–2.5 mm long, 0.4–0.9 mm wide; apex acute to obtuse, usually with a short, red-tipped glandular hair; margins flat, entire, with sparse, short, red-tipped glandular hairs; adaxial surface light green, glabrous or with a few simple hairs towards apex, not glaucous; abaxial surface light green, glabrous or pubescent towards apex or with sparse small, red-tipped glandular hairs, not glaucous. *Flowers* solitary in leaf axils. *Bracts* paired, linear, narrowly triangular or narrowly ovate, 0.5–0.9 mm long, 0.2–0.4 mm wide, green and pink or red, adaxial surface with either simple hairs or a mixture of simple and small, red-tipped glandular hairs along margin and towards apex, abaxial surface glabrous or with scattered small, red-tipped glandular hairs or a mixture of glandular and simple hairs in the upper half. *Pedicels* gently curved at base then ±straight or gently curved along length, 5.7–7.5 mm long, 0.15–0.3 mm wide, red becoming green towards apex, mostly glabrous with sparse papillae and occasional glandular hairs in upper third, not glaucous, very finely striate, expanding abruptly at apex into a receptacle 1.5–1.8 mm wide; receptacle with some warty projections and scattered, usually reflexed, red-tipped glandular hairs 0.2–1 mm long. *Calyx* segments 5(6), inserted inside receptacle rim, the base thickened and folded with the thickened portion on top of the rim, deciduous, ovate or elliptic, 2.3–2.9 mm long, 1.5–1.7 mm wide, concave in TS, apex acute to obtuse, erect; margins thinner, flat to gently reflexed; outer surface pink, glabrous but with warty thickenings mainly in the lower half, or also with scattered red-tipped glandular hairs; inner surface with few, fine, short hairs inside margin and towards apex, mid-vein thickened. *Petals* 5(6), deciduous, broadly obovate with a distinctly narrowed base, 9.9–12.2 mm long, 7.1–10 mm wide with the widest point at 7.3–7.7 mm length (*c.* 1/3 from the apex), apex broadly rounded, with a small triangular fold from the centre, bright pink with purple-black patch at base (to 3 mm length). *Stamens* 10(12), 3.3–3.9 mm long, free or very shortly fused into pairs at base; filaments fleshy, compressed, obliquely angled, 0.3–0.6 mm long, red-purple, a little paler than the anther body, pubescent on all surfaces; body gently curved from the filament on the inner edge, ±straight for a distance then slightly incurved into the tube, outer edge broadly curved from filament then strongly incurved at juncture with the tube, 1.6–2.1 mm long, dark red-purple, pubescent at base on outer surface, on entire inner surface and in depressions between anther cells on lateral surfaces; tube arising smoothly from the body on inner edge, distinctly contracted from the body on the outer edge, gently curved along its length, 1.3–1.6 mm long, orifice narrow, oblique, lower lip slightly longer than upper lip, dark red-purple, paler at tip, pubescent on inner edge in lower third. *Ovary* ±circular in outline, compressed, with a thickened rim at base, 0.8–1.1 mm long, 0.7–1.1 mm wide, pink to red, with a moderately dense to dense external covering of long glandular hairs, these with large, red, ±globular (L:W = 1:1–1:1.25)

heads when fresh, becoming ±discoid when dried, glabrous internally; *style* straight to slightly kinked in the mid-region, 2.3–3.1 mm long, red at base grading into yellow at apex, glabrous; *stigma* simple, sometimes shortly tufted; *ovules* 2, 1 in each locule, attached near the apex of the septum by a small placenta. *Fruit* not seen. *Seed* not seen. (Figure 1)

Specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 27 Sep. 2007, *R. Butcher, F. Hort & J. Hort* RB 1179 (K, MEL, NSW, PERTH 07719590), RB 1180 (CANB, PERTH 07719582); 1843, *J. Drummond* 101 (MEL 1008122); 9 Nov. 2005, *F. Hort* 2693 (AD, PERTH 07217331); 7 Oct. 2006, *F. Hort & J. Hort* 2895 (HO, PERTH 07719604).

Distribution and habitat. Known only from a single area within the Julimar State Forest, north-west of Toodyay (Figure 2), growing in red-brown clayey loam with lateritic gravel over laterite. Most commonly seen in and around shallow gullies below lateritic breakaways. Occurs in *Eucalyptus accedens* open woodland with *Gastrolobium spinosum*, *Acacia pulchella*, *Macrozamia reidlei*, *Hakea lissocarpha*, *H. undulata*, *Lasiopetalum exiguum* ms, *Trymalium urceolare* and *Goodenia pinifolia*.

Phenology. Flowers September to November.

Conservation status. Listed as Priority Two (as *T. nuda* var. *spartea*) under Department of Environment and Conservation (DEC) Conservation Codes for Western Australian Flora (Atkins 2008).

Etymology. The epithet *spartea* was apparently used by Bentham (1863) in reference to the dense, erect and almost leafless stems of this taxon, which is superficially similar to broom (e.g. *Spartium junceum*) in habit. The varietal epithet is retained here at species rank.

Affinities. *Tetratheca spartea* is evidently closely related to *T. nuda*, but can be easily distinguished by the following suite of characters: the long anther tube (1.3–1.6 mm compared with 0.35–0.5 mm long), which has a narrow orifice without a prominently longer inner lip; the ovary covered with

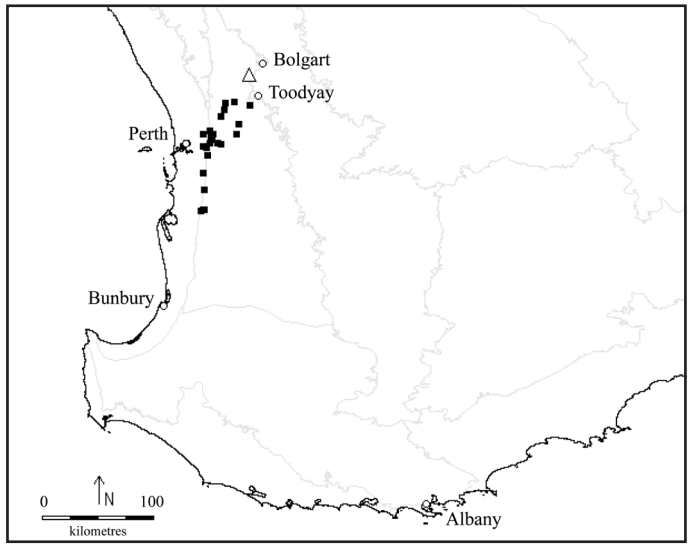

Figure 2. Distribution of *Tetratheca spartea* (△) and *T. nuda* (■) in south-west Western Australia.

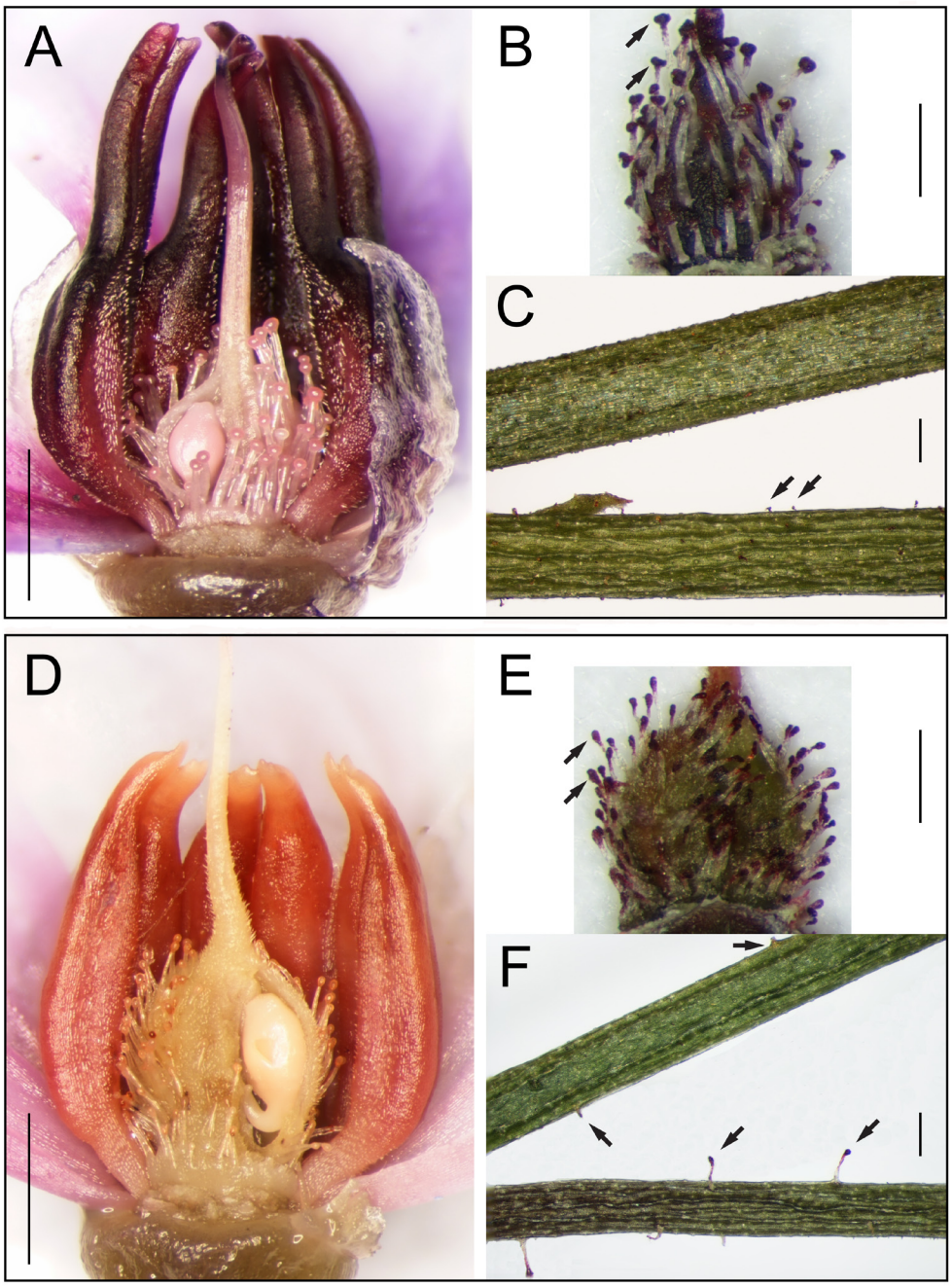

Figure 3. Comparative morphology of *Tetratheca spartea* (A–C; *R. Butcher*, *F. Hort & J. Hort* RB 1179) and *T. nuda* (D–F; *R. Butcher*, *F. Hort & J. Hort* RB 1189). A – dissected rehydrated flower showing elongate anther tubes, ±globular-headed glandular hairs on the ovary and glabrous style; B – dried ovary showing ±discoid-headed glandular hairs (arrowed); C – mature (upper) and young (lower) stems showing papillae and minute glandular hairs (arrowed); D – dissected rehydrated flower showing short anther tubes and orifices with elongate lower lip, ovary with both simple and glandular hairs and pubescent style base; E – dried ovary showing ±ellipsoid-headed glandular hairs (arrowed); F – mature (upper) and young (lower) stems showing longer glandular hairs and remnant bases (arrowed). Scale = 1 mm (A, D); 0.5 mm (B, C, E, F).

glandular hairs only (rather than both simple and glandular hairs), which are stouter with ±globular glandular tips which are broader than long and appear ±discoid when dried (rather than being ±elliptic in both the fresh and dried states); the glabrous style (rather than pubescent to 1/3 length); and slightly thicker stems (0.7–1.2 mm compared with 0.5–0.9 mm wide in the flowering region) with much shorter glandular hairs (to 0.1 mm compared with 0.2–0.5 mm long), which do not leave a noticeable remnant (Figure 3).

Tetratheca applanata is very similar to *T. nuda* in having slender, terete, leafless stems with long glandular hairs which leave a distinct remnant, as well as glandular hairs on the pedicel, receptacle and calyx segments, and the ovary densely covered with simple hairs and sparser, slender glandular hairs. This species differs from both *T. nuda* and *T. spartea* in stamen morphology; having the anther tube 0.6–1 mm long and the lower part of the anther body flattened and similar to the filament (Butcher 2007, Figure 7), as is seen in *T. paucifolia* Joy Thomps., as well as in having spathulate to narrowly obovate petals. *Tetratheca angulata* has stamens with similar dimensions to *T. nuda*, but is distinctive in this group in having compressed to quadrate stems and only simple hairs on the ovary.

Although Mueller (1882) placed *T. spartea* (as *T. nuda* var. *spartea*) under *T. virgata*, this latter species is distinctly different and can be distinguished by the following suite of characters: typically 4-merous flowers; frequent possession of slender, retrorse setae on stems; longer leaves with strongly revolute margins; glabrous ovary; and longer stamens (4.5–5 mm long), which are either glabrous or lightly tuberculate (rather than pubescent) and have longer filaments (*c.* 1 mm long), a prominent out-curving of the base of the anther body on the outer surface and anther tubes which are usually yellow and are longer (*c.* 2 mm long) and broader, with a broader orifice.

Notes. Habitat notes on *Tetratheca nuda* specimens indicate that this species is associated with granite substrates and in close proximity to granite outcrops. *Tetratheca spartea* has only been collected from areas at the base of lateritic breakaways, and this may indicate habitat specificity for the latter taxon. Further searches for this taxon should concentrate on similar habitat within the region.

Key to species of 'leafless' *Tetratheca* in Western Australia (amended from Butcher 2007)

1. Plants with a generally leafless aspect, although some leaves may be present **2**
1: Plants leafy ..... **group not addressed here**
2. Stems winged. Ovules 1 to 5 per loculus (Yallingup, Balingup to Cape Riche) ..... **T. affinis**
2: Stems terete or tri- to quadrangular in cross-section. Ovules 1 or 2 per loculus. **3**
3. Ovules typically 1 per loculus. **4**
4. Pedicels and calyx densely pubescent, pedicels less than 5 mm in length. **5**
5. Pedicels and calyx hispid with few small, red, glandular hairs. Leaf margins flat (NE Southern Cross, Newdegate) ..... **T. aphylla**
5: Pedicels and calyx hispid with numerous large, red glandular hairs, these frequently bearing small, simple hairs towards their base. Leaf margins loosely revolute. **6**
6. Stems 0.8–0.9 mm broad in the flowering region. Anther body 1.9–2.5 mm long with the lowest 0.6–1 mm extremely flattened and resembling the 0.6–1 mm long filament (Beverley to Arrino) ..... **T. paucifolia**
6: Stems 1.7–1.9 mm broad in the flowering region. Anther body 2.5–2.6 mm long, not flattened in the lower region, curved at base abaxially and abruptly meeting the 1.1–1.8 mm long filament (Eneabba)..... **T. nephelioides**

4: Pedicels and calyx glabrous or with occasional glandular hairs, pedicels 5 mm or more in length. **7**

7. Stems glabrous or very sparsely glandular hairy. Ovary pubescent to sericeous, with or without additional glandular hairs, or with glandular hairs only. Anther tube 0.35–1.6 mm long.

8. Stems compressed to quadrangular (Badgingarra to Eneabba) ..... **T. angulata**

8: Stems terete **9**

9. Ovary covered with stout glandular hairs only. Style glabrous. Anther tube 1.3–1.6 mm long (NW Toodyay) ..... **T. spartea**

9: Ovary with a dense covering of simple hairs as well as slender glandular hairs. Style pubescent at base. Anther tube 0.35–1 mm long. **10**

10. Body of anther flattened in lower third, filament 0.6–1.4 mm long, tube 0.6–1 mm long (Scattered; Dardadine, Broomehill, Ravensthorpe) ..... **T. applanata**

10: Body of anther not flattened towards base, filament 0.2–0.35 mm long, tube 0.35–0.5 mm long (Darling Scarp) ..... **T. nuda**

7: Stems usually with fine to coarse, scattered to dense setae, occasionally glabrous. Ovary glabrous. Anther tube 1.5–2.5 mm long **11**

11. Stems densely covered with patent, stout setae arising from broad tubercles. Leaves small (1.9–6.2 mm long) with flat, sparsely dentate and/or glandular hairy margins (NE Southern Cross) ..... **T. harperi**

11: Stems glabrous or finely setose, setae reflexed to retrorse when present and arising from small tubercles. Leaves large (2–15.5 mm long) with revolute, glabrous margins. **12**

12. Leaf-blades tapered at the base. Anther filaments stout, *c*. 1 mm long (E side Darling Scarp, York to Albany) ..... **T. virgata**

12: Leaf-blades broad at the base. Anther filaments slender, *c*. 0.5 mm long (Mt. Lesueur) ..... **T. remota**

3: Ovules typically 2 per loculus. **13**

13. Stems densely covered in broad tubercules bearing patent, stout, somewhat senescent setae. Petals white to pale pink with dark pink spots or pale mauve (NE Southern Cross) ..... **T. erubescens**

13: Stems smooth to minutely tuberculate, usually glabrous or with scattered glandular hairs or retrorse setae. Petals uniformly dark or mauve-pink, occasionally white. **14**

14. Anther tube 2.5–3 mm long with a conspicuously 2-lipped orifice (Tammin to Norseman) ..... **T. efoliata**

14: Anther tube 0.6–2 mm long, the orifice oblique or with a longer inner lip **15**

15. Base of the plant usually covered with strongly retrorse, dark coloured setae. Pedicels glabrous, pink-green to pink-red, 7–16 mm long. Leaves with revolute margins (Wongan Hills to Katanning) ..... **T. retrorsa**

15: Base of the plant lacking strongly retrorse, dark coloured setae. Pedicels scabrous to hispidulous, often with scattered, small glandular hairs, glossy green-red, 1–11 mm long. Leaves without revolute margins. **16**

16. Stems minutely tuberculate with scattered glandular hairs. Calyx segments broadly elliptic (Carnarvon Range) ..... **T. chapmanii**

16: Stems densely covered with rounded to truncate tubercles. Calyx segments narrowly triangular to lanceolate (NE Southern Cross) ..... **T. paynterae**

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