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Drosera murfetii (Droseraceae): a new species from Tasmania, Australia

Allen Lowrie[a] *& John G. Conran*[b]

[a] 6 Glenn Place, Duncraig, Western Australia 6023

[b] Australian Centre for Evolutionary Biology and Biodiversity *and* Sprigg Geobiology Centre, School of Earth & Environmental Sciences, Benham Building, DX 650 312, The University of Adelaide, South Australia 5005
Email: john.conran@adelaide.edu.au

Abstract

Drosera murfetii Lowrie & Conran is a new species from south-west Tasmania, Australia, bearing mainly non-carnivorous leaves and usually several large flowers per inflorescence. It is compared to its morphologically closest taxon, *Drosera arcturi* Hook., with which it often grows. The two species are described and illustrated, a key to species and a comparison table of characters is provided. *Drosera arcturi* is lectotypified.

Keywords: *Drosera arcturi*, *D. murfetii*, Droseraceae, taxonomy, new species, Tasmania.

Introduction

Drosera arcturi Hook. from alpine southern Australia and New Zealand is very variable across its range and in Tasmania sometimes produces large, robust plants (Morris 2009), including a form bearing several conspicuous, basal glabrous leaves, a usually single, large trapping leaf, with obvious glandular hairs, and often several flowers per scape, each with 4–5 larger, greenish-white or cerise stigmas (Lowrie 1998, Clayton 2003, Gibson 2010). This form is widespread in south-west Tasmania and contrasts strongly with the type form (with which it often co-occurs at more elevated altitudes). The type form of *D. arcturi* is generally a smaller plant and always bears numerous trapping leaves, highly reduced (or no) scale-like glabrous leaves, almost always single flowers per scape, and usually three stigmas (rarely four). The so-called 'giant form' of *D. arcturi* was considered by Gibson (1998, 1999, 2010) to be at least an ecotype, while Clayton (2003) thought that the two forms should deserve at least subspecific status; both authors suggested that further study was needed. However, the fact that both morphotypes occur together over such a wide geographic range and in the same habitats, but without apparent intermediate forms, suggests instead that they may be distinct albeit closely related species, as subspecies are generally regarded as being geographically (Schlauer 1996) and/or ecologically allopatric (Stace 1989).

Although *D. arcturi* also occurs in New Zealand, where it grows mainly in montane to subalpine bogs southwards from 39°S (Allan Herbarium 2000, Salmon 2001), it extends down to sea level in the far south of its range in both countries (Allan Herbarium 2000, CHAH 2013). Several New Zealand morphotypes have been given taxonomic status in the past (Colenso 1890, 1896, 1899), but these were later deemed to be relatively trivial size or foliage colour variants and reduced to synonymy (Cheeseman 1906). Specimens with 4–5 large, greenish white or cerise stigmas are absent from both New Zealand and mainland Australian populations and any large plants occurring there also lack the 2–5 large, non-carnivorous basal leaves seen in the Tasmanian 'giant form' plants. Although isolated plants in New Zealand very rarely bear two flowers per peduncle, the plants and flowers are otherwise identical to the 'type' form both in size and morphology (Conran, pers. obs.)

The two Australian morphs appear to differ consistently from each other for a range of characteristics relating in particular to the glabrous leaves, flower and stigma number, and there is a lack of apparent intermediate forms for these features when the morphs co-occur. Accordingly, this study compares the morphology of the two forms and examines the taxonomic implications of these differences.

Methods

Living and dried specimens of *D. arcturi* across its geographic range and covering all known Australian and New Zealand morphotypes were examined under dissecting microscope and/or by SEM. Descriptions and, where possible, type specimens for the formerly segregated names from New Zealand were investigated, as well as *D. arcturi* collections at AD, HO, MEL, OTA, PERTH, Gunn's and Brown's collections at K and BM, and personal collections by A. Lowrie and D.E. Murfet.

To assess character variability in the complex, up to five complete specimens per herbarium sheet, representing a total of 354 specimens from 107 accessions

Table 1. T-test comparisons between PATN dendrogram groups for the characters used in the cluster analysis assuming unequal variances, as well as Kruskal Wallace and r^2 values from the cluster and ordination analyses of 354 specimens from 107 accessions.

Character code	*D. arcturi* mean ± SD	*D. murfetii* mean ± SD	t	df	*P*	KW	r^2
E#	0.56 ± 0.83	2.91 ± 0.88	25.95	1, 334.38	<0.0001	224.30	0.887
EL (mm)	4.31 ± 6.02	33.77 ± 16.67	21.43	1, 290.83	<0.0001	130.51	0.737
EW (mm)	0.87 ± 1.11	5.48 ± 1.47	33.12	1, 194.18	<0.0001	145.05	0.727
G#	4.92 ± 1.44	1.34 ± 0.57	32.29	1, 282.69	<0.0001	251.54	0.768
GP (mm)	17.21 ± 7.75	24.46 ± 14.63	5.58	1, 217	<0.0001	18.67	0.202
GL (mm)	23.20 ± 9.36	42.71 ± 22.21	10.24	1, 193.96	<0.0001	106.03	0.125
SC (mm)	44.08 ± 17.31	92.46 ± 33.13	16.61	1, 224.95	<0.0001	185.10	0.769
F#	1.01 ± 0.10	1.20 ± 0.50	4.74	1, 167.23	<0.0001	6.26	0.203
SL (mm)	6.33 ± 1.46	8.29 ± 1.74	11.27	1, 305.54	<0.0001	88.50	0.684
SW (mm)	1.83 ± 0.47	2.43 ± 1.05	6.65	1, 208.42	<0.0001	57.56	0.367
PL (mm)	6.57 ± 1.48	8.99 ± 1.85	13.37	1, 296.40	<0.0001	115.85	0.667

Table 2. Summary comparison of distinguishing morphological character and character states differences between *Drosera arcturi* and *D. murfetii* derived from measurements of 354 specimens from 107 accessions.

Character	*Drosera arcturi*	*Drosera murfetii*
Basal, glabrous leaf size (mm)	3–27 × 0.7–4	(1–) 3–5 (–12) × 5–15
Glandular leaf number	2–12	(0–) 1–2 (–4)
Glandular leaf length (cm)	1.3–12	3.5–21.7
Scape length (cm)	0.8–9	3–20
Flower number	1 (–2)	1–4
Petals (mm)	3–10 × 2.5–7	5–14 × 4–5
Style number	3 (–4)	4– 5
Stigma colour	greenish-white to pale yellow	greenish-white or reddish-cerise
Seed size (mm)	0.5–1 (–1.3) × 0.4–0.8	(0.8–) 1–2 × (0.4–) 0.6–1

collected from Australia and New Zealand, were coded for 11 morphological characters:

1. Glabrous leaf number (**E#**)
2. Longest glabrous leaf length (mm) (**EL**)
3. Longest glabrous leaf width (mm) (**EW**)
4. Glandular leaf number (**G#**)
5. Longest glandular petiole length (mm) (**GP**)
6. Longest glandular lamina length (mm) (**GL**)
7. Scape length (mm) (**SC**)
8. Flowers per scape (**F#**)
9. Sepal length (mm) (**SL**)
10. Sepal width (mm) (**SW**)
11. Petal length (mm) (**PL**).

These data were then transformed by $\log_{10}+1$ for continuous data and square root + 0.5 for counts (Zar 1996) and then subjected to cluster analysis using Gower Association, flexible UPGMA with a beta value of 0.0. Ordination used non-metric semi-strong multidimensional scaling (SSH) with 100 random starts and a cutoff value of 0.9 in the program PATN v. 3.1.2 (Belbin & Collins 2008), with character/specimen cluster relationships in the ordination space explored using Principal Component Correlation (PCC) analysis (Faith 1991). In addition, character mean comparisons were undertaken on the raw data using t-tests in JMP 4.0.3 (SAS Institute 2000) for the two groups defined by the PATN cluster analyses, with the assumption of unequal variances.

Seed micromorphology is considered important in *Drosera* at subgeneric and sectional level (Dwyer 1983, Boesewinkel 1989), as well as between related species (Susandarini et al. 2002, Lowrie 2005, Lowrie & Conran 2007, 2008). Accordingly, ten seeds per sample from 14 samples, representing both morphs and including material from New Zealand, were measured and the two morphotypes compared using the Student t-test on $\log_{10}+1$ transformed data, allowing for unequal variances. SEM micrographs were also produced at The University of Adelaide Microscopy Centre (CEMMSA), following the methods of Susandarini et al. (2002), with additional information on the seeds of New Zealand material of *D. arcturi* obtained from Webb & Simpson (2001).

Results

The cluster analysis (Fig. 1) and ordination (Fig. 2) both show that there are two clearly separated morphotypes within the *D. arcturi* complex, differing consistently for nearly all of the characters measured. One cluster represents all of the (0–) 1–2 (–4) trapping-leaved, multi-flowered specimens with multiple, large, broad, glabrous leaves from SW Tasmania, including all samples reported to have cerise stigmas; the other, consists of the multiple glandular-leaved, single-flowered and widespread type form with no or few, small, linear, glabrous leaves from New South Wales, Victoria, Tasmania and New Zealand. The vegetative morphological differences between the two forms, as well as inflorescence and floral characteristics clearly support the justification to treat these two taxa as distinctive species (Tables 1, 2), particularly as they co-

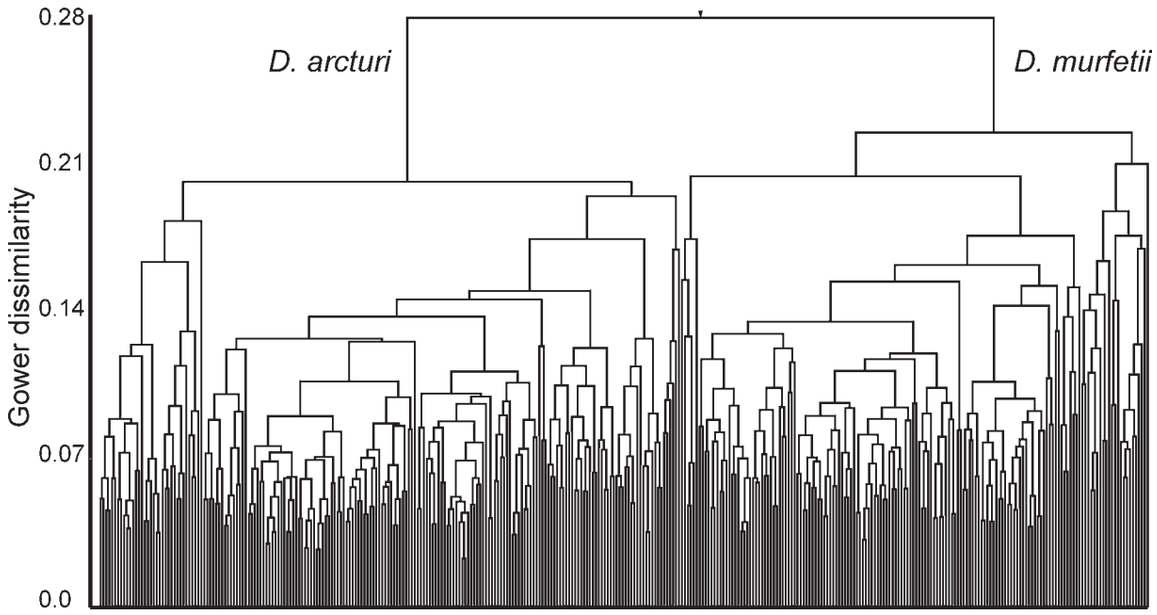

Fig. 1. Gower Metric flexible UPGMA clustering dendrogram of 354 specimens from 107 accessions in the *Drosera arcturi* complex from SE Australia, Tasmania and New Zealand.

occur across a wide part of their respective ranges with no obvious intermediacy seen in our analysis (Stace 1989). Accordingly, a new species, *Drosera murfetii*, is proposed and described here and *D. arcturi* is redefined. Illustrations, descriptions and a comparison table for both species are provided.

Character comparisons between the two clusters (Table 1) show that there are significant mean differences for all features used in the analyses, with *D. murfetii* on average larger for all features, as well as generally bearing more flowers per scape (i.e. >1) and having larger, broader and more numerous glaborous leaves. In contrast, the type form of *D. arcturi* (which also included all type specimens and related accessions from Australian and New Zealand taxa in the same cluster) has few, small and linear (if any) glabrous leaves, more numerous glandular, trapping ones, but was otherwise significally smaller for the features measured here.

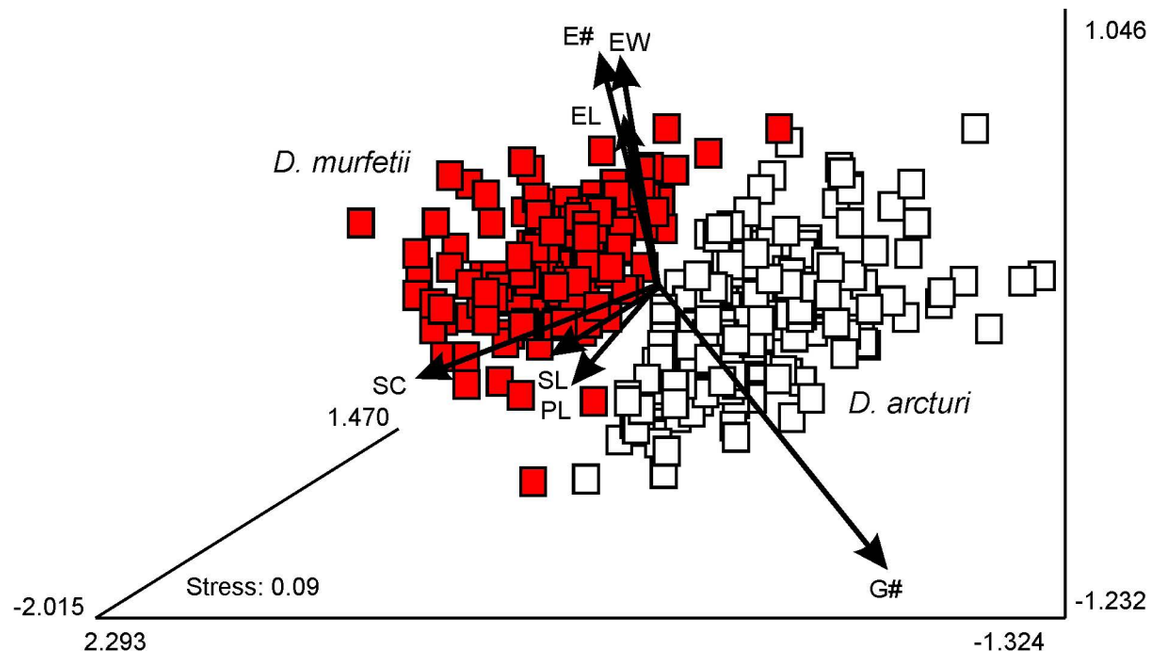

Fig. 2. Non-metric semi-strong hybrid 3-D multidimensional scaling ordination of the *Drosera arcturi* complex specimens and clusters from the dendrogram shown in Fig. 1; white = *D. arcturi*; red = *D. murfetii*; Principal Canonical Correlation vector arrows indicate direction of increasing score in the ordination space for the characters listed in Table 1.

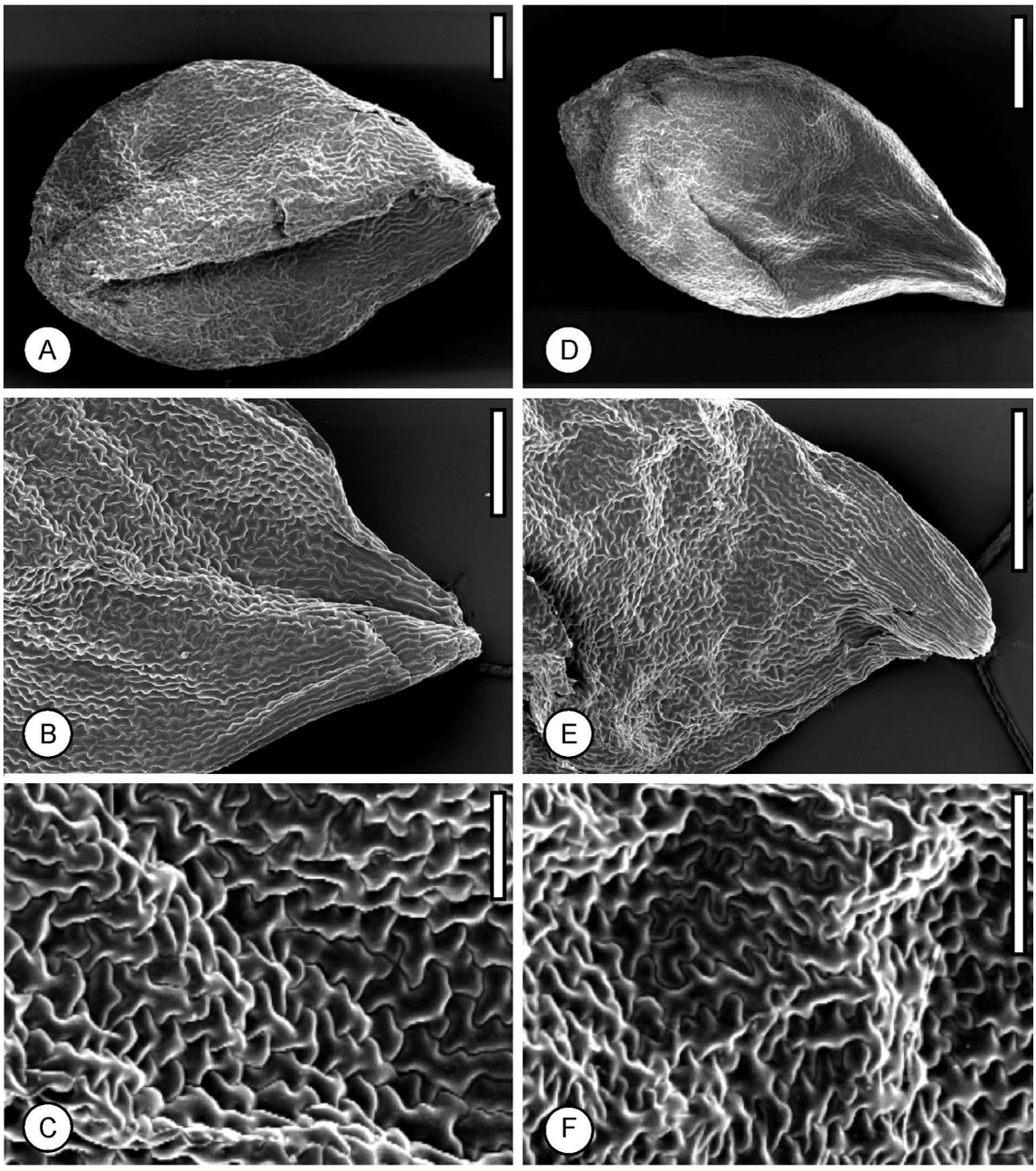

Fig. 3. Seeds of Australasian alpine *Drosera arcturi* complex species under SEM. A–C *Drosera arcturi*: A seed; B close up of funicle; C detail of testa. D–F *D. murfetii*: D seed; E close up of funicle; F detail of testa. Scale bars: A–D 200 µm; E–F 100 µm. — A–C *A.Lowrie 3178*; D–F *A.Lowrie 3181 & D.E.Murfet*.

The ordination (Fig. 2) shows that the two clusters had virtually no overlap. The stress value of 0.09 is well within the limits deemed acceptable for dimensional distortion (Belbin & Collins 2008) and the PCC plot shows the same pattern as the t-test and Kruskal-Wallace (KW) comparisons between the clusters from the dendrogram, albeit with much lower r^2 (<0.4) for glandular leaf size features, flower number and sepal width, indicating that these were not as important in the ordination space as the other features (all >0.6). The features with the highest t, KW and r^2 scores were glabrous leaf number, length, width, glandular leaf number, scape length, sepal and petal length.

The overall character ranges for features observed to differ between the two taxa are listed in Table 2 (including some excluded from the cluster analysis as there were too many specimens missing those characteristics and/or the binary nature of the feature may have skewed the result). The seeds of the two forms, although similar in shape and testal morphology to each

other (Fig. 3), as might be expected for closely related taxa, differ in overall size; the seeds of *Drosera murfetii* being significantly longer (t = 14.762, df 1, 81.87, P <0.0001) and wider than those of *D. arcturi* (t = 8.505, df 1, 90.62, P <0.0001), though there is some overlap.

Amended key to the species of Tasmanian Droseraceae

The key to Tasmanian Droseraceae of Morris (2009) should be amended to incorporate the new species by inserting a new couplet after number 5, as follows:

5. Leaves orbicular, < 2 cm long; flowers 2–20 . . . . . ***D. glanduligera***
5: Leaves linear-oblong, 3–20 cm long; flowers 1–4
5a. Basal leaves broad, spreading, glabrous; inner leaves (0–) 1–2 (–4), glandular, erect . . . . . ***D. murfetii***
5a: Basal leaves small or absent; glandular leaves numerous, often semi-erect . . . . . ***D. arcturi***

Taxonomy

1. *Drosera arcturi* Hook.

J. Bot. (Hooker) 1: 247 (1834), emend.; Icon. Pl. 1: tab. 56 (1837). — **Type citation:** "summit of Mt Arthur Mr Gunn, (n. 139 [sic].)", corrected by Diels, Pflanzenr. 4(112) [Heft 26]: 64 (1906): "Mount Arthur (Gunn n. 129 […])". **Type sheet:** "Summit of Mt Arthur, Van Dn's [Diemen's] Land, 129. W. Gunn 1832", bottom collection on sheet. **Lectotype (here designated, Fig. 6):** K 000215043!*, pro parte [top middle specimen], ex Herb. Hook. **Remaining syntypes:** K 00215043!* pro parte [remaining five specimens], MEL 96027A!

Drosera polyneura Colenso, *Trans. & Proc. New Zealand Inst.* 22: 460 (1890) ["1889"]. — **Type citation**: "Swampy spots, base of Mount Tongariro, County of East Taupo; 1889." **Syntype:** Swampy spots, base of Mount Tongariro, County of East Taupo, [1889,] *H.Hill s.n.* (K 000659184).

Drosera ruahinensis Colenso, *Trans. & Proc. New Zealand Inst.* 28: 593 (1896). — **Type citation:** "Ruahine Mountain-range: Mr. H.Hill, 1895; Mr. A. Olsen, 1895" **Syntype:** Ruahine Mountain-range, east side, wet spots near summits, [1895,] *A.Olsen s.n.* (K 000659178).

Drosera atra Colenso, *Trans. & Proc. New Zealand Inst.* 31: 269 (1899). — **Type citation**: "Ruahine Mountain-range, east side, wet spots near summits." **Syntype:** Ruahine Mountain-range, east side, wet spots near summits, [1898,] *A.Olsen s.n.* (WELT 23581).

Drosera ligulata Colenso, *Trans. & Proc. New Zealand Inst.* 31: 269 (1899). — **Type citation**: "Euahine [sic] Mountain-range, east side, wet spots near summits; 1898." **Syntype:** Ruahine Mountain-range, east side, in low-lying wet spots, [1898,] *A.Olsen s.n.*; n.v., fide Colenso (1899).

A cold tolerant, fibrous-rooted alpine *perennial herb*; *rhizome* 1–5 (>10) cm long, covered with persistent dead leaf bases. *Hibernaculum* bud-like, derived from glabrous basal leaf sheaths covering rhizome apex. *Glabrous leaves* at emergence (0–) 1–5, 3–27 × 0.7–4 mm, lanceolate, apically acute, glabrous, often short-lived and absent by anthesis; *glandular leaves* 2–12, narrowly lanceolate-spathulate, loosely distichous,

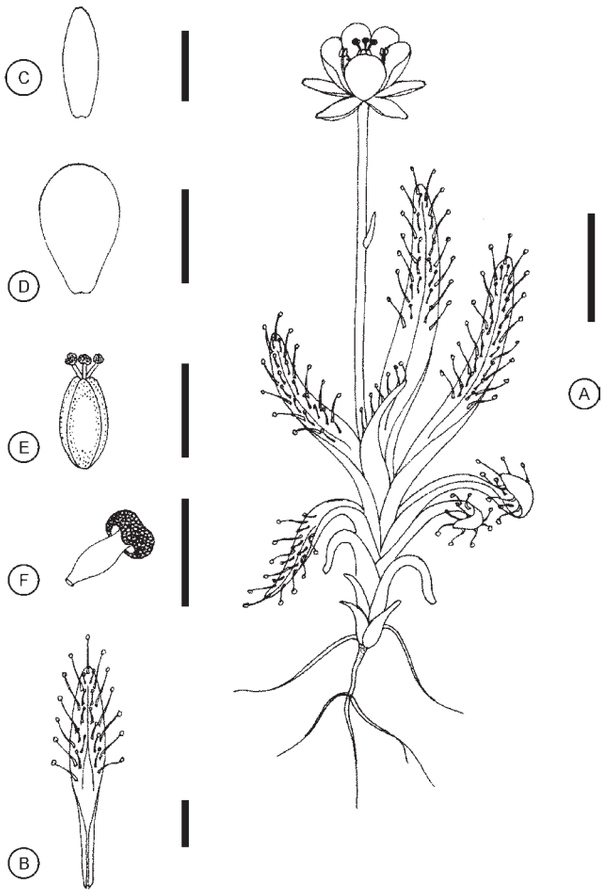

Fig. 4. *Drosera arcturi*. A plant; B lamina; C sepal; D petal; E gynoecium; F style and stigma. Scale bars: A 10 mm; B–D 5 mm; E–F 1 mm. — Drawn by A. Lowrie, 1988, from live material from the Snowy Mountains, New South Wales.

semi-erect to spreading, 1.3–12 cm long, green to greenish-bronze, red or almost black, persisting after senescence; *petioles* stem-sheathing, 0.6–0.8 mm wide at sheath apex, 1.5–1.8 mm wide at lamina, glabrous; *lamina* 9–70 × 2–6 mm, narrowly oblong, apex rounded, adaxial surface bearing large, sub-marginal insect-catching glands and smaller glands within, abaxial surface glabrous with a prominent midrib. *Inflorescence* terminal, scapose, 1 (–2)-flowered, 0.8–9 cm long, 0.4–0.5 mm diam., glabrous, enclosed basally by leaf sheaths, persistent, erect after senescence. *Flower* shortly pedicellate, erect in fruit; *pedicel* 3–12 mm; *floral bract* subulate, 2–2.5 × 0.4–0.6 mm. *Sepals* greyish-green, 4–10 × 1–3 mm, narrowly elliptic, adaxially concave, horizontal to recurved at anthesis, margins entire, apex obtuse, irregularly crenate, both surfaces glabrous. *Petals* white, 3–10 × 2.5–7 mm, obovate, entire, apex broadly rounded. *Stamens* 5, 4–6 mm long, filaments white, anthers and pollen yellow. *Ovary* 4–4.5 × 2.5–2.7 mm, ellipsoid, green, ovules numerous. *Styles* 3 (–4), greenish-white to pale yellow, 0.5–0.6 mm long (excluding stigmas), semi-erect, fusiform, flat in cross-section; *stigmas* ± reniform-peltate, 0.6–0.7 × 0.2–0.3

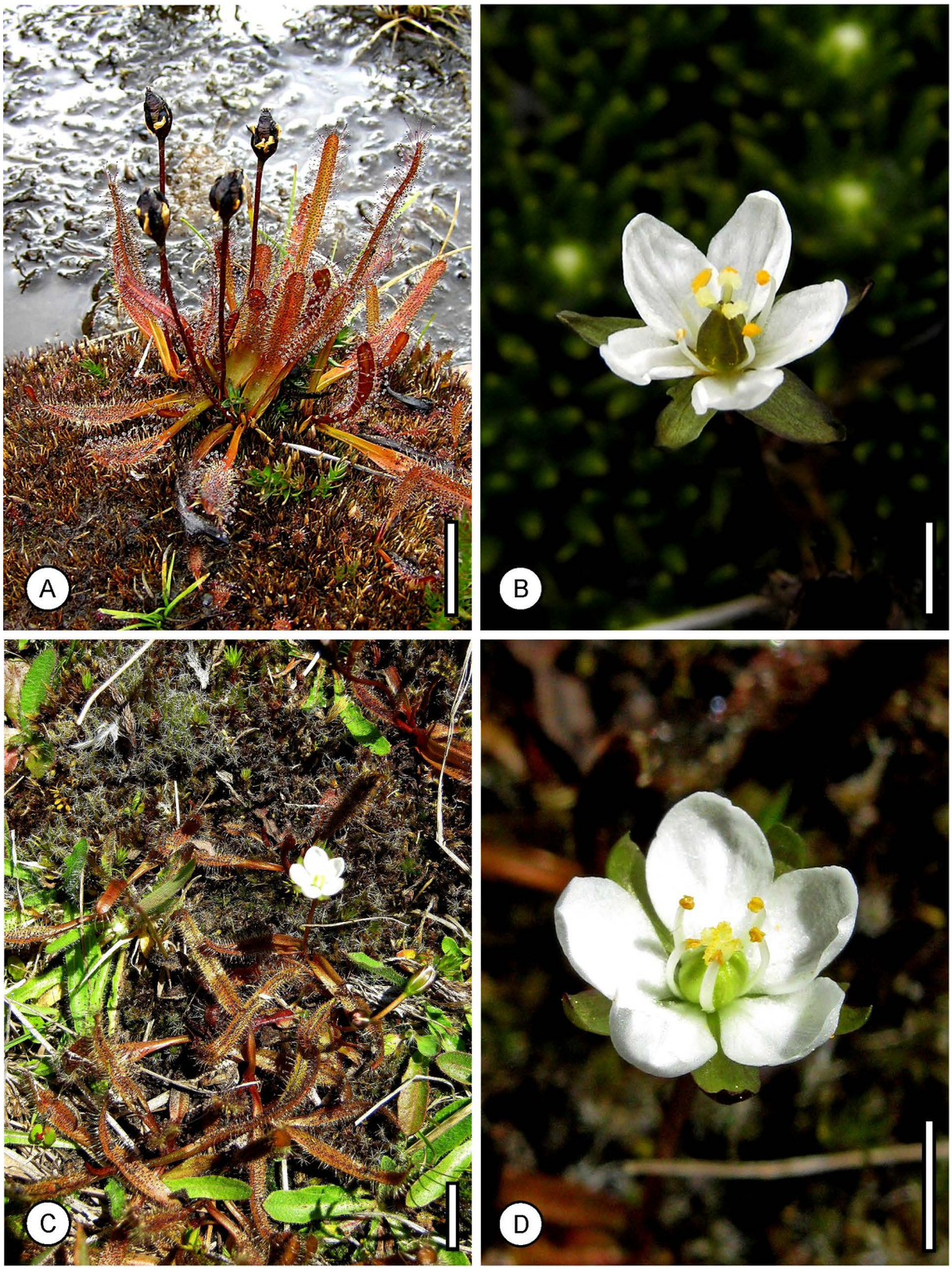

Fig. 5. *Drosera arcturi* in Australia and New Zealand. A–B Hartz Range, Tasmania: A habit; B close up of flower with 3 styles. C–D Grey Lake, Central Otago, New Zealand: C habit; D close up of flower with 4 styles. Scale bars: A, C 10 mm; B, D 5 mm. Photos: A, B A. Lowrie; C, D J.G. Conran.

mm, stigma adaxially papillate. *Fruit* ellipsoid, 10–11 × 4–4.5 mm. *Seeds* c. 50–60, brown, 0.5–1 (–1.3) × 0.4–0.8 mm, irregularly lachrymoid to obovoid, ± longitudinally flattened; *funicle* sulcate; *testa* minutely reticulate-foveolate, anticlinal cells walls sinuous. **Alpine sundew. Figs. 3a–c, 4–7.**

Etymology. The epithet *arcturi* comes from the Latinised form of the Ancient Greek Αρκτουρος (*Arcturus*), meaning "Guardian of the Bear", and from which the name Arthur is sometimes thought to be derived; it is referring to the type locality of Mt Arthur, Tasmania.

Distribution and ecology. Victoria, New South Wales, Tasmania & New Zealand: *Drosera arcturi* is a relatively common herb of the alpine and sub-alpine regions of mainland Australia and Tasmania, as well as southern New Zealand (Fig. 10), extending to middle altitudes or even down to sea level in western and south-western Tasmania and southern New Zealand. It grows in sphagnum bogs on wet heathlands, as well as in black peat soils along the margins of small mountain streamlets and rivulets, or the boggy margins of lakes. It also frequently grows in cushion plants such as *Donatia novae-zealandiae* Hook.f. (Stylidiaceae) and *Dracophyllum minimum* F.Muell. (Ericaceae) (Cameron 1981) and sometimes grows intermixed with *D. murfetii*, with which it is sympatric over much of south-west Tasmania, but with no clear evidence of hybrids or intermediate plants.

Conservation status. Not currently threatened.

Flowering period. October–January (during the snow-free season).

Lectotypification of Drosera arcturi. William Hooker (1834) gives the type citation for *D. arcturi* as: "Summit of Mount Arthur Mr Gunn, (n. 139. [sic])", but this appears to be an error, as J.D. Hooker (1860) cited the collection as "Gunn 129" in his *Fl. Tasmaniae*. The type sheet at Kew holds two collections (Fig. 6), but as noted by Diels (1906), the lower sheet gathering with hand notation "summit of Mt Arthur, Van Dn's [Diemen's] Land, 129. W. Gunn 1832" (K 000215043) represents the type material of *Drosera arcturi*. Nevertheless, as no lectotype has been nominated previously, we accordingly here nominate the top middle specimen of that collection as the lectotype, with the other 5 duplicate specimens from that collection and the specimens on the duplicate at MEL regarded as residual syntypes. In contrast, the upper sheet gathering with hand notation "129 [over] 1842 Mt Wellington 1/3/39 [1 Mar. 1839] & 31/1/40 [31 Jan. 1840]" (K 000215085), represents material of *D. arcturi* from two separate, later gatherings from Mount Wellington and is not considered to be type material.

The gazetteer (Geoscience Australia 2013) lists three Mt Arthur locations in Tasmania:

1. Wellington Park, NE of Mt Wellington (42°53'6"S, 147°13'5"E), which overlooks the city of Hobart
2. Mt Arthur State Reserve, SW of Port Arthur near the original English convict penal settlement (43°9'14"S, 147°48'51"E)
3. Lilydale, NW of Launceston (41°16'44"S, 147°17' 17"E).

However, of these, Mt Arthur at Lilydale, north-west of Launceston, appears to be where Gunn's original specimens of *Drosera arcturi* were collected in 1832. Buchanan (1988) noted that Gunn was a resident of Launceston, when he sent his first consignment of herbarium specimens to Hooker in 1832, and that these were gathered from east of Launceston, principally from Ben Nevis and Mt Arthur, including the type material for *Drosera arcturi*.

Robert Brown collected material of what is now *D. arcturi* (Bennett no. 4850: BM 001050170) from near the summit of 'Table Mountain' (now part of Mt Wellington) in 1804 and labelled it with the unpublished manuscript name "*Drosera lingulata*" (Chapman et al. 2001). Unfortunately, this excellently preserved flowering material (Fig. 7) was not included in his *Prodromus* (Brown 1810), nor was it apparently seen by Hooker. Gibson (2010, p. 11) referred to this collection, saying "Robert Brown collected samples of the 'Giant' form of *D. arcturi* from Port Davey in March 1804, which were later described as *D. 'lingulata'*." However, the Brown collection at K is labelled "In paludosis summitatis Montis Tabularis prope fluvio Derwent Feb: 18 Mar 1804" [in a swamp at the summit of Table Mountain near the Derwent River] and Brown is not known to have visited Port Davey in Feb–Mar 1804, but was instead collecting in the region around Hobart (Vallance et al. 2001). This collection is also clearly conspecific with the type form of *D. arcturi* and was placed into that cluster in the analyses. As the epithet "*lingulata*" was never published validly it has no taxonomic standing, nor does the Brown collection represent type material.

Colenso (1890, 1896, 1899) described several taxa from New Zealand which are clearly part of the *D. arcturi* complex and examination of photographs of specimens of *D. atra* (WELT 23581), *D. polyneura* (K 000659184), and *D. ruahinensis* (K 000659178) shows that they all fall well within the variability seen for *D. arcturi* sens. str. to where they were reduced in synonymy by Cheeseman (1906). These specimens also fell into the *D. arcturi* clusters in the numerical analyses.

*Specimens examined (specimens marked * were used in the numerical analysis)*

New South Wales: Found below Snowy Crossing and not far below Charlotte Pass Road, Kosciusko Nat. Park, 6 Feb. 1975, *A.M.Ashby 5128* (*AD 97529011); Near site of old Soil Conservation Hut near Blue Lake, 3 Feb. 1988, *A.M.Buchanan 10806* (*HO 129367); Near Bett's Creek S of The Paralyser (c. 9 km ENE of Mt Kosciusko), 24 Jan. 1957, *Hj.Eichler 13461* (*AD 95736072); Near Bett's Creek S of The Paralyser (c. 9 km ENE of Mt Kosciusko), 24 Jan. 1957, *Hj.Eichler 13472* (*AD 95736029).

Tasmania: 1 km N of Reservoir Lakes, 11 Jan. 1984, *D.G.Adams 7* (*HO 76687); Lake Salome, Walls of Jerusalem, 25 Jan. 1982, *M.J.Brown 117* (*HO 65857); In paludosis summitatis Montis Tabularis prope fluvio Derwent, 18 Feb.

Fig. 6. Type sheet of *Drosera arcturi* with two collections by Gunn. The lectotype (K 000215043, collected in 1832) is indicated by a thick black line; residual syntypes by a dashed line. The upper collection (K 000215085, mixed collection from 1839 and 1840) is not type material. Image copyright of the Board of Trustees of the Royal Botanic Gardens, Kew; used with permission.

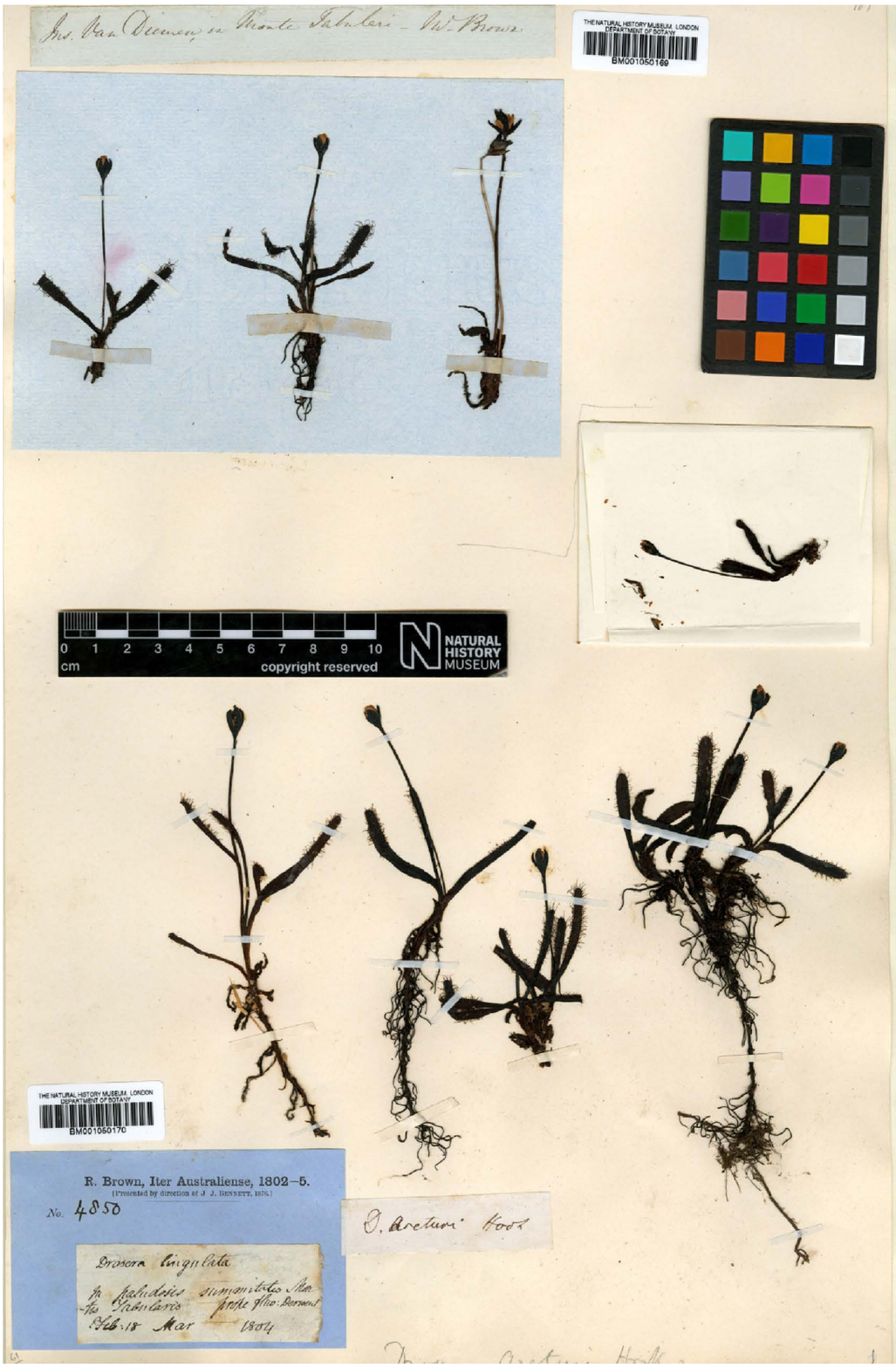

Fig. 7. Robert Brown's 1804 collection of *Drosera arcturi* (Bennett no. *4850*: BM 001050170) from near the summit of "Table Mountain" (now part of Mt Wellington) and labelled with the unpublished manuscript name "*Drosera lingulata*". The upper collection on the sheet (BM 001050169) is possibly a duplicate specimen. Image copyright of the The Picture Library, The Natural History Museum, London; used with permission.

1804, *R.Brown 4850* (*BM 001050170, Fig. 7); Near Giblin River, 7 km from mouth, 23 Jan 1986, *A.M.Buchanan 8091* (HO 142845); Lake Ewart, 4 Feb. 1987, *A.M.Buchanan 9895* (*HO 409074, mixed collection); SW Nat. Park, Middle Giblin River Basin, 8 km NW of Mt Gaffney, 13 km N of Mulcahy Bay, 17 Feb. 1989, *J.R.Croft 10158* (*HO 410760); Eagle Tarn, Mt Field Nat. Park, 2 Jan. 1948, *W.M.Curtis s.n.* (*HO 3309); Mt Wellington, near Hobart, 1 Feb. 1947, *W.M.Curtis s.n.* (*HO 42667); Cradle Mountain Nat. Park, Lake Dove, near boat shed, 7 Jan. 1960, *Hj.Eichler 16465* (*AD 96107068); Near Cradle Mt, Along track to Artist Pool, 9 Jan. 1960, *G.Ford s.n.* (*AD 98142217); Gordon River, 27 Nov. 1937, *H.D.Gordon s.n.* (*HO 3322); Mt Wellington, 1 Mar. 1839 & 31 Jan. 1840, *R.C.Gunn* 129/1842 (*K 000215085, Fig. 6); Hartz Mt, 18 Dec. 1966, *J.H.Hemsley 6072* (*HO 3317); Mt Wellington plateau S, 27 Jan. 1968, *J.H.Hemsley 6503* (*HO 3318); Upper Maxwell Valley, 15 Dec. 1978, *S.J.Jarman s.n.* (*HO 30380); Surrounds of Lake Esperance, Hartz Mts, alt. 1000 m, 23 Jan. 2005, *A.Lowrie 3105 & D.E.Murfet* (AD, HO, MEL, NSW, PERTH); Near Ben Lomond alpine village, alt. 1425 m, 26 Jan. 2005, *A.Lowrie 3135 & D.E.Murfet* (*AD, HO, MEL, NSW, PERTH); On Belton & Belcher Lakes walk trail c. 500 m from road to Lake Dobson, Mt Field, alt. 1090 m, 22 Jan. 2006, *A.Lowrie 3173 & D.E.Murfet* (*AD, HO, MEL, NSW, PERTH); Saddle c. halfway between Mt Arthur & Mt Wellington summits, overlooking Hobart, alt. 1180 m, 23 Jan. 2006, *A.Lowrie 3178 & D.E.Murfet* (*AD, HO, MEL, NSW, PERTH); Start of the Hobartian Walk Trail on summit of Mt Arthur near road to Mt Wellington summit, alt. 1120 m, 23 Jan. 2006, *A.Lowrie 3180 & D.E.Murfet* (*AD, HO, MEL, NSW, PERTH); Near Lady Tarn, Hartz Mts, alt. 1000 m, 24 Jan. 2006, *A.Lowrie 3185 & D.E.Murfet* (*AD, HO, MEL, NSW, PERTH); Second Bar Lake, 11 Mar. 1984, *A.Moscal 6888* (HO 401488); Julian Lakes, 29 Dec. 1984, *A.Moscal 9113* (*HO 404030); Abbotts Lookout, 24 Mar. 1985, *A.Moscal 10353* (*HO 143814); Hartz Mts Nat. Park, Lake Esperance area, 23 Jan. 2005, *D.E.Murfet 4893* (*AD 178970, HO); Hartz Mts Nat. Park, Lake Esperance area, 23 Jan. 2005, *D.E.Murfet 4894* (*AD 178971, HO); Mt Ben Lomond, near ski lodge area, 26 Jan. 2005, *D.E.Murfet 4912* (*AD 178963, HO); Lake Dobson in the Mt Field Nat. Park, 22 Jan. 2006, *D.E.Murfet 5184* (*AD 190697, HO); Lake Belcher/Belton walking trail, Mt Field Nat. Park, 22 Jan. 2006, *D.E.Murfet 5185* (*AD 190655, HO); Mt Wellington on saddle on way up from Mt Arthur, alt. 1180 m, 23 Jan. 2006, *D.E.Murfet 5190* (*AD 190792, HO); Mt Arthur, off Mt Wellington road near sharp bend, 23 Jan. 2006, *D.E.Murfet 5191* (*AD 190791, HO); Ladies Tarn in the Hartz Mts Nat. Park, alt. 1000 m, 24 Jan. 2006, *D.E.Murfet 5196* (*AD 190654, HO); Hartz Mts Nat. Park, Ladies Tarn, 27 Dec. 2007, *D.E.Murfet 5846* (*AD 216591, HO); Mt Field Nat. Park, Lake Dobson, 28 Dec. 2007, *D.E.Murfet 5851* (*AD 216748, HO); Pine Lake on the Highland Lakes Highway, 31 Dec. 2007, *D.E.Murfet 5902* (*AD 216520, HO); Ben Lomond Nat. Park, Land of Little Sticks, 26 Mar. 1979, *M.G.Noble 28509* (*HO 73420); Edge of Tarn, Wombat Moor, Mt Field Nat. Park, 26 Mar. 1932, *O.Rodway 104* (*HO 3311); Upper reaches of North West Bay River, Mt Wellington, 6 Feb. 2000, *A.C.Rozefelds 1626* (*HO 502869); Near Lake Dobson huts, Mt Field, 6 Jan. 1978, *J.M.B.Smith 246* (*HO 36364); N end of Tarn Shelf, Mt Field Nat. Park, 21 Mar. 2006, *M.Visoiu 176* (*HO 539027, mixed collection); Lake Augusta, 13 Feb. 2009, *M.Visoiu 537, J.Balmer & M.Van Slageren* (*HO 551187; Millennium Seedbank Voucher).

Victoria: Mt Baw Baw, NE of Ski Village, 22 Jan. 1966, *A.C.Beauglehole 15272* (MEL 538741A); Bogong High Plains, Watchbed Creek, 27 Jan. 1966, *A.C.Beauglehole 15629* (MEL 538743A); Mt Cope, 21 Feb. 1982, *E.A.Chesterfield 1609* (MEL 2130844A); Bogong High Plains, surroundings of Mt Nelse, alt. 1900 m, 13 Feb. 1958, *Hj.Eichler 14831* (*AD 96105210); Bogong High Plains, Rocky Knobs, alt. 1800 m, 3 Feb. 1958, *Hj.Eichler s.n.* (*AD 96105056); Alpine Nat. Park, Bogong High Plains, Head of Middle Creek, about 100 m N of start of track to Cope Hut, alt. 1700 m, 18 Mar. 2009, *J.A.Jeanes 2148* (MEL 2325711A); Mt Mueller, Gippsland, alt. 1540 m, s.dat., *J.G.Luehmann s.n. & C.H.French Jr* (MEL 95997A); Bogong High Plains, Rocky Valley, alt. 1560 m, 20 Jan. 1959, *T.B.Muir 704* (*AD 96435006); Bridge crossing on walk to Derrick Hut, S of Mt Lock, 2 Jan. 2005, *D.E.Murfet 4866* (*AD 178932, HO); Near Mt Cope on Bogong High Plains, 13 Jan. 2005, *D.E.Murfet 4871* (*AD 178939, HO); Bogong High Plains, 20 Jan. 1936, *R.T.Patton s.n.* (MEL 96023A); Mt Erica, s.dat., *G.Weindorfer s.n.* (MEL 580029A); Bogong High Plains. (c. 130 km SE of Wangaratta), s.dat., *J.H.Willis s.n.* (MEL 96024A); Echo Flat, Lake Mt, near Marysville, alt. 1480 m, 6 Dec. 1943, *J.H.Willis s.n.* (MEL 2217024A); Echo Flat, Lake Mt, c. 10 miles [16 km] NE of Marysville, alt. 1450 m, 25 Jan. 1948, *J.H.Willis s.n.* (MEL 95999A); Baw Baw Mts, 2 Jan. 1905 *H.B.Williamson s.n.* (MEL 620164A).

New Zealand: Mt Sebastopol, Canterbury, 3 Feb. 1946, *G.T.S.Bayliss s.n.* (*OTA); Devils Elbow Stream, Mt Cook, Canterbury, 11 Feb. 1968, *A.M.Buchanan s.n.* (HO 80813); Upper West Matakitaki River valley, 15 Jan. 1992, *A.M.Buchanan 12263* (HO 538074); Near summit of Mt Whitecoomb, Umbrella Mts, 14 Dec. 1985, *K.J.M.Dickinson & B.D.Race s.n.* (*OTA); Little Pomohaka Headwater, Umbrella Ecology District, 6 Jan. 1986, *K.J.M.Dickinson & B.D.Race s.n.* (*OTA); Maungatua, Central Otago, 23 Mar. 1985, *J.Eason s.n.* (*OTA); Lammermoors, 20 Dec. 1977, *D. Holdsworth s.n.* (*OTA); Maungatua, Central Otago, s.dat., *J.E.Holloway s.n.* (*OTA); Lewis Pass, Canterbury, 4 Jan. 1968, *P.N.Johnson s.n.* (*OTA); Red Mt, NW Otago, 1 Feb. 1975, *W.G.Lee & A.F.Mark s.n.* (*OTA); Wiarau Valley, Red Hills, 30 Nov. 1972, *W.G.Lee s.n.* (*OTA); Maungatua, Central Otago, s.dat., *A.B.Lloyd s.n.* (*OTA); Maungatua, Central Otago, s.dat., *A.F.Mark s.n.* (*OTA); Blue Mts, 31 Dec. 1964, *A.F.Mark s.n.* (*OTA); Red Creek Barrier U, Pyke River , 9 Dec. 1969, *A.F.Mark s.n.* (*OTA); Maungatua, Central Otago, Mar.1951, *A.F.Mark s.n.* (*OTA); Olivine Ledge, W. Otago, 17 Feb. 1968, *A.F.Mark s.n.* (*OTA); Mueller Valley, Turnbull River, Mt Aspiring Nat. Park, 21 Jan. 1969, *A.F.Mark s.n.* (*OTA); Mueller Valley, Turnbull River, Mt Aspiring Nat. Park, 21 Jan. 1969, *A.F.Mark s.n.* (*OTA); Upper Makarora Valley, Young Range, Mt Aspiring Nat Park, Fiordland, 9 Feb. 1969, *A.F.Mark s.n.* (*OTA); Upper Aparima Valley, Takitimu Mts, N Southland, 1 Feb. 1971, *A.F.Mark s.n.* (*OTA); Waitutu Forest, W Southland, 13.May 1985, *A.F.Mark s.n.* (*OTA); Lake Sylvester, NW Nelson, 17 Dec. 1967, *A.F.Mark & N.M.Adams s.n.* (*OTA); Arthurs Pass, Arthurs Pass Nat. Park, 30 Dec. 1967, *A.F.Mark & N.M.Adams s.n.* (*OTA); Borland Saddle, Hunter Mts, Fiordland, 7 Jan. 1968, *A.F.Mark & N.M.Adams s.n.* (*OTA); Key Summit, Fiordland, 10 Jan. 1968, *A.F.Mark & N.M.Adams s.n.* (*OTA); Mt Richmond, Two Thumb Range, Canterbury, 1 Jan. 1969, *A.F.Mark & N.M.Adams s.n.* (*OTA); Williamson Flat, Joe – Arawhata River, Mt Aspiring Nat. Park, Fiordland, 16 Jan. 1968, *A.F.Mark & M.L.Burke s.n.* (*OTA); Lake Tehafer, 27 Dec. 1958, *D. Scott s.n.* (*OTA); Ajax Swamp, Catlins, SE Otago, 29 July 1975, *A.F.Mark*, *P.H.Johnson & G.T.S.Bayliss s.n.* (*OTA); Secretary Island, Feb. 1959, *J.Murray 4463* (*OTA); Gardiners Rd area, 16 Feb. 1980, *J.F.West s.n.* (*OTA); Gardiners Rd area, Glendhu, 16 Feb. 1980, *J.F.West s.n.* (*OTA);

2. Drosera murfetii* Lowrie & Conran, *sp. nov.

A Drosera arcturi *foliis viridis et rubis, foliis basalis 2–5, glabris, (1–) 3–5 (–12) longis, foliis distalis (0–) 1–2 (–4), glandulosis, 3.5–21.7 cm longis, styliis 4–5; viridi-albis ad purpureo-ceriseis stigmata, semina (0.8–) 1–2 × (0.4–) 0.6–1 mm, differt.*

Typus: shores of Lake Esperance, Hartz Mountains, Tasmania, 43°13'44"S 146°46'14"E, alt. 1000 m, *A. Lowrie 3181 & D.E.Murfet*, 24 Jan 2006. — **Holotypus:** HO. **Isotypi:** PERTH; MEL, AD, NSW, *distribuendi.*

Drosera arcturi auct. non Hook.: Marchant, Fl. Austral. 8: 54 (1982), pro parte; Lowrie, Carniv. Pl. Austral. 136 (1998), pro parte; Morris, Fl. Tas. Online, Droseraceae 3 (2009), pro parte.

A cold tolerant, green, turning red with age or exposure, fibrous-rooted alpine *perennial herb*; *rhizome* 1–5 (>10) cm long, covered with persistent dead leaf bases. *Hibernaculum* bud-like, derived from non-glandular basal leaf sheaths covering rhizome apex. *Leaves* at emergence 2–5, (1–) 3–5 (–12) × 0.5–1.5 cm, lanceolate, apically acute, glabrous; *glandular leaves* (0–) 1–2 (–4), linear to narrowly lanceolate-spathulate, loosely distichous, erect, 3.5–21.7 cm long, persisting after senescence; *petioles* stem-sheathing, 1.5–2.5 cm long, 0.8–1 mm wide at sheath apex, 1.5–2 mm wide at lamina, glabrous; *lamina* 22–55 (>75) × 2–6 mm, more or less linear to lanceolate or narrowly oblong, apex blunt to rounded, adaxial surface bearing large, sub-marginal insect-catching glands and smaller glands within, abaxial surface glabrous with a prominent midrib (occasional plants bear no trapping leaves at all). *Inflorescence* terminal, scapose, 1–4-flowered, 3–20 cm long, 0.5–0.6 mm diam, glabrous, enclosed basally by leaf sheaths, persistent, prostrate after senescence. *Flowers* shortly pedicellate, erect in fruit; *pedicels* 1.5–12 mm long; *floral bract* subulate, 1–2 × 0.4–0.5 mm. *Sepals* greyish-green, 10–16 × 2.3–2.5 mm, narrowly elliptic, adaxially concave, horizontal at anthesis, margins entire, apex obtuse, irregularly crenate, both surfaces glabrous. *Petals* white, 5–14 × 4–5 mm, obovate, entire, apex broadly rounded. *Stamens* 5, 6–7 mm long, filaments white, anthers and pollen yellow. *Ovary* 7–8.5 × 4.2–5.1 mm, ellipsoid, green, ovules numerous. *Styles* 4–5, white, basally black, 0.8–2 × 0.2–0.3 mm (excluding stigmas), semi-erect, fusiform, flat in cross-section; *stigmas* greenish-white throughout most of its range or reddish-cerise (Hartz Mountains), ± reniform-peltate, 1.5–2.5 × 0.5–0.6 mm, stigma adaxially papillate. *Fruit* ellipsoid, 7–11 × 4.5–7.7 mm. *Seeds* c. 80–90, dark brown, (0.8–) 1–2 × (0.4–) 0.6–1 mm, irregularly lachrymoid to obovoid, ± longitudinally flattened; *funicle* sulcate; *testa* minutely reticulate-foveolate, anticlinal cells walls sinuous. **Giant alpine sundew. Figs. 3d–f, 8, 9.**

Etymology. The species is named in honour of Denzel Edwin Murfet (1957–), communications technician, amateur botanist, carnivorous plant, *Stylidium* and orchid enthusiast, who collected the species in the Hartz Range, Tasmania.

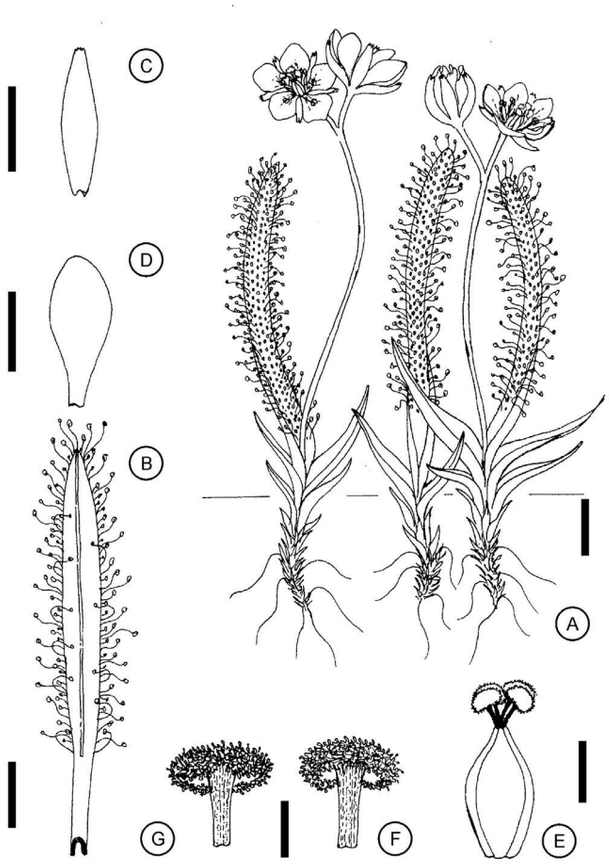

Fig. 8. *Drosera murfetii*. A plant; B lamina; C sepal; D petal; E gynoecium; F style and stigma, posterior view; G style and stigma, anterior view. Scale bars: A 10 mm; B–D 5 mm; E–G 1 mm. — Drawn by A. Lowrie, 2007, from type material (*A.Lowrie 3181 & D.E.Murfet*).

Distribution and ecology. Widespread from sea-level to alpine areas of western and south-western Tasmania (Fig. 11) in wet heathlands, near the shores of tarns, and at higher altitudes, commonly grows in cushion plants (*Donatia novae-zealandiae* and *Dracophyllum minimum*), often alongside *Drosera arcturi.*

Conservation status. Drosera murfetii throughout its range is common and not threatened.

Flowering period. November–January, with a peak flowering period for *D. murfetii* observed by AL and DEM at the end of Dec. 2007 (during the snow-free season).

Distinguishing characters. The morphologically most similar species to *D. murfetii* is *D. arcturi*, whose distinguishing characters are given in parenthesis. *Drosera murfetii* is distinguished by having: green and red foliage (green to greenish-bronze, red or almost black) conspicuous, glabrous basal leaves, usually (1–) 3–5 (–12) cm long above the soil surface (glabrous basal leaves absent or small, linear, mostly 3–12 mm long, but occasionally up to 27 mm); glandular leaves commonly 1, sometimes 2, rarely up to 4, usually 3.5–8 cm long, but sometimes up to 21.7 cm long or longer (glandular leaves 3–12, 3–5 cm long, but sometimes up to 12 cm

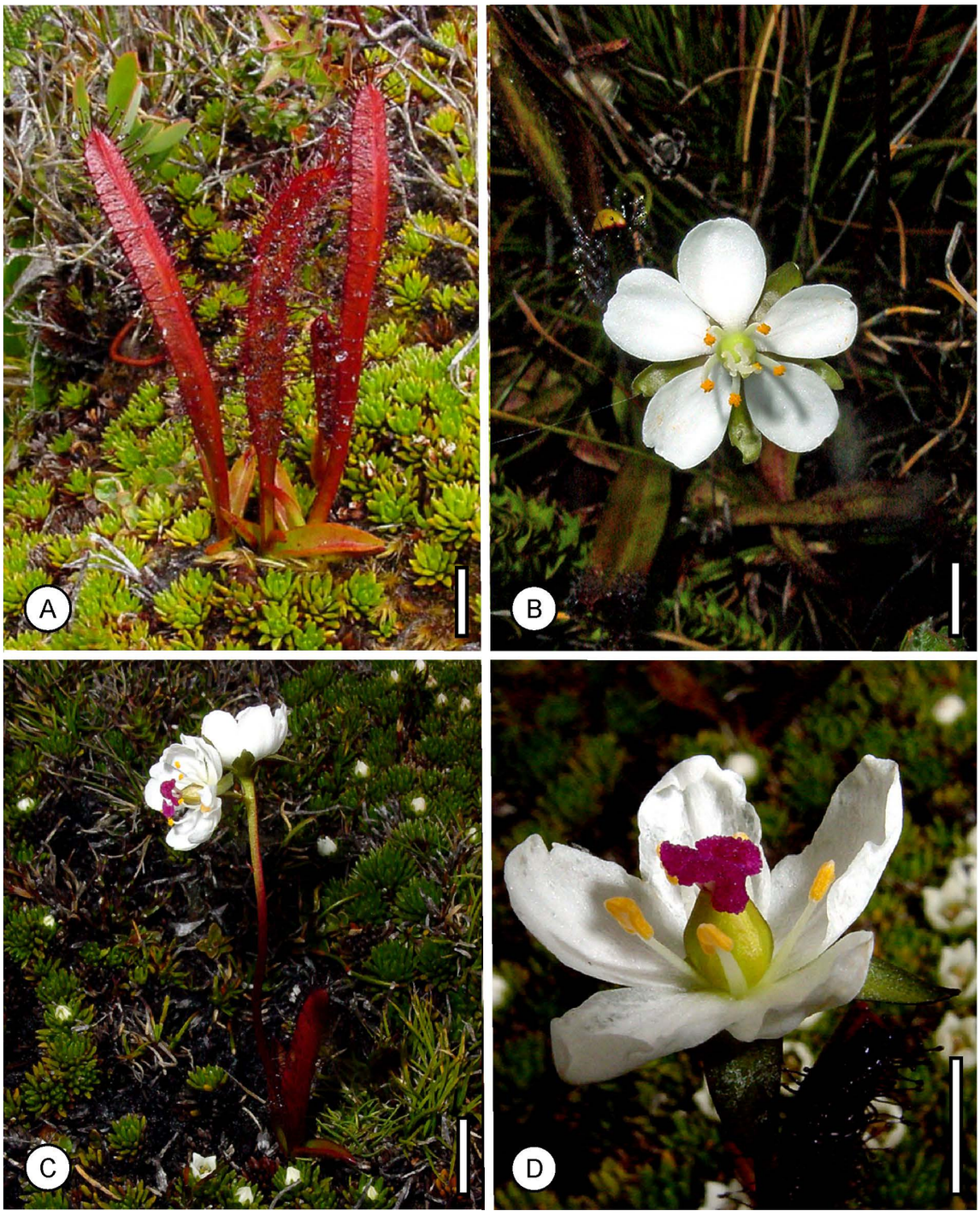

Fig. 9. *Drosera murfetii* in the Hartz Mountains, Tasmania. A plants showing broad glabrous basal leaves and few, erect trapping leaves; B close up of flower with white stigmas; C plant showing multiple flowers per scape; D close up of cerise stigma form. Scale bars: A, C 10 mm; B, D 5 mm. — Photos: A. Lowrie.

long); styles 4–5 (styles 3–4); seeds (0.8–) 1–2 × (0.4–) 0.6–1 mm (seeds 0.5–1 (–1.3) × 0.4–0.8 mm).

Notes. Throughout its range, *D. murfetii* is more common than *D. arcturi* at lower elevations and particularly at or near sea level in south west Tasmania. *Drosera murfetii* coexists with *D. arcturi* at higher elevations, where it commonly grows side by side with *D. arcturi*, sharing the same cushion plants. Despite extensive field explorations carried out by AL and DEM in Jan. 2005, Jan. 2006 and Dec. 2007 at several sites in south-west Tasmania, no intermediate forms were found in terms of

the possession of large glabrous leaves and few, erect (versus numerous, semi-erect) trapping leaves.

*Specimens examined (specimens marked * were used in the numerical analysis)*

Tasmania: Moores Garden, 14 Jan. 1984, *D.G.Adams 41* (*HO 76650); 1 km NE of the W-most causeway on the S side of Lake Augusta, 5 Jan. 1971, *W.R.Barker 1030* (*AD 97114123); Ooze Lake, 31 Jan. 1981, *A.Brown 221* (*HO 327549); Head of D'Entrecasteaux River, 22 Mar. 1984, *A.M.Buchanan 3039* (*HO 76816); Jubilee Range, 13 Jan. 1985, *A.M.Buchanan 5241* (*HO 120685); 2 km W of Granite Tor, 22 Jan. 1985, *A.M.Buchanan 5469* (*HO 122115); Giblin River c. 7 km from mouth, 11 Jan. 1986, *A.M.Buchanan 7804* (*HO 405459); S ridge of Mt Gaffney, 14 Jan. 1986, *A.M.Buchanan 7862* (*HO 405516); N peak of Mt Gaffney, 14 Jan. 1986, *A.M.Buchanan 7880* (*HO 405532); SE ridge of the Lawson Range, 25 Jan. 1986, *A.M.Buchanan 8107* (*HO 404985); Low hills behind Coffin Bay, Port Davey, 5 Jan. 1987, *A.M.Buchanan 9244* (*HO 405370); Ridge E of Deadmans Creek, 21 Jan. 1987, *A.M.Buchanan 9761* (*HO 402904); Lake Ewart, 04 Feb. 1987, *A.M.Buchanan 9895* (HO 409074, mixed collection); Between Deadmans Bay and Lousy Bay, 19 Jan. 1987, *A.M.Buchanan 9638* (*HO 123668); Schnells Ridge, 27 Jan. 1998, *A.M.Buchanan 15037* (HO 324160); Mt Read S side of summit, 21 Feb. 2008, *A.M.Buchanan 16916* (HO 548612); Lake Dobson, Mt Field Nat. Park, 22 Jan. 1949, *N.T.Burbidge 3259* (*HO 3310); Darwin Plateau, 25 Dec. 1984, *P.Collier 220* (*HO 116495); Mt Field Nat. Park (Lake Belcher track, beyond saddle), 2 Feb. 1969, *E.M.Canning s.n.* (*AD 97026096); Mt Solitary summit, 25 Mar. 1990, *P.Collier 4641* (*HO 142923); Lake Dobson, Mt Field Nat. Park, 23 Jan. 1944, *W.M.Curtis s.n.* (*HO 42666); Near Cradle Mt, along track to Artist Pool, 9 Jan. 1960, *G.Ford s.n.* (*AD 98204400); Denison Range, Reeds Peak area, 30 Nov. 1978, *C.Harwood s.n.* (*HO 29560); Hamilton Range, 29 Jan. 1977, *S.J.Jarman s.n.* (HO 411337); Propsting Range, 16 Feb. 1977, *S.J.Jarman s.n.* (*HO 410974); Mt Humboldt, 17 Jan. 1978, *S.J.Jarman s.n.* (*HO 411973); Mt Rugby, 16 Feb. 1978, *S.J.Jarman s.n.* (HO 411018); Mt Lee, 3 Mar. 1978, *S.J.Jarman s.n.* (*HO 411087); Upper tributaries of the Giblin River, E of the Lawson Range, 31 Dec. 1978, *S.J.Jarman s.n.* (*HO 30472); Moth Creek, Bathurst Harbour, 31 Jan. 1962, *H.J.King s.n.* (*HO 3315); Melaleuca Creek, 31 Jan. 1929, *F.H.Long s.n.* (HO 3323); Shores and surrounds of Lady Tarn, Hartz Mts, 27.Dec. 2007, *A.Lowrie 3740 & D.E.Murfet* (*AD, MEL, NSW, PERTH); Mt Lyell camp, Julia Creek, 8 Dec. 1980, *M.K.Macphail s.n.* (*HO 37056); Hamilton Moraine, Basin Lake, 9 Dec. 1980, *M.K.Macphail s.n.* (*HO 37115); Jubilee Range, 8 Jan. 1985, *A.Moscal 9187* (HO 97042); Jubilee Range, 13 Jan. 1985, *A.Moscal 9255* (*HO 400964); Jubilee Range, 14 Jan. 1985, *A.Moscal 9333* (*HO 95532); Jubilee Range, 16 Jan. 1985, *A.Moscal 9372* (*HO 95146); Mulcahy River plain, 13 Jan. 1986, *A.Moscal 11631* (*HO 144694); Lawson Range, 25 Jan. 1986, *A.Moscal 11944* (*HO 402114); Wilson Bight, 13 Jan. 1987, *A.Moscal 13935* (*HO 409828); Hartz Mts Nat. Park, Lake Esperance area, 23 Jan. 2005, *D.E.Murfet 4894 & A.Lowrie* (*AD 178971, HO); Lake Dobson in the Mt Field Nat. Park, 22 Jan. 2006, *D.E.Murfet 5183 & A.Lowrie* (*AD 190696, HO); 200 m from Ladies Tarn in the Hartz Mts Nat. Park, 24 Jan. 2006, *D.E.Murfet 5192 & A.Lowrie* (*AD 190794, HO); Ladies Tarn in the Hartz Mts Nat. Park, 24 Jan. 2006, *D.E.Murfet 5195 & A.Lowrie* (*AD 190793, HO); Anthony Rd 8.3 km N of Zeehan Highway, 27 Jan. 2006, *D.E.Murfet 5208 & A.Lowrie* (*AD 190708, HO); Hartz Mts Nat. Park, Lake Esperance, 27 Dec. 2007, *D.E.Murfet 5843 & A.Lowrie* (*AD 216534, HO); Hartz Mts Nat. Park, Ladies Tarn, 27 Dec. 2007, *D.E.Murfet 5844 & A.Lowrie* (*AD 216536, HO); Mt Field Nat. Park, Lake Dobson, 28 Dec. 2007, *D.E.Murfet 5850 & A.Lowrie* (*AD 216513, HO); Queenstown, along Anthony Rd toward Tullah, 29 Dec. 2007, *D.E.Murfet 5867 & A.Lowrie* (*AD 216515, HO); Hartz Mts, 29 Jan. 1938, *A.M.Olsen s.n.* (*HO 411530); Hartz Mts, 22 Jan. 1939, *A.M.Olsen s.n.* (*HO 312393); Mt Wellington, 31 Dec. 1892, *L.Rodway 190* (*HO 3316); Twelvetrees Range, 12 Jan. 1980, *D. Jan Morris 8038* (HO 32596); Dove Lake, 31 Dec. 1908, *L.Rodway 231* (*HO 3312); Near Arve River, below hut, Hartz Mts, no date, *J.Somerville s.n.* (*HO 3313); Moth Creek, Bathurst Harbour, 31 Jan. 1962, *S.Stanier s.n.* (*HO 3314); N end of Tarn Shelf, Mt Field Nat. Park, 21 Mar. 2006, *M.Visoiu 176* (*HO 539027, mixed collection); Sharlands Peak, Frenchmans Cap Nat. Park, 2 Jan. 1981, *T.J.Wardlaw s.n.* (*HO 541098); Charles Range, summit of Southern Peak, SW aspect, 17 Feb. 1987, *J.M.Wells* (*HO 315576).

Discussion

Drosera arcturi occurs in the alpine regions of Victoria and New South Wales on the mainland of Australia, as well as Tasmania and New Zealand. The species is placed in subgenus *Arcturia* (Planch.) Schlauer [= *Drosera* section *Psychophila* auct. non. Planch. sensu Diels (1906) and Marchant et al. (1982)], along with *D. murfetii*. The New Zealand endemic *Drosera stenopetala* J.D.Hook and *D. uniflora* Willd. from southern South America are also traditionally included here (Diels 1906), but Culham (1993) found that pollen of *D. arcturi* was distinct from *D. uniflora*. This led Schlauer (1996) to transfer the latter to subgen. *Ptycnostigm*a (Planch.) Drude, albeit with reservations on its placement. Although molecular studies also widely separated these two species, *D. stenopetala* was found to be sister to *D. uniflora* in an isolated lineage inside *Drosera* L. subgen. *Drosera*, rather than close to *D. arcturi* (Rivadavia et al. 2003, Yesson & Culham 2006). The latter is instead sister to most of the genus, with only the isolated South African *D. regia* Stephens sitting below it in the phylogenetic tree of Cameron et al. (2002).

Species concepts and taxon variability in Droseraceae vary considerably, with many taxa that are currently recognised at specific level within Australia (CHAH 2008–) reduced in rank or placed into synonymy by some overseas researchers (Schlauer 1996, 2006–), largely due to differences in opinion on species definitions. Nevertheless, recent research on *Drosera* has found that there are generally more species than were thought previously within so-called species complexes, with the trend being to recognise more rather than fewer entities, usually as a result of detailed multi-character comparisons (e.g. Fleischmann et al. 2008, 2011; Rivadavia et al. 2009; Gonella et al. 2014).

Cluster analysis and ordination is a standard method for the determination of morphometric variability within and between plant taxa (e.g. Stace 1989; Quinn & Keogh 2002) and the technique was applied recently to the polymorphic *Drosera peltata* Thunb. complex (Gibson

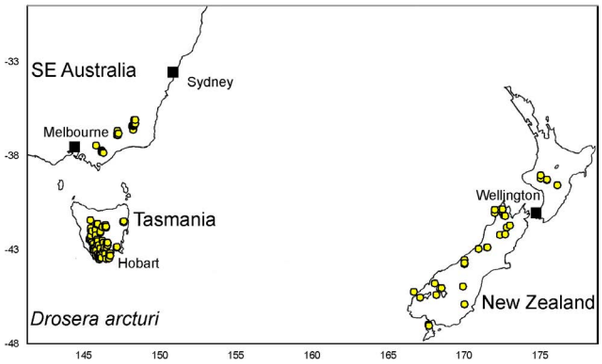

Fig. 10. Distribution map of *Drosera arcturi*. Map derived from AVH and specimens examined at AD, HO, MEL, OTA, and PERTH.

et al. 2012). As with the present study, the use of multi-character comparisons including morphometrics, found that there were clear differences between the different entities in the complex, allowing the determination of exactly how many taxa there are for the group.

When applied to *D. arcturi*, this approach shows that there are two discrete entities which differ in a range of features. Although *D. murfetii* is statistically significantly larger for nearly all measured features, there is still wide variability and overlap with *D. arcturi* for most of the size-related characteristics. Similarly, although the majority of *D. arcturi* specimens examined had three stigmas, while those of *D. murfetii* mostly had five, there were still plants in both taxa which possessed four.

The most obvious difference between the two species relates to the possession of broad, glabrous non-trapping leaves. These were completely absent in *D. arcturi*, where, if there were still glabrous leaves present at anthesis, they were tiny linear structures, the leaves instead all being typical, mostly semi-erect to spreading *Drosera* glandular trapping leaves. In contrast, all the *D. murfetii* plants examined bore broad, obviously photosynthetic outer leaves with only 1–2 larger, erect, inner gland-bearing leaves, or in the case of ten plants examined, apparently no trapping leaves at all. These features, combined with the overlapping distributions of the plants in south-western Tasmania and absence in the field of any obvious intermediate plants for these features, even when both taxa are growing in mixed populations, support our conclusion that they represent discrete taxa at species level.

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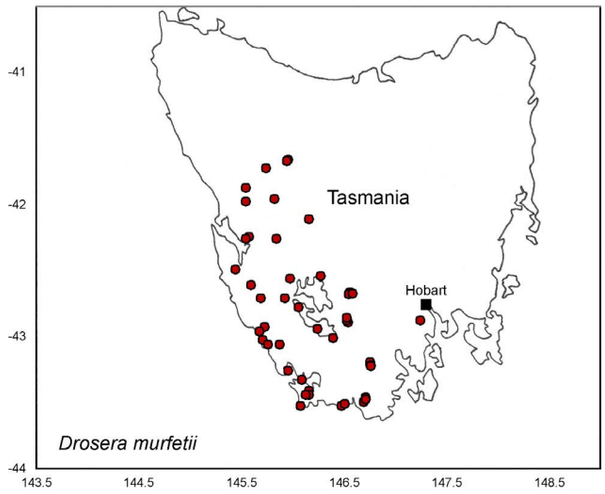

Fig. 11. Distribution map of *D. murfetii*. Map derived from AVH and specimens examined at AD and HO.

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