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A revision of Australian *Eriocaulon* (Eriocaulaceae)

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Abstract

Thirty three species of *Eriocaulon* are recognized in this generic revision for Australia. *Eriocaulon carsonii* F.Muell, is recognized with 3 subspecies. The identity of *E. pallidum* R.Br. remains uncertain and this species is treated as 'Incertae Sedis'. A conservative approach to species recognition has been adopted and a number of forms are discussed under *E. athertonense* G.J.Leach, *E. australe* R.Br., *E. cinereum* R.Br., *E. depressum* R.Br. ex Sm., *E. nanum* R.Br., *E. patericola* G.J.Leach and *E. pygmaeum* Sol. ex Sm. The new species *E. fenshamii* and *E. wolseleyi* are described. Lectotypifications are provided for *Electrosperma australasicum* F.Muell., *Eriocaulon ciliiflorum* F.Muell., *E. concretum* F.Muell., *E. nanum* R.Br., *E. nigricans* R.Br., *E. smithii* R.Br., *E. spectabile* F.Muell. and *E. willdenovianum* Moldenke. The genus is found in all mainland States and Territories of Australia but is best represented in the tropics and sub-tropics. Species with extra-Australian distributions are *E. australe*, *E. cinereum*, *E. depressum*, *E. setaceum* L., *E. truncatum* Buch.-Ham. ex Mart., *E. willdenovianum* and *E. zollingerianum* Koernicke. A key to the Australian species, descriptions and distribution maps are provided. Seed coat ornamentation is an important diagnostic and identification character and SEM images are provided for each species.

Introduction

The Eriocaulaceae is represented in Australia by the single genus *Eriocaulon* and as recognised in this revision comprises 33 species with 3 subspecies. Although on species numbers it is a relatively minor genus in the Australian context, it nevertheless assumes some importance as a distinctive element in the wetland habitats it occupies and with a number of taxa of some conservation significance (Chambers et al. 2003; Davies et al. 2007).

The family displays an essentially tropical distribution centred on the New World and comprises about 10 genera and 700 to 1400 species (Stützel 1998). *Eriocaulon* is one of the larger genera with approximately 400 known species worldwide with centres of diversity in South America, Africa and the Indian subcontinent. Other large genera are *Paepalanthus* (c. 500 species) and *Syngonanthus* (c. 200 species).

The only Australia-wide treatment of the genus is that of Bentham (1878). A Kimberley region treatment (Leach 1992) at that time recognised 16 species in the Kimberley of which seven were considered as undescribed taxa. The treatment of Leach (2000a) provided a full account of the genus as it was known at that time in the Northern Territory with 21 species recorded. Evans (1966) and later Conn (1993) provided accounts for NSW with four species recognised in that State. Conn (1994) recognised two species in Victoria. The only account for Queensland is that of Bailey (1902). The lack of a contemporary Australian treatment and the notorious

difficulty in interpreting the diverse floral structure of the unisexual flowers which are only 1 to a few mm long has led to a confused application of the many published names.

This study highlights a number of species complexes and trends in some morphological characters that are not fully resolved by morphological data. For example the interpretation of the male sepaline spathe and the degree of fusion of the parts is discussed under *E. pygmaeum* and *E. cinereum*. Molecular analysis should assist in further unravelling these complexes and character variation and may lead to the recognition of further taxa.

Materials and Methods

All measurements are from dry material. Specimens were borrowed from AD, BRI, CANB, CNS, MEL, NSW and PERTH. Further material was examined at B, BM, K, LINN and Z. Distribution maps have been generated from the Australian Virtual Herbarium (CHAH 2017). Doubtful records not seen by the author were excluded from the data. Maps were prepared using QGIS software. Seeds were extracted from dried specimens, mounted on stubs with double sided tape and gold coated for photography using a scanning electron microscope. Data is coded and stored in the DELTA system (Dallwitz et al. 1993) which was used to generate the initial descriptions.

Morphology and Terminology

Life form and phenology: The Australian species, with the exception of *E. setaceum,* are herbs with a basal rosette of leaves. Only the truly aquatic species, *E. setaceum,* has an elongated stem bearing filiform cauline leaves. The species in Australia are typically annuals of seasonally wet areas. In the strongly monsoonal climate of northern Australia, species often germinate while inundated in the early part of the wet season. As the wet season progresses and the water recedes the emergent flower heads mature and as the substrate is drying out the mature seeds are shed. The southernmost distributed species (*E. australasicum*) is a summer flowering species with flowers recorded from November to March. Specimens with mature seed are typically collected late in the wet or early into the dry season. A few species (e.g. *E. aloefolium, E. rivicola*, *E. willdenovianum*) have been observed to be perennial provided there is a year round water supply such as in permanent creeks or in mound springs.

Often several species can be found growing together and this has resulted in numerous mixed gatherings on herbaria sheets. Despite the frequency of mixed populations, there has been little evidence to suggest that hybridization is a frequent occurrence. The name *E. brunonis* (see discussion under *E. spectabile*) is an exception with a postulated hybrid origin.

***Peduncle development*:** There are many collections of Australian *Eriocaulon* where the flower heads are sessile in the leaf axils. This feature has been observed across several taxa and these plants have a very distinctive habit which has led to some taxonomic recognition with at least phrase names proposed. A number of collections from the NT and Cape York appeared to be a distinctive entity and was given the phrase name *Eriocaulon* sp. Kakadu (*J.R. Clarkson 6057*). However, in some collections (e.g. *Brennan 2887*, *Latz 10180*) there are occasional flower heads that show some development of the peduncle. On examination of the floral structures of this entity, it is identical with *E. depressum*. Within *E. tricornum* a population was observed where numerous individuals had sessile heads (*Leach 4646*) but were clearly in association with plants with emergent heads on long peduncles (*Leach 4645*). A similar feature has also been observed in *E. carpentariae* with a collection (*Beauglehole 54794*) where the peduncle varies from more or less sessile to 8.5 cm long. The sessile heads have been observed to have normally developed seeds.

Specimens of *E. pusillum* from the Tiwi Islands collected at the same location and date by Fensham are identical in floral structure but one specimen has sessile heads (*Fensham 485*) while the other has elongated peduncles (*Fensham 489*). Variants with sessile heads have in all cases been attributable to a described taxon with normal peduncular development. As these have also been observed growing mixed with individuals with elongated peduncles, it is considered to be a developmental variation that does not merit taxonomic recognition.

***Peduncle sheath*:** The peduncle has a closed sheath at the base formed by a single leaf (Stützel 1998). The sheath may be shorter or longer than the other leaves and the length of the sheath has been found to be a significant diagnostic character (Davies et al. 2007). Sheath pubescence, the extent of fusion, apical shape and number of ribs are additional characters that have been used in descriptions.

***Involucral bracts*:** A number of species have the involucral bracts thickened at the base and the bract is quite rigid. The flower head retains its shape at maturity with the floral bracts held tightly in the head. (e.g. *E. australe, E. willdenovianum, E. depressum*). This contrasts with those species where the involucral bracts are relatively

thin and become reflexed as the head matures. In these species the floral bracts and flowers become more exposed and the head readily disintegrates.

***Floral dimorphism*:** Some species show differing floral morphology within a head of flowers and the term floral dimorphism has been used here to describe this condition. For example, the lowermost female flowers of *E. fistulosum*, *E. carpentariae* and *E. depressum* have sepals with a broad dorsal wing. The upper female flowers lack the sepaline whorl. This can be confounding when either using the key or comparing descriptions.

***Perianth dimorphism*:** The perianth segments within a whorl in some species are dimorphic. In some species in the female flowers where there are three sepals this can take the form of the two lateral sepals being larger and of a different shape with the third median sepal being smaller (e.g. illustrations of *E. australe* (Leach 2000a) and *E. athertonense* (Leach 2000b)). In some cases the third smaller sepal is lost altogether and a 3-merous flower appears to have only two sepals. In other species the reverse occurs where one perianth segment is enlarged and the others are smaller. A common example in the male flowers of some species is where the petal at the opening of the sepaline spathe is enlarged. The reduction or even loss of some perianth segments can confuse the interpretation of the actual number of perianth segments. Further complication occurs where perianth segments are readily caducous or where the dimorphism is only a subtle difference in size.

***Sepals of male flowers*:** The sepals of the male flowers show considerable variation in degree of fusion. They can appear free or only slightly fused at the base of the segments. The sepals can also be completely fused into a tubular structure such as in *E. australe*. In many other species the segments are fused into a spathe-like structure. This typically shows the original number of segments by the number of lobes at the spathe apex. The depth of lobing can vary and some of this variation is attributed to physical processes that separate the spathe segments as the flower ages. *E. pygmaeum* and *E. cinereum* are species that are treated here as showing considerable variation in the degree of fusion of the male sepals. Refer to those species accounts for further discussion.

***Sepals of female flowers*:** The sepals of the female flowers show an extraordinary diversity both in reduction and increasing complexity. The simplest structure of the 3-merous flower has equal sepals which are a simple planar elliptic shape. In many species there is a reduction of the third median sepal which in some species is seen as only a vestigial segment or is lost altogether. In contrast with this reduction there is in other species an increasing complexity in the structure of the female sepal. Compared with the simple planar sepal some species show a folding of the sepal into a navicular structure. This is further developed in other species into a sepal which has a ridged keel and in other species to a structure with a broad dorsal wing (Fig. 1).

***Carpel number*:** The number of carpels and hence ovary locules being either two or three is considered a strong character in the Australian species at least for identification purposes. However, Zhang (1999) in the illustration of *E. echinulatum* shows flowers with either a 2-locular or 3-locular ovary. Such variation within a species has not been observed in Australian species.

***Seed coat*:** It has become increasingly recognised that the seed coat morphology can provide a diagnostic set of characters that are both useful for identification and in providing data on species relationships. Nair (1987) and Giulietti et al. (1987) observed that most species had a constant seed coat pattern and this observation has been verified during the current study of the Australian species. The seed coat characters can, for the most part, be as readily observed under a dissecting microscope as the floral features.

The ontogenetic development of these features has been discussed by Giulietti et al. (1987) and briefly summarised by Phillips (1994). In summary, the testa is always formed from two integuments, each consisting of two cell layers. The outermost layer of the outer integument is very thin and composed of much smaller cells than the inner layer. In most species, this thin outer layer degenerates so that the characteristic surface of the seed is formed only by the inner layer of the outer integument. However, in some species and in unripe seeds, the outer layer of the outer integument remains intact and forms a thin diaphanous layer over the collapsed cells of the inner layer (e.g. see *E. cinereum*).

In most species the outer layer disappears, at least after wetting, and the characteristic surface formed by the anticlinal walls of the cells of the inner layer of the outer integument becomes visible. The anticlinal walls often have various thickenings which persist and form the distinctive sculpturing of the seed. The wall thickenings can be even around the cell (e.g. *E. fistulosum*, *E. nematophyllum*) or restricted to particular walls such as the longitudinal wall (e.g. *E. pusillum*). Particular regions of the cell wall can become thickened and these develop into projections which have a distinctive location (e.g. predominantly on the transverse walls in *E. odontospermum*) and orientation. Small warty protuberances are present in some species scattered over the thickenings and cell wall surface (e.g. *E. tortuosum*). These are referred to as tertiary protuberances by Zhang (1999).

Seed dispersal: Seed dispersal mechanisms vary greatly within the Australian species but all appear to be related to water dispersal. The tardily dehiscent capsule of *E. setaceum* and the apparent diaspore being the entire 3-locular ovary is discussed in further detail under that species. The development of a broad dorsal sepaline wing on the female sepals in some species appears to be a mechanism to assist seed dispersal in that, following release from the locule, the seed is observed to be trapped within the fold of the sepal. Hairs at the opening of the sepaline cavity further assist in retaining the seed within the sepal. The seed is thus dispersed with the broad sepaline wing presumably assisting with flotation and water dispersal (Fig. 1). Flower heads with floral dimorphism therefore have two types of diaspore: the naked seed dispersed directly from the capsule and the diaspore made up of the seed retained within the winged female sepal.

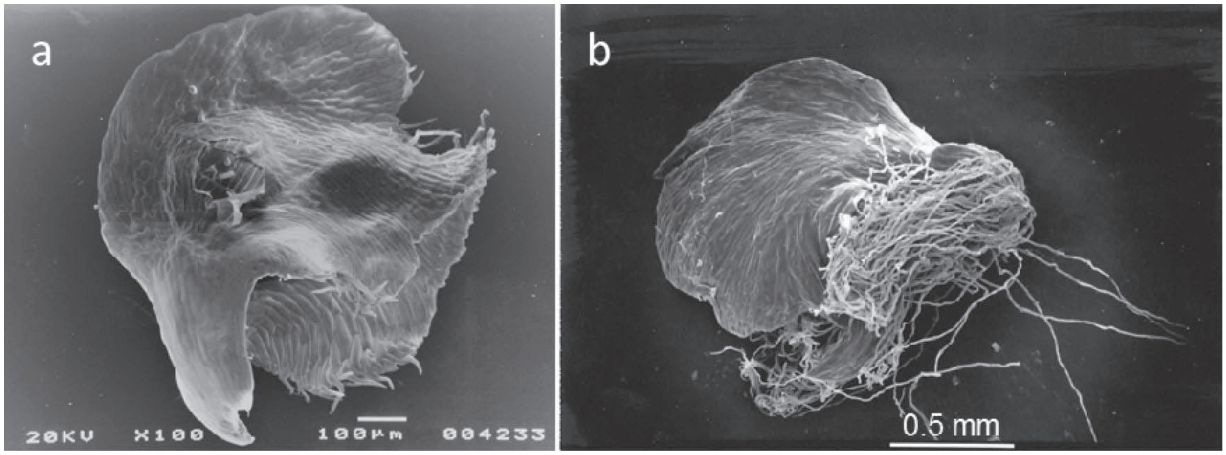

Fig. 1. Female sepals of *E. fistulosum* (**a**) and *E. carpentariae* (**b**) showing the broad, flattened dorsal wing, hairs at opening of folded sides of the sepal and the seed retained within the cavity of the sepal. *Eriocaulon fistulosum* has an extended pointed apex, a feature that is termed 'crested'. *E. fistulosum* from *Clark 1218*; *E. carpentariae* from *Henry 125*.

E. tricornum is unusual amongst the Australian species in that the three fleshy aristate female petals retain the seeds and the entire petaline whorl with the entrapped seeds functions as the diaspore.

Seed surface ornamentation is also considered to have a role in seed dispersal in some species. These ornamentations can increase the diameter and surface area of the seed which presumably assists with flotation and water dispersal. The collapsed peg-like projections of the cell wall in some species come into a vertical position after hydration, so that the diameter of the seed can be up to twice that at dehiscence. It is suggested that the projections may either increase the surface area, act to anchor the seed in the substrate or assist in attaching the seed to animals. However, globally the most widespread species is *E. cinereum* which has a smooth shiny seed (Fig. 4 a) through retention of the outer cell layer. This species lacks any specialisations in either seed coat or female sepal morphology to assist dispersal but appears to be a readily dispersed species and has been reported as a weed, particularly in rice paddies (Soerjani et al. 1986, Stützel 1998).

Vivipary: The emergence of plantlets from within the head has been observed in a number of Australian species such as *E. lividum* and *E. inapertum*. The character has led to formal recognition of some taxa such as *E. sexangulare* L. f. *viviparum* Moldenke. Zhang (1999) notes that this behavior has been observed in a number of species of *Eriocaulon* such as *E. sexangulare* L., *E. willdenovianum* and *E. modestum* Kunth and has also been observed in some taxa of the genera *Paepalanthus* and *Syngonanthus*. While an interesting feature in terms of presumably an asexual reproductive strategy it is not a character that carries any taxonomic weight.

Subgeneric classification

Subgeneric classifications and attempts at grouping species of *Eriocaulon* have taken a variety of approaches and produced highly diverse results. The most recent subgeneric classification is that proposed by Zhang (1999) based on a study of south-eastern Asian species. Characters used by Zhang included floral morphology, peduncle anatomy and seed coat ornamentation. Zhang (1999) also provides a compilation and summary of the classifications by Fyson (1922), Satake (1940), Ma (1991) and Ansari and Balakrishnan (1994). A number of these authors, including Zhang (1999), used various formal subgeneric, sectional and series names, whereas the classification of Ansari and Balakrishnan (1994) simply used 12 informal numbered sections. These classifications present markedly different categories, placements and groupings of species and it is difficult to

reconcile them to present a unified single classification. A factor contributing to the differences is that each one was based on a geographic group of species i.e. S.E. Asia, India, Japan, China.

Zhang recognized two subgenera. Subgenus *Spathopeplus* Koern., which is not known for Australia, has the sepals of the female flowers fused to some extent into a spathe, the epidermal cells of the peduncular ribs are thickened and the petaline glands are sunken. The subgenus *Trimeranthus* Nakai, to which all Australian species would belong has free female sepals, the epidermal cells of the peduncular ribs are not thickened and the petaline glands are on the petal surface. In defining the subgeneric sections, Zhang attributed importance to such characters as anther colour, female sepal dimorphism with reduction of the median sepal, female petal dimorphism with enlargement of the median petal, presence of a stem with cauline leaves, extreme enlargement of the median male petal and seed ornamentation features.

In the only Australian treatment, Bentham (1878) proposed two unnamed Series based solely on whether the flowers were 2- or 3-merous. Series I was circumscribed as 'Flower 3- or rarely partially 2-merous by abortion, especially the females'. Series II was circumscribed as 'Flowers all 2-merous'.

Mueller (1859) proposed section *Dimorphogyne* in which he placed his *E. heterogynum* F.Muell. (= *E. depressum* R.Br. ex Smith). As circumscribed by Mueller the section would include those 2-merous species that have the lower flowers in the head with a sepaline whorl while the upper flowers lack sepals. These features are shared with two other Australian species, *E. carpentariae* G.J.Leach and *E. fistulosum* R.Br. ex Sm.

In addition to this group, other groups within the Australian species can be recognised. Some equate to previously proposed subgeneric categories. For example, a group defined by having pale anthers would include *E. australasicum* (F.Muell.) Koern., *E. cinereum* R.Br., *E. patericola* G.J.Leach, *E. rivicola* G.J.Leach, M.D.Barrett & R.L.Barrett, and *E. scullionii* G.J.Leach and equates with section *Leucantherae* Fyson. *Eriocaulon australe* R.Br. and *E. willdenovianum* Moldenke seem closely related and are typically grouped together in most other classifications, including placement in the section *Heterochiton* Ruhl (Zhang 1999). The only truly aquatic species with cauline leaves, *E. setaceum,* also has an unusual ovary dehiscence mechanism and is often treated as an isolated species, being placed, for example, in section *Macrocaulon* Ruhl by Zhang (1999).

Other Australian species are difficult to place in Zhang's classification and, if applied, it would separate what otherwise appear to be closely related taxa. For example, *E. athertonense* and *E. odontospermum*, which appear to be closely related on seed ornamentation, would be placed in different sections due to the degree of dimorphism of the female sepals. The emphasis in Zhang's classification on the dimorphism of perianth parts may not be so well supported in the Australian species, as this character shows quite a continuum across species.

As discussed above, the use of solely morphological characters in circumscribing infrageneric taxa has led to disparate classifications. To clarify relationships of species, molecular analyses of an array of species covering the total distribution of the genus needs to be carried out.

Taxonomy

ERIOCAULACEAE

Herbs, annual or perennial, monoecious, rarely dioecious. *Leaves* alternate, usually rosetted, rarely cauline, parallel-veined and grass-like, lacking well-developed sheath. *Inflorescence* a dense, white to cream or grey to black head usually terminating a peduncle, rarely sessile, subtended by an involucre of bracts. *Flowers* generally subtended by a bract, often stipitate, 2–3-merous, actinomorphic or zygomorphic, hypogynous, unisexual, both sexes intermingled in the same head, or the female flowers marginal, rarely heads unisexual. *Sepals* 0–3, free, or connate to form a lobed tube or spathe-like scale. *Petals* 0–3, free, often separated from outer perianth segments by expansion of androphore or gynophore. *Stamens* in dimerous flowers 2 or 4, in trimerous flowers (3)–6; filaments adnate to the corolla tube or appearing to rise from apex of androphore; anthers usually 2-celled, opening by longitudinal slits. *Gynoecium* of 2–3 carpels, connate, superior, often stipitate; ovary with as many cells as carpels; ovules 1 per cell; style terminal, stigmatic branches as many as carpels, simple or bifid, linear, often with appendages. *Capsule* loculicidal.

A family of c. 13 genera and 1200 species, predominantly in the tropics and subtropics.

ERIOCAULON L.

Type: *E. decangulare* L.

Herbs, annual or rarely perennial. *Leaves* in a basal rosette and typically broadest at base, tapering to an acute to acuminate apex, or rarely cauline and filiform, often with fenestrate thickenings, blade mostly glabrous, often with tangled hyaline hairs in axils. *Peduncle* erect, rarely poorly developed or lacking, often ribbed, sometimes twisted, glabrous. *Petals* in male flowers obscure, arising at summit of androphore, black nectariferous gland epipetalous at apex, sometimes obscure. *Sepals* in female flowers free. *Style* appendages absent. *Seeds* ellipsoid, shiny, variously hairy or sculptured, epidermal cells often outlined with wall thickenings and mostly arranged in longitudinal rows.

A large genus of c. 400 species worldwide; 33 species in Australia. Typically species growing in wet places or rarely submerged with emergent inflorescences.

Key to species of *Eriocaulon* in Australia

1.	Leaves in basal rosette	**2**
	Leaves along an elongated stem	**E. setaceum**
2(1).	Ovary 2-locular	**3**
	Ovary 3-locular	**10**
3(2).	Seed longitudinal thickenings white, prominent, thicker than transverse walls.	**E. fenshamii**
	Seed longitudinal thickenings lacking or similar size to transverse walls.	**4**
4(3).	Female sepals lacking a broad dorsal keel or wing, sometimes slightly keeled, acuminate to acute	**5**
	Female sepals with broad dorsal wing, crested	**6**
5(4).	Floral bracts hyaline; receptacle glabrous; stamens 4; female perianth parts if bearing hyaline hairs then hairs shorter than perianth	**E. spectabile**
	Floral bracts black; receptacle densely pilose; stamens 2; female perianth parts bearing hyaline hairs which are much longer than the perianth	**E. wolseleyi**
6(4).	Involucral bracts thin, flexible, becoming reflexed at maturity	**7**
	Involucral bracts thickened, rigid, not reflexed at maturity	**9**
7(6).	Male petals equal; female flowers dimorphic within head with upper flowers lacking sepals; female sepal hairs marginal	**8**
	Male petals dimorphic; female flowers equal within head with all flowers having sepals; female sepal hairs on adaxial surface	**E. concretum**
8(7).	Floral bracts acuminate to acute; female petals spathulate, glabrous	**E. carpentariae**
	Floral bracts obtuse; female petals elliptic, pubescent	**E. fistulosum**
9(6).	Floral bracts pubescent; male sepals fused for greater part, glabrous; stamens 4	**E. willdenovianum**
	Floral bracts glabrous; male sepals free to fused at base, pubescent; stamens 2	**E. depressum**
10(2).	Seed longitudinal thickenings white, prominent, thicker than transverse walls.	**11**
	Seed longitudinal thickenings lacking or similar thickness to transverse walls	**12**
11(10).	Floral bracts obovate; male sepals 2, free to fused at base; female sepals equal	**E. pusillum**
	Floral bracts spathulate; male sepals 3, fused but split on one side to form a spathe; female sepals dimorphic	**E. truncatum**
12(10).	Anthers yellow	**13**
	Anthers black	**17**
13(12).	Female petals lacking	**14**
	Female petals present, 2 or 3	**15**

14(13). Male petals equal; male sepals fused but split on one side to form a spathe; male petal hairs white, in apical fringe ..... **E. cinereum**

Male petals dimorphic; male sepals free to fused at base; male petal hairs hyaline, marginal ..... **E. australasicum**

15(13). Leaves greater than 10 cm long, plants often exceeding 30 cm in height ..... **E. rivicola**

Leaves less than 5 cm long, plants rarely approaching 30 cm in height **16**

16(15). Involucral bracts glabrous, floral bracts obtuse; male flowers less than 1 mm long; female sepals glabrous ..... **E. patericola**

Involucral bracts pubescent, floral bracts acuminate to acute; male flowers greater than 1.5 mm long; female sepals pubescent ..... **E. scullionii**

17(12). Female sepals with a broad, flattened dorsal wing **18**

Female sepals lacking a broad, flattened dorsal wing, at most a slight dorsal keel **19**

18(17). Involucral bracts thickened, rigid, not reflexed at maturity ..... **E. australe**

Involucral bracts thin, flexible, becoming reflexed at maturity **36**

19(17). Receptacle glabrous to sparsely hairy **20**

Receptacle densely pilose **31**

20(19). Female petals inflated, fleshy **21**

Female petals thin **22**

21(20). Female petals with long mucro and broad stipe, all three petals persisting around the seeds ..... **E. tricornum**

Female petals obtuse with prominent knob-like gland, abruptly constricted into narrow stipe, petals individually caducous ..... **E. lividum**

22(20). Involucral bracts thin, flexible, becoming reflexed at maturity **23**

Involucral bracts thickened, rigid, not reflexed at maturity **29**

23(22). Floral bracts with white hairs **24**

Floral bracts glabrous **28**

24(23). Epidermal cells of seeds more or less isodiametric, peg-like projections on both transverse and longitudinal walls ..... **E. scariosum**

Epidermal cells of seeds transversely elongated, projections only on transverse walls **25**

25(24). Leaves less than 6 mm wide at base **26**

Leaves greater than 10 mm wide at base **27**

26(25). Floral bracts acuminate, with arista prominently exserted from head; receptacle glabrous; male sepals free; female sepals acute to acuminate ..... **E. clarksonii**

Floral bracts obtuse to acute; receptacle sparsely hairy; male sepals fused but split on one side into a spathe; female sepals obtuse to truncate ..... **E. schultzii**

27(25). Leaves 4–9.4(–16) cm long; female sepals 2.6–3.7 mm long; female petals 2.2–3.2 mm long ..... **E. aloefolium**

Leaves 12–22 cm long; female sepals 1.1–2.4 mm long; female petals 1.3–2.1 mm long ..... **E. giganticum**

28(23). Seed epidermal thickenings continuous bands on transverse walls ..... **E. nanum**

Seed epidermal thickenings of unidirectional peg-like projections on transverse walls ..... **E. athertonense**

29(22). Hairs mostly absent on floral bracts and female sepals; short hairs on male petals (c. 0.1–0.2 mm) and female petals (0.05–0.15 mm) ..... **E. carsonii subsp. carsonii**

Hairs always present on all floral bracts and female sepals; long hairs on male petals (c. 0.2–0.6 mm) and female petals (c. 0.1–0.4 mm) **30**

30(29). Leaves with broadly subulate apex with an obtuse tip; leaf width 0.7–1.6 mm at 1 mm from apex ..... **E. carsonii subsp. orientale**

Leaves with long filiform to narrowly subulate apex with a mostly acute leaf tip; leaf width 0.4–0.8 mm at 1 mm from apex ..... **E. carsonii subsp. euloense**

31(19). Seeds with even thickenings around epidermal cells **32**

Seeds with peg-like projections in various arrangements **33**

32(31). Floral bracts aristate ..... **E. nematophyllum**

Floral bracts obtuse to acute, lacking arista ..... **E. pygmaeum**

33(31). Seed with transversely elongated epidermal cells and unidirectional peg-like projections on transverse walls **34**

Seed with ± isodiametric epidermal cells and with peg-like projections on all walls **35**

34(33). Floral bracts pubescent; male sepals pubescent; female sepals equal, pubescent ..... **E. odontospermum**

Floral bracts glabrous; male sepals glabrous; female sepals dimorphic, glabrous ..... **E. athertonense**

35(33). Flower heads smooth in outline; involucral bracts glabrous; floral bracts lacking pronounced arista; male sepals fused into a spathe, rarely apparently free; female sepals dimorphic with two laterals larger and navicular ..... **E. scariosum**

Flower heads squarrose in outline; involucral bracts pubescent with white hairs; floral bracts with pronounced aristate tip; male sepals free; female sepals equal ..... **E. tortuosum**

36(18). Floral bracts pubescent, hyaline; male sepals pubescent; female petals pubescent ..... **E. inapertum**

Floral bracts glabrous, straw yellow; male sepals glabrous; female petals glabrous ..... **E. zollingerianum**

E. aloefolium R.J.Davies, *Austral. Syst. Bot.* 20: 445 (2007)

Type: Queensland: Long Spring, Edgbaston, NE of Aramac, 12 Dec 2006, *R.J. Fensham 5546* (holo BRI).

Eriocaulon sp. (Edgbaston *R.J.Fensham 5546*) P.D. Bostock and A.E. Holland, *Census of the Queensland Flora 2007* (2007).

Illustrations: R.J.Davies *Austral. Syst. Bot.* 20: 438 fig. 5 (E); 440 fig. 7 (E) (2007).

Herb, perennial, 14–36 cm high. Leaves lanceolate, 4–9.4(–16) cm long, 10–19 mm wide, acuminate, broadly subulate or linear, apex tapering to a conspicuously fleshy broad flat base, apex obtuse often uncinate and frequently with an obvious apical gland, 11–13-nerved. *Peduncle* 12.8–34.5 cm long, with 7–8 ribs. *Sheath* 40–100 mm long. *Flower heads* hemispherical, 9–12 mm long, 8–17 mm wide. *Involucral bracts* cream to brown to black, broadly spathulate to obovate, 2.7–3.4(–4.5) mm long, 2.1–3.5 mm wide, obtuse, glabrous, sterile, reflexed at maturity. *Floral bracts* hyaline, cream to brown, rhomboid-oblanceolate, cucullate, 2.6–4 mm long, 0.8–1.6 mm wide, subacute, moderately dense to very dense hairs on margins and abaxial surface. *Receptacle* glabrous, narrowly conical to globular. *Male flowers:* 3–4.5 mm long, dimorphic frequently with smaller flowers with larger anthers towards centre of head; sepals 3, free, hyaline, dimorphic with one smaller, linear to narrowly oblanceolate to rhomboidal and hooded at apex, smaller sepal 1.5–2.5 mm long, 0.3–0.4 mm wide, larger sepals 2.2–3.4 mm long, 0.4–0.8 mm wide, acute, pubescent with dense to very dense white hairs on margins and abaxial surface of sepal; petals 3, hyaline, dimorphic with one larger and two slightly smaller, elliptic to ovate-lanceolate to rhomboid, obtuse, pubescent with very dense white hairs, confined to margins and sometimes the abaxial surface of petals; stamens 6; anthers dark brown to black, included. *Female flowers:* sepals 3, margins hyaline, dimorphic, larger sepals shallowly navicular, acute, 2.6–3.7 mm long, 0.5–1.3 mm wide, with thick and fleshy dorsal keel with hyaline margins, lamina gradually tapering to short, narrow but winged stipe, pubescent with scattered to very dense white hairs on margins (also sometimes on the keel and/or abaxial surface); median sepal narrowly linear oblanceolate, 1.5–2.5 mm long, 0.2–0.3 mm wide; petals 3, dimorphic slightly in size only, oblong-oblanceolate, 2.2–3.2 mm long, 0.4–0.8 mm wide, acute, pubescent with scattered to dense white hairs, confined to margins and sometimes the abaxial surfaces. *Ovary* 3-locular. *Seeds* 0.7–0.8 mm long, 0.5–0.6 mm wide; smooth, lacking sculpturing or epidermal cell outline only faintly visible. **Fig. 2a–b.**

Distribution: Only known from Edgbaston Station near Aramac. It has been found on only two springs despite extensive searching of every spring on that station (Davies et al. 2007). **Fig. 11.1.**

Habitat: Restricted to mound springs dominated by *Phragmites australis*, *Sporobolus pamelae*, *Myriophyllum* sp., and *E. carsonii* on the spring vent; and *Fimbristylis dichotoma, Cyperus laevigatus* and *Myriophyllum* sp. and *E. carsonii* on the spring tail.

Conservation Status: Davies et al. (2007) showed the species existed with approximately 500 individual plants at one spring and ten plants at the other spring with a total area occupied of less than 0.5 hectares. The extent of occurrence is approximately 5 hectares. This information supported the listing of this species as critically endangered according to IUCN (2001) criteria. It is not protected in any conservation reserves. It is listed as Endangered under Queensland legislation (*Nature Conservation Act 1992*).

Etymology: The species name refers to the superficial similarity of its foliage to that of species in the genus *Aloe*.

Specimens examined: AUSTRALIA: Queensland: Edgbaston Stn, 40 km E of Aramac, natural artesian spring, 1 Jun 1994, *Wilson s.n.* (DNA)

Specimens examined by Davies (2007): Queensland: Edgbaston Stn, 40 km E of Aramac, 16 Nov 1994, *Wilson 109* (BRI); Edgbaston Station, North Spring-group, Oct 2003, *Davies ERIO140, 410-421* (AD).

E. athertonense G.J.Leach, *Austral. Syst. Bot.* 13: 756 (2000)

Type: Queensland: Carrington Falls, 8 km SSE of Atherton, 1 Aug 1992, *J.R. Clarkson 9713* (holo DNA!; iso BRI!, CNS!, NSW).

Illustrations: G.J.Leach *Austral. Syst. Bot.* 13: 756 fig. 1 (B) (2000).

Herb 4–14(–24) cm high. *Leaves* linear to lanceolate, 2–7 cm long, 1.5–4.7 mm wide, acute to acuminate, 5–10-nerved. *Peduncle* 4–14(–24) cm long, with 4–6 ribs. *Sheath* 17–35(–50) mm long. *Flower heads* hemispherical or globular, 2.3–5 mm long, 3.5–5 mm wide. *Involucral bracts* hyaline to straw yellow, obovate, oblanceolate or elliptic, 1.2–2.2 mm long, 0.5–1.1 mm wide, acute to obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* black, oblanceolate to spathulate, 1.5–2.3 mm long, 0.7–1.2 mm wide, acuminate or acute, glabrous or rarely sparsely pubescent with white hairs. *Receptacle* sparsely hairy to densely pilose, rarely glabrous, conical. *Male flowers*: 1–1.6 mm long; sepals 3, fused but split on one side to form a spathe, sometimes deeply lobed, black, 1–1.6 mm long, 0.5–0.8 mm wide, truncate, lacerated, glabrous or rarely with occasional white hairs; petals 3, sometimes obscure, hyaline, dimorphic with one larger in spathe opening, triangular, acute, glabrous or pubescent with white hairs in apical fringe; stamens 6; anthers black. *Female flowers:* sometimes variable in head with some flowers lacking smaller median sepal and sometimes either the 2 smaller petals or the larger petal; sepals (2)3, black, dimorphic with one reduced or sometimes absent, navicular or geniculate, lacking dorsal keel or wing or dorsally keeled, 0.9–1.5 mm long, 0.15–0.43 mm wide, acute, glabrous or sparsely pubescent with white hairs on upper margin; median sepal linear, 0.45–1.1 mm long, 0.02–0.1 mm wide, acute, glabrous; petals variable 1, 2 or typically 3, hyaline, equal or slightly dimorphic with one larger, narrowly elliptic, 1–1.4 mm long, 0.28–0.3 mm wide, smaller petals 0.75–0.8 mm long, c. 0.1 mm wide, acute or obtuse or truncate, pubescent with white hairs on upper margin and apex, hyaline hairs typically on margin, rarely absent. *Ovary* 3-locular. *Seeds* 0.3–0.45 mm long, 0.2–0.34 mm wide; epidermal cells transversely elongated, unidirectional peg-like projections on transverse walls. **Fig. 2c–d.**

Distribution: Common between Townsville to north of Cairns and westwards to near Croydon. Isolated southerly records from Proserpine and in the Maranoa district. The outlying locality records appear to be associated with isolated spring-fed systems. **Fig. 11.2.**

Habitat: Often associated with rocky creek and stream margins in rainforest, open forest or open grassy swamps.

Notes: This species is part of a closely related Queensland complex including *E. odontospermum* G.J.Leach, *E. scariosum* Sm. and *E. nanum* R.Br.

The phrase name *Eriocaulon* sp. Lappa (H. Aston 2312) G.J.Leach was given to a possible entity represented by the single specimen (*Aston 2312*). The specimen has variable female flowers within a head with some flowers lacking the median smaller sepal and sometimes also either the 2 smaller petals or the larger petal. The female petals are also distinctly dimorphic. Examination of a larger suite of material relating to *E. athertonense* demonstrates that there is variability in the degree of dimorphism of the female petals. The presence or absence of the smaller median female sepal is variable within a flower head (e.g. *Fensham 4702, 4704*). The original published description of *E. athertonense* (Leach 2000) has been expanded here to include this variation. Further molecular work in this Queensland-based complex is desirable.

Conservation Status: Not considered under threat.

Etymology: The epithet refers to the distribution of the species being centred on the Atherton Tableland.

Specimens examined: AUSTRALIA: Queensland: 4 km E of Lappa, 28 May 1982, *Aston 2312* (BRI, CANB, MEL); 9.6 km along Granite Creek road, 4 Aug 1997, *Bean 12200* (BRI, DNA, MEL); Lower Mulgrave River, Pete's Creek Falls, 23 Aug 1968, *Berry s.n.* (CNS, DNA); Atherton, Aug 1901, *Betche s.n.* (NSW); Stony Creek, W of Ingham, near Wallaman Falls , 13 Aug 1951, *Blake 18800* (BRI, CANB); Lamb Range, Davies Creek, 25 Aug 1968, *Brass 33904* (CNS, DNA); 5 km S of Herberton, 10 Apr 2014, *Corlis 8* (CNS); 3 km N of Walsh River community, 10 Apr 2014, *Corlis 9* (CNS); 15 km NW of Mareeba, 11 Apr 2014, *Corlis 12* (BRI, CNS, DNA); 8 km W of Mareeba, 10 Apr 2014, *Corlis 18* (BRI, CNS); 15 km W of Mission Beach, 25 May 2014, *Corlis 22* (BRI, CNS); spring near homestead at Pony Hills station, E of Injune, 7 Nov 2000, *Fensham 4209* (BRI); Buhot spring, Cuba Plains, 25 Mar 2001, *Fensham 4269 & 4699* (BRI, DNA); Boredrain spring, Wairuna, 6 Jun 2001, *Fensham 4702* (BRI, DNA); Mud Soak spring, Springfield, N of Mt Surprise, 3 Jun 2001, *Fensham* 4704 (BRI, DNA); McLeod River, 18 Sep 1936, *Flecker s.n.* (CNS); Davies Creek, 27 Sep 1954, *Flecker s.n.* (CNS); Herberton Weir, 24 Feb 1990, *Forster 6252* (BRI); Donkey Spring Creek, 80 km NW of Mt Surprise, 22 Apr 1998, *Forster 22454* (BRI, DNA, MEL); McLeod River, 4 Nov 2001, *Jensen 1053* (BRI, DNA); Proserpine, *Michael 1448* (BRI); Glen Harding, 45 km N of Valley of Lagoons, 8 Aug 1976, *Paijmans 2108* (CANB); Barron R., 1886, *Sayer s.n.* (MEL 2 sheets); McLeod River, 10 Oct 2009, *Worboys 862* (CNS).

E. australasicum (F.Muell.)Koern. *Linnaea* 27: 616 (1854)

Basionym: *Electrosperma australasicum* F.Muell. *Trans. & Proc. Phil. Soc. Vic.* 1: 24 (1854).

Type: Murray River, Dec 1853, *F. Mueller s.n.* (**lecto (here designated**) MEL224413!; isolecto MEL1597055!, K000457706!, K001056248!, TCD!)

Illustrations: B.J.Conn, *Fl. NSW*. 4: 264, (1993); B.J.Conn, *Fl. Victoria* 2: 178, fig. 37d-e (1994).

Herb 2–10 cm high. *Leaves* linear, 2–6.5 cm long, 1.0–2.2 mm wide, acuminate, 3–5-nerved. *Peduncle* 1.4–10 cm long, with 4-6 ribs. *Sheath* 7–35 mm long. *Flower heads* globular or hemispheric, 2–3 mm long, 2.5–3.5 mm wide. *Involucral bracts* hyaline to black, elliptic to broadly elliptic, 1.4–1.75 mm long, 0.75–1 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* black, narrow-elliptic, 1.0–1.6 mm long, 0.25–0.6 mm wide, acute, glabrous. *Receptacle* glabrous, conical. *Male flowers:* c. 1 mm long; sepals 2 or rarely 3, free, black, linear, 0.35–0.75 mm long, c. 0.1 mm wide, acuminate, glabrous; petals 3, hyaline, dimorphic with one larger, acute, glabrous or pubescent, hairs hyaline, marginal; stamens 6; anthers yellow. *Female flowers:* apical flowers typically lacking perianth; sepals absent or rarely 2, black, equal, linear, c. 0.9 mm long, c. 0.01 mm wide, acuminate, glabrous; petals absent. *Ovary* 3-locular. *Seeds* 0.25–0.35 mm long, 0.175–0.25 mm wide; smooth, lacking sculpturing or epidermal cell outline only faintly visible. **Fig. 2e–f.**

Distribution: Restricted to south-western Victoria and adjoining regions of South Australia and NSW. The protologue by Mueller describes it as "Along the Murray, towards the junction of the Murrumbidgee". It does not appear to have been recollected in this locality since the original collection. **Fig. 11.3.**

Sutter (2010) confirms the species from 3 locations - in the Mereek Flora Reserve near Edenhope (Vic); in the Little Desert National Park along the Border Track, (Vic) and on adjoining private land at Bangham in South Australia; and a single 1987 record from the Grampians National Park near Woohlpooer (Vic). Since publication of the Recovery Plan there have been cited collections from 2 additional locations in NSW south-west of Braidwood and from near Narrabri towards the Pilliga East State Forest. The author has not seen the specimen from near Narrabri. It appears the only record for SA is an observational one with no supporting specimen.

Habitat: In the protologue it is described as occurring in wet places. Other recent collections and Sutter (2010) record the species as an aquatic in shallow seasonally inundated depressions and swamp margins on clay plains. Commonly associated species include *Chorizandra enodis*, *Villarsia reniformis*, *Gratiola pumilo*, *Centrolepis polygyna*, *Myriophyllum* spp. and *Utricularia dichotoma*.

Notes: Three sheets at MEL, two at K and one at TCD have all been identified as probably belonging to the type gathering. CHAH (2017) lists a collection at NSW (NSW58361) as Murray River collected in 1853 but without a collector. It is likely to be part of the Mueller type gathering.

MEL 224413 has on a white fragment packet the information "Eriocaulon Murray River with *Elythrophorus* Dec 1853". On the sheet is a large blue folded specimen packet with "*Electrosperma Australasicum* fur Mueller Murray". On this packet is also written in different ink "*Eriocaulon australasicum* Koernicke". This was clearly written after the publication of Koenicke's new combination – putting the species back into *Eriocaulon* from

the new Mueller genus *Electrospermum*. This material is selected as the lectotype in having labels in Mueller's handwriting and the collection is dated Dec 1853, prior to the publication by Mueller.

MEL 1597055 has a Mueller label with "*Eriocaulon electrospermum* Murray R F. Mueller 1854. A separate label states "Extracted from the collection of H.B. Williamson August 1991". This interestingly indicates Mueller's intention at one stage to describe it as a new species of *Eriocaulon* rather than as he ultimately published it as a new genus. Another small label bears the name "*Centrolepis*". MEL 1224412 has a small label with "618 *Eriocaulon electrospermum*" and underneath "(*Electrosperma Australasicum)*". Separately is written "On wet places along the Murray towards the junction of the Murrumbidgee". None of the labels are in Mueller's hand and there are only three scrappy plants on the sheet. The TCD specimen is labelled as "*Eriocaulon australasicum* F. Muell. Murray".

There are two sheets at K one of which is labelled as presented from the Linnean Society 1915. The other sheet almost appears as two gatherings. There are a series of smaller plants on the upper part of the sheet with a white label in Mueller's hand. There are two larger plants on the lower part of the sheet with a blue label.

Conservation Status: Listed as Endangered in NSW and Victoria and nationally under the *EPBC* Act. Sutter (2010) records that the species has suffered a major decline in range and abundance, especially through widespread clearing of habitat and draining of shallow freshwater swamps. A Recovery Plan has been prepared for this species (Sutter 2010). Sutter (2010) records that the total population may be as few as 2000 plants. Three populations with more than 1,000 plants (1987 data) occurred in the Meereek Flora Reserve. The Little Desert NP and Bangham sites contained an estimated 500–700 plants (1990 data). The SA record is either in or near the Bangham Conservation Park. Some of the Victorian locations (e.g. Meereek, the Little Desert and the Grampians) are on reserved land managed by Parks Victoria.

Specimens examined: AUSTRALIA: Victoria: 11.5 km SW of Edenhope, 20 Mar 1975, *Beauglehole 49756* (DNA, MEL, NSW, PERTH); Big Swamp, 5 km NE of Woohlpooer, 9 Mar 1987, *Albrecht 3151* (MEL).

E. australe R.Br., *Prodromus Florae Novae Hollandiae* 254 (1810)

Type: ['(J.) *v.v*'] New South Wales: Port Jackson, 1802, *R. Brown s.n. [Iter Austral. 5821]* (lecto (Prajaksood *et al.* 2012) BM80218!; isolecto BM802015!, BM802016!).

Syntypes E00280000!, K001056253!

Eriocaulon sexangulare L. var. *australe* (R.Br.) Praj. & J. Parn. *Kew Bulletin* 67: 1-31 (2012)

Type: as for *E. australe*

Illustrations: G.J.Leach, *Floodplain Flora*, 227, fig. 47 (2000).

Herb 33–100 cm high. *Leaves* linear, 23–80 cm long, 0.2–1.2 cm wide, acute, 8–18-nerved. *Peduncle* 33–100 cm long, with 5–7 ribs. *Sheath* 12–15 cm long. *Flower heads* hemispherical or slightly depressed, 4–8 mm long, 7–10.5 mm wide. *Involucral bracts* straw-yellow, broadly ovate, 1.5–3.5 mm long, 1.6–3.5 mm wide, obtuse, pubescent at base of outermost bracts with hyaline hairs, not reflexed at maturity. *Floral bracts* straw-yellow, broadly spathulate or obovate, 2–3 mm long, 1.4–2.5 mm wide, obtuse and mucronate with tip inflexed, pubescent apically with short white hairs. *Receptacle* densely pilose, rarely sparsely so, convex. *Male flowers:* sepals 3, fused for greater part into a truncate tube, hyaline, 1.75–3 mm long, 0.7–1.5 mm wide, glabrous, rarely a few white hairs at apex; petals 3, hyaline, equal, linear, acute or obtuse, pubescent with apical fringe of white hairs; stamens 6; anthers black, included. *Female flowers:* sepals 3, hyaline, dimorphic; laterals navicular, with broad dorsal wing and dissected margin, 1.9–3 mm long, 0.75–1.25 mm wide, crested, pubescent at base of crest with patch of white hairs; median sepal linear, 1.7–2.25 mm long, 0.25–0.6 mm wide, obtuse, glabrous; petals 3, hyaline, equal, linear, 1.5–2.5 mm long, 0.1–0.2 mm wide, acute, pubescent with white hairs in apical fringe and hyaline hairs on margin or rarely absent. *Ovary* 3-locular. *Seeds* 0.75–0.8 mm long, 0.45–0.5 mm wide; epidermal cell walls with longitudinal rows of hair or peg-like projections, often with a terminal cap and often erect. **Fig. 2g–h.**

Distribution: Near-coastal locations from northern NSW, Qld and NT where known from Arnhem Land and the Tiwi Islands. Also recorded from New Guinea and extending to Indonesia, Thailand and China. **Fig. 11.4.**

Habitat: Open swampy areas on riverine plains or perennial creeks or springs.

Notes: The Australian material is generally larger in many parts compared with the Thai material identified as var. *australe* e.g. leaves to 80 cm (cf. to 37 cm); leaves to 12 mm wide (cf. to 8 mm); peduncle to 100 cm (cf. 70 cm); heads to 8 mm long (cf. 6 mm); heads to 10.5 mm wide (cf. 8 mm). Examination of Sri Lankan material of *E. sexangulare* held at DNA showed the median female sepal to be very thin and diaphanous so this character appears unreliable. The Thai material differs from the Australian material by the presence of rhizomes, the glabrous receptacle and the indumentum features of the male sepals, the female median sepal and the female petals. A summary of the distinguishing characters as reported by various authors is shown in Table 1. On this basis the Asian material is not included in *E. australe*. Future proposed molecular studies may clarify these relationships.

Table 1. Comparison of the distinguishing characters between *E. sexangulare*, the Thai populations referred to as var. *australe* and Australian material of *E. australe*.

Character	*E. sexangulare*	*'E. australe'* Thailand	*E. australe* Australia
Life form	? annual	perennial	annual rarely perennial
Rhizome	absent	present	absent
Leaf indumentum	glabrous	hairy	hairy
Sheath indumentum	glabrous	hairy	hairy or glabrous
Involucral bract indumentum	glabrous	hairy on upper part	hairy on lower area
Receptacle indumentum	glabrous	glabrous	pilose
♂ **sepal hairs**	glabrous	hairy at apex	glabrous
♀ **median sepal texture**	thick	thin	thin
♀ **median sepal hairs**	glabrous	hairy on upper part	glabrous
♀ **petal shape**	filiform	linear	linear
♀ **petal hairs**	long hyaline hairs on upper part	white hairs on apex	white hairs on apex, hyaline hairs on margin

Zhang (1999) did not treat the Asian and Australian material of *E. australe* as distinct and recorded it from China, Indonesia, Thailand, Australia and New Guinea. *E sexangulare* L. was recorded from China (including Taiwan), Japan, Thailand, Vietnam, India, Philippines, Indonesia, Malaysia, Burma, Sri Lanka, Australia, New Guinea, Madagascar and Africa. However, although Zhang recorded it from Australia, she does not cite any specimens.

Prajaksood et al. (2012) in their work on Thai *Eriocaulon* reduced *E. australe* to a variety of *E. sexangulare* and highlighted the differences from *E. sexangulare* in that the Thai material they referred to *E. australe* was perennial, had rigid rhizomes and a thinner median female sepal, the female petals being linear and having an indumentum of short white hairs at the apex. They confirmed the differences noted by other authors with *E. australe* having hairy leaves, sheaths, involucral bracts and receptacles. Zhang (1999) distinguished *E. australe* and *E. sexangulare* by the glabrous nature of these parts in *E. sexangulare*. The Thai occurrence is highly restricted being known from only 5 widely separated locations and confined to the Peninsular and South-Eastern regions. It has been coded as Vulnerable in Thailand. The geographical distribution of 'var. *australe*' and the typical *E. sexangulare var. sexangulare* overlap in Thailand with both varieties found in Changwat Trat.

Recorded in mixed collections with *E. willdenovianum* (*Hyland 8840* and *8842*).

Conservation Status: Widespread in Australia and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: Tozers Gap, 22 Feb 1980, *Clarkson 2878* (BRI, CNS, K, NSW, PERTH); Sanamere lagoon, c. 3 km N of Jardine R crossing, 31 Aug 1985, *Clarkson 6162* (BRI, CNS, DNA, K, L, MO, NSW); 3 km S of Jardine River, 3 Mar 1992, *Clarkson 9299* (BRI, CNS, DNA); Sanamere Lagoon, 21 Jul 1992, *Clarkson 9630* (BRI, CNS, DNA, K, MEL); Osborne's hut, Thornton Vale, 13 Dec 1940, *Flecker 7063* (CNS); Bolt Head, Temple Bay, 13 Jul 1991, *Forster 8999* (BRI, DNA); *Porn 593,* 26 May 1976, *Hyland 8842* (CNS) Jardine River, 1 km N of McHenry R. junction, 19 Oct 1979, *Irvine 1967* (CNS); Elliot Falls, S of Jardine R, 03 Mar 1992, *Jacobs 6282* (BRI, CNS, DNA, NSW); Lynch's carter, Atherton Tableland, Jul 1970, *Kershaw 10066* (BRI, CANB, CNS, DNA); tributary of Bridge Creek Xing, 18 Jul 1984, *Puttock UNSW*

16919 (DNA, NSW). **New South Wales:** Hat Head, Jan 1953, *Constable NSW22205* (NSW); Hat Head, Jan 1961, *Ingram NSW63344* (NSW); Byron Bay, Nov 1903, *Maiden NSW58392* (NSW). **Northern Territory:** Habgood River, Arnhem Land, 5 Oct 1987, *Clark 1597* (DNA, NSW); Buckingham River, 2 Dec 1987, *Dunlop 7417* (BRI, DNA); Melville Island, 28 Jun 1988, *Fensham 936* (DNA); Bathurst Island, Ngaru swamp, 15 Dec 1991, *Fensham* 1088 (DNA); Bathurst Island, 11 Jan 1994, *Leach 3928* (BRI, DNA); Habgood River, 5 Dec 1987, *Russell-Smith 4422* (DNA); swamp S of Yirrkala Rd, 1 Dec 2007, *Westaway 2420* (DNA). **PAPUA NEW GUINEA:** Wuroi, Oriomo River, Jan-Mar 1934, *Brass 5751, 5752* (BRI); c. 35 km E of Morehead, 23 Sep 1990, *Conn 3514* (L, LAE, MEL, NSW, UPNG); Morehead-Arufi road, Morehead subdistrict, Western District, 14 Nov 1972, *Henty NGF 49406* (CANB, LAE); 1 Mile S of Morehead patrol post, 25 Aug 1967, *Pullen 7154* (CANB, MEL); Maprik, Jun 1964, *Smith 3* (BRI).

E. carpentariae G.J.Leach, *Austral. Sys. Bot.* 13: 755–772 (2000)

Type: Northern Territory: Balbirini - Borroloola road, 13 Jul 1976, *A.C. Beauglehole 54794* (holo DNA!; iso MEL, AD).

Eriocaulon sp. (Sefton *J.R. Clarkson 3771*)

Illustrations: G.J.Leach, *Floodplain Flora*, 227, fig. 47 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 759 fig. 3 (A), 760 fig. 4 (A) (2000).

Herb 7–15 cm high. *Leaves* linear, 5–12 cm long, 3–5.5 mm wide, 10–17-nerved. *Peduncle* 5–14 cm long, rarely ± sessile. *Sheath* 40–95 mm long. *Flower heads* ovoid to hemispherical, 4–8.5 mm long, 4.5–6 mm wide. *Involucral bracts* hyaline or black with straw yellow midvein and base, sometimes hyaline at apex, lanceolate or elliptic to broadly obovate, 2–3.2 mm long, 1.25–2.5 mm wide, obtuse to acute, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, often with dark apex, oblanceolate, 1.5–2 mm long, 0.5–0.9 mm wide, acute, glabrous. *Receptacle* glabrous or sparsely hairy, conical. *Male flowers*: 1.2-2 mm long; sepals 0; petals 0 or 2, hyaline, triangular, obtuse, glabrous or pubescent with hyaline hairs in apical fringe; stamens 4; anthers black. *Female flowers*: dimorphic with upper flowers lacking sepals; sepals 0 or 2, rarely 1, hyaline with dark apex and wing margin, navicular, with broad dorsal wing, 1.2–1.5 mm long, 0.6–1 mm wide, truncate to crested with 2 lobes, glabrous or pubescent with sparse to dense, pilose hyaline hairs on inside and outside of orifice; petals 2, hyaline, sometimes with dark apex, equal or dimorphic with one slightly smaller, spathulate on narrow stalk, 1.5–2.5 mm long, 0.75–1 mm wide, bifid or irregularly serrate, glabrous. *Ovary* 2–locular. *Seeds* 0.4–0.45 mm long, 0.23–0.3 mm wide; epidermal cells transversely elongated, unidirectional peg-like projections on transverse walls. **Fig. 3a–b.**

Distribution: NT and Qld, from NE Arnhem Land through the Gulf of Carpentaria and western Cape York. **Fig. 11.5.**

Habitat: Seasonally flooded waterholes or lagoons in *Melaleuca* swamps or on floodplains; typically on clay soils.

Notes: In the type specimen the peduncle length is highly variable from more or less sessile to c. 8 cm long. The sessile heads have fully developed and mature seeds. Several taxa have been observed with forms lacking a peduncle. This species is closely related to *E. depressum* R.Br. ex Sm. and the 2 taxa have been recorded in mixed stands (*Clarkson 9585*). However, even when growing together no intergrading has been observed.

Conservation Status: Not known from many collections but seems to be widely distributed around the Gulf of Carpentaria and not considered under threat. Coded as Data Deficient in the NT (FloraNT 2017).

Etymology: Refers to the distribution of this species around the Gulf of Carpentaria.

Selected specimens examined: AUSTRALIA: Queensland: 4.4 km towards Sefton from the Koolatah t/off on the Sefton-Oroners Rd, 28 Jun 1981, *Clarkson 3771* (BRI, CNS, DNA, K, MO, NSW, PERTH); Alice River Nat Park; 11.1 km from Emu Lagoon, 27 May 1992, *Clarkson 9585* (BRI, CNS, DNA); 3.8 km S of Croydon, 23 Apr 2011, *McDonald 10956* (BRI, DNA). **Northern Territory**: 13 km NNW Amungee Mungee Stn. Hmsd. Cooee Hill, 07 May 1994, *Albrecht 5884* (DNA, NT); 17.9 km from Borroloola T-junction towards Wollogorang, 8 Jun 1999, *Bean 15112* (BRI, DNA); old Gove Rd b/n Emu Springs and Goyder R., 17 Sep 1999, *Harwood 660* (DNA); 3 miles SSW Bing Bong Hmsd, 08 Jun 1971, *Henry 125* (DNA); 12 km N Amungee Mungee Hmsd, 06 May 1994, *Latz 13712* (BRI, DNA, NT); 22 km W of Cape Crawford roadhouse, 4 Aug 2004, *Latz 20101* (DNA, NT).

E. carsonii F.Muell., *Proc. Linn. Soc. N.S.W.* 5: 250 (1891)

Type: N.S.W., Wee Wata Springs, Kallara Station, towards the junction of the Paroo and Darling River, 7 Mar 1888, *D. Carson s.n.* (lecto (Davies *et al.* 2007) MEL710194!; isolecto MEL710159! NSW66346!; K001056348!).

Eriocaulon submersum Tate, *Trans. Royal Soc. S.A.* 23: 291 (1899), *nom illeg. Eriocaulon tatei* Ruhland, Engler *Pflanzenr.* 13: 117 (1903). *nom. nov.*

Type: Public House Springs, Oct 1899, *M. Koch, 467* (syn AD97427495!, AD98100205!, AD97516029!, NSW58363!; Mt Lyndhurst, Oct 1899, *M. Koch, 467* (syn AD98100204!, AD98100206!, E279996 *n.v.*, K1056347!, M152665 *n.v.* BM!).

The *E. carsonii* complex, comprises five distinct taxa; made up of the 3 subspecies of *E. carsonii* along with *E. aloefolium* and *E. giganticum*. The complex is a group of endemic perennial mat-forming forbs endemic to the mound springs of central and NE Australia. *E. carsonii sens lat.* is recorded from spring complexes in South Australia, Queensland and New South Wales (Fensham et al. 2010). It is restricted to flowing mound springs on the margins of the Great Artesian Basin (GAB) that are associated with fractures or fault lines. Davies et al. (2007) recognised two new species and 2 new subspecies found on the mound springs in the *E. carsonii* complex and provide detailed distributional information for these taxa. In summary subsp. *carsonii* can be distinguished by its mostly glabrous floral bracts and female sepals, the significantly shorter hairs on the petals and the shiny seeds. Subsp. *orientale* differs from subsp. *carsonii* by its consistently pubescent floral bracts and female sepals, the significantly longer hairs on the petals and the elongated protuberances on the seed coat. Subsp. *euloense* differs by having leaves which are narrowly rather than broadly subulate towards the apex and narrowly acute leaf apices.

The species is listed nationally as Endangered under the EPBC Act and at state level as Endangered in Queensland, SA and NSW.

It is recognised as having 3 subspecies.

E. carsonii subsp. **carsonii**

Illustrations: R.J.Davies *et al Austral. Syst. Bot.* 20: 438 fig. 5 (A); 440 fig. 7 (A) (2007).

Herb 5–6 cm high. *Leaves* broadly lanceolate, 1–7.5 cm long, 2–11 mm wide, acuminate, (3–)4–7–nerved. *Peduncle* 1.1–9 cm long, with 4–5 ribs. *Sheath* 2–20 mm long. *Flower heads* hemispherical, 3–4 mm long, 1.5–6 mm wide. *Involucral bracts* brown, broadly ovate, 1.3–2 mm long, 1.1–1.8 mm wide, obtuse, glabrous, fertile or sterile, not reflexed at maturity. *Floral bracts* hyaline, brown, rhomboid-oblanceolate, cucullate, 1.3–2 mm long, 0.3–1.3 mm wide, obtuse or subacute, glabrous or very rarely with marginal and abaxial white hairs. *Receptacle* glabrous, narrowly conical to globular. *Male flowers*:1.2–2.2 mm long; sepals 3, free, hyaline, linear to obovate/oblanceolate, hooded at apex, dimorphic, two larger, 0.8–1.5 mm long, 0.2–1 mm wide, one smaller, 0.9–1.2 mm long, 0.1–0.2 mm wide, obtuse to subacute, glabrous or with scattered to moderately dense white hairs on margins and/or abaxial surface; petals 3, dimorphic, one lobe larger and two slightly smaller, elliptic to obovate, obtuse, pubescent with sparse to dense white marginal hairs; stamens 6; anthers dark brown to black. *Female flowers:* sepals 3, hyaline margins, dimorphic, larger lateral sepals navicular, 1.1-2.0 mm long, 0.4–1.0 mm wide, acute, with thick and fleshy dorsal keel with hyaline (rarely crenulate) margins, lamina gradually tapering to subsessile base, glabrous or very rarely with isolated white hairs on margins and keel; median sepal narrowly linear-lanceolate to lanceolate or oblanceolate, 0.6–1.4 mm long, 0.1–0.4 mm wide; petals 3, dimorphic slightly in size only, narrowly oblong–oblanceolate/obovate, 0.9–1.7 mm long, 0.1–0.5 mm wide, obtuse, pubescent with scattered to dense marginal and apical white hairs. Ovary 3-locular. Seeds 0.6–0.8 mm long, 0.4–0.6 mm wide; smooth, lacking sculpturing or epidermal cell outline only faintly visible. **Fig. 3c–d.**

Distribution: The subspecies is endemic to discharge mound springs of the western, south western and southern margins of the Great Artesian Basin in NSW, SA and Qld. **Fig. 11.6.**

Habitat: The subspecies is confined to the vents and tails of mound spring wetlands. In New South Wales and South Australia, the subspecies is confined to plant-species-poor sedgelands/grasslands most commonly dominated by *Cyperus laevigatus* with or without *Phragmites australis* and *Fimbristylis dichotoma*. In Queensland, associated sedgeland/grassland vegetation is slightly more species-rich and also contains other sedges (e.g. *Fimbristylis* spp., *Schoenus falcatus*), grasses (e.g. *Cynodon dactylon*, *Diplachne fusca*, *Pennisetum alopecuroides*, *Eragrostis* sp.) and forbs (e.g. *Myriophyllum* sp., *Utricularia* spp.).

Conservation Status: The data presented by Davies et al. (2007) support the listing of *E. carsonii* subsp. *carsonii* as Endangered according to IUCN (2001) criteria. The subspecies is conserved in Elizabeth Springs

Conservation Park in Qld (Fensham and Fairfax 2003) and Paroo-Darling National Park in NSW (Chambers et al. 2003).

Etymology: The species is named after the collector of the type specimen, Mr D. Carson.

Specimens examined: AUSTRALIA: Queensland: Elizabeth Springs, 24 Feb 1999, *Ponder1011* (K, NSW); Elizabeth Springs, Springvale Hstd, 20 May 1994, *Wilson 103A* (AD, CANB, DNA, MEL, NSW). **South Australia:** Twelve Springs, 16 Sep 1987, *Bell 1267* (AD, DNA); Old Finniss Springs, 10 Jun 1983, *Fatchen 601* (NSW); Hermit Hill Springs, 12 Jun 1983, *Fatchen 623* (AD, NSW); Hermit Springs, 25 Mar 1988, *Fatchen s.n.* (DNA); Hermit Hill Springs, 2 Oct 1978, *Symon 11242* (AD).

Selected specimens examined by Davies *et al.* (2007): New South Wales: Peery Lake, 30 Sep 1986, *Johnson & Goodson s.n.* (NSW274274). **South Australia:** Twelve Springs, 16 Sep 1987, *Bell 1267* (AD, DNA); Gosse Springs, Oct 2003, *Davies R. ERIO271, 274, 277* (AD); Hermit Hill Springs, 2 Oct 1978, *Symon 11242* (AD); Hermit Hill Springs, 12 Jun 1983, *Fatchen 623* (AD, NSW); Old Finniss Springs, 10 Jun 1983, *Fatchen 601* (NSW); North West Springs, Oct 2003, *Davies R. ERIO65* (AD); West Finniss Springs, 14 May 2003, *Fensham 5079* (BRI); Public House Springs, Sep 1889, *Koch 467* (AD, NSW); Public House Springs, Aug 1899, *Koch s.n.* (AD98100205). **Queensland:** Elizabeth Springs, 24 Feb 1999, *Fensham 3672* (BRI); Bulla Bulla Spring, Warra, 60km E of Boulia, 25 Feb 1999, *Fensham 3690* (BRI); Elizabeth Springs, 10 Sep 1984, *Ponder 1011* (NSW, AD).

Eriocaulon carsonii subsp. **euloense** R.J.Davies *Austral. Syst. Bot.* 20: 443–444 (2007)

Type: Queensland: Yowah Creek, Bundoona, approximately 40 km NW of Eulo, artesian spring wetland, 21 Feb 1999, *R.J. Fensham 3687* (holo BRI).

Illustrations: R.J.Davies *et al., Austral. Syst. Bot.* 20: 438 fig. 5 (B); 440 fig. 7 (B) (2007).

Herb 7–9 cm high, perennial, mat-forming. *Leaves* broadly lanceolate, 1.7–4.3 cm long, 2–7 mm wide, acuminate, 5–8-nerved. *Peduncle* 31–123 mm long, with 4–5 ribs. *Sheath* 4–15 mm long. *Flower heads* hemispherical, 3–4 mm long, 3–5 mm wide. *Involucral bracts* green to light brown, obovate to broadly obovate, 1.3–2.6 mm long, 1.3–2.0 mm wide, obtuse, glabrous, fertile or sterile, not reflexed at maturity. *Floral bracts* hyaline, white or green or light brown, rhomboid-oblanceolate or oblong-oblanceolate, sometimes cucullate, 1.7–2.3 mm long, 0.5–1.5 mm wide, obtuse or subacute, scattered to dense hairs present on margins of inner bracts. Receptacle glabrous, narrowly to broadly conical. *Male flowers*: 1.2–2.0 mm long, dimorphic with smaller flowers with larger anthers towards centre; sepals 3, free, hyaline, dimorphic with one smaller (1.0–1.1 x 0.3–0.4 mm) and two larger (1.0–1.6 mm x 0.4–0.6 mm), narrowly spathulate to spathulate, sometimes hooded at apex, obtuse, scattered to dense white hairs on margins and abaxial surface; petals 3, dimorphic with one larger and two slightly smaller, elliptic to ovate, obtuse, with moderately dense to very dense white hairs on margins; stamens 6; anthers dark brown. *Female flowers:* 1.4–2.0 mm long; sepals 3, free, with hyaline margins, dimorphic, lateral larger sepals navicular, acute or obtuse, 1.3–2.0 mm long, 0.5–0.9 mm wide, mostly with thick and fleshy dorsal keel with hyaline margins, lamina gradually tapering to subsessile base, scattered to dense white hairs on margins and keel (± abaxial surface); median sepal narrowly (linear-) lanceolate or oblanceolate, 1.0–1.6 mm long, 0.3–0.4 mm wide; petals 3, free, dimorphic slightly in size only, narrowly oblong-oblanceolate, 1.2-1.8 mm long, 0.3–0.5 mm wide, obtuse, with dense to very dense white hairs confined to margins of petals. *Ovary* 3-locular. Seeds c. 0.7 x 0.6 mm; epidermal cell outline faint and with obscure peg-like projections on transverse walls. **Fig. 3e–f.**

Distribution: *Eriocaulon carsonii* subsp. *euloense* is endemic to mound springs in the Eulo Supergroup (Davies et al. (2007) in the vicinity of Eulo in Southern Qld, 300 km north of the southern margins of the Great Artesian Basin. **Fig. 11.7.**

Habitat: In these springs it is confined to the vents and tails of mound spring wetlands where it occurs in sedgelands/grassland vegetation dominated by grasses (*Sporobolus pamelae*, *Pennisetum alopecuroides*, *Eragrostis sp. Fensham 3705*), sedges (*Fimbristylis* spp.) and forbs (e.g. *Myriophyllum artesium*).

Conservation Status: The data presented by Davies et al. (2007) supported the listing of *E. carsonii* subsp. *euloense* as endangered according to IUCN (2001) criteria. The national and Queensland legislation only list the species and not subspecies. The subspecies is not conserved in any conservation reserves.

Etymology: This subspecies is named after the spring super-group to which it is endemic.

Selected specimens examined by Davies et al., (2007): AUSTRALIA: Queensland: Yowah Spring-group, *R.Davies ERIO180-193, 195-199* (AD).

Eriocaulon carsonii subsp. **orientale** R.J.Davies *Austral. Syst. Bot.* 20: 444–445 (2007)

Type: Queensland, Joshua Spring, Doongmabulla, NW of Clemont, spring fed wetland, 1 Sep 2004, *R.J. Fensham 5096, (*holo BRI).

Illustrations: R.J.Davies *Austral. Syst. Bot.* 20: 438 fig. 5 (C); 440 fig. 7 (C) (2007).

Herb 5–12 cm high, perennial, mat-forming. *Leaves* lanceolate, 1–6.7 cm long, 2–9 mm wide, acuminate, (3–)4–7-nerved. *Peduncles* 14–150 mm long, with 4–6 ribs. *Sheath* 4–19 mm long. *Flower heads* hemispherical, 3-5 mm long, 3-6 mm wide. *Involucral bracts* green to light brown, broadly ovate, 0.9–2.0 mm long, 0.6–0.8 mm wide, obtuse or subacute, glabrous or rarely with scattered hairs on margins and abaxial surface, fertile or sterile, not very reflexed at maturity. Floral bracts hyaline, white or light brown, rhomboid oblanceolate or oblong-oblanceolate, cucullate, 1.1–2.0 mm long, 0.4–1.5 mm wide, obtuse or subacute, scattered to very dense hairs present on margins and abaxial surface. *Receptacle* glabrous, narrowly to broadly conical. *Male flowers:* 1.2–1.5 mm long, dimorphic with smaller flowers with larger anthers towards centre; sepals 3, free, hyaline, dimorphic with one smaller (0.8–1.3 x 0.1–0.4 mm) and two larger (0.8–1.6 mm x 0.3–0.5 mm), linear to spathulate, sometimes hooded at apex, obtuse, sparse to very dense white hairs on margins and abaxial surface (rarely only on apex); petals 3, dimorphic with one larger and two slightly smaller, lobes 0.2–0.6 mm long, 0.1–0.4 mm wide, elliptic to ovate, obtuse to subacute, with dense to very dense (rarely sparse) white hairs, confined to margins ±abaxial surface (or rarely only on apex); stamens 6; anthers dark brown or black. *Female flowers:* sepals 3, hyaline margins, dimorphic laterals navicular, 1.3–1.8 mm long, 0.4–0.9 mm wide, acute, mostly with thick and fleshy dorsal keel with hyaline margins, lamina gradually tapering to subsessile base, scattered to very dense white hairs on margins (± keel and/or abaxial surface); median sepal narrowly linear oblanceolate 1.1–1.2 mm long, 0.2–0.3 mm wide; petals 3, dimorphic slightly in size only, narrowly oblong-oblanceolate, 1.0–1.9 mm long, 0.2–0.4 mm wide, obtuse, scattered to very dense white hairs, confined to margins. *Ovary* 3-locular. *Seeds* 0.6–0.7 long, 0.4–0.5 mm wide; epidermal cell outline faint and with obscure peg-like projections on transverse walls. **Fig. 3g–h**.

Distribution: Endemic to mound springs in the vicinity of the recharge area at the eastern edge of the GAB (Spingsure, Barcaldine and Mitchell Staaten Super-groups) but also occurs on several springs fed by a similar but localised aquifer adjacent to the northeast edge of the GAB (north east of the Flinders River Super-group. **Fig. 11. 8.**

Habitat: Confined to the vents and tails of mound spring wetlands occuring in vegetation dominated by grasses (*Sporobolus pamelae*, *Pennisetum alopecuroides*), sedges (*Fimbristylis dichotoma, Cyperus laevigatus*) and forbs (*Myriophyllum* sp.).

Conservation Status: Davies et al. (2007) recommended the listing of this subspecies as Vulnerable according to IUCN (2001) criteria. The subspecies is protected in only one conservation reserve: a Nature Refuge gazetted under Queensland legislation on Doongmabulla Station in Queensland.

Etymology: The subspecific epithet is derived from the Latin meaning "east" and refers to the distribution of the subspecies on springs near the eastern edge of the Great Artesian Basin.

Specimens examined: AUSTRALIA: Queensland: Edgbaston, Aramac, 11 Mar 1995, *Chuk & Wylkes 5* (BRI, DNA); Soda spring, Gamboola, 26 May 2001, *Fensham 4697* (BRI, DNA); 10 km SSW of Lyndhurst HS and 4 km E of highway, Cook District, 13 Jul 1976, *Lazarides 8169* (BRI, CANB); 2.3 km NE of Edgbaston Homestead, 26 Sep 1984, *Ponder 1012* (NSW, AD); On edge of spring, 3 km S of Doongmabulla, Apr 1992, *Thompson GAL11* (BRI); Edgbaston Station, 40 km E of Aramac, 1 Jun 1994, *Wilson s.n.* (BRI, DNA).

Selected specimens examined by Davies et al. (2007). Queensland: Shiprock Station, ENE of Injune, 7 Nov 2000, *Fensham 4128* (BRI); Karalee Plains, SE of Taroom district, 23 Apr 1999, *Fensham 3805* (BRI); Lucky Last Spring-group, Dec 2003, *Davies* 23 *ERIO154-5,158* (AD); Moorabinda, 55km SW of Taroom, 28 Jan 1999, *Fensham 3818* (BRI); Edgbaston E of Aramac, 6 Feb 1998, *Fensham 3346* (BRI); Corinda, N of Aramac, 16 Apr 1999, *Fensham 3760* (BRI); Myross, E of Aramac, 15 May 2000, *Fensham 3882* (BRI); Hot Spring, Tallaroo, W of Mount Surprise, 29 Mar 2001, *Fensham 4353* (BRI); Mud Spring, Routh, SE of Georgetown, 26 Mar 2001, *Fensham 4349* (BRI).

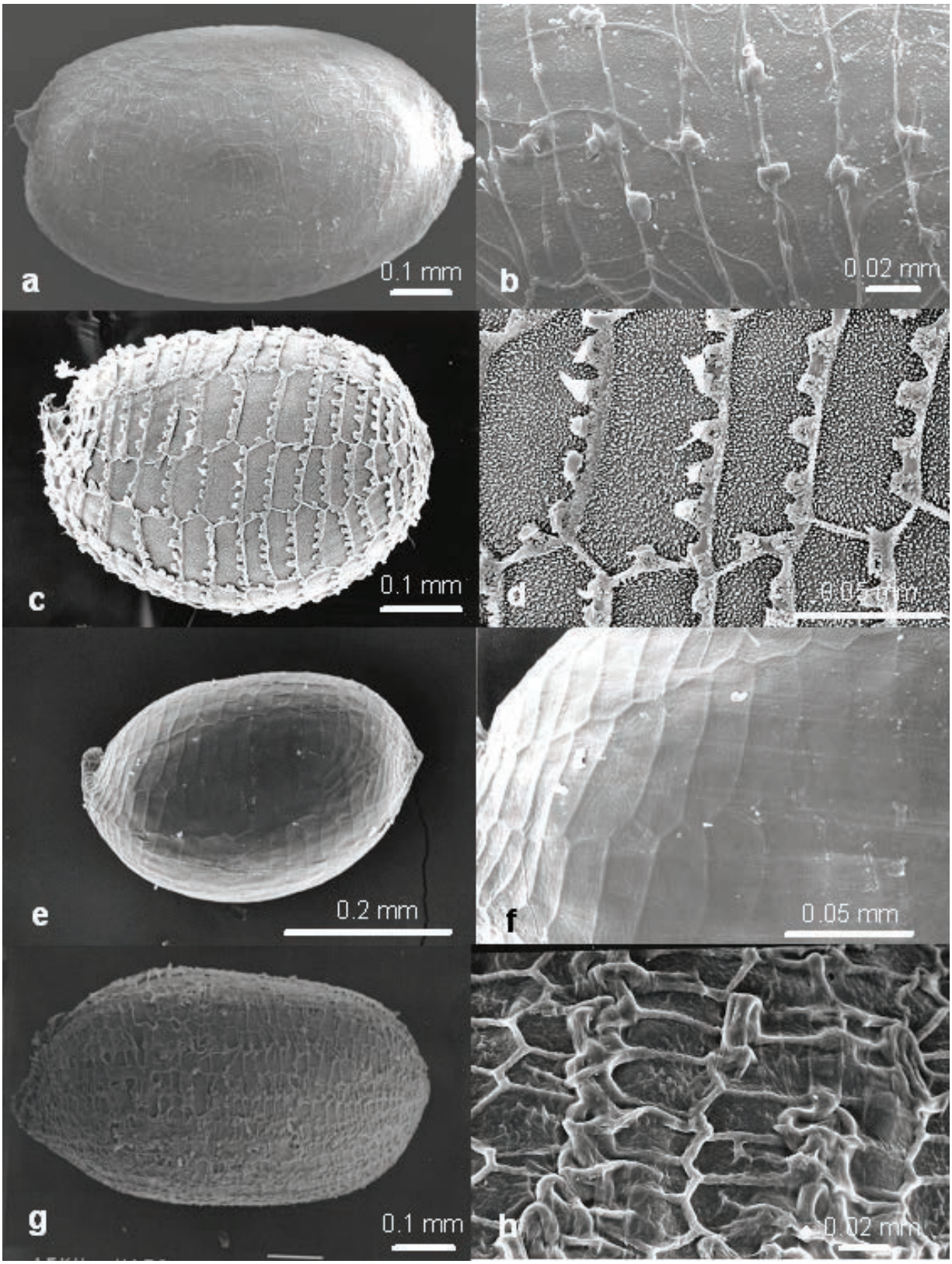

Fig. 2. Seed and seed surface: *Eriocaulon aloefolium* **a, b**; *E. athertonense* **c, d**; *E. australasicum* **e, f**; *E. australe* **g, h**. Material used: a-b from *Davies 418*; c-d from *Blake 18800*; e-f from *Mueller K001056248*; g-h from *Durrington 1441*.

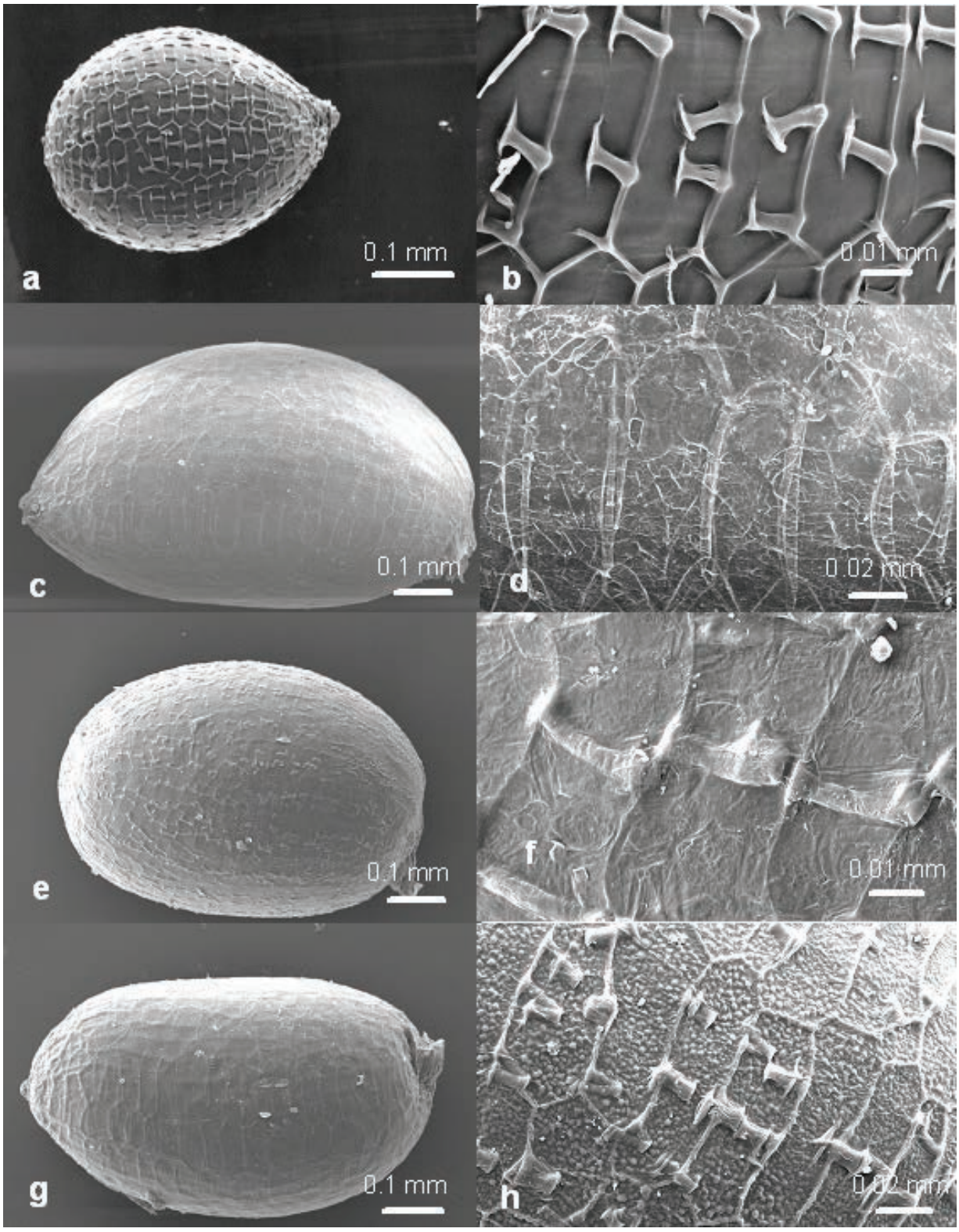

Fig. 3. Seed and seed surface: *Eriocaulon carpentariae* **a, b**; *E. carsonii* subsp. *carsonii* **c, d**; *E. carsonii* subsp. *euloense* **e, f**; *E. carsonii* subsp. *orientale* **g, h**. Material used: a-b from *Beauglehole 54794*; c-d from Peery Lake 4, 5; e-f from Bundoona Stn 1 and 3; g-h from *Davies 95*.

E. cinereum R.Br., *Prodromus Florae Novae Hollandiae*. 254 (1810)

Type: ['(T.) *v.v.*'] Australia: NT, Carpentaria, Island h [North Island, Sir Edward Pellew Group], 1802, *R. Brown s.n. [Iter Austral. 5823]* (holo BM802017!)

Eriocaulon ciliiflorum F.Muell. *Fragmenta Phytographiae Australiae* 1(4): 95 (1859)

Type: 'In locis udis ad flumen Victoriae.', *F. Mueller s.n.,* (**lecto (here designated)** MEL710192!, plant second from top on the left hand side; isolecto K!)

Eriocaulon sieboldianum Siebold & Zucc. ex Steudel, *Synopsis Plantarum Glumacearum* 2(10): 272 (1855)

Type: 'Japonia', *Siebold & Zuccarini s.n.* (holo LE *n.v.*)

Eriocaulon sp. G G.J.Leach in *Fl. Kimberley Reg.*, 1034 (1992)

Eriocaulon sp G Kimberley Flora (K.F. Kenneally 11374E) in *FloraBase*, http://florabase.dpaw.wa.gov.au/ [accessed 2 Jan 2017])

Eriocaulon A87689 Arid Zone in Albrecht DE *et al.*, *Vascular plant checklist for the southern bioregions of the Northern Territory*. Edn 2: 43 (2007)

Eriocaulon sp Arid Zone (D. Schunke 28/Aug/90)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307A (1992); G.J.Leach, *Floodplain Flora*, 227, fig. 47 (2000); M.Soerjani *et al. Weeds of rice in Indonesia*, 275, fig.4.122 (1986).

Herb 2.5–18(–23) cm high. *Leaves* filiform to linear, 2–9 cm long, 0.16–2 mm wide, 3–4-nerved. *Peduncle* 2.5–16 cm long (rarely to 23). *Sheath* 6–25 mm long. *Flower heads* ovoid to hemispherical, 1–3.5(–4.5) mm long, 1.5–4.5(–6) mm wide. *Involucral bracts* hyaline, obovate to narrowly elliptic, 0.8–2.25 mm long, 0.3–1 mm wide, obtuse, glabrous, not reflexed at maturity. *Floral bracts* hyaline or black, elliptic to narrowly lanceolate, 0.9–2.25 mm long, 0.225–0.6 mm wide, acute, glabrous. *Receptacle* sparsely hairy. *Male flowers*: sepals 3, fused but split on one side to form a spathe which is often shallowly to deeply 3-lobed, black, 0.65–1.6 mm long, 0.23–0.5 mm wide, acute to obtuse, glabrous or with white or hyaline hairs in apical fringe; petals 3, hyaline, equal, triangular, acute, pubescent with apical fringe of white hairs; stamens 6; anthers yellow. *Female flowers*: sepals 2–3, hyaline or black, equal or sometimes one slightly different in size, linear, lacking dorsal keel or wing, 0.5–1.4 mm long, c. 0.03 mm wide, acuminate, pubescent with marginal hyaline hairs or glabrous; petals 0. *Ovary* 3-locular. *Seeds* 0.22–0.43 mm long, 0.15–0.3 mm wide; smooth, lacking sculpturing or epidermal cell outline only faintly visible. **Fig. 4a–d.**

Distribution: Widespread from Africa, India, Sri Lanka, Japan, and China through Malesia to Australia. Phillips (1997) suggests it is not native to Africa and the species has been noted as being spread as a weed of rice (Soerjani et al. 1986). The most widespread of the Australian species and common in northern Australia but occurs also in suitable microhabitats in the Pilbara, Central Australia, central and southern Qld. **Fig 11. 9.**

Habitat: Margins of seasonal swamps, seepage areas and streams, rocky creek beds, margins of pools and lagoons, *Melaleuca* woodland, typically on sandy soil but rarely recorded on heavy soil.

Notes: For further detailed extra-Australian synonymy see Phillips (1997) and Zhang (1999). In the protologue of *E. ciliiflorum*, Mueller describes the male calyx spathe as trifid and the heads as "pallidus v nigrescentibus". The mixed collection on MEL 710192 shows this variation. Mueller goes on to compare this collection with *E. nigricans* and *E. sexangulare* but interestingly makes no reference to a similarity with *E. cinereum*. On the MEL sheet he first identified his collection as *E. nigricans*, crossed this out and changed it to *E. cinereum* and then annotated it with a new name 'cilioligerum' before finally describing it as the new species *E. ciliiflorum*. The collections on this sheet are clearly mixed gatherings as they are at different levels of maturity. Due to the need to clarify the application of names to variants of *E. cinereum* it is therefore necessary to select a lectotype. The individual plant second from top on the left hand side of the sheet is selected as it clearly has the deeply lobed male spathe which corresponds to Mueller's description and is typical of what has been recognised as the inland form of *E. cinereum.*

A form found in more arid areas from the Gulf of Carpentaria to central Australia and the Kimberley is distinguishable by the deeply lobed to ± free male sepals and the generally darker head. This entity has been given phrase names *Eriocaulon* A87689 Arid Zone and *E.* sp. Arid Zone (D.Schunke 28/Aug./1990) in various editions of Northern Territory checklists (Albrecht et al. 2007). Another form is noted as typically aquatic with emergent heads and found in seasonal pools in rocky areas or rocky creek beds where plants become inundated and produce a longer peduncle. This form also has seeds with some ornamentation in contrast to the smooth, shiny seeds of typical populations. The longer peduncle is considered to be a response to growing

in deeper water that is retained for longer periods on the rocky substrate. Otherwise the only character that seems to distinguish it from the typical *E. cinereum* is the observed sculpting of the seed. Based on the SEM work, in all these forms of *E. cinereum* the outer integument persists and the cell outline of the inner layer can be seen to varying degrees through the thin outer layer (Fig. 4a–d). The difference appears to be one of only degree of thickness or turgidity of the outer layer.

Further molecular work is needed to assess the merits of recognising either of these forms as distinctive taxa.

Conservation Status: Common and widespread and not under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: Lawn Hill NP, 14 Apr 2003, *Booth 3245* (BRI, DNA); Alice River NP, 27 May 1992, *Clarkson 9584* (CNS, DNA); 18.7 km E of Lake Emma t/o, 19 May 1993, *Clarkson 10037* (CNS, DNA, K, MEL); 15 km W of Herberton, 10 Apr 2014, *Corlis 19* (BRI, CNS); Rungulla, Gregory range, 29 Apr 2010, *Ford 5722* (BRI, CNS, DNA); Hann River crossing, Lakefield NP, 14 Jul 2010, *Kilgour 261* (BRI, CNS); Laura, 23 Jun 1949, *Storr s.n.* (CNS); Gorge creek waterhole, Bowthorn station, 15 Aug 2001, *Wilson 82* (CNS). **Northern Territory:** lower Fitzmaurice River, 12 May 1994, *Albrecht 6021* (DNA); 10 km SE of Bradshaw Homestead, 7 Jun 1999, *Brock 76* (DNA); Gregory NP, 2 Jun 2015, *Cuff 237* (DNA, PERTH); Koolpinyah, 5 Jul 1974, *Dunlop 3614* (DNA); 29.7 km NNE of Pungalina h/stead, 20 Jul 2012, *Jensen 2678* (BRI, DNA); Winnecke creek, 27 Sep 2003, *Latz 19360* (DNA, MEL, NT); Macarthur River stn, 10 May 1997, *Michell 682* (DNA, NT); Flora River reserve, 12 Apr 1997, *Michell 790* (DNA); 1km E of Carmichael Crag, Watarrka NP, 1 Jul 1991, *Schunke 1514* (DNA, NT); Eva Valley, 22 April 1990, *van der Werrf 11843* (CNS, MO); Groote Eylandt, 3 Aug 2010, *Westaway 3324* (DNA, NT). **Western Australia:** Granite creek, near Lake Argyle, 26 Apr 1985, *Aplin 466* (PERTH); Gibb River road, 3 May 1985, *Aplin 972* (PERTH); 1.5 km W of Lake Argyle turn off, 6 Jul 1974, *Beauglehole 46841* (PERTH); 30 km NW of Drysdale River crossing, 5 Jun 1976, *Beauglehole 52232* (PERTH); Middle Spring, Deception Range, 14 Apr 1958, *Burbidge 5737* (CANB, PERTH); Prince Regent River, 11 Jul 1950, *Gardner 9629* (PERTH); 1.5 miles N of Kalumburu Mission, 30 May 1971, *Taylor 92* (DNA, PERTH).

Representative specimens of the arid zone form: Queensland: 129 km NW of Croydon, 28 May 1967, *Symon 4935* (AD, BRI, DNA, K). **Northern Territory:** 14.5 km W of East Baines River, 6 Jul 1974, *Beauglehole 46789* (DNA); Maria Island, Gulf of Carpentaria, 13 Jul 1972, *Dunlop 2811* (BRI, CANB, L, LAE, NT); 3 miles SSW of Bing Bong Hstd, 8 Jun 1971, *Henry 126* (DNA); Nicholson river area, 4 Jun 1974, *Henshall 260* (DNA); Singleton stn, 12 Jun 1975, *Henshall 1058* (AD, DNA); Nicholson river area, 13 Jun 1974, *Kanis 1826* (DNA, K, L, US); 96 km S of Elliott, 21 Jun 1974, *Latz 5511* (DNA, NT); Davenport Range, 5 May 1977, *Latz 6922* (AD, DNA); Murray Downs, 6 May 1977, *Latz 6933* (AD, DNA, K, TEX); Arnold River stn, 1977, *Latz 7148* (DNA); Pandanus Creek, Benmara stn, 4 May 1984, *Strong 198* (DNA); c. 9 km W of Fletchers Gully mine, 9 Aug 1986, *Strong 912* (DNA); Dunmarra, 7 Mar 1991, *Wilson 125* (DNA). **Western Australia:** above Joffre Falls, Hammersley Range, 14 Aug 1965, *Beauglehole 11509* (PERTH); S side of Cockburn Range, 11 Jul 1974, *Beauglehole 47232* (DNA, PERTH); Adcock Gorge, 26 Jul 1974, *Beauglehole 47998* (DNA, PERTH); Taylors Lagoon, Broome, 26 Jul 2008, *Byrne 3503* (PERTH); 66 miles E of Derby, 10 Mar 1967, *Power 175* (PERTH; 1 km above Joffre Falls, Hamersley Range, 26 Sep 1974, *Trudgen 1122* (PERTH); Joffre Creek, Hamersley Range, 2 Jul 1975, *Trudgen 1402* (PERTH).

Representative specimens of ornamented seed form: Northern Territory: Little Horse Creek, 6 Mar 1989, *Leach 2349* (DNA). **Western Australia:** Gibb River – El Questro Road, 28 May 1976, *Beauglehole 51534* (DNA, PERTH); King Edward River, 22 Aug 1978, *Beauglehole 58891* (DNA, PERTH); King Edward River crossing, Mitchell Plateau, 23 Jun 1994, *Kenneally 11459* (DNA); 24 km WSW of Ord River dam, 13 Mar 1978, *Lazarides 8540* (CANB, DNA); Cockburn Range, 16 Mar 1978, *Lazarides 8579* (CANB, DNA).

E. clarksonii G.J.Leach, *Austral. Syst. Bot.* 13: 758 (2000)

Type: c. 0.5 km north of the Jardine River at telegraph line crossing, Qld, 31 Aug 1985, *J.R. Clarkson 6200,* (holo DNA!; iso BRI!, MBA, QRS, PERTH, K, L, NSW, MO).

Illustration: G.J.Leach *Austral. Syst. Bot.* 13: 759 fig. 3 (B), 760 fig. (B) (2000).

Herb (2–)4.5–26 cm high. *Leaves* linear, 2–9.5 cm long, 1.5–4 mm wide, apex acute, 3–6-nerved. *Peduncle* 8.5–26 cm long, with 4–6 ribs. *Sheath* (9–)25–60 mm long. *Flower heads* globular, 4–6.5 mm long, 4–7(–9) mm wide. *Involucral bracts* hyaline, ovate or elliptic, 2.5–3 mm long, 1–1.5 mm wide, acute or obtuse, glabrous or with sparse white hairs, sterile, strongly reflexed at maturity. *Floral bracts* straw yellow to hyaline at apex, narrowly lanceolate, 1.75–2.7 mm long, 0.5–1 mm wide, acuminate, pubescent on apical half, hairs white. *Receptacle* glabrous, conical. *Male flowers*: 1.5–2 mm long; sepals 3, free, hyaline or straw yellow, spathulate,

1.1–1.5 mm long, 0.3–0.7 mm wide, obtuse to truncate, pubescent with white hairs in apical fringe and median region; petals 3, hyaline, equal, triangular, acute or obtuse, with white hairs in an apical fringe and adaxially; stamens 6; anthers black. *Female flowers:* equal; sepals 3, straw yellow, equal, spathulate and navicular, often ± thick to fleshy, dorsally keeled or sometimes lacking, 1.5–2.75 mm long, 0.5–0.6 mm wide, acuminate or acute, with white hairs in an apical fringe and on abaxial surface; petals 3, free, hyaline or straw yellow, equal, spathulate, often ± fleshy, 1.1–2 mm long, 0.35–0.6 mm wide, acute or obtuse, with white hairs in apical fringe and on the abaxial distal half. *Ovary* 3-locular. *Seeds* 0.5–0.55 mm long, 0.3–0.35 mm wide; epidermal cells with even wall thickenings. **Fig. 4e–f.**

Distribution: Restricted to Cape York Peninsula, Qld. **Fig. 11.10.**

Habitat: In open swampy habitats on sand associated with low heath or open *Melaleuca* woodlands.

Notes: The species has been recorded growing mixed with *Eriocaulon australe* R.Br. (*Paijmans 3066*). Numerous collections are from early in the dry season and very few have ripe seed which is typically only found on those collected in the late dry season around September. This suggests the species may be associated with permanent water and may be perennial.

Some collections also display individuals that appear to have only male flowers in the inflorescence. Others have the male flowers restricted to the base of the head and these appear to mature much earlier than the female flowers within the inflorescence.

Conservation Status: Common on Cape York and not considered under threat.

Etymology: The epithet acknowledges the contribution to our knowledge of the Cape York flora through the plant collecting efforts of John Clarkson.

Selected specimens examined: AUSTRALIA: Queensland: Lockerbie, 10miles WSW of Somerset, 01 May 1948, *Brass 18588* (CANB); 5.5 km ESE of Aurukun, 03 Jun 1982, *Clarkson 4507* (BRI, CNS, DNA, K, MO, PERTH); Sanamere Lagoon ca 3 km N Jardine River crossing on road to Bamaga, 31 Aug 1985, *Clarkson 6164* (BRI, CNS, DNA, K, L, PERTH); Sanamere Lagoon ca 3 km N Jardine Riv. crossing on road to Bamaga, 31 Aug 1985, *Clarkson 6165* (BRI, CNS, DNA); 2.5 km W crossing of Glennie Ck; track Bromley to Bolt Hd, 12 Jul 1990, *Clarkson 8756* (BRI, CNS, DNA, K, L, MEL, PERTH); 17.7 km N Morehead River crossing; Peninsula Development Rd, 16 Apr 1991, *Clarkson 8913,* (BRI, CNS, DNA, K, L); Sanamere Lagoon; W of Telegraph Line, 21 Jul 1992, *Clarkson 9629* (BRI, CNS, DNA, K,); 25 km SW of Heathlands, Cape York, 15 Apr 1993, *Clarkson 9797* (BRI, CNS, DNA, K); Jardine River, 01 Aug 1968, *Gittins 1865* (CANB); 27.3 km E of Musgrave Telegraph stn, 24 May 2004, *Kerrigan 838* (DNA); 3/4 km N of Archer River crossing, between Moreton Telegraph Station and Coen, 11 Jul 1980, *Ollerenshaw 552* (CBG); 25 km WNW of Ussher Point, 29 Aug 1978, *Paijmans 3066* (CANB); c. 2 km S of Wenlock R crossing, 17 Jul 1984, *Puttock 16912* (DNA, UNSW); 13.5 km ENE of Weipa Mission, 24 Jul 1974, *Specht s.n.* (BRI); 2.5 km S of the lodge on Bamaga Rd, 01 Jul 1985, *Thiele 922* (CANB); 2 miles E of Marina Plains, 22 Jun 1972, *Wrigley 1599* (CBG); 29 miles NNW of Coen along Cape York Rd, 26 Jun 1972, *Wrigley 1751* (CBG); 12 miles NNW of Coen along Cape York Rd, 26 Jun 1972, *Wrigley 1771* (CBG).

E. concretum F.Muell., *Fragmenta Phytographiae Australiae* 1: 92–93 (1859)

Type: "In locis passim prolutis terrae Arnhem's Land", *F. Mueller* **(lecto (here designated)** MEL1554395!)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307B (1992); G.J.Leach, *Floodplain Flora*, 227, fig. 47 (2000).

Herb 1.5–8.5 cm high. *Leaves* linear, 0.6–5.5 cm long, 0.15–0.35 cm wide, apex acuminate, 4–7–nerved. *Peduncle* 1.5–8.5 cm long, ribs obscure. *Sheath* 6–25 mm long. *Flower heads* hemispherical, 1.5–4 mm long, 2.2–4 mm wide. *Involucral bracts* straw yellow to hyaline, obovate or ovate to elliptic, 1.25–1.7 mm long, 0.6–1.3 mm wide, obtuse or rarely acute, glabrous, sterile, strongly reflexed at maturity. *Floral bracts* hyaline, mostly with stramineous or black apex, obovate to spathulate, 1–1.75 mm long, 0.6–1.1 mm wide, acute or obtuse, glabrous. *Receptacle* sparsely hairy, conical. *Male flowers*: 0.75–1.3 mm long; sepals 2, fused but split on one side to form a spathe, hyaline, sometimes black at apex, 0.9–1.3 mm long, 0.4–0.66 mm wide, truncate, glabrous; petals 2, hyaline, dimorphic with petal in spathe opening larger, triangular, acute, glabrous; stamens 4; anthers black, often included. *Female flowers*: sepals 2, hyaline or straw yellow with black window, equal, navicular, with broad dorsal wing, 0.75–1.1 mm long, 0.35–0.86 mm wide, crested to obtuse, pubescent with hyaline hairs adaxially or glabrous; petals 2, hyaline, equal, linear to spathulate, 0.8–1.2 mm long, 0.15–0.43 mm wide, acute to obtuse, glabrous. *Ovary* 2–locular. *Seeds* 0.325–0.425 mm long, 0.25–0.275 mm wide; epidermal cells with even wall thickenings. **Fig. 4g–h.**

Distribution: From the Kimberley to the NT through the Victoria River region to Katherine and western Arnhem Land. Appears disjunct to Qld on the Atherton Tableland and Einasleigh Uplands. **Fig. 11.11.**

Habitat: Typically in open grassy swamps or seepage areas or margins of creeks or waterholes.

Conservation Status: Widespread and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: SW of Mareeba, between Channel and Granite Creeks, 6 Aug 1960, *Goodall s.n.,* (BRI). **Northern Territory:** Mary River, 11 May 1989, *Clark 1811* (DNA); Baralil Creek, 12 Jun 1978, *Latz 7746* (DNA); 4 miles W of Pine Creek, 15 Mar 1965, *Lazarides 240* (CANB, DNA, K, L); 7 km W of Pine Creek, 17 Mar 1989, *Leach 2686* (DNA); Allia Creek, 9 May 1994, *Leach 4286* (DNA); Fish River block, 13 Apr 2010, *Lewis 1260* (DNA, CANB, LD); 7 miles E of Pine Creek, 13 Apr 1962, *Nelson 276* (DNA); Petherick's Park, Woolaning, 1 Apr 1990, *Russell-Smith 8224* (DNA, MEL); Mt Bundey area, 25 May 1989 *Wightman 5610* (DNA). **Western Australia:** Doongan Station, 24 Apr 2008, *R. Barrett RLB 4667* (PERTH); 30 km S of New Theda homestead, 21 May 2009, *R. Barrett RLB 5644* (PERTH); 1.5 km W of Lennard River Gorge turn off, 24 July 1974, *Beauglehole 47831* (NT, PERTH); Gibb River – Kalumburu Mission road, 31 May 1976, *Beauglehole 51749* (DNA, PERTH); 24 km NW of Drysdale R crossing, 30 May 1976, *Beauglehole 51686* (DNA, PERTH); Rocky Creek, 31 May 1976, *Beauglehole 51834A* (DNA, PERTH); 1.5 km W of Lennard River gorge turn off, 24 Jul 1974, *Carr 4053* (DNA); Gardner Plateau, 28 May 1993, *Cowie 4501* (DNA); Airfield swamp, Mitchell Plateau, 23 Jun 1993, *Kenneally 11374C* (PERTH); King Edward River crossing, 23 Jun 1994, *Kenneally 11466* (PERTH).

E. depressum R.Br. ex Smith, *Rees' Cyclopaedia.* 13 (1809)

Type: "Native of New Holland", Endeavour River, 1770, *J. Banks and D. Solander s.n*. (lecto (Leach 2000: 770) LINN-HS 146.25!).

Syntypes B100296735!, BM001053427!, BM001053424!, LL00374531 *n.v.*.

E. depressum R.Br. *Prodromus Florae Novae Hollandiae.* 255 (1810), *nom. illeg.*

Type: ['(T.) *v.v.*'] Carpentaria, Groote, *R. Brown s.n. [Iter Austral. 5825]* (lecto (Leach 2000) BM001053426!)

Syntypes BM001053425, E00279999 *n.v.*, K001056346!, L0041746!.

E. deustum R.Br. *Prodromus Florae Novae Hollandiae.* 255 (1810).

Type: ['(T.) *v.v.*'] *s. loc*., *R. Brown s.n*. (lecto (Leach 2000: 770) BM001053424!).

Syntypes K001056235! fragment only – had been mounted with Mueller material.

E. heterogynum F.Muell., *Fragmenta Phytographiae Australiae* 1:93 (1859)

Type: "In alveis rivulorum periodice exarescentium terrae Arnhemicae, e.g. prope montes Macadam Range.", MacAdam Range, October 1855, *F. Mueller s.n. (*lecto (Leach 2000: 770) MEL1554396!; isolecto MEL710188!).

E. arfakense van Royen, *Nova Guinea* 10: 26-28 (1959).

Type: Indonesia: Tamoerik camp, Wentholt expedition, Irian Jaya, 6 August 1941, *Anta 222* (BO, L!).

Eriocaulon sp Kakadu (J.R. Clarkson 6057) G.J. Leach

Illustrations: G.J.Leach, *Floodplain Flora*, 228, fig. 48 (2000).

Herb 4–24 cm high. *Leaves* linear to lanceolate, (3.5–)5.5–20 cm long, (1.5–)2.5–6 mm wide, 8–15–nerved. *Peduncle* 3.5–24 cm long, rarely in some populations the heads sessile. *Sheath* 20–30(–75) mm long. *Flower heads* depressed globular, 2.8–4 mm long, 3.8–7 mm wide. *Involucral bracts* straw yellow or sometimes black in upper half or at apex, broadly elliptic to oblong, 2–3(–4) mm long, 2–3.2 mm wide, obtuse, glabrous, not reflexed at maturity; in sessile heads the bracts may be more lanceolate with acute apices. *Floral bracts* straw yellow or sometimes black at apex, obovate to spathulate, 1.9–2.5(–4) mm long, 1.4–2.5 mm wide, truncate and mucronate or acute, glabrous. *Receptacle* glabrous. *Male flowers*: sepals 0(2), free, hyaline, navicular, c. 1.2 mm long, c. 0.3 mm wide, obtuse or truncate, pubescent with hyaline marginal hairs; petals 2 or absent (then flower consisting only of androphore), hyaline, acute, glabrous; stamens 2; anthers black. *Female flowers*: dimorphic; sepals absent or 2 (outermost flowers with sepals, innermost flowers lacking sepals), hyaline and rarely with dark patches on wing, equal, navicular, with broad dorsal wing and transparent window, 1–1.6 mm long, 0.7–1.3 mm wide, crested, pubescent with tangled hyaline hairs at opening; petals 2(–3), hyaline, equal or dimorphic with one smaller, elliptic, 1.5–2.3 mm long, 0.5–0.85 mm wide, bifid, glabrous. *Ovary* 2-locular.

Seeds 0.45–0.63 mm long, 0.25–0.4 mm wide; epidermal cell walls with longitudinal rows of hair or peg-like projections, often with a terminal cap and often erect. **Fig. 5a–b.**

Distribution: Common species throughout northern NT and Qld and extending to New Guinea. **Fig. 11. 12.**

Habitat: On margins of waterholes, streams, swamps, floodplains and typically on sandy soils.

Notes: A morphologically variable species, ranging from diminutive to a comparatively large size and with considerable variation in the degree of pigmentation of the floral and involucral bracts. The observed variability in plant size and degree of bract pigmentation is continuous and does not support formal recognition of any segregate taxa based on these characters. The form with sessile flower heads was given the phrase name *Eriocaulon* sp Kakadu (J.R. Clarkson 6057) G.J. Leach. Leach (2000b) provides the details of the lectotypification and a discussion of the synonymy.

Recorded in mixed collection with *E. odontospermum* (*Clarkson 4983*). Also recorded mixed with *E. fistulosum* and *E. spectabile* (*Munir 5925*).

Conservation Status: Not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: 38 km NNW of Cooktown, 30 Jul 1978, *Clarkson 3313* (CNS); Embley Range, 26 Jul 1985, *Clarkson 6061* (CNS, DNA, K, L, MEL, MO, NSW, PERTH); 0.5 km N of Jardine River, 31 Aug 1985, *Clarkson 6197* (CNS, DNA, K, L, NSW, PERTH); 20 km S of Tully, 2 May 2014, *Corlis 4* (CNS); Dallachy airstrip, 10 Apr 2014, *Corlis 7* (CNS); Thorne Creek Highbury Station, 27 Jul 2003, *Fox 2196* (BRI, CNS); 71 km S of Musgrave, 14 Jun 1981, *Maconochie 2682* (BRI, DNA); Laura, 24 Jun 1949, *Storr s.n.* (CNS); Lake Boronto, 22 Sep 1974, *Webb 13612B* (CNS). **Northern Territory**: Fitzmaurice River, 14 May 1994, *Barritt 1359* (DNA, MEL); Wildman River floodplain, 1 May 2012, *Brennan 9725* (DNA); Mary River, 12 May 1989, *Dunlop 8424* (DNA); 45 km SE of Ramingining, 18 Jun 1989, *Dunlop 8482* (DNA); Moyle River, 10 May 1994, *Dunlop 9841* (DNA); 50 km SW of Nathan River, 30 Aug 1985, *Latz 10214* (BRI, DNA, NT); Lake Eanes, Vanderlin Island, 23 Jul 1988, *Latz 10721* (DNA, NT); Jenkins Road, 19 May 1999, *Leach 4640* (DNA); Wongalara reserve, 5 Jul 2012, *Leitch 252* (DNA); 65 miles E of Carlton Stn, 28 Jul 1949, *Perry 2643* (CANB, DNA); Groote Eylandt, 27 Jul 2010, *Westaway 3278* (DNA, MO, NT). **PAPUA NEW GUINEA:** junction of Mai Kussa and Wassi Kussa, 11 Jun 1973, *Henty NGF 49668* (A, BISH, BRI, CANB, CNS, E, K, L, MUN, NSW, US); Morehead River, 10 Aug 1967, *Pullen 7034* (BRI, CANB); Weam, 31 Jul 1967, *Ridsdale NGF 33533* (A, BRI, CANB, K, L).

Representative specimens with sessile heads: Queensland: 9.6 km S of Sefton – Oroners road, 29 Jun 1981, *Clarkson 3782* (CNS, K, NSW, PERTH); 4.5 km E of Aurukun, 1 Jun 1982, *Clarkson 4460* (BRI, CNS, K); Embley Range, 26 Jul 1985, *Clarkson 6057* (CNS, DNA, K, L, NSW, P, MO); Biboorha, 30 Apr 1986, *Clarkson 6498* (CNS, DNA, K, PERTH); 45 km N of Coen, 18 Jun 1981, *Maconochie 2710* (BRI, DNA); 3 miles E of Mareeba, 3 May 1959, *Thorne 21089* (BRI). **Northern Territory:** Gulungul Creek, 17 May 1994, *Brennan 2789* (DNA); 50 km SW of Nathan River Hstd, 29 Aug 1985, *Latz 10180* (DNA, NSW); 14 km towards Ramingining from Central Arnhem road, 24 Jul 1999, *Short 5020* (DNA); track running N from Goodparla road, Kakadu NP, 25 Apr 1990, *Slee 28887* (CANB, DNA); near Winmurra billabong, 20 Jun 1980, *Waterhouse 10140* (DNA, UNSW).

Eriocaulon fenshamii G.J.Leach, ***sp. nov.***

Diagnosis: The seed sculpture suggests an alliance with *E. pusillum* and *E. truncatum* but it differs from these two species in having 2-merous flowers. It also differs from *E. pusillum* by the male sepals being fused into a spathe.

Type: Northern Territory: Wessel Islands, 3 Oct 1972, *P.K. Latz 3406* (holo DNA; iso BRI *n.v.*, CANB, MEL, K *n.v.*).

Eriocaulon sp. Wessel (P. Latz 3406) G.J. Leach

Herb c. 1.75–3 cm high. *Leaves* linear, 0.6–0.8 cm long, 0.7–1.1 mm wide, acuminate, 3–4-nerved. *Peduncle* 0.9–1.2 cm long, with 4 ribs. *Sheath* 6–8 mm long. *Flower heads* obovoid, 2.5–3.6 mm long, 3.5–4 mm wide. *Involucral bracts* hyaline to greyish, obovate, 2–2.3 mm long, 1.7–1.9 mm wide, obtuse, glabrous, not reflexed at maturity. *Floral bracts* greyish to black, obovate to oblanceolate, 1.6–2.1 mm long, 0.8–1.2 mm wide, obtuse to acute, glabrous or pubescent with easily deciduous white hairs. *Receptacle* densely pilose, conical. *Male flowers:* 1.4–1.6 mm long; sepals 2, fused but split on one side to form a 2-lobed spathe, black, 1.4–1.6 mm long, c. 0.45 mm wide, obtuse, glabrous or pubescent with sparse white hairs; petals 2, hyaline, dimorphic with petal in spathe opening larger, obtuse, pubescent with apical white hairs; stamens 4; anthers black. *Female flowers:* sepals 2, black or hyaline with black tips, equal, linear, geniculate, 1.2–1.6 mm long, 0.1–0.18 mm wide, acuminate, glabrous or rarely pubescent with a few apical white hairs; petals 2, hyaline, equal, narrowly elliptic, 1.4–1.6 mm long, c. 0.75 mm wide, obtuse, pubescent with hyaline hairs on margin and adaxially, apical

fringe of white hairs. *Ovary* 2-locular. *Seeds* c. 0.38 mm long, c. 0.32 mm wide; epidermal cell wall longitudinal thickenings white, prominent, thicker than transverse walls. **Fig. 5c–d.**

Distribution: NT where it is known only from a single collection on the Wessel Islands. **Fig. 11.13.**

Habitat: Seepage area in rock crevices in sandstone coastal cliff.

Conservation Status: Only known from a single location on a very remote poorly surveyed offshore island. Considered Data Deficient under IUCN criteria (IUCN (2001). Coded as Not Evaluated in the NT (FloraNT 2017).

Etymology: The specific epithet acknowledges the efforts of botanist Rod Fensham who has collected numerous specimens and made detailed observations of *Eriocaulon* in his work on mound springs and wetlands.

E. fistulosum R.Br. ex Smith, *Rees' Cyclopaedia.* 13 (1809)

Type: Endeavour River, 1770, *J. Banks & D. Solander s.n.* (holo LINN-HS 146.24!; iso BM001053421!, BM001053422!, BM001053423!, MEL7101887!)

Eriocaulon fistulosum R.Br., *Prodromus Florae Novae Hollandiae.* 255 (1810), *nom. illeg.*

Type: ['(T) B. *v.s.*']

Eriocaulon scariosum R.Br. pro parte sensu Bentham, *Fl. Austral.* 7: 197 (1878)

Eriocaulon sp. A G.J.Leach in *Fl. Kimberley Reg.,* 1032 (1992).

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1031, fig. 308B, as *Eriocaulon* sp. A (1992); G.J.Leach, *Floodplain Flora*, 228, fig. 48 (2000).

Herb 6–33 cm high. *Leaves* linear, 1.5–14 cm long, 1–3.5 mm wide, 6–9–nerved. *Peduncle* 7–27 cm long. *Sheath* 20–65 mm long. *Flower heads* ovoid or hemispherical, sometimes depressed, 3–6.5 mm long, 4–6 mm wide. *Involucral bracts* straw yellow, obovate to oblong, 1–2.5 mm long, 1.1–2 mm wide, obtuse, glabrous or pubescent with hyaline hairs, not reflexed at maturity. *Floral bracts* straw yellow or hyaline, sometimes with dark apices, obovate to spathulate, 1.5–2.6 mm long, 0.85–2 mm wide, obtuse with mucro, glabrous or pubescent with sparse hyaline hairs on upper margin and apex. *Receptacle* sparsely hairy or densely pilose. *Male flowers*: 1.1–2 mm long; sepals (0–)1(–2), free, hyaline, linear, 0.83–1.5 mm long, 0.16–0.5 mm wide, acute, pubescent with marginal hyaline hairs or glabrous; petals 0–2 but lobes often obscure, hyaline, equal, oblong, acute, glabrous or pubescent with hyaline hairs in apical fringe; stamens 4; anthers black. *Female flowers*: dimorphic; sepals (0)1(2), straw yellow to hyaline, equal, navicular, with broad dorsal wing and transparent window, 1.25–1.8 mm long, 0.7–1.5 mm wide, crested usually with 2 prominent teeth, glabrous or pubescent with a few hyaline hairs on teeth and inner margin; petals 2, hyaline, equal, narrowly elliptic, 1.25–1.8 mm long, 0.25–0.8 mm wide, bifid, pubescent with hyaline marginal hairs. *Ovary* 2–locular. *Seeds* 0.375–0.45 mm long, 0.275–0.4 mm wide; epidermal cells with even wall thickenings. **Fig. 5e–f.**

Distribution: From the Kimberley, VRD, Arnhem Land to the Gulf of Carpentaria and Cape York. **Fig. 11.14.**

Habitat: Creek lines, alluvial fans, marine plains and seepage areas in open grassy swamps or with *Melaleuca* or *Pandanus* swamp open forest, woodland. Also recorded from disturbed sites such as graded banks and roadside drains. On a variety of soil types.

Notes: Britten (1900) clarified the publication by Smith of some of Brown's manuscript names including that of *E. fistulosum*. In the Smith Herbarium, specimen 146.24 is labelled 'E. fistulosum R.Brown Prodr. 255' . Brown cites the type of *E. fistulosum* as a Banks & Solander collection. There are 5 sheets considered to be part of the same gathering by Banks and Solander from the Endeavour River; 1 at LINN, 3 at BM and 1 at MEL.

Bentham (1878) in his circumscription of *E. scariosum* R.Br. cites material that is referable to both *E. brunonis* Britten and *E. fistulosum* R.Br. ex Smith. He cites the specimen Schultz 261 which has been identified as *E. fistulosum.*

Both the LINN-HS specimen 146.24 and the BM specimen sheet 1 are labelled '*striatum*', a name attributed to Solander. The Solander name is probably a manuscript name and was never published. A note on the back of BM sheet 1 by E.W. Groves (vi.1972) states "No Solander manuscript description under *Eriocaulon striatum* of a Banks and Solander gathering could be found in the bound volumes of Solander's MSS slips (in BM(NH) Bot library when searched by me in 1972". The name *Eriocaulon striatum* published by Lamarck (Encycl. 3(1): 275. 1789 [19 Oct 1789] is a taxon found on Madagascar, Reunion and Mauritius.

The species has been found in mixed collections and presumably growing sympatrically with *E. pygmaeum* (*Telford NQ1505*), *E. nanum* (*Coveny 6955*) and *E. pusillum* (*Blake 23435*).

Conservation Status: Widespread and common; not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: 30 km S of Ingham, 11 Mar 2014, *Corlis 2* (CNS); 15 km from Kennedy River, 24 Jun 1981, *Clarkson 3705* (CNS); c. 1 km N of Aurukun, 2 Jun 1982, *Clarkson 4477* (CNS); 1 km from Merapah h/stead, 11 May 1987, *Clarkson 7163* (CNS); 3.5 km S of Hann River, 18 May 1989, *Clarkson 7954* (CNS, DNA, L, PERTH); c. 5 km ENE mouth of Macdonald River, 18 Apr 1993, *Clarkson 9907* (CNS, DNA, K, NSW); 26.5 km N of Hopevale t/o, 20 May 1993, *Clarkson 10065* (CNS, DNA, K, L); 42.5 km N of Musselbrook mining camp, 4 May 1995, *Johnson MRS808* (BRI, DNA). **Northern Territory:** Melville Island, 10 Jul 1997, *Calliss 38* (DNA); near upper Charlotte River, 25 Mar 2003, *Cowie 9698* (DNA); Spirit Hills, 16 Apr 2007, *Kerrigan 1218* (DNA); Headwaters of Florence Creek, 25 May 1989, *Leach 2598* (DNA); Bickerton Island, 29 Apr 1993, *Leach 3501* (BRI, DNA); Yamburran Range, 16 May 1994, *Leach 4563* (DNA); 17 miles N of Wilton River crossing, 17 Jun 1972, *Latz 2759B* (DNA); Upper Ban Ban gorge, 9 Jun 1987, *Latz 10570* (DNA); Vanderlin Island, 22 Jul 1988, *Latz 10692* (DNA); 30 km ENE of Oenpelli, 27 May 1988 *Munir 5925* (AD, DNA); Darwin River dam, 22 Apr 1977, *Must 1468* (CANB, DNA); Nitmiluk NP, 18 Apr 2001, *Risler 1351* (DNA). **Western Australia:** 41 m SE of New Theda Station homestead, 29 Apr 2008, *R. Barrett RLB 4871* (PERTH); Chapman River, 28 May 1976, *Beauglehole 51519* (NT, PERTH); 70 km NE of Gibb River Road, 13 Jun 1976, *Beauglehole 52738A* (DNA, PERTH); 3 km W of Kalumburu, 24 May 1993, *Cowie 4260* (DNA, PERTH); Beverley Springs Station, 8 Jun 1995, *Kenneally 11573* (PERTH); Heywood Island, 22 May 1972, *Wilson 10908* (PERTH).

Eriocaulon giganticum R.J.Davies *Austral. Syst. Bot.* 20: 445–446 (2007)

Type: Queensland: Edgbaston E of Aramac, Artesian Spring, *R.J. Fensham 3476* (holo BRI; iso AD, DNA!)

Eriocaulon sp. (Lake Mueller R.J.Fensham 3476) P.D. Bostock and A.E. Holland, *Census of the Queensland Flora* (2007).

Illustrations: R.J.Davies *et al., Austral. Syst. Bot.* 20: 438, fig. 5 (D); 440 fig. 7 (D) (2007).

Herb 14–38 cm high, perennial, tussock-forming. *Leaves* lanceolate, 12.0–22.2 cm long, 12–18 mm wide, acuminate, 13–14-nerved. *Peduncle* 13–41 cm long, with 7–9 ribs. *Sheath* 40–116 mm long. *Flower heads* cylindrical to hemispherical, 4–8 mm long, 5–10 mm wide. *Involucral bracts* cream to brown, broadly ovate, 1.7–2.5 mm long, 1.5–2.0 mm wide, obtuse, glabrous, sterile, reflexed at maturity. *Floral bracts* hyaline, cream to brown, spathulate-oblanceolate, cucullate, 1.7–2.5 mm long, 0.8–1.5 mm wide, subacute, dense hairs present on margins and abaxial surface. Receptacle glabrous, broadly conical to globular. *Male flowers*: 2.3–3.0 mm long, dimorphic frequently with smaller flowers with larger anthers towards centre; sepals 3, free, hyaline, dimorphic with one smaller, spathulate to oblanceolate and hooded at apex, 1.5–1.8 mm long, 0.3–0.5 mm wide, subacute, dense white hairs on margins and abaxial surface of sepals; median sepal 1.2-1.5 mm long, 0.3–0.4 mm wide; petals 3, hyaline, dimorphic with one larger and two slightly smaller, elliptic to ovate, acute or obtuse, pubescent with sparse to dense white hairs on margins and abaxial surfaces; stamens 6; anthers black. *Female flowers:* sepals 3, sometimes with hyaline margins, dimorphic, laterals navicular, 1.1–2.4 mm long, 0.3–1.0 mm wide, acute, with thick and fleshy dorsal keel without hyaline margins, lamina abruptly narrowing to a long narrowly winged stipe sometimes with auricles at point of narrowing, dense white hairs on margins and keels and abaxial surfaces of petals; median sepal narrowly linear spathulate, 1.1–1.5 mm long, 0.3 mm wide; petals 3, dimorphic slightly in size only, narrowly linear oblanceolate, 1.3–2.1 mm long, 0.3–0.58 mm wide, subacute, sparse to dense white hairs, on margins and abaxial surfaces of petals. *Ovary* 3-locular. *Seeds* ellipsoid, c. 0.6–0.7 x 0.4–0.5 mm; epidermal cell outline faint and with obscure peg-like projections on transverse walls. **Fig. 5g–h.**

Distribution: Known from Edgbaston Station and a historic collection from Bowen Downs in Qld. **Fig. 11.15.**

Habitat: The mound spring containing the species is dominated by grasses and sedges and is surrounded by *Melaleuca bracteata*.

Conservation Status: The data presented by Davies et al. (2007) supported the listing of this species as critically endangered according to IUCN (2001) criteria. It is listed as Endangered under Queensland legislation (Nature Conservation Act 1992). It is not protected in any conservation reserves. The total area of occurrence is less than 0.001 hectares, while the extent of occurrence is 0.001 hectares. Current data records one population of 30 plants confined to one mound spring on Edgbaston Station.

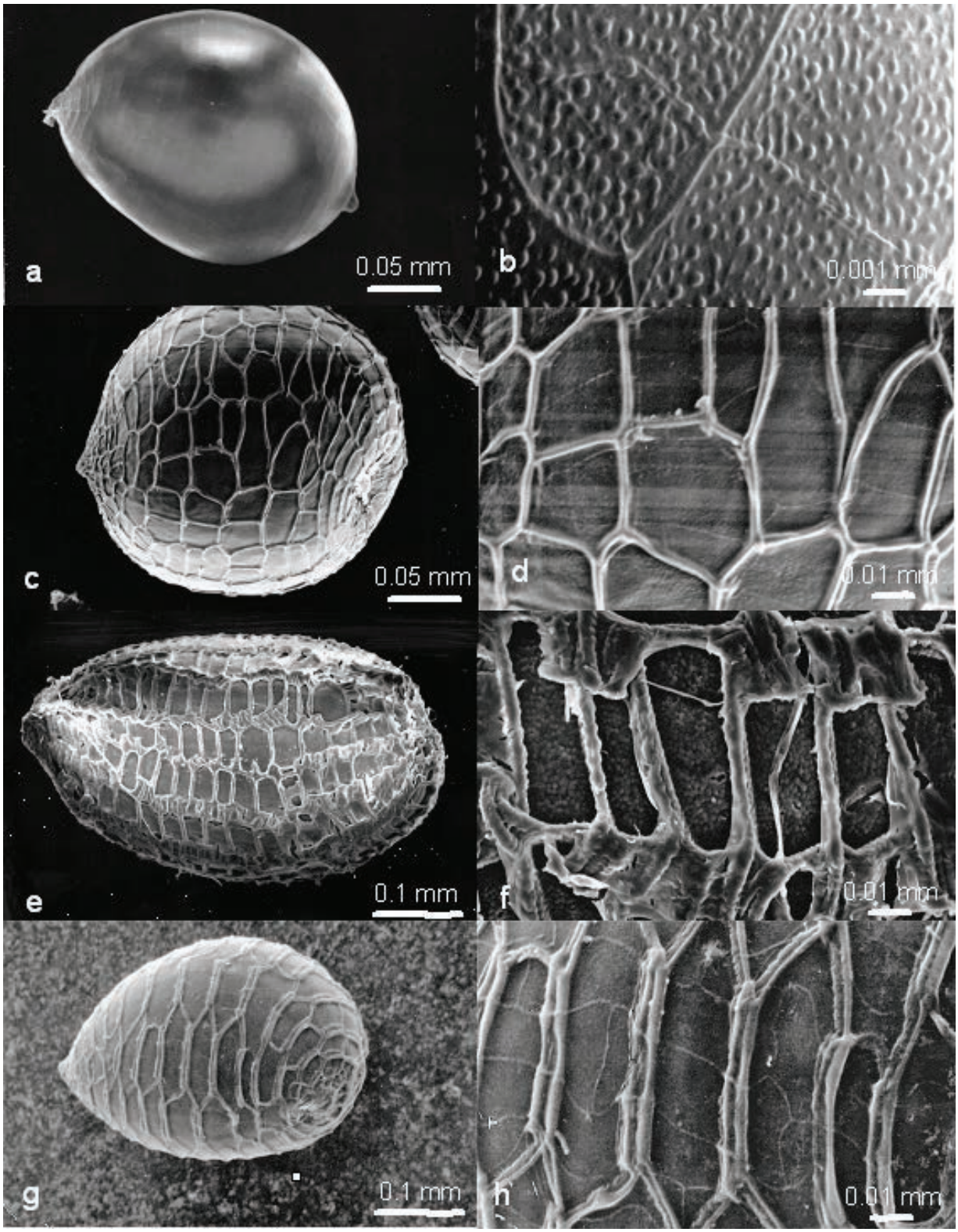

Fig. 4. Seed and seed surface: *Eriocaulon cinereum* **a, b**; *E. cinereum* sculpted seed form **c, d**; *E. clarksonii* **e, f**; *E. concretum* **g, h**. Material used: a-b from *Dunlop 3614*; c-d from *Leach 2349*; e-f from *Specht W439*; g-h from *Mueller MEL1554395*.

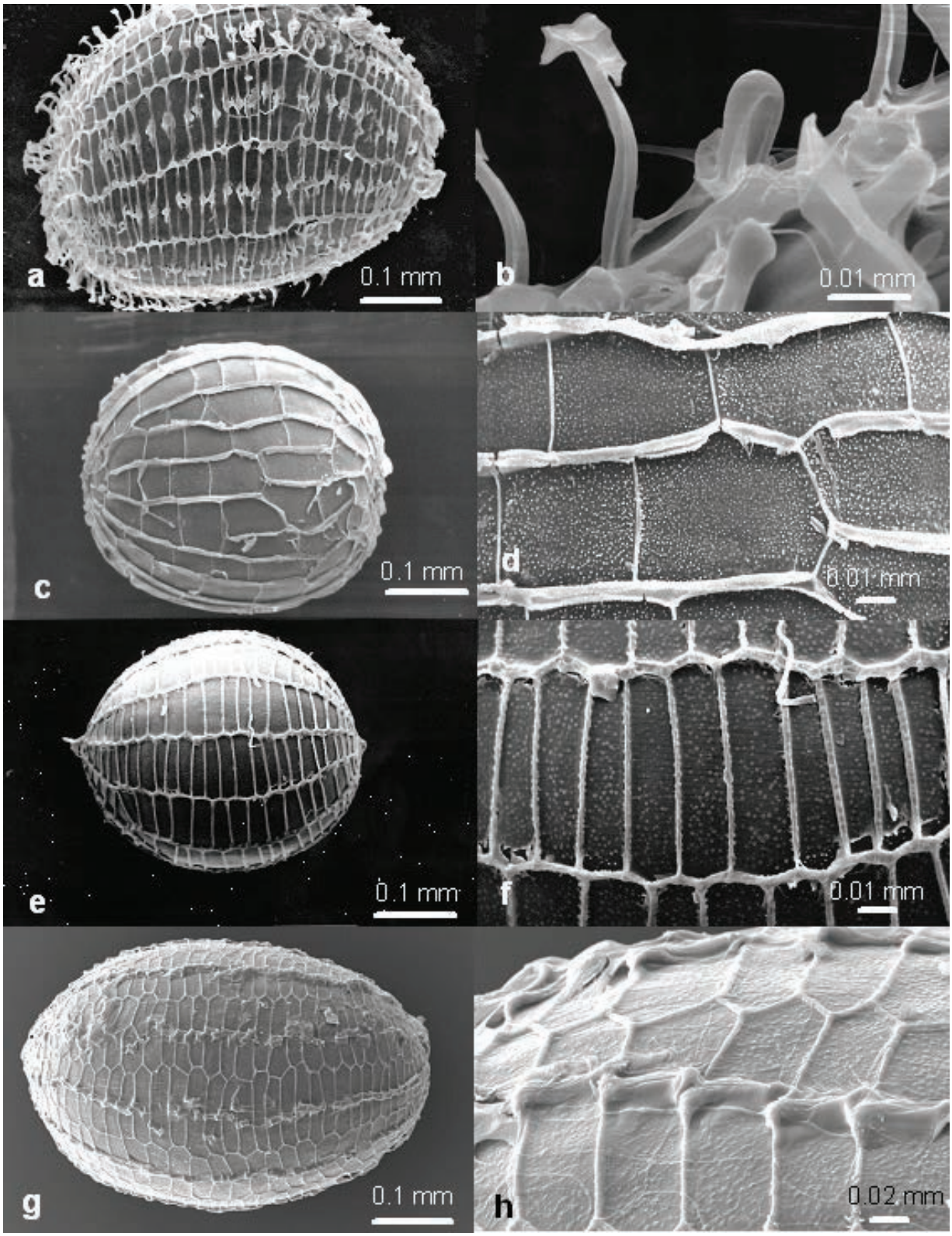

Fig. 5. Seed and seed surface: *Eriocaulon depressum* **a, b**; *E. fenshamii* **c, d**; *E. fistulosum* **e, f**; *E. giganticum* **g, h**. Material used: a-b from *Latz 7674*; c-d from *Latz 3406*; e-f from *Clark 1218*; g-h from *Davies 401*.

Etymology: The name of this species refers to the great length of the foliage of mature individuals in relation to other *Eriocaulon* species on mound springs in Australia.

Specimens examined: AUSTRALIA: Queensland: Bowen Downs, 1879, *Weldon de Burgh Birch s.n.* (MEL).

Specimens examined by Davies (2007): Queensland: Edgbaston Station, North Spring-group, Oct 2003, *Davies ERIO398-402* (AD).

E. inapertum G.J.Leach, *Austral. Syst. Bot.* 13: 762 (2000)

Type: Northern Territory: Daly River, N.T., 23 July 1946, *S.T. Blake 16579* (holo DNA!; iso BRI!, AD, CANB).

Illustrations: G.J.Leach, *Floodplain Flora*, 228, fig. 48 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 759 fig. 3 (C), 760 fig. 4 (C) (2000).

Herb 10–23(–30) cm high. *Leaves* linear, 2–6 cm long, 1.7–4 mm wide, 4–10-nerved. *Peduncle* 12.5–21 cm long. *Sheath* 25–35 mm long. *Flower heads* hemispherical or globular, 3–5.5 mm long, 4–5.5 mm wide. *Involucral bracts* straw yellow, obovate, 2–2.5 mm long, 0.8–1.75 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, oblanceolate, 2–2.75 mm long, 0.9–1.6 mm wide, acuminate, pubescent with white hairs. *Receptacle* densely pilose. *Male flowers*: sepals 3, fused but split on one side to form a spathe with spathe margins overlapping and appearing as a tube, hyaline, 1.3–1.55 mm long, 0.75 mm wide, truncate, pubescent with sparse scattered white hairs; petals 3, sometimes obscure, hyaline, equal or dimorphic with one larger and prominent, obtuse, pubescent with apical fringe of white hairs or glabrous; stamens 6; anthers black. *Female flowers*: sepals 2–3, hyaline or straw yellow, dimorphic, laterals navicular, with broad, rarely narrow dorsal wing, 1–1.7 mm long, 0.5–0.7 mm wide, crested, pubescent with sparse white hairs along crest and upper margin, hyaline hairs inside orifice; median sepal linear, hyaline, sometimes obscure amongst receptacle hairs, 0.9–1.2 mm long, c. 0.01 mm wide, acute, glabrous; petals 3, hyaline, equal or slightly dimorphic with one slightly larger, linear to narrowly elliptic, 1.2–1.4 mm long, 0.13–0.27 mm wide, acute, pubescent with white hairs in apical fringe and on margins. *Ovary* 3–locular. *Seeds* 0.4–0.45 mm long, 0.275–0.33 mm wide; epidermal cell wall thickenings as continuous bands on transverse walls. **Fig. 6a–b.**

Distribution: Western NT in the catchments of the Daly, Fitzmaurice and Victoria Rivers and scattered locations in the Kimberley, WA. **Fig. 12.16.**

Habitat: In the NT typically associated with sandstone ranges; open grass or sedge swamps associated with seepage areas. In shallow water to 20 cm deep. In the Kimberley associated with organic mound springs on black peaty clay in sedgeland.

Notes: The seeds of this species are "odontospermum" type. The SEM from Leach 2259 shows the wall thickenings to be connected with thinner remnants of the wall (Leach 2000). It is probably a somewhat immature seed. Collected mixed with *E. pygmaeum* (Kimberley form) (*Stuckey 19*). Some collections noted as viviparous (*Black 9*).

Conservation Status: Although known from relatively few collections, the geographic range of the species covers a very isolated region and the species is considered under collected. It is not considered under threat. In WA it has a conservation code of Near Threatened Priority One (Western Australian Herbarium, in FloraBase (2017). Coded as Near Threatened in the NT (FloraNT 2017).

Etymology: The epithet refers to the overlapping margins of the sepaline spathe in the male flower, which give the appearance of a closed tube.

Specimens Examined: AUSTRALIA: Northern Territory: 8 km SW of Mt Greenwood, 25 Feb 1989, *Leach 2176* (DNA); NE extremity of Kooendong Valley, 3 Mar 1989, *Leach 2259* (DNA); 19 km NE Mt Millikmonmir; Yambarran Range, 14 May 1994, *Leach 4458* (BRI, CANB, DNA, K, MEL); Bradshaw Military Training area, 31 Mar 2007, *Stuckey 19* (BRI, DNA, MEL, PERTH). **Western Australia:** 22 km N of Beverley Springs Station Homestead, 7 Dec 1993, *R. Barrett RLB909* (PERTH); Gap spring, Mt Elizabeth Station, 14 Sep 1999, *Black 4* (PERTH); Fern pool, Drysdale River Station, 19 Sep 1999, *Black 9* (PERTH); Mt Elizabeth Station, 1.5 km from Hann River, 14 Sep 1999, *Black 6* or *s.n.* (DNA, PERTH).

E. lividum F.Muell., *Fragmenta Phytographiae Australiae* 1: 92 (1859)

Type: Near McAdam Range, *F. Mueller s.n.* (holo MEL1501980!; iso K1056245!)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307C (1992); G.J.Leach, *Floodplain Flora*, 231, fig. 49 (2000).

Herb 3–26 cm high. *Leaves* lanceolate, 4.5–18 cm long, 0.2–0.65 cm wide, 5–7–nerved. *Peduncle* 3–26 cm long, with 8-10 ribs. *Sheath* 18–25 mm long. *Flower heads* globular, 4–10 mm long, 4–8 mm wide. *Involucral bracts* hyaline, broadly obovate, 2–2.2 mm long, 1–1.8 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, obovate to spathulate, 2–3 mm long, 0.9–1.75 mm wide, acute, glabrous or pubescent with easily deciduous white hairs. *Receptacle* glabrous or sparsely hairy, conical. *Male flowers*: 1.5–2.5 mm long; sepals 3, fused but split on one side to form a spathe which is 3-lobed, often deeply so as to appear free; also occasionally with one lobe more or less free and other two joined higher, hyaline, 1.5–2.75 mm long, 0.75–1 mm wide, obtuse, pubescent with white hairs in apical fringe; petals 3, hyaline, equal, oblong, acute or obtuse, pubescent with white hairs in apical fringe; stamens 6; anthers black. *Female flowers*: sepals 3 (rarely appearing as 2), hyaline, equal, navicular, fleshy, dorsally keeled, 1.5–2.5 mm long, 0.5–1 mm wide, acute, glabrous or pubescent, with white hairs externally on apical half; petals 3, hyaline, fleshy, equal, oblong and abruptly narrowed into stipe, 1.75–3.25 mm long, 0.5–1 mm wide, obtuse, glabrous. *Ovary* 3–locular. *Seeds* 0.6–0.7 mm long, 0.4–0.53 mm wide; epidermal cell walls with longitudinal rows of hair or peg-like projections, often with a terminal cap and often erect. **Fig. 6c–d.**

Distribution: In the Kimberley region of WA and in the western NT from the Macadam Range to Darwin, the Katherine region and western Arnhem Land. **Fig. 12.17.**

Habitat: Sandy edges of perennial streams in sandstone. Also on heavier alluvial sediments in river margins.

Notes: The Kew isotype sheet also has mounted on it collections by Alan Cunningham (K1056246, 1056247) but these were not cited by Mueller in his description of the species and so are not part of the type material.

Viviparous behaviour has been observed in a number of collections of this species (*Dunlop 5546*, *Michell 2513*, *Mitchell 8456*). Some flower heads appear to consist of only male flowers (e.g. *Beauglehole 52564, 59125*, *Dunlop 4215, Kenneally 2044*).

Conservation Status: Widely distributed and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Northern Territory: Cadell River crossing, 25 Jun 1972, *Byrnes 2699* (CANB, DNA, USA); Gulungul Creek, 15 Sep 1986, *Cowie 343* (DNA); Jabiru, 10 May 1975, *Dunlop 4215* (DNA, NSW, NT); Twin Falls, Kakadu NP, 2 Sep 1980, *Dunlop 5546* (CANB, DNA); Liverpool River Xing, 27 Jun 1972, *Latz 3032* (BRI, DNA, NT); Katherine River headwaters, 8 Jul 1996, *Mangion 212* (DNA); Mann River headwater, 12 Sep 2000, *Michell 2513* (DNA); Jim Jim falls, 8 Jun 1988, *Munir 6186* (AD, DNA); 40 km E of Oenpelli, 15 Oct 1981, *Thomson 96* (DNA); 25 km E of Goomadeer River Xing, 16 Jun 1987, *Wightman 3820* (DNA, K). **Western Australia:** 27.6 km N of Doggan River, 31 May 1976, *Beauglehole 51843* (DNA, PERTH); Manning Gorge, 8 Jul 1976, *Beauglehole 52564* (DNA, PERTH); King Edward River, 25 Aug 1978, *Beauglehole 59147* (DNA); West Bay, Napier Broome Bay, 21 May 1984, *Chesterfield 271* (DNA, MEL); King Edward River, 12 Jun 1987, *Edinger 354* (PERTH); Cracticus Falls, Drysdale River NP, 9 Aug 1975, *Kenneally 4120* (PERTH); King George River, above falls, 7 Jun 1992, *Kenneally 11278* (PERTH); track Honeymoon beach to Pago, 4 Jul 1997, *Kenneally 11899* (DNA, PERTH); 44 miles SW of Kalumburu, 5 Sep 1954, *Lazarides 4933* (CANB, DNA, PERTH); Woorakin Creek, Aug 1969, *Main s.n.* (PERTH); East bank Drysdale River, 2 Jun 1996, *Mitchell 4410* (BROOME, DNA, PERTH); King Edward River campground, 8 Sep 2005, *Mitchell 8456* (BRI, DNA, PERTH).

E. nanum R.Br., *Prodromus Florae Novae Hollandiae* 254 (1810)

Type: ['(T.) *v.v.*'] Nova Hollandia ora septentrionalis, Carpentaria, Port I [between Curtis and Facing Islands], *R. Brown s.n. [Iter Austral. 5822]* (**lecto (here designated)** BM000990772!); Syntypes East coast within the tropics, 1802, *R. Brown s.n.* (BM9990773!), *R. Brown s.n. [Iter Austral. 5822]* (K1056251!).

Herb 1.5–16 cm high. *Leaves* linear, 1–6.5 cm long, 0.75–3 mm wide, apex acute, 3–7-nerved. *Peduncle* 1.5–12 cm long, with 4–6 ribs. *Sheath* 6–25 mm long. *Flower heads* globular or hemispherical, 2–4 mm long, 3–4 mm wide. *Involucral bracts* hyaline to black or black with hyaline base, obovate, 1.1–1.9 mm long, 0.4-1.3 mm wide, obtuse, glabrous, thin, flexible, becoming reflexed at maturity. *Floral bracts* black rarely greyish, oblanceolate, 1.1–1.8 mm long, 0.4–1 mm wide, acute, glabrous. *Receptacle* glabrous or sparsely hairy, conical. *Male flowers:* 1–1.5 mm long; s*epals* (2-)3, fused but split on one side to form a spathe which is often 3-lobed, rarely apparently

2–3 free, black, 0.875–1.2 mm long, 0.35–0.9 mm wide, acute, glabrous or rarely pubescent, hairs white in apical fringe; petals 3, hyaline, dimorphic with larger petal at opening of spathe, acute, glabrous or pubescent with white hairs in apical fringe; stamens 6; anthers black, included. *Female flowers:* equal; sepals 2 or 3, black rarely greyish, dimorphic, navicular and geniculate, 0.95–1.4 mm long, 0.15–0.4 mm wide, acute, glabrous; median sepal linear, 0.6–0.875 mm long, 0.1 mm wide, acute, glabrous; petals 3, hyaline, dimorphic, spathulate to narrowly elliptic, 0.9–1.5 mm long, 0.2–0.325 mm wide; 2 smaller petals c. 1 x 0.175 mm, acute or obtuse, glabrous or pubescent with white and hyaline hairs, white hairs in apical fringe, scattered hyaline hairs on margin and adaxially. *Ovary* 3-locular. *Seeds* 0.35–0.45 mm long, 0.245–0.3 mm wide; epidermal cell wall thickenings as continuous bands on transverse walls. **Fig. 6e–f.**

Distribution: Along the eastern coastal area of Qld and in northern NSW. **Fig. 12.18.**

Habitat: On stream margins, in drains and seepage areas. Also recorded from hot springs.

Notes: *Eriocaulon nanum* is part of a complex with *E. odontospermum* and *E. athertonense*. It is distinguished from these taxa by the typically glabrous floral parts and the seed sculpturing consisting of transversely thickened bands. The male sepals are typically united into a spathe but rarely do they appear as free segments. Recorded in mixed collections with *E. fistulosum* (*Coveny 6955*), *E. scariosum* (*Henderson 584*) and *E. cinereum* (*Armit 450*).

E. pallidum R.Br. is a possible synonym of *E. nanum* but due to uncertainty of application of the name it is discussed under 'Incertae Sedis'.

Conservation Status: Widespread and not considered under threat.

Selected specimens examined: AUSTRALIA: Queensland: Einasleigh River, *Armit 450* (MEL); Brisbane River, *Bailey s.n.* (BRI, MEL); Verrierdale Road, 8 km W of Peregian Beach, 12 May 1990, *Bean 1584* (BRI); near Blady Grass creek, 20 km S of Cardwell, 4 Jul 1991, *Bean 3466* (BRI); Newcastle Range, Jul 1906, *Blackman s.n.* (BRI); Cairns, 26 Jun 1935, *Blake 9628* (CANB); S of Burdekin and Bogie Rivers, 9 Oct 1950, *Blake 18682* (BRI, CANB); Shiptons Flat, 12 Sep 1948, *Brass 202101* (BRI, CANB); Mt Pring, 18 Apr 1978, *Byrnes 3897* (BRI); Shoalwater Bay Military Reserve, 7 Jul 1977, *Clarkson 743* (BRI); Shoalwater Bay Military Reserve, 9 Jul 1977, *Clarkson 844* (BRI, MEL); 1 km N or Ravenshoe, 1 May 2014, *Corlis 11* (CNS); 10 km W of Herberton, 10 Apr 2014, *Corlis 17*; S of Mimosa Creek, Blackdown Tableland, 12 Jun 1977, *Crisp 2972* (CBG); Keelbottom Creek, 23 June 2006, *Dowe s.n.* (CNS); Shoalwater Bay army area, 23 Jul 1973, *Edwards s.n.* (BRI); Cockatoo Spring, SE of Mt Garnett, 25 May 2001, *Fensham 4700* (BRI, DNA); Station Creek, 1 Jan 1936, *Flecker 1193*; Innot Hot Springs, 11 May 1937, *Giddins s.n.* (CNS); c 32 km SE of Blackwater, Blackdown Tableland, 17 Apr 1971 *Henderson 584A* (BRI, MEL); Moreton Bay, 1857, *Hill s.n.* (MEL); Mt Perry, *Keys s.n.* (BRI); Bluewater Creek, 20 km N of Townsville, 10 Jun 1975 *Sharpe s.n.* (BRI); **New South Wales:** 2 km NE of Applethorpe, 20 May 1971, *Briggs 4230* (NSW); c. 1 km W of Mummulgum on Tenterfield Road, 12 May 1981, *Wilson 3870* (NSW).

Representative specimen with apparently free male sepals: Queensland: Mt Stowe area, May 1992, *Elsol s.n.* (BRI).

E. nematophyllum G.J.Leach, *Austral. Syst. Bot.* 13: 763 (2000)

Type: Northern Territory: Mt Brockman, 20 Apr 1989, *G.J. Leach 2562* (holo DNA!; iso BRI!, CANB!, K!, MEL!).

Illustrations: G.J.Leach, *Floodplain Flora*, 231, fig. 49 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 760 fig. 4 (D), 765 fig. 7 (A) (2000).

Herb 5–12.5 cm high. *Leaves* filiform, 2.5–5 cm long, 0.08–0.15 cm wide, 1–3-nerved. *Peduncle* 4.5–11.5 cm long. *Sheath* 15–25 mm long. *Flower heads* globular, often squarrose, 2.5–4.5 mm long, 3.5–4 mm wide. *Involucral bracts* straw yellow to hyaline, elliptic to narrowly lanceolate, 1.75–3 mm long, 0.6–0.8 mm wide, acuminate to acute, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline to black at apex, lanceolate, 1.4–2.5 mm long, 0.4–0.8 mm wide, acuminate with arista 0.5–1 mm long, glabrous or pubescent with sparse white hairs. *Receptacle* densely pilose, convex *Male flowers*: 0.8–1 mm long; sepals 3, fused but split on one side to form a spathe which is sometimes 3-lobed, hyaline to black, 0.9–1.4 mm long, 0.43–0.53 mm wide, truncate, glabrous or pubescent with apical fringe of white hairs; petals 3 or obscure, hyaline, equal, triangular, obtuse to acute, glabrous; stamens 6; anthers black. *Female flowers*: sepals 3, hyaline to black, dimorphic, navicular and geniculate, lacking dorsal keel or wing, 0.6–1.2 mm long, 0.1–0.2 mm wide, acute, glabrous or pubescent with white hairs in apical fringe and median region; median sepal narrowly elliptic, 0.6–1.2 mm long, 0.1–0.3 mm wide, acute, pubescent with white hairs in apical fringe and median region or glabrous; petals 3, hyaline, equal, linear to spathulate, 0.8–1.2 mm long, 0.06–0.2 mm wide, acute to acuminate, pubescent with white hairs in apical fringe or margins or adaxially. *Ovary* 3-locular. *Seeds* 0.35–0.4 mm long, 0.2–0.3 mm wide; epidermal cells with even wall thickenings. **Fig. 6g–h.**

Distribution: In the NT with scattered records from Darwin, Katherine region and Arnhem Land. Apparently disjunct between Arnhem Land and western Cape York. **Fig. 12.19.**

Habitat: Seasonally inundated floodout areas or margins of watercourses, often with *Melaleuca*.

Notes: Has been recorded growing mixed with *E. pusillum* Sol. ex R.Br.

Conservation Status: Not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Etymology: From the Greek "nemato" meaning thread-like and "phyllum" leaf; referring to the fine filiform leaves.

Specimens examined: AUSTRALIA: Queensland: 4.5 km E Aurukun - Beagle North Camp road, 01 Jun 1982, *Clarkson 4461* (BRI, K, CNS). **Northern Territory:** 19 km NNW Twin Falls, 03 Jun 1980, *Craven 6294* (CANB, DNA); E of Shoal Bay Reserve, 16 May 2011, *Kerrigan 342* (DNA); 17 Miles N Wilton R. crossing, 15 Jun 1972, *Latz 2757* (DNA, NT); Nitmiluk NP, 20 Apr 2001, *Michell 3175* (DNA); 27 km NE of Wilton River crossing near swamp area at turnoff to Maningrida, 15 Jun 1972, *Symon 7694* (DNA, ADW).

E. odontospermum G.J.Leach, *Austral. Syst. Bot.* 13: 764 (2000)

Type: Northern Territory: Cape Shield, 3 May 1993, *I.D. Cowie 4074 & G.J. Leach* (holo DNA!; iso CANB!)

Eriocaulon sp. B G.J.Leach, *Fl. Kimberley Reg.* 1032 (1992)

Eriocaulon quinquangulare sensu Bentham, *Fl. Austral.* 7: 192 (1878).

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1031, fig. 308C, as *Eriocaulon* sp B (1992); G.J.Leach, *Floodplain Flora*, 231, fig. 49 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 760 fig. 4 (E), 765 fig. 7 (B) (2000).

Herb 6.5–26 cm high. *Leaves* linear, 2–14 cm long, 0.15–0.7 cm wide, 6–12–nerved. *Peduncle* 6.5–26 cm long, with 4-6 ribs. *Sheath* 20–60 mm long. *Flower heads* depressed globular, 2.5–4.5 mm long, 4–6 mm wide. *Involucral bracts* straw yellow, obovate to elliptic, 1.25–2.2 mm long, 0.5–1.2 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* black, spathulate, 1.25–2 mm long, 0.4–0.9 mm wide, acute or mucronate, densely pubescent with white hairs on margin and apex. *Receptacle* densely pilose, conical. *Male flowers*: 1.1–1.6 mm long; sepals 3, fused but split on one side to form a spathe which is often 3-lobed, black, 1.1–1.6 mm long, 0.45–0.65 mm wide, obtuse, pubescent with apical fringe of white hairs; petals 3, hyaline, equal, oblong, acute or obtuse, pubescent with apical fringe of white hairs; stamens 6; anthers black. *Female flowers*: sepals 3, black, equal, navicular and geniculate, lacking dorsal keel or wing, 1–1.5 mm long, 0.16–0.45 mm wide, acute, pubescent with white hairs in apical fringe and along keel or margins; petals 3, hyaline, equal, linear to narrowly elliptic, 1–1.5 mm long, 0.16–0.23 mm wide, obtuse, pubescent with apical fringe of white hairs and hyaline hairs adaxially and on margins although hyaline hairs sometimes reduced or absent. *Ovary* 3–locular. *Seeds* 0.3–0.5 mm long, 0.23–0.375 mm wide; epidermal cells transversely elongated, unidirectional peg-like projections on transverse walls. **Fig. 7a–b.**

Distribution: Common in the west Kimberley region with scattered records through the Victoria River region, south of Darwin to Arnhem Land and coastal Qld as far south as Mackay. **Fig. 12.20.**

Habitat: Typically in sandstone habitats on perennial water sources but also recorded on limestone. In gorges and often in protected rocky areas but also associated with riparian forest, *Melaleuca* forest or watercourses in eucalypt woodland.

Notes: Has been recorded growing mixed with *Eriocaulon depressum* R.Br. ex Sm. in Qld (*Clarkson 4983*). Several collections from late in the dry season suggest that this species may be perennial where water is permanently available.

Conservation status: Apparently quite common in the western part of its range and not considered under any threat. Coded as Least Concern in the NT (FloraNT 2017).

Etymology: From the Greek "odonto" meaning tooth and "sperma" seed; referring to the tooth-like rows of projections on the seed.

Selected Specimens examined: AUSTRALIA: Queensland: Ravenshoe, 21 Jun 1935, *Blake 9546* (CANB); 3.3 km SW track Myerfield to Batavia downs on Weipa track, 09 Aug 1983, *Clarkson 4983* (AD, BRI, CANB, DNA, K, L, MEL, MO, NSW, PERTH, QRS); 15 km W of Mareeba, 10 Apr 2014, *Corlis 13* (BRI, CNS). **Northern Territory:** Fitzmaurice River, 12 May 1994, *Barritt 1254* (DNA, MEL); Arnhem Land, Yarunga Crk, 25 Jul 1987, *Clark 1297* (DNA, MO); Matta Murta R. crossing, Arnhem Land, 10 Oct 1987, *Clark 1644* (DNA); Elizabeth R., 25 M SE Darwin, 11 Jun 1964, *Nelson 1125* (DNA); Fish River Gorge, 70 km SE of Daly River, 04 Oct 1989, *Wightman 4800* (DNA). **Western Australia:** c. 200 km E Derby, 25 Jul 1974, *Beauglehole 47956* (PERTH); c.

180 km E Derby, 26 Jul 1974, *Beauglehole 48001* (PERTH); 4 Miles W Mt. Barnett Stn. King Leopold Range, 01 Aug 1970, *Butler s.n.* (PERTH); Monger Creek, 10.5 km NW of Kalumburu, 25 May 1993, *Cowie 4281* (CANB, DNA, PERTH); c. 6 km W of Mitchell River Falls, 29 May 1993, *Cowie 4342* (CANB, DNA, PERTH); Sandy Creek Gorge, Leopold Range, 27 Apr 1988, *Cranfield 571* (PERTH); 0.5 km S camps on W Bank of King Edward R, 21 Jun 1987, *Edinger 355* (PERTH); Mt Hart Hmstd. Barker R., 19 Jun 1987, *Edinger 396* (PERTH); Yampi peninsula, in Trent R. Gorge, 31 May 1985, *Fryxell 4570* (CANB, DNA, PERTH); Lawley R., 01 Jul 1921, *Gardner 1153* (PERTH); Surveyor Falls near Mitchell R., 18 Jun 1975, *George 13141* (PERTH); Palmoondoora Crk above Morgan Falls, Drysdale R. Nat Park, 18 Aug 1975, *George 13989* (PERTH); Galvens Gorge Mt Barnett, 03 Jun 1982, *Jacobs 4400* (NSW); Pseudomys Hills, Camp Crk Mitchell Plateau, 15 Jul 1976, *Kenneally 4924* (CANB, PERTH); Surveyors Pool 2 km NE Mining Campsite, Mitchell Plateau, 15 Oct 1982, *Kenneally 8593* (CANB); Unnamed Crk & Sale R Junction 30 km SE mouth, 13 May 1986, *Kenneally 9595* (PERTH); Bachsten Creek Camp Pool Tributary, 30 Jul 1996, *Kenneally 11837A* (PERTH); Mitchell Plateau 20 Miles S Amax Buildings, 19 Aug 1976, *Lewis 12* (PERTH); East Kimberely, Mabel Downs Station, Winnama Spring, 15 Nov 1989, *Menkhorst 704* (DNA, MEL, PERTH); creek running into W arm of Secure Bay, 27 May 1993, *Mitchell 3131* (DNA, PERTH); c. 5 km E Drysdale Hstd; along Gibb River Rd., 08 Jul 1994, *Mitchell 3672* (DNA, PERTH); Apex Creek near Inglis Gap; King Leopold Range; 47 km NE of Lennard River crossing, 13 May 1988, *Streimann 8249* (CANB, CBG, DNA, L, PERTH); c. 80 km NNE Derby, 12 km N Kimbolton Hmstd, 01 Jul 1977, *Telford 6321,* (CBG, PERTH); NNE of Derby, Trent River Gorge, 16 km NW of Kimbolton homestead, 01 Aug 1977, *Telford 6351* (CBG).

E. patericola G.J.Leach, *Austral. Syst. Bot.* 13: 767 (2000)

Type: Western Australia: Mitchell Plateau, 26 Feb 1980, *C.R. Dunlop 5314* (holo DNA!; iso BRI!, K, PERTH).

Eriocaulon sp. F G.J.Leach, *Fl. Kimberley Reg.* 1034 (1992)

Eriocaulon sp. Harding Range (M.D. Barrett & R.L. Barrett MDB1826) in FloraBase (2017)

Eriocaulon sp. Morgan River (A.T. Cross ATC62) in FloraBase (2017)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1033, fig. 309D (1992); G.J.Leach, *Floodplain Flora*, 231, fig. 49 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 760 fig. 4 (F), 765 fig. 7 (C) (2000).

Herb 5.5–29 cm high. *Leaves* linear, 0.9–3 cm long, 0.06–0.1 cm wide, 1–3-nerved. *Peduncle* 5.5–29 cm long, with 4–5 ribs. *Sheath* 11–32 mm long. *Flower heads* globular to cylindric, 1.3–3.25 mm long, 1.1–2.5 mm wide. *Involucral bracts* hyaline, sometimes with darker central area, elliptic to broadly elliptic, 0.4–0.75 mm long, 0.475–0.7 mm wide, obtuse, glabrous, not reflexed at maturity. *Floral bracts* hyaline, elliptic to obovate to ± orbicular, 0.55–0.925 mm long, 0.4–0.55 mm wide, obtuse, glabrous or pubescent with apical patch of white hairs. *Receptacle* glabrous, conical. *Male flowers*: c. 0.8 mm long; sepals 3, fused but split on one side to form a spathe which is often deeply 3-lobed, black or hyaline, 0.45–0.875 mm long, 0.3–0.375 mm wide, obtuse lobes or spathe truncate, glabrous or pubescent with apical fringe of white hairs; petals 3, hyaline, equal, linear or oblong, obtuse, pubescent with white hairs in apical fringe and adaxially; stamens 6; anthers yellow. *Female flowers*: sepals 0–3, hyaline, equal, linear to narrowly elliptic, lacking dorsal keel or wing, 0.3–0.6 mm long, 0.05–0.1 mm wide, acute, glabrous; petals (2–)3, hyaline, equal, linear, 0.4–0.6 mm long, 0.05–0.125 mm wide, obtuse, pubescent with apical fringe of white hairs. *Ovary* 3–locular. *Seeds* 0.375–0.4 mm long, 0.35–0.4 mm wide; epidermal cells with even wall thickenings. **Fig. 7c–d.**

Distribution: Apparently disjunct between the Mitchell Plateau in the Kimberley region to western Arnhem Land and the Katherine region. Further disjunct collections on Groote Eylandt. **Fig. 12.21.**

Habitat: In small, ephemeral, shallow rock pools typically on sandstone pavement or in creek beds.

Notes: *Eriocaulon patericola* is here treated in a broad sense to encompass a number of populations found in the specific habitat of ephemeral rock pools. As currently known it has a markedly disjunct distribution between the Kimberley region and Arnhem Land and the Katherine River catchment. There is observable variation, particularly in the Kimberley region, in characters such as shape and apex of the floral bracts and the indumentum of the floral bracts and female sepals (M.D. Barrett *pers. comm.*). The Western Australian Herbarium has two *Eriocaulon* phrase names on FloraBase (2017), which are here placed under *E. patericola* - *Eriocaulon* sp. Harding Range (M.D. Barrett & R.L. Barrett MDB1826) and *Eriocaulon* sp. Morgan River (A.T. Cross ATC62).

Some of the NT collections are noted to have glabrous floral bracts with more acute apices but this is not consistent across all NT material. The highly fragmented nature of this habitat seems likely to have driven some differentiation of populations and the recognition of further taxa may be supported by molecular analysis proposed in a future study. The type of *E. patericola* is from the Mitchell Plateau and so the name will belong to a Kimberley entity if future studies recognise new taxa and separate the WA and NT material.

Conservation Status: Restricted to a very specific habitat but likely to be more common in this habitat than current collections would indicate. In the broad sense of the species accepted here it is not considered under threat. In WA it has a conservation code of Near Threatened Priority One (Western Australian Herbarium, in FloraBase (2017). The phrase name taxon *Eriocaulon* sp. Morgan River (A.T. Cross ATC62) has a WA conservation code of Near Threatened Priority One. Coded as Least Concern in the NT (FloraNT 2017).

Etymology: Latin *pater*, shallow dish or saucer, and *cola*, dweller, in reference to the habitat of the shallow saucer-like rock pools.

Selected specimens examined: AUSTRALIA: Northern Territory: Nourlangie Rock, 19 Jan 1991, *Brennan 859* (DNA); Nitmiluk NP, 6 Mar 2001, *Brennan 5511* (DNA); Groote Eylandt, 14 Mar 2005, *Brennan 6469* (DNA); Nourlangie Rock, 13 Feb 2011, *Brennan 9120* (DNA); Nourlangie Creek; 28 Feb 1973, *Dunlop 3388* (DNA); Nourlangie Rock, 1 Apr 1988, *Finlayson s.n.* (DNA); SW slope of Nourlangie Rock, 22 Feb 1987, *Gartrell UNSW 19964* (DNA, UNSW); 15 km SW of Mt Howship, Arnhem Land, 18 Apr 1989, *Leach 2558* (DNA, MEL); Mount Brockman, Kakadu NP, 20 Apr 1989, *Leach 2568* (DNA, MEL); Kakadu NP, 8 km NNE of Mt Evelyn, 08 Apr 1989, *Menkhorst 302* (DNA, MEL); Nitmiluk NP, 10 Feb 2001, *Michell 2719* (DNA); Nitmiluk NP, 7 Mar 2001, *Michell 2720* (DNA); Nitmiluk NP, 17 Apr 2001, *Michell 3176* (DNA); 10 km S of Oenpelli, 24 May 1988, *Munir 5853* (AD, DNA); Jabiluka outlier, 30 Mar 1980, *Waterhouse UNSW 9603* (DNA, UNSW).

E. pusillum Sol. ex R.Br., *Prodromus Florae Novae Hollandiae* 254 (1810)

Type: ['(T.) B. *v.s.*'] Queensland: Endeavour River, 1770, *J. Banks & D. Solander s.n.* (holo BM 000900919!; iso K001056249!)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307D (1992); G.J.Leach, *Floodplain Flora*, 231, fig. 49 (2000).

Herb 1.2–12 cm high. *Leaves* linear, 1.7–6 cm long, 0.09–0.55 cm wide, 7–11-nerved. *Peduncle* 1.2–12 cm long, with 4–8 ribs. *Sheath* 10–30 mm long. *Flower heads* ovoid to hemispherical, 2–3.5 mm long, 2.5–5.5 mm wide. *Involucral bracts* hyaline, obovate to oblanceolate, 1.5–3 mm long, 0.9–1.4 mm wide, obtuse to acute, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, sometimes darker at apex, narrowly obovate, 1.25–2.6 mm long, 0.6–0.76 mm wide, acute to obtuse, glabrous or rarely pubescent with white hairs. *Receptacle* densely pilose or rarely sparsely hairy, conical. *Male flowers* 1.2-1.75 mm long; sepals (1–)2(–3), free, hyaline with dark tips, linear, 0.9–1.5 mm long, 0.1–0.2 mm wide, acute, glabrous or rarely pubescent with apical fringe of white hairs; petals 3, hyaline, equal or dimorphic sometimes with one larger or only one apparently developed, triangular, acute or obtuse, glabrous or pubescent with apical fringe of white hairs; stamens 6; anthers black. *Female flowers*: sepals 2(–3) but often deciduous, hyaline with dark tips, equal, linear, lacking dorsal keel or wing, 0.75–1.6 mm long, 0.1 mm wide, acuminate, glabrous; petals 3, hyaline, equal, linear to narrowly elliptic, 0.76–2 mm long, 0.1 mm wide, acute, pubescent with apical fringe of white hairs and hyaline hairs on margin and adaxially or rarely glabrous. *Ovary* 3-locular. *Seeds* 0.36–0.43 mm long, 0.225–0.26 mm wide; epidermal cell wall longitudinal thickenings white, prominent, thicker than transverse walls. **Fig. 7e–f.**

Distribution: Qld north of Rockhampton to Cape York, western side of the Gulf of Carpentaria, through Arnhem Land and the VRD to the Kimberley. **Fig. 12.22.**

Habitat: Seasonal or perennial creeks, edges of permanent spring-fed rainforest, or seepage areas and typically associated with sandstone.

Notes: Has been recorded in mixed collections with several other *Eriocaulon* species, notably with *E. spectabile* (*Gunn 17*), *E. depressum* (*Morton 716*) and *E. fistulosum* (*Blake 23435*).

Conservation Status: Widely distributed and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected Specimens Examined: AUSTRALIA: Queensland: Water Park Creek near Byfield, 16 Aug 1970, *Davis 18* (BRI); Off Peninsula road, Blackdown Station, 11 Apr 1988, *Forster 4053* (BRI, DNA); Beening Creek, Weipa, 20 Apr 1980, *Morton AM716A* (BRI). **Northern Territory:** Cape Arnhem, 3 Aug 1995, *Barritt 1904* (DNA, MEL); Kapalga, 27 Apr 1977, *Collins 396* (DNA); upper catchment of Magela Creek, 12 Apr 1995, *Cowie 5662* (CANB, DNA, MEL, MO); Katherine Gorge NP, 8 Apr 1981, *Craven 6751* (CANB, DNA); Mount Boulder, 24 Feb 1989, *Dunlop 7993* (DNA); Macadam Range, 2 Mar 1989, *Dunlop 8089* (DNA); Kakadu NP, 22 Apr 1990, *Dunlop 8613* (DNA, CANB); Bickerton Island, 29 Apr 1994, *Dunlop 9279* (DNA); Bickerton Island, 11 May 1993, *Egan 2371* (DNA); 15 km SSE of Legune Homestead, 5 Mar 1989, *Leach 2306* (DNA); 15 km SW of Mt Howship, 18 Apr 1989, *Leach 2555* (DNA); Mt Brockman, Kakadu NP, 20 Apr 1989, *Leach 2567* (BRI, DNA); E of Springs Hunting Reserve, 24 May 2000, *Leach 4648* (BRI, DNA); Arafura swamp, 13 Apr 1998, *Mangion 619* (DNA); Howard River area, 8 Jul 1973, *Parker 134* (DNA); 7 km SE of mouth of Giddy River, 22 Feb 1988, *Russell-Smith 4884* (DNA);

Western Australia: 20.7 km E of Bedford Downs Hmstd, 22 Jun 1976, *Beauglehole 53562* (DNA, PERTH); Mitchell River, 23 Feb 1980, *Dunlop 5281* (DNA, PERTH); Hanover Bay, 5 Apr 2006, *Mitchell 8552* (BRI, CANB, DNA, PERTH); Durack station, 29 May 2014, *Thiele 4892* (PERTH).

E. pygmaeum Sol. ex Smith, *Rees' Cyclopaedia* 13 (1809)

Type: "Native of New Holland", *J. Banks & D. Solander s.n.* (lecto (Leach 2000: 771) LINN-HS 146.15; isolecto LINN-HS 146.16).

Syntypes B100296817!, BM000900916!, BM (two sheets without original labels) *n.v.*, K001056344!, LL00374589 *n.v.*

E. nigricans R.Br. *Prodromus Florae Novae Hollandiae* 254 (1810)

Type: ['(T.) *v.v*'] Endeavour River, *J. Banks & D. Solander s.n.* **(lecto (here designated)** BM000900916!)

Syntypes BM (two sheets without original labels) *n.v.*, LINN-HS 146.15!, 16!, B100296817!, K001056344!, LL00374589 *n.v.*

E. graphitinum F.Muell. & Tate ex Ewart & Cookson, *Fl. N. Territory*: 67, pl. 6 (1917).

Type: Northern Territory: MacDonnell Ranges, 1889, *Tietkens s.n.,* (lecto (Leach 2000: 771)) MEL710186!; isolecto MEL710176 (ex ADU)!)

Eriocaulon sp. C G.J.Leach, *Fl. Kimberley Reg.* 1032 (1992)

Eriocaulon D76325 Cape Shield, in Albrecht D E *et al. Vascular plant checklist for the southern bioregions of the Northern Territory.* Ed. 2: 43 (2007)

Illustrations: G.J.Leach, *Floodplain Flora*, 233, fig. 50 (2000).

Herb 4.5–20 cm high. *Leaves* linear, 0.6–3.5 cm long, 0.7–3 mm wide, 3-5–nerved. *Peduncle* 4–13 cm long, with 4-6 ribs. *Sheath* 9–20 mm long. *Flower heads* hemispherical, globular or cylindrical, 1.8–7 mm long, 2.5–6 mm wide. *Involucral bracts* hyaline, obovate, 1.1–1.5 mm long, 0.5–1 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline to black, narrowly obovate to oblanceolate to spathulate, 1.2–1.9 mm long, 0.4–0.8 mm wide, acute to acuminate, glabrous. *Receptacle* densely pilose, convex to conical. *Male flowers*: 0.85–1.3 mm long; sepals 1-3, free or fused at base or in a spathe which is deeply 3-lobed, hyaline or rarely black, linear, 0.62–1.1 mm long, 0.1–0.4 mm wide, acute, glabrous; petals 3 but often obscure, hyaline, acute, glabrous; stamens 6; anthers black. *Female flowers*: sepals 2–3 but all perianth parts easily deciduous, hyaline or black, equal or dimorphic if 3; laterals elliptic or navicular and geniculate, lacking dorsal keel or wing or dorsally keeled, 0.6–1.1 mm long, 0.06–0.2 mm wide, acuminate, glabrous; median sepal linear, 0.45–0.9 mm long, c. 0.1 mm wide, acute, glabrous; petals 0–3, hyaline, equal, linear, 0.6–1.2 mm long, 0.06–0.07 mm wide, acuminate, pubescent with apical fringe of white hairs or glabrous. *Ovary* 3-locular. *Seeds* 0.2–0.3 mm long, 0.175–0.225 mm wide; epidermal cells with even wall thickenings. **Fig. 7g–h.**

Distribution: Widespread from the Kimberley to the NT and Qld. In the NT recorded from the Victoria River region (Fitzmaurice River, Jasper Gorge), Daly Basin, Nitmiluk National Park, Pine Creek, Arnhem Land and Barkly Tableland (Elliot and Tennant Creek). Probably extinct in the MacDonnell Ranges. **Fig. 12.23.**

Habitat: In damp sand along watercourses in grass-sedge swamps, *Melaleuca* woodlands and seepage areas. Typically associated with sandstone but one specimen from Qld noted on granite.

Conservation Status: Widespread and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Notes: The interpretation of the degree of fusion of the male sepals is difficult in this species. Most material from Qld and the NT shows apparently free male sepals but with some degree of fusion at the base. Material from the Kimberley mostly has the sepals fused into a spathe which is typically deeply divided. This considerable variation could all represent derivations from a 3-lobed spathe which has become variously divided. The most typical form is two free sepals as seen in the Banks & Solander type specimen, but one and three free sepals have been also observed. The observation that these are often fused at the base supports that these could all be derived from a deeply divided spathe. The observation of one sepal could also be that of a very narrow spathe. The Kimberley material was recognised as a distinct entity, *E. sp. C.*, in the Flora of the Kimberley Region (1992). In all aspects other than the fused male sepals it is a good match for *E. pygmaeum*. Noted growing mixed with *E. depressum* (*Michael 1082,* BRI), with *E. tortuosum* (*Thorne 21129*, CANB, *Forster 22520*) and also with *E. spectabile* and *E. odontospermum* (*Specht 343*). Leach (2000b) clarified the application of the name *E. graphitinum* as a synonym of *E. pygmaeum*. Britten (1900) clarified the application of names for six species

of *Eriocaulon* published by Smith in Rees's Cyclopaedia. One of these is *E. nigrica*ns R.Br., and based on both the specimens and labels at BM, Britten synonymised *E. nigricans* under the Solander manuscript name of *E. pygmaeum*. In his *Prodromus*, Brown cites *E. nigricans* as 'v.v' which indicates he had seen living material. To date material collected by Brown that might relate to the type has not been located. This citation may be in error in his publication. A Banks & Solander specimen at K (K001056344) under the name of *E. nigricans,* labelled as collected from Endeavour River, matches *E. pygmaeum* and is considered part of the type gathering of *E. pygmaeum*.

Selected specimens examined: AUSTRALIA: Queensland: Between Townsville and Rollingstone, 28 Apr 1945, *Blake 15777* (BRI, DNA); Near Pentland, 3 Jul 1954, *Blake 19345* (BRI, DNA); 21 miles SE of Croydon, 17 Jul 1954, *Blake 19589* (BRI, DNA); Esmeralda, SSE of Croydon, 19 Jul 1954, *Blake 19648* (BRI, DNA); 18.7 km E of Lake Emma turnoff, 19 May 1993, *Clarkson 10047B,* (BRI, DNA); Irvinebank to Chilligoe Road, 15 km N of Montalbian ruins, 10 Apr 2014, *Corlis 14* (BRI, CNS, DNA); Toy Creek, 9 Feb 2014, *Corlis 15* (CNS); Bellenden, lower Tully, 1 May 1938, *Henry s.n.* (CNS); Bulleringa NP, 80 km NW of Mt Surprise, 23 Apr 1998, *Forster 22520B* (BRI, DNA, MEL). **Northern Territory:** Fitzmaurice River, 12 May 1994, *Barritt 804* (DNA); Ranger mine lease, 25 Mar 1991, *Brennan 1266* (DNA); Attack Creek, Stuart Hwy, 1 Jul 1974, *Carr 2536* (DNA); E of Cadell River, 15 Apr 2000, *Cowie 8874* (DNA); Ware Range, 1 May 2004, *Dixon 1182* (DNA); Jarong Spring, Fish River station, 16 Mar 1989, *Dunlop 8529* (DNA); Nicholson River area, 9 Jun 1974, *Henshall 544* (DNA); Mitiebah Stn, 26 Mar 1981, *Henshall 3465* (DNA); 69 km S of Elliott, 21 Jun 1974, *Latz 5510* (DNA, NT); 7 km W of Pine Creek, 17 Mar 1989, *Leach 2514* (DNA); catchment of Hayward Creek, 14 Mar 1989, *Leach 2581* (DNA); Bullo River stn, 20 Mar 2009, *Lewis 890* (DNA, LD); Nitmiluk NP, 20 Feb 2001, *Michell 2726* (DNA); Bickerton Island, 7 Jun 1948, *Specht 491* (PERTH); Bradshaw Military training area, 31 Mar 2007, *Stuckey 19A* (BRI, DNA, MEL, PERTH); Daly River, Mission area, 24 Mar 1993, *Wightman 6045* (DNA).

Representative specimens with the male sepals in a variously divided spathe (treated as E. sp. C in Fl. Kimberley Region): Nortrhern Territory: Bullo River stn, 20 Mar 2009, *Lewis 890* (DNA LD*).* **Western Australia:** 1.5 km W of Lake Argyle t/o, Kununurra – Timber Creek road, 6 Jul 1974, *Beauglehole 46834* (DNA, PERTH); 80 km N of Gibb River, 13 Jun 1976, *Beauglehole 53738* ((DNA); Durack River station, 5 Jun 2014, *Butcher 1967* (PERTH); 12 km W of Mt Hann, 28 May 1993, *Cowie 4311* (DNA, PERTH); Mirrima N.P. 19 May 2000, *Handasyde 83* (DNA, PERTH); crusher area, Mitchell Plateau, 19 Apr 1982, *Keighery 4610* (PERTH); Bell creek, Gibb River road, 5 Jun 1995, *Kenneally 11548* (DNA, PERTH); 1 km E of Turkey Creek on Lissadell Station road, 8 May 1980, *Weston 12360* (DNA, PERTH).

E. rivicola G.J.Leach, M.D.Barrett & R.L.Barrett, *Nuytsia* 26: 53 (2015)

Type: Western Australia: east of the Prince Regent Nature Reserve, 27 Mar 2010, *R.L Barrett & M.D. Barrett RLB6730* (holo PERTH *n.v.*; iso BRI, CANB, DNA, K, MEL, NSW *n.v.*)

Eriocaulon sp. E G.J.Leach, *Fl. Kimberley Reg.* 1034 (1992)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1033, fig. 309C (1992); R.L.Barrett & M.D.Barrett *Nuytsia* 26: 55 fig. 15 A-F (2015).

Herb to 44 cm high. *Leaves* linear, 11.5–30 cm long, 1.0–2.5 mm wide, acuminate, 4–12-nerved, glabrous except for tangled hairs at base. *Peduncle* 11–44 cm long, with 10–14 ribs, sometimes twisted. *Sheath* 40–70 mm long. *Flower heads* globular to depressed globular, 3.0–6.5 mm long, 4–7.5 mm wide. *Involucral bracts* hyaline, broad-obovate to ovate, 1.5–2.5 mm long, 0.7–1.9 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, obovate to lanceolate, 1.75–2.5 mm long, 0.7–1.0 mm wide, acute, glabrous or with sparse to dense white hairs in apical third. *Receptacle* glabrous, conical. *Male Flowers*: 1.4–2 mm long; sepals 3, fused but split on one side to form a spathe, black, 1.4–2.0 mm long, 0.5–0.8 mm wide, truncate, pubescent with dense apical fringe of white hairs; petals 3, fused for greater part, hyaline, acute, pubescent with dense apical fringe of white hairs; stamens 6; anthers yellow. *Female flowers:* sepals 3, free, hyaline, equal, linear, 1.0–1.6 mm long, 0.2 mm wide, acute, pubescent with white hairs at apex, sparse hyaline hairs on margin; petals 3, free, hyaline, equal, narrowly elliptic to narrowly obovate, 0.8–1.3 mm long, 0.4 mm wide, obtuse, glabrous abaxially and pubescent internally with dense white hairs apically and hyaline hairs basally. *Ovary* 3-locular, sessile. *Seeds* 0.5 mm long, 0.45 mm wide; smooth, lacking sculpturing or epidermal cell outline only faintly visible. **Fig. 8a–b.**

Distribution: WA. Known from scattered coastal locations in the vicinity of the Prince Regent River, King George River and York Sound. **Fig. 12.24.**

Habitat: Broken sandstone in small, ephemeral or permanent creeks.

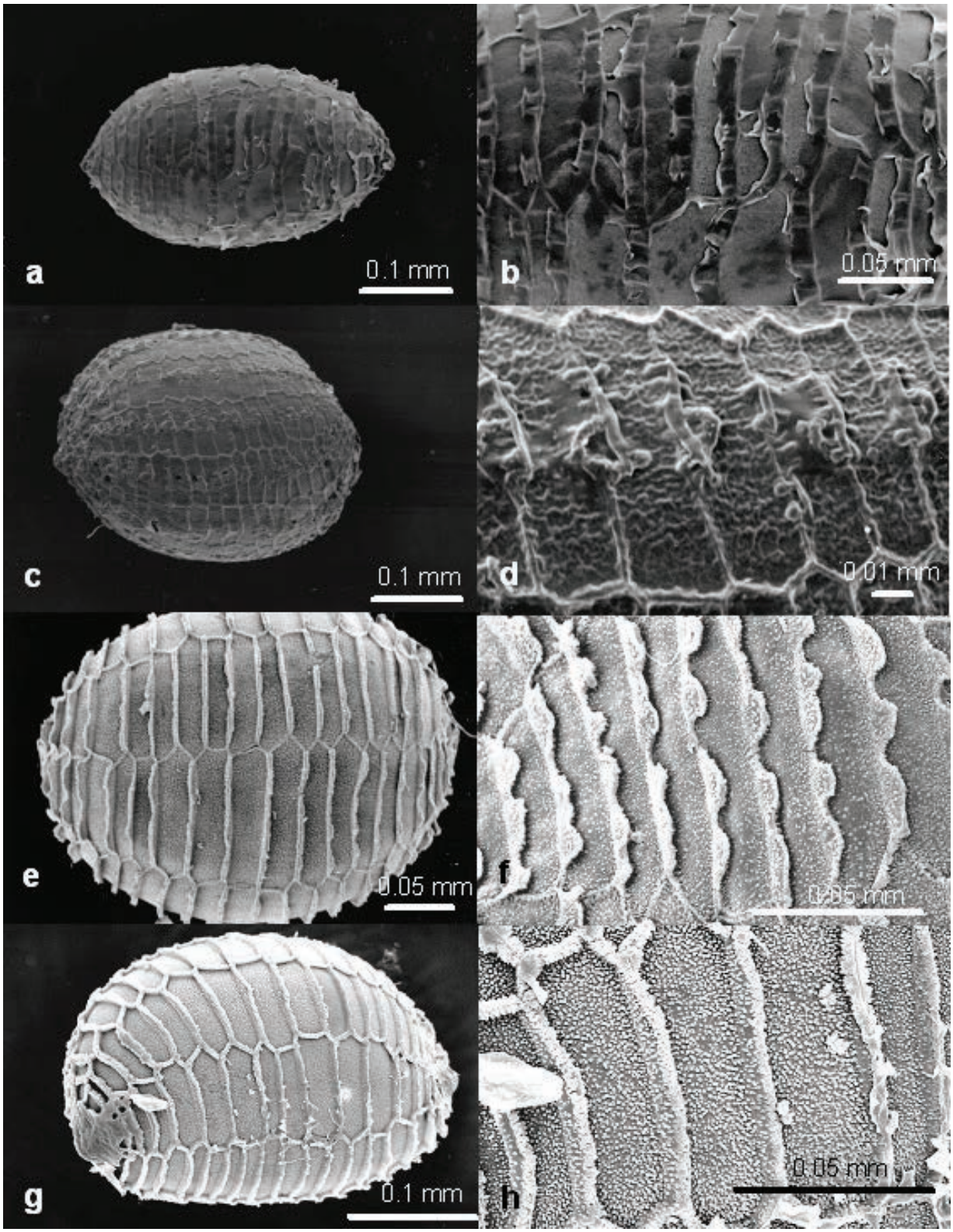

Fig. 6. Seed and seed surface: *Eriocaulon inapertum* **a, b**; *E. lividum* **c, d**; *E. nanum* **e, f**; *E. nematophyllum* **g, h**. Material used: a-b from *Leach 2259*; c-d from *Edinger 354*; e from *Wilson 3870*; f from *Brown 5822* K; g-h from *Clarkson 4461*.

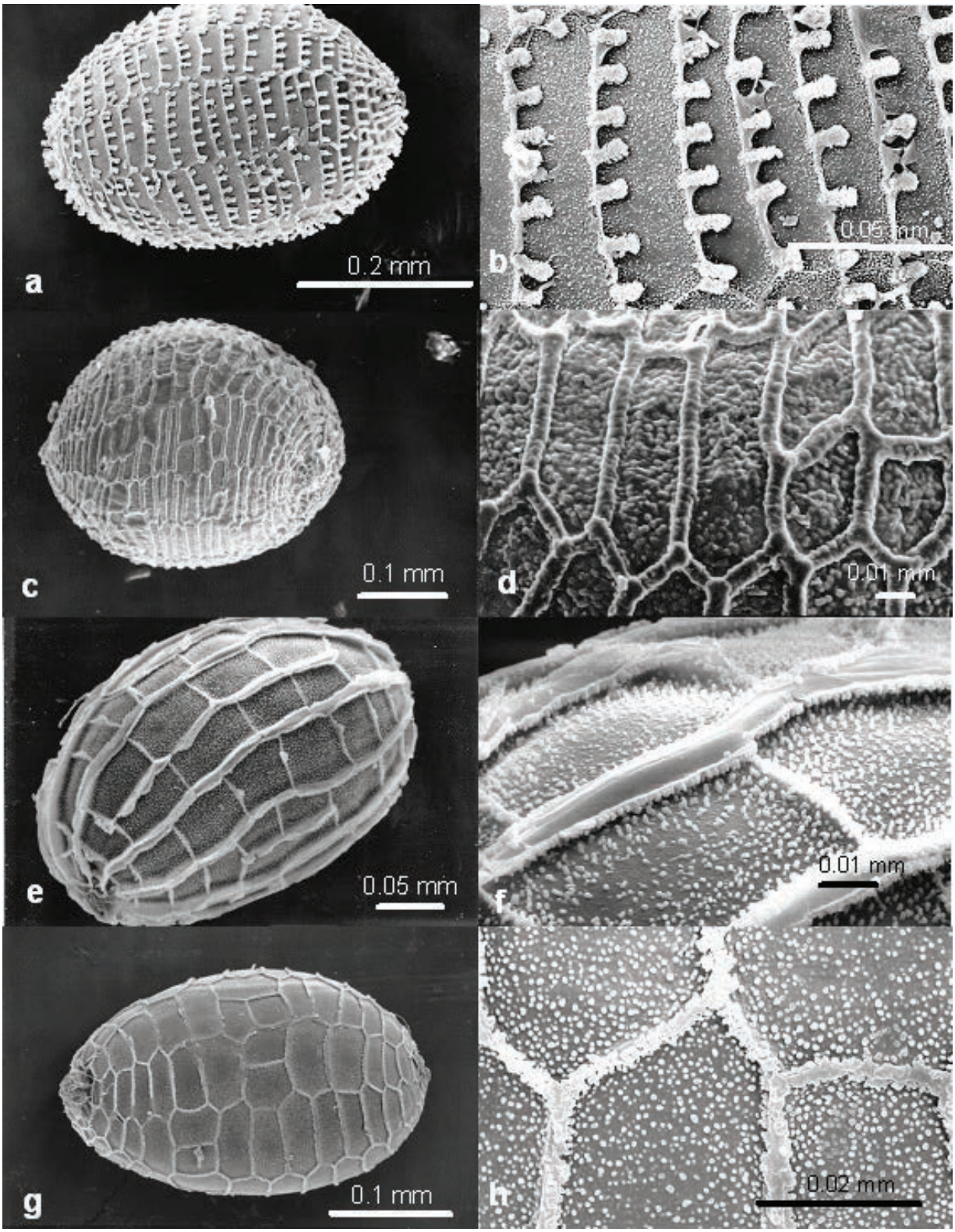

Fig. 7. Seed and seed surface: *Eriocaulon odontospermum* **a, b**; *E. patericola* **c, d**; *E. pusillum* **e, f**; *E. pygmaeum* **g, h**. Material used: a-b from *Blake 9546*; c-d from *Menkhorst 302*; e-f from *Latz 6305*; g-h from *Banks & Solander BM000900916*.

Conservation Status: Listed as Priority Two under Department of Parks & Wildlife Conservation Codes for Western Australian Flora, (Western Australian Herbarium, in FloraBase (2017))..

Etymology: The epithet is from the Latin *rivus* (brook, small stream) and *–cola* (dweller), in reference to the occurrence of this species in small, highly ephemeral or permanent streams.

Specimens examined: AUSTRALIA: Western Australia: 10 km N of Charnley River, 6 Jul 1993, *M. Barrett MDB 237* (CANB, PERTH); 29.8 km W of Mt Agnes, 26 Mar 2010, *M. Barrett MDB 2832* (K, PERTH); 3 km NE of Enid Falls, 22 Jan 2003, *R. Barrett RLB 2637* (AD, HO, PERTH); downstream from Acacia flat, 30 Mar 2010, *R. Barrett RLB6879* (CANB, DNA, PERTH); Uwins Island, 31 May 2003, *Handasyde 1989* (DNA, PERTH); Artesian Range, c. 54.4 km WNW of Charnley River, 31 May 2013, *Jensen 2876* (BRI, PERTH); York Sound, 22 Jun 2015, *Leach 4733* (BRI, CANB, DNA, PERTH); near East Arm, King George River, 18 Jul 2015, *Leach 4748* (DNA).

E. scariosum Smith, *Rees' Cyclopaedia.* 13 (1809).

Type: 'Nova Cumbria australis apud Port Jackson', 1792, *J. White s.n.* (holo LINN-HS 146-17!; iso BM990771! (fragment of LINN-HS specimen).

E. smithii R.Br. *Prodr*. 254 (1810).

Type: ['(J.) *v.v.*'] in palud prope Sydney, Port Jackson, *R. Brown s.n. [Iter Austral. 5820]* **(lecto (here designated)** BM000990768!)

Syntypes Port Jackson, *R. Brown s.n.* (BM000990770), Cumberland, Port Jackson, *R. Brown s.n.* (BM990769!), *R. Brown s.n. [Iter Austral. 5820]* (K001056252!)

E. lhotskyi Steudel *Syn. Pl. Glum.* 2: 270 (1885).

Type: New Holland, *Lhotzky s.n*. (holo P *n.v*.; iso BRI ! (fragment of type from Steudel herbarium at P), B10 0296815!, BM000990767, K!)

Busseuillia novae-hollandiae Lesson, in Bougainville, *Journ. Navig*. 2: 348, t. 46 (1837).

Type: *n.v.*

Illustrations: B.J.Conn, *Fl. NSW* 4: 265 (1993); B.J.Conn, *Fl. Victoria* 2: 178, fig. 37a-c. (1994)

Herb 3.5–30 cm high. *Leaves* linear, 1.5–8.5 cm long, 2–5.5 mm wide, acuminate, 4–11-nerved. *Peduncle* to 30 cm long with 4–7 ribs. *Sheath* 12–60 mm long. *Flower heads* hemispherical to globular, 3–6 mm long, 3.5–5.5 mm wide. *Involucral bracts* straw yellow, obovate to elliptic to broad-elliptic, 1.75–2 mm long, 0.9–1.5 mm wide, obtuse, glabrous, reflexed at maturity. *Floral bracts* hyaline to black or with hyaline base, obovate to oblanceolate, 1.5–2.5 mm long, 0.6–1.1 mm wide, acute or obtuse and mucronate, glabrous or pubescent with sparse white hairs at apex. *Receptacle* sparsely hairy to densely pilose, conical. *Male flowers*: 1.3–2.2 mm long; sepals (2–)3, fused but split on one side to form a spathe which is sometimes 2–3-lobed, rarely apparently 2 free, black, 1.25–2.4 mm long, 0.5–0.75 mm wide, acute to obtuse, pubescent with white hairs in apical fringe; petals 3, hyaline, equal or slightly dimorphic with one larger, acute, pubescent with white hairs in apical fringe; stamens 6; anthers black, included. *Female flowers*: sepals 3, rarely 2, black or rarely hyaline, dimorphic, laterals navicular and geniculate, 1.1–1.75 mm long, 0.2–0.35 mm wide, acute, pubescent with white, hairs in apical fringe or marginal, rarely reduced to a few marginal hairs; median sepal linear, 1–1.3 mm long, 0.1–0.2 mm wide, acute, pubescent with white, marginal hairs; petals 3, hyaline, equal or rarely one slightly larger, elliptic, 1–1.6 mm long, 0.16–0.5 mm wide, acute, pubescent with white hairs in apical fringe and dense hyaline hairs adaxially. *Ovary* 3-locular. *Seeds* 0.4–0.53 mm long, 0.3–0.38 mm wide; epidermal cells more or less isodiametric, peg-like projections on both transverse and longitudinal walls. **Fig. 8c–d.**

Distribution: Common along the east coast from central and eastern Vic, NSW, southern Qld and scattered records in north Qld. **Fig. 12.25.**

Habitat: *Melaleuca* swamps, springs and soaks, margins of lakes and lagoons, in peatland, bog communities and swampy places, alongside roadside drains; usually on sandy soils.

Notes: Evans (1966) clarifies that the locality of the type of *E. lhotskyi* cited by Steudel as from Brazil is in error as Moldenke states the type sheet is clearly marked "N. Holl.". There is a fragment of the type from P at BRI which matches *E. scariosum*.

Conservation Status: Widespread and not considered under threat.

Selected specimens examined: AUSTRALIA: Queensland: Caloundra, 25 Aug 1932, *Blake 4224* (BRI); 38 km S of Yuleba, 9 Nov 1958, *Johnson 659* (BRI); Teewah, Lake Cootharaba, 25 Jul 1976, *Telford 4315* (BRI, CBG, DNA); Spring Creek Stn, 1 Feb 1995, *Wilson s.n.* (DNA). **New South Wales:** Maroubra Bay, Feb 1899, *Camfield NSW58377* (NSW); Centennial Park, Nov 1898, *Cheel NSW58375* (NSW); Wingello State Forest, Jan 1956, *Constable NSW36567* (NSW); Wollar to Ulan road, Jan 1964, *Constable NSW64031* (NSW); East Lakes, 17 Aug 1993, *Coveny 11765* (BRI, DNA, NSW); Watson's Bay, Sydney, Dec 1884, *Deane NSW58373* (NSW); Uarbry via Gulgong, Mar 1952, *Ingram NSW66343* (NSW); Horse swamp, Barrington Tops Plateau, 23 Apr 1994, *Kodela 296* (CANB, DNA, MEL, NE, NSW); Tenterfield to Sandy Flat, Dec 1908, *Maiden NSW58367* (NSW); 10 miles NW of Grafton, 1960, *O'Grady NSW58369* (NSW); Lake Innes Nature Reserve, 5 Oct 1998, *Phillips 154* (DNA, K). **Australian Capital Territory:** Smokers Flat, 13 Mar 1986, *Gray 7117* (CANB, DNA, NSW). **Victoria:** Kiewa Valley, Mt Beauty, 30 Nov 1987, *Bates 12932* (AD); Cowambat Flat, East Gippsland, 26 Jan 1971, *Beauglehole 36534* (DNA, MEL); Wonnangatta River, c. 7 miles E of Mt Howitt, 3 Jan 1973, *Beauglehole 40945* (MEL, NSW); NE of Perry River bridge, 18 km ESE of Stratford, 6 May 1985, *Beauglehole 79587* (CANB); Holey Plains, 19 May 1973, *Carr 662* (MEL); Beechworth township, 25 Jun 1950, *McBarron 4668* (MEL, NSW); Gooram, Jan 1910, *Williamson* (CANB).

E. schultzii Benth., *Fl Austral.* 7:195-196 (1878)

Type: Northern Territory: Port Darwin, N. Australia, *F. Schultz 288* (holo K001056244!; iso MEL1501978!, B0296814!, LL00374593 *n.v.*)

Illustrations: G.J.Leach, *Floodplain Flora*, 233, fig. 50 (2000).

Herb 4–24 cm high. *Leaves* filiform or linear, 2.5–13 cm long, 0.1–0.3 cm wide, 3–6-nerved. *Peduncle* 4–24 cm long, with 4–8 ribs. *Sheath* 10–95 mm long. *Flower heads* globular, 3–8 mm long, 3.5–9 mm wide. *Involucral bracts* hyaline, ovate to elliptic, 1.75–3.5 mm long, 1–2.5 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, obovate or elliptic or lanceolate or oblanceolate, 1.6–3.75 mm long, 0.6–1.5 mm wide, acute to obtuse, pubescent with white hairs towards apex. *Receptacle* sparsely hairy, conical. *Male flowers*: 1.5–2.1 mm long; sepals 3, fused but split on one side to form a spathe which is often deeply lobed and readily splitting, hyaline, 1.25–3.25 mm long, 0.53–1 mm wide, obtuse, pubescent with white hairs in apical fringe and on median region; petals 3, hyaline, equal, oblong, acute or obtuse, pubescent with apical fringe of white hairs; stamens 6; anthers black. *Female flowers*: sepals 3, hyaline, equal, oblong or elliptic or obovate, lacking dorsal keel or wing but rarely with midvein slightly raised, 1–2.6 mm long, 0.4–0.7 mm wide, obtuse to truncate, pubescent with white hairs on median region; petals 3, hyaline, equal, spathulate or linear or oblong, 1.25–2.75 mm long, 0.25–0.5 mm wide, acute to obtuse, glabrous or pubescent with apical fringe of white hairs. *Ovary* 3–locular. *Seeds* 0.3–0.43 mm long, 0.26–0.33 mm wide; epidermal cell walls with longitudinal rows of hair or peg-like projections, often with a terminal cap and often erect. **Fig 8e–f.**

Distribution: Endemic to the NT where recorded from around Darwin, Mary River, Kakadu NP and the Tiwi islands. **Fig. 12.26.**

Habitat: Depression areas with *Melaleuca,* seasonal swamps or creek lines on sandy soils or heavy alluvials.

Notes: Many flower heads appear to contain only male flowers. Recorded in mixed collection with *E. fistulosum* (*Fensham 956*).

Conservation Status: A common species within its limited range and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Northern Territory: Flying Fox Creek, 14 Aug 1978, *Beauglehole 58722* (DNA); Howard Springs area, 16 May 1959, *Chippendale 6162* (DNA); Howard River Floodplain, 23 Apr 2001, *Cowie 9383* (BRI, DNA, MEL); Dundee Beach road, 31 Mar 2003, *Cowie 9719* (DNA); Wangi road, near Finniss River crossing, 11 May 2004, *Cowie 9996* (BRI, DNA); Point Stuart, 17 May 1987, *Dunlop 7013* (DNA, NT); Mary River, 10 May 1989, *Dunlop 8369* (DNA, MEL); Tsiripu Creek, Melville Island, 28 Jun 1988, *Fensham 956* (DNA); Shoal Bay Conservation Reserve, 25 May 2000, *Harwood 950* (DNA, MO); 3 km W of Flying Fox creek, 19 Jul 1980, *Henshall 3353* (DNA, MEL); Lake Deane, 26 May 1973, *Latz 3703* (BRI, CANB, DNA, L); Baralil Creek, 12 Jun 1978, *Latz 7749* (BRI, DNA, NT); Bees Creek road, 30 Apr 1999, *Leach 4632* (DNA); End of Gulnare Road, near Elizabeth River, 30 Apr 1999, *Leach 4634* (BRI, DNA); Jenkins Road, 19 May 1999, *Leach 4641* (DNA): Elizabeth Valley, 13 May 1999, *Mangion 879* (B, DNA); Cox Peninsula, Oct 1998, *Manning s.n.* (DNA); Howard River – Gunn Point, 9 May 1996, *Michell 113* (DNA); Berry Springs, 27 Apr 1978, *Rankin 1236* (DNA); Whitestone Creek, 14 May 1980, *Rankin 2446* (CANB, DNA); Koolpinyah track, 14 Jul 1964, *Robinson 706* (DNA); 22 miles S of Darwin, 5 Jun 1962, *Walter s.n.* (DNA).

E. scullionii G.J.Leach, *Austral. Syst. Bot.* 13: 768 (2000)

Type: Northern Territory: 15 km south of Mt Howship, 18 Apr 1989, *G.J. Leach 2556* (holo DNA!; iso BRI!, CANB!, K!, MEL!, PERTH!).

Eriocaulon sp. D Leach, *Fl. Kimberley Reg.* 1032 (1992)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1033, fig. 309B, as *Eriocaulon* sp. D (1992); G.J.Leach, *Floodplain Flora*, 233, fig. 50 (2000); G.J.Leach, *Austral. Syst. Bot.* 13: 760 fig. 4 (G), 765 fig. 7 (D) (2000).

Herb 1.5–5 cm high, to 18 cm when inundated. *Leaves* linear, 0.6–1.3 cm long, 0.04–0.07 cm wide, 1-nerved. *Peduncle* 1.5–4.5 cm long, to 18 when inundated. *Sheath* 8–10 mm long. *Flower heads* globular, 2.5–5 mm long, 2.5–6.5 mm wide. *Involucral bracts* hyaline, elliptic, 1.3–2.5 mm long, 0.7–1 mm wide, acute, pubescent with sparse white hairs, strongly reflexed at maturity. *Floral bracts* hyaline, elliptic or oblanceolate to narrowly spathulate, 1–2.5 mm long, 0.46–1.1 mm wide, acute to acuminate, pubescent with dense white hairs on apical half, basally with hyaline hairs. *Receptacle* glabrous. *Male flowers*: sepals 3, fused but split on one side to form a spathe, hyaline to greyish, 1–2.1 mm long, 0.4–0.75 mm wide, truncate, pubescent with apical fringe of white hairs; petals 3, hyaline, equal, oblong, obtuse, pubescent with apical fringe of white hairs; stamens 6; anthers yellow. *Female flowers*: sepals 3, hyaline, equal, linear, lacking dorsal keel or wing, 0.75–1.6 mm long, 0.05–0.15 mm wide, acute, pubescent with hyaline hairs on apex and margins, rarely white hairs on apex; petals 3, hyaline, equal, linear, 0.75–1.3 mm long, 0.05 mm wide, acute, pubescent with apical fringe of white hairs and hyaline hairs basally and on margins. *Ovary* 3-locular. *Seeds* 0.275–0.33 mm long, 0.175–0.25 mm wide; epidermal cells with even wall thickenings. **Fig. 8g–h.**

Distribution: Found in the Kimberley, the Victoria River region and Katherine area, to Darwin and the western Arnhem Land escarpment. A single disjunct specimen was collected from Qld between Cardwell and Ingham. **Fig. 12.27.**

Habitat: Creek margins or seepage areas in sandstone. On sand sheets near Darwin. Sometimes in shallow water, often sheltered amongst rocks or boulders.

Conservation Status: The species is quite common over a large area of sandstone habitat and not considered under any threat. Coded as Least Concern in the NT (FloraNT 2017).

Etymology: The species epithet acknowledges the efforts of Mr Nigel Scullion, who as skipper of both the *Kalidris* and *Reliance* has been instrumental in transporting herbarium staff into many isolated coastal localities and has also been an enthusiastic natural history observer and collector.

Selected specimens examined: **AUSTRALIA: Northern Territory:** Jabiru area, 19 Feb 1973, *Adams 3017* (CANB, DNA); Arnhem Land; upper catchment of Magela Ck, 11 Apr 1995, *Cowie 5621* (CANB, DNA, MEL, PERTH); 20 Feb 1973, *Craven 2322* (CANB, DNA); Mt Gilruth, 22 Feb 1977, *Dunlop 4423* (DNA); Narbalek, 04 Feb 1989, *Hinz 224* (DNA); 27 Feb 1973, *Lazarides 7897* (CANB, DNA); 17.5 km NNE of Jabiru East, 28 May 1980, *Lazarides 9039* (CANB, DNA); Mt Brockman, Kakadu NP, 20 Apr 1989, *Leach 2566* (DNA, PERTH); Tributary of Fitzmaurice River, 23 Feb 1994, *Leach 4211* (BRI, DNA); Kakadu National Park, Gulungul Creek, mouth of Radon Gorge, 4 km WSW of Mount Brockman, 21 Apr 1980, *Telford 7950* (CBG, DNA, K); Gorge b/n Twin & Jim Jim Falls, 24 Mar 1984, *Wightman 1303* (CANB, DNA, MEL). **Western Australia:** Mitchell R., 23 Feb 1980, *Dunlop 5276* (DNA, PERTH,); Crystal Head area, Mitchell Plateau, 10 May 1986, *Latz 10292* (DNA); Five Man Creek, Montague Sound, 18 Jun 2015, *Leach 4729* (DNA); 6 km NE of Kalumburu, 21 Feb 1996, *Mitchell 4264* (BROOME, DNA, PERTH); Bigge Island, 01 Apr 1994, *Scullion 4* (BRI, CANB, DNA).

E. setaceum L., *Sp. Pl.*: 87 (1753)

Type: Sri Lanka, Herb. Hermann species no. 50 (lecto (Trimen 1888: 136) BM00621372!).

Eriocaulon bifistulosum Van Heurck & Muell. Arg. in Van Heurck, *Observationes Botanicae et Descriptiones Plantarum Novarum Herbarii van Heurckiani*: 105 (1870)

Type: Nigeria: Nupe, 1857-59, *C. Barter 1021* (holo AWH *n.v.*; iso G00168238 *n.v.*, K000346116!, M0064955 *n.v.*, P00458971, 00458972 *n.v.,* S-G-8093 *n.v.*)

E. equisetoides van Royen, *Blumea* 10: 132–133 (1960)

Type: Indonesia: West Java, Indramajoe, Apr 1936, *C.G. van Steenis 7542*, (holo L!; iso BO!, SING005466 *n.v.*)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307E (1992); G.J.Leach, *Floodplain Flora*, 233, figs. 50, 51 (2000).

Herb 12–70 cm long, submerged aquatic in water to c. 1m deep. *Leaves* crowded, cauline, filiform, 2.5–16 cm long, 1-nerved. *Peduncle* 5–27 cm long. *Sheath* 25–50 mm long. *Flower heads* depressed globular, 2.5–5 mm long, 3.5–6 mm wide. *Involucral bracts* black, oblong to broadly obovate, 0.95–1.75 mm long, 0.5–1.3 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* black or straw yellow with black apex, obovate, 0.9–1.8 mm long, 0.43–0.7 mm wide, acute to obtuse, pubescent with easily deciduous white hairs at apex or rarely glabrous. *Receptacle* glabrous or rarely sparsely hairy, conical. *Male flowers*: 0.9–1.5 mm long; sepals 3, fused but split on one side to form a spathe which is 3-lobed and readily splitting with age, black to hyaline, 0.8–1.5 mm long, 0.2–0.53 mm wide, obtuse to truncate, pubescent with apical fringe of white hairs or rarely glabrous; petals 3, hyaline, equal, acute, pubescent with apical fringe of white hairs or rarely glabrous; stamens 6; anthers black. *Female flowers*: sepals 3, dark grey to black or rarely hyaline, equal, elliptic and shallowly navicular, lacking dorsal keel or wing, 0.7–1.7 mm long, 0.35–0.53 mm wide, obtuse or truncate, pubescent with apical fringe of white hairs or rarely glabrous; petals 3, dark grey to black or hyaline, equal, linear to elliptic, 0.6–1.5 mm long, 0.1–0.3 mm wide, acute or obtuse to truncate, pubescent with apical fringe of white hairs or rarely glabrous. *Ovary* 3-locular. *Seeds* 0.45–0.6 mm long, 0.32–0.43 mm wide; epidermal cell outline faint and with obscure peg-like projections on transverse walls. **Fig. 9a–b.**

Distribution: Widespread from Africa, India, SE Asia, New Guinea and Australia. In northern Australia from the Kimberley, Top End, Gulf of Carpentaria and north Qld. **Fig. 12.28.**

Habitat: In permanent or semi-permanent freshwater bodies such as waterholes, running streams or standing water in *Melaleuca* swamps, open forests or sedge/grasslands, floodplains and sandstone pavements. In full sun or shaded situations. Also survives on drying margins.

Notes: For further detailed extra-Australian synonymy see Phillips (1997) and Zhang (1999). *Eriocaulon setaceum* is the most distinctive of the Australian species being a true aquatic with long submerged stems bearing cauline filiform leaves giving the plant a 'bottle brush' appearance. The flower heads are carried by the peduncles above the water.

A number of closely related species and sub-specific taxa have been described by various authors and applied to taxa in various parts of the world. These taxa have been differentiated on characters such as the hairiness of the receptacle, the presence of white hairs on the floral bracts and sepals and the degree of dark pigmentation in the floral bracts and perianth parts. Dense pigmentation gives the head a very dark appearance. This can be emphasised by a lack of the white hairs on the bracts and sepals or muted so the head appears a greyish white if there are dense white hairs present.

The Australian material shows some variation in these characters. The receptacle is glabrous or rarely sparsely hairy. The floral bracts are typically black or at least with a black apex and also with white hairs at the apex though rarely glabrous. The sepals in both male and female flowers are typically black and with white hairs at the apex, though they can be rarely hyaline and glabrous.

Recent authors (Phillips 1997; Zhang 1999) have adopted a broad view of the species and included all the aquatic forms under *E. setaceum*. Following examination of a large suite of specimens from the range of *E. setaceum sens. lat.*, the conclusion here is that until detailed molecular studies are done it is best treated as a single widely distributed taxon.

Fruit and seed dispersal in *E. setaceum* appears quite different to other species of *Eriocaulon*. In other species the ovary is readily dehiscent and the seeds are released through a loculicidal opening in the ovary wall while the female flower is within the capitulum. In *E. setaceum* the ovary is tardily dehiscent and the entire 3-merous ovary is shed from the capitulum with the seeds retained within the ovary locules. The ovary is buoyant and appears to function as the diaspore unit. Eventually the loculicidal slit opens and releases the seeds which are covered in mucilage and appear to sink soon after release. Ramaswarmy et al. (1983) reported in various species of *Eriocaulon* that the cells of the inner layer of the ovary wall develop band-like thickenings which they suggest help in the dehiscence of the fruit. They note these bands are absent in *E. setaceum* which may explain the tardy dehiscence.

Conservation Status: Widespread across northern Australia and not considered under any threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: Quinkin creek, 19 May 1975, *Byrnes 3411* (CNS); Evelyn Conservation Park, 8 Mar 2012, *Clarkson 3192* (CNS, DNA, K, MEL, PERTH); c. 32 km N of Weipa, 10 Dec 1981, *Clarkson 4181* (CNS, MEL); Mt Mulligan, 12 Apr 1984, *Clarkson 5298* (BRI, CNS, K, MEL, NSW, PERTH); 50 km S of Ingham, 11 May 2014, *Corlis* 3 (CNS); tributary of Scrubby Creek, 8 Sep 1973,

Hyland 6837 (CNS); Laradeenya Creek, 18 Oct 2010, *Kilgour 452* (BRI, CANB, CNS). **Northern Territory:** Headwaters of Cui-Eci Creek, 11 May 1994, *Albrecht 5995* (DNA, NT); Edith falls, 24 Jul 1965, *Beauglehole 10910* (BRI, DNA); 13 miles SE of Darwin, 25 May 1958, *Chippendale 4451* (DNA); 3.5 miles SE of Raffles Bay, 18 Jul 1961, *Chippendale 8195* (DNA); Point Stuart, 26 Mar 1987, *Clark 870* (DNA); Nourlangie Creek, 7 Jul 1977, *Craven 4653* (CANB, DNA); Yipilika, Melville Island, 23 Apr 1986, *Fensham 206* (DNA); Tolmer Falls, 30 May 1978, *Henshall 1820* (DNA); Goomadeer River, 15 Jun 1978, *Henshall 1995* (DNA); Ritjirriur swamp. Elcho Island, 6 Jul 1975, *Latz 6118* (DNA); Tributary of East Baines River, 17 Apr 1976, *Walsh 4520* (DNA, MEL). **Western Australia:** King Edward River, 2 Jun 1976, *Beauglehole 51921* (DNA, PERTH); Ngoolalah Creek, 4 Jun 1976, *Beauglehole 52174* (DNA, PERTH); Mitchell Plateau, 24 Aug 1978, *Beauglehole 59008* (DNA); S side of Cockburn Range, 10 Jul 1974, *Carr 3429* (DNA, PERTH); 1.5 km W of Lennard Rivergorge turn off, 24 Jul 1974, *Carr 4096* (DNA, PERTH); Adcock gorge, 26 Jul 1974, *Carr 4221* (DNA, PERTH); Pauline Bay 22 May 1984, *Forbes 2096* (DNA, MEL, PERTH); Durack Ranges, 24 Mar 1978, *Lazarides 8691* (CANB, DNA); Osmond Valley station, 18 Nov 1989, *Menkhorst 752* (DNA, MEL, PERTH); 10 km NW of Barton Plains Outcamp, Drysdale River, 18 Jun 1997, *Mitchell 4758, 4760* (DNA PERTH); Pago Pago Mission site, 19 Jul 1999, *Mitchell 5936* (DNA, PERTH); Isdell River crossing, 26 Oct 2002, *Mitchell 7364* (DNA, PERTH).

E. spectabile F.Muell., *Fragmenta Phytographiae Australiae* 1: 95 (1859)

Type: Northern Territory: head of Limmen Bight River, *F. Mueller s.n.* (**lecto (here designated)** K001056240!; isolecto MEL1501981!).

E. monoscapum F.Muell., *Fragmenta Phytographiae Australiae* 1: 94 (1859) *syn. nov.*

Type: Northern Territory: McAdam Range, Oct 1855, *F. Mueller s.n.* (holo MEL1501979!; iso K!).

E. scariosum R.Br., *Prodromus Florae Novae Hollandiae* 255 (1810), *nom illeg. E. brunonis* Britten, *J. Bot.* 38: 482 (1900) *nom. nov.*

Type: [‘(T.) *v.v.*] Australia: *R. Brown s.n. [Iter Austral. 5824]* (lecto (Leach 2000: 771) BM001053420 (second and last individuals from left; sheet labelled by Bennett as no.5824); isolecto K001056238 (was left hand individual on previously mixed sheet).

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1028, fig. 307F (1992); G.J.Leach, *Floodplain Flora*, 237, fig. 52 (2000).

Herb (4.5–)8–33 cm high. *Leaves* linear, (1.8–)3–16 cm long, (0.6–)2–4 mm wide, (4–)10–16 –nerved. *Peduncle* (4.5–)8–30 cm long, with 6–8 ribs. *Sheath* 15–70 mm long. *Flower heads* hemispherical, 2–5.5 mm long, 3–6 mm wide. *Involucral bracts* hyaline or straw yellow sometimes with dark apex, obovate, 1.4–3.25 mm long, 0.85–2.5 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline but sometimes with dark apex, obovate or elliptic or lanceolate or oblanceolate, 1.4–2.75 mm long, 0.5–1.2 mm wide, acute to acuminate, glabrous. *Receptacle* glabrous, conical. *Male flowers*: 0.65-1.6mm long; sepals 2, free, hyaline, linear, 0.45–0.95 mm long, 0.06–0.16 mm wide, acute or obtuse or truncate, pubescent with hyaline hairs in apical fringe and marginal or rarely glabrous; petals 2, hyaline, equal, triangular, acute, glabrous or pubescent with hyaline hairs in apical fringe; stamens 4; anthers black. *Female flowers*: sepals 2, hyaline but mostly with dark tips, equal, navicular and geniculate, lacking dorsal keel or wing or rarely slightly dorsally keeled, 0.9–1.7 mm long, 0.13–0.3 mm wide, acute, pubescent with hyaline hairs on keel or rarely glabrous; petals 2, hyaline, equal, linear, 0.7–1.3 mm long, 0.05–0.1 mm wide, acute to obtuse but irregularly divided, pubescent with hyaline hairs in apical fringe and on margins. *Ovary* 2-locular. *Seeds* 0.35–0.43 mm long, 0.26–0.35 mm wide; epidermal cells with even wall thickenings. **Fig. 9c–d.**

Distribution: From the Kimberley region through the Victoria River region, Arnhem Land to the Gulf and Cape York. **Fig. 12.29.**

Habitat: Creek margins, *Melaleuca* swamps on sandy soils, edge of freshwater lake in sand dunes, black soil.

Notes: The MEL and K specimens are considered to be part of the same gathering and so a lectotype is required. Evidence on the K sheet suggests that Mueller sent the major portion of his collection to Bentham which was retained in Bentham’s herbarium leaving only a somewhat fragmentary specimen at MEL. The more complete specimen at K has been selected as the lectotype.

Leach (2000b) clarified the application of the names *E. scariosum* R.Br. and *E. brunonis* Britten. No further collections attributable to *E. brunonis* have been found. The female flowers in the type collection appear malformed with the ovary poorly developed. It is suggested that these individuals may be of hybrid origin with *E. spectabile* as one parent or represent an aberrant form of *E. spectabile.*

The specimen in B of *Schultz 261* has been marked by Moldenke as an isotype of *E. brunonis*. This is in error as the name *E. brunonis* proposed by Britten as a *nomen novum* for the illegitimate *E. scariosum* R.Br. is based solely on the material collected by Brown and used by him to describe his *E. scariosum* R.Br. The error probably originates from Bentham (1878) where, in his description of *E. scariosum* R.Br., in addition to citing the Brown material, he cites *Schultz 261*. The MEL sheet of *Schultz 261* has been identified as *E. fistulosum*. This is consistent with Bentham's comments in his description of *E. fistulosum* R.Br. which he states is "Evidently very near *E. scariosum* R.Br. and most probably a variety only".

Mueller in his description of *E. spectabile* refers to the preceding species (*E. monoscapum*) as agreeing in essential features but differing in habit. Following examination of both type specimens including SEM detail of the seeds, these are considered the same taxon. Certainly the single scape character referred to by Mueller is not a reliable or diagnostic character.

Conservation Status: Widespread and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: 18.7 km E of Lake Emma t/o, 19 May 1993, *Clarkson 10047B* (CNS, DNA, K); Chewko, 30 Aug 1970, *Kershaw 10127* (CNS); Lake Boronto, 22 Sep 1974, *Webb 13612A* (CNS). **Northern Territory:** Fitzmaurice River, 12 May 1994, *Barritt 1253* (DNA); Howard River Hunting reserve, 7 Jul 1995, *Cowie 5867* (DNA, MEL); 24 km SE of Maningrida, 22 Aug 1995, *Cowie 5931* (DNA); Moyle River, 10 May 1994, *Dunlop 10100* (DNA); 11 km SSE of Pungalina H/std, 3 Jun 2009, *Jensen 1794* (BRI, CNS, DNA); c. 14.1 km E of Pungalina H/std, 10 Jun 2009, *Jensen 1833* (BRI, CNS, DNA); Leach Lagoon, 22 May 1994, *Latz 13993* (DNA, NT); 40 km N of Murgenella, 28 Aug 1987, *Leach* 1384 (DNA); Angularli Creek, 29 Aug 1987, *Leach 1399* (BRI, DNA, K, MEL, NT); W of Macadam Range, 12 May 1994, *Leach 4430* (DNA, MEL); Yamburran Range, 16 May 1994, *Leach 4566* (DNA, MEL); Katherine river headwaters, 8 Jul 1996, *Mangion 209* (DNA); 30 km ENE of Oenpelli, 27 May 1988, *Munir 5925* (AD, DNA); 20 km E of Goomadeer Crossing, 16 June 1987, *Wightman 3808* (BRI, DNA); Katherine River, 14 Jul 1997, *Wightman 7013* (DNA). **Western Australia:** Casuarina Creek, King George River, 29 Jun 2015, *Leach 4724* (DNA).

E. tortuosum F.Muell., *Fragmenta Phytographiae Australiae* 1: 91 (1859)

Type: Northern Territory: Victoria River, May 1856, *F. Mueller s.n.* (holo MEL1554397!; iso K001056243!)

Illustrations: G.J.Leach, *Fl. Kimberley Reg.*, 1031, fig. 308A (1992); G.J.Leach, *Floodplain Flora*, 237, fig. 52 (2000).

Herb 6–35 cm high. *Leaves* linear, 1.2–6 cm long, 0.16–0.7 cm wide, 4–11-nerved. *Peduncle* 6–30 cm long, with 4–7 ribs. *Sheath* 20–60 mm long. *Flower heads* hemispherical to ovoid, squarrose, 2.5–6.5 mm long, 3.5–6 mm wide. *Involucral bracts* dirty straw yellow or black with pale tips, obovate to lanceolate, 1.25–2.5 mm long, 0.75–1.9 mm wide, acuminate to acute, sparsely pubescent with white hairs, strongly reflexed at maturity. *Floral bracts* black with pale tip, obovate to spathulate, 1.4–2.4 mm long, 0.5–1 mm wide, acuminate to aristate with tip to 0.6 mm long, pubescent with white hairs which are readily deciduous leaving a pustulate surface. *Receptacle* densely pilose, conical. *Male flowers*: 1.2–1.6 mm long; sepals 3, free, black, equal, linear to oblong, slightly dilated at apex, 0.7–1.25 mm long, 0.2–0.35 mm wide, obtuse to truncate, glabrous or rarely sparsely pubescent with white hairs in apical fringe and median area; petals 3, hyaline, dimorphic with one larger, triangular, acute, glabrous; stamens 6; anthers black or rarely yellow. *Female flowers*: sepals 3 but readily deciduous and often appearing fewer, black, equal, linear or navicular and geniculate, lacking dorsal keel or wing, 1–1.8 mm long, 0.13–0.25 mm wide, obtuse to truncate or lobed, pubescent with white hairs in apical fringe and median area which are readily deciduous leaving a pustulate surface; petals 3, black, dimorphic with one slightly larger, spathulate, 1–1.5 mm long, 0.2–0.4 mm wide, acute, pubescent with white hairs abaxially and hyaline hairs on margin and adaxially. *Ovary* 3–locular. *Seeds* 0.33–0.5 mm long, 0.26–0.36 mm wide; epidermal cells more or less isodiametric, peg-like projections on both transverse and longitudinal walls. **Fig. 9e–f.**

Distribution: From the Kimberley region through the Victoria River region to Arnhem Land to Cape York, Qld. **Fig. 12.30.**

Habitat: Creek lines, riparian woodland, *Melaleuca* swamps, seepage areas and open grassy swamps, rock pavements.

Notes: Recorded growing with *E. fistulosum* (*Leach 4630*).

Conservation Status: Widespread and not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: c. 10 km W of Mareeba, 15 Apr 1989, *Clarkson 7879* (CNS, DNA, L, PERTH); 18.7 km E of Lake Emma t/o, 19 May 1993, *Clarkson 10046* (CNS, DNA); Bulleringa NP, 23 Apr 1998, *Forster 22520* (BRI, DNA, MEL). **Northern Territory:** Fitzmaurice River area, 13 May 1994, *Barritt 1336* (DNA); Yarunga Creek, 24 Jul 1987, *Clark 1123* (DNA); Marlow's Lagoon, Palmerston, 25 Apr 1986, *Cox 25* (DNA); 17 km NE of Moline, 5 Apr 1974, *Dunlop 3491* (CANB, DNA, NSW); Jarong Spring, Fish River, 16 Mar 1989, *Dunlop 8346* (DNA); Umbrawarra Gorge, 19 Apr 1993, *Egan 2120* (DNA); Amy Johnson Drive swamp, Apr 1983, *King 319* (DNA); 17 miles N or Wilton River crossing, 17 Jun 1972, *Latz 2759A* (DNA, NT); Haywood Creek catchment, 14 Mar 1989, *Leach 2579* (DNA); Kurundie Creek, Kakadu NP, 20 Apr 1990, *Leach 2816* (DNA); Bickerton Island, 29 Apr 1993, *Leach 3502* (DNA); Elizabeth river, 30 Apr 1999, *Leach 4630* (DNA); Baralil Creek, 11 May 1999, *Leach 4636* (BRI, DNA); Fish River block, 18 Apr 2010, *Lewis 1624* (DNA); Darwin, 2 Apr 1976, *Mitchell s.n.* (DNA); Yambarran Range, 15 May 1994, *Walsh 3778* (DNA, MEL); **Western Australia:** 1.5 km W of Lennard River, 24 Jul 1974, *Beauglehole 47832* (DNA, PERTH); 24 km NW of Drysdale River crossing, 30 May 1976, *Beauglehole 51686A* (DNA, PERTH); King Creek Gorge, 23 Jun 1976, *Beauglehole 53688* (DNA, PERTH); Gardner Plateay, 28 May 1993, *Cowie 4500* (DNA); Bell Creek, 5 Jun 1995, *Kenneally 11549* (DNA, PERTH); 47 miles W of Durack River, 21 May 1967, *Maconochie 196* (DNA).

E. tricornum G.J.Leach, *Austral. Syst. Bot.* 13: 769 (2000)

Type: Northern Territory: Baralil Creek, downstream of Arnhem Hwy, Kakadu National Park, N.T., 11 May 1999, *G.J. Leach 4635* (holo DNA!; iso BRI!, CANB!, K!).

Illustrations: G.J.Leach, *Floodplain Flora*, 237, fig. 52 (2000); G.J.Leach *Austral. Syst. Bot.* 13: 756 fig. 1 (A) (2000).

Herb 4–9 cm high. *Leaves* lanceolate, (3–)4.5–6.5 cm long, 0.2–0.7 cm wide, (4–)7–9-nerved. *Peduncle* 4.5–7.5 cm long, with 4-5 ribs. *Sheath* (35–)45–65 mm long. *Flower heads* globular but spikey in appearance due to prominent mucro of the floral bracts, 3–5.5 mm long, 4–5 mm wide. *Involucral bracts* hyaline, spathulate, 2–2.5 mm long, 1–1.5 mm wide, acute, glabrous, strongly reflexed at maturity. *Floral bracts* hyaline, narrowly oblanceolate, 1.5–2.3 mm long, 0.4–0.6 mm wide, acuminate or acute, glabrous but with slightly raised tubercles. *Receptacle* glabrous, conical. *Male flowers*: 1–1.25 mm long; sepals 3, fused but split on one side to form a spathe which is deeply lobed and easily torn, hyaline, 0.8–1 mm long, c. 0.36 mm wide, acute or obtuse, glabrous or rarely pubescent with a few white hairs abaxially on median region; petals 3, hyaline, equal, triangular, acuminate or obtuse, glabrous or pubescent with sparse white hairs in apical fringe; stamens 3; anthers black. *Female flowers*: sepals 3, hyaline, equal, elliptic, lacking dorsal keel or wing or ± swollen along ridge, 1–1.5 mm long, 0.35–0.5 mm wide, acuminate or acute, glabrous; petals 3, hyaline, equal or dimorphic with one at maturity often with a longer mucro, spathulate or oblanceolate, 1.6–2.6 mm long, 0.5–0.8 mm wide, acuminate or mucronate, pubescent with sparse white hairs or glabrous. *Ovary* 3-locular. *Seeds* c. 0.48 mm long, c. 0.38 mm wide; epidermal cells with even wall thickenings. **Fig. 9g–h.**

Distribution: Endemic to the NT. In drainage systems of Kakadu National Park (Wildman, Baralil, Flying Fox watercourses); Koolpinyah, Howard Springs, Elizabeth River, Adelaide River floodplain. Collected once near Gove. **Fig. 13.31.**

Habitat: Open grassy swamps, sedgelands with *Grevillea pteridifolia* and *Melaleuca spp.*, sandy seepage areas.

Notes: This species is most unusual amongst the Australian members of the genus in the swollen, aristate female petals which persist and enclose the seed and obviously function as a diaspore unit. It is also unusual in that the leaves appear to be few in number and perhaps functionally replaced by the well-developed peduncular sheath which is more or less as long as the peduncles. A collection with sessile heads (*Leach 4646*) was made in association with plants with emergent heads on long peduncles (*Leach 4645*).

Conservation Status: A wide distribution in sandy areas from Darwin to Gove and known from Kakadu National Park. Not considered under threat. Coded as Data Deficient in the NT (FloraNT 2017).

Etymology: From the Latin "tri" meaning three and "cornu" horned; referring to the distinctive three aristate tips of the female petals.

Specimens examined: AUSTRALIA: Northern Territory: Arnhem Hwy, Kakadu NP, 22 Apr 2011, *Brennan 9328* (DNA); Flying Fox Creek, Arnhem Highway, 1 May 2012, *Brennan 9727* (DNA); N of Black Jungle reserve, Adelaide River floodplain, 23 Apr 2001, *Cowie 9384* (DNA); W of Wildman River, Kakadu NP, 8 Apr 2003, *Cowie 9740, 9743* (DNA); W of Elizabeth R., Darwin; 24 Apr 1993, *Egan 2177* (DNA); Baralil creek crossing, 11 May 1999, *Leach 4635* (BRI, CANB, DNA, K); E of Howard Springs hunting reserve, 24 may 2000, *Leach 4645, 4646* (BRI, DNA); Gove Peninsula area, 7 Jul 2010, *Stuckey 677* (DNA); Koolpinyah Station area, 23 May 2011, *Stuckey 839* (DNA).

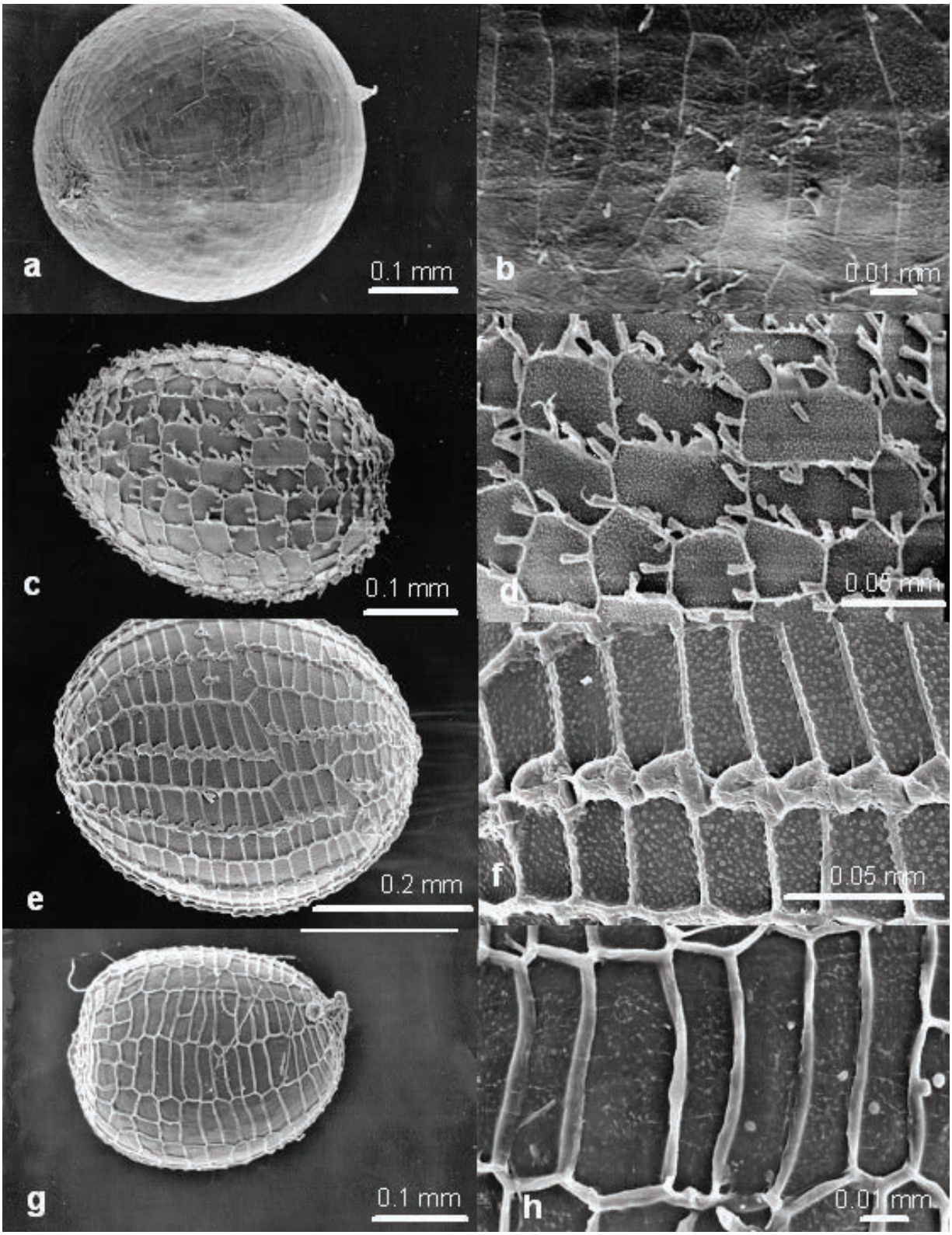

Fig. 8. Seed and seed surface: *Eriocaulon rivicola* **a, b**; *E. scariosum* **c, d**; *E. schultzii* **e, f**; *E. scullionii* **g, h**. (a-b from *George 12635*; c-d from *Wilson 989*; e-f from *Fensham 956*; g-h from *Leach 2566).*

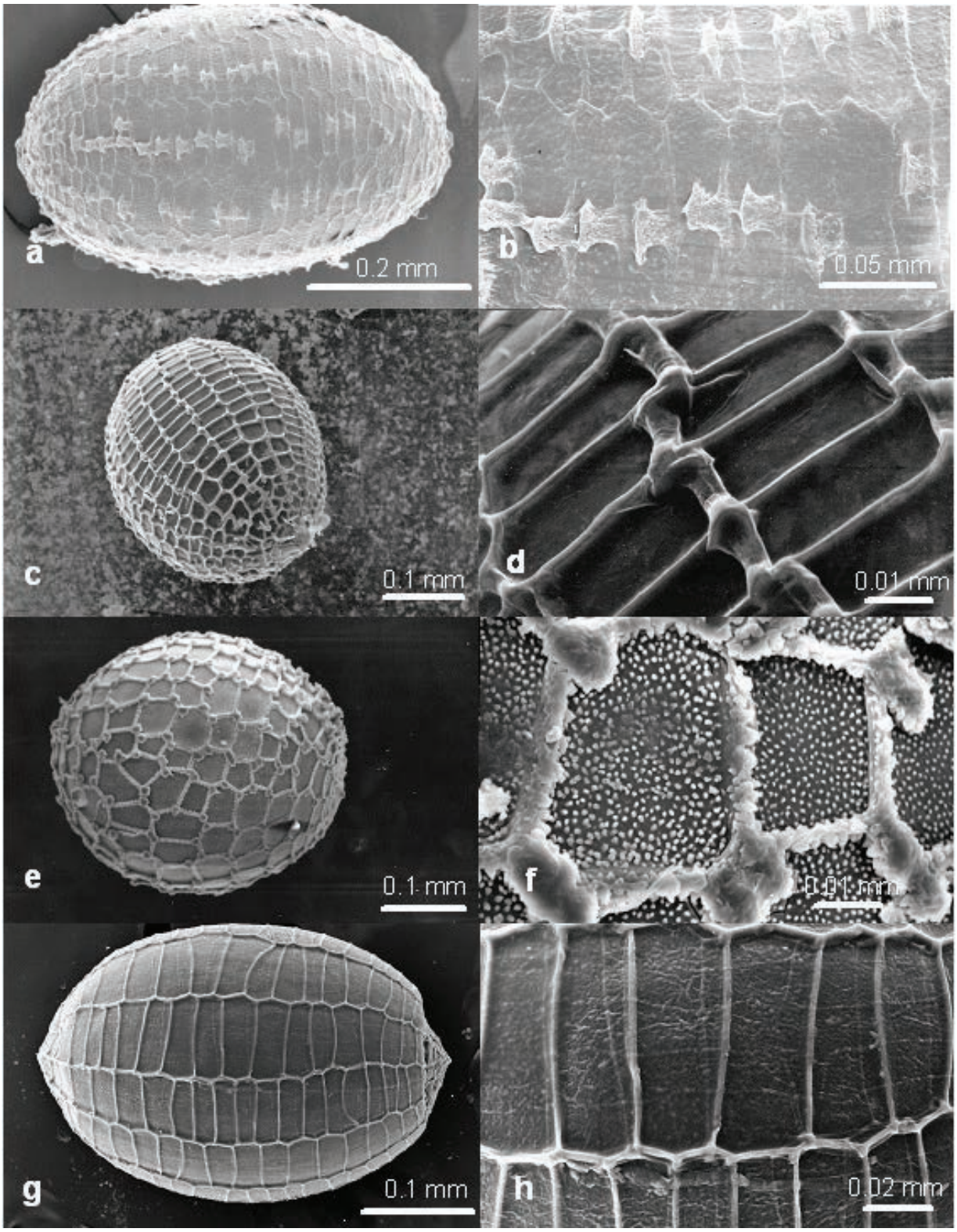

Fig. 9. Seed and seed surface: *Eriocaulon setaceum* **a, b**; *E. spectabile* **c, d**; *E. tortuosum* **e, f**; *E. tricornum* **g, h**. Material used: a-b from *Wilson 339*; c-d from *Mueller MEL1501981*; e-f from *Dunlop 3725*; g-h from *Egan 2177*.

E. truncatum Buch.-Ham. ex Mart., *Plantae Asiaticae Rariores* 3: 29 (1832)

Type: India: 'Crescit in montibus Monghir', 23 Jun 1811, *F. Buchanan-Hamilton s.n.*, Wallich Cat no. 6076 (lecto (Phillips 1997: 11) K001122955!; isolecto BM000802024 *n.v.*

Syntypes India: *F. Buchanan-Hamilton s.n.*, Wallich Cat no 2368 BR918712 *n.v.*, NY02721 *n.v.*; Mongger hills [Monghir] 23 Jun 1811, *F. Buchanan-Hamilton 346* (E00027110)

Illustrations: M.Soerjani *et al. Weeds of rice in Indonesia*, 281, fig.4.125 (1986).

Herb 2–11 cm high. *Leaves* lanceolate, 0.9–5.5 cm long, 1–6 mm wide, acute, 6–11-nerved. *Peduncle* 1-10.5 cm long, with 4–6 obscure ribs. *Sheath* 7–45 mm long. *Flower heads* hemispherical, 2–3.5 mm long, 3–5 mm wide. *Involucral bracts* hyaline to greyish, elliptic, 1.5–2.6 mm long, 0.9–1.3 mm wide, obtuse, glabrous, not reflexed at maturity. *Floral bracts* hyaline, spathulate, 1–1.68 mm long, 0.7–0.9 mm wide, obtuse, glabrous. *Receptacle* sparsely hairy to densely pilose, convex. *Male flowers:* 0.9–1.5 mm long; sepals 2 or 3, fused but split on one side to form a spathe which is often deeply lobed with age, hyaline or black at apex, 1.1–1.3 mm long; 0.35–0.42 mm wide, truncate, or lobes acute, glabrous or pubescent with sparse white apical hairs; petals 3, hyaline, equal, narrow-triangular, obtuse, glabrous, or pubescent with sparse white apical hairs; stamens 6; anthers black. *Female flowers:* sepals 2 or 3, hyaline or black to greyish at apex, dimorphic if 3 sepals, narrow-elliptic or navicular, 1–1.3 mm long, 0.1–0.14 mm wide, acute, glabrous or pubescent with sparse white hairs at apex; median sepal linear, c. 0.9 mm long, c. 0.07 mm wide, hyaline, glabrous; petals 3, hyaline, equal, narrowly spathulate to linear, 0.75–1.7 mm long, 0.14–0.3 mm wide, obtuse, glabrous or pubescent with sparse, short, hyaline hairs on margin and adaxially and with or without white hairs at apex. *Ovary* 3-locular. *Seeds* ellipsoid; 0.385–0.4 mm long; 0.25 mm wide; epidermal cell wall longitudinal thickenings white, prominent, thicker than transverse walls. **Fig. 10a–b.**

Distribution: Widespread in Asia (China, Japan, India, Malaysia, Indonesia, Papua New Guinea, Philippines, Singapore, Sri Lanka and Thailand) and also East Africa. In Australia it is scattered across locations from the Osmond Range in the Kimberley to Boodjamulla (Lawn Hill) National Park, to near Ingham and Badu Island in Qld. Appears disjunct between Qld and the Kimberley region. **Fig. 13.32.**

Habitat: Shallow tea tree swamps; depression in eucalypt forest; under *Melaleuca* near small stream; spring fed creek in sandstone. Also from disturbed habitats such as roadside drains beside cane farms and waterlogged sandy soil in lawn.

Notes: Phillips (1997) cited the K sheet as a holotype, however, as there are a number of sheets that relate to the type gathering not referred to by Phillips, the K sheet cited by Phillips is considered to be a lectotypification. In all there are six sheets (CAL, E, K, BM, BR, NY) which appear to be part of the original material collected by Buchanan-Hamilton though not all sheets were seen by von Martius.

Souladeth et al. (2016) discusses some of the history of the Buchanan-Hamilton collections. Buchanan-Hamilton's own herbarium is now at E and was not seen by von Martius in the preparation of the descriptions of *Eriocaulon* in Wallich's *Plantae Asiaticae Rariores*. The specimens at BR and NY are both attributed to Wallich's List number 2368. This number is cited in the Catalogue as *Ruellia brunoniana* (Wallich Catalogue Online, 2008) and the specimens at K and E under the Wallich Catalogue number 2368 were collected by de Silva and are identified as *Strobilanthes brunonianus*. The specimens at BR and NY are definitely *Eriocaulon* and appear to be part of the Buchanan-Hamilton collection. The attribution to the Wallich Catalogue number 2368 appears to be in error. Ansari and Balakrishnan (1994) cite a specimen of Buchanan-Hamilton at CAL as part of the type collection but no details are available. The BR, CAL, E and NY specimens are therefore, for different reasons, properly excluded from consideration as a lectotype. The material at K is considered the 'top set' of the East India Company Herbarium and Souladeth et al. (2016) indicates that von Martius may have seen the K material and subsequently returned it to K after identification.

For further detailed extra-Australian synonymy see Phillips (1997) and Zhang (1999).

Conservation Status: A globally widespread species and although there are only a few collections from Australia it is not considered under threat.

Specimens examined: AUSTRALIA: Queensland: Cooktown, 22 May 1962, *Blake 21831* (BRI); near Cooktown, 17 May 1970, *Blake 23348* (BRI); Lockerbie, 22 Apr 1948, *Brass 18356* (BRI, CANB); Chester River, 28 Jul 1978, *Butler 419* (BRI); 30 km S of Ingham, 11 Mar 2014, *Corlis 1* (CNS); Black Spring, Lawnhill NP, 27 Jun 2001, *Fensham 4693* (BRI, DNA); Dulhunty River, 6 Mar 1992, *Johnson 5120* (BRI, DNA, NSW); Badu Island, 11 Jun 1990, *Waterhouse 874* (CNS, DNA). **Western Australia:** Wade Creek, Osmond Range, 19 Jun 1991, *Cowie 1886* (DNA, MEL). **MALAYSIA:** Shah Alam, Petaling Distr., 22 Feb 1987, *Worthington 12494* (AD). **SRI LANKA:** Doragasmulla to Kurunegala road, 18 Feb 1994, *Philcox 10605* (DNA, K).

E. willdenovianum Moldenke, *Phytologia* 18: 44 (1968)

Eriocaulon longifolium Nees ex Kunth,, *Enumeratio Plantarum Omnium Hucusque Cognitarum* 3: 567-568 (1841). *nom. illeg.*, *non* Raf. (1840).

Type: without locality or collector (lecto (Ansari and Balakrishnan1994: 81) B-W 2369! (left hand individual)).

Syntypes: Sri Lanka or India, Willd. herb. n. 2359 B-W 2359 (excl. right hand fragment), HAL109750; Madagascar, Willd. Herb. n. 2370 B-W 2370.

Probable syntypes: Madagascar, *Chapelier 80* (P00102922, P00102923 *n.v.*).

Illustrations: G.J.Leach, *Floodplain Flora*, 237, fig. 52 (2000); M.Soerjani et al. *Weeds of rice in Indonesia*, 279, fig.4.124 (1986).

Herb 7–70 cm high. *Leaves* linear to lanceolate, 4–65 cm long, 0.4–1.3 cm wide, 15–25–nerved. *Peduncle* 12–46 cm long, with 5–6 ribs. *Sheath* 80–130 mm long. *Flower heads* hemispherical to ovoid, 3–6 mm long, 4–6 mm wide. *Involucral bracts* straw yellow, broadly ovate, 1.5–2 mm long, 1.5–2.25 mm wide, obtuse, glabrous, not reflexed at maturity. *Floral bracts* straw yellow, broadly obovate, 1.4–2 mm long, 2–2.5 mm wide, obtuse with tip inflexed, pubescent apically with white hairs. *Receptacle* glabrous, convex to conical. *Male flowers*: sepals 2, fused for greater part, hyaline, 1.5–2 mm long, 0.9–1.5 mm wide, obtuse but irregularly toothed, glabrous; petals 2, hyaline, equal, linear, acute, with apical fringe of white hairs; stamens 4; anthers black. *Female flowers*: sepals 2, hyaline, equal, navicular, with broad dorsal wing, 1.2–2 mm long, 0.5–0.9 mm wide, crested, glabrous or rarely a fringe of hairs along margin; petals 2, hyaline, equal, linear, 1.25–1.75 mm long, c. 0.1 mm wide, acuminate, pubescent with apical fringe of white hairs and hyaline hairs on margins. *Ovary* 2–locular. *Seeds* 0.6–0.85 mm long, 0.45–0.5 mm wide; epidermal cell walls with longitudinal rows of hair or peg-like projections, often with a terminal cap and often erect. **Fig. 10c–d.**

Distribution: Coastal or near coastal locations in northern Qld and the NT. Also widely distributed throughout Malesia, India and Madagascar. **Fig. 13.33.**

Habitat: Typically on shaded margins of perennial streams and often partially submerged.

Notes: The earlier name *E. longifolium* Raf. (Rafinesque 1840) for a North American taxon made *E. longifolium* Nees ex Kunth illegitimate as a later homonym. Moldenke (1968) described *E. willdenovianum* as a new name for this taxon. The species was first recognised in Australia under the illegitimate name of *E. longifolium* (Leach 1989).

Ansari and Balakrishnan (1994) cited *B-W 2369* as the holotype, however, there are a number of sheets referred to in the Kunth protologue that are not referred to by Ansari and Balakrishnan. Hence sheet *B-W 2369* cited by them is considered to be a lectotypification (ICN, Art. 9.9).

There are three sheets in the Willdenow herbarium that relate to the type description by Kunth but two of these sheets comprise mixed material, which was recognised by Kunth. The first sheet he cited is the specimen number *2369* but he specifically excludes the right hand fragment. Later in the description he also cites Willd. Herb. n. *2359* referencing it as Willdenow's *E. sexangulare* and similarly specifically excludes the right hand fragment which is of another taxon. Also cited is Madagascan material as Willd. Herb. n. *2370*. A fragmentary specimen at HAL (109750) has a typed label indicating that the specimen is from B from the Willdenow herbarium n. *2359* and collected from Sri Lanka. Although the collection locality of Willd. Herb. n. *2369* is unknown it is the material that Kunth first clearly attributes to the name *E. longifolium* and the entire plant on the left hand side is here considered as the lectotype. Material at G comprising two sheets (G0019180) collected by C.M. Lemann is marked as type material of *E. longifolium* but does not appear to relate to the species description by Kunth.

Conservation Status: Not considered under threat. Coded as Least Concern in the NT (FloraNT 2017).

Selected specimens examined: AUSTRALIA: Queensland: Skull Creek, Cape York, 31 Aug 1987, *Aston 2668* (DNA, MEL); 0.3 km S of Elim Beach, 23 May 1990, *Clarkson 8703* (CNS, DNA, K, L); Burster Creek, 31 Aug 1985, *Clarkson 6184* (CNS, DNA, PERTH); Eliot Creek, 3 Mar 1992, *Clarkson 9283* (BRI, CNS, DNA, K, L); 21.1 km from McIvor R crossing, 20 May 1999, *Clarkson 10076* (BRI, CNS, DNA, K); Dallachy airstrip, 10 April 2014, *Corlis 6* (BRI, CNS); Tam O'Shanter NP, 16 May 2007, *Ford 5028* (BRI, CNS); Porn, 26 May 1976, *Hyland 8840* (CNS); Jowalbinna swamp, 15 June 1990, *van der Werff 11719* (CNS, MO). **Northern Territory:** Melville Island, 19 Sep 1986, *Fensham 316* (DNA); Wangi Stn, Florence Falls, 30 May 1978, *Henshall 1835* (AD, DNA, NT); Wessel Island, 3 Oct 1972, *Latz 3407* (BRI, CANB, DNA, MEL); Amagula Pools, Groote Eylandt, 27 Jan 1975, *Levitt 409* (DNA); 8 km SW of Umbakumba, 15 Jul 1987, *Russell-Smith 2756* (DNA); Burton's Creek, Woolaning, 7 Oct 1988, *Russell-Smith 5963* (CANB, DNA); Killunbunie Creek, Melville Island, 31 Jul 1966, *Stocker 680* (DNA, NT); Emerald River, Groote Eylandt, 29 Jul 1976, *Waddy 562* (DNA).

Eriocaulon wolseleyi G.J.Leach ***sp. nov.***

Diagnosis: Most similar to *E. spectabile* but differs in having dark involucral and floral bracts, the receptacle being densely pilose, with two stamens and the female perianth parts bearing hyaline hairs which are much longer than the perianth.

Type: Queensland: 4.4 km ESE of Bulimba, 13 Jul 2006, *R. Lovatt & C. Appelman R215* (holo BRI; iso DNA).

Eriocaulon sp. Bulimba (R. Lovatt R215) G.J.Leach

Herb 7–8 cm high. *Leaves* linear, 2–2.5 cm long, c. 0.5 mm wide, apex acuminate, 3-nerved. *Peduncle* 7–8 cm long, with 4 ribs. *Sheath* 15–18 mm long. *Flower heads* ovoid, 3.8–4 mm long, 3.0–3.5 mm wide. *Involucral bracts* black, obovate, c. 0.4–0.75 mm long, c. 0.3 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* black, narrowly oblanceolate, c. 1.3 mm long, 0.3 mm wide, acute, glabrous. *Receptacle* sparsely hairy to densely pilose, conical. *Male flowers:* c. 1.25 mm long; sepals 2, free, hyaline, linear, c. 0.5 mm long, c. 0.05 mm wide, acuminate, glabrous; petals 2, hyaline, equal, glabrous; stamens 2; anthers black. *Female flowers:* sepals 2, hyaline to black, equal, linear, lacking dorsal keel or wing, 0.5–0.8 mm long, c. 0.05 mm wide, acute, hyaline hairs as long or longer than the sepal in an apical fringe and on margins towards apex; petals 2, hyaline, equal, linear, c. 0.7 mm long, c. 0.05 mm wide, acute, pubescent with hyaline hairs as long or longer than petals on upper part of margin. *Ovary* 2-locular. *Seeds* c. 0.25 mm long, c. 0.2 mm wide; epidermal cell outline only faintly visible. **Fig. 10e–f.**

Distribution: Queensland where known from single collection c. 4.4 km ESE of Bulimba. **Fig. 13.34.**

Habitat: Clay swamp with *Eleocharis* surrounded by *Melaleuca viridiflora*.

Notes: The distinctive long hairs are not apparent in immature heads and so appear to develop as the head matures. The species is perhaps most closely related to *E. spectabile.*

Conservation Status: As the species is known only from one collection in a relatively poorly surveyed area it is considered as Data Deficient.

Etymology: The species is named in honour of the highly regarded Melbourne-based artist Mr John Wolseley. He has worked with many botanists over a long period in his interpretation of landscapes, the plants within them and the relationship of people with plants. His recent works have focused on Australian wetlands to raise awareness of the threats they face.

E. zollingerianum Koernicke, *Linnaea* 27: 682–683 (1856)

Type: Indonesia: Java, 24 Jul 1842, *H. Zollinger 333* (holo B 100106846 *n.v.*; iso BM000802019!, L!, LE00010643 *n.v.*, LL00374622 *n.v.*)

Illustrations: G.J.Leach, *Floodplain Flora*, 235, fig. 51 (2000).

Herb 7–23.5 cm high. *Leaves* linear or lanceolate, 0.9–3 cm long, 0.15–0.35 cm wide, 7–9–nerved. *Peduncle* 6–9 cm long, with c. 4 ribs. *Sheath* 17–45 mm long. *Flower heads* globular or cylindric, 3–5 mm long, 3.5–4.5 mm wide. *Involucral bracts* straw yellow to hyaline, broadly obovate, 1.25–1.5 mm long, 0.9–1.5 mm wide, obtuse, glabrous, strongly reflexed at maturity. *Floral bracts* straw yellow, lanceolate to spathulate, 1.6–2 mm long, 0.85–1.75 mm wide, acute, glabrous. *Receptacle* densely pilose, conical. *Male flowers*: 1.2-1.5 mm long; sepals 3, fused but split on one side to form a spathe, hyaline or straw yellow, 1–1.45 mm long, 0.55–0.8 mm wide, obtuse or truncate, glabrous; petals 3, hyaline, equal or dimorphic, triangular, acute or obtuse, pubescent with apical fringe of white hairs or glabrous; stamens 6; anthers black. *Female flowers*: sepals 2 or 3, straw yellow, dimorphic, navicular, broad dorsal wing with dark window, c. 1 mm long, 0.8–1 mm wide, crested, pubescent with hyaline hairs inside at opening; median sepal linear, hyaline, 0.45–0.7 mm long, c. 0.05 mm wide, acute, glabrous; petals 3, hyaline, equal or dimorphic, linear, 1–1.1 mm long, 0.07–0.1 mm wide, acute, glabrous. *Ovary* 3–locular. *Seeds* 0.3–0.35 mm long, 0.25 mm wide; epidermal cells with even wall thickenings. **Fig. 10g–h.**

Distribution: In Australia recorded in the Weipa and Aurukun area of Cape York; extends to New Guinea, Indonesia (Java, Flores, Sulawesi, Sumatra), Thailand, India and the Philippines. The record for the NT (*Floodplain Flora*, 239 (2000)) is incorrect and was based on a specimen of *E. inapertum.* **Fig. 13.35.**

Habitat: Creeks and sandy drainage channels in grassy swamps or eucalypt woodland.

Conservation Status: Although only known in Australia from several collections on the west of Cape York it is likely to be under-collected and is not considered under threat.

Specimens examined: AUSTRALIA: Queensland: 5.3 km E of Brown Creek, 29 May 1982, *Clarkson 4409* (BRI, CNS, K, PERTH); Off Peninsula road, 57.8 km along main Weipa road, 11 Apr 1988, *Forster 4066* (BRI).

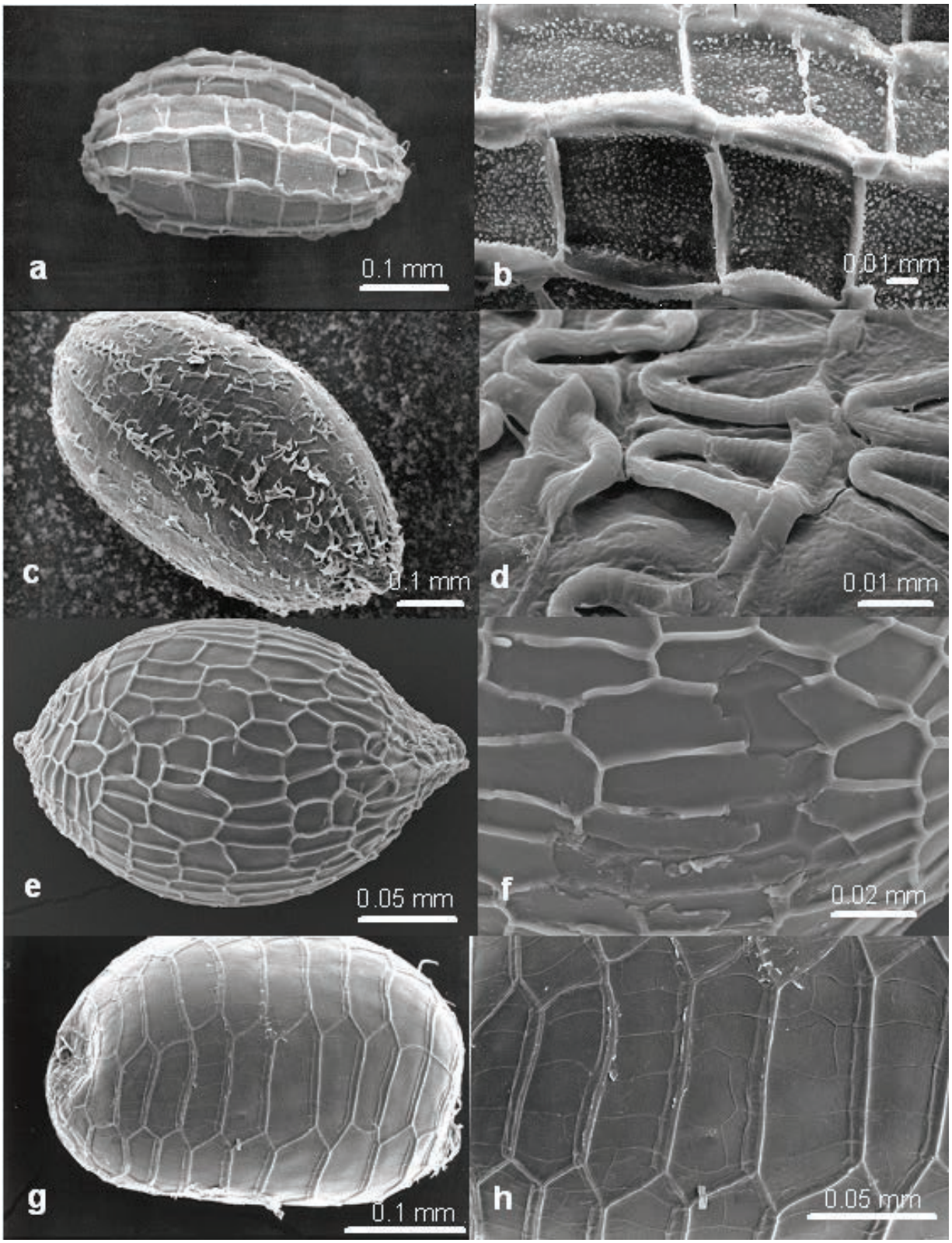

Fig. 10. Seed and seed surface: *Eriocaulon truncatum* **a, b**; *E. willdenovianum* **c, d**; *E. wolseleyi* **e, f**; *E. zollingerianum* **g, h**. Material used: a-b from *Blake 23348*; c-d from *Leach 1529*; e-f from *Lovatt R215*; g-h from *Clarkson 4409*.

Incertae Sedis

E. pallidum R.Br., *Prodromus Florae Novae Hollandiae* 254 (1810)

Type: ['(T.) B. *v.s.*'] Queensland: Endeavour River, *J. Banks & D. Solander s.n.* (holo BM900915!)

A second sheet at BM (990774) is marked as a type specimen but it has no collector or location associated with it.

Brown described this species based on Banks & Solander material collected from the Endeavour River. There is a note on the specimen by Britten that the material of *E. pallidum* was on the same sheet as *E. depressum* but subsequently removed to its own sheet. The plants on the sheet are 25 – 40 mm high. The main distinguishing features from Brown's description are the five part female perianth with two narrow sepals and three ciliate petals; and the male flowers with two sepals and obsolete petals. Bentham (1878) keys *E. pallidum* as close to *E. pusillum*, differing only by plant height and leaf size and both having free or nearly so male sepals and the presence of both sepals and petals in the female flower. Bentham cites only the Banks & Solander type specimens from the Endeavour River for each of *E. pusillum* and *E. pallidum* and notes that he was not able to satisfactorily examine the flowers of the latter.

There is no mature seed present in the BM type of *E. pallidum*. The receptacle is glabrous and the female flowers have two, linear, dark, glabrous sepals and three hyaline petals. Contrary to Bentham's observation, the male flowers are in a spathe which was divided into two or three lobes. In the absence of any mature seed on the type material the application of the name *E. pallidum* is problematic. Based on the observations of the type material of *E. pallidum* having a glabrous receptacle and the male sepals being fused into a spathe, although the identity of *E. pallidum* remains uncertain, it appears closest to *E. nanum* R.Br.

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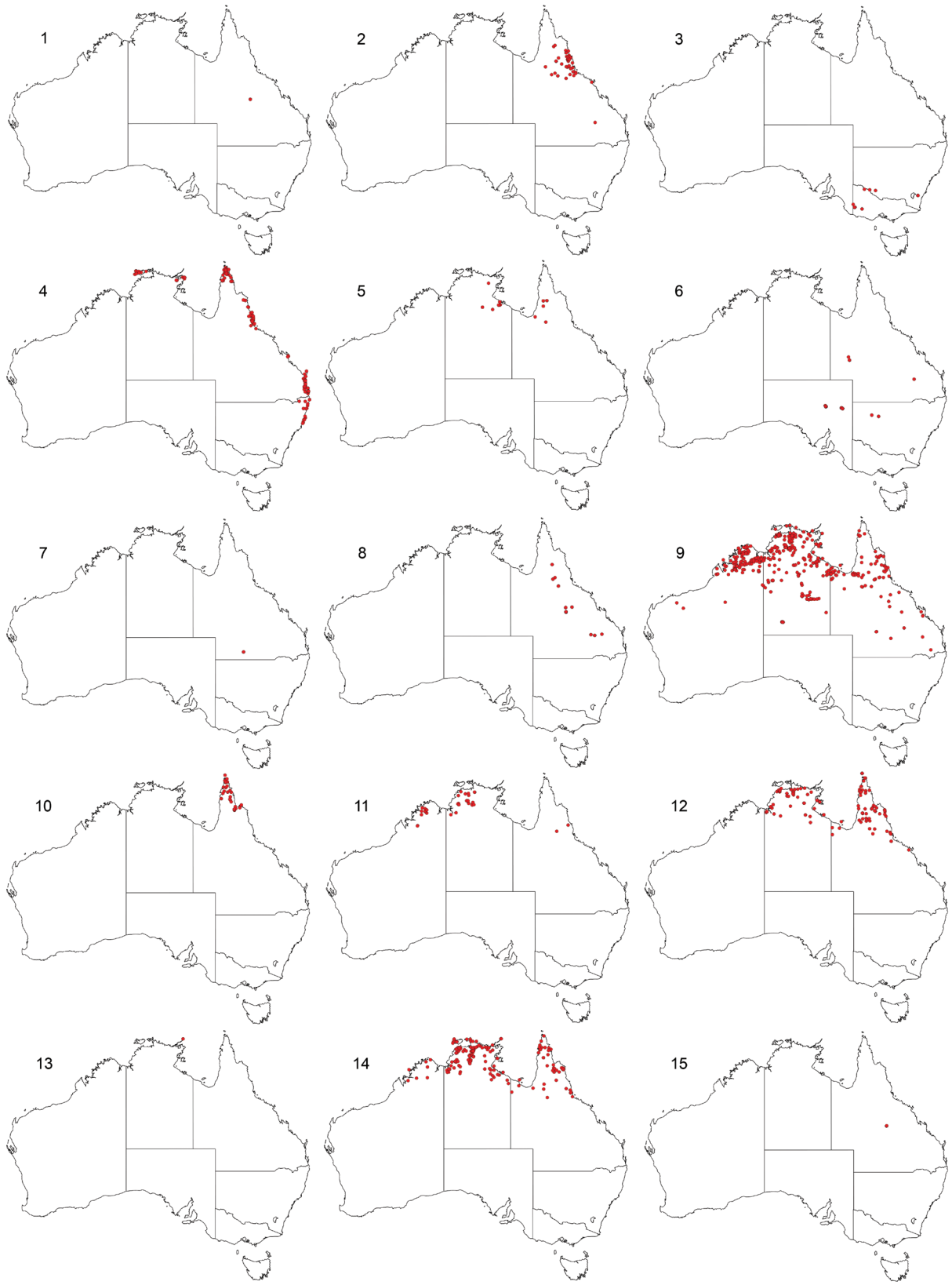

Fig. 11. Distribution maps: **1**. *E. aloefolium*; **2**. *E. athertonense*; **3**. *E. australasicum*; **4**. *E. australe*; **5**. *E. carpentariae*; **6**. *E. carsonii* subsp *carsonii*; **7**. *E. carsonii* subsp *euloense*; **8**. *E. carsonii* subsp *orientale*; **9**. *E. cinereum*; **10**. *E. clarksonii*; **11**. *E. concretum*; **12**. *E. depressum*; **13**. *E. fenshamii*; **14**. *E. fistulosum*; **15**. *E. giganticum*.

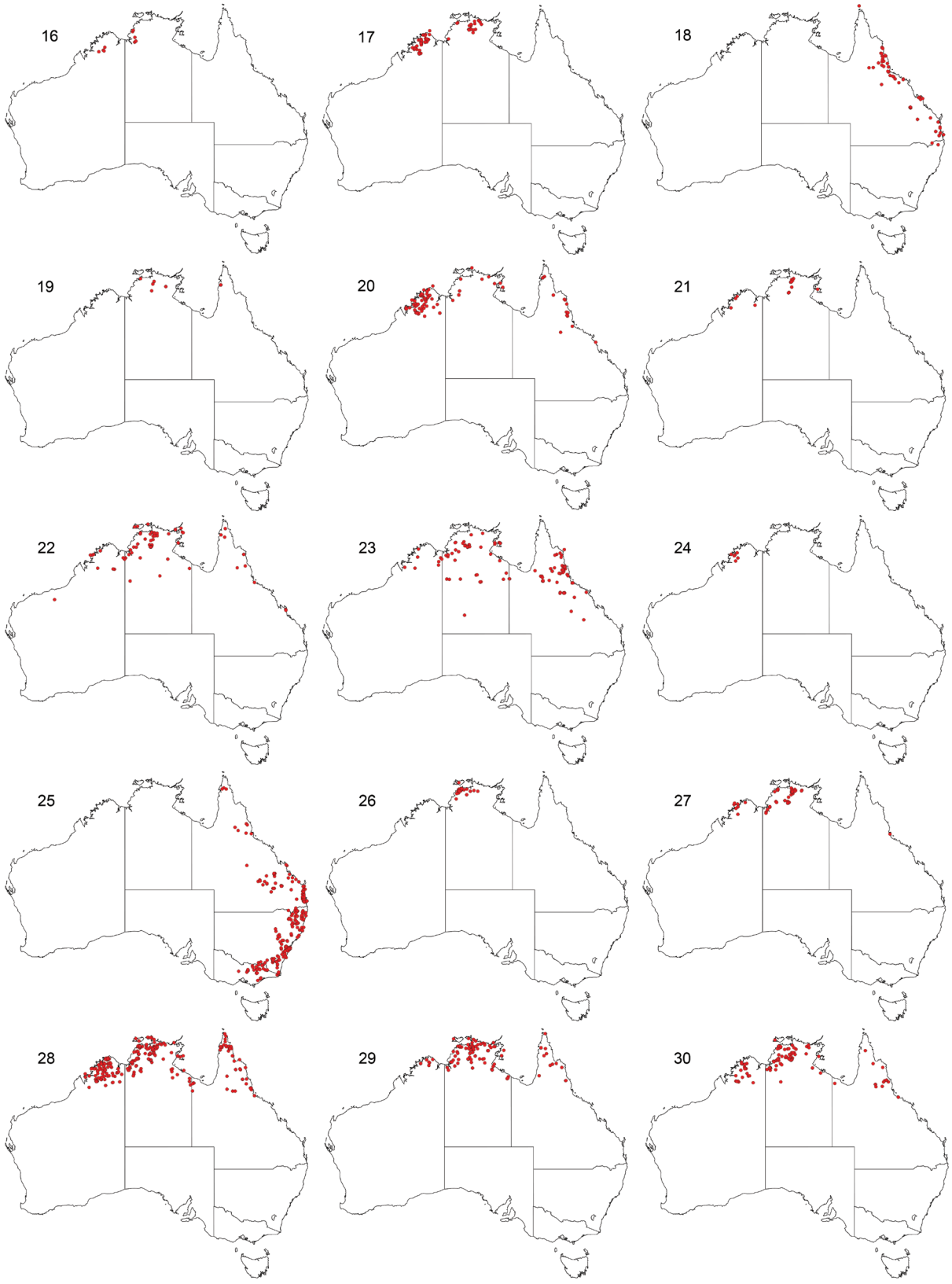

Fig. 12. Distribution maps: **16**. *E. inapertum*; **17**. *E. lividum*; **18**. *E. nanum*; **19**. *E. nematophyllum*; **20**. *E. odontospermum*; **21**. *E. patericola*; **22**. *E. pusillum*; **23**. *E. pygmaeum*; **24**. *E. rivicola*; **25**. *E. scariosum*; **26**. *E. schultzii*; **27**. *E. scullionii*; **28**. *E. setaceum*; **29**. *E. spectabile*; **30**. *E. tortuosum*.

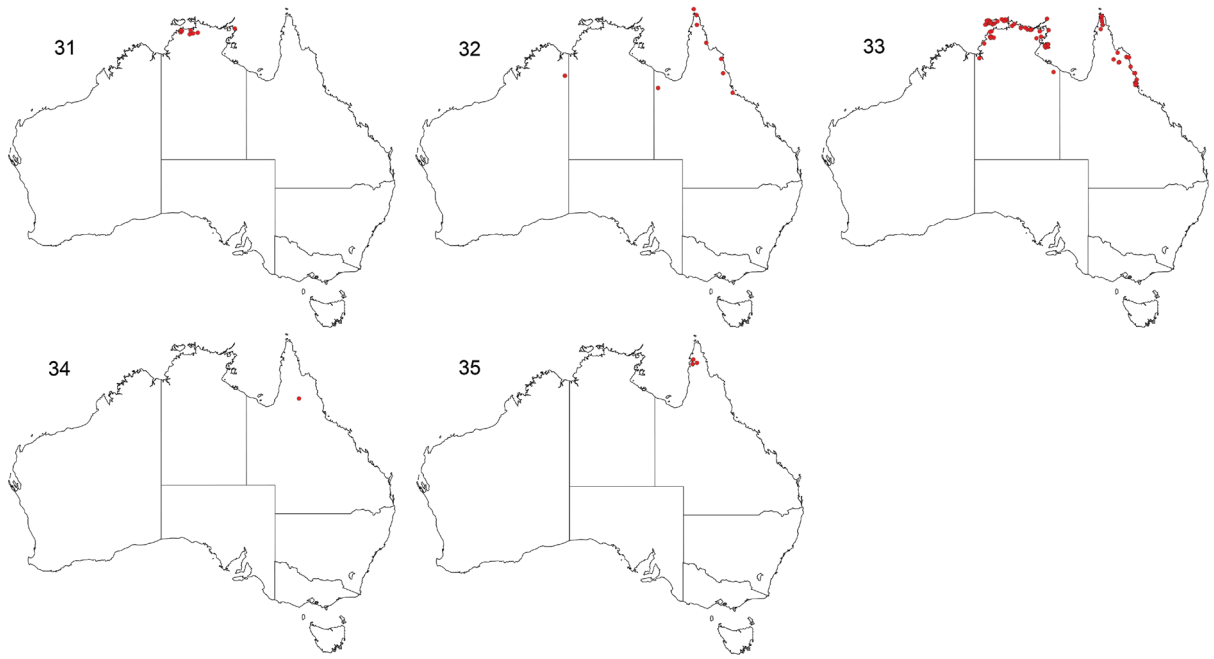

Fig. 13. Distribution maps: **31**. *E. tricornum*; **32**. *E. truncatum*; **33**. *E. willdenovianum*; **34**. *E. wolseleyi*; **35**. *E. zollingerianum*.