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A taxonomic revision of *Drosera* section *Stolonifera* (Droseraceae), from south-west Western Australia

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Abstract

Lowrie, A. A taxonomic revision of *Drosera* section *Stolonifera* (Droseraceae), from south-west Western Australia. *Nuytsia* 15(3): 355–393 (2005). Ten species are recognized in the *Drosera* section *Stolonifera*: *D. fimbriata* DeBuhr, *D. humilis* Planchon, *D. platypoda* Turcz., *D. porrecta* Lehm., *D. purpurascens* Schlott., *D. ramellosa* Lehm., and *D. stolonifera* Endl., including three new combinations: *D. monticola* (Lowrie & Marchant) Lowrie, *D. prostrata* (Marchant & Lowrie) Lowrie and *D. rupicola* (Marchant) Lowrie. All are endemic to the south-west of Western Australia and belong in *Drosera* L. subgen. *Ergaleium* DC. sect. *Stolonifera* DeBuhr. Each taxon is described in detail as well as illustrated. A key is provided to all taxa in sect. *Stolonifera.* A schematic illustration of all ten species life-form is provided for comparison and cross referencing with each other. SEM micrographs of the seeds of each species, field and cultivation studies and historical investigations are also presented.

Introduction

The first three members of *Drosera* sect. *Stolonifera* to have been described were those that were most readily accessible to the early collectors in the Swan River Colony, as all were found in the vicinity of Perth. Endlicher (1837) described *Drosera stolonifera*, based on an early collection from the Swan River and this was followed by Lehmann's (1844) descriptions of *Drosera ramellosa* from Rottnest Island and *D. porrecta* from Mount Eliza in the present day Kings Park overlooking the City of Perth where this species can still be found.

Planchon (1848) assigned these three species to sect. *Ergaleium* Planchon and his series *Erythrorhizae* subseries *Stoloniferae* [as *Stolmiferae*] and added the new species *D. humilis*. He also named *D. penduliflora* but this was later reduced (Bentham 1864) to synonymy under *D. ramellosa*. Two further species, *Drosera platypoda* and *D. purpurascens*, were added by Turzaninow (1854) and Schlotthauber (1856).

Bentham (1864) in his "Flora Australiensis" recognised fewer taxa and also suggested that *D. humilis* might prove to be a variety of *D. stolonifera*. He did not agree with Planchon's infrageneric classification, adopting a much simpler division of the entire genus into two sections, placing all tuberous species in sect. *Ergaleium* Planchon and non-tuberous ones in sect. *Rorella* DC.

Diels (1906) reduced *D. humilis* to a variety of *D. stolonifera* as suggested by Bentham but preferred a more complex classification of the genus *Drosera*. He included *D. stolonifera* and its relatives in sect.

Erythrorhiza (Planchon) Diels of subg. *Ergaleium* DC. Another section of this subgenus recognised by Diels was his new sect. *Polypeltes* Diels, which was characterised by the leaves being cauline and peltate.

No further members of the species group were described until DeBuhr (1975) named *Drosera fimbriata*, a species resembling *D. stolonifera* in its whorled leaves as well as sepal and inflorescence characters but differing in its leaves being peltate. It was questionable whether *D. fimbriata* should be positioned in Diel's sect. *Polypeltes* because it had cauline, peltate leaves or in sect. *Erythrorhiza* because it had whorled leaves.

This problem prompted Debuhr's (1977) re-evaluation of the sectional classification of *Drosera* subgen. *Ergaleium* based on anatomical studies of 28 tuberous species. He established that subgen. *Ergaleium* could be divided into three natural groups of species with the introduction of a third section, sect. *Stolonifera* based on Planchon's subser. *Stoloniferae*. Into his new section he placed *D. fimbriata, D. platypoda, D. ramellosa* and *D. stolonifera.* He retained sect. *Polypeltes* now known by the earlier name sect. *Ergaleium* for those species having an erect or climbing habit and alternate, peltate, cauline leaves; and sect. *Erythrorhiza* for the rosetted species.

In their treatment of *Drosera* sect. *Stolonifera* for "Flora of Australia", Marchant & George (1982) recognized four species, *Drosera fimbriata, D. platypoda, D. ramellosa* and *D. stolonifera*, the last of which was divided into four subspecies. Three additional subspecies of *Drosera stolonifera* were recognised in later publications (Marchant & Lowrie 1987, Lowrie & Marchant 1992), including two newly discovered taxa. This brought the total number of taxa recognised in the section to ten.

Materials and methods

Extensive field studies of the ten taxa in sect. *Stolonifera* were undertaken in the south-west of Western Australia from 1980 to 2001. Specimens were examined in the field at the time of their first emergence from their summer dormancy right through to the stage when the seeds were ripe.

Specimens of all ten species were brought from the field into cultivation where they were grown in similar soils of 50/50 peat and silica sand soils in 15 cm diam plastic flower pots. Plants were watered from below via a 5 mm depth of water where the pots were stood in trays, 30% shade cloth was used to cut down sunlight and shade cloth windbreaks were provided to protect the plants from dry easterly winds.

When the specimens had finished their above ground growth cycles, water was reduced slowly over a two month period to provide a little soil moisture while the stolon slowly receded from the soil surface. As the stolon (being that portion between the plant at the soil surface and the old tuber below) in mature plants recedes it gradually transfers all of its bulk and energy into a new tuber which is either developed along side of the old spent tuber or renewed within the skin of an existing but emaciated tuber. The skin of the tubers that follow this later arrangement eventually turn into a paper-like consistency which tightly shrouds the tuber. A new and persistent papery sheath is added around the tuber annually as a result of this tuber renewal process. As one papery sheath is added annually, an approximate age of a mature plant (excluding its juvenile stages leading up to maturity) can be established by peeling and counting each papery sheath shrouding its tuber, one papery sheath representing one year of life.

Specimens were grown side by side under similar growing conditions. All ten taxa in cultivation produced healthy robust plants because of the constant moisture availability, protection from pests and the effects of the sometimes devastating elements of the weather such as irregular seasonal rains in drought affected seasons, prolonged frosts or pounding rain combined with hail. These cultivation studies showed, even though they were healthy non stressed plants, they still maintained their respective life-forms and growth cycles to that which normally occurred in the field.

Seed micromorphology was studied using scanning electron microscopy (SEM). Seeds were cleaned of dust with a fine brush, mounted on stubs with double-sided adhesive tape, coated with gold-carbon in a vacuum evaporator and examined under a Phillips XL-20 SEM at 10 kV. The SEM work was carried out under the direction of my colleague Dr John Conran of the Department of Environmental Biology at The University of Adelaide. All seeds for the SEM work were harvested by the author from specimens that best matched the type material for each of the ten taxa.

Type material was examined for all ten taxa. The illustrations were drawn by the author from live material. Morphological descriptions were based on these fresh dissections as well as dried and spirit materials.

Results

Life form

Controlled cultivation experiments established that there was no noticeable difference for each species in its overall life-form to that found in the field. This showed each species life-form was genetic and not influenced by different habitat or moisture availability conditions. Schematic life-form illustrations for the ten taxa are presented for direct comparison (Figure 14).

Drosera monticola, D. porrecta and *D. purpurascens* display quite different life-forms between their flowering and non-flowering modes, so both are illustrated to show these differences. One taxon, *D. porrecta* has its basal rosette(s) borne above the soil surface whether flowering or not, whereas all other taxa have basal rosettes situated on the soil surface. A lack of knowledge of this all-important character has led to erroneous interpretations by some previous authors. For example, both Diels (1906) and Planchon (1848) believed *D. stolonifera* and *D. porrecta* to be conspecific simply because of the way the leafy growth branched above the basal rosettes in both taxa. Without the benefit of field observations, they could not have known that the basal rosette of *D. porrecta* bearing its branching state is always situated above the soil surface, nor that this branching arrangement is only found in flowering specimens. *D. porrecta* often has more than one basal rosette, whereas *D. stolonifera* always has a solitary basal rosette situated on the soil surface whether it is flowering or not.

Drosera humilis, D. purpurascens and *D. stolonifera* have a horizontal stolon (in addition to a vertical stolon which is situated between the tuber and where it first emerges from the soil) which rests on the soil surface. Often this stolon is lightly covered with a thin layer of wind-blown sand and/or leaf litter humus. In *D. humilis* these horizontal stolons are commonly on average 6 cm long.

Seed morphology

The SEM micrographs of seeds for all taxa in *Drosera* sect. *stolonifera* are presented in Figures 11, 12 and 13. These SEM micrographs clearly illustrate that each of the 10 taxa in section *Stolonifera* differ from each other in seed size, with measurements ranging between 0.3–1.5 mm long, 0.2–1.5 mm wide or diam.; seed shape, being broadly obovoid, cupiform, ellipsoid, globose, subglobose, spherical, turbinate or variably shaped with rounded and angled sides; apical pole, indented or truncate with or without a central umbo surrounded by a flattened apron; basal pole funicle barely projected or prominently projected beyond the overall seed shape; surface sculpturing, testa cell patterns ranging from reticulate, foveate, hexagonal, tetragonal, ruminate and scaly; and cell ridges shallow and smooth, shallow and irregular, irregular undulate or irregular and longitudinally dentate.

Conclusions

These studies have shown that each of the ten taxa in sect. *Stolonifera* are very different from each other. Seed characters alone are sufficient to distinguish all of the taxa. The combination of life-form (see fig. 14: A–M, schematic life-form illustration) and other morphological characters such as: tuber colour; basal rosettes present or not; variable leaf shapes; leafy stems either simple or branched; cauline leaves solitary or in whorled groups; inflorescences basal, terminal or arising from the axils of the upper leaves, also gives a complete separation between all taxa. Life-form is constant in the field over the total range for each species and is maintained even under cultivation in foreign soils in an artificially controlled environment.

Three species pairs, *Drosera humilis and D. prostrata, D. porrecta* and *D. stolonifera,* as well as *D. porrecta* and *D. purpurascens* were found to coexist with each other in the field. No hybrids or intermediates between these species were found suggesting that there are effective breeding barriers between them.

The combined results from all these lines of enquiry provide strong evidence for each of the ten taxa in sect. *Stolonifera* to be treated as legitimate species.

Taxonomy

Drosera section **Stolonifera** DeBuhr, *Austral. J. Bot.* 15: 215 (1977). – *Drosera* subser. *Stoloniferae* Planchon [as *Stolmiferae*], *Ann. Sci. Nat.* (Paris) ser. 3,9: 95 (1848). *Type: Drosera stolonifera* Endl.

Perennial *herbs*, with a red or orange tuber covered in brown papery sheaths which are sometimes additionally densely covered with persistent root fibres, with a rosette of leaves (sometimes lacking in *D. prostrata*) on or a short distance above the soil surface and 1 or more leafy stems arising from the basal rosette. *Leaves* reniform, spathulate, obovate with the leaf lamina along with its petiole longitudinally semi-folded to appear pseudo-peltate, or if peltate (i.e. *Drosera fimbriata*) at first in whorls then solitary and alternate towards the apex, with insectivorous glands (also some non-insectivorous leaves present in *Drosera fimbriata*). *Leafy stems* simple or branched**,** erect when solitary, spreading semi-erect or prostrate when two or more; upper cauline leaves borne singly or whorled in groups of 3 to 4. *Inflorescences* terminal and sometimes also from the axils of the upper cauline leaves well below

the apex. *Seeds* very variable, spherical, subglobose, obovoid, ellipsoid, turbinate, cupiform or with rounded and angled sides within a cylindrical or rectangular figure.

Key to *Drosera* section *Stolonifera*

1. Plants with non-insectivorous whorled fimbriate leaves on the basal portions of the stem; upper cauline leaves peltate (Scott River to Manypeaks area) ..... **D. fimbriata**
1. Plants with all leaves insectivorous; upper cauline leaves not peltate **2**
2. All leaves solitary, alternate along the erect stems **3**
2. Leaves commonly whorled along the erect and/or lateral stems **4**
3. Inflorescence arising from the centre of the basal leafy rosette, infructescence pendulous (Kalbarri to Cranbrook to Mt Ragged area) ..... **D. ramellosa**
3. Inflorescence terminal, infructescence erect (Manjimup to Scott River to Albany area) ..... **D. platypoda**
4. Leafy stems appressed to the soil surface… (Tamala area to Binnu) ..... **D. prostrata**
4. Leafy stems semi-erect and/or erect, held above soil surface **5**
5. Cauline leaf lamina transversely elliptic to depressed ovate, slightly longitudinally folded; lamina sides mobile, folding together onto captured insects during the digestion process (Pithara to Hyden area) ..... **D. rupicola**
5. Cauline leaf lamina flabellate, circular or reniform; lamina sides non-mobile, remaining apart **6**
6. Cauline leaf lamina flabellate. Flowers pink. Plants asexually forming colonies, restricted to the cloud lines of mountain summits (Stirling Range) ..... **D. monticola**
6. Cauline leaf lamina circular and/or reniform with a distinctive upper wedge-shaped gap, or fully reniform. Flowers white. Solitary plants of the lowlands and hills **7**
7. Cauline leaf lamina reniform and/or circular with a distinctive upper wedge-shaped gap **8**
7. Cauline leaf lamina fully reniform **9**
8. Plant without a prostrate stolon, foliage robust; lowermost basal rosette of leaves above the soil surface. Cauline leaf petiole longitudinally channeled on upper edge. Leafy stems arising from the uppermost of 1–3 basal rosettes, laterally branching only when flowering. (Eneabba and Marchagee to Pinjarra) ..... **D. porrecta**
8. Plant with prostrate stolon above the soil surface, foliage fine; lowermost basal rosette of leaves appressed to the soil surface. Cauline leaf petiole terete. Leafy stems arising from the basal rosette, laterally branching whether flowering or not. (Kalbarri to Moore River to Wongan Hills) ..... **D. humilis**
9. Plants 3–10 cm tall, cauline leaf petioles 8–30 mm long, non-flowering specimens often with only 1 erect leafy stem, bearing additional solitary cauline leaves with long petioles at the base. (Katanning to Ongerup to Albany area) ..... **D. purpurascens**
9. Plants 15–25 cm tall, cauline leaf petioles 5–10 mm long, non-flowering specimens with 3 or more semi-erect leafy stems, without additional solitary cauline leaves at the base (Perth to Pinjarra) ..... **D. stolonifera**

Drosera fimbriata DeBuhr, *Aliso* 8: 267 (1975). *Type:* 18 miles [28.8 km] north-east of Manypeaks along road to Jerramungup, Western Australia, 14 October 1974, *DeBuhr* 4098 (*holo:* RSA; *iso:* CANB, K, PERTH 1053191, US).

Illustration. J. Deliana, *Aliso* 8: 265, fig. 1, D–G, (1975).

Photographs. L. Debuhr, *Aliso* 8: 270, fig. 4, A& C, (1975); S. Carlquist, *Aliso* 8: 268, fig. 3, A–D, 270, fig. 4, B& D, (1975); A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 115 A–D (1987).

A tuberous-rooted *perennial herb;* leafy stem solitary, erect, glabrous, 10–15 cm tall, lower portion of stem with 2 or 3 whorls of non-insectivorous leaves, followed by 2–5 whorls of insectivorous leaves and a few alternate solitary leaves near the apex. *Tuber* orange, ellipsoid, *c.* 10 mm long, *c.* 7 mm diam., enclosed in brown papery sheaths and again enclosed in a mass of old coarse root fibre; vertical stolon (below ground) *c.* 10 cm long. *Non-insectivorous leaves* linear, 4–6 mm long, 0.4–0.7 mm wide, margins fimbriate, fringes up to 3 mm long; *Insectivorous leaves* in 3–5-leaved whorls at base, then sometimes opposite but always solitary and alternate near apex; petiole terete, 5–18 mm long, peltate, glabrous; lamina suborbicular in outline but truncate-emarginate a little at the top and therefore forming an overall broadly reniform shape, 2.5–4 mm diam., adaxial surface with insect-trapping glands around the margins and smaller glands within, abaxial surface glabrous. *Inflorescence* either a simple raceme or a corymb, terminal, 4–18-flowered, 3.5–6.5 cm long (including scape), glabrous; pedicels 3–5 mm long, glabrous. *Sepals* green, ovate, acute, 3.5–5.5 mm long, 2–2.5 mm wide, margins often irregularly dentate in upper half, black dotted, glabrous. *Petals* white, cuneate, apex crenate, 8–10 mm long, 5–8 mm wide. *Stamens* 5, 1.5–2.5 mm long; filaments white; anthers white with reddish dots, pollen pale yellow. *Ovary* green, subglobose, *c.* 0.8 mm long, *c.* 1 mm diam. at anthesis; carpels 3, bilobed. *Styles* 3, white, reddish at base, *c.* 1 mm long, each divided into many segments, some arranged in a whorl, fused at the base and curved upwards to the apex, a small number erect in the centre, each free style segment terete and tapering towards apex; stigmas forming a slender projection at the apex of each style segment. Fruit ellipsoid, 2–3 mm long, 2.5–3 mm diam., containing *c.* 20 seeds. *Seeds* black, spherical to subglobose, testa cell pattern irregularly honeycombed, reticulate, cell shape longitudinally hexagonal, ridges and cell floors irregularly undulate, 0.4–0.5 mm diam. (Figures 1: (species illustration); 11: A–B (seed micrographs); 14: A (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: William Bay National Park, SW of Denmark, 27 Sep. 1990, *B.G. Hammersley* 383 (PERTH); on Hassell Highway, 29 km NE of Manypeaks, 19 Oct. 1992, *A. Lowrie* 692 (MEL, PERTH); Scott River Rd, E of Augusta, 7 Dec. 1993, *A. Lowrie s.n.* (PERTH); 9.9 km NE of Manypeaks on Highway 1, 7 Oct. 1996, *A. Lowrie* 1580 (MEL, PERTH); 25.1 km NE of Manypeaks on Highway 1, 7 Oct. 1996 *A. Lowrie* 1583 (MEL, PERTH); 2 km NE of Manypeaks on Highway 1, 10 Oct. 2000 *A. Lowrie* 2577B (MEL, PERTH); 27 km NE of Manypeaks on Highway 1, 10 Oct. 2000 *A. Lowrie* 2578B (MEL, PERTH); 15 km W of Ledge Point, 2 Oct. 1974, *K.R. Newbey* 4452 (PERTH).

Distribution. Known from a few collections from the Scott River area east to the Denmark area, but mostly collected in the Manypeaks area.

Habitat. Drosera fimbriata grows in winter-wet, well drained, white or grey sandy soils, amongst low shrubs on heathland east of Manypeaks and Scott River regions. In the Denmark area it grows in moss pads with *Borya* species.

Flowering period. October.

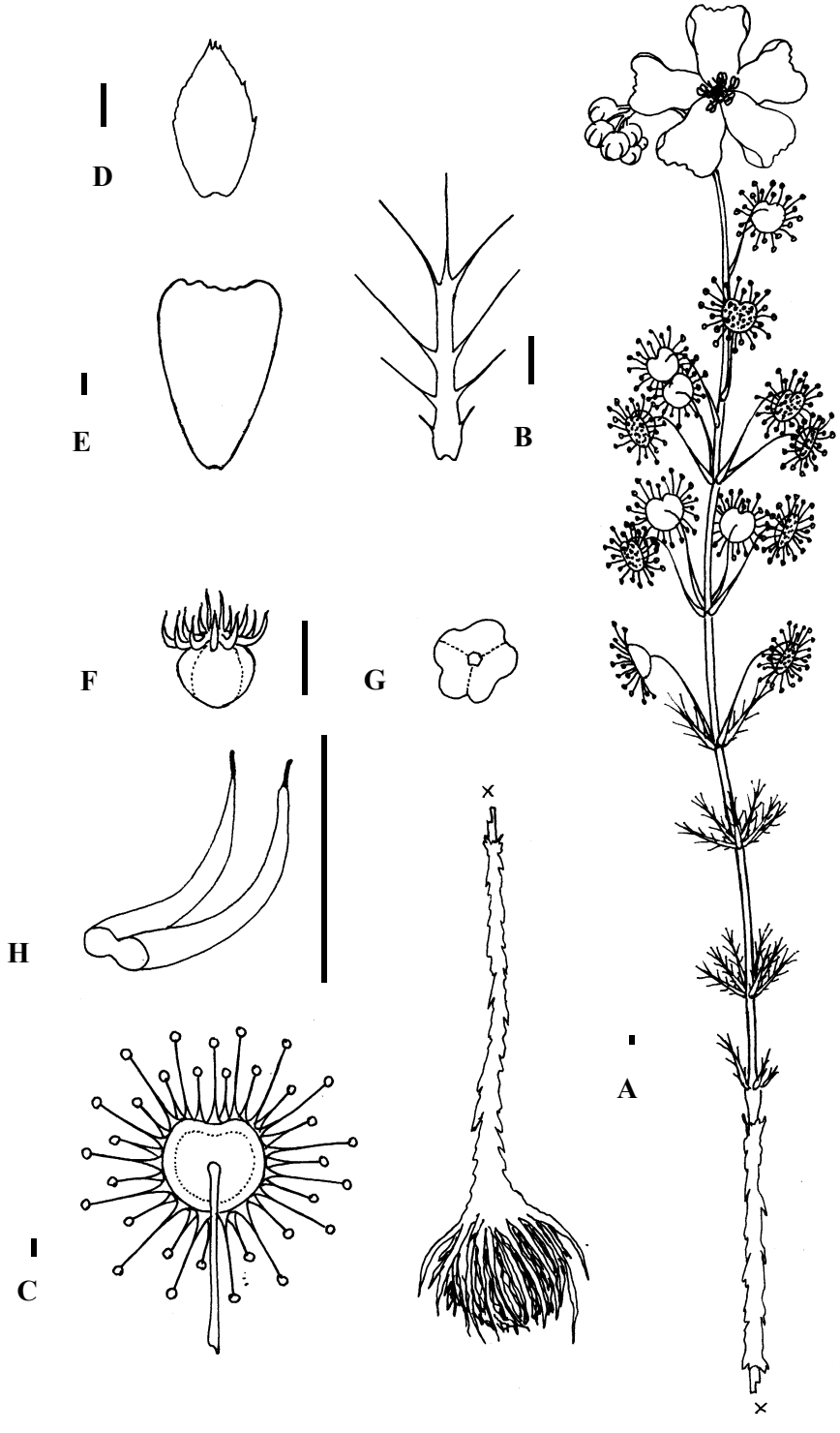

Figure 1. *Drosera fimbriata.* A.–plant; B.–basal non-insectivous fimbriate leaves; C.–cauline leaf lamina; D.–sepal; E.–petal; F.–ovary-styles; G.–ovary, basal view; H.–style-stigmas, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from north east of Manypeaks, Western Australia, voucher *A. Lowrie* 692.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although it has not been thoroughly and systematically surveyed in the Manypeaks region, the species is abundant there and currently not under threat. It is also currently secure in the William Bay National Park south-west of Denmark.

Unfortunately the *Drosera fimbriata* populations in the Scott River region are not safe. The few known locations for the species in this region are situated near an active mining lease. The species could be threatened with extinction there if sand mining, dredging, temporary or permanent storage of overburden spoil or roads to service the sand mining operation were expanded or developed before a management plan for the species was in place. One population of *D. fimbriata (A. Lowrie s.n.,* 7 Dec. 1993) has already been destroyed by the construction of a sealed service road to the current sand mine dredging operations in the area.

Etymology. From the Latin *fimbriatus* – fringed, in reference to the fimbriate nature of the modified leaves on the lower portion of the stem.

Affinities. Drosera fimbriata is unusual in that its cauline leaves are fully peltate, a condition not met with in other members of section *Stolonifera.* The non-carnivorous fimbriate basal leaves are not only unique to section *Stolonifera* but also to all other tuberous sundews. Even though *D. fimbriata* is somewhat atypical of section *Stolonifera* is it is best placed for now in this section.

Its tubers are covered in brown papery sheaths, which in turn are densely covered with spent root fibre similar to that found in *D. platypoda*. The inflorescence arrangement and flowers are more or less similar to that found in *D. platypoda, D. porrecta* and *D. stolonifera*.

Notes. The whorled linear fimbriate leaves are at first erect, shrouding and providing a spikey protective barrier for the juvenile major axis growth bud as it emerges from the soil and for a short period thereafter. These leaves are later arranged semi-erect so that all of the fringes of the leaves slightly overlap each other, resembling a web around the basal stem. This leaf arrangement appears to be simply a barrier against crawling insects that might feed on the upper leaves or the inflorescence.

Drosera humilis Planchon, *Ann. Sci. Nat.* (Paris) ser. 3, 9: 300 (1848). – *Drosera stolonifera* var. *humilis* (Planchon) Diels, *Pflanzenr.* 26: 126 (1906). – *Drosera stolonifera* subsp. *humilis* (Planchon) N. Marchant, *Fl. Australia* 8: 384 (1982). *Type:* "cum praecedente; Drummond in herb. Hook. [south-west Western Australia, *J. Drummond s.n.*]" (*iso:* K).

Illustration. R. Erickson, *Plants of Prey in Australia*, plate 4: upper right (1968).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 135 A–C (1987).

A tuberous-rooted *perennial herb*, with 3–5 semi-erect lateral stems 3–15 cm long arising from the centre of a small basal rosette of leaves; foliage fine, reddish or golden green, leaves of the lateral stems in whorls of 3 or 5. *Tuber* orange, globose, *c.* 10 mm diam., enclosed in a number of brown papery sheaths; stolon vertical (below ground), *c.* 20 cm long, stolon prostrate (on soil surface) 4–8 cm long. *Basal leaves* petiole flat, 2.5–3.5 mm long, 0.5–0.7 mm wide; lamina obovate and flabellate, 1.5–2 mm long, 2–3 mm wide, adaxial surface with insect trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole terete, tapering, 5–15 mm long; lamina circular to reniform always with an upper wedge-shaped gap, 1.5–2 mm long, 2–3 mm wide, with insect-trapping retentive glands around the

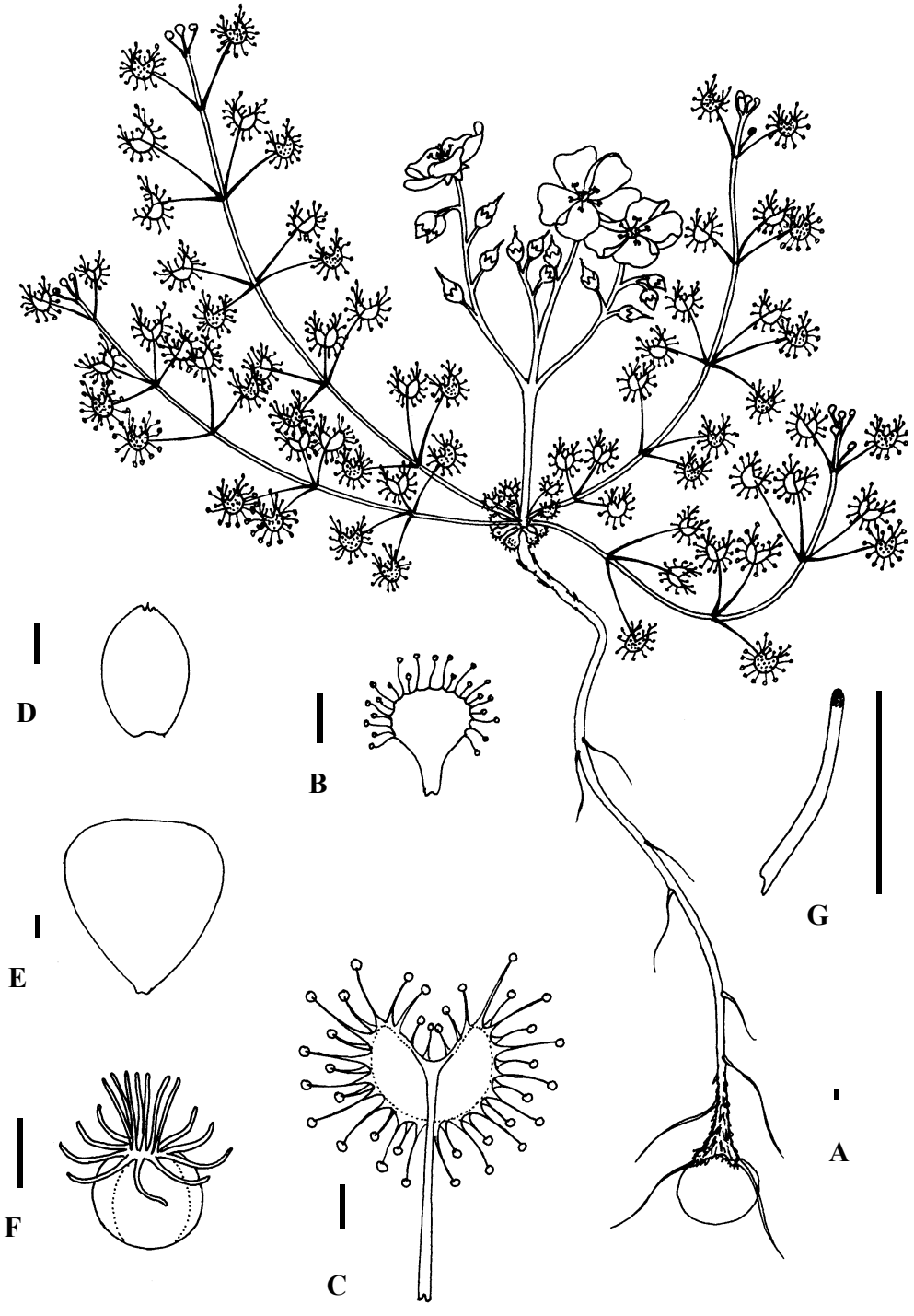

Figure 2. *Drosera humilis*. A.–plant; B.–basal leaf lamina; C.–cauline leaf lamina; D.–sepal; E.–petal; F.–ovary-styles; G.–style-stigma, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from Kalbarri, Western Australia, voucher *A. Lowrie s.n.*, 6 July 1991.

margins and smaller glands within. *Inflorescence* of a number of simple racemes or 2–4-branched corymbs, the major one arising from the basal rosette of leaves and smaller ones sometimes arising terminally from the semi-erect lateral leafy stems; racemes or corymbs 2–10 cm long (including scape), 5–45-flowered, scape and pedicels yellowish green with scattered minute glands; pedicels 3–7 mm long. *Sepals* green, ovate or elliptic, acute, 2.5–4.5 mm long, 1.7–3 mm wide, margins entire, apex sometimes slightly dentate, adaxial surface with a few scattered minute sessile glands, otherwise glabrous. *Petals* white, obovate, apex truncate, 5–7.5 mm long, 4–5 mm wide. *Stamens* 5, 2.5–3 mm long; filaments white; anthers and pollen yellow. *Ovary* green, subglobose, *c.* 1 mm long, *c.* 1.5 mm diam., at anthesis. *Styles* 3, white, *c.* 1 mm long, each divided into many terete segments, some arranged in a whorl and curved out and upwards from their base, a number erect in the centre of the whorl; stigmas simply formed at the apex of each style segment. *Fruit* obovoid, *c.* 5 mm long, *c.* 4.5 mm diam., containing *c.* 16 seeds. *Seeds* brown, variably shaped with ± rounded and angled sides, testa cell pattern scaly, scales ± scallop seashell-like, imbricate, 1–1.5 mm long, 0.8–1.5 mm diam. (Figures 2: (species illustration); 11: C–D (seed micrographs); 14: B (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: Drummond's Cove near Geraldton, 16 Aug. 1969, *A.C. Burns* 57 (PERTH); 13 miles [20.8 km] W of Mogumber, 31 Aug. 1966, *A.S. George* 7795 (PERTH); 161.25 miles [258 km] from Mount Magnet on Geraldton road, 17 Aug. 1963, *D.W. Goodall* 2004 (PERTH); 7 km S of Eneabba, 2 Aug. 1977, *E.A. Griffin* 937 (PERTH); on road to The Loop, Kalbarri, 6 July 1991, *A. Lowrie s.n.* (MEL, PERTH); E of Ross Graham turn off, Kalbarri, 4 Sep. 1992, *A. Lowrie* 644 (MEL, PERTH); 3.2 km N of Wongan Hills, 13 Sep. 1996, *A Lowrie* 1543 (MEL, PERTH); near Westrail Station, Arrowsmith, 20 Aug. 1997, *A. Lowrie* 1800 (MEL, PERTH); 13.3 km W of Binnu, 21 Aug. 1997, *A. Lowrie* 1810 (MEL, PERTH); 16.7 km W of Binnu, 21 Aug. 1997, *A. Lowrie* 1814 (MEL, PERTH); 17.3 km W of Binnu, 21 Aug. 1997, *A. Lowrie* 1816 (MEL, PERTH); 49 mile peg [78.4 km] on Geraldton–Mullewa road near Tenindewa, 28 Aug. 1964, *N. Marchant* 64183 (PERTH); Howatharra Hill Reserve, Moresby Range, 21 road miles [33.6 km] N of Geraldton, 8 Aug. 1974, *D. & N. McFarland* 1067 (PERTH).

Distribution. Drosera humilis is common species from the Moore River north to Kalbarri and inland to Ajana in the north and Wongan Hills in the south.

Habitat. Drosera humilis grows in well drained winter wet deep white or yellow sandy soils amongst low shrubs on heathland on the northern sand plains.

Flowering period. June to September.

Conservation status. Drosera humilis is a common species and is currently not under threat.

Etymology. The epithet, from the Latin *humilis* meaning low growing, refers to its small low growth habit.

Affinities. Drosera humilis differs from all species in the *D. stolonifera* complex by flowering well before the plant is fully developed, and by its fine foliage; cauline leaves with terete petioles and circular to reniform lamina always with an upper wedge-shaped gap; and large, brown, rounded and angled seeds.

Notes. Drosera humilis (A. Lowrie 1816) coexists with *D. prostrata (A. Lowrie* 1815) in the Binnu region without apparently hybridizing. *D. humilis* has also been recorded (without vouchers) growing side by side with *D. prostrata* (*G.J. Keighery & N. Gibson* 1453 and 1535), near Zuytdorp National Park, in two permanent 20 m x 20 m quadrants without apparently hybridizing. These discoveries provide further evidence that these two taxa are genetically isolated from each other and both taxa should be treated as distinct entities (Neil Gibson pers. comm.).

Drosera monticola (Lowrie & Marchant) Lowrie, *comb. nov.*

Drosera stolonifera subsp. *monticola* Lowrie & Marchant, *Nuytsia* 8(3): 323–332 (1992). *Type:* summit of Toolbrunup Peak, Stirling Range National Park, Western Australia, 14 November 1989, *P. Mann s.n.* (*holo:* PERTH 02642964).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 3, 251 A–F (1998).

A tuberous-rooted *perennial herb*; main stem usually not developed in non-flowering specimens, more or less erect, 2–7 cm tall; foliage reddish, basal leaves in a rosette, cauline leaves usually scattered, rarely sub-opposite or whorled. *Tuber* bright red, globose, *c.* 6 mm diam., enclosed in a number of black papery sheaths; stolon vertical (below ground), *c.* 3.5 cm long, branching laterally (below ground) and asexually producing additional tubers and producing compact plant colonies. *Basal leaves* petiole flat, tapering, 3–5 mm long, 0.5–1.5 to 1–2 mm wide; lamina broadly obovate, 3–6 mm long, 3–6.5 mm wide, adaxial surface with insect trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole dilated towards the lamina, 10–30 mm long, 0.4–0.9 to 0.7–1 mm wide, longitudinally channeled above; lamina flabellate, distinctly concaved, 3–5 mm long, 4–8 mm wide, with insect trapping retentive glands around the margins and smaller glands within. *Inflorescence* a simple raceme, terminal, 3–5 cm long (including scape), glabrous; pedicels 5–11 mm long, 1–5-flowered. *Sepals* greenish orange, ovate, acute, 4–5 mm long, 2–2.5 mm wide, lower margin entire, upper margin and apex irregularly dentate-crenate, glabrous. *Petals* pale pink with dark pink closely spaced flabellate veining, obovate, 8–9 mm long, 4–5 mm wide. *Stamens* 5, 2.5–3 mm long; filaments white tinged brown; anthers white, pollen yellow. *Ovary* green, ellipsoid, *c.* 1.3 mm long, *c.* 1.2 mm diam. at anthesis. *Styles* 3, white, *c.* 0.8 mm long, each divided into many terete segments, half of them forming an irregular horizontally spreading whorl, remainder erect; stigmas simply formed at the apex of each style segment. *Fruit* when mature unknown. *Seeds* (mature seed unknown, current data from immature seed only, see notes below) mature seed colour unknown, ± subglobose, testa cell pattern ruminate, *c.* 0.3 mm long, *c.* 0.2 mm diam. (Figures 3: (species illustration); 11: E–F (seed micrographs); 14: C & D (schematic life-form illustrations))

Other specimens examined. WESTERN AUSTRALIA: summit of Bluff Knoll, Stirling Range, 8 Nov. 1994, *S. Barrett s.n.* (PERTH); summit of Toolbrunup Peak, Stirling Range, 26 Nov. 1991, *A. Lowrie* 530 (MEL, PERTH); summit of Bluff Knoll, Stirling Range, 8 Oct. 1991, *P. Mann s.n.* (MEL, PERTH).

Distribution. Drosera monticola is common species on the summits of Toolbrunup Peak and Bluff Knoll. It is likely to occur on the summits of other peaks of the Stirling Range.

Habitat. Drosera monticola is restricted to winter moist, black or brown loamy soils on ledges and in shallow depressions, often growing with moss. Only recorded from the upper slopes and summits which are frequently cloud-covered and are usually very moist. Its habitat on Bluff Knoll is often covered with snow for short periods in winter.

Flowering period. October to November.

Conservation status. Drosera monticola is a relatively common species in the Stirling Range National Park where it is not under threat.

Etymology. From the Latin *montis* – mountain and *cola* – dweller, in reference to this species being restricted to the summits of the Stirling Range.

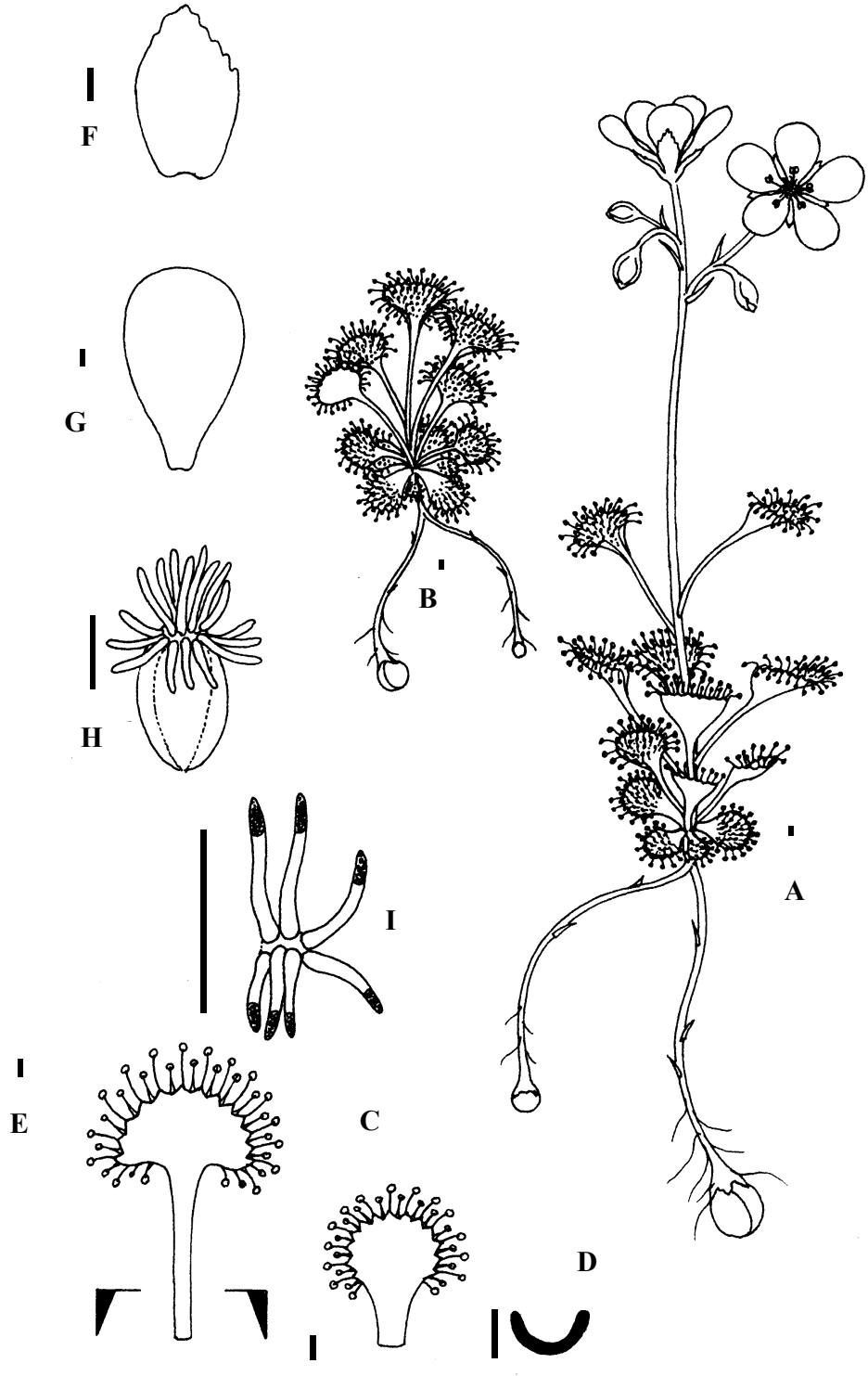

Figure 3. *Drosera monticola.* A.–non-flowering plant; B.–flowering plant; C.–basal leaf lamina; D.–petiole section; E.–cauline leaf lamina; F.–sepal; G.–petal; H.–ovary-styles; I.–style-stigmas, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1990 from live material from Toolbrunup Peak, Western Australia, voucher *A. Lowrie* 530.

Affinities. Considered to be most similar to *Drosera purpurascens*. *D. monticola* differs from *D. purpurascens* by having plants forming compact colonies, with additional below-ground stolons and tubers present at maturity but lacking a prostrate stolon on the soil surface, and pale pink flowers. It also has a different distribution, occurring only on the summits in the Stirling Range.

Notes. Under normal conditions, *Drosera monticola* rarely flowers, and then only on a very small number of plants even in the largest of populations. However, after bushfires, flowering occurs en masse.

Collection of mature seed from this species has been unattainable up to the time of this paper publication due to the infrequency of its flowering regime. However, a few well developed but still a little immature seeds were available from the *A. Lowrie* 530 gathering. This immature seed material has been used for the SEM micrographs and description data to gain some understanding as to its approximate size and likely testa cell pattern.

Drosera platypoda Turcz., *Bull. Soc. Imp. Nat. Moscou* 27(2): 343 (1854). *Type:* "Nova Hollandia [Australia], Drum. [*J. Drummond*] V [5th coll.] n. 281." (*iso:* K, MEL).

Drosera flabellata Benth., *Fl. Austral*. 2: 464 (1864). *Type:* " W. Australia. towards Cape Riche, *Drummond,* 5th coll. n. 281." (*iso:* FL, K).

Illustrations. L. Diels*, Pflanzenr*. 26: 127, fig. 40, D, (1906); R. Erickson, *Plants of Prey in Australia* 32; plate 5, 1–4 (1968).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 119 A–C (1987).

A tuberous-rooted *perennial herb*; stem solitary, erect, glabrous, 15–20 cm tall, with a flat basal rosette of leaves and alternate cauline leaves. *Tuber* orange, obovoid, slightly laterally compressed, *c.* 10 mm long, *c*. 7 mm diam., enclosed in brown papery sheaths and again enclosed in a mass of old coarse root fibre; stolon rarely completely vertical (below ground), *c.* 18 cm long. *Basal leaves* petiole flat, 5–9 mm long, dilating, 0.5–2 to 1–3 mm wide, adaxial surface in the upper parts with insect-trapping retentive glands around the margins and smaller glands within; lamina flabellate, 2.5–5 mm long, 4–9 mm wide. *Cauline leaves* not appressed, with the petiole and lamina slightly folded and rolled along their length forming an open-sided cone-like configuration; lamina similar in size and shape to that of the basal leaves. *Inflorescence* a simple raceme or 2–4-branched corymb, usually terminal but sometimes subterminal, 7–12 cm long (including scape), glabrous; 8–35-flowered; pedicels 5–10 mm long, glabrous. *Sepals* green, broadly ovate, acute, 3.5–4.5 mm long, 1.5–3 mm wide, margins entire, apex sometimes slightly dentate, densely covered with minute papillae, densely black dotted. *Petals* white, obovate, apex truncate and slightly crenate, 7.5–10 mm long, 5–8 mm wide. *Stamens* 5, 2.5–3 mm long; filaments and anthers white, pollen yellow. *Ovary* dark red, subglobose, *c.* 1 mm long, *c.* 1.8 mm diam. at anthesis, papillose; carpels 3, bilobed. *Styles* 3, white, reddish at base, *c.* 1.5 mm long, each divided from the base into many long terete segments, each segment rarely dividing again; stigmas slightly swollen and rounded at the apex of each style segment. *Fruit* obovoid, 3–3.5 mm long, 3–3.5 mm diam., containing *c.* 100 seeds. *Seeds* dark brown, variably shaped but ± turbinate, testa cell pattern reticulate with irregular longitudinal dentate ridges, 0.5–0.7 mm long, 0.4–0.5 mm diam. (Figures 4: (species illustration); 11: G–H (seed micrographs); 14: E (schematic life-form illustration))

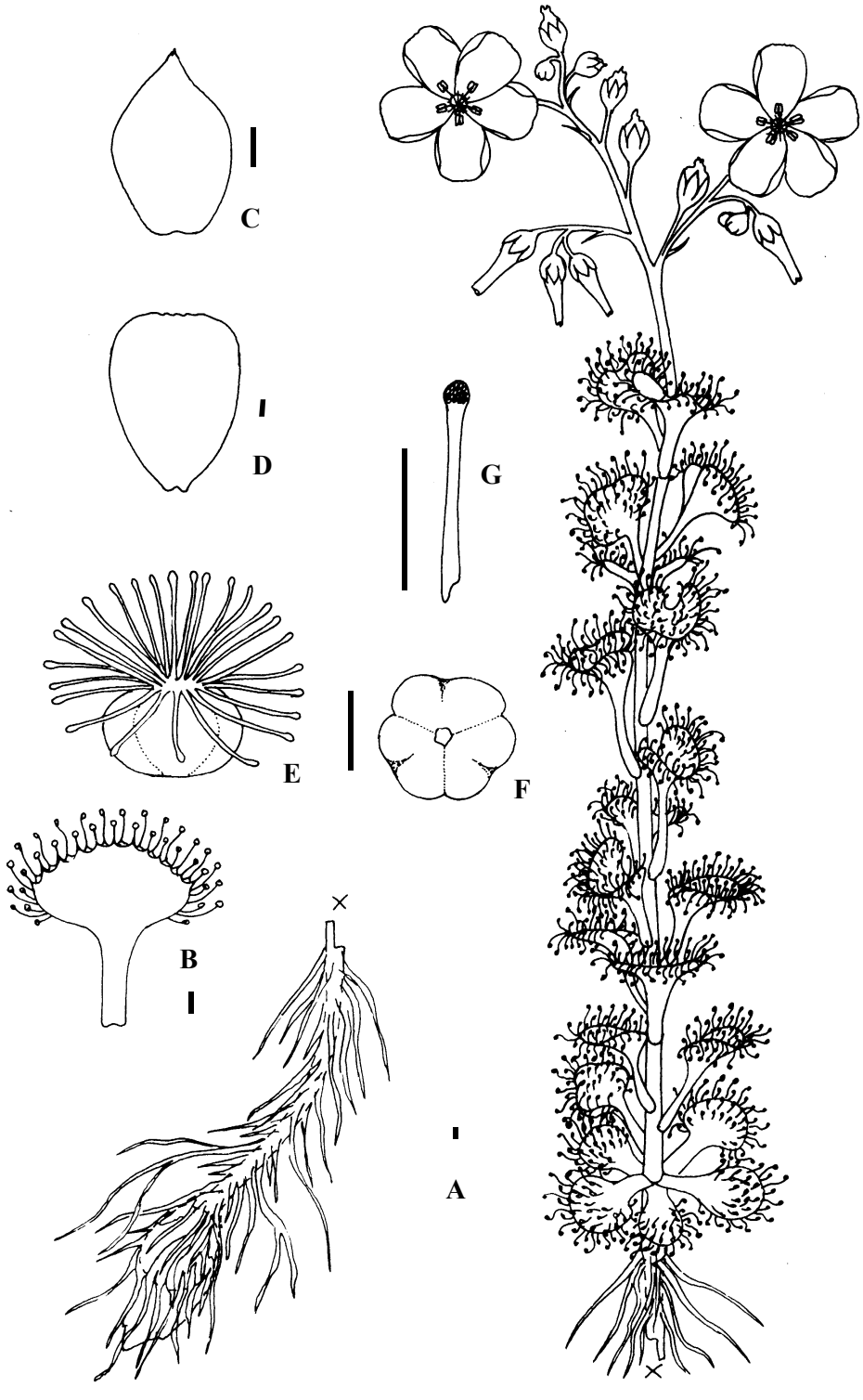

Figure 4. *Drosera platypoda.* A.–plant; B.–basal and cauline leaf lamina; C.–sepal; D.–petal; E.–ovary-styles; F.–ovary, basal view; H.–style-stigma, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from Albany, Western Australia, voucher *A. Lowrie* 695.

Other specimens examined. WESTERN AUSTRALIA: Collis Rd, 4 km from Boronia Rd, Frankland National Park, 9 Feb. 1995, *A.R. Annels* 5293A & *R.W. Hearn* (PERTH); along Two Peoples Bay Rd, *c.* 4 miles [6.4 km] W of Two Peoples Bay Wildlife Reserve, 18 Sep. 1974, *L. DeBuhr* 3646 (PERTH); 18 miles [28.8 km] S of Margaret River on Augusta to Margaret River road, 19 Oct. 1974, *L. DeBuhr* 4176 (PERTH); Chester Pass, Toolbrunup, 22 Oct. 1961, *F.* [Rica] *Erickson s.n.* (PERTH); Manjimup side of Inlet River, 22 Sep. 1970, *D. Forman* 46 (PERTH); Chester Pass, 15 miles [24 km] N of King River, 1 Oct. 1963, *T.Y. Harris* 4176 (PERTH); Mersea Lake, Wilgarup, Nov. 1962, *W.A. Laneragan s.n.* (PERTH); on Yellanup Rd, N of Albany, 20 Oct. 1992, *A. Lowrie* 695 (MEL, PERTH); on Parker Brook Rd, NW of Albany, 8 Oct. 1996, *A. Lowrie* 1589 (MEL, PERTH); Palgarup, N of Manjimup, 9 Oct. 1996, *A. Lowrie* 1594 (MEL, PERTH); Cape Riche homestead *c.* 70 miles [112 km] E of Albany, 14 Aug. 1964, *N. Marchant* 6488 (PERTH); Pfeiffer Rd, 4 miles [6.4 km] N of Hassel Highway E of Albany, 12 Sep. 1974, *N. Marchant* 74310 (PERTH); Scott River National Park, 20 Sep. 1990, *C.J. Robinson* 109 (PERTH); 2 km SE of Wedge Hill, Stirling Range, 25 Sep. 1979, *J. Taylor et al.* 840 (PERTH).

Distribution. Extends from Manjimup south-west to the Scott River area and east to Cape Riche.

Habitat. Drosera platypoda grows in saturated winter wet grey sandy soils amongst low shrubs on heathland.

Flowering period. October.

Conservation status. Drosera platypoda is a common species in the Albany region, is locally common near Manjimup, and is known from several national parks. It is currently not under threat.

Etymology. The epithet is from the Greek *platys* – flat and *podos* – foot, in reference to the flat basal rosette of leaves appressed to the soil surface.

Affinities. Drosera platypoda differs from all species in the *D. stolonifera* complex by having a solitary, non-branching, erect major axis bearing only alternate leaves and a terminal inflorescence.

Notes. Both *Drosera platypoda* and *D. fimbriata* encase their dormant tubers in papery sheaths as well as a layer of coarse dry root fibre. This root fibre also encases the stolon almost to the soil surface. When the stolon recedes to its tuber at the start of dormancy, a narrow tube-like passage remains through the root fibre. In the following growing season, the new plant stolon will grow back to the soil surface via this passage.

Examination of old field specimens of *Drosera platypoda* has revealed an interesting feature of this passage through the root fibre. Scattered along its length are small secondary tubers. These secondary tubers appear to be produced only in good growing seasons. When dormancy is broken, the stolons of the secondary tubers grow out through the mass of root fibre and then vertically to the soil surface. This results in a small compact colony of plants that have been produced asexually from one parent. All plants in such a colony are interconnected to the same root system. Although each plant functions as an individual, the connecting root mass persists.

Drosera porrecta Lehm., *Nov. Stirp. Pug.* 8: 41 (1844). – *Drosera stolonifera* subsp. *porrecta* (Lehm.) Marchant & Lowrie, *Kew Bulletin* 47: 320 (1992). *Type:* "Crescit in Iocis arenosis montis Eiza mountain [Mount Eliza] (Perth) [Western Australia]. (Herb. *Preiss.* no. 1985)." (*iso:* K, MEL 96886, 96891 & 96893, P).

Illustrations. P. Nikulinski, *Fl. Australia* 8,: 42, fig. 11, (1982) [as *Drosera stolonifera* subsp. *stolonifera*]; R. Erickson, *Plants of Prey in Australia*, plate 4: centre page (1968).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 139 A–C (1987).

A tuberous-rooted *perennial herb* with (1) 2 or 3 basal rosettes of leaves with internodes 10–20 mm long, lowermost rosette (or solitary rosette) always above the soil surface, cauline leaves in many whorls of 3–5 along erect and lateral stems with internodes 12–30 mm long; non-flowering plants erect, up to 45 cm tall, with solitary main stem or very rarely with 2–4 major stems of a similar length arising (side by side) from the uppermost basal rosette of leaves; flowering plants generally up to 15 cm tall (excluding inflorescence), sometimes taller, with (1) 2 or 3 semi-erect leafy main stems arising from the centre of the uppermost rosette of basal leaves. *Tuber* orange, reniform, *c.* 15 mm long, *c.* 20 mm diam., enclosed in a number of brown papery sheaths; stolon vertical (below ground), *c.* 20 cm long, prostrate stolon absent from the soil surface. *Basal leaves* petiole flat, 4–6 mm long, 1.3–2 to 2–3 mm wide; lamina broadly obovate and flabellate, 3.5–4.5 mm long, 4–6 mm wide, adaxial surface with insect trapping retentive glands around the upper margins and smaller glands within. *Cauline leaves* petiole terete, tapering, 7–22 mm long, 0.2–0.5 mm diam., longitudinally narrowly channeled on the upper side; lamina orbicular with an upper wedge-shaped gap, 5–10 mm diam., 2 sides of the removed wedge section gap arranged almost touching to form lamina into a concave cone-shape, mouth of cone facing outward and slightly up from the erect major axis, with insect trapping retentive glands around the margins and smaller glands within. *Inflorescences* of simple racemes or 2–4-branched corymbs, a major one arising from the uppermost basal rosette of leaves and shorter lateral ones from any whorl of leaves scattered along the main lateral stems; racemes or corymbs 3.5–14 cm long (including scape), 25– to over 100-flowered, scape and pedicels with scattered minute glands; pedicels 4–12 mm long. *Sepals* green, elliptic or ovate, apex acute, 3.5–5.5 mm long, 2–2.5 mm wide, margins entire, apex slightly dentate, adaxial surface densely black-dotted, glabrous. *Petals* white, obovate, apex truncate, 5–6.5 mm long, 3–4 mm wide. *Stamens* 5, 1.5–2.5 mm long; filaments white; anthers and pollen yellow. *Ovary* green, subglobose, *c.* 0.7 mm long, *c.* 1.3 mm diam. at anthesis. *Styles* 3, greenish white, *c.* 1 mm long, each divided into many terete tapering segments, some flattened along their length, curved out and upwards from their base and arranged in a whorl, the remainder terete, tapering and erect in the centre of the whorl; stigmas simply formed at the apex of each style segment. *Fruit* obovoid, 2–2.5 mm long, 2–2.4 mm diam., containing 20–28 seeds. *Seeds* black, broadly obovoid to subglobose, testa cell pattern ± honeycombed, reticulate, cells mostly hexagonal, others irregularly tetragonal, ridges and cell floors smooth, 0.4–0.5 mm long, 0.4–0.5 mm diam. (Figures 5: (species illustration); 12: A–B (seed micrographs); 14: F & G (schematic life-form illustrations))

Other specimens examined. WESTERN AUSTRALIA: Claremont, July–Aug. 1900, *C. Andrews s.n.* (PERTH); W of Three Springs, 28 June 1970, *A. M. Ashby* 3247 (PERTH); 32.7 miles [59 km] from Arrowsmith River towards Three Springs on Dongara–Three Springs road, 22 Sep. 1968, *E.M. Canning s.n.* (PERTH); S shore of Mt Henry Spit, Canning River foreshore, 13 Aug. 1974, *M.L. Clark* 58 (PERTH); 60 m from W shore of Mt Henry Spit, Canning River foreshore, 13 Aug. 1974, *M.L. Clark* 61 (PERTH); 20 m from SW corner of Mt Henry Spit, Canning River foreshore, 13 Aug. 1974, *M.L. Clark* 63 (PERTH); Canning Mills Rd, Roleystone, 24 July 1978, *R.J. Cranfield* 289 (PERTH); Kings Park, Perth, 11 Aug. 1920, *C. A. Gardner s.n.* (PERTH); North Fremantle, 10 July 1897, *R. Helms s.n.* (PERTH); North Fremantle, Swan

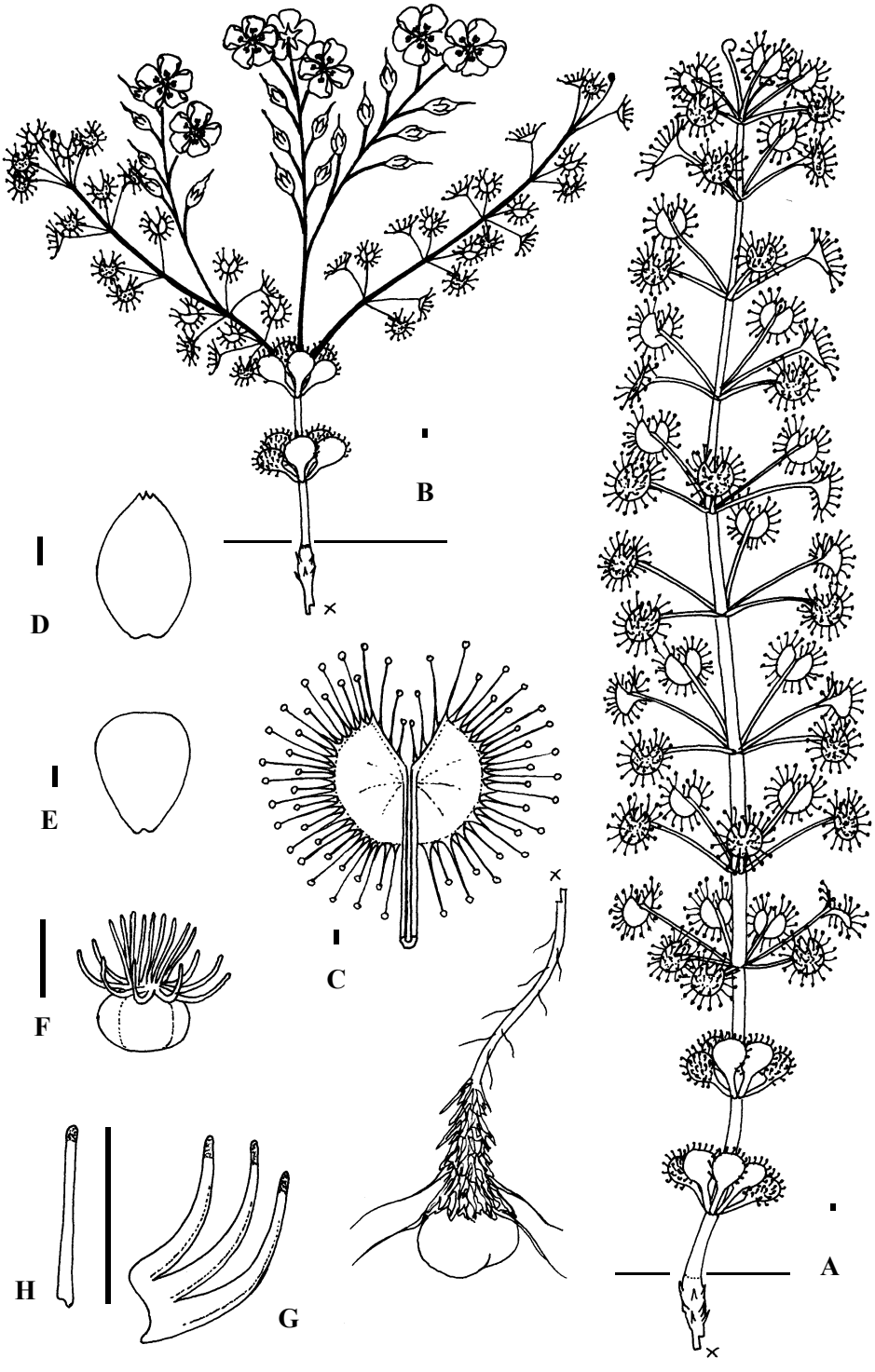

Figure 5. *Drosera porrecta.* A.–non-flowering plant; B.–flowering plant; C.–cauline leaf lamina; D.–sepal; E.–petal; F.–ovary-styles; G.–whorled style-stigmas, enlarged; G.–erect style-stigma, enlarged. Scale bars for all = 1 mm, except A. & B. = 2 mm. Drawn by A. Lowrie in 1984 from live material from north of Cataby, Western Australia, voucher *A. Lowrie* 1791.

River [specimen marked A.], 17 July 1897, *R. Helms s.n.* (PERTH); Cottesloe, 22 July 1897, *B. Helms s.n.* (PERTH); Leederville, 8 Aug. 1897, *R. Helms s.n.* (PERTH); near Perth, Swan River, 8 Aug. 1897, *R. Helms s.n.* (PERTH); Pinjarra, [specimen marked A.], 23 Sep. 1897, *B. Helms s.n.* (PERTH); Darlington, *R. Helms s.n.*, spring [Sep.] 1898, *R. Helms s.n.* (PERTH); on Brand Highway, 4.8 km N of Cataby, 20 Aug. 1997, *A. Lowrie* 1791 (MEL, PERTH); Coomallo, 57.3 km N of Cataby, 20 Aug. 1997, *A. Lowrie* 1794 (MEL, PERTH); *c.* 30 km N of Eneabba, 20 Aug. 1997, *A. Lowrie* 1799 (MEL, PERTH); Mount Eliza, Kings Park, Perth [type location], 31 Aug. 1997, *A. Lowrie* 1830 (MEL, PERTH); Burnside Rd, SE of Pinjarra, 21 Sep. 1997, *A. Lowrie* 1875 (MEL, PERTH); W side of Mount Cooke, 2 Oct. 1997, *A. Lowrie* 1892 (MEL, PERTH); Moores Rd, Pinjarra, 1 Sep. 2001, *A. Lowrie* 2639 (MEL, PERTH); Karrakatta Cemetery, 16 July 1965, *N. Marchant* 6532 (PERTH); Smith's Mill, Darling Range, 6 Aug. 1898, *A. Morrison s.n.* (PERTH).

Distribution. Extends from Eneabba and Marchagee south to the Pinjarra area, including the Darling Range southwards to Mt Cooke.

Habitat. Drosera porrecta grows in well drained deep white or beige sandy soils amongst low shrubs on heathland on the northern sand plains. In the Perth region it occurs in *Banksia* woodlands in sandy soils over limestone on the coastal plain; also in sand near winter-wet swamp margins as well as adjoining open Jarrah woodland in the Pinjarra region; and in sand mixed with a little laterite in Jarrah woodlands in the Darling Range.

Flowering period. July to September.

Conservation status. Drosera porrecta is a common species, especially between Eneabba and Cataby, and is currently not under threat.

Etymology. From the Latin *porrectus* meaning extending outwardly. It is unclear as to what the author's epithet was to signify but possibly refers to the leafy growth and inflorescences arising from the basal whorl of leaves as found on the type material specimens.

Affinities. Non-flowering specimens of *Drosera porrecta* differ from all species in the *D. stolonifera* complex by having a solitary erect major axis stem bearing whorls of leaves along the length or, when very rarely 2–4 major axis stems of a similar length occur, these are arranged side by side in the uppermost basal rosette of leaves. This later condition maybe in response to insect damage to juvenile apical leaf tissue early in the growing season.

Flowering specimens of *Drosera porrecta* are closest to *D. stolonifera* in size and appearance. *D. porrecta* differs from *D. stolonifera* (whose contrasting characters are given in parenthesis) by lacking a prostrate stolon on the soil surface (prostrate stolon commonly present); having an erect lower major axis stem with mostly 2 or 3, rarely 1, obovate and flabellate leaved basal rosettes with distinctive internodes and the lowermost basal rosette always positioned above the soil surface (basal rosette solitary, always appressed to the soil surface); whorled leaved stems arising from the uppermost basal rosette of leaves on both flowering or non-flowering specimens (whorled leaved stems arising from the lowermost basal rosette); major inflorescence always arising from the terminal basal rosette (major inflorescence arising from the basal rosette); and lamina of uppermost whorled leaves along erect and lateral major axis stems circular with an upper wedge-shaped gap (lamina of whorled leaves along uppermost erect and lateral major axis stems reniform).

Notes. The K material of *Preiss* 1985 is on a shared sheet of seven plants, of which three are *Drosera porrecta* (one top right and two bottom right). The remaining specimens on the sheet, labeled "Swan River, N. Holland, *Drummond*", are *D. stolonifera.*

Diels (1906) agreed with Planchon (1848) that *Drosera porrecta* and *D. stolonifera* should be treated as the same species. Under Diels' treatment of *D. stolonifera* he noted the following:

> "Branching different, for which *cl.* Lehmann on *D. porrecta* Lehm. says it is in the habit of producing. Comparing (*Plant. Preiss.* 1 (1845) 252 [*D. porrecta*], [with] 253 [*D. stolonifera*]) the different branching is found in one and the same species and both species are found in one and the same locality. Therefore that species [*D. porrecta*] *cl.* Planchon in Ann. Sci. Nat. 3. ser IX (1848) 300 is rightly rejected."

Here Diels noted that the branching systems of *Drosera stolonifera* and *D. porrecta* according to Lehmann's descriptions were similar. Flowering specimens of *D. porrecta* and *D. stolonifera* do have more or less similar branching strategies. That is, a major inflorescence arising from a basal rosette of leaves along with lateral semi-erect whorled leafy stems which often supporting additional minor inflorescences. Both Diels and Planchon's assumption that *D. porrecta* and *D. stolonifera* were one and the same species was an acceptable conclusion for their time, bearing in mind that they were only ever equipped with dried material and minimal field data notation to work with.

The facts are, *Drosera porrecta* only produces similar branching to *D. stolonifera* when it flowers. Non-flowering specimens of *D. porrecta* are commonly an erect solitary plant consisting of major axis up to 45 cm tall, bearing 1 to 3 basal rosettes with broadly obovate and flabellate leaves situated above the soil surface, followed by whorled leaves supporting circular lamina with a small apical gap towards the apex with well defined internodes between basal rosettes and whorled leaves. In contrast *Drosera stolonifera* consists of a solitary basal rosette of transversely elliptic and depressed ovate leaves situated on the soil surface. Commonly 2 to 5, and sometimes more, lateral semi-erect stems up to 25 cm tall bearing whorled leaves supporting reniform lamina arise from this basal rosette, whether flowering or not.

Lehmann also recorded in his description that *Drosera porrecta* differs from *D. stolonifera* "chiefly in fact with respect to flowering at all times out of whorled leaves higher, by no means in fact from whorls in lower part."

What Lehmann was describing here was the position of the basal rosette, from which the major inflorescence as well as the leafy stem(s) arise, in relation to the soil surface. In the case of *Drosera porrecta* it is always situated above the soil surface whether flowering or not. When more than 1 basal rosette is present, and groups of 2 or 3 basal rosettes are common, the uppermost rosette supports the major inflorescence as well as the erect leafy stem(s) growth, and along with the lowermost rosette of the group as a whole, are always situated well above the soil surface. In contrast, *D. stolonifera* only ever has a solitary basal rosette supporting the major inflorescence as well as the erect leafy stems growth, and this rosette is always situated on the soil surface whether flowering or not.

Diels incorrectly recorded that the Preiss' collections of *Drosera porrecta* and *D. stolonifera* recorded by Lehmann in his paper are found at the same location. *D. porrecta* (*Preiss* 1985) was collected from Mount Eliza, overlooking Perth on the 20 August 1839, and *D. stolonifera* (*Preiss* 1984) was collected from Peninsula, Perth on 31 August 1839.

The Peninsula, as it was once unofficially called (now in the suburb of Maylands) was originally named Point Garling by Capt. Sir James Stirling in 1827 on his exploration of the Swan River. Frederick Garling was an artist on the *H.M.S. Success* who accompanied him on his exploration. A distance of 6 km exists between Priess' two collection stations.

Drosera porrecta still occurs at the type location on Mount Eliza in Kings Park, located above the City of Perth, growing with other undisturbed native vegetation in open *Banksia* woodland, but *D. stolonifera* has not been recorded there. *D. stolonifera* no longer occurs in the degraded remnant vegetation on the peninsula in Maylands. The lay of the land and remnant paperbark trees (*Melaleuca* species) on the foreshore of the Swan River, suggest a large part of the peninsula was mostly swampland heath.

Prior to urbanization, Preiss' *D. stolonifera* collection area on the peninsula may have been similar to an area that once occurred at Canning Vale (*c.* 16 km south-east of Perth). Today unfortunately this area too has been drained and is largely urbanized. Thirty five years ago however, Canning Vale supported huge areas of swampland heath which were extremely rich in a vast array of species, especially triggerplants, orchids and carnivorous plants. *D. stolonifera* was a common species there growing around the bases of the paperbark trees in black peaty sand. Now only a few small remnant bushland areas remain, one of which, next to a shopping complex car-park still supports a colony of *D. stolonifera* (*A. Lowrie* 2634).

South-east of Pinjarra in a similar swampland heath, specimens of *Drosera stolonifera (A. Lowrie* 1876) have been found growing within 3 metres of *D. porrecta (A. Lowrie* 1875). without apparently hybridising, providing further justification to treat these taxa as distinct entities. At this location *D. stolonifera* favoured the wetter parts of the habitat whereas the majority of D. *porrecta* preferred the higher better drained soils.

One half of this south-east of Pinjarra habitat had been burnt the previous summer. *Drosera stolonifera* was found in the un-burnt area with a few *D. porrecta* plants and only one *D. stolonifera* was found in flower between the two species. All specimens of *D. porrecta* on the burnt side of the habitat however, where *D. stolonifera* was absent, were in flower, providing evidence that a bushfire (when the species is dormant in summer) stimulates mass flowering in spring.

Recently *Drosera porrecta* (*A. Lowrie* 2639) and *D. stolonifera* (*A. Lowrie* 2640), both flowering and growing intermixed with each other, have been observed at another location which was recently burnt near Pinjarra. Here *D. porrecta* was nearing the end of anthesis while *D. stolonifera* was at the beginning of anthesis. Both species displayed white flowers which freely emitted a very sweetly perfumed pheromone. I discovered a distinct difference to the nose in the type of perfume each species produced. I also established from the fully opened flowers of each species (it was late in the afternoon and both species flowers had been open since early morning) that *D. stolonifera* was far more strongly perfumed than *D. porrecta.* Again, no hybrids were observed between these two species.

Drosera prostrata (Marchant & Lowrie) Lowrie, *comb. nov.*

Drosera stolonifera subsp. *prostrata* Marchant & Lowrie, *Kew Bulletin* 47: 320–321 (1992). *Type:* Kalbarri, on the road to The Loop, in yellow and white sandy soils between low shrubs on heathland, Western Australia, 14 June 1984, *A. Lowrie* 84/073 (*holo:* PERTH 04179005; *iso:* PERTH 02345005).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1,143 A–C (1987).

A tuberous-rooted *perennial herb* with 4–5 prostrate lateral stems (with a few stems sometimes branching further along their length) 3.5–15 cm long, radiating out from the centre of a rarely formed basal rosette of 3 or 4 leaves; foliage reddish, cauline leaves in many whorls of 3–5 along the prostrate stems, each whorl oriented so that the leaves are all at an equal height above the soil surface, distance between

internodes 6–10 mm long. *Tuber* orange, globose, *c.* 8 mm diam., enclosed in a number of brown papery sheaths; stolon vertical (below ground), *c.* 10 cm long, prostrate stolon (on soil surface) absent. *Basal leaves* (when present) spathulate (including the petiole); lamina 2–5.5 mm long, 0.8–1.2 mm wide, adaxial surface with insect trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole dilated towards the lamina, 1.7–3 mm long, 0.2–0.3 to 0.4–0.8 mm wide; lamina broadly obovate, 2–3.5 mm long, 2.6–5 mm wide, with insect trapping retentive glands around the margins and smaller glands within. *Inflorescence* of 1–4 panicles, 1–9-flowered, 3–5.5 cm long (including scape); scape yellowish green with scattered minute sessile glands; pedicels 5–14 mm long. *Sepals* yellowish green, narrowly ovate, acute, 4.5–5 mm long, 1.5–2 mm wide, margins entire, apex serrate, adaxial surface with scattered minute sessile glands, black dotted. *Petals* white, narrowly obovate, apex truncate crenate and sometimes retuse, 5–6 mm long, 2–2.5 mm wide. *Stamens* 5, 1.5–2 mm long; filaments white; anthers and pollen yellow. *Ovary* green, globose, *c.* 1.5 mm diam. at anthesis. *Styles* 3, white, *c.* 1 mm long, each divided into many terete segments; stigmas simply formed at the apex of each style segment. *Fruit* obovoid, 2.5–3.5 mm long, 3–4 mm diam., containing *c.* 20 seeds. *Seeds* brown (just before dispersal from the seed capsule), black (on dispersal), variably shaped from subglobose to ellipsoid, apical pole indented, basal pole funicle barely projected beyond overall seed shape, testa cell pattern colliculate at apex, remainder reticulate-foveate, ridges and cell floors smooth, 0.6–0.8 mm long, 0.5–0.6 mm wide. (Figures 6: (species illustration); 12: C–D (seed micrographs); 14: H (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: 29 km Tamala road, on road to Tamala from the turnoff from the Overlander Roadhouse-Monkey Mia road, 12 Aug. 1976, *H. Demarz* 6121 (PERTH); Kalbarri, near gun club, 18 Aug. 1974, *R. Garraty* 511 (PERTH); 46.4 km W of Great Northern Highway on sandy track to Zuytdorp more or less parallel to state barrier fence, 26 Aug. 1994, *G.J. Keighery & N. Gibson* 1453 (PERTH); 59.3 km W of Great Northern Highway on sandy track to Zuytdorp more or less parallel to state barrier fence, 26 Aug. 1994, *G.J. Keighery & N. Gibson* 1535 (PERTH); 16.5 km W of Binnu, 21 Aug. 1997, *A. Lowrie* 1813 (MEL, PERTH); 17.3 km W of Binnu, 21 Aug. 1997, *A. Lowrie* 1815 (MEL, PERTH); 20 km N of Junga Dam, Kalbarri National Park, 11 May 1968, *P.G. Wilson* 6699 (PERTH); Tamala, 12 Aug. 1976, *E. Wittwer* 1807 (PERTH).

Distribution. Extends from the Tamala area (near Shark Bay) south to near Binnu.

Habitat. Drosera prostrata grows in yellow sand, yellow sand sometimes mixed with a little white sand and red sand soils amongst low shrubs on heathland on the northern sand plains.

Flowering period. May to June.

Conservation status. Drosera prostrata is locally abundant at scattered locations over its range, which includes the Kalbarri National Park, and is currently not under threat.

Etymology. The epithet from the Latin *prostratus* meaning prostrate, refers to this species lateral leafy stems prostrate growth habit.

Affinities. Drosera prostrata differs from all species in the *D. stolonifera* complex by its prostrate growth habit.

Notes. D. prostrata (*G.J. Keighery & N. Gibson* 1453, 1535 and *A. Lowrie* 1815) coexists with *Drosera humilis* (recorded but not vouchered) at the *G.J. Keighery & N. Gibson* 1453, 1535 locations near the Zuytdorp National Park (pers. comm. Neil Gibson), and in the Binnu region (*A. Lowrie* 1816) without apparently hybridizing, providing further justification to treat both taxa as distinct entities.

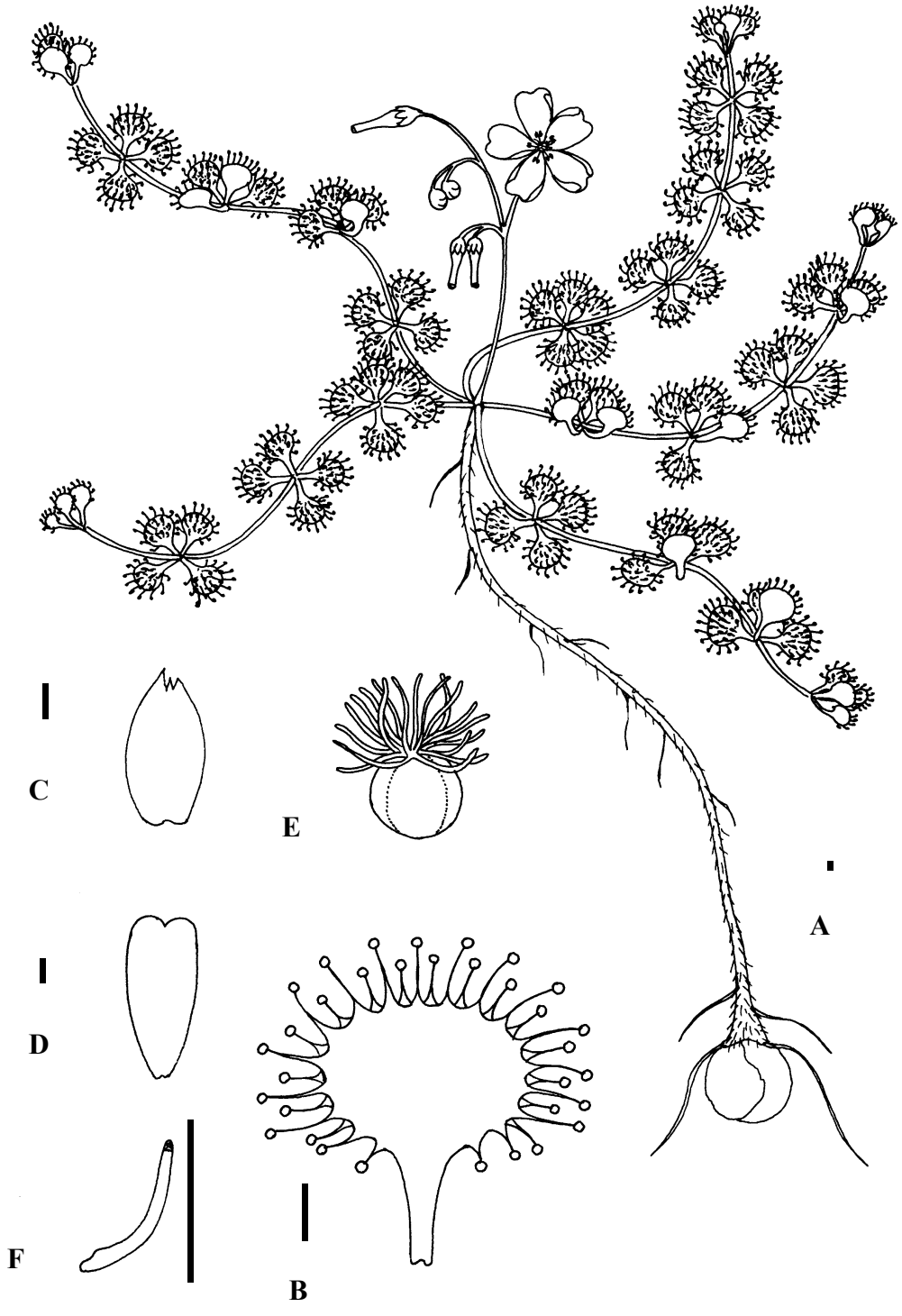

Figure 6. *Drosera prostrata.* A.–plant; B.–cauline leaf lamina; C.–sepal; D.–petal; E.–ovary-styles; F.–style-stigma, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from the type location, Western Australia, voucher *A. Lowrie* 84/073.

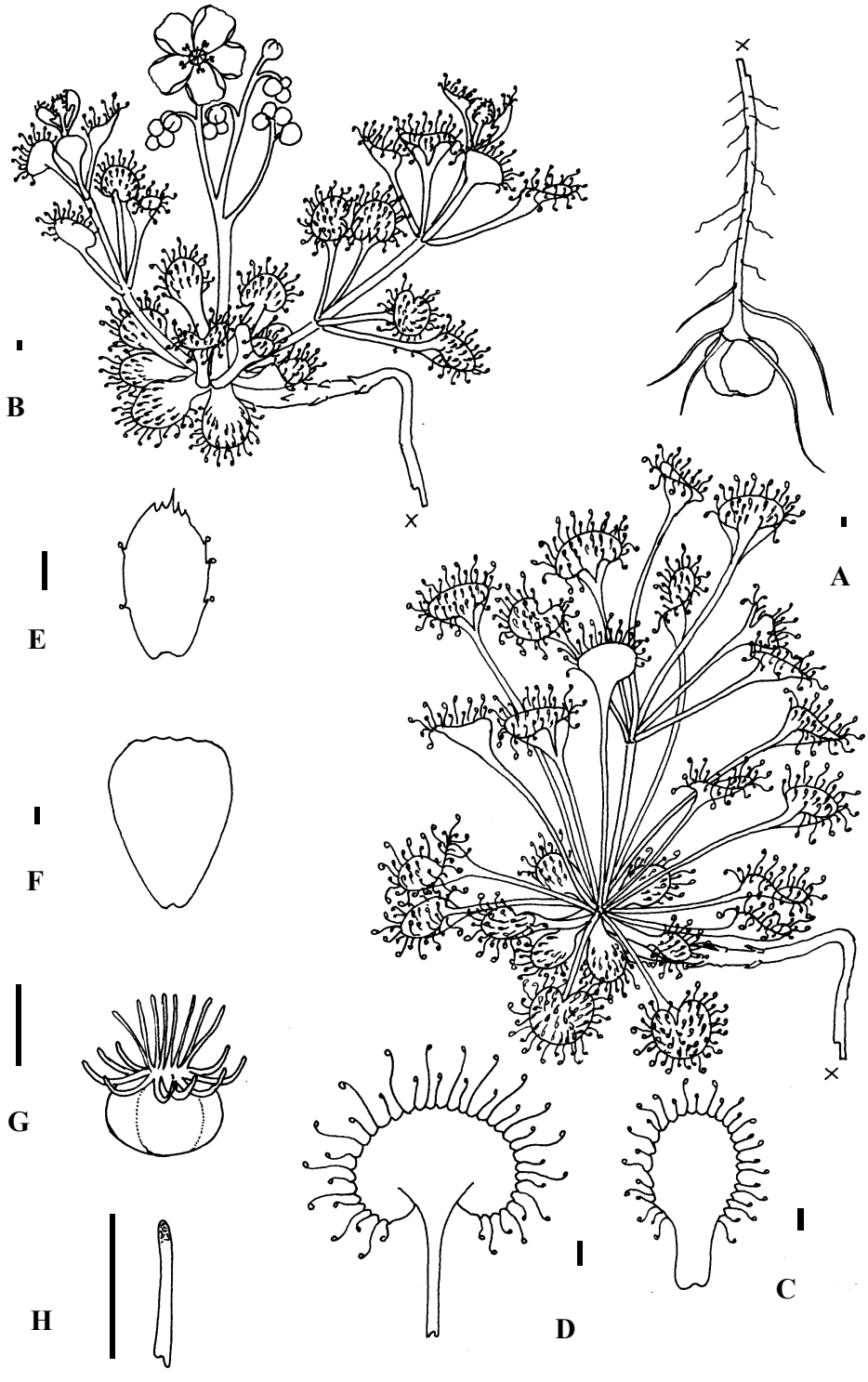

Figure 7. *Drosera purpurascens.* A.–non-flowering plant; B.–flowering plant; C.–basal leaf lamina; D.–cauline leaf lamina; E.–sepal; F.–petal; G.–ovary-styles; H.–style-stigma, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from Kojonup, Western Australia, voucher *A. Lowrie* 292.

Drosera purpurascens Schlott., *Bonplandia* 4(7): 111 (1856). *Type:* "Schedula Preissiana Nr. 1977. In solo turfos-arenoso prope montem "Wuljenap (Plantagenet) [Wolyamup Hill, 33°32'S, 117°54'E, *c.* 35 km NE of Katanning, Western Australia] *non* Mt Willyung [Albany area] *sensu* Marchant (1982) or Wuljenup *sensu* Lehmann (1844) and Bentham (1864)]" L. Preiss legit." [*L. Preiss* 1977] (*iso:* P).

Drosera stolonifera subsp. *compacta* N.G. Marchant, *Fl. Australia* 8: 384 (1982). *Type:* 2 miles [3.2 km] SW of Ongerup, Western Australia, 28 September 1963, *K.R. Newbey* 977 (*holo:* PERTH 06230946).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 131 A–C (1987).

A tuberous-rooted *perennial herb*, compact, with 1 erect or 2–5 semi-erect lateral stems 3–10 cm long (mostly *c.* 3 cm long at anthesis) arising from the centre of a small basal rosette of leaves; foliage reddish, cauline leaves with rather long petioles in whorls along the erect or semi-erect main stems as well as from the base of the stems. *Tuber* red, globose, *c.* 8 mm diam., enclosed in a number of brown papery sheaths; stolon vertical (below ground), *c.* 12 cm long, stolon prostrate (on soil surface) *c.* 10 cm long. *Lowermost basal leaves* petiole flat, 4–5 mm long, 1.5–2 to 2.5–4 mm wide; lamina spathulate (including the petiole), 4–9 mm long, 2.5–5 mm wide, adaxial surface with insect trapping retentive glands around the margins and smaller glands within. *Uppermost basal leaves* petiole flat, 4.5–10 mm long, 0.5–0.7 to 1–1.5 mm wide; lamina flabellate, 3–4 mm long, 4–4.5 mm wide, adaxial surface with insect trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole 8–30 mm long, 0.4–0.6 mm wide, longitudinally channeled on upper side; lamina reniform, 2–3.5 mm long, 3–6 mm wide, lamina margins rolled towards the centre forming an open-sided, concave, cone-like arrangement, with insect-trapping retentive glands around the margins and smaller glands within. *Inflorescence* of panicles, each 4–14 cm long (mostly 4–6 mm long including the scape), 3–30-flowered, arising from the centre of the basal rosette of leaves, with minute glands few and scattered on lower parts but becoming denser on the upper parts and pedicels; pedicels 1.5–4 mm long. *Sepals* green, ovate or elliptic, acute, 3.5–4.5 mm long, 1.5–2 mm wide, margins irregularly dentate with a few glands, apex serrate, adaxial surface with a few scattered minute sessile glands, otherwise glabrous, black dotted. *Petals* white, obovate, apex truncate and crenate, 9–10 mm long, 6–7 mm wide. *Stamens* 5, 2–2.5 mm long; filaments and anthers white, pollen yellow. *Ovary* green, subglobose, *c.* 0.8 mm long, *c.* 1.5 mm diam. at anthesis. *Styles* 3, white, *c.* 1 mm long, each divided into many terete segments, half arranged in a whorl and curved out and upwards from their base, remainder erect in the centre of the whorl; stigmas simply formed at the apex of each style segment. *Fruit* obovoid, 2.5–3 mm long, 3–3.5 mm diam., containing *c.* 14 seeds. *Seeds* black, ± subglobose, apical pole indented, basal pole funicle *c.* 0.06 mm long, *c.* 0.09 mm diam., testa cell pattern reticulate, foveate, ridges and cell floors slightly irregularly undulate, *c.* 0.5 mm long, *c.* 0.45 mm diam. (Figures 7: (species illustration); 12: E–F (seed micrographs); 14: I & J (schematic life-form illustrations))

Other specimens examined. WESTERN AUSTRALIA: 1 km N of Nutcracker Rd, 15 km NNW of Denmark, 21 Oct. 1991, *A.R. Annels* 1742 (PERTH); Lake Ninijup Reserve, 15 km WSW of Tenterden, 22 Sep. 1993, *A.R. Annels* 3838 (PERTH); Salt River Rd, 2 km E of Cranbrook, 23 Sep. 1994, *W. Bopp* 109 (PERTH); Ledge Beach Rd off Gull Rock Rd, Lower Kalgan, 9 Sep. 1983, *E.J. Croxford* 2887A (ALBANY, PERTH 04420365); 10 miles [16 km] E of Cranbrook along road to Borden, 10 Sep. 1974, *L. DeBuhr* 3573 (PERTH, RSA); W of Kendenup, Oct. 1961, *R. Erickson s.n.* (PERTH); Qualenup North, 35 km W of Kojonup, 20 Sep. 1995, *C. Lewis* 84 (PERTH); on the walk trail to summit of Mt Lindesay, N of Denmark. 18 Aug. 1991, *A. Lowrie* 287 (MEL, PERTH); Albany Highway 20 km N of Kojonup, 17 Aug. 1991, *A. Lowrie* 292 (MEL, PERTH); W side of Mt Cooke, 2 Oct. 1997, *A. Lowrie* 1893 (MEL, PERTH); North East Rd, *c.* 2.5 km W of Albany Highway, 2 Oct. 1997, *A. Lowrie* 1894 (MEL, PERTH); Wolyaming Rd, *c.* 34.4 km E of Katanning [*c.* 6 km south of type location], 3 Oct. 1997, *A. Lowrie* 1915 (MEL, PERTH); 4.7 miles [7.5 km] SW of Chillinup

on Cape Riche Rd, 18 July 1965, *N. Marchant* 6559 (PERTH); 5 miles [8 km] N of Ongerup, 20 Sep. 1972, *K. Newbey* 3581 (PERTH); 16 miles [25.6 km] SE of Ongerup, 13 Sep. 1966, *E.M. Scrymgeour* 980 (PERTH).

Distribution. Extends from Mt Cooke area to north-east of Katanning, south-east to Ongerup and south to Denmark–Albany region.

Habitat. Drosera purpurascens grows in sand-laterite soils on heathland and in stony, sandy clay soils in *Eucalyptus* woodlands.

Flowering period. July to October. Mass flowering occurs after bushfires.

Conservation status. Drosera purpurascens is a common species and is currently not under threat, occurring throughout the Stirling Range National Park.

Etymology. From the Latin *purpurascens* – purplish, in reference to the colour of the glandular hairs on herbarium specimens which in the living state at maturity are reddish.

Affinities. Drosera purpurascens is characterized from all other members of sect. *Stolonifera* by having: compact foliage; lamina of the leafy whorls along the semi-erect lateral stems as well as those from base reniform, with margins rolled towards the centre forming an open-sided, concave, cone-like arrangement; and rather long petioles for the compact size of the plant.

Notes. Schlotthauber (1856) recorded that Lehmann (1844) had falsely attributed the type for *Drosera purpurascens* to his [Lehmann's] *D. stolonifera* [Endl.] #10 treatment and also had produced an exact worded description for this species from Endlicher's (1837) descriptions. Lehmann had also used other exactly worded species descriptions from Endlicher's paper in his own paper. What Schlotthauber was saying was that Lehmann had wrongly placed the type collection for *Drosera purpurascens* along side a *D. stolonifera* collection on his list of cited specimens in his treatment of *D. stolonifera*. Schlotthauber also recorded that Lehmann had copied word for word Endlicher's previously published description for *D. stolonifera* and likewise with other species. Schlotthauber may have been suggesting Lehmann had plagiarized Endlicher's work. Even though Lehmann had used just the short introduction (not the full description) for each of Endlicher's species he did so in Endlicher's exact words. At the end of which he cited Endlicher and the relevant publication he had lifted the wording from.

Drosera purpurascens (*A. Lowrie* 1893) coexists with *D. porrecta* (*A. Lowrie* 1892) on the west side of Mt Cooke, *c.* 40 km south-east of Armadale apparently without hybridizing, providing further justification to treat them as distinct entities genetically isolated from each other. Furthermore, *c.* 10 km to the north east of this Mt Cooke location *D. stolonifera* (*A. Lowrie* 1891) also occurs. Because *D. stolonifera* has been recorded near Mt Cooke, further exploration around Mt Cooke could possibly reveal the presence of all three species growing together at the one location. If this occurred it would further enhance an already outstanding living laboratory for cutting edge genetic studies.

Drosera ramellosa Lehm., *Nov. Stirp. Pug.* 8: 40 (1844). *Type:* "Crescit in locus arenosis humidis prope lacum insulae Rotenest. [Rottnest, Western Australia], (Herb. Preiss. no 1990)." [*Preiss* 1990](*iso:* FI, MEL, S).

Drosera penduliflora Planchon, *Ann. Sci. Nat.* (Paris) ser. 3, 9: 301 (1848). *Type:* "in colonia Swan River [Swan River Colony south-west Western Australia], Drummond in herb. Hook." [*J. Drummond s.n.*](*iso:* K).

Illustrations. L. Diels, *Pflanzenr.* 26: 127, fig. 40 E, (1906); R. Erickson, *Plants of prey in Australia*, plate 5: 5 (after Diels), (1968); P. Nikulinsky, *Fl. Australia* 8: 46, fig. 13 A–E (1982).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 123 A–C (1987).

A tuberous-rooted *perennial herb;* major axis stem(s) 1–3, mostly 2, erect, glabrous, 4–12 cm tall, with a compact basal rosette of leaves not quite appressed to the soil and alternate leaves along the erect stem(s). *Tuber* orange, obovoid, slightly laterally compressed, *c.* 10 mm long, *c.* 7 mm wide, enclosed in brown papery sheaths; stolon vertical (below ground), *c.* 5 cm long. *Basal leaves* petiole flat, 3.5–6 mm long, dilated towards the lamina, 1–2 to 1.5–3 mm wide; lamina obovate, 3–5 mm long, 3–8 mm wide, adaxial surface in the upper parts with insect trapping retentive glands around the margins and smaller glands within. *Cauline leaves* with petiole and lamina slightly folded and rolled along their length forming an open-sided-cone-like configuration closely appressed to the erect stem; lamina more or less similar in shape to that of basal leaves, with only a little variation in overall size except those near the stem apex always smaller. *Inflorescence* of 1–3 racemes arising from the centre of the basal rosette of leaves; racemes 1.5–4 cm long (including scape), glabrous, 1–3-flowered, scapes and petioles covered with scattered minute sessile glands; pedicels terete, 5–12 mm long. *Sepals* green, ovate-elliptic, 2–4 mm long, 1.5–2 mm wide, margins entire, apex dentate, adaxial surface covered with minute papillae and a few scattered red sessile glands, black dotted. *Petals* white, obovate, apex entire or slightly crenate, 3–5 mm long, 2.5–3 mm wide. *Stamens* 5, 2–2.5 mm long; filaments and anthers white, pollen yellow. *Ovary* green, subglobose, *c.* 1 mm long, *c.* 1.5 mm diam. at anthesis; carpels 3. *Styles* 3, white, *c.* 1 mm long, each divided just up from the base into a small number of thick terete segments; stigmas simple at the apex of each style segment. *Fruit* pendulous, globose-ellipsoid, 5–5.5 mm long, 4–5.5 mm diam., containing *c.* 28 seeds. *Seeds* greyish brown, variably shaped but ± cupiform with a central umbo surrounded by a small flattened apron around the apical pole, testa cell pattern at apical pole ± irregularly colliculate, remainder reticulate, foveate, ridges ± smooth, cell floors ± irregularly undulate, 0.8–1 mm long, 0.7–0.9 mm diam. (Figures 8: (species illustration); 13: A–B (seed micrographs); 14: K (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: Cannington (Perth), Sep. 1904, *C. Andrews s.n.* (PERTH); 1.5 km W of One Tree Hill, 30 km NE of Eneabba, 7 Sep. 1994, *W. Bopp* 55 (K, PERTH, RNG); along the Cape Le Grand Rd, *c.* 12 miles [19.2 km] E of junction with Israelite Bay Rd, 23 Sep. 1974, *L. DeBuhr* 3737 (PERTH); Kalbarri, near gun club, 18 Aug. 1974, *B. Garraty* 512 (PERTH); Hill River, *c.* 16 miles [24 km] NW of Badgingarra, 1 Sep. 1966, *A.S. George* 7802 (PERTH); Lort River crossing on Ravensthorpe–Esperance road *c.* 60 km W of Esperance, 11 Oct. 1968. *E.N.S. Jackson* 1394 (PERTH); Hay Flat Rd, W of Great Northern Highway, 31 Aug. 1991, *A. Lowrie* 299 (MEL, PERTH); 4.9 miles [7.8 km] S of Mogumber, 23 Aug. 1964, *N. Marchant* 64150 (PERTH); 40 miles [64 km] E of Esperance on Israelite Bay Rd, 14 Sep. 1964, *N. Marchant* 64222 (PERTH); Coragina Rock N of Mt Ragged, 15 Sep. 1971, *N. Marchant* 71426 (PERTH); Coolinup Nature Reserve, 23 Sep 1991, *D.E. Murfet* 1190 (MEL, PERTH); Heinsman Rock, 30 Sep. 1991, *D.E. Murfet* 1233 (MEL, PERTH); Ponier Rock, *c.* 65 km S of Balladonia Motel on Eyre Highway, 13 Sep. 1980, *K Newbey* 7295 (PERTH); Coragina Rock, *c.* 63 km S of Balladonia Motel on Eyre Highway, 16 Sep. 1980, *K Newbey* 7417 (PERTH); 22 km N of coast at Stokes Inlet, 75 km W of Esperance, 27 Sep. 1968, *A.E. Orchard* 1225 (PERTH).

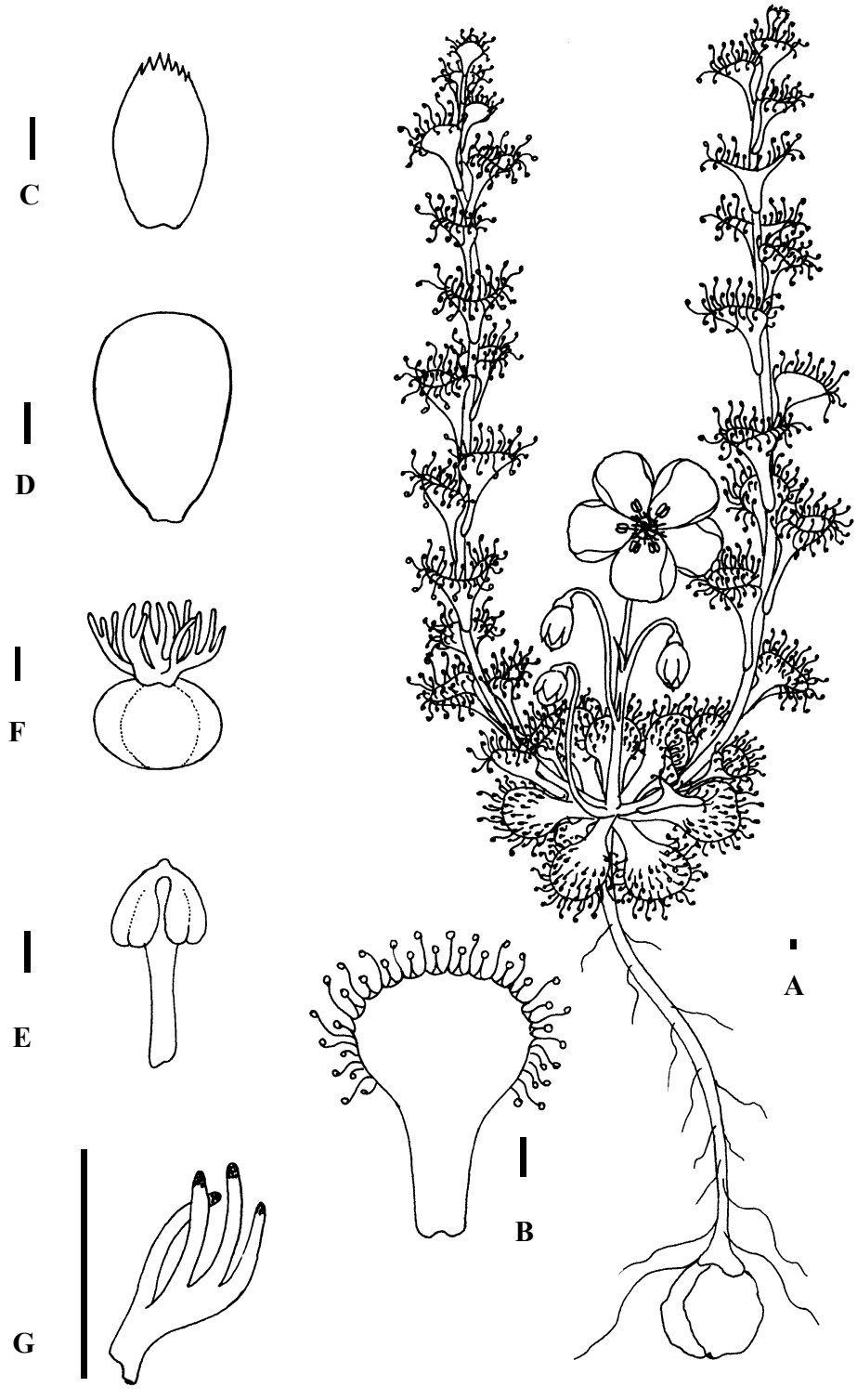

Figure 8. *Drosera ramellosa.* A.–plant; B.–basal and cauline leaf lamina; C.–sepal; D.–petal; E.–stamen; F.–ovary-styles; G.–style-stigmas, enlarged. Scale bars for all = 1 mm, except A = 0.5 mm. Drawn by A. Lowrie in 1984 from live material from Hay Flat Rd, Western Australia, voucher *A. Lowrie* 299.

Distribution. Drosera ramellosa is a widespread species from Kalbarri southwards to Cranbrook and eastwards to Mt Ragged east of Esperance. Large populations commonly occur on the aprons of granite outcrops in inland regions.

Habitat. Drosera ramellosa grows in saturated winter wet grey sandy soils, clayey sand soils or red loam soil amongst low shrubs on the shores of lakes, floodways, watersheds and creek margins as well as in moss on the aprons of granite outcrops.

Flowering period. July to September.

Conservation status. Drosera ramellosa is a common species and is currently not under threat.

Etymology. From the Latin *ramosus* – much branched, in reference to the erect leafy innovations arising from the basal rosette of leaves.

Affinities. Drosera ramellosa differs from all members in the sect. *stolonifera* by having: 1–3 (mostly 2) erect major axis bearing only alternate leaves and inflorescences arising from the basal rosette of leaves bearing pendulous fruit.

Notes. Drosera ramellosa is often found in small compact colonies up to 15 cm diam. Whether this is the product of asexual reproduction, or the result of poor seed dispersal, is unknown.

An unusual but common habitat for *Drosera ramellosa* is on the banks of salt lakes. *D. ramellosa* grows just above the flood level of the salt lake banks in sandy, salt-free, rainwater leached soils.

Much confusion has arisen from Diels' German in translation to English in regard to what habitat the type was collected from by Preiss on Rottnest Island. Diels recorded "Ufer des Sees" which was firstly translated to mean "shore of the sea" when in fact it should have been translated as "bank of the lake".

Drosera rupicola (Marchant) Lowrie, *comb. nov.*

Drosera stolonifera subsp. *rupicola* N. Marchant, *Fl. Australia* 8, 384 (1982). *Type:* Murray Rock, SE of Hyden, W.A. [Western Australia], 22 September 1971, *N. G. Marchant* 7l/680 (*holo:* PERTH 06230954).

Illustrations. R. Erickson, *Plants of Prey in Australia*, plate 4: upper left (1968); P. Nikulinsky, *Fl. Australia* 8: 44, fig. 12 A–D (1982).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 147A,B (1987).

A tuberous-rooted *perennial herb*, with 3–5 semi-erect lateral stems up to 15 cm long mostly arising from the centre of a basal rosette of leaves (which is sometimes absent); foliage mostly golden-green but often reddish or bronze, cauline leaves of the lateral stems in whorls of 3 or 4. *Tuber* red, turbinate, *c*. 30 mm long, *c.* 20 mm diam., enclosed in a number of brown papery sheaths; vertical stolon (below ground), 15–20 cm long, prostrate stolon (when present on soil surface) up to 5cm long. *Basal leaves* petiole flat, 2.5–11 mm long, 1–3 mm to 1.5–5 wide; lamina obovate, 3–9 mm long, 3–10 mm wide, adaxial surface with insect-trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole dilated towards the lamina (when flattened), 5–7 mm long, 0.5–2 to 1–3 mm wide, slightly

longitudinally folded, lamina variable throughout, transversely-elliptic to depressed-ovate, 4–10 mm long, 5.5–15 mm wide, with insect trapping retentive glands around the margins and smaller glands within, sides mobile, folding together onto captured insects. *Inflorescences* 1–4 racemes, arising from the basal rosette of leaves and sometimes also from lower axils of the semi-erect stems; racemes 8–10-flowered, sweetly perfumed, 10–12 cm long (including scape); scape green, glabrous; pedicels green, terete, 6–17 mm long, glabrous. *Sepals* green, broadly ovate or elliptic, acute, 2.5–4 mm long, 1.5–2.5 mm wide, margins in lower half entire, remainder and apex irregularly dentate and serrate tipped with a few glands, adaxial surface with a few scattered minute sessile glands, otherwise glabrous. *Petals* white, obovate, apex truncate and crenate 9–10 mm long, 5–6 mm wide. *Stamens* 5, 2.5–3 mm long; filaments and anthers white, pollen yellow. *Ovary* yellow, subglobose, *c*. 1.5 mm long, *c*. 2 mm diam. at anthesis. *Styles* 3, white, red at the base *c*. 1.5 mm long, each divided into many terete segments, lowermost segments almost whorled, branching more than the erect spreading remainder; stigmas forming 1–3 knob-like projections at the apex of each style segment. *Fruit* broadly obovoid, 4.5–5 mm long, 4.5–5 mm diam., containing *c*. 28 seeds. *Seeds* greyish brown, variably shaped within the bounds of a cylindrical or rectangular figure, apical pole truncate, with a central umbo surrounded by a small flattened apron, longitudinal sides to basal pole irregularly undulate, testa cell pattern reticulate, foveate, ridges irregular, cell floors shallow and irregular, 1–1.3 mm long, 0.8–1 mm wide. (Figures 9: (species illustration); 13: C–D (seed micrographs); 14: L (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: Chingah Hills NW of Muntadgin along road to Muntadgin from junction with Narembeen–Merredin road, 26 Sep. 1974, *L. DeBuhr* 3801 (PERTH); Bushfire Rock, 28 Aug. 1990, *A. Lowrie s.n.* (MEL, PERTH); Borrikin Rock, 4 Sep. 1967, *A. R. Main s.n.* (PERTH); Sandlewood Rocks, 30 miles [48 km] S of Moorine Rock, 16 Sep. 1964, *N. Marchant* 64232 (PERTH); 12 miles [19.2 km] SE of Merredin on Muntadgin road, 17 Aug. 1964, *N. Marchant* 64116 (PERTH), Merredin Rock, NE of town, 21 Sep. 1970, *N. Marchant* 70320 (PERTH); 18 miles [28.8 km] E of Pithara, 22 July. 1971, *N. Marchant* 71301 (PERTH); Emu Rock, 21 Sep. 1971, *N. Marchant* 71594 (PERTH); 3.1 miles [4.9 km] W of cross roads SW of Lake Cronin, 21 Sep. 1972, *N. Marchant* 72786 (PERTH); 1.5 km S of North Ironcap *c.* 74 km E of Hyden, 13 Sep. 1981, *K Newbey* 8902 (PERTH); 15 miles [24 km] E of Ballidu, 9 Sep. 1946, *R.D. Royce* 1238 (PERTH); Mt Cramphorne E of Muntadgin, 28 July 1963, *R.D. Royce* 7858 (PERTH); Mt Hampton, 7 Aug. 1972, *M. Trudgen s.n.* (PERTH).

Distribution. On inland granite outcrops from Pithara to south-east of Hyden.

Habitat. Drosera rupicola grows in loam soil washes on the aprons of granite outcrops.

Flowering period. July to October.

Conservation status. Drosera rupicola is a common species and is currently not under threat.

Etymology. From the Latin *rufus* – rock and suffix *cola* – dweller, in reference to its preferred granite outcrop habitat.

Affinities. Drosera rupicola differs from all members in sect. *Stolonifera* by having: a turbinate tuber; leafy whorls along the semi-erect lateral stems with transversely-elliptic to depressed-ovate lamina; lamina sides mobile, folding together onto captured insects; and seeds greyish brown, colliculate, reticulate-foveate and variably shaped within the bounds of a cylindrical or rectangular figure.

Notes. All species in sect. *Stolonifera* have small digestive glands centrally positioned close to the lamina

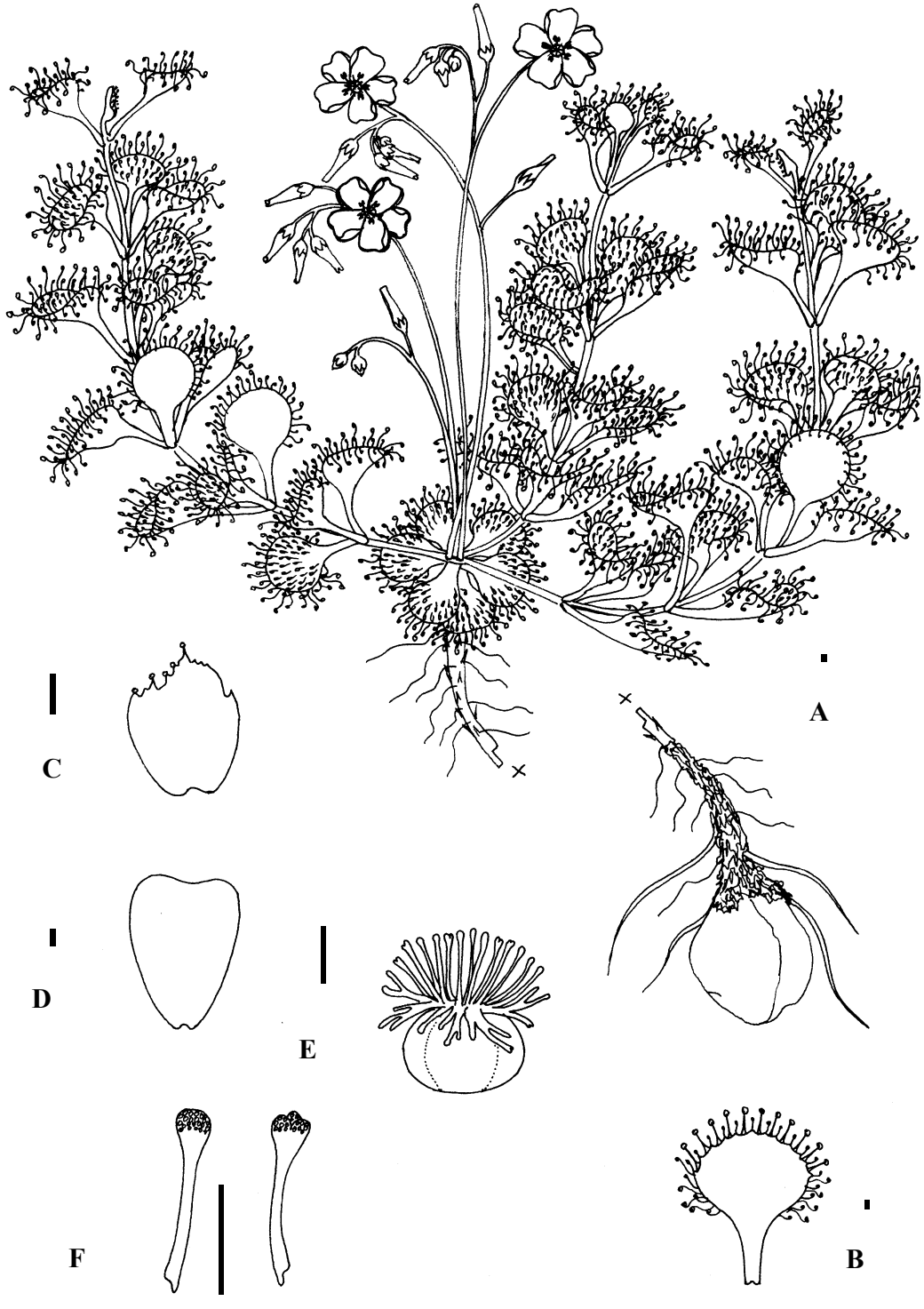

Figure 9. *Drosera rupicola.* A.–plant; B.–cauline leaf lamina; C.–sepal; D.–petal; E.–ovary-styles; F.–style-stigmas, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 1984 from live material from Bushfire Rock, Western Australia, voucher *A. Lowrie s.n.*, 28 August 1990.

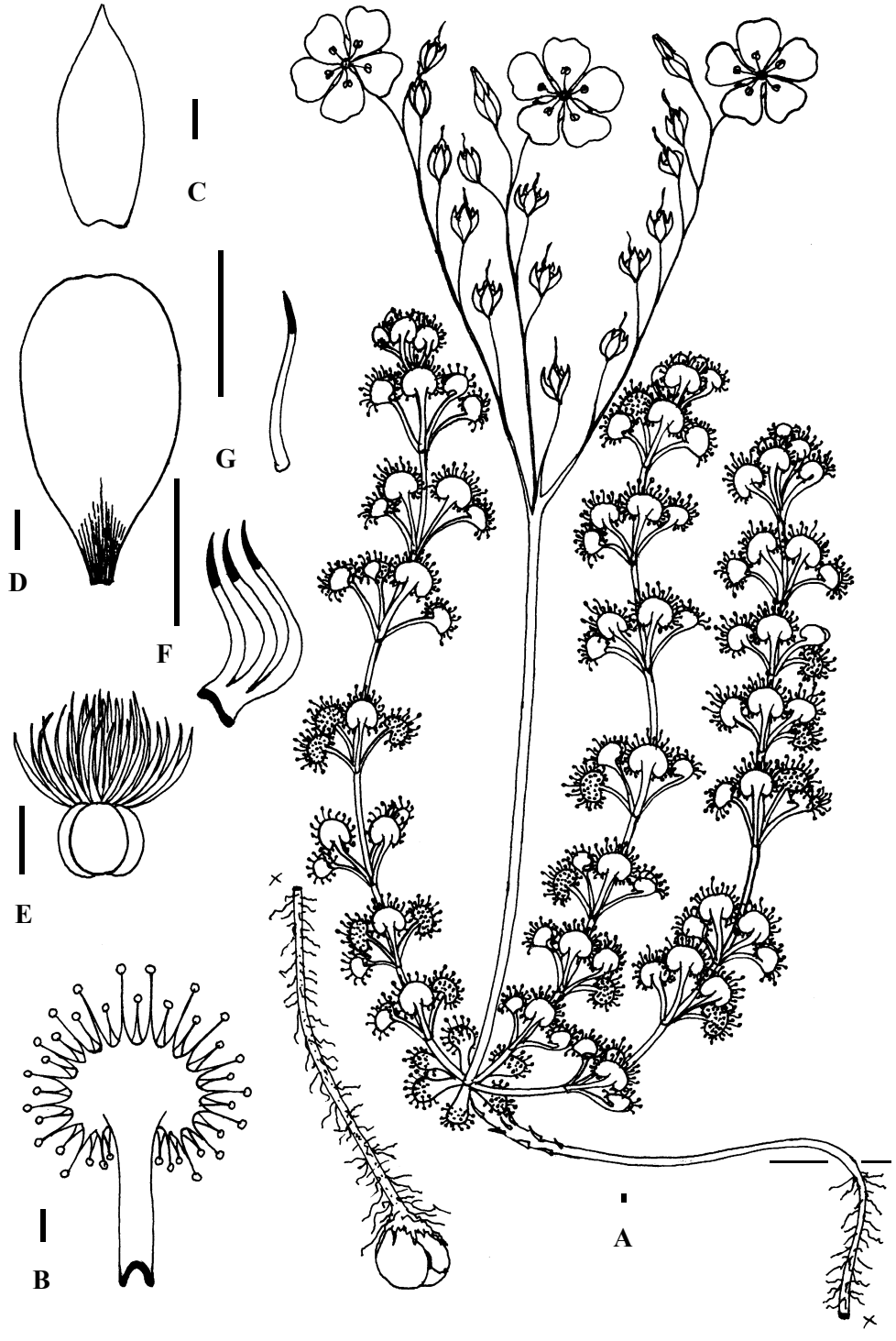

Figure 10. *Drosera stolonifera.* A.–plant; B.–cauline leaf lamina; C.–sepal; D.–petal; E.–ovary-styles; F.–whorled style-stigmas, enlarged; G.–erect style-stigma, enlarged. Scale bars for all = 1 mm. Drawn by A. Lowrie in 2001 from dried and live material from Canning Vale, Western Australia, vouchers (dried material) *R Nash* 736; (live material) *A. Lowrie* 2634.

surface as well as longer retentive glands mostly positioned near and along the margins. Even a single marginal retentive gland has the ability to not only to capture but also hold a struggling prey for a short time.

All retentive glands have mobility. Provided caught prey continues to struggle, it provides the stimulation needed to induce other nearby retentive glands to move towards and adhere their viscid glandular tips onto the prey, thus insuring the prey does not escape. Once the prey is well restrained by a number of retentive glands, they then begin in unison to position the prey closer to the shorter digestion glands covering the adaxial surface of the lamina. It takes about an hour from prey capture to digestion zone placement. Digestion takes but a few days, after which the chitinous exoskeleton of the prey is all that remains, and this is eventually washed away by rain. The retentive glands move back to their positions on the lamina and are ready once more to capture prey.

The time taken for the prey to be digested is directly related to the number of digestion glands in contact with the prey. *Drosera rupicola* is unique within sect. *stolonifera* in as much as it also has mobile laminae. Longitudinally the two halves of a lamina can slowly fold onto the prey in a similar motion to that found in the American Venus Fly Trap *Dionaea muscipula* Ellis ex L. but not as spectacularly fast. This adaptation brings more digestion glands into contact with the prey so complete digestion time is reduced.

The flowers of *Drosera rupicola* are sweetly perfumed. They remain open during the day and night over several weeks or until pollinated.

Drosera stolonifera Endl., *Enumeratio plantarum ...Hügel* 5 (1837). *Type:* "Swan-River. [Western Australia, 3–6 or 16–17 December 1833] (*Hügel*)." (*iso:* W).

Illustrations. L. Diels, *Pflanzenr*. 26: 127, fig. 40 A–C, (1906); R. Erickson, *Plants of Prey in Australia*, plate 4: lower right (1968).

Photographs. A. Lowrie, *Carnivorous Plants of Australia* vol. 1, 127B (1987).

A tuberous-rooted *perennial herb;* foliage green, with 2 or 3 sometimes more semi-erect lateral stems 10–15 cm long arising from the centre of a sparsely leaved basal rosette of 2 leaf types, with another leaf type towards the apex, in whorls of 3 or 4 along the semi-erect stems, all 3 leaf types, petioles, erect stems and scape covered with glass-like minute glands. *Tuber* red, reniform, *c*. 10 mm long, *c*. 15 mm wide, enclosed in a number of brown papery sheaths; stolon vertical (below ground), *c.* 15 cm long, prostrate stolon commonly present, rarely absent (on soil surface), *c.* 1–1.5 mm thick, *c*. 10 cm long. *Lowermost basal leaves* few; petiole flat, 4.5–5 mm long, 1.5–2 to 2.5–3 mm wide; lamina cuneate, 4–5 mm long, 1.5–2 mm wide, adaxial surface in upper parts with insect trapping retentive glands around the margins and smaller glands within; *Upper basal leaves* lamina transversely elliptic, 3–4 mm long, 5.5–7 mm wide, adaxial surface with insect-trapping retentive glands around the margins and smaller glands within. *Cauline leaves* petiole with margins parallel, 5–10 mm long, 1–1.6 mm wide, longitudinally channeled on upper side; lamina reniform, 2.5–3.5 mm long, 4–5.5 mm wide, side margins rolled towards each other to form an open-sided, concave, cone-like arrangement facing upward, almost horizontal, with insect trapping retentive glands around the margins and smaller glands within. *Inflorescence* of a 2–3-branched corymb arising from the basal rosette of leaves and sometimes also minor ones bearing fewer flowers present arising from the leaf axils along the upper parts as well as the apex of the semi-erect leafy stems;

main corymb 15–20 cm long (including scape), 12–20-flowered; pedicels 7–12 mm long. *Sepals* ovate, acute, 3.5–5 mm long, 1.7–3 mm wide, margins entire, glabrous, black dotted. *Petals* white, obovate, apex a little crenate, 7.5–8 mm long, 4–5 mm wide. *Stamens* 5, 3–4 mm long; filaments white; anthers and pollen yellow. *Ovary* green, subglobose, *c*. 1 mm long, *c*. 1.3 mm diam. at anthesis. *Styles* 3, white, *c*. 1.5 mm long, each divided into many long segments, a number arranged in a whorl, flattened and tapering to a point and curved out and upwards from their base, remainder terete, tapering, erect in the centre of the whorl; stigmas simply formed at the apex of each style segment. *Fruit c.* 1.5 mm long, *c.* 2 mm diam., containing *c*. 12 seeds. *Seeds* Black, cupiform, testa cell pattern reticulate, ridges shallow irregular, cell floors shallow ± smooth, 0.5–0.6 mm long, 0.4–0.5 mm wide. (Figures 10: (species illustration); 13: E–F (seed micrographs); 14: M (schematic life-form illustration))

Other specimens examined. WESTERN AUSTRALIA: Claremont, July 1907, *C. Andrews s.n.* (PERTH); between Dunsborough and Cape Naturaliste, 20 Oct. 1982, *K.H. Bechinger s.n.* (PERTH); Pinjarra, Murray River, 23 Sep. 1897, *R. Helms s.n.* (PERTH); Pinjarra, [specimen marked B.], 23 Sep. 1897, *R. Helms s.n.* (PERTH); Burnside Rd, SE of Pinjarra, 21 Sep. 1997, *A. Lowrie* 1876 (MEL, PERTH); NW corner of the junction of Ranford Rd and Nicholson Rd, Canning Vale, 23 Aug. 2001, *A. Lowrie* 2634 (MEL, PERTH); Moores Rd, Pinjarra, 1 Sep. 2001, *A. Lowrie* 2640 (MEL, PERTH); Burnside Rd, SE of Pinjarra, 1 Sep. 2001, *A. Lowrie* 2641 (MEL, PERTH); Canning Vale swamps [urbanised], 15 Oct. 1970, *R. Nash* 736 (PERTH); In Nova Hollandia ad flumen Swan-River, Peninsular, Perth, 31 Aug. 1839, *L. Preiss* 1943 (MEL).

Distribution. Drosera stolonifera populations can still be found in undeveloped swampy locations southwards from Perth to Pinjarra.

Habitat. Drosera stolonifera grows in swamp heathland with paperbark trees *(Melaleuca* sp.). The soil is black, peaty, sandy and water-logged.

Flowering period. September to October. Mass flowering occurs after bushfires.

Conservation status. Drosera stolonifera is a common species and is currently not under threat.

Etymology. From the Latin *stolonis* – stolon and *fero* – to bear, in reference to the fleshy root (stolon) between the tuber and the basal rosette of the foliage.

Affinities. Drosera stolonifera is close to but differs from *D. purpurascens* (whose contrasting characters are given in parenthesis) by having: a life-form 15–25 cm tall (3–10 cm tall); cauline leaf petioles 5–10 mm long (cauline leaf petioles 8–30 mm long); and non-flowering specimens with 3 or more semi-erect leafy stems, without additional solitary cauline leaves at the base (non-flowering specimens often with only 1 erect leafy stem, bearing additional solitary cauline leaves with long petioles at the base.

Notes. Baron Charles von Hügel was in the Swan River region for 23 days between 27 November–19 December 1833, when the young Swan River Colony had only been established for 10 years. A study of his New Holland Journal (Hüegel 1994, translated and edited by Clark) reveals six possible days when he was collecting botanical specimens in suitable swampy areas for the *Drosera stolonifera* type material to have been found. The only recent observation of *D. stolonifera* close to Perth is in the Canning Vale region on swampy flats that retain moisture well into December. From the 3 to the 6 December, Hügel journeyed from Perth to Peninsula [Peninsula, now in suburb of Maylands], Bassendean, Guildford and returned, with a short detour via Helena Valley. Preiss' *D. stolonifera* material, which is similar to Hügel's

type material, was collected from Peninsula, Perth on 31 August 1839. It is possible that Hügel collected his specimens from the same location.

On the 16 December, Hügel journeyed from Perth to swampy areas in the direction of present day Mongers Lake. Swampy areas were common from Perth northwards before urbanization. So Hügel had many opportunities to collect *Drosera stolonifera* from many suitable habitats within and near the town site of Perth on his Swan River visit.

On the 17 December, Hügel traveled from Perth a short distance to an area he called the lagoons, which he described as a marshy area. If it was a fresh water area it too could possibly be a habitat for *Drosera stolonifera.* We will never establish exactly where Hügel collected the type material of *D. stolonifera* but at least the field has been narrowed down to a short list of collection areas on one of six possible days of his visit.

The illustration for *D. stolonifera* page 42, Figure 11. in Marchant (1982) drawn by Philippa Nikulinski has the soil surface line erroneously positioned immediately below the lowermost basal rosette of leaves. This soil line should be drawn just below the tips of the group of prophylls further below. This illustration was drawn from material collected at Bibra Lake, by A. S. George and the species illustrated is a flowering specimen of *D. porrecta,* not *D. stolonifera.*

Two morphs of *Drosera stolonifera* are found in south-west Western Australia, the typical variant from swampland and a hills variant. The swampland variant (which matches the type) grows in peaty sand on winter-wet heath often in association with paperbarks (*Melaleuca preissiana*). The hills variant (Lowrie 1987: photographs 127 A & C) grows in well drained (by runoff) clayey sand mixed with laterite pebbles in Jarrah woodlands and also well drained (by runoff) red loamy soils in Wandoo woodlands. The swampland plant has foliage that remains green throughout its life cycle whereas the hills plant has foliage that starts out green but becomes more reddish with age. The hills morph is generally a more robust individual than the swampland one. Further research using chromosome and DNA studies may establish further grounds to separate these two variants and allow formal recognition of the hills variant.

Drosera stolonifera produces a thick clear jelly-like mass which encloses the first emerging plant bud. This gel remains until the bud bursts into leaf. The gel appears to protect the plant bud from mechanical damage such as that from abrasive sand grains as it grows through the soil. It is possible the gel acts hydraulically to move soil particles ahead away from the fragile plant bud as it grows through the soil. The gel may also protect the juvenile bud from attack by foraging insects or slugs at the soil surface.

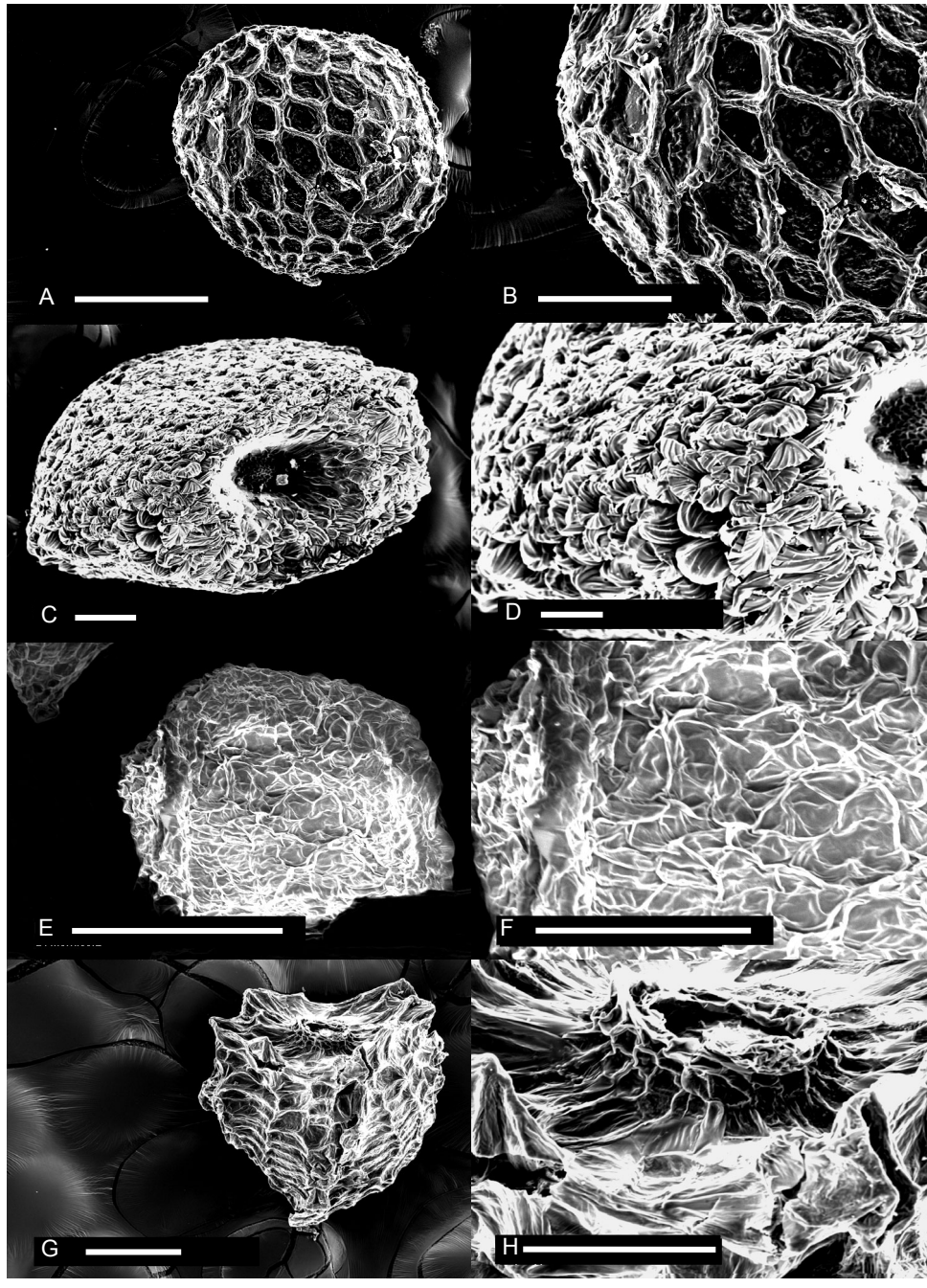

Figure 11: SEM micrographs of *Drosera* seeds and details of testa cell patterns. A–B: *D. fimbriata* (*A. Lowrie* 1583, PERTH). C–D: *D. humilis* (*A. Lowrie* 1543, PERTH). E–F: *D. monticola* (immature seed) (*P. Mann* s.n 8 October 1991, PERTH). G–H: *D. platypoda* (*A. Lowrie* 2573, PERTH). Scales: A,C,E,G = 200mm B,D,F,H = 100µm.

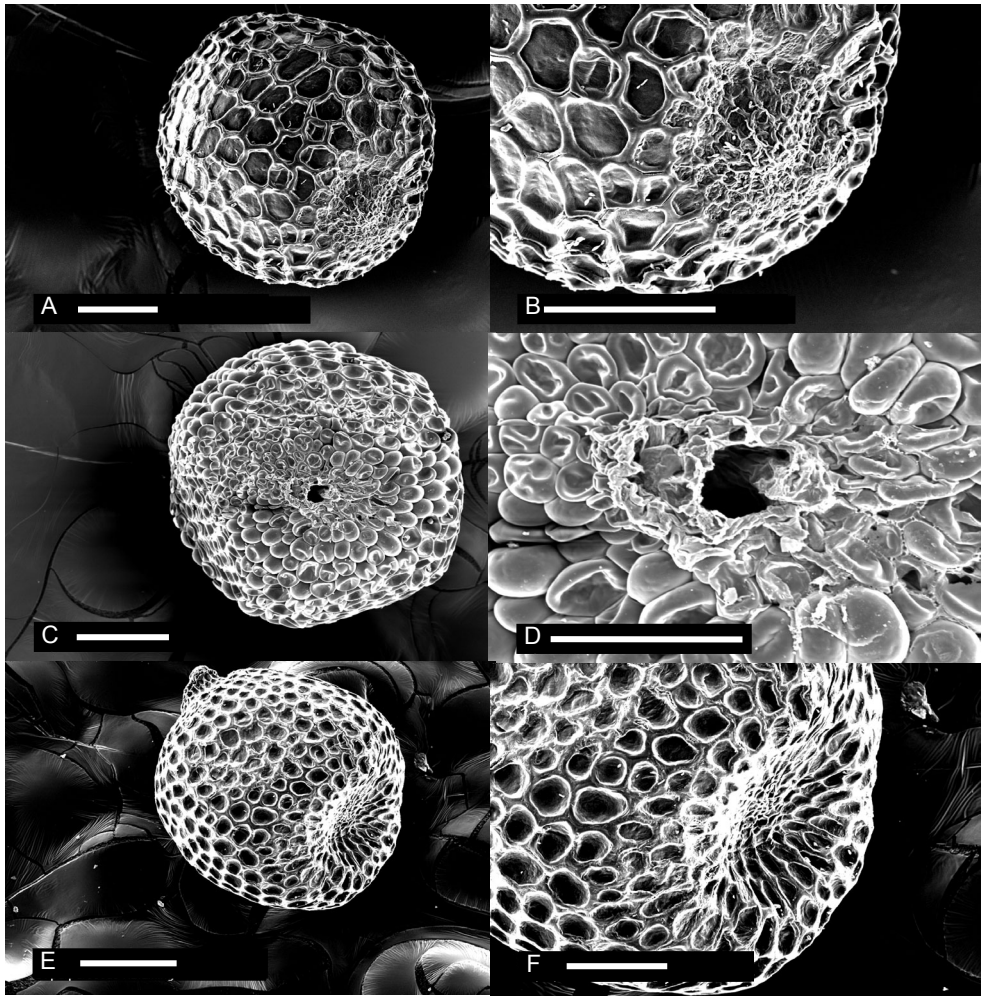

Figure 12. SEM micrographs of *Drosera* seeds and details of testa cell patterns. A–B: *D. porrecta* (*A. Lowrie* 2639., PERTH). C–D: *D. prostrata* (*A. Lowrie* 1813, PERTH). E–F: *D. purpurescens* (*A. Lowrie* 1915, PERTH). Scales: A,C,E = 200mm B,D,F = 100µm.

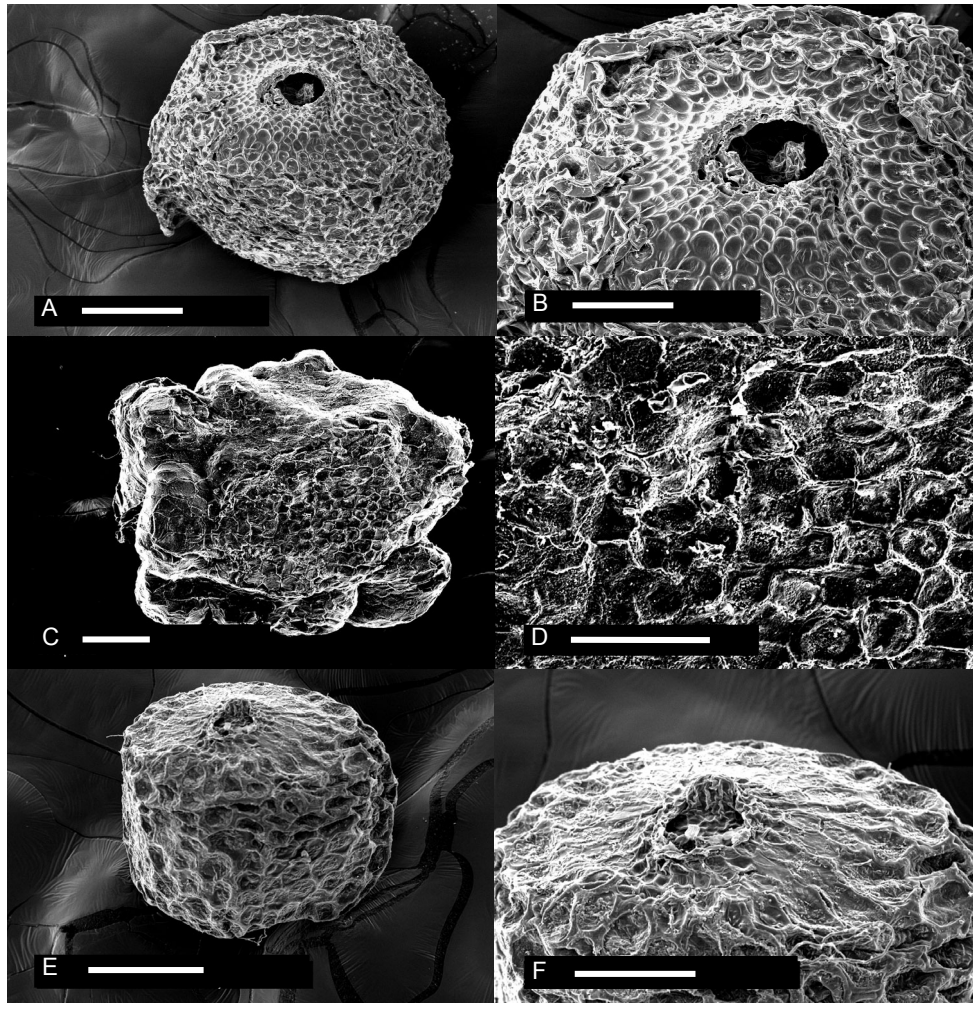

Figure 13. SEM micrographs of *Drosera* seeds and details of testa cell patterns. A–B: *D. ramellosa* (*A. Lowrie* 299, PERTH). C–D: *D. rupicola* (*A. Lowrie* 2093, PERTH). E–F: *D. stolonifera* (*A. Lowrie* 2640, PERTH). Scales: A,C,E = 200mm B,D,F = 100µm.

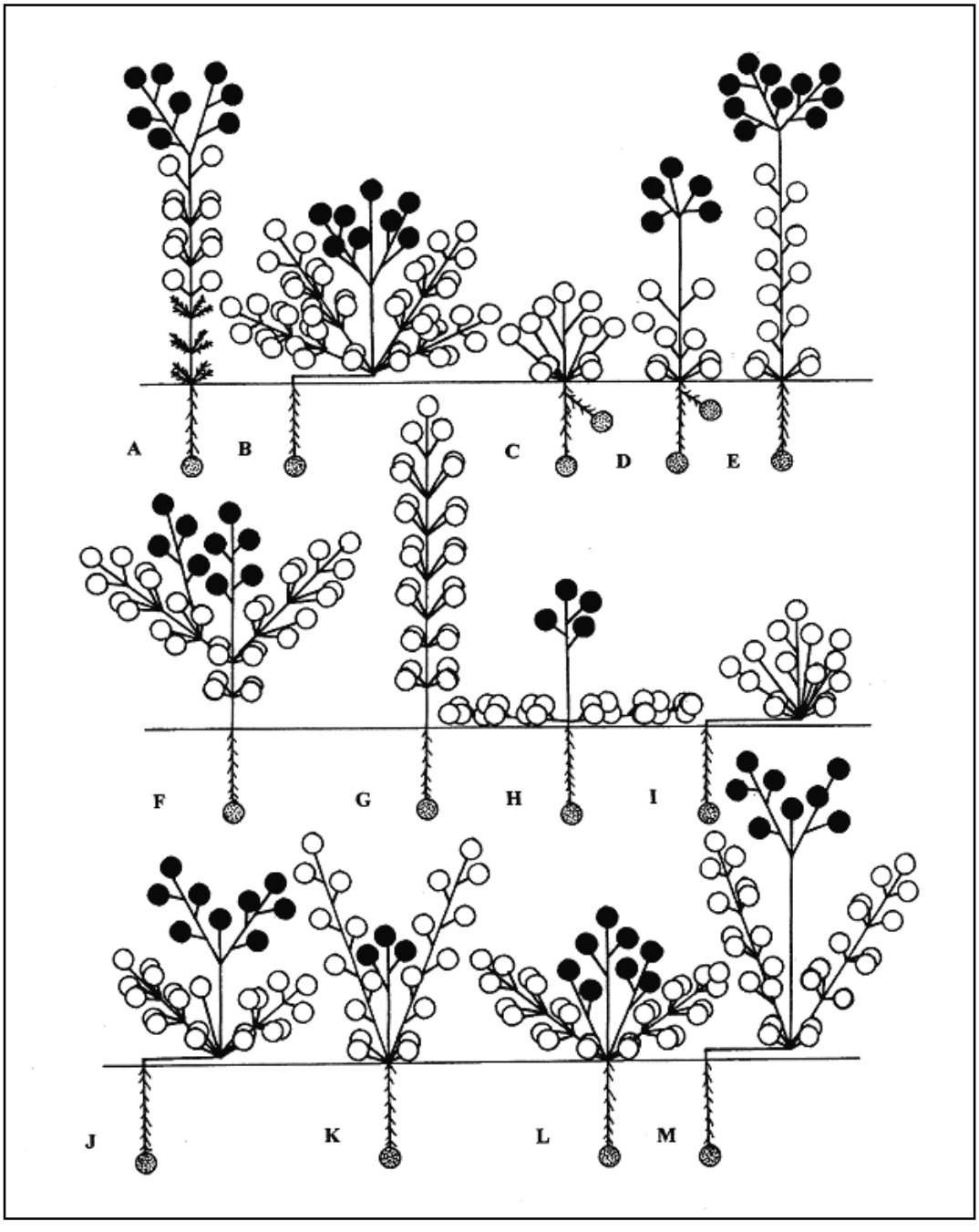

Figure 14: Schematic life-form illustrations of Sect. *Stolonifera.* Stippled circles below the long horizontal lines representing the soil surface are the tubers, whereas open circles above this line represent the leaves and closed circles the flowers. Taxa having horizontal soil surface resting stolons are illustrated with their stolons in parallel just above soil surface line.
A – *D. fimbriata*, B – *D. humilis*, C – *D.monticola (*non-flowering), D – *D. monticola* (flowering), E – *D. platypoda*, F – *D. porrecta* (flowering), G – *D. porrecta* (non-flowering), H – *D. prostrata*, I – *D. purpurascens* (non-flowering), J – *D. purpurascens* (flowering), K – *D. ramellosa*, L – *D. rupicola*, M – *D. stolonifera.* Drawn by Allen Lowrie (2002) in the style of Diels' schematic illustrations (1906: 35).

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