

## Typification and application of names in *Drosera* section *Arachnopus* (Droseraceae)

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### Abstract

Barrett, R.L. & Lowrie, A. Typification and application of names in *Drosera* section *Arachnopus* (Droseraceae). *Nuytsia* 23: 527–541 (2013). Taxonomic review of the *Drosera indica* L. (Droseraceae) complex requires the clarification of a number of published names. This paper is focussed on the application of names applying to taxa occurring in Australia. Two lectotypes are chosen and one neotype is designated for names historically listed as synonyms of *D. indica*. *Drosera serpens* Planch. and *D. angustifolia* F.Muell. are lectotypified. A neotype is selected for *D. hexagynia* Blanco as no original material is known. *Drosera hexagynia* is considered to be a synonym of *D. indica*. *Drosera angustifolia* and *D. indica* f. *robusta* F.M.Bailey are here considered to be synonyms of *D. finlaysonianana* Wall. ex. Arn. *Drosera angustifolia* var. *purpuriflora* F.Muell. ex Diels is an illegitimate name. Notes are provided on *D. hartmeyerorum* Schlauer, the only other named Australian taxon in this species complex. Characteristics of the seeds, anthers and glandular hairs are considered diagnostic at the species level. Illustrations of key identifying features and full descriptions of the Australian species are provided.

### Introduction

The *Drosera indica* L. species complex is known to be highly morphologically variable (Lowrie 1998; Susandarini *et al.* 2002; Short 2011). A number of species have been recognised in this complex: *D. indica* from Sri Lanka (Linnaeus 1753), *D. minor* Schum. & Thon. from Guinea (Schumacher 1827), *D. finlaysonianana* Wall. ex Arn. from Vietnam (Wallich 1828; Arnott 1837), *D. hexagynia* Blanco from the Philippines (as *D. hexaginia*, Blanco 1837), *D. serpens* Planch. from northern Australia (Planchon 1848), *D. angustifolia* F.Muell. from southern Australia (Mueller 1855), *D. metziana* Gand. from Mangalore in India (Gandoger 1913), *D. makinoi* Masam. from southern Japan (Masamune 1932) and *D. hartmeyerorum* Schlauer from the north-west of Australia (Schlauer 2001).

While the taxa listed above and a number of infraspecific taxa (not listed) have been named formally, a stable nomenclature addressing the observed morphological variation has not been achieved. Most authors have recognised a single variable taxon, widespread from Australia, north to Japan, and across Asia, India and Africa (van Steenis 1953; Ohwi 1965; Obermeyer 1970; Conn 1980; Marchant 1981;

Marchant & George 1982; Wheeler 1992; Lowrie 1998; Lu Lianli & Katsuhiko Kondo 2001; Jayaram & Prasad 2006; Conran & Marchant 2011; Short 2011). Most of the available species names were published pre-1900 and all of them were synonymised under a variable *D. indica* by Diels (1906) whose broad concept has been largely followed ever since. Susandarini *et al.* (2002) assessed a large range of Australian material and identified significant levels of variation, suggesting that multiple taxa should be recognised, but they were unable to satisfactorily resolve species boundaries at that time.

In naming *D. angustifolia* in 1855, Ferdinand Mueller stated ‘Only the thoughts, that science does not disdain the smallest gift, that the last links of a long chain of observations are often closed by a most insignificant discovery, which isolated would be unimportant—only those thoughts could induce me to offer out of the botanical treasures of this country some novelties or rarities which rewarded my last explorations’ (Mueller 1855). The conclusions we arrive at here follow extensive study in the field and in herbaria across Europe and Australia, and build on a long history of botanical discovery and description by other authors. The characteristics that we believe to define species are relatively fine and require close examination of specimens. Illustrations of some of the main features are provided as an aid to specimen identification. Recognition of distinct taxa is particularly strengthened by extensive fieldwork and the opportunity to examine co-occurring taxa in their natural setting.

Field observation of this species complex by both authors spanning more than 20 years, particularly in the Kimberley region of Western Australia, has made it apparent that multiple species should be recognised. This paper addresses some of the taxonomic issues regarding existing names as a precursor to a book on the carnivorous plants of Australia (Lowrie in press). A key to all Australian taxa will be provided by Lowrie (in press). While this paper is concerned primarily with material from Australia, the status of several names from outside Australia requires clarification, as a number of morphotypes are shared between Asia and Australia.

Two lectotypes are chosen and one neotype is designated for names historically listed as synonyms of *D. indica*. A neotype is selected for *D. hexagynia* based on a collection from Luzon Province in the Philippines. *Drosera serpens* is lectotypified based on a collection from north Queensland. *Drosera angustifolia* is lectotypified based on collections from near the Murray River, New South Wales. *Drosera angustifolia* var. *purpuriflora* F.Muell. ex Diels is a *nomen illeg.* The type of *D. indica* f. *robusta* F.M.Bailey has been examined and, along with *D. angustifolia*, is considered to be a synonym of *D. finlaysoniana*. We are here reinstating *D. finlaysoniana* and *D. serpens* as species distinct from *D. indica*. We also confirm specific recognition of *D. hartmeyerorum*.

## Methods

Specimens from the *D. indica* species complex have been examined by the first author at B, BM, BRI, CANB, FI, K, L, LD, MEL, NSW, P and PERTH using light microscopy and imaged using a Jeol JCM 6000 NeoScope bench-top scanning electron microscope at Kings Park and Botanic Garden. Microphotographs were taken using a Canon EOS 40D digital camera with a Canon MP-E 65 1–5× Macro lens and Canon Macro Twin Lite MT-24EX flash system.

### Diagnostic morphological features

Susandarini *et al.* (2002) assessed a number of morphological features in the *D. indica* species complex without adequately resolving discrete taxa. We consider several features to be diagnostic for taxa in this species complex.

1. The extent of long-stalked glandular hairs on the adaxial surface at the base of the lamina: reaching the stem, or with an obvious gap of 5–20 mm.
2. A variety of hair types are found in the *D. indica* complex: stalked, multi-vesicular, capitate (blackberry-like) hairs; Y-shaped hairs with curved arms; T-shaped hairs; undulating, peltate hairs; stalked hairs with a dome-shaped head with a thickened rim (bowler hat-like); stalked mucilage glands (insect-trapping hairs, stalks short, medium or long); and simple unicellular hairs (Figure 1).
3. Anther shape: anther types in the *D. indica* complex may be: hooded and dilated, narrowly dilated, elongate, apically recurved, or standard (Figure 2).
4. Seed surface morphology: reticulate, ribbed-reticulate, or longitudinally sulcate (Figure 3).
5. Seed size: small or large.

This paper provides a summary of the combinations of these characters defining each taxon dealt with here, along with full descriptions of the Australian species (*i.e.* excluding *D. indica s. str.*). A full review of this species complex in Australia will be provided by Lowrie (in press).

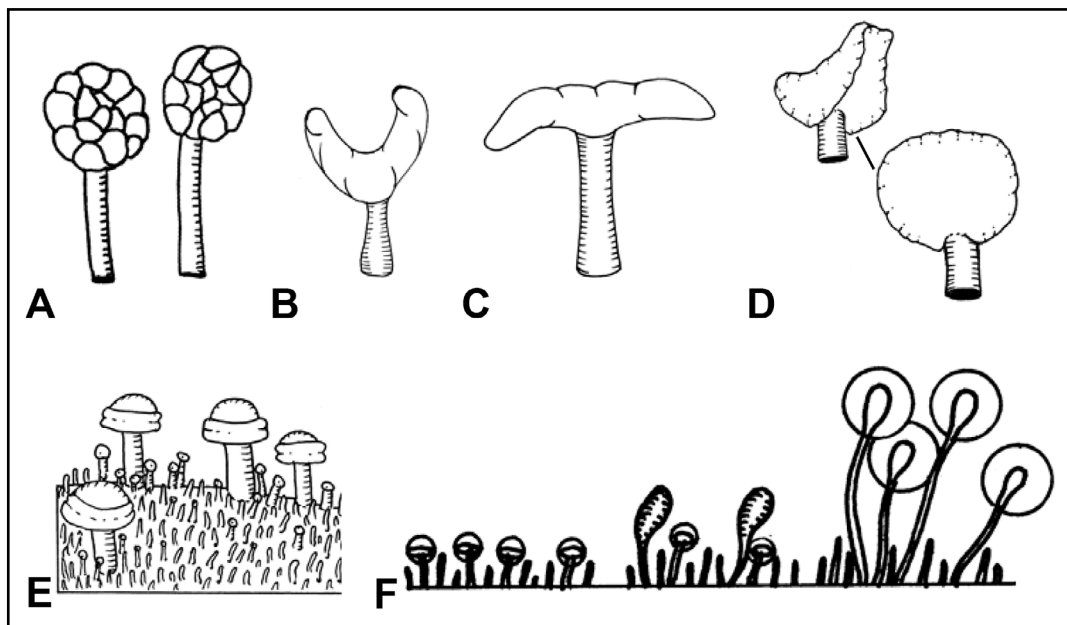


Figure 1. Variation in hair types in the *Drosera indica* complex: A – stalked, multi-vesicular capitate, or ‘blackberry-like’; B – Y-shaped with curved arms; C – T-shaped; D – undulating peltate; E – stalked, dome shaped head with a thickened rim, or ‘bowler hat-like’; F – stalked glandular hairs (short, medium and long) with short simple hairs. Illustrations by A. Lowrie.

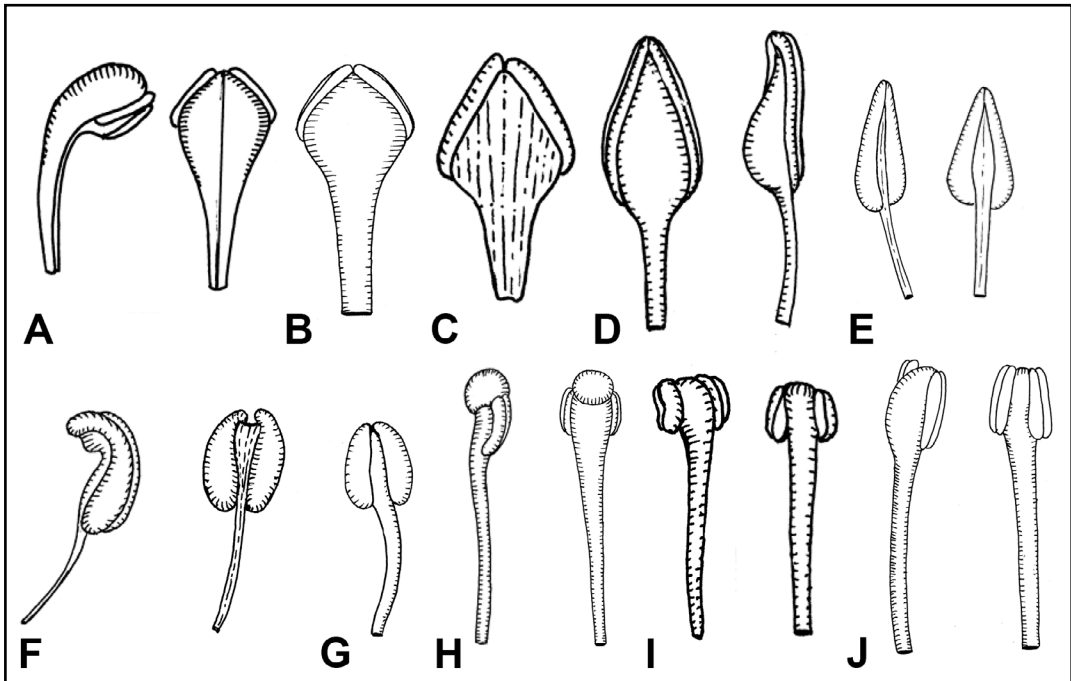


Figure 2. Anther types in the *Drosera indica* complex: A–C – hooded and dilated; D – narrowly dilated; E – elongate; F – apically recurved; G–J – standard (note globular apical projection on H). Illustrations by A. Lowrie.

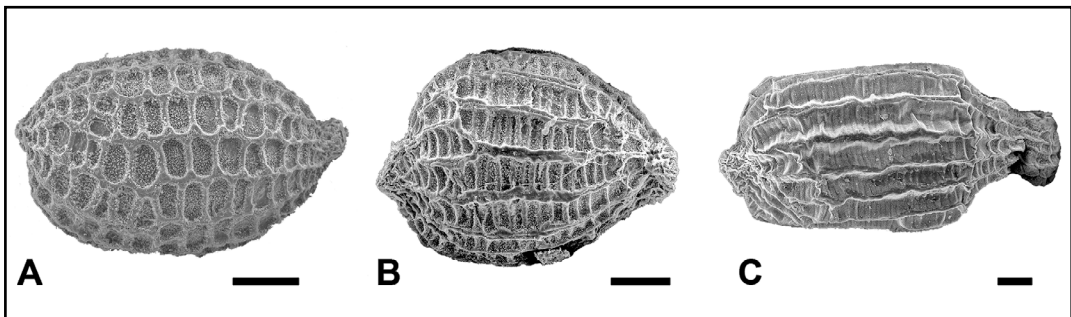


Figure 3. Representative seed types in the *Drosera indica* complex: A – reticulate; B – ribbed-reticulate; C – longitudinally sulcate. Scale bar = 100  $\mu\text{m}$ . Images by R.L. Barrett.

### Taxonomy

Species of the *D. indica* complex are assigned to *D.* sect. *Arachnopus* Planch.

***Drosera* sect. *Arachnopus*** Planch., *Ann. Sci. Nat. (Paris) ser. 3*, 9: 93 (1848).

*Type: D. indica* L.

Published names in the *D. indica* species complex are detailed below where they potentially affect the application of names in Australia. *Drosera hexagynia* is neotypified and placed in synonymy with *D. indica*, which is not known to occur in Australia. Without neotypification, the name *D. hexagynia*



could potentially have been applied as an earlier name for the taxon recognised here as *D. serpens*. Several names (such as *D. minor*) are known not to apply to Australian material, but their correct application requires further study. Names are dealt with in their order of original publication.

***Drosera indica*** L., *Sp. Pl.* 1: 282 (1753). *Type citation*: ‘Habitat in India.’ *Lectotype*: Herb. Hermann 5: 227, No. 121 [icon] (*lecto*: BM 000621002!), designated by Laundon in Hubbard & Milne-Redhead, *Fl. Trop. E. Africa, Droseraceae* 2 (1959).

*Drosera hexagynia* Blanco, *Fl. Filip.* (1<sup>st</sup> edn): 226 (1837), as ‘*hexaginia*’. *Neotype* (here designated): Luzon Central, Philippines, [received 6 November 1903], *A. Loher* 1637 (*neo*: P 04583118!).

*Selected specimens*. INDIA: Prope Mangalore, *R.F. Hohenacker* [*Pl. Indiae Or.* No. 189] (G–DC; P). SRI LANKA: ‘Zeylanica’, *Burman s.n.* (G–Burmman); ‘Ceylon’ *G.H.K. Thwaites* 1088 (G–DC; P). VIETNAM: ‘Cochinchina’, 1879, *Germain* 26 (G–DC).

*Characteristics*. The neotype of *D. hexagynia* has the following five character states: 1 – the stalked glandular hairs at the base of the lamina do not reach all the way to the stem, presenting a distinct gap; 2 – there are only a few short, simple hairs at the base of the lamina; 3 – anthers are classed as normal, not hooded or dilated; 4 – seeds have a distinctly reticulate surface; 5 – seeds are relatively small (c. 0.4 mm long). The type specimen also has distinctive filiform stipules and the leaf laminae are relatively short.

*Typification*. No original material of *D. hexagynia* is known to exist, so a neotype is required to fix the application of this name. Two morphotypes are found in Luzon Province where Blanco’s *D. hexagynia* was named from, one the same as *D. indica* and one the same as *D. serpens*. The original description is quite detailed in many respects, but it does not enable us to distinguish between these two morphotypes, and so it does not direct our choice of neotype. Typifying this name as a synonym of *D. indica* is consistent with the treatments of Planchon (1848) who placed it there at the time of naming *D. serpens*, Naves & Fernandez-Villar (1880), and Merrill (1905, 1918), who declined to choose a representative specimen for Blanco’s name as he was convinced the name was a synonym of *D. indica*.

***Drosera finlaysoniana*** Wall. ex Arn., in Hook., *Companion Bot. Mag.* 2: 315 (1837).

*Type*: Turon Bay, Cochinchina [Đà Nẵng Bay, Vietnam], *G. Finlayson* 507 [*Wallich* Cat. No. 3752] (*holo*: G!; *iso*: K 000217501!, K 000659132!).

*Drosera finlaysonii* Wall., *Cat.*: No. 3752 (1828), *nom. nud.*

*Drosera angustifolia* F.Muell., *Trans. Philos. Soc. Victoria* 1: 7 (1855). *Type citation*: ‘On the moist gravelly margins of the Lakes on the Murray River towards Eustone.’ *Lectotype* (here designated): Ad riparium glareosum humidum limose [illegible, c. ‘imbuis’] inundatum lacus [illegible, c. ‘ualb’] fl. Murray [Near to banks of gravelly moist, muddy, [illegible] flooded lakes [illegible] River Murray, New South Wales], Dec. [18]53, *F. Mueller s.n.* (*lecto*: MEL 96369!; *isolecto*: LD!; probable *isolecto*: MEL 96386!). *Additional syntypes*: Lagoons near Eustone [Euston], New South Wales, *s. dat.*, *F. Mueller s.n.* (*syn*: MEL 659388!); Victoria, *F. Mueller* (*syn*: P 04963025!).

*Drosera angustifolia* F.Muell. var. *purpuriflora* F.Muell. ex Diels, *Pflanzenr.* 26: 77 (1906), *pro syn.* (*nom. illeg.*).

*Drosera indica* f. *robusta* F.M.Bailey, *Queensland Agric. J.* 31: 115, t. 100 (1913). *Type*: Mill Stream Falls, Ravenshoe, Queensland, [31 May, supplied] June 1913, *E. W. Bick s.n.* (*holo*: BRIAQ0183206!).

*Misapplied names.* *Drosera indica* *auct. non* L.: R. Erickson, *Pl. of Prey* 52, t. 12(2) (1968), *p.p.*; N.G. Marchant, *Fl. Centr. Austral.* 90, Figure 113 (1981); N.G. Marchant & A.S. George, *Fl. Australia* 8: 15 (1982), *p.p.*; T.D. Stanley & E.M. Ross, *Fl. S.E. Queensland* 1: 192 (1983); J. Brock, *Top End Native Pl.* 142, pl. (1988), *p.p.*; A. Urban, *Wildflowers Centr. Austral.* 56, pl. (1990); J.R. Wheeler in J.R. Wheeler (ed.), *Fl. Kimberley Reg.* 238, Figure 67b (1992), *p.p.*; P. Latz, *Bushfires & Bushtucker* 162, Figure (1995); B.J. Conn in N.G. Walsh & T.J. Entwisle (eds), *Fl. Victoria* 3: 356, Figure 73i (1996); K.F. Kenneally *et al.*, *Broome & Beyond* 97, pl. (1996), *p.p.*; B.J. Grieve, *How Know W. Austral. Wildflowers.* (2<sup>nd</sup> edn.) 2: 58, Figure (1998); A. Lowrie, *Carnivorous Pl. Aust.* 3: 180, Figure, pl. (1998), *p.p.*; G.J. Harden in G.J. Harden, *Fl. New S. Wales* (2<sup>nd</sup> edn.) 1: 494, Figure (2000); J. Conran & N.G. Marchant, *Fl. S. Austral.* (5<sup>th</sup> edn.) 6, Figure 1g, pl. 2f–h (2011).

A fibrous-rooted annual *herb* with alternate leaves radiating outwards from its major axis in a very loose open rosette (in plan view). *Leaves* erect and circinate in the early stages of growth, unfurling to a semi-erect position then slowly becoming horizontal as they age, resting in a hanging position on the basal portion of the erect or scrambling stem when spent. Major axis 10–20 cm tall, 1.0–1.3 mm diam.; covered with tiny translucent white glandular trichomes. *Petiole* absent, lamina attached directly to the major axis at its base, 2–3 mm wide, longitudinal margins curved downwards; covered with stalked mucilage glands and sessile digestive glands, positioned right into the leaf axil against the major axis, abaxial surface sparsely glandular. *Lamina* linear tapering towards their apices, longitudinal margins curved downwards, the adaxial surface convex and the abaxial surface concave in section, 6–8 cm long, 2–3 mm at their widest, adaxial surface including the rolled margins covered with long insect-catching, retentive and digestion glands, abaxial surface sparsely covered with short glands. *Inflorescence* a one-sided helicoid cyme, curving outwards from low on the major axis before ascending, 7–10 cm long including the peduncle, many-flowered provided good growing conditions prevail; peduncle densely covered with tiny translucent white glands; pedicels curved and erect in fruit, 4–8 mm long, very densely covered with similar glands; bracts subulate, 2.5–3.0 mm long, glandular, scattered along the rachis. *Sepals* reddish bronze, lanceolate, 3.5–4.0 mm long, 1.2–1.3 mm wide, upper margins and apex irregularly serrate, abaxial surface and margins glandular. *Petals* pink or white on adaxial and abaxial surfaces, obovate, 4–5 mm long, 3.5–4.0 mm wide. *Stamens* 5, 1.5–1.8 mm long; filaments translucent, white; anthers yellow, ovate, 0.7–0.8 mm long; pollen yellow. *Ovary* green, subglobose, 1.0–1.3 mm diam. at anthesis; carpels 3, each carpel slightly bi-lobed, glabrous. *Styles* 3, translucent, white, 1.8–2.0 mm long, each forked near the base to form a  $\pm$  V-shape configuration with each free terete style segment slightly raised upwards. *Stigmas* translucent, white, formed within the upper apices of each of the 6 style segments, papillose, stigmas often curved backwards towards their point of attachment. *Seeds* slate grey,  $\pm$  ellipsoidal, 0.50–0.55 mm long, 0.28–0.33 mm wide, funicle positioned prominent of the basal pole, 0.040–0.045 mm long, 0.060–0.065 mm wide, apical pole rounded with a little apical bump, surface sculpture with wide, prominent, zig-zagged longitudinal ridges, ridge summits flat, transverse ridges similar, forming deep elliptic cells, under high SEM magnification the cell walls and floors are covered with sand-like stellate clusters. (Figure 4)

*Distribution.* This species appears to be relatively widespread in South East Asia, recorded from Vietnam, Laos, Taiwan and mainland China, extending to Australia where it is the most widespread taxon in this species complex. This species is widespread in the interior of Australia, from the Murray River, New South Wales and Victoria in the south-east, extending north to around Cairns in north Queensland and Yalgoo in the south-west, to Kununurra in the north of Western Australia.

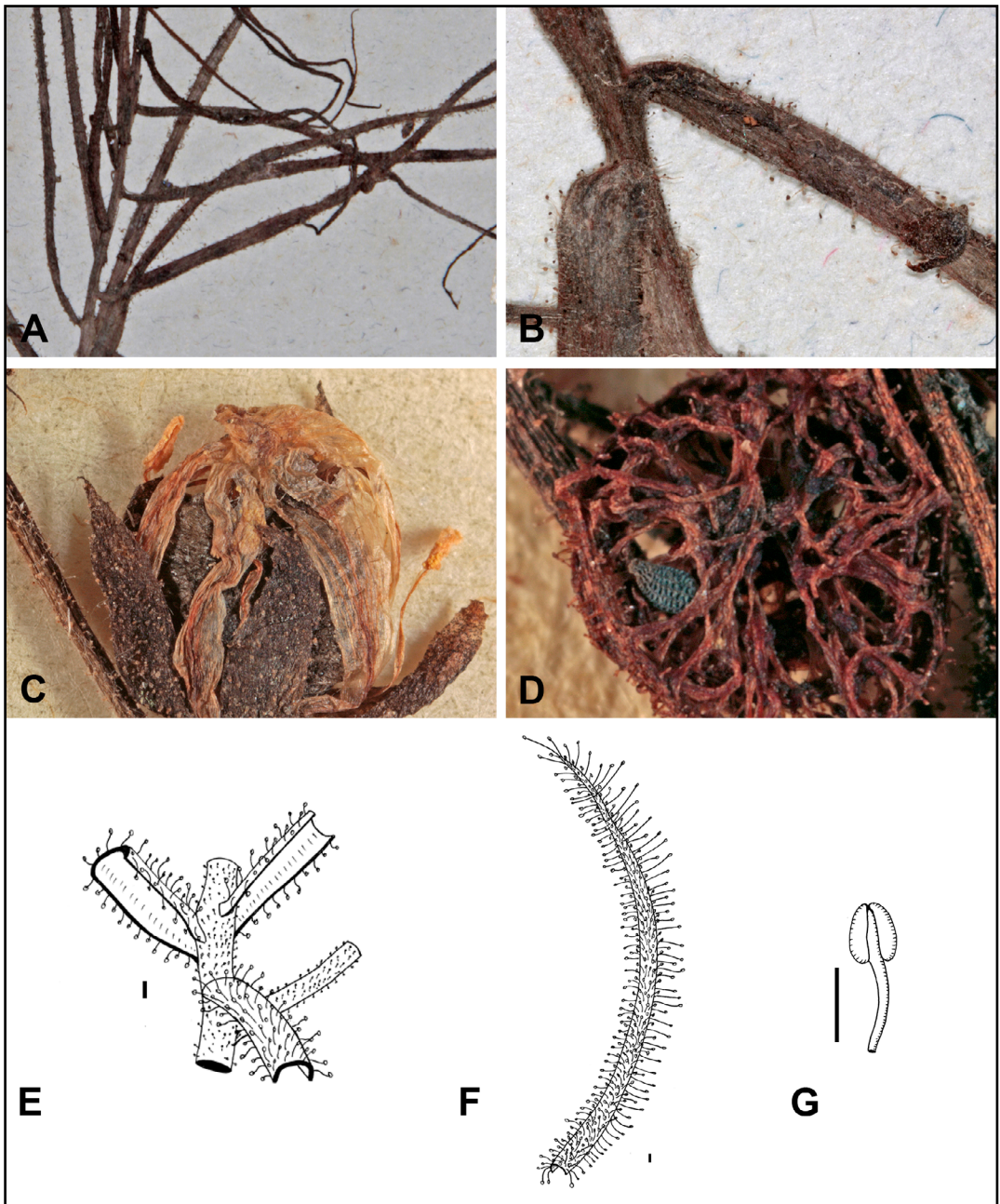


Figure 4. *Drosera finlaysoniana*. A – base of leaf lamina; B – glandular hairs on leaf lamina; C – anthers and dried flower; D – seed sitting on curled leaf lamina; E – stem and leaf bases; F – leaf lamina; G – stamen. Images from the holotype, *Finlayson* (A, B); Vietnam, *Gaudichaud s.n.*, 1839 (G) (C, D) and *A. Lowrie* 4005 (PERTH) (E–G). Images A–D by R.L. Barrett, illustrations E–F by A. Lowrie.

*Selected Australian specimens examined.* WESTERN AUSTRALIA: Mount Edgar Station, SE from Marble Bar, 11 June 1941, *N.T. Burbidge* 1125 (PERTH, 2 sheets); Wade Creek, Osmond Range, 19 July 1991, *I. Cowie* 1884 (DNA, MEL, PERTH); Nallum Lake, 24 km N of Cue, on Great Northern Highway, 18 July 2009, *A. Lowrie* 4005 (PERTH). NORTHERN TERRITORY: Mount Olga, Mar. 1967, *W.H. Butler s.n.* (PERTH); near False Mount Russell, 11 Aug. 1970, *S. Parker* 273 (NT *n.v.*, PERTH). QUEENSLAND: 31.6 km from the Hann Highway towards ‘Clarke Hills’, 9 Aug. 1997, *A.R. Bean* 12259 (BRI). NEW SOUTH WALES: Mutawintji National Park, Homestead Creek, 19 Sept. 1990, *G.J. White, I.H. Parbery & C.L. Bale s.n.* (NSW). VICTORIA: Hattah/Kulkyn National Park, E side of Mournpall Track, c. 1.4 km S of Lake Mournpall, 4 Mar. 1993, *J.H. Browne* 451 (MEL).

*Selected extra-Australia specimens examined.* CHINA: Sam Mo Watt Village, Kan-en District, 19 Mar. 1934, *S.K. Lau* 3489 (P). TAIWAN: ‘Formosa’, 27 May 1903, *U. Faurie* 186 (G–DC; P). VIETNAM: ‘Cochinchina’, 1839, *C. Gaudichaud-Beaupré s.n.* (G–DC).

*Typification.* Wallich (1828) listed *D. finlaysoniana* in his catalogue of plants in the Museum of the East India Company but the name was not validly published there as no description was given. The name was validated by G.A. Walker Arnott (1837) who summarised the *Drosera* taxa recognised in ‘East India’ and gave a brief description of *D. finlaysoniana*, describing it as close to *D. indica*, but larger with a different habit. Arnott notes that he had only seen one specimen, and that this was imperfect. Since the specimen at G lacks flowers it is considered to be the holotype. The isotypes at K (two sheets), where Wallich’s main collection is held, are fertile.

Original material of *D. angustifolia* was examined at LD, MEL and P. Only two sheets at MEL have been annotated as *D. angustifolia* by Mueller, the sheet with the largest amount of material is here designated the lectotype sheet. A sheet at LD has the same labels details and is considered an isolectotype. The second annotated sheet at MEL has less detail on the label, but is probably a duplicate sheet and is considered to be a probable isolectotype. Additional Mueller specimens from near Euston were not annotated as *D. angustifolia* by Mueller and they are considered syntypes. All of the specimens considered are quite uniform in morphology and fit the protolog well.

The holotype and isotypes of *D. finlaysoniana* have the following five character states: 1 – the stalked glandular hairs at the base of the lamina reach all the way to the stem (Figure 4A); 2 – there are only a few simple hairs among the glandular hairs at the base of the lamina (Figure 4B); 3 – anthers are classed as normal, not hooded or dilated (Figure 4C); 4 – seeds have a distinctly reticulate surface (Figure 4D); 5 – seeds are relatively small (c. 0.40 mm long) (Figure 4D).

The lectotype of *D. angustifolia* shares the same character states as *D. finlaysoniana* (Figure 5), with slightly larger seeds (c. 0.45 mm long).

Initial investigation of type material of *D. finlaysoniana* and *D. angustifolia* suggested that two taxa should be recognised based on differences in seed ornamentation, a greatly disjunct distribution and different habitat preferences. Specimens in a number of Australian herbaria were thus determined as *D. angustifolia* by R. Barrett over a number of years. Further examination of specimens has shown that there is a more or less continuous distribution between Australia and Vietnam, that the seed ornamentation is not as distinct as first thought, and that habitat preference shows a greater range than first observed. The two names are here considered to be synonymous, with *D. finlaysoniana* having priority.



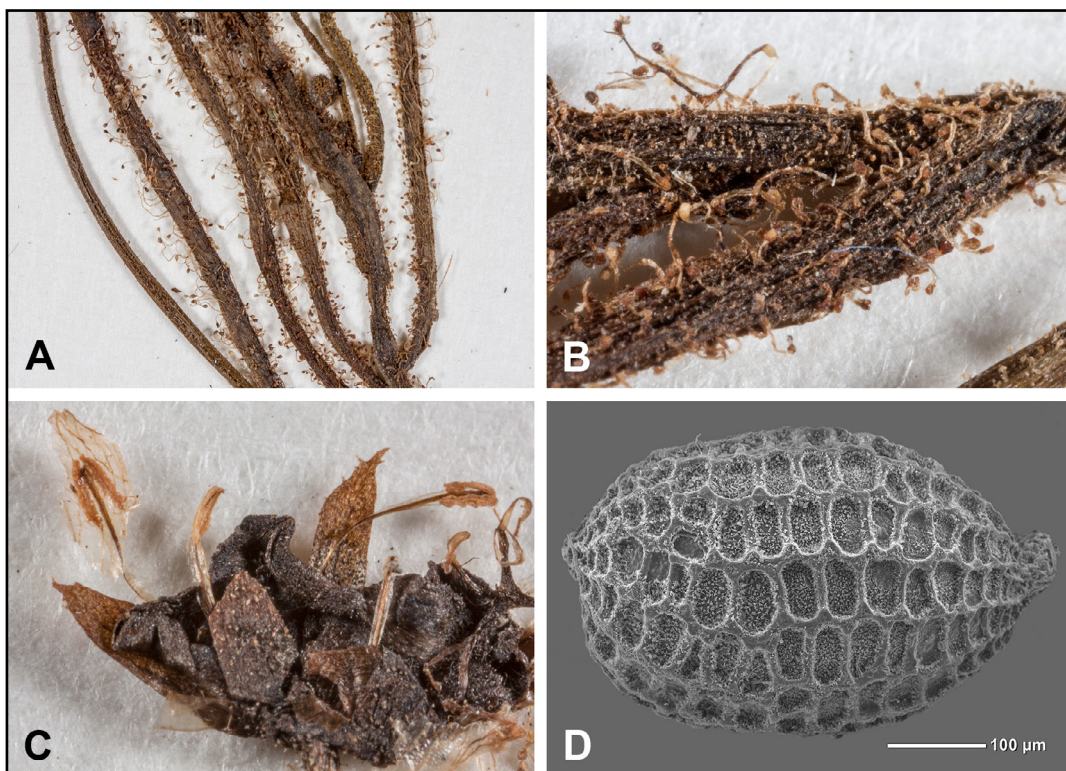


Figure 5. *Drosera angustifolia*. A – base of leaf lamina; B – glandular hairs on leaf lamina; C – anthers and dried flower; D – seed. Scale bar = 100 µm. Images from lectotype, *F. Mueller* (MEL 96369) (A–C) and Cue, Western Australia, *A. Lowrie* 4005 (PERTH) (D). Images by R.L. Barrett.

Although the varietal name *D. angustifolia* var. *purpuriflora* is sometimes cited as having been validated by Mueller along with his original description of the species name, it is not mentioned in that publication. The first published reference we have located is a listing in synonymy in Diels (1906). No specimen with this name could be located at MEL. All sheets collected by Mueller from the vicinity of the Murray River are labelled *Drosera indica*. Both white- and pink- to purple- flowered forms are known in this species. Flowers of white-flowered forms dry pink to purple.

The holotype of the form *D. indica* f. *robusta* is a good match for the types of both *D. angustifolia* and *D. finlaysoniana* and it is here synonymised under the latter name.

***Drosera serpens*** Planch., *Ann. Sci. Nat. (Paris) ser. 3*, 9: 204 (1848).

*Type citation*: ‘Hab. in Novae-Hollandiae ora Boreali ad Port-Essington, Armstrong n° 618 in herb. Hook. — In eadem regione loco proprio non indicato (*A. Cunningham* in herb. Hook.). — Nec non in ora orientali ad ostia fluminis *Endeavour*; *Banks et Soland.* in herb. Mus. Brit.’ *Lectotype* (here designated): Cape Grafton, Endeavour River, Point Lookout, [Queensland], 1770, *J. Banks & D. Solander s.n.* (*lecto*: BM 000810138!; *isolecto*: MEL 96397!). *Additional syntypes*: Port Essington, [Northern Territory], *Armstrong* 618 (*syn*: K!); north coast of Australia, *A. Cunningham s.n.* (*syn*: K!, MEL 96376!); north coast of Australia, *A. Cunningham* 133 (*syn*: BM 000790593!).

A fibrous rooted annual *herb* with alternate leaves radiating outwards from its major axis in a very loose open rosette (in plan view). *Leaves* erect and circinate in the early stages of growth, unfurling to a semi-erect position then slowly becoming horizontal as they age, resting in a hanging position on the basal portion of the erect or scrambling stem when spent. Major axis 15–30 cm tall, 1.6–1.7 mm diam.; densely covered with tiny, eglandular, translucent, white trichomes as well as a few scattered, larger, translucent, red glands; a number of larger, translucent, red trichomes bearing large, shiny, yellow, eglandular, mushroom-like heads (in the style of a bowler hat) but with a  $\pm$  double rim around its basal circumference; a few larger, translucent, white glands are also scattered throughout. *Petiole* 10–12 cm long, 1.0–1.2 mm diam.; free of all long, stalked mucilage glands; densely covered with tiny, eglandular, translucent, white trichomes as well as a small number of short, translucent, white glands; Y-shaped, eglandular appendages with translucent, white stems and translucent, pale yellow arms, positioned mostly on the adaxial surface of the petiole but also scattered elsewhere; lower margins bearing few or many large, clavate, translucent, red glands. *Lamina* linear, tapering towards the apex, longitudinal margins curved downwards, the adaxial surface convex and the abaxial surface concave in longitudinal section, 10–15 cm long, 1.0–1.2 mm wide, adaxial surface including the rolled margins covered with long, stalked mucilage glands and sessile digestive glands, abaxial surface very sparsely covered with short glands. Inflorescence a one-sided helicoid cyme, terminal, 15–20 cm long including the peduncle, many-flowered provided good growing conditions prevail; peduncle indumentum moderately covered with tiny, eglandular, translucent, white trichomes as well as a few scattered, larger, translucent, white glands; pedicels semi-erect in fruit, 10–18 mm long, indumentum more densely covered with similar eglandular and scattered glands; bracts filiform, 1.0–1.5 mm long, glandular, scattered along the rachis. *Sepals* reddish, lanceolate, 4.0–4.5 mm long, 1.0–1.2 mm wide, upper margins and apex irregularly serrate, abaxial surface and margins glandular. *Petals* pink or white on adaxial and abaxial surfaces, obovate, 5.5–6.0 mm long, 4.5–5.0 mm wide. *Stamens* 5, 2.5–3.0 mm long; filaments translucent, white; anthers white, triangular, 1.0–1.2 mm long; pollen pale lemon. *Ovary* green, subglobose, 0.8–1.0 mm diam. at anthesis; carpels 3, each carpel slightly bi-lobed, glabrous. *Styles* 3, translucent, white 5–7 mm long, each forked near the base to form a  $\pm$  V-shape configuration with each free, terete, style segment slightly longitudinally curved upwards. *Stigmas* translucent, white, formed within the upper apices of each of the 6 style segments, papillose, stigmas often curved backwards towards their point of attachment. *Seeds* slate grey,  $\pm$  obovoid, 0.50–0.55 mm long, 0.32–0.37 mm wide, funicle positioned slightly prominent of the basal pole, 0.040–0.045 mm long, 0.10–0.15 mm diam., apical pole rounded with a little bump 0.050–0.055 mm long, 0.10–0.15 mm diam., surface sculpting with wide, wavy, irregular, prominent longitudinal ridges, summits of ridges flat, deep transverse ridges set at  $\pm 90^\circ$ , rounded, regularly ribbed, positioned close together, shallow, under high SEM magnification the regularly ribbed transverse ridges and furrows between are covered with gritty, sand-like grains. (Figure 6)

*Distribution.* As recognised here, this species is widespread across northern Australia, extending to South East Asia, including China, Vietnam and the Philippines.

*Selected Australian specimens examined.* WESTERN AUSTRALIA: Yampi Peninsula, 4 Aug. 2000, *A. Lowrie* 2508 (PERTH). NORTHERN TERRITORY: Darwin, July 1955, *R. Erickson s.n.* (PERTH); Cox River Station, 14 July 1977, *T.S. Henshall* 1366 (DNA, MEL, NT *n.v.*, PERTH). QUEENSLAND: Sanamere Lagoon, 2 Aug. 2008, *A. Lowrie* 3838 (PERTH).

*Selected extra-Australian specimens examined.* CAMBODIA: ‘Cambodige’, 27 Oct. 1927, *M.E. Poilane* 14459 (P). CHINA: Hainan, Nov. 1889, *A. Henry* 8122 (P). PHILIPPINES: Alaminos, Pangasinan, Luzon, Sept. 1920, *E. Fenix s.n.* (P). VIETNAM: Nha-trang, 4–5 Feb. 1914, *A. Chevalier* 30.427 (P).

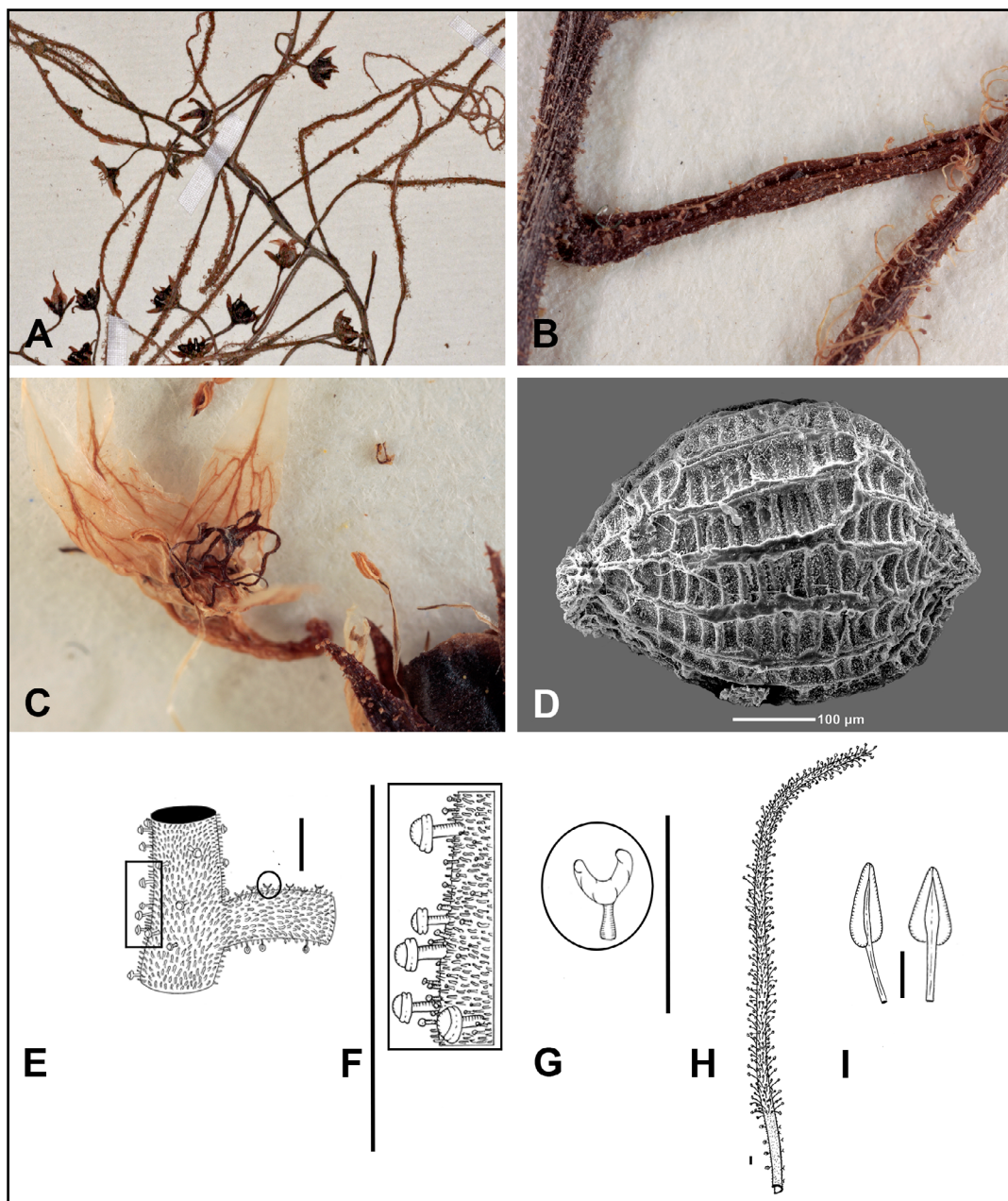


Figure 6. *Drosera serpens*. A – base of leaf lamina; B – glandular hairs on leaf lamina; C – anthers and dried flower; D – seed; E – stem and leaf base; F – dome-capped hairs on stem; G – Y-shaped hairs on base of leaf lamina; H – leaf lamina; I – elongated stamens. Scale bar = 100 µm. Images from lectotype, *Banks & Solander s.n.* (BM 000810138) (A–C), Sanamere Lagoon, North Queensland, *A. Lowrie* 3838 (PERTH) (D–I). Images by R.L. Barrett, illustrations E–I by A. Lowrie.

*Typification.* Application of the name *D. serpens* has been complicated by the availability of three syntypes cited in the original publication. Six sheets have been located at BM, K and MEL. This material is not uniform and at least two taxa are represented. Not all of the sheets are in good condition with both flowers and seeds, so the Banks and Solander collection is designated here as the lectotype

as it is the best material and can be clearly matched to modern collections from the original collection location. The original description does not detail the differences we recognise between the available syntypes, so it does not influence the choice of lectotype.

The lectotype of *D. serpens* has the following five character states: 1 – the stalked glandular hairs at the base of the lamina do not reach the stem, presenting a distinct gap (Figure 6A); 2 – there are scattered Y-shaped hairs with curved arms in the otherwise bare area at the base of the lamina (Figure 6B); 3 – anthers are classed as normal, but elongated (Figure 6C); 4 – seeds have a distinctly ribbed-reticulate surface (Figure 6D); 5 – seeds are relatively small (*c.* 0.5 mm long) (Figure 6D).

*Notes.* While the name *D. serpens* has never been taken up due to uncertainties over its application, Planchon (1848) recognised this species as closely related to *D. indica*, but considered it to differ by being a more robust plant with longer leaves. He noted the distinct ‘petiole’ (bare area at base of lamina), a characteristic also found in *D. indica*, but not in *D. finlaysoniana*.

***Drosera hartmeyerorum*** Schlauer, *Carniv. Pl. Newslett.* 30: 104 (2001). *Type:* Cultivated in Germany from seed [seed collected from the Ord River region near Kununurra, Western Australia], 30 Apr. 2001, *S. Hartmeyer & I. Hartmeyer s.n. (holo: herb. Jan Schlauer, n.v.; iso: K 000659174!)*.

A fibrous-rooted annual *herb* with alternate leaves radiating outwards from its major axis in a very loose open rosette (in plan view). *Leaves* erect and circinate in the early stages of growth, unfurling to a semi-erect position then slowly becoming horizontal as they age, resting in a hanging position on the basal portion of the erect or scrambling stem when spent. Major axis uniformly red, 10–15 cm tall, 0.8–1.0 mm diam.; densely covered with tiny, translucent, white, glandular trichomes. *Petiole* ± absent, lamina green to reddish, attached directly to the major axis at its base, 1.7–2.2 mm wide, longitudinal margins curved downwards; covered with long uniformly red stalked mucilage glands and sessile digestive glands, positioned ± in the leaf axil against the major axis, abaxial surface very sparsely glandular; small, compact groups of large, eglandular appendages, 0.5–0.6 mm long, having translucent, red stems and shiny, yellow, blackberry-like heads, 0.30–0.35 mm diam., positioned on the adaxial surface of the lamina in clusters of 4–10, ± *c.* 5 mm distance from the major axis. *Lamina* linear tapering towards their apices, longitudinal margins curved downwards, the adaxial surface convex and the abaxial surface concave in longitudinal section, 4–6 cm long, 1.7–2.2 mm at their widest, adaxial surface including the rolled margins covered with long, uniformly red, stalked mucilage glands and sessile digestive glands, abaxial surface sparsely covered with short glands. *Inflorescence* a one-sided helicoid cyme, curving outwards a little from the major axis before ascending, 10–20 cm long including the peduncle, many-flowered provided good growing conditions prevail; peduncle sparsely covered with tiny, translucent, white glands, sometimes almost glabrous; pedicels reflexed at base, erect at the apex in fruit, 10–15 mm long, moderately densely covered with similar glands; bracts narrowly ovate, 1.8–2.0 mm long, margins glandular, adaxial surface glabrous, scattered along the rachis, some bracts often bearing a few multi-vesicular, capitate (blackberry-like) eglandular appendages at their base. *Sepals* reddish, lanceolate, 3.5–4.0 mm long, 1.0–1.2 mm wide, upper margins and apex irregularly serrate, abaxial surface and margins glandular. *Petals* pink on adaxial and abaxial surfaces, obovate, apex irregularly crenate, 4.5–5.5 mm long, 3.5–4.0 mm wide. *Stamens* 5, 2.8–3.0 mm long; filaments dark pink, capped with a distinctive reflective, opalescent pearl-coloured, rounded, apical dome; anthers yellow, positioned just below and to either side of the apical dome, 0.9–1.0 mm long; pollen yellow. *Ovary* green, ellipsoidal, 1.0–1.5 mm diam. at anthesis; carpels 3, each carpel slightly bi-lobed, glabrous. *Styles* 3, translucent, white 3–4 mm long, each forked near the base, branches erect, free, terete, style segment slightly raised upwards. *Stigmas* translucent, white, formed within the upper apices of each of the 6 style segments, papillose, stigmas often curved backwards towards their



point of attachment. *Seeds* charcoal black,  $\pm$  ovoid, 0.34–0.35 mm long, 0.20–0.24 mm wide, funicle prominent of the basal pole, 0.04–0.45 mm long, 0.050–0.055 mm wide, apical pole rounded, surface sculpting reticulate, with deep, prominent, slightly undulate, longitudinal ridges, summits of ridges rounded, transverse ridges similar, forming irregular pentagonal cells, under high SEM magnification the cell walls and floors are moderately covered with granular projections. (Figure 7)

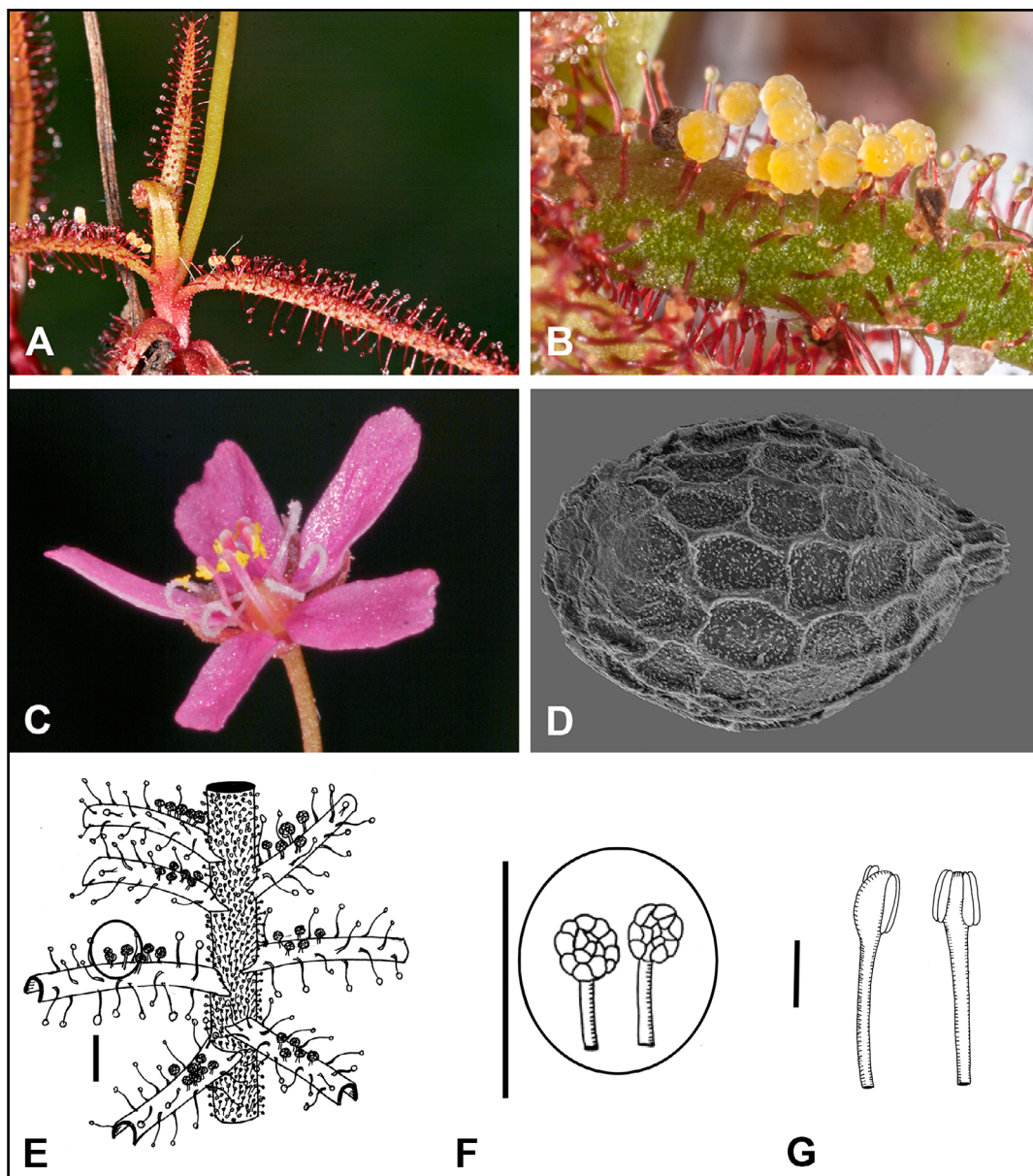


Figure 7. *Drosera hartmeyerorum*. A – base of leaf lamina; B – mixed glandular hairs and multi-vesicular, capitate (blackberry-like) hairs at base of leaf lamina; C – anthers and fresh flower; D – seed; E – stem and leaf bases; F – stalked, multi-vesicular capitate (blackberry-like) hairs; G – stamens. Scale bar = 100  $\mu$ m. Images from near type location, R.L. Barrett & M.D. Barrett RLB 3318 (A–C), Taylors Lagoon, Western Australia, A. Lowrie 2212 (PERTH) (D–G). Images by R.L. Barrett, illustrations E–G by A. Lowrie.

*Distribution.* *Drosera hartmeyerorum* is currently only known from the Kimberley region where it is widespread, but it may also occur in the Northern Territory, having been observed within five kilometres of the State border.

*Selected specimens examined.* WESTERNAUSTRALIA: Pack Saddle Plain, 23.1 km from Kununurra, 24 Apr. 1983, R.M. Barker 269 (AD, PERTH); Mount Brophy Springs, Gardner Range, 190 km SE of Halls Creek, 7 July 1995, K. Coate 370 A (PERTH); Revolver Creek, upper slopes of southern Carr Boyd Ranges, 12 Mar. 1978, T.G. Hartley 14506 (CANB, PERTH); Lake Champion, 60 km E of Broome on Great Northern Highway, 29 June 1993, K.F. Kenneally 11384 (CANB, MEL, PERTH); Parry Lagoon, W of Kununurra, 25 Apr. 1995, A. Lowrie 1103 (PERTH); Taylors Lagoon, 7 May 1999, A. Lowrie 2212 (PERTH).

*Typification.* The type specimen of *D. harmeyerorum* has the following five character states: 1 – the stalked glandular hairs at the base of the lamina come close to, but do not reach the stem, presenting a short but distinct gap (Figure 7A); 2 – there are scattered stalked, multi-vesicular, capitate hairs (blackberry-like) in the otherwise bare area at the base of the lamina (Figure 7B); 3 – anthers are classed as normal, not hooded or dilated (Figure 7C); 4 – seeds have a distinctly shallow-reticulate surface pattern (Figure 7D); 5 – seeds are very small (c. 0.3 mm long) (Figure 7D).

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Directors and staff at B, BM, BRI, CANB, FI, K, L, LD, MEL, NSW, P and PERTH are thanked for access to collections and facilities. Permission to photograph type specimens at BM, G, and MEL is gratefully acknowledged. Matt Barrett is thanked for assistance with fieldwork and for comments on the manuscript. Nicholas Lander and John Conran are thanked for comments that improved the manuscript.

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