

## The Tasmanian species of *Philothea* (Rutaceae)

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### Abstract

*Philothea freyciana* sp. nov. is described from the Freycinet Peninsula in Eastern Tasmania. The five-merous flowers and obcordate glandular leaves suggest affinities with *P. verrucosa* (A.Rich.) Paul G. Wilson, but it differs from this taxon in having anthers with an acute apex, larger leaves and flowers, and also in habit. The morphology of both these species and *P. virgata* (Hook.f.) Paul G. Wilson is described, and the variation in leaf size and anther morphology is illustrated. A key to the species of *Philothea* in Tasmania is provided, along with data on the distribution and phenology of each species.

### Introduction

Wilson (1998) recently completed a taxonomic revision of the genera, *Eriostemon* Sm. and *Philothea* Rudge (Rutaceae), and transferred the two Tasmanian species *E. verrucosus* A.Rich. and *E. virgatus* Hook.f. to *Philothea*. In preparing the revised State Flora, the Tasmanian species in *Philothea* were re-examined using the collections in the Tasmanian Herbarium. A study of these collections indicated that a previously undescribed taxon occurred on the Freycinet Peninsula in eastern Tasmania. Wilson (1970, p. 48) had also noted much earlier that "on Freycinet Peninsula a plant with broad, imbricate leaves (to 12 × 9 mm) is found, considerably larger than the mainland form". Limited fieldwork by the author resulted in the finding of three plants of this taxon, in two separate localities.

*Philothea virgata* is sympatric with the new taxon, but it differs in leaf shape, floral merotomy and inflorescence structure. *Philothea verrucosa* has not been collected on the Freycinet Peninsula. The new taxon differs from *P. verrucosa* in having larger leaves and flowers, the apex of the anthers is acute, and the leaves are almost imbricate. The morphological differences identified indicate that formal recognition of the Freycinet populations as a discrete taxon is required and specific rank seems appropriate. Information on the morphology and distribution of *P. verrucosa* and *P. virgata* in Tasmania is also included.

### Materials and Methods

Herbarium material of all Tasmanian taxa of *Philothea* were examined in the Tasmanian Herbarium. For scanning electron microscopy alcohol-preserved material was taken through an alcohol dehydration series, critical point dried, placed onto aluminium stubs with carbon or double-sided tape and sputter coated with gold to a thickness of ~20 µm and examined with an Environmental Scanning Electron Microscope 2020 operated at 15–20 kV under high vacuum. The geographical regions of Tasmania used are those of Orchard (1988).

### Taxonomy

Basionyms, nomenclature and complete synonymies for *P. virgata* and *P. verrucosa* are cited in Wilson (1970, 1998).

### 1. *Philothea virgata* (Hook.f.) Paul G. Wilson

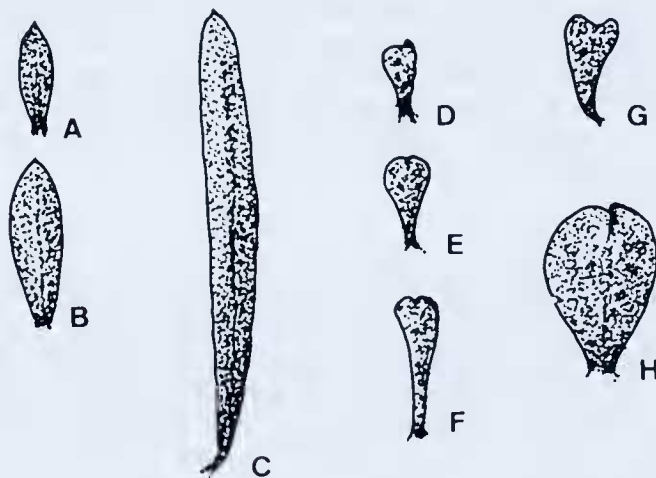
An erect *shrub*, occasionally up to 1–2(–2.5) m tall, glabrous except for the pilose staminal filaments. *Branches* terete, scarcely to strongly glandular-verrucose. *Leaves* sessile, flat to slightly convex, oval to narrowly obovate, 9–18(–40) mm long, 3–5 mm wide, coriaceous, relatively thin, with mid-rib extended into a mucronate tip, smooth on abaxial surface, with tubercular glands on adaxial surface (Figs 1A–C). *Inflorescence* single flowered, axillary, *peduncle* absent; *flowers* 4(–5)-merous; *bracteoles*, c. 1 mm long, four, deltoid, caducous, inserted at the base of the pedicel; *pedicel* 3–5 mm long; *sepals*  $\pm$  semiorbicular, 0.5–1 mm long; *petals* 4(–5), broadly elliptical, 5.0–6.5 mm long, 3.0–3.5 mm wide, white; *stamens* 8(–10), filament broadly flattened proximally and prominently pilose near apex, tapering abruptly or gradually towards the anther, *antepetalous filaments* 1.8–2.8 mm long, *antepetalous filaments* 1.8–2.4 mm long; *anther* cordate, versatile, introrse, c. 1 mm long, apex biglandular, apiculum bluntly pointed, pollen orange (Fig. 2A–B); *ovary* inserted into the disc; *carpels* 4(–5), narrow, *style* <0.5 mm free; *stigma* 4(–5)-partite. *Cocci* spreading, 4.5–6.0 mm long, 2.5 mm wide, adaxial margin rounded, the apex acute to rostrate, surface irregularly rugose. *Seed* black, shiny, c. 3 mm long.

*Habitat and Distribution:* *Philothea virgata* occurs commonly in western Tasmania, with disjunct populations on the East Coast in the Coles Bay area, and further north in the Scamander area (Fig. 3A), and there are also disjunct populations at Mt Imlay in southern New South Wales, and Mt Kaye in Victoria. In Tasmania, it is typically a lowland taxon, usually occurring at altitudes of less than 300 m, but occasionally up to 800 m as in the Mt Imlay population in New South Wales; and it occurs in a range of community types including both heath and sedge communities.

*Conservation Status:* The species is common in western Tasmania.

*Phenology:* *Philothea virgata* flowers in October–February, but plants may be found in flower throughout the year.

*Notes:* *Philothea virgata* varies in leaf-size between populations (Fig. 1A–C), and plants with very long slender leaves, usually 30–40 mm long, occur in the Cygnet area in southern Tasmania. There are also differences between populations in the width and the shape of the



**Figure 1.** Variation in leaf size and shape in *Philothea* species. A–C *P. virgata*, A D.Ziegler 5, HO 99916; B W.D.Jackson s.n., HO 4882; C Rozefelds 952, HO 329845; D–G *P. verrucosa*, D F.H.Long 875, HO 92397; E A.V.Giblin s.n., HO4864; F P.Collier 654, HO 97961; G J.F.Thompson s.n., HO 97800; H *P. freyciana*, B.Gee s.n., HO 320402. All 1.4  $\times$  natural size.

filaments of the stamens. Material from Freycinet (*Rozefelds 1668* HO) and Mt Imlay (*Duretto 720* MEL) have a relatively broad filament-base which tapers abruptly, while the West Coast specimens (e.g. *W.J.Jackson s.n.* (HO 4882)) have narrower filaments which taper gradually. The filaments of the West Coast material are also often strongly sigmoid.

*Representative Specimens:* **NEW SOUTH WALES:** Mt Imlay, 20 km SW of Eden, 37°11'S 149°44'E altitude 850m, *I.R.Telford 6761*, 25 Oct. 1977 (HO 59327), Mt Imlay summit, 37°11'S 149°45'E, altitude 880 m, *M.F.Duretto 720*, 2 Oct. 1995 (HO 326895). **TASMANIA:** EAST COAST: Middleton Creek, 3 kms NE of Coles Bay, 42°06'S 148°18'E, *D.Ziegeler 5*, 4 Oct. 1986 (HO 99916); Coles Bay, 42°08'S 148°17'E *W.M.Curtis s.n.*, Oct. 1946 (HO 4884); Nicholls Rivulet near Cygnet, 43°09' 52"S 147°09'40"E, altitude 120m, *A.C.Rozefelds 952*, 6 Nov. 1998 (HO 329845). WEST COAST: 7 miles from Zeehan, on Granville Harbour Road, 41°50'S 145°15'E, altitude 190m, *A.E.Orchard 5615*, 3 Dec. 1981 (HO 120567); Long Plains, Corinna, 41°31'S 145°13'E, *W.D. Jackson s.n.*, Jan. 1954 (HO 4882); SOUTH WEST: Plateau area between Hills Creek and Fern Creek on track 42°28'S 145°21'E, altitude 180 m *A.M.Buchanan 1911*, 7 Dec. 1983, (HO 89967).

## 2. *Philothea verrucosa* (A. Rich.) Paul G. Wilson

*Shrub* to 1.0 m tall, erect, spreading to scandent in habit, glabrous except for staminal filaments. *Branches* terete, green, prominently glandular-verrucose. *Leaves* sessile, thick, slightly concave to conduplicate, narrowly obcordate or obovate, (4–)5–10(–14) mm long and 3.5–5 mm wide, coriaceous with prominent tubercular glands on the abaxial surface, the adaxial surface smooth (Figs 1D–G). *Inflorescence* 1(–3) flowered, axillary; *peduncle* 2.0–3.0 mm long; *flowers* 5-merous; *bracteoles* four, brown, caducous at base of pedicel; *pedicel* 1.0–2.0 mm long; *sepals* semiorbicular, c. 1 mm long, c. 1 mm wide, margin finely ciliate; *petals* 5, elliptical, 4–6 mm long, 2.8–3.0 mm wide, white, pink in bud; *stamens* 10, staminal filaments slightly flattened, narrow and tapering, margin sparsely pilose, *antepetalous filaments* 2.4–2.8 mm long, *antepetalous filaments* 2.3–2.5 mm long; *anthers* versatile, introrse, c. 1 mm long, apex biglandular, rounded with “pinched” apex in bud (Figs 2C–D), less evident in mature stamens, apex obtuse with a small indentation near the apex (Fig. 2E), pollen orange; *ovary* inserted into the disc, *carpels* 5, narrow, style <0.5 mm free; *stigma* 5 partite. *Cocci* spreading, 4.0–4.5 mm long, c. 2.8–3.0 mm wide, adaxial margin rounded, apex acute, sometimes shortly rostrate, surface weakly rugose. *Seed* black and shiny, 4–4.5 mm long.

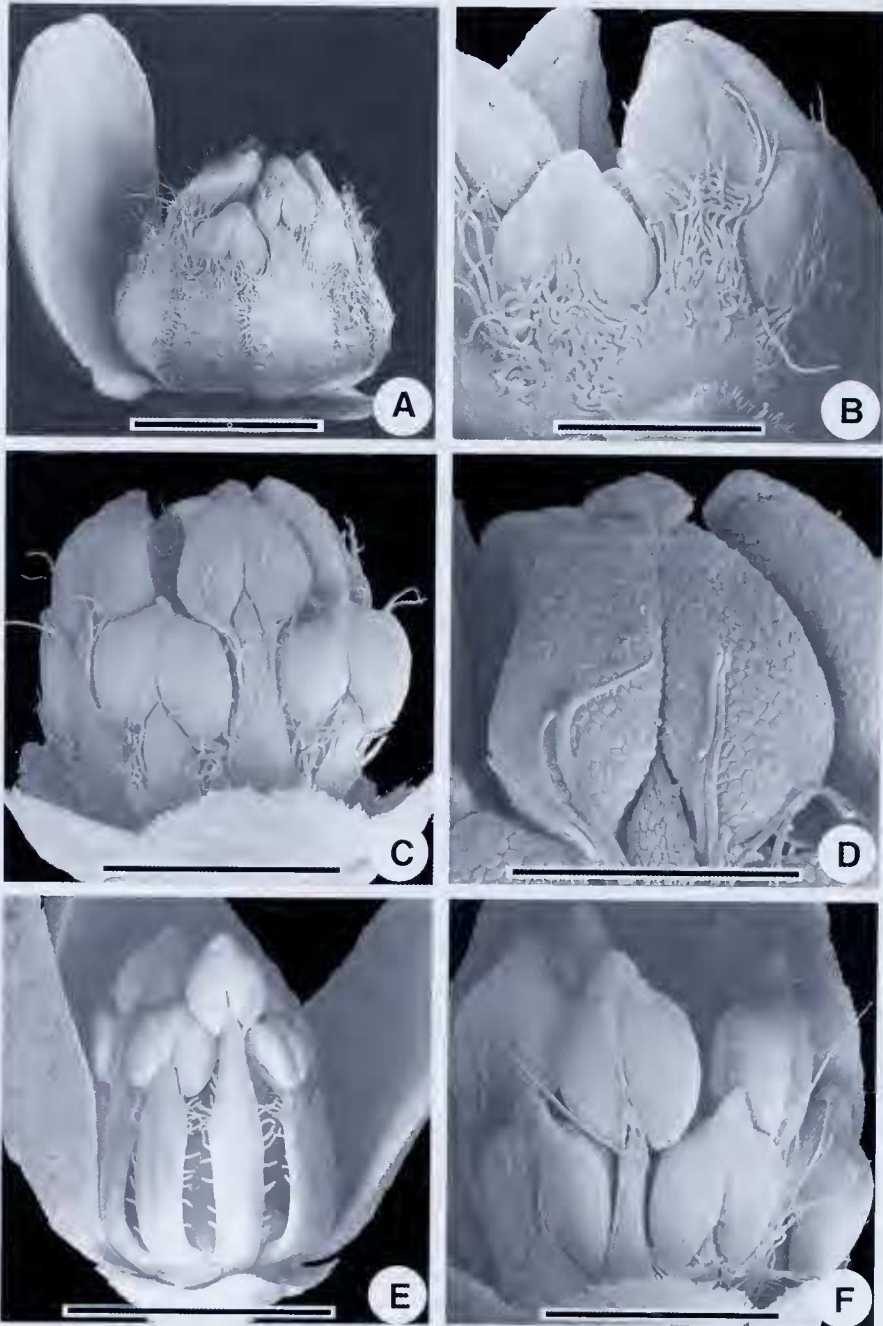
*Habitat and Distribution:* *Philothea verrucosa* occurs in Victoria, South Australia and Tasmania (Wilson 1970). In Tasmania, it occurs in forests of *Eucalyptus amygdalina* Labill. and *E. viminalis* Labill. on dry hillsides and is restricted to the eastern half of the State (Fig. 1B). It typically occurs at low altitudes (< 200 m), but occasionally up to 500 m, as in the Mount Sugarloaf locality.

*Conservation Status:* This species is common in eastern Tasmania and is not considered under threat.

*Phenology:* *Philothea verrucosa* flowers commonly in October–January, but plants have been collected in flower in most months of the year.

*Representative Specimens:* **VICTORIA:** Mt Difficult Road, The Grampians, *T.B.Muir 2613*, 10 Oct. 1962; (HO 37594, MEL 4503); 1 km SW of Chewton and 4 km ESE of Castlemaine, 37°05'S 144°05'E, *T.B.Muir 6744*, 6 Oct. 1981 (HO 83168). **TASMANIA:** EAST COAST: Near South East Boundary of east Risdon Nature Reserve, 42°49'S 147°19'E, altitude 110 m, *A.M.Buchanan 3775*, 21 Oct. 1984, (HO 86743); North of the Basin, Ouse River, 42°24'S 146°48'E, altitude 180 m, *P.Collier 654*, 15 Sept. 1985 (HO 97961); Mt Peter, Eastern Ridge, dry dolerite ridge, 42°01'S 148°15'E, altitude 200 m, *A.M.Buchanan 7671*, 29 Dec. 1985 (HO 406919); Lynes Sugarloaf, 42°55'S 148°7'E, altitude 552 m, *A.Moscal 357*, 15 Jun. 1980 (HO 35287); Upper Proctors Road, Hobart, 42°54'S 147°20'E, *J.F.Thompson s.n.*, Oct. 1959 (HO 97800); Campania, 42°40'S 147°25'E, *A.V.Giblin s.n.*, Nov. 1929 (HO 4864); Glenorchy, on water reserve, 42°49'S 147°18'E, altitude 300 m, *F.H.Long 875*, 25 Oct. 1931 (HO 92397).





**Figure 2.** Abaxial views of anthers of the three Tasmanian *Philotheca* species: *P. virgata*, **A** – Dissected bud showing arrangement of stamens, note the broad flattened hairy anther filaments, **B** – Detail of anther from 2A; *P. verrucosa*, **C** – Dissected bud showing arrangement of stamens and note the relatively thin filaments, **D** – Detail of anther from Fig. 2C showing the pinched apex and note that the shape of the apex of the anther varies slightly between episepalous and epipetalous anthers, **E** – open flower with stamens fully elongated; *P. freyciana*, **F** – Dissected bud showing the conspicuous glands towards the apex of the anther (A–B, *Rozefelds 1668*, Coles Bay, Tasmania, Oct, 1999 (HO); C–E, *Rozefelds 1667*, Orford, Tasmania Sept. 1999 (HO); F, *Rozefelds 1666* (HO)). Scale Bars: A,C,F = 1 mm; B, D, E = 500  $\mu$ m.

Comments: Wilson (1970) considered *P. verrucosa* a uniform taxon, although it is variable in leaf-shape, the degree of leaf-concavity, and also in the appearance of glands on the abaxial surface of the leaves. Leaf shape in *P. verrucosa* varies from narrowly obovate to obcordate (Fig. 1D–F).

**3. *Philotheca freyciana* Rozefelds sp. nov.**

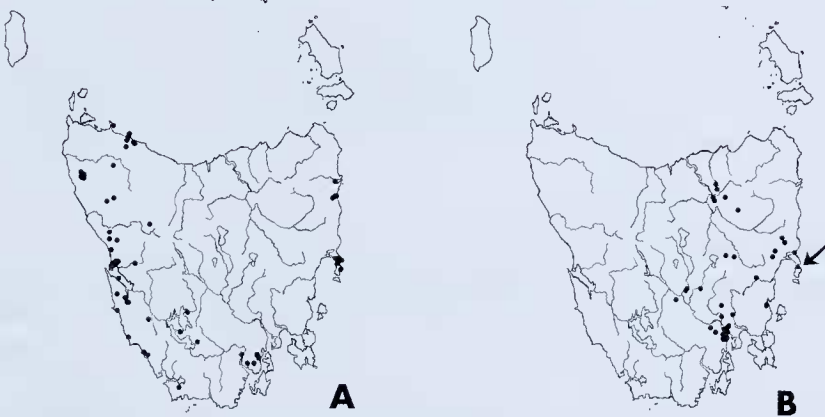
*a Philotheca verrucosa* (A.Rich.) Paul G. Wilson foliis 9–13 mm longis, 8–13 mm latis, et antheris valde apiculatis, *a P. virgata* (Hook. f.) Paul G. Wilson foliis obcordatis, *a P. myoporoides* (DC) M.J.Bayly foliis obcordatis, valde conduplicatis, pagina abaxiali manifeste glandulosa differt.

*Type:* Mt Amos, Freycinet National Park, anon., Oct. 1970. (holotype HO 33348).  
*E. verrucosus* p. p. Paul G. Wilson, *Nutysia* 1: 48 (1970)

An erect *shrub* less than 40 cm tall, compact, glabrous except for sparsely pilose stamen filaments. *Branches* green, terete, prominently glandular, verrucose. *Leaves* sessile, almost imbricate in appearance, coriaceous, broadly obcordate-obovate, folded through to 90° in life, 9–13 mm long, 8–13 mm wide, with prominent tubercular glands on the abaxial surface, smooth on the adaxial surface, margins tinged red (Fig. 1I). *Inflorescence* uniflowered, axillary; *peduncle* 1.0–2.0 mm long; *flowers* 5-merous; *bracteoles* four, brown, caducous, at base of pedicel; *pedicel* 3–4 mm long; *sepals* semiorbicular, c. 1 mm long, c. 1.5 mm wide; *petals* 5(–6), broadly elliptical, white, pink in bud, 8–10 mm long, 4–5 mm wide; *stamens* 10, staminal filaments flattened, margins sparsely pilose, *antesepalous filaments* 3.5–4.0 mm long, *antepetalous filaments* 2.7–3.2 mm long; *anthers* versatile, introrse, c. 1 mm long, apex biglandular and pointed, pollen orange (Fig. 2F); *ovary* inserted into the disc; *carpels* 5, narrow; *style* c. 1 mm long, *stigma* rounded, 4–5-partite. *Cocci* c. 4 mm long, c. 3.5 mm wide, adaxial margin rounded with apex acute, surface smooth, weakly rugose, with a few scattered glands. *Seed* black, shiny, c. 4 mm long.

*Etymology:* This species is named after Freycinet Peninsula, the type locality.

*Habitat and Distribution:* *Philotheca freyciana* occurs in skeletal sandy soils, derived from granitic rocks, and is found with *Eucalyptus amygdalina* Labill., *E. tenuiramis* Miq., *Leptospermum grandiflorum* Lodd., and *Hakea megadenia* R.M.Barker. *Philotheca freyciana* is known from four herbarium specimens, and three living plants.



**Figure 3.** Map of Tasmania showing the distribution of *Philotheca* species based upon Tasmanian Herbarium (HO) records. **A** – *P. virgata*, **B** – *P. verrucosa* and *P. freyciana* (triangle) arrowed.

*Conservation Status:* While the species is conserved in the Freycinet National Park, it is considered endangered as only three plants, from two separate localities, were located during fieldwork.

*Phenology:* Buds in *P. freyciana* are formed prior to winter, and flowers have been seen in autumn (April–May), and also in spring (September–October).

*Other Specimens Seen* (3 examined): **TASMANIA:** East Coast: Mt Amos, Freycinet Peninsula. *B. Gee s.n.*, 5 Oct. 1961 (HO 320402 [two sheets], MEL 4316); *ibid.* *M. E. Phillips s.n.*, 13 Jan. 1962 (AD 99951060 *n.v.*); *ibid.* *Rozefelds 1666* Oct. 1999 (HO). Cape Tourville, Freycinet Peninsula, *Rozefelds 1788*, 14 June 2000 (HO).

*Notes:* The locality information on three herbarium sheets from Mt Amos is limited. Phillips indicates that her material was collected from 900 feet (~ 300 m) which would suggest that it was collected from a different plant to that known by the author (*Rozefelds 1666*), which is growing at about 150 m altitude. The B.Gee Collections in HO and MEL are interpreted as being duplicates. A recent collection from Cape Tourville (*Rozefelds 1788*) would suggest that the species is more common than currently thought.

### Comparisons with other species in Section *Erionema*

*Philothea freyciana* is placed in *Philothea* sect. *Erionema* (F. Muell.) Paul G Wilson as it shares with the other species in this section embedded glands in the anthers and characteristic seeds (Wilson 1998). Nine species are currently recognised in Section *Erionema*. *Philothea freyciana* differs from *Philothea hispidula* (Spreng.) Paul G Wilson, *P. obovalis* (A. Cunn.) Paul G Wilson and *P. buxifolia* (Sm.) Paul G Wilson and most forms of *P. scabra* (Paxton) Paul G Wilson (= *P. scaber* in Bayly, 1999 and Weston and Porteners 1991) in having glabrous stems and/or foliage (Bayly 1999; Weston and Porteners 1991). It differs from *Philothea trachyphylla* (F. Muell.) Paul G Wilson, *P. virgata* and *P. brucei* (F. Muell.) Paul G. Wilson in having pedunculate inflorescences (Bayly 1999; Wilson 1970).

Comparisons with *P. myoporoides* are difficult because of the morphological variation in this taxon (Bayly 1998). The following combination of characters: unflowered inflorescence, obcordate concave leaves that are smooth above with large glands on the underside, and sparsely pilose staminal filaments separates *Philothea freyciana* from all recognised subspecies of *Philothea myoporoides* complex and an undescribed form from Mt Stewart, in Victoria (Bayly 1998).

Wilson (1970) included the Freycinet populations, here described as *P. freyciana*, in *P. verrucosa*. *Philothea freyciana* is larger in all its parts than *P. verrucosa* although it shares with it the concave and conspicuously glandular thick obcordate leaves, and in having similar staminal filaments. It seems likely that the two species are closely related.

### Key to *Philothea* species in Tasmania

1. Flowers 4-merous, rarely 5-merous, inflorescences not pedunculate leaves thin flat, apex acute with mucronate tip ..... *P. virgata*
1. Flowers 5-merous, inflorescences shortly pedunculate, leaves thick, conduplicate, apex usually obcordate, not conspicuously acute ..... 2
2. Apex of anthers "pinched" in bud, obtuse at maturity, habit erect to scrambling, leaves narrowly obovate to obcordate, < 5 mm wide ..... *P. verrucosa*
2. Apex of anthers not pinched in bud, pointed at maturity, habit compact, leaves broadly obovate to obcordate, > 8 mm wide ..... *P. freyciana*





**Figure 4.** *Philotheca freyciana* sp nov. **A** – view of upper branches showing ‘imbricate’ foliage, **B** – detail of flowers and leaf morphology, and verrucose stems.

**Endemicity on the Freycinet Peninsula**

Kirkpatrick and Brown (1984a, b) recognised centres of higher plant endemicity in Tasmania, including Great Oyster Bay, which is a physiographically and geologically diverse region. The endemic flora of the Great Oyster Bay includes species restricted to dolerites, e.g., *Eucalyptus barberi* L.Johnson & Blaxell, *Ozothamnus lycopodioides* Hook.f., *Lasiopetalum micrantheum* Hook.f. and *Melaleuca pustulata* Hook.f., and those that only occur on the granitic rocks of the Freycinet Peninsula and associated areas.

Freycinet Peninsula has a number of local endemics including *Epacris barbata* Melville, *Philotheca freyciana* and a new taxon of *Boronia* (Duretto pers comm.). A species of *Zieria* (Duretto 1999), that was previously recorded as *Zieria cytisoides* Sm. in Curtis and Morris (1975), is also restricted to the granitic soils of eastern Tasmania. *Viminaria juncea* (Scrad. & J.Wendl.) Hoffsgg. occurs in mainland Australia and also in Freycinet Peninsula. The only mainland Tasmanian occurrences of *Pseudanthus divaricatissimus* (Müll. Arg.) Benth. are also in the Freycinet Peninsula.

An undescribed subspecies of *Leptospermum grandiflorum* Lodd. (Rozeffelds pers. obs.) occurs in the Freycinet Peninsula. The systematic status of the Freycinet populations of *Almaleea subumbellata* (Hook.) Crisp & P.Weston and the *Tetratheca pilosa* spp. complex also require study, and may include local endemics. The Freycinet Peninsula is an important centre of endemicity in eastern Tasmania.

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## References

- Bayly, M.J. (1998). Notes on the *Eriostemon myoporoides* (Rutaceae) species complex, including new names and a new generic placement in *Philotheca*. *Mnelleria* **11**, 113–126.
- Bayly, M.J. (1999). *Eriostemon*. in *Flora of Victoria* **4**, 178–183.
- Curtis, W.M. and Morris, D.I. (1975). *The Student's Flora of Tasmania*. Part 1, Second Edition.
- Duretto, M.F. (1999). Rutaceae, excluding *Eriostemon*. in *Flora of Victoria* **4**, 152–197.
- Kirkpatrick, J.B. and Brown, M.J. (1984a). A numerical analysis of Tasmanian higher plant endemism. *Botanical Journal of the Linnean Society* **88**, 165–183.
- Kirkpatrick, J.B. and Brown, M.J. (1984b). The palaeobiogeographical significance of local endemism in Tasmanian Higher Plants. *Search* **15**, 112–113.
- Orchard, A.E. (1988). A natural regions map for Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* **122**, 47–51.
- Weston, P.H. and Porteners M.F. (1991). *Eriostemon*. in *Flora of New South Wales Vol 2*, 250–254.
- Wilson, P.G. (1970). A taxonomic revision of the genera *Crowea*, *Eriostemon* and *Phebalium*. *Nutysia* **1**, 1–155.
- Wilson, P.G. (1998). A taxonomic review of the genera *Eriostemon* and *Philotheca*. *Nutysia* **12**, 239–265.