

## SHORT COMMUNICATION

A key to the species of *Thomasia* (Malvaceae: Byttnerioideae)

*Thomasia* J. Gay (Malvaceae Juss.) is predominantly Western Australian; only *T. petalocalyx* F. Muell. has populations that extend to South Australia and Victoria (AVH 2019). There are 31 formally named species in the genus with a further six potentially new phrase named taxa currently recognised (Western Australian Herbarium 1998–). Published information is limited as *Thomasia* has not been revised in full since Bentham's (1863) original *Flora Australiensis* treatment. Additionally, nearly half of all species are listed as priority taxa under the Conservation Codes for Western Australian Flora, with *T. glabripetala* S.J. Patrick, *T. montana* Steud. and *T. sp. Green Hill* (S. Paust 1322) recognised as Declared Rare Flora and *T. gardneri* Paust presumed to be extinct (Smith & Jones 2018). Finally, *T. triloba* Turcz. is currently only known from type material (*J. Drummond* 106: E00279375 image!; E00279376 image!; G00358699 image!; G00358700 image!; G00358701 image!; GH00061420 image!; K000686031!; K000686032!; K000686033!; KW001000146 image!; MEL1539808 image!; MEL723992 image!; NSW386401!; TCD0010921 image!) (Figure 1). The original location of this species is uncertain and while it currently has a Priority One conservation status it has never been recollected and so may also be extinct.

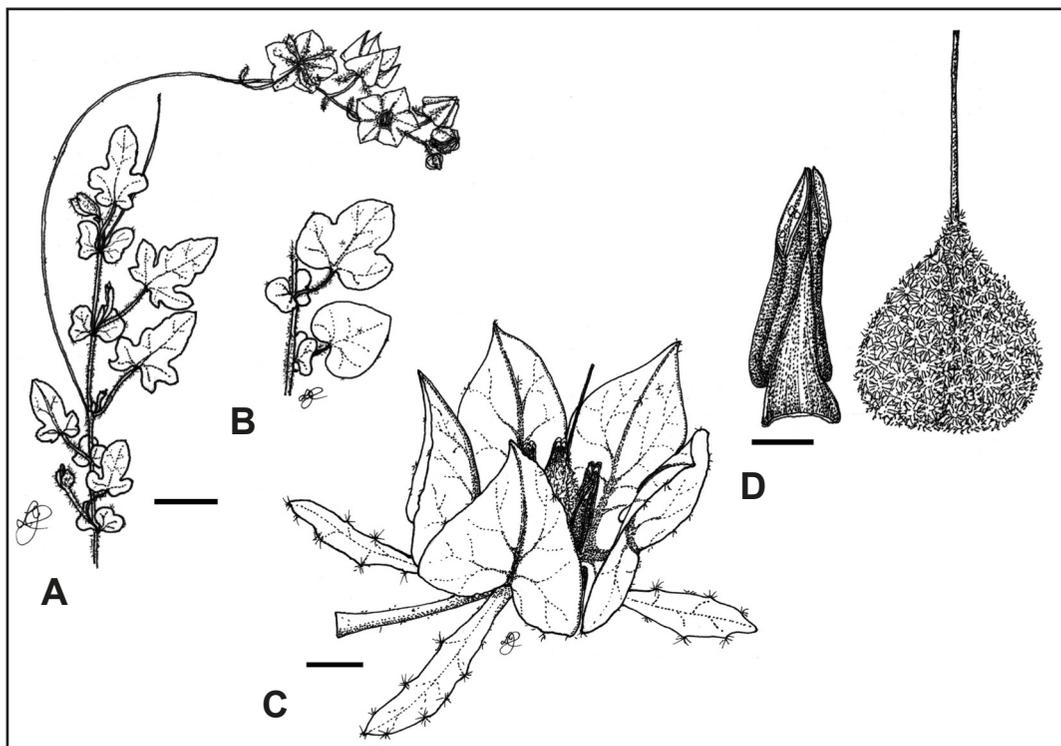


Figure 1. Illustration of *Thomasia triloba* Turcz. A – leaves and inflorescence; B – typical trilobed mature leaves and stipules; C – flower showing three epicalyx bracts subtending the petaloid calyx, both of which have very few multiangulate stellate hairs; D – detail of an anther, glabrous style and ovary with an indumentum of stellate hairs with short arms. Scale bars = 10 mm (A); 2 mm (C); 1 mm (D). Voucher: *J. Drummond* 106 (NSW386401). Illustration by Lorraine Cobb.

With so many species of *Thomasia* being poorly known it is hoped that a key to the genus will prove useful. As noted in a recent key of the closely related genus *Lasiopetalum* Sm. (Shepherd & Wilkins 2018), the size, shape, dissection, and indumentum of juvenile leaves can vary considerably as plants mature. Similarly, the petaloid calyx in *Thomasia* can also expand during development. As such, characters in the key are based on observations of herbarium specimens and field collections of fully developed leaves from mature plants with flowers at anthesis. The form and shape of hairs can be diagnostic and stellate hairs may be multiangulate (Figure 2C) or flat and scale-like with fused arms (Figure 2B). Anthers may exhibit poricidal (Figure 2D, F; Figure 3E) or early lateral dehiscence as seen in *T. foliosa* J.Gay and allied taxa (Figure 2E), and the true petals, if present, are small and scale-like (Figure 3C, F), and may be glabrous (Figure 2D) or covered in stellate hairs (Figure 2F). The indumentum of the ovary may also be important and comprise white multiangulate stellate hairs (Figure 2D, F), pink stellate hairs with very short arms (Figure 3B) or flat, scale-like hairs (Figure 2E). Alternatively, the ovary may have an indumentum that is a mixture of stellate hairs and stalked glandular hairs (see Figure 1F, Shepherd & Wilkins 2018 for glandular hairs) or is papillate and covered in multicellular, sessile (or almost so), wart-like bumps (Figure 2G).

### Key to species of *Thomasia*

\*taxa appear in more than one section of key

1. Stipules absent; flowering stems mainly with only scale-like stellate hairs or a mix of scale-like and scattered multiangulate stellate hairs
  2. Leaves narrowly ovate to oblong-linear, usually >15 mm long
    3. Calyx inner surface stellate hairy (NE Northcliffe–Fitzgerald River NP) ..... **T. stelligera**
    - 3: Calyx inner surface glabrous (New Norcia) ..... **T. sp. GreenHill\***
  - 2: Leaves ovate, oblong to orbicular, < 15 mm long
    4. Style 5-winged; petals absent; ovary with peltate scale-like stellate hairs over glandular hairs (Albany E–Esperance W) ..... **T. pygmaea**
    - 4: Style filiform; petals present; ovary with peltate scale-like stellate hairs or flat stellate hairs
      5. Ovary with 4–5 locules; petals with dense marginal peltate scale-like stellate hairs or multiangulate stellate hairs; calyx > 8 mm long; peduncles < 6 mm long (Mount Holland) ..... **T. gardneri†**
      - 5: Ovary with 3 locules; petals glabrous or occasional scale-like stellate hairs on abaxial surface; calyx < 8 mm long; peduncles > 7 mm long
        6. Leaves usually > 7 mm long, lower leaf surface with flat scale-like stellate hairs, sometimes with occasional multiangulate stellate hairs; peduncles (10–)30–50 mm long with 3–7 flowers
          7. Calyx outer surface with flat scale-like stellate hairs alone, inner surface glabrous; leaves with midvein only indented (New Norcia) ..... **T. sp. GreenHill\***
          - 7: Calyx outer surface with flat scale-like and scattered multiangulate stellate hairs, inner surface with scattered white stellate hairs; leaves with midvein and minor veins indented (W of Woodanilling) ..... **T. sp. Arthur River**
        - 6: Leaves < 7 mm long, lower leaf surface with peltate scale-like stellate hairs; peduncles 10–23(–30) mm long with 1–2(3) flowers (Ongerup–Esperance east) ..... **T. microphylla**
  - 1: Stipules present, leaf-like and conspicuous or minute and inconspicuous; flowering stems with only multiangulate stellate hairs

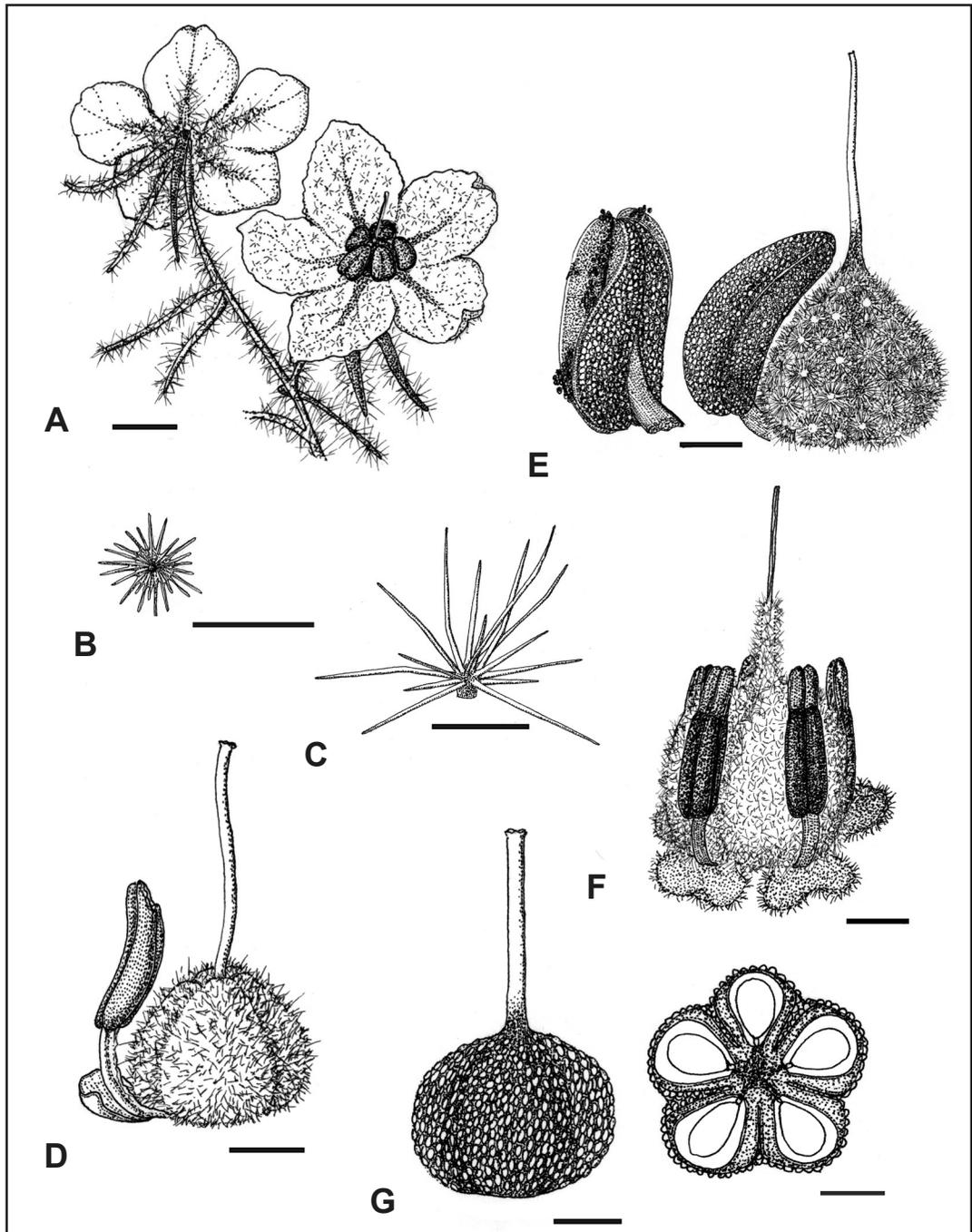


Figure 2. Floral features of *Thomasia*. A – flower showing the petaloid calyx and stellate hairs with long arms on the peduncle and epicalyx bracts; B – flat scale-like hair; C – multiangulate stellate hair; D – anther with poricidal dehiscence, glabrous scale-like petal, ovary with stellate hairs, and a glabrous style; E – anthers with early lateral dehiscence and ovary with flat, scale-like stellate hairs and a glabrous style; F – anthers with poricidal dehiscence, scale-like petals with dense stellate hairs, ovary with stellate hairs, and base of style prominently tomentose to 1/3 of length; G – papillose ovary with a glabrous style, transverse section showing 5 carpels. Scale bars = 2.5 mm (A); 0.25 mm (B); 1 mm (C); 0.5 mm (D); 0.5 mm (E); 1 mm (F); 0.5 mm (G). Vouchers: *Thomasia* sp. Vasse (C. Wilkins & K. Shepherd CW 581) (*K.A. Shepherd & J.A. Wege* KS 345) (A–C, E); *T.* sp. Hopetoun (K.R. Newbey 4896) (*K.A. Shepherd & J.A. Wege* KS 277) (D); *T. paniculata* Lindl. (*P.M. Olde* 678, NSW 270044) (F); *T. rulingioides* Steud. (*K.A. Shepherd & J.A. Wege* KS 201) (G). Illustration by Lorraine Cobb.

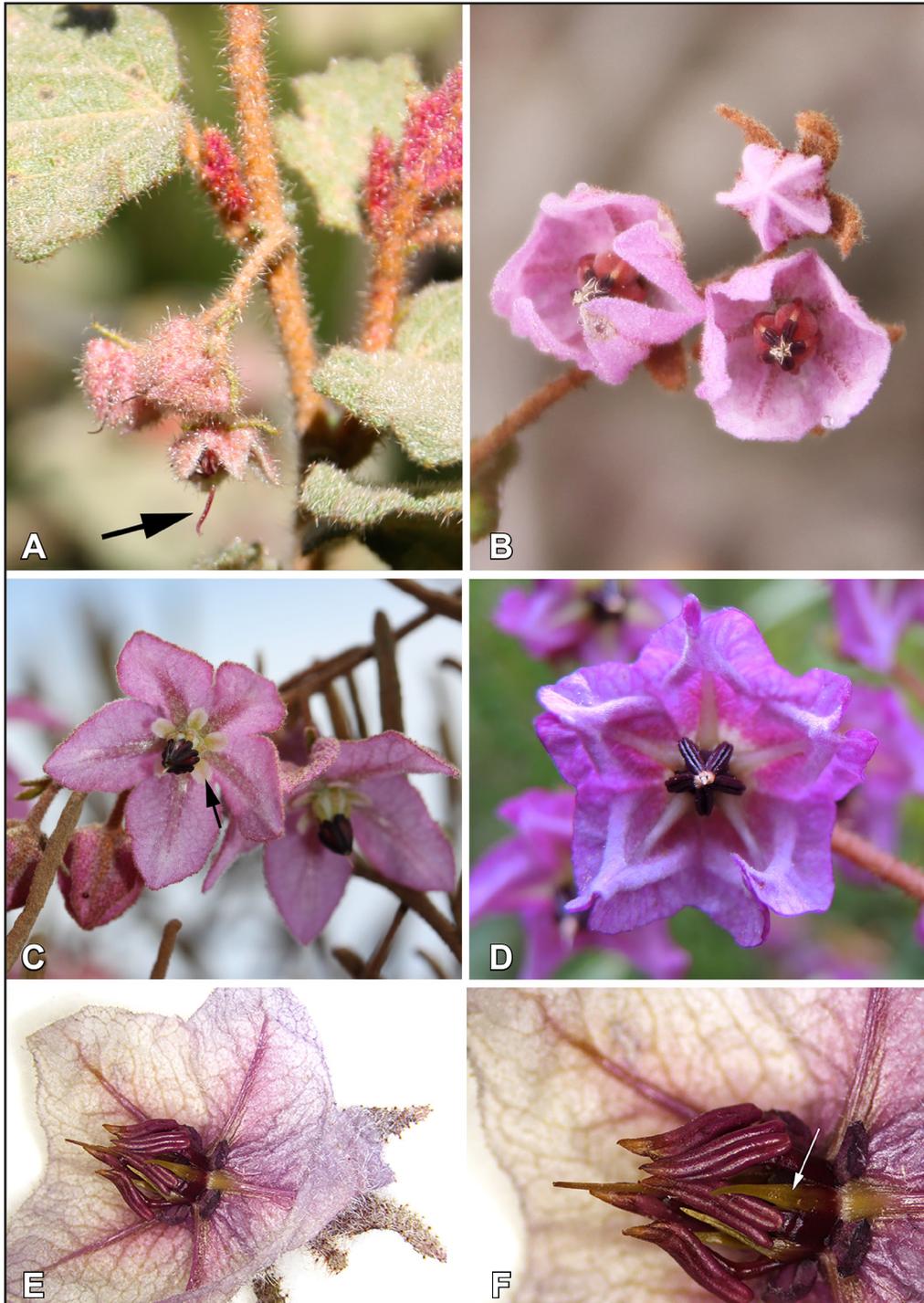


Figure 3. Informative floral characters in *Thomasia*. A – style > 3 times longer than ovary and well exerted from the calyx; B – ovary with pink stellate hairs with short arms to 0.15 mm long; C – scale-like petals (black arrow); D – calyx thickened along the central area with thin, undulating margins; E – poricidally dehiscent anthers; F – perigynous cup with staminodes (white arrow). Vouchers: *T. aff. foliosa* (K.A. Shepherd & C.F. Wilkins KS 1614) (A); *T. pauciflora* Lindl. (K.A. Shepherd & C.F. Wilkins KS 1643) (B); *Thomasia sarotes* Turcz. (K.A. Shepherd et al. KS 1462) (C); *T. grandiflora* Lindl. (in cultivation) (D); *T. montana* Steud. (D. Rasmussen 2013/003) (E, F). Images by K.A. Shepherd.

8. Stipules conspicuous; anthers poricidally dehiscent or with late lateral splitting; style *c.* 2 times longer than ovary and not well exerted from the calyx
9. Leaves and stipules linear, with margins tightly revolute
10. Inflorescence with 2 flowers (rarely 3); calyx < 4.5 mm long; ovules 2 per locule (Hopetoun–Ravensthorpe)..... **T. sp. Hopetoun**
- 10: Inflorescence with 3–6 flowers; calyx usually > 4.5 mm long; ovules 6–8 per locule (Mukinbudin–Quaalup)..... **T. sarotes**
- 9: Leaves and stipules not linear, margins flat or scarcely recurved to recurved
11. Mature leaves lobed
12. Mature leaves divided almost to midvein, appearing ‘oak-like’
13. Leaves coriaceous, lower surface with a close tomentum of short stellate hairs each with arms to 0.2 mm long (Denmark–Esperance)..... **T. quercifolia**
- 13: Leaves soft, lower surface with scattered to medium dense long stellate hairs each with arms to 0.8 mm long (Augusta–Denmark)..... **T. sp. Vasse**
- 12: Mature leaves lobed or trilobed, not divided almost to the midvein
14. Leaves discolorous, lower surface with a close tomentum of stellate hairs; calyx 13–20 mm long with a strongly dissected tube *c.* 20% of the total length (Albany)..... **T. discolor**
- 14: Leaves almost concolorous, lower surface with scattered to dense stellate hairs; calyx 6–10 mm long with a moderately dissected tube *c.* 40% of the total length
15. Leaves (20)30–83 mm long, soft, lower surface with moderately dense stellate hairs
16. Petals absent or minute *c.* 0.4 mm long; epicalyx bracts narrowly obovate or narrowly elliptic (Denmark–Bremer Bay)..... **T. solanacea**
- 16: Petals > 1 mm long; epicalyx bracts ovate (Stirling Range National Park) .... **T. brachystachys**
- 15: Leaves 12–44 mm long, coriaceous, lower surface glabrous or with scattered stellate hairs
17. Leaf margins strongly multi-lobed with a ±trilobed base, lamina usually longer than wide; anther filaments > 2.5 mm long (Cervantes to Esperance in coastal heath) ..... **T. triphylla**
- 17: Leaf margins distinctly trilobed, lamina as long as wide; anther filaments < 2 mm long (Unknown) ..... **T. triloba**
- 11: Mature leaves entire to scarcely sinuate, not distinctly lobed
18. Stamens and staminodes united in a glabrous or hairy perigynous cup *c.* 2 mm long (often longer than the ovary)
19. Perigynous cup hairy (Perth–Bridgetown) ..... **T. macrocarpa**
- 19: Perigynous cup glabrous
20. Petals with scattered to dense stellate hairs (Brookton–Tutanning NR) ..... **T. montana**
- 20: Petals glabrous (York area) ..... **T. glabripetala**
- 18: Stamens free or scarcely united at base, or with a glabrous staminal tube < 0.8 mm long
21. Calyx thickened along the central area either side of the midvein and with thin, undulating margins; leaves usually coriaceous with very few scattered

- stellate hairs (Geraldton-Augusta-Esperance) ..... **T. grandiflora**
- 21:** Calyx thin except for midvein; leaves thin and soft, indumentum various
- 22:** Leaves usually discoloured with a tomentose indumentum of dense stellate hairs below (Dryandra–Stirling Range NP) ..... **T. dielsii**
- 22:** Leaves almost concolorous with an indumentum of scattered to moderately dense stellate hairs below
- 23:** Leaves < 10 mm long; pedicels with long glandular hairs (Morawa–Bencubbin) ..... **T. tremandroides**
- 23:** Leaves > 10 mm long; pedicel with glandular hairs absent or inconspicuous
- 24:** Ovary with ±sessile papillose glands sometimes mixed with stellate hairs, without stalked glandular hairs
- 25:** Petioles 0.2–1.5 mm long; leaf margins strongly recurved; upper surface of epicalyx bracts glabrous or rarely with 1–2 hairs (S of Dongara–N of Cervantes) ..... **T. rulingioides**
- 25:** Petioles (1.6–)2–8 mm long; leaf margins scarcely recurved; upper surface of epicalyx bracts with hairs throughout
- 26:** Calyx usually < 6.5 mm long, ovules 2 per locule
- 27:** Ovary with red papillose glands only; flowers (3–)5–6 per inflorescence (Albany area) ..... **T. purpurea**
- 27:** Ovary with red papillose glands and scattered to dense white stellate hairs at the apex; flowers (4)5–8(–12) per inflorescence (Albany) ..... **T. multiflora**<sup>§</sup>
- 26:** Calyx usually > 6.5 mm long; ovules 4–8 per locule
- 28:** Calyx lobes broadly ovate, *c.* 6 mm wide, tube almost half of total length; ovary with papillose glands only (Three Springs–Israelite Bay) ... **T. macrocalyx**
- 28:** Calyx lobes ovate to narrowly ovate, *c.* 3.5 mm wide, tube < 20 % of total length; ovary with papillose glands only or a mix of papillose glands and white stellate hairs (Frankland River–W of Cape Arid NP; SA, Vic) ..... **T. petalocalyx**
- 24:** Ovary with stellate hairs, sometimes with white, red- or pink-tipped stalked glandular hairs, or with stalked glandular hairs only
- 29:** Base of style prominently tomentose to 1/3 of length; leaf margin recurved but entire to scarcely crenulate
- 30:** Ovary with short stellate hairs only
- 31:** Epicalyx bracts ovate, (1.7–)2–3 mm wide; flowers 1–2(3) per inflorescence; ovules (2–)4–7 per locule ; erect spreading shrub (Gracetown–Albany–Stirling Range National Park) ..... **T. rhynchocarpa**
- 31:** Epicalyx bracts narrowly ovate, 0.8–1 mm wide; flowers (2)3(4) per inflorescence; ovules 2 per locule; low mounded shrub (Perth–Augusta–E of Albany) ..... **T. pauciflora**
- 30:** Ovary with short stellate hairs and conspicuous glandular hairs 0.5–0.6 mm long

32. Inflorescence a monochasium of < 3–7(–9) flowers; calyx > 7 mm long; leaves usually narrowly ovate (L:W *c.* 6:1) (Perth–Albany) ..... **T. paniculata**
- 32: Inflorescence a dichasium or monochasium of 7–20 flowers; calyx < 7 mm long; leaves usually ovate (L:W *c.* 2.5:1) (N of Collie–W of Pemberton–E to the Porongurups) ..... **T. sp. Big Brook**
- 29: Base of style completely glabrous or with a few stellate hairs; leaf margin recurved and somewhat crisped
33. Leaves ovate, 8–27 mm wide
34. Leaf upper surface prominently rugose; epicalyx bracts 2.1–3.3 mm wide; petals absent (Wongan Hills–E of Ravensthorpe) ..... **T. rugosa**
- 34: Leaf upper surface not prominently rugose; epicalyx bracts 0.8–1.2 mm wide; petals stellate hairy (Carnamah to Bendering) ..... **T. tenuivestita**
- 33: Leaves narrowly ovate, elliptic or oblong, 1.2–8 mm wide
35. Petals with stellate hairs on the margin; anthers < 1.5 mm long; ovary hairs 0.7–1.25 mm long; peduncle stellate hairs with arms to 1.3 mm long (Cervantes–Esperance, in coastal heath) ..... **T. cognata**
- 35: Petals glabrous; anthers > 1.7 mm long; ovary hairs 0.15–0.3 mm long; peduncle stellate hairs with arms 0.2–0.4 mm long
36. Leaves with veins scarcely impressed; inflorescence < 60 mm long; epicalyx bracts *c.* 1.5 mm wide; flowers 5-merous; anthers 1.8–1.9 mm long; ovules 2 per locule (Kojonup–Israelite Bay) ..... **T. angustifolia**
- 36: Leaves with veins strongly impressed; inflorescence > 60 mm long; epicalyx bracts 2.1–4 mm wide; flowers 5- or 6-merous; anthers *c.* 3 mm long; ovules 6–8 per locule (Three Springs) ..... **T. formosa<sup>#</sup>**
- 8: Stipules minute and inconspicuous; anthers showing early lateral dehiscence; style > 3 times longer than ovary and well exerted from the calyx<sup>§</sup>
37. Leaf lower surface and calyx outer surface with a dense indumentum of small stellate hairs, each with *c.* 12 arms (*c.* 0.2 mm long) arms, beneath moderately dense large stellate hairs (*c.* 0.5 mm long); moderately dense red-tipped glandular hairs on new growth and outer calyx of flowers in bud (Lesueur NP) ..... **T. sp. Lesueur**
- 37: Leaf lower surface and base of calyx outer surface with an indumentum of very few small stellate hairs, each with *c.* 6 arms (0.2 mm long), beneath moderately dense large stellate hairs (0.5 mm long); scattered red-tipped glandular hairs on new growth and outer calyx of flowers in bud (Eneabba–Esperance E) ..... **T. foliosa**

<sup>#</sup>Presumed extinct (see Smith & Jones 2019).

<sup>§</sup>*Thomasia multiflora* is currently only known from two collections (L. Diels 5528, K. Newbey 4869). This species is poorly differentiated from *T. purpurea* and may not be supported as distinct.

<sup>#</sup>Possible hybrid between *Lysiosepalum rugosum* × *T. macrocalyx* (see Wilkins & Chappill 2001: 593).

<sup>°</sup>Further work is required to resolve this complex. *Thomasia foliosa* and *T. sp. Lesueur* (M. Hislop 4217) usually have dark green leaves with an indumentum of scattered stellate hairs on the upper leaf surface; however, a variant currently determined as *T. aff. foliosa* (K.A. Shepherd & C.F. Wilkins KS 1614, K.A. Shepherd & C.F. Wilkins KS 1617) with pale green leaves and an indumentum of dense stellate hairs on the upper leaf surface (Figure 3A) was collected east of Bindoon, co-occurring with typical *T. foliosa* (K.A. Shepherd & C.F. Wilkins KS 1616, K.A. Shepherd & C.F. Wilkins KS 1616b). Furthermore, another unusual specimen (C.W. Parker 1628.08) with affinity to the closely allied *T. sp. Lesueur* (M. Hislop 4217) was collected east of Hopetoun, which is more than 800 kms to the south of known populations.

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## References

- AVH (2019). *The Australasian Virtual Herbarium*. Council of Heads of Australasian Herbaria. <http://avh.chah.org.au> [accessed 19 March 2019].
- Bentham, G. (1863). *Flora Australiensis*. Vol. 1. (Reeve and Co.: London.)
- Shepherd, K.A. & Wilkins, C.F. (2018). Typification of *Lasiopetalum* and an interim key to the Western Australian species of the genus (Malvaceae: Byttnerioideae). *Nuytsia* 29: 181–192.
- Smith, M.G. & Jones, A. (2018). *Threatened and Priority Flora list 05 December 2018*. Department of Biodiversity, Conservation and Attractions. <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-plants> [accessed 19 March 2019].
- Western Australian Herbarium (1998–). *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. <https://florabase.dpaw.wa.gov.au> [accessed 7 February 2018].
- Wilkins, C.F. & Chappill, J.A. (2001). A taxonomic revision of the Western Australian genus *Lysiosepalum* (Malvaceae: Lasiopetaleae). *Nuytsia* 13 (3): 571–594.

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