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Five new species of *Utricularia* (Lentibulariaceae) from Australia

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Abstract

Utricularia fenshamii R.W.Jobson, *U. ameliae* R.W.Jobson, *U. barkeri* R.W.Jobson, *U. grampiana* R.W.Jobson, and *U. lowriei* R.W.Jobson (Lentibulariaceae) are described as new and are considered members of *Utricularia* subg. *Polypompholyx* section *Pleiochasia*. The distribution and habitat preferences of these species are discussed. The morphological differences between all five species and species to which they are allied are here discussed and identification keys provided.

Introduction

The five species of the current study possess a two parted calyx, lack scales on their peduncles, and have bladder-traps with a single unbranched dorsal appendage. Therefore they are considered members of sect. *Pleiochasia* (subgen. *Polypompholyx*) (Jobson et al. 2003, Reut & Jobson 2010). All species described here (Figs 1–6, 8) are restricted to eastern Australia (Fig. 7).

Recognition as distinct species is supported by morphological data (this paper), and preliminary molecular phylogenetic results (Jobson et al., in prep.). All species, except for *U. lowriei* R.W.Jobson, were previously included in *U. dichotoma* Labill. (sensu lato), a species distributed across all Australian states except the Northern Territory (Taylor 1989). The main inflorescence characters differentiating these four new taxa from *U. dichotoma* are shape and size of the ridges located near the base of the corolla lower lip, and the consistently gibbous shape of the base of bracts and bracteoles in *U. dichotoma* (refer to 'Key to species of *Utricularia dichotoma* complex')

The fifth new species, *U. lowriei* (Figs 6, 8), was recently collected by the author north of Cooktown, Queensland (Fig. 7a). This new species shows close affinities to *U. antennifera* P.Taylor and *U. dunstaniae* F.E.Lloyd, both occurring in the Kimberley region of Western Australia, with the latter also collected near Darwin and on the Arnhem Land Escarpment, Northern Territory (Taylor 1989). All three species possess a single flowered inflorescence, apricot-coloured corolla with scrotiform spur, and a corolla lower lip consisting of five lobes (Reut and Jobson 2010). Of these five lobes, the lateral pair is erect and filiform, with the three central lobes either minutely deltoid or highly reduced and less than half the length of the spur in *U. antennifera* and *U. dunstaniae* (Taylor 1989); whereas in *U. lowriei* they are deeply lobed, capillary, and longer than the spur (Fig 6h). Two other Northern Territory species, *U. capilliflora* F.Muell. and *U. dunlopii* P.Taylor, have erect filiform corolla lobes, but in both cases these lobes arise from the corolla upper lip (Taylor 1989), and have evolved independently from one another (Reut and Jobson 2010) (refer to 'Key to Australian *Utricularia* species possessing an erect pair of capillary corolla lobes').

Herein five new taxa are named and compared with the morphology of related species, with notes on distinguishing characters, phenology, distribution and ecology, and conservation status. Taxonomic keys are provided for identification and terminology follows Taylor (1989).

Methods and Materials

Relevant dried and alcohol-preserved material representing synonymous taxa and related species, held at the National Herbarium of New South Wales (NSW), Queensland Herbarium (BRI), Australian National Herbarium (CANB), State Herbarium of South Australia (AD), and the National Herbarium of Victoria (MEL) were examined. Seed and pollen were examined using a standard compound microscope (magnification X40). Distribution maps used in Figure 7, and all associated data, were created and downloaded from the spatial portal of the Atlas of Living Australia web site (http://spatial.ala.org.au/). The specimens examined are summarised according to the following geographic regions: 'Pastoral Districts' of Queensland (Anonymous 1975), 'Botanical divisions' of New South Wales (Jacobs and Pickard 1981, modified from Anderson 1961), 'Natural regions' of Victoria (Conn 1993), 'Floristic regions' of South Australia (Jessop and Toelken 1986), and 'Natural regions' of Tasmania (Orchard 1988).

Taxonomy

1. *Utricularia fenshamii* R.W.Jobson *sp. nov*.

Diagnosis: This species differs from *U. dichotoma* with presence of bracts and bracteoles that are basally non-gibbous; corolla lower lip central ridge twice the length of neighbouring ridges.

Type: Australia: Queensland: Warrego: Yowah Creek Springs, Bundoona, NW of Eulo, (27.941°S,144.777°E), 30 Sep 2012, *R.W. Jobson 1523* (holo: NSW901605 iso: BRI, CANB).

Small to medium-sized perennial, terrestrial herb. Rhizoids capillary, simple, up to 20 mm long 0.1–0.3 mm thick, numerous from base of peduncle, with one or a few from nodes of stolon. Stolons few, filiform 0.2–0.3 mm thick, unbranched, up to 50 mm long, internode length c. 1 mm long, nodes slightly thickened. Leaves numerous, several from base of the peduncle and often in threes from stolon internodes, petiolate; lamina fleshy c. 0.15 mm thick, 0.2–0.5 mm wide, 3–8 mm long, linear to narrowly obovate, single nerve, apex rounded. Traps stalked, numerous at base of peduncle and up to three at nodes of stolon, ± uniform, ovoid, 1.5–2.5 mm long, mouth lateral, with an inward folding dorsal appendage simple 0.3–0.5 mm long, two lateral appendages somewhat flattened, laciniate on terminal margin, ventral wings laciniate. Inflorescence erect, solitary 80–250 mm long; peduncle terete, glabrous, hollow near base, 0.5–1 mm thick. Scales absent. Bracts and bracteoles c. 2 mm long, similar, basifixed, ovate-deltoid with apex acute. Flowers 2–4, often 3, rarely 1, in opposite pairs, occasionally on an elongated axis, pedicels erect, dorsiventrally flattened, 5–10 mm long. Calyx lobes unequal; upper lobe c. 3 mm long, 2.6 mm wide, ovate with apex rounded; lower lobe c. 2.5 mm long, 2.2 mm wide with apex emarginate. Corolla blue-violet; lower lip 6–10 mm long with three yellow raised ridges at base with central ridge twice the length of those immediately adjacent, bordered marginally by a whitish band, two white outer ridges c. equal in length to the adjacent yellow ridges. Lower lip with limb transversely elliptic, apex rounded, slightly 3-lobed, palate pubescent, with a marginal rim; spur whitish or violet, subulate, straight or weakly curved forwards near the apex, at 90° from, and slightly shorter than the lower-lip; upper lip c. 5 mm long, constricted at middle, at which point it is straight or reflexed to c. 30 degrees, superior part truncate with apex entire or slightly emarginate, inferior part ovate, ciliate on margin. Staminal filaments curved, c. 1.5 mm long, anther thecae subdistinct. Ovary ovoid, c. 1 mm long; style c. 0.8 mm long; stigma with lower lip semicircular, upper lip deltoid. Capsule globose, 2–4 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, weakly thickened slit. Seeds obovoid, c. 0.75 mm long, 0.3 mm wide. Pollen: 3-colporate, c. 30 × 30 µm (*Jobson 1523*, NSW901605) (Figs 1, 5a–b).

S**pecimens examined: Queensland: Warrego**: Moorabinda, *Fensham 3510*, 28 Jan 1999 (BRI-AQ0665426); 'Bingara', W of Eulo, *Fensham 4070*, 28 Aug 2000 (BRI-AQ0491742); Tunga Spring, W of Eulo, *Jobson 1527*, 30 Sep 2012 (NSW901609); 'Werewilka', *Jobson 1668 & Cherry*, 14 Apr 2013 (NSW972811); **Mitchell**: Thomson River, *Birch s.n.*, anno c. 1875, (MEL90020A); **South Kennedy**: Carmichael River, NW of Clermont, *Fensham 3337*, 4 Feb 1998 (BRI-AQ0670427); Moses Spring Doongmabulla, *Fensham 3488*, 19 Aug 1998 (BRI-AQ0670264); 3 km S of Doongmabulla, *Thompson GAL9 & Simon*, 1 Apr 1992; **Cook**: Gamboola, N of Chillagoe, *Fensham 4435*, 26 May 2001 (BRI-AQ0498726); Soda spring on 'Gamboola', *Jobson 1946 & Quinn*, 7 Jul 2013 (NSW977122). **New South Wales: North Far Western Plains**: Peery Lake, *Holmes s.n.*, 16 Sep 1985 (NSW251159); Peery Lake, *Jacobs 4943*, 4 Nov 1986 (NSW251155); **North Western Plains**: Wee Waa, SW of Cuttabri on Cuttabri Road., *Jobson 1539*, 1 Oct 2012 (NSW901631). **South Australia: Lake Eyre**: Mt. Lyndhurst,

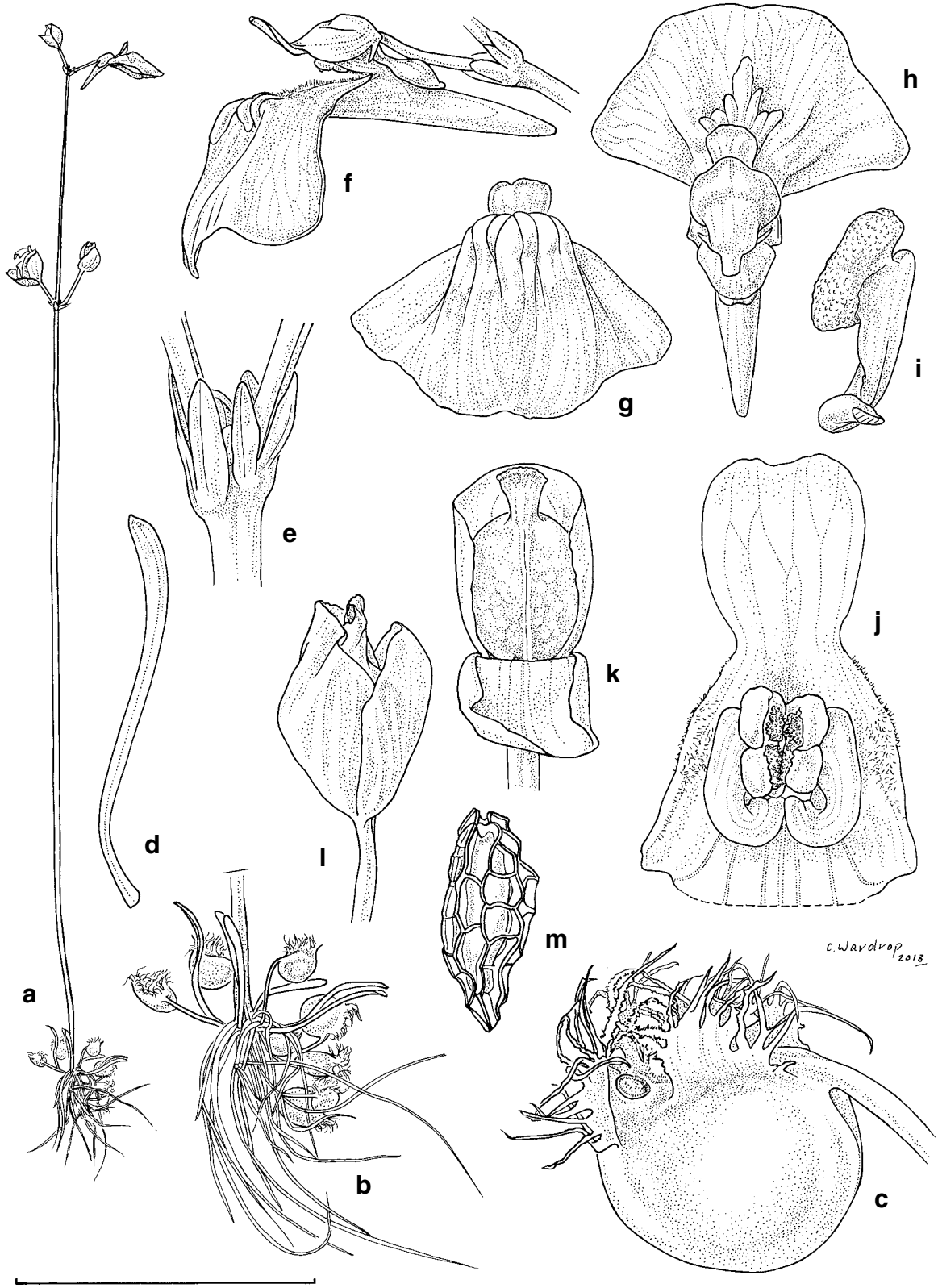

Fig. 1. *Utricularia fenshamii* **a**, habit; **b**, leaves and rhizoids at base of peduncle; **c**, bladder-trap in lateral view; **d**, leaf adaxial surface; **e**, bracts & bracteoles with pedicel base *in situ*; **f**, flower in lateral view; **g**, flower in frontal view; **h**, flower in dorsal view; **i**, stamen; **j**, upper lip with stamens; **k**, fruiting capsule showing suture ventral view; **l**, fruiting capsule and calyx lateral view; **m**, seed. Scale bar: a = 4.8 cm; b = 2 cm; c = 0.3 cm; d = 0.4 cm; f,g&h = 1 cm; i = 0.25 cm; j = 0.3 cm; k&l = 0.5 cm; m = 0.1 cm. Material used: a = R.W. Jobson 1523 (NSW901605); b-f,h-m = R.W. Jobson 1523 (spirit – NSW820786); g = photograph of type collection.

Koch s.n., Oct 1899 (AD97948389); Moolawatana Station, Twelve Springs, *Bell 1266*, 16 Sep1987 (BRI-AQ0467192); 10 km NW of Moolawatana, *Murfet 5807 & Duval*, 1 Oct 2007 (AD224111).

Etymology. The specific epithet refers to Associate Prof. Roderick Fensham of the School of Biological Sciences, The University of Queensland, and the Queensland Herbarium, who has contributed greatly to our knowledge of the biology and ecology of the mound springs distributed across the Great Artesian Basin.

Phenology. Flowers and fruits recorded from August until May. Seed-set has been observed in the following specimens: *Jobson 1523* (type), *Koch s.n, Bell 1266, Murfet 5807 & Duval, Jobson 1668 & Cherry*, *Fensham 4435.* Flowers do not seem to emit a detectable fragrance.

Distribution and Ecology. Australia: apart from a single non-mound spring collection (*Jobson 1539*) west of Wee Waa in New South Wales, this species is restricted to wetlands associated with discharge mound springs across the Great Artesian Basin. The most southerly locations are in South Australia near Mt Lyndhurst, halfway between Lakes Frome and Eyre at 30.1°S (Alt. 150 m), and in New South Wales at Lake Peery at 30.7°S (Alt. 90 m). The remaining distribution is scattered across the central Queensland districts of Warrego, Mitchell, South Kennedy, and a single site in Cook north of the Mitchell River at Gamboola 16.6°S (Fig. 7a). The first collecting locality was the Thompson River c. 100 km SW of Longreach within the Mitchell Grass Downs bioregion. A specimen from this locality was collected by C.W. Burgh de Birch (circa 1871) and was sent to Ferdinand von Mueller as "*Utricularia*" *sp*. until determined as *U. dichotoma* by Peter Taylor in 1985. The site description is vague – "Thomson River", and probably refers to an extinct or active mound spring site NE of Longreach on the upper reaches of the Thomson River.

This species is locally common, inhabiting permanent to semi-permanent wetlands fed by artesian discharge springs. Populations are often found in association with the sedges *Cyperus laevigatus* L. and *Fimbristylis* sp., and other spring endemics *Myriophyllum artesium* Halford & Fensham and *Eriocaulon carsonii* F.Muell. (Westbrooke *et al*. 2003; Fensham and Price 2004).

Conservation Status. *Utricularia fenshamii* has a large distribution across the seasonally arid regions of the Great Artesian Basin (Fig. 7a). This distribution is extremely scattered with the shortest distance between a set of sites c. 280 km (*Jacobs 4943* and *Jobson 1527*), while the furthest distance between two closest sites is c. 660 km (*Fensham 3337* to *Fensham 4435*). At the local level *U. fenshamii* is restricted to small clusters of artesian spring habitats (Fig. 7a). Most of the collections were made on leasehold land, but the spring wetlands are protected under EPBC legislation and Peery Lake is in the Paroo-Darling National Park. The population in the North Western Plains near Wee Waa NSW (*Jobson 1539*) exists in an ephemeral shallow swampy depression, in open *Casuarina cristata* Miq. dominated woodland. This non protected site is situated on private property approx. 4 km north of the Piliga East State Forest boundary.

There is a strong prima-facie case that this species satisfies IUCN Red List criteria (IUCN 2001) for listing as a Vulnerable species, under both Commonwealth legislation and that of the States of occurrence. To more definitively determine conservation status, future work should include a population assessment that examines levels of genetic isolation, also looking at relationships within and between the sites, and levels of divergence from closely related taxa.

2. *Utricularia ameliae* R.W.Jobson *sp. nov*.

Diagnosis: This species differs from *U. dichotoma* with presence of bracts and bracteoles that are basally non-gibbous; spur tapers to an acutely bifid apex; white corolla upper lip.

Type: Australia: Queensland: Gregory North: Elizabeth Springs, S of Boulia, (23.33°S, 140.58°E), 15 April 2013, *R.W. Jobson 1694 & W.A. Cherry* (holo: NSW972812; iso: CANB).

Small perennial, terrestrial herb. Rhizoids capillary, simple, often flattened, up to 20 mm long 0.1–0.3 mm thick, numerous from base of peduncle, with three or six from nodes of stolon. Stolons numerous, filiform, 0.3–0.5 mm thick, unbranched, up to 20 mm long, internode length c. 5 mm long. Leaves numerous, several from base of the peduncle and 4–6 from stolon internodes, petiolate; lamina fleshy c. 0.15 mm thick, 0.4–2.5 mm wide, 4–10 mm long, narrowly ovate to obovate, 1 or 3–6-nerved, apex rounded. Traps several at base of peduncle and up to three at nodes of stolon, stalked 1.5–2.5 mm long, ovoid, surface glandular, 1.6–4.5 mm long, mouth lateral, with dorsal appendage simple 0.7–1.5 mm long, two lateral appendages shorter, simple or flattened and laciniate, ventral wings usually absent, or if present, then laciniate. Inflorescence erect, solitary 50–110 mm long; peduncle terete, glabrous, hollow, 0.3–0.6 mm thick. Scales absent. Bracts c. 0.9 mm long, bracteoles c. 0.6 mm long, similar, basifixed, originating from a circumscissile bulge, deltoid with apex acute. Flowers 1, pedicels erect, often with a single twist, dorsiventrally flattened, 4–8 mm long. Calyx lobes unequal; upper lobe c. 3 mm long, 2.2 mm wide, obovate with apex rounded; lower lobe c. 2.5 mm long,

2.2 mm, ovate with apex emarginate. Corolla dark-violet; lower lip 5–9 mm long, reniform or transversely oblong, apex rounded with three yellow strongly raised ridges at base, bordered by two white/yellow outer ridges, sometimes equal length to the three central ridges, with the central ridge slightly shorter than those immediately adjacent, palate glandular, with a marginal rim; spur whitish, narrowly subulate from a short conical base, tapering to an acutely bifid apex, curved forwards near the middle, sharply so near the apex, shorter than the lower-lip; upper lip c. 9 mm long, constricted at middle, at which point it is reflexed outward to c. 45 degrees, superior part emarginate or bilobed, inferior part obovate, glandular on margin. Staminal filaments curved, c. 2 mm long, anther thecae confluent, surface glandular. Ovary ovoid, c. 1 mm long; style c. 1 mm long; stigma with lower lip semicircular, upper lip deltoid. Capsule globose, c. 4 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, marginally thickened slit. Seeds obovoid, c. 0.7 mm long, 0.3 mm wide. Pollen: 4-colporate, c. 27 × 27 μm (*Jobson 1694 & Cherry*, NSW972812) (Figs 2, 5c–d).

Specimens examined: Queensland: Gregory North: Elizabeth Springs, Springvale Homestead. *Wilson 103*, 20 May 1994 (BRI-AQ0628041); *Fensham 3671*, 24 Feb 1999 (BRI-AQ0679274).

Etymology. The specific epithet refers to Miss Amelia Pieternella Jobson, plant enthusiast and daughter of the author.

Phenology. Flowers and fruits recorded from February until May. Seed-set has been observed in the following specimens: *Jobson 1694* (type). Flowers emit a faint sweet fragrance.

Distribution and Ecology. Australia: situated in the Diamantina River Catchment on the flood-plain of Spring Creek. Elizabeth Springs forms part of the Springvale group of artesian discharge springs about 100 km SE of Boulia (Fig. 7a). The associated spring wetland is approximately 1600 m^2 in area (pers. observation), consisting of about 40 active springs (ANCA, undated; Fensham *et al.* 2010).

Although *U. ameliae* is locally common, it has only been collected from Elizabeth springs. A population of '*Utricularia dichotoma*' was previously recorded from a spring on Warra Station, c. 40 km N of the Elizabeth springs (R. Fensham pers. communication), although no collection was made. To determine whether this is an extension of range for *U. ameliae*, future fieldwork should attempt to collect a specimen from Warra Station, and locate additional populations in other nearby regions known to contain Artesian springs.

Colonies of *U. ameliae* are scattered throughout the permanently wet sedgeland bog habitat (Fensham *et al.* 2004, 2010). Colonies are found in association with *Cyperus laevigatus, Eragrostis fenshamii* B.K.Simon, *Fimbristylis sp., Myriophyllum artesium, Eriocaulon carsonii* subsp. *carsonii and Utricularia caerulea*.

Conservation Status. The Elizabeth Springs wetland is a Conservation Reserve and the community is protected under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (Australian Government [2010]; Fensham *et al.* 2010). *Utricularia ameliae* forms small flowering colonies that are scattered across the northern half of the springs. On the 15th April 2013 a survey estimated that at least 5% of the wetland vegetation was affected by fresh pig damage (pers. obs.). The species should be listed as endangered in Queensland. This species appears to satisfy the IUCN (2001) Red List criteria for listing as an Endangered species – criteria B1 (EOOa), B2 (AOOa) and C (population size EN, and C1). Further study is required to more definitively determine threats and conservation status.

3. *Utricularia barkeri* R.W.Jobson *sp. nov*.

Diagnosis: This species differs from *U. dichotoma* with presence of basiolute bracts with upper and lower lobes of ±equal length; corolla upper lip light mauve with purple flecks.

Type: Australia: Victoria: Wannon: Casterton, S on Casterton-Dartmoor Road, (37.713°S, 141.309°E), 26 Nov 2012, *R.W. Jobson 1621 & R.P. Gibson* (holo: NSW905026; iso: AD, MEL).

Small to medium-sized perennial, terrestrial herb. Rhizoids capillary, simple, up to 20 mm long 0.2–0.4 mm thick, numerous from base of peduncle, with usually two from stolon nodes. Stolons few, filiform 0.3–0.5 mm thick, unbranched, up to 100 mm long, internode length c. 4 mm long. Leaves few, rarely from base of the peduncle and often in one or two from stolon internodes, petiolate; lamina 0.2–0.6 mm wide, 3–12 mm long, linear to narrowly obovate, single nerve, apex rounded or sometimes subulate. Traps stalked, few at base of peduncle and one or two at nodes of stolon, uniform, ovoid, 1.5–2.0 mm long, mouth lateral, with a small dorsal appendage simple 0.2–0.4 mm long, two lateral appendages folded inward, flattened, laciniate, ventral wings large, margin entire or laciniate. Inflorescence erect, solitary 80–280 mm long; peduncle terete, glabrous, ± solid, 0.5–1.5 mm thick. Scales absent. Bracts and bracteoles c. 1.1 mm long, similar, basiolute, upper and lower bract parts c. equal length; upper part ovate-deltoid with apex rounded, lower truncate. Flowers usually 2 in opposite pair, sometimes 1 or 3, pedicels erect, dorsi-ventrally flattened, 3–7 mm long. Calyx lobes ± equal; upper lobe c. 2.5 mm long, 2.5 mm wide, ovate with apex rounded; lower lobe

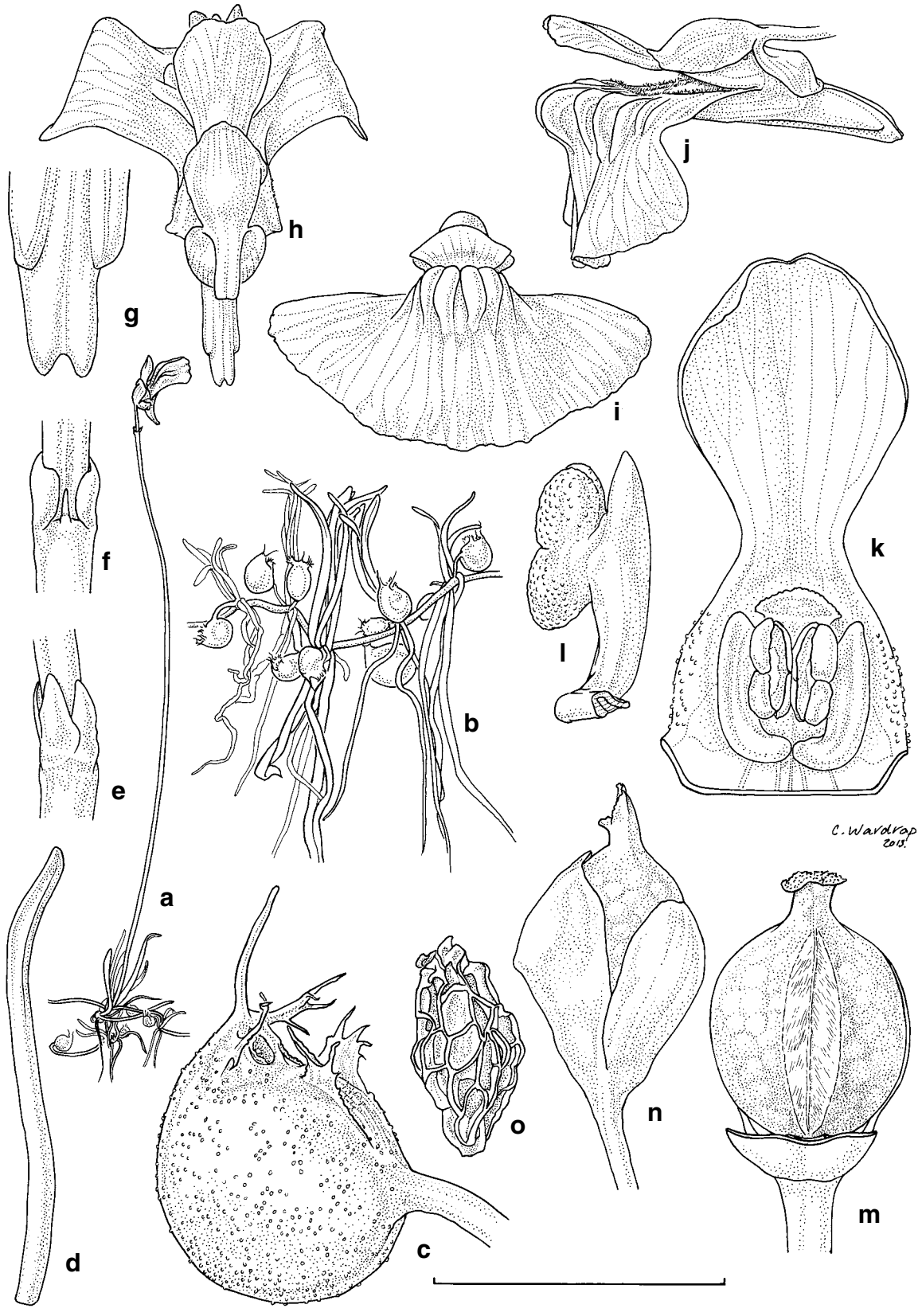

Fig. 2. *Utricularia ameliae* **a**, habit; **b**, stolon nodes - leaves, traps, rhizoids; **c**, bladder-trap in lateral view; **d**, leaf; **e,f,** bracts & bracteoles with pedicel base *in situ*; **g,** spur apex adaxial surface; **h**, flower in dorsal view; **i**, flower in frontal view; **j**, flower in lateral view; **k**, upper lip with stamens; **l**, stamen; **m**, fruiting capsule showing suture ventral view; **n**, fruiting capsule and calyx lateral view; **o**, seed. Scale bar: a = 4.8 cm; b = 2 cm; c&g = 0.3 cm; d = 0.6 cm; e,f&k = 0.4 cm; h, i & j = 1 cm; l,m&n = 0.25 cm; o = 0.1 cm. Material used: a-o = R.W. Jobson 1694 (spirit – NSW824653).

c. 2.5 mm long, 2.5 mm wide with apex emarginate. Corolla light mauve; lower lip limb transversely elliptic, apex rounded, 5–12 mm long with 2 raised yellow central ridges at base, not projecting apically beyond the purple ridge on either side, bordered marginally by a thick purple band; palate pubescent, with a marginal rim; spur cylindrical, straight, emarginate with broadly rounded lobes at the base, mauve, reddish nearer the base, about 90° from lower lip, 1/3 shorter than the lower-lip; upper lip very light mauve with purple flecks c. 3.5 mm long, constricted at middle, straight or slightly curved upward, superior part ovate with apex entire, inferior part ovate, ciliate on margin. Staminal filaments curved, c. 1.6 mm long, anther thecae confluent. Ovary ovoid, c. 1 mm long; style c. 0.6 mm long; stigma with lower lip semicircular, upper lip deltoid. Capsule globose, 3–3.5 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, none-thickened slit. Seeds obovoid, c. 0.5 mm long, 0.3 mm wide. Pollen: 4-colporate, c. 28 × 28 μm (*Jobson 1621*, NSW905026) (Figs 3, 5e–f).

Specimens examined: Victoria: Wannon: Casterton, *Cunningham 298*, 10 Dec 1990 (AD99108060); Cobboboonee State Forest, on Heath Rd, S of Fitzroy River, *Jobson 1623 & Gibson*, 26 Nov 2012 (NSW905044); Lower Glenelg National Park, Kentbruck heath, *Entwisle 2077*, 31 Oct 1991 (MEL2018742): **Lowan Mallee**: Little Desert, 26 km S of Nhill PO, *Beauglehole 66380*, 9 Nov 1979 (MEL1564768): **Grampians:** The Grampians, 34 km S of Hall Gap, *Nordenstam 1165 & Anderberg*, 9 Oct 1989 (AD99149025); Grampians (Gariwerd) National Park, *Murfet 4540*, 26 Nov 2003 (AD156542): **Gippsland Plain**: Melbourne suburb of Wantirna, Sheppard's Bush near Dandenong Creek, *Paget 184*, 19 Oct 1985 (MEL683614); Langwarrin Flora Reserve, *Beauglehole 71246 & Elmore*, 8 Nov 1982 (MEL1564696). **Tasmania: Furneaux Group**: Flinders Island, east of Ragged Peaks, in conservation area, *Whinray 12288*, 25 Nov 2004 (MEL2316276A); **North West**: Mouth of the Harcus River, *Buchanan 8909*, 26 Dec 1986 (HO405716); 18 km SE of Balfour, *Murfet 5895*, 30 Dec 2007 (AD216550); **West Coast**: SW of Reece Dam, *Gray 1621*, 11 Dec 2005 (HO 537157). **South Australia: Kangaroo Island**: Larrikin Lagoon, Flinders Chase, *Jackson 3197*, 29 Nov 1994 (AD99617231); **South-eastern**: Marsh's Swamp, c. 45 km NE of Mt Gambier, *Wilson 924*, 26 Oct 1968 (AD96936371); Berkins Forest Reserve, NE of Penola, *Murfet 4576*, 2 Dec 2003 (AD156382); Mount Lyon Perch Swamp, *Murfet 5123*, 28 Dec 2005 (AD190630); Island swamp heath, Native Forest Reserve via Nangwarry, *Bates 66786*, 2 Nov 2005 (AD192773).

Etymology. The specific epithet refers to Dr William (Bill) R. Barker, former Chief Botanist of the State Herbarium of South Australia (AD), who has made significant contributions to Australian botany with studies of Australasian Scrophulariaceae and various other families. In the mid 1980's Dr. Barker provided the framework for the description of the current species by way of annotating the substantial AD collection of *U. dichotoma*, differentiating *U. barkeri* from the latter based mainly on the presence of "medifixed" bracts.

Phenology. Flowers and fruits recorded from October until January. Seed-set has been observed in the following specimens: *Jobson 1621 & Gibson*, *Jobson 1623 & Gibson*, *Beauglehole 71246 & Elmore*, *Murfet 4576*, *Nordenstam 1165 & Anderberg*. Flowers do not seem to emit a detectable fragrance.

Distribution and Ecology. Australia: distributed on flat coastal areas of South Australia, Victoria, and west coast Tasmania usually at or near sea level. On Kangaroo Island (South Australia), Flinders Islands (Tasmania), and within the Grampians (Gariwerd) National Park (Victoria), it is found at higher elevations (alt. 150–250 m) (Fig 7b). *Utricularia barkeri* occupies coastal ephemeral sedge swampland and heath soakage on deep sand. Often found growing with *Utricularia dichotoma* sensu lato (pers. observation)

Conservation Status. *Utricularia barkeri* has a broad distribution across South Australia, Victoria and Flinders Island and the west coast of Tasmania. In South Australia populations are protected within the Flinders Chase National Park on Kangaroo Island (*Jackson 3197*), and north of Mt Gambier collections represent populations protected within the Penola Forest and Mt Burr Forest Reserves (*Murfet 4576*, *Bates 66786*). In Victoria a collection was made within the Grampians (Gariwerd) National Park near Glenisla Crossing (*Murfet 4540*), in addition to several collections representing protected populations within the Lower Glenelg National Park and adjacent Coboboonee State Forest (*Entwisle 2077, Jobson 1623*). In Tasmania a population is known to be protected within the Arthur Pieman Conservation Area, SE of Balfour (*Murfet 5895*).

4. *Utricularia grampiana* R.W.Jobson *sp. nov*.

Diagnosis: This species differs from *U. dichotoma* with presence of basiolute bracts with upper lobes about twice the length of lower; corolla upper lip cream with purple flecks.

Type: Australia: Victoria: Grampians: Mt William, Mt William Road, entrance to carpark, (37.287°S,142.593°E), 27 Nov 2012, *R.W. Jobson 1630* & R.P. Gibson (holo: NSW; iso: AD, MEL).

Small to medium-sized probably annual, terrestrial herb. Rhizoids capillary/flattened, simple, up to 15 mm long 0.3–0.4 mm wide, numerous from base of peduncle, with one or two from nodes of stolon. Stolons few, flattened or cylindrical 0.1–0.2 mm wide, branched, up to 20 mm long, internode length c. 4 mm long. Leaves numerous, a rosette of leaves forming the base to the peduncle, and often one or occasionally two from stolon internodes, petiolate; lamina fleshy c. 0.8 mm thick, 1–1.4 mm wide, 1.5–6 mm long, obovate, ovate

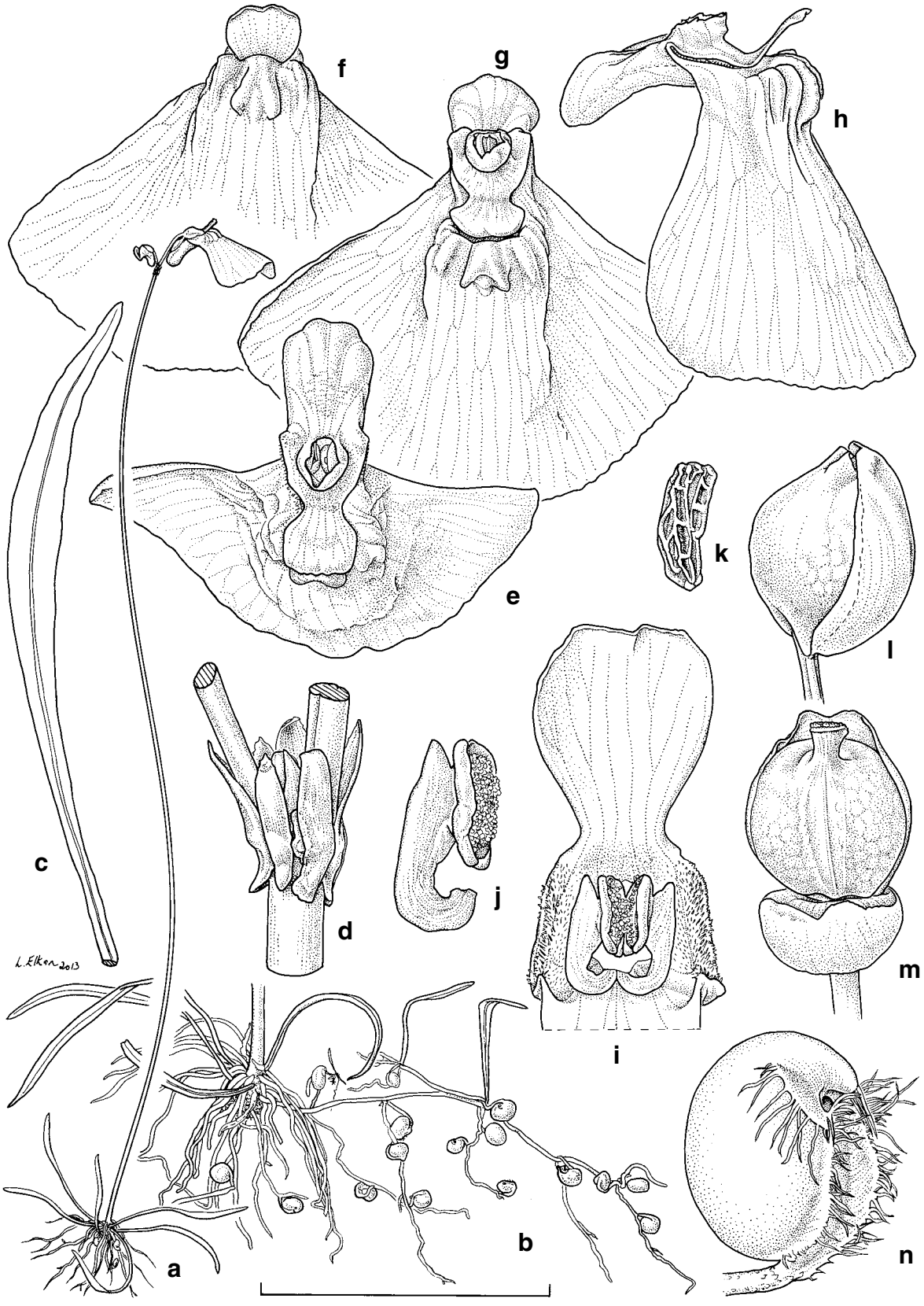

Fig. 3. *Utricularia barkeri* **a**, habit; **b**, peduncle base & stolon nodes - leaves, traps, rhizoids; **c**, leaf; **d**, bracts & bracteoles with pedicel base *in situ*; **e**, flower in dorsal view; **f**, flower in frontal view; **g**, flower in ¾ frontal view; **h**, flower in lateral view; **i**, upper lip with stamens; **j**, stamen; **k**, seed; **l**, fruiting capsule and calyx lateral view; **m**, fruiting capsule showing suture ventral view; bladder-trap in lateral view. Scale bar: a = 4 cm; b = 2 cm; c,l&m = 0.6 cm; c = 0.3 cm; d&i = 0.4 cm; e-h = 0.1 cm; j = 0.25 cm; k = 0.1 cm; n = 0.2 cm. Material used: a = R.W. Jobson 1621 (NSW905026); b-n = R.W. Jobson 1621 (spirit – NSW824604).

or spatulate, single nerve, apex rounded. Traps stalked, few at base of peduncle and two at nodes of stolon, ± uniform, ovoid, 1.1–1.7 mm long, mouth lateral, with a dorsal appendage simple 0.8–1.3 mm long, two lateral appendages truncate, flattened, laciniate on terminal margin, ventral wings splayed outwards, fimbriate margins. Inflorescence erect, solitary 60–190 mm long; peduncle terete, glabrous, 0.5–1 mm thick, often curved near apex. Scales absent. Bracts and bracteoles c. 6 mm long, similar, basiolute, upper bract part approximately twice the length of lower; upper part lanceolate-deltoid with apex subulate, lower part truncate. Flowers 1 or 2 (or 3), when 2 then in opposite pair, pedicels usually curved, sometimes erect, cylindrical, 5–15 mm long. Calyx lobes subequal; upper lobe c. 2.5 mm long, 1.5 mm wide, truncate; lower lobe ovate c. 2.5 mm long, 2.5 mm wide with apex emarginate. Corolla light mauve; lower lip limb transversely elliptic, apex rounded, 4–10 mm long with 2 strongly raised yellow central ridges at base, projecting apically beyond the purple ridge on either side, each hooked near the apex, bordered marginally by a thick purple band; palate pubescent, with a marginal rim; spur cylindrical, curved forward at middle, broadly rounded, reddish green, about 90° from lower lip, shorter than the lower-lip; upper lip cream-coloured with purple flecks, c. 3 mm long, constricted at middle, at which point it is reflexed to c. 30 degrees, superior part ovate with apex entire, inferior part ovate, ciliate on margin. Staminal filaments curved, c. 1 mm long, anther thecae confluent. Ovary ovoid, c. 1 mm long; style c. 0.5 mm long; stigma with lower lip semicircular, upper lip obtuse. Capsule globose, 4 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, marginally thickened slit. Seeds broadly obovoid, c. 0.25 mm long, 0.2 mm wide. Pollen: 4, 5-colporate, c. 30 × 30 μm (*Jobson 1630*, NSW905060) (Figs 4, 5g–h).

Specimens examined: Victoria: Grampians: Mt William, SSE of Halls Gap, *Streimann 3088*, 15 Dec 1975 (CBG63857); Grampians National Park, Devils Gap from Sundial carpark, *Murfet 4536 & Lowrie*, 26 Nov 2003 (AD156538); Western district, Black Range, *Bates 40042*, 25 Nov 1994 (AD9961317); Stoney Creek, between Wonderland carpark and Cascades, *Jobson 1633 & Gibson*, 27 Nov 2012 (NSW905088): **Midlands**: Mt Langi Ghiran; on flats at foot of steep north facing slopes, *Corrick 7505*, 31 Oct 1981 (MEL603620).

Etymology. The specific epithet refers to the Grampians National Park (Gariwerd) located in Victoria's western highland region.

Phenology. Flowers and fruits recorded from October to January. Material from the type location was cultivated in Sydney and flowered May–September 2013. Seed-set has been observed in the following specimens: *Bates 40042*, *Jobson 1630* and *1633*: Flowers emit a detectable sweet fragrance.

Distribution and Ecology. Australia: thus far restricted to high elevation (alt. 400 – 1170 m) on sandstone seepages in the Mt Difficult and Mt William Ranges within the Grampians National Park (Gariwerd), and in similar habitat at Mt Langi Ghiran c. 10 km E of Ararat (Fig. 7b). Usually forms small colonies among mosses and sedges in seepage areas on rock platforms.

Conservation Status. Within Victoria *Utricularia grampiana* has a restricted distribution, all recorded collections represent populations protected within the Grampians National Park, and Langi Ghiran State Park.

Key to species of *Utricularia dichotoma* complex.

1a. Bracts and bracteoles basiolute; corolla upper lip cream/light mauve with purple flecks **2**

1b. Bracts and bracteoles basifixed; corolla upper lip uniformly white or mauve/purple **3**

2a. Bract upper and lower lobes ±equal length; corolla lower lip 2 yellow central ridges not projecting apically beyond ridges on either side ..... ***U. barkeri*** **(SA, Vic, Tas)**

2b. Bract upper lobes about 2× length of lower; corolla lower lip 2 yellow central ridges projecting apically beyond ridges on either side ..... ***U. grampiana*** **(Vic)**

3a. Spur subulate, conical at base, tapering to an acutely bifid apex, corolla upper lip white .... ***U. ameliae*** **(Qld)**

3b. Spur straight, cylindrical from the base, apex truncate to subulate, corolla upper lip purple/mauve **4**

4a. Corolla lower lip central palate ridge 2× longer than neighbouring ridges .... ***U. fenshamii*** **(SA, NSW, Qld)**

4b. Corolla lower lip central palate ridge equal or shorter than neighbouring ridges **5**

5a. Corolla lower lip with 4–11 conspicuous yellow central ridges, bracts and bracteoles non-gibbous at base ..... ***U. beaugleholei*** **(SA, Vic, NSW)**

5b. Lower corolla lip with 2–3 conspicuous yellow central ridges; bracts and bracteoles gibbous at base .... ***U. dichotoma*** **s. lat. (All states except NT)**

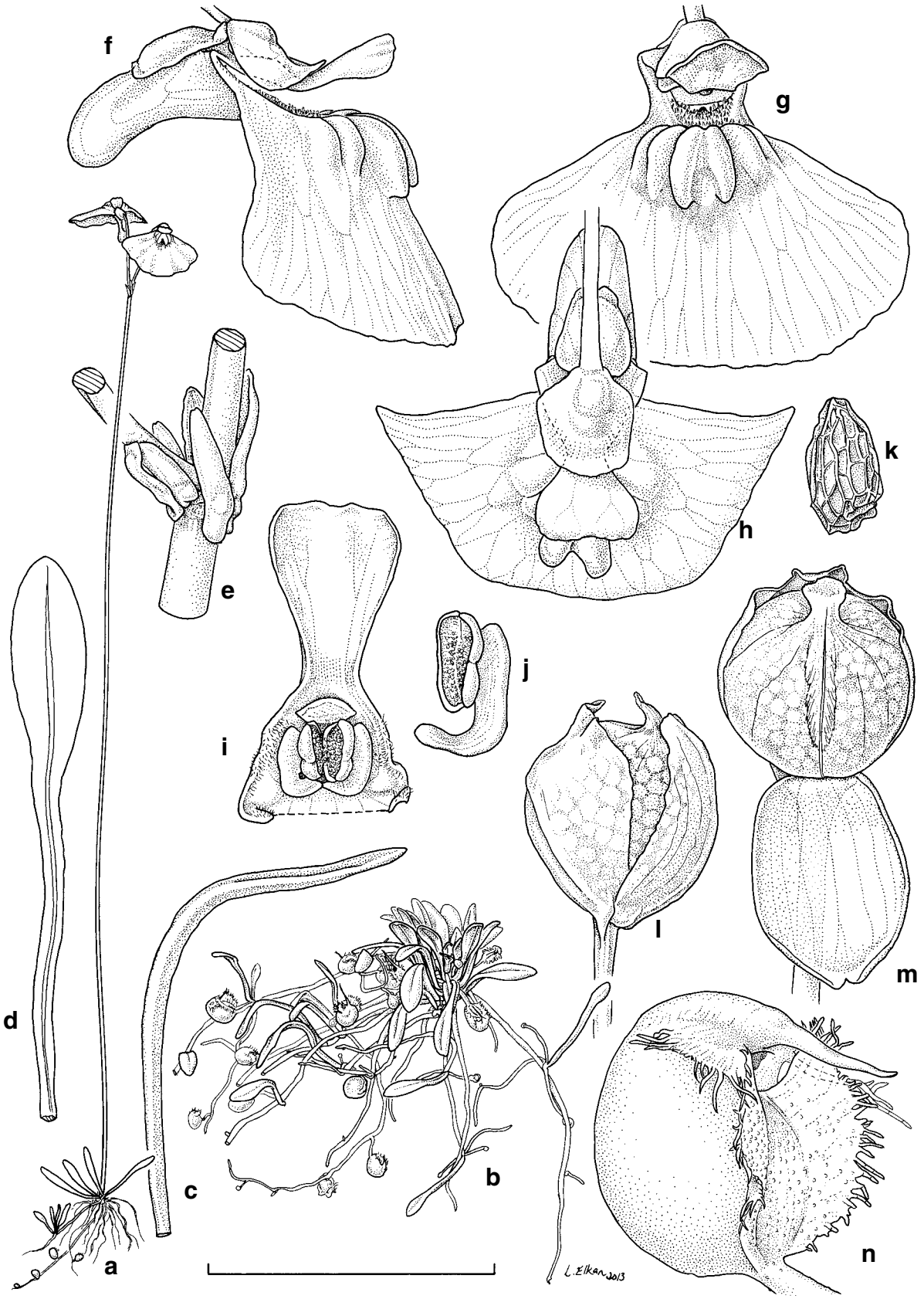

Fig. 4. *Utricularia grampiana* **a**, habit; **b**, stolon nodes - leaves, traps, rhizoids; **c**, leaf lateral view; **d**, leaf adaxial surface; **e**, bracts & bracteoles with pedicel base *in situ*; **f**, flower in lateral view; **g**, flower in frontal view; **h**, flower in dorsal view; **i**, upper lip with stamens; **j**, stamen; **k**, seed; **l**, fruiting capsule and calyx lateral view; **m**, fruiting capsule showing suture ventral view; **n**, bladder-trap in lateral view. Scale bar: a = 4 cm; b = 2 cm; c,d,f-h,l&m = 0.6 cm; e,i = 0.4 cm; j = 0.25 cm; k = 0.1 cm; n = 0.2 cm. Material used: a = R.W. Jobson 1630 (NSW905026); b-n = R.W. Jobson 1630 (spirit – NSW824604).

Fig. 5. Flowers in lateral and frontal view: **a–b,** *U. fenshamii* showing the long central yellow ridge at base of lower lip; **c–d,** *U. ameliae* showing bifid spur apex and white upper lip; **e–f,** *U. barkeri* showing two yellow ridges at the base of lower lip not exceeding those adjacent; **g–h,** *U. grampiana* showing two strongly raised yellow ridges at base of lower lip that exceed those adjacent. Scale bars represent both sides of the plate.

5. *Utricularia lowriei* R.W.Jobson *sp. nov*.

Diagnosis: This species differs from *U. dunstaniae* F.E.Lloyd with presence of three filiform central lower lip lobes that are longer than the spur.

Type: Australia: Queensland: Cook: North of Cooktown, (15.01°S, 145.13°E), 6 July 2013, *R.W. Jobson 1921* (holo: NSW976183; iso: BRI).

Small probably annual, terrestrial or affixed subaquatic herb. Rhizoids numerous, capillary, simple, up to 6 mm long, 0.1 mm thick, from base of peduncle, with one from nodes of stolon. Stolons few, filiform, 0.1–0.2 mm thick, unbranched, up to 30 mm long, internode length c. 5 mm long. Leaves few, two or three from base of peduncle and 1 from stolon internodes, petiolate; lamina narrowly obovate c. 0.3 mm wide, 2–3 mm long, single nerve, apex rounded. Traps several at base of peduncle and one at nodes of stolon, ovoid, 0.75 mm long, mouth lateral, with dorsal appendage reduced to a slight bump, lateral appendages long capillary or highly reduced, ventral wings absent, stalk 3–7 mm long. Inflorescence erect, solitary 40–70 mm long; peduncle terete, glabrous, ± hollow, 0.5 mm thick. Scales absent. Bracts and bracteoles similar, basifixed, ovate with rounded apex, c. 0.5 mm long. Flowers 1, pedicels erect or apically curved, slightly dorsiventrally flattened, 2–5 mm long. Calyx lobes unequal; upper lobe c. 1.7 mm long, 1.6 mm wide, oblong, convex with apex rounded; lower lobe c. 1 mm long, 1.2 mm wide, ovate with apex bifid. Corolla reddish-brown to apricot; lower lip 5–lobed with lateral pair filiform, erect, papillose on inner surface, 9–15 mm long, three central lobes descending, subulate/filiform, mostly equal length c. 3 mm long, usually twice the length of the spur; spur scrotiform, glabrous, from a cylindrical base, longer than the calyx lobe, apex bilobed with each lobe more-or-less rounded. Staminal filaments straight, c. 1 mm long, anther thecae distally confluent. Ovary ovoid, adnate to calyx lobe, c. 1 mm long; style c. 0.5 mm long; stigma with lower lip semicircular forming a flap concealing a slightly deltoid upper lip. Capsule ovoid, c. 1.5 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, marginally thickened slit. Seeds ovoid 0.15–0.2 mm long, major end subtruncate, testa cells slightly elongated, with raised anticlinal boundaries. Pollen: 3-colporate, c. 28 × 28 μm (*Jobson 1921*, NSW976183) (Figs 6, 8).

Etymology. The specific epithet honours botanist and colleague Allen Lowrie, who has greatly advanced the study of *Drosera*, *Stylidium,* and *Utricularia.*

Phenology. Flowers recorded in July. Seed-set has been observed in the type specimen. Flowers do not emit an obvious fragrance.

Distribution and Ecology. Australia: N of Cooktown (Fig. 7a), in shallow water at edge of depression on deep sand with *Utricularia albiflora* R.Br., *U. caerulea* L., *U. chrysantha* R.Br., *U. subulata* L., *U. quinquedentata* F.Muell. ex. P.Taylor, *U. gibba* L., *Dapsilanthus ramosus* (R.Br.) B.G.Briggs & L.A.S.Johnson, *Melaleuca arcana* S.T.Blake.

Probably endemic to a small area north of Cooktown, with a brief survey of the surrounding area (several adjacent swamps) finding no other populations. However, a single inflorescence collected by Ann G. Gunness, at Namaleta Creek, c. 90 km N of Weipa, (AG 2306, 11 Apr 1994; specimen held in Herbarium Lowrieanum, Perth), provides some evidence of a second population some 500 km to the NW of the type location. Although specimen AG-2306 was poorly preserved, an interpretation of the inflorescence by Allen Lowrie seems to match the floral morphology of *U. lowriei* (A. Lowrie, pers. comm.). A revisit of the Namaleta Creek site is required for formal identification, and if positive will provide a significant extension of the *U. lowriei* range, and might indicate that this species is more widespread and previously overlooked by collectors.

Conservation Status. Further study is required to determine threats and conservation status.

Key to Australian *Utricularia* species possessing an erect pair of capillary corolla lobes (modified from Taylor 1989).

1a. Corolla with 2 capillary lobes arising from the corolla upper lip **2**
1b. Corolla with 2 capillary lobes arising from the corolla lower lip **3**

2a. Corolla lower lip 5-lobed ..... ***U. capilliflora***
2b. Corolla lower lip 3-lobed ..... ***U. dunlopii***

3a. Three central lower lip lobes filiform, longer than the spur ..... ***U. lowriei***
3b. Three central lower lip lobes reduced or deltoid, shorter than the spur **4**

4a. Dorsal bladder-trap appendage always absent ..... ***U. dunstaniae***
4b. Dorsal bladder-trap appendage long and filiform ..... ***U. antennifera***

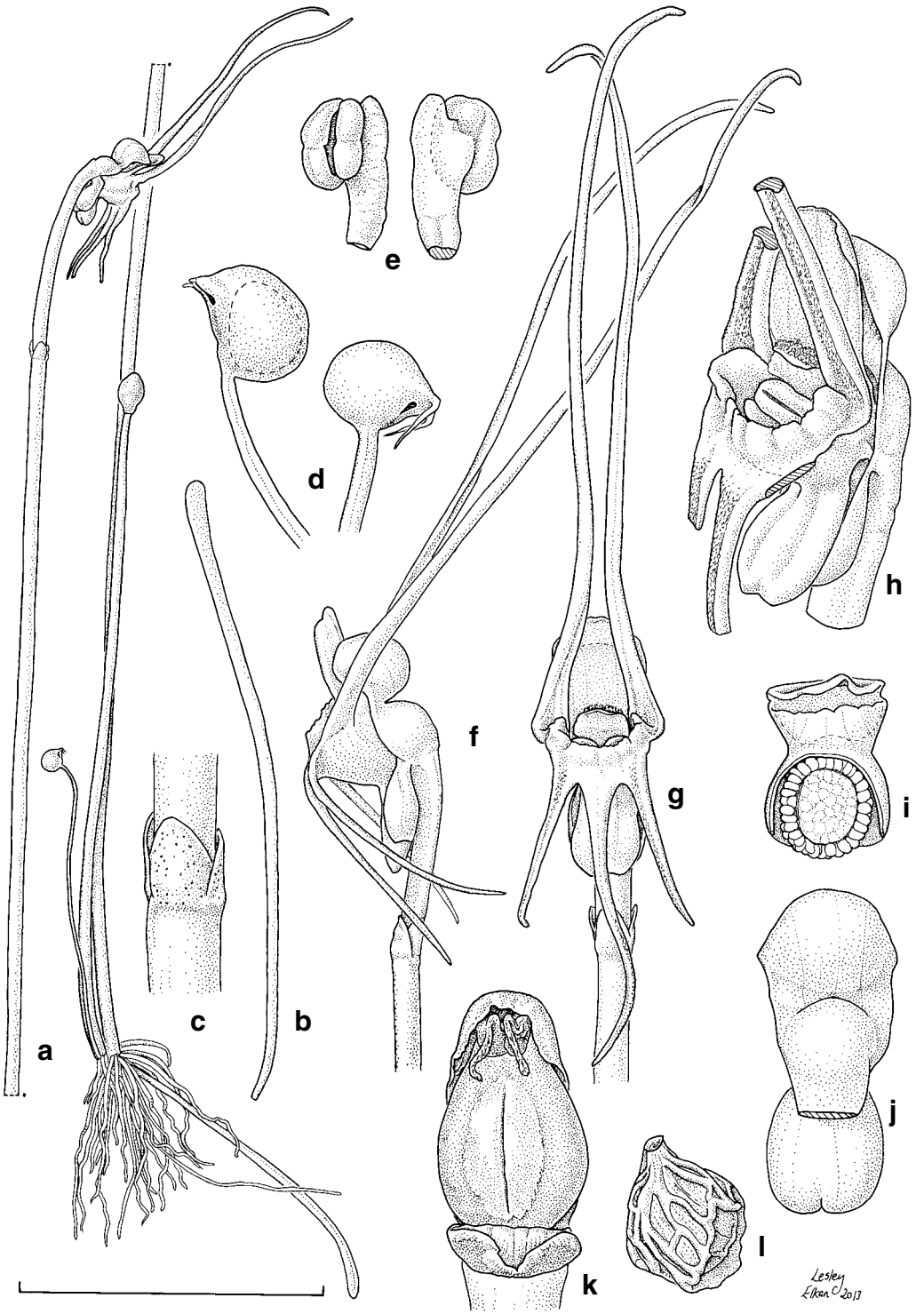

Fig. 6. *Utricularia lowriei* **a**, habit; **b**, leaf; **c**, bracts & bracteoles with pedicel base *in situ*; **d**, bladder-traps in lateral view; **e**, stamen ventral & dorsal view; **f**, flower in lateral view; **g**, flower in frontal view; **h**, corolla showing spur; **i**, pistil sectioned; **j**, calyx dorsal view; **k**, fruiting capsule with calyx; **l**, seed. Scale bar: a = 1 cm; b = 0.6 cm; c,d,e&i = 0.2 cm; f&g = 0.4 cm; h,j&k = 0.5 cm; l = 0.05 cm. Material used: a-l = R.W. Jobson 1921 (spirit – NSW922741).

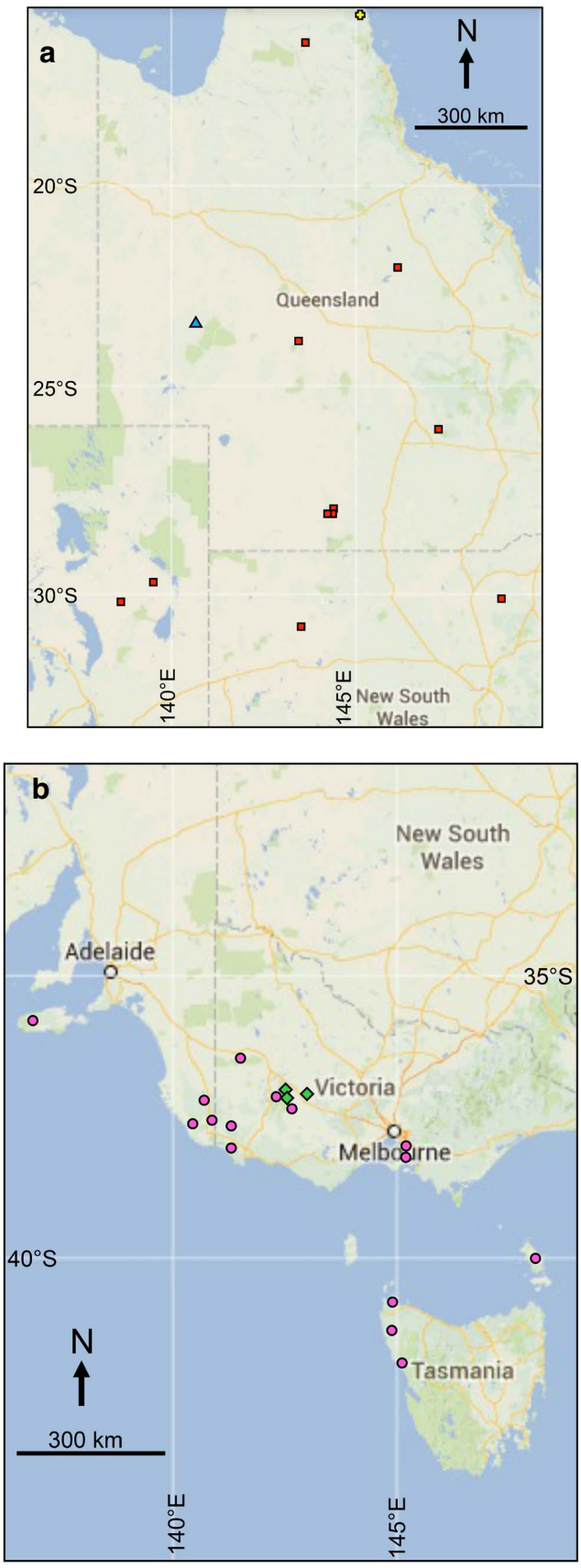

Fig. 7. a, North eastern Australia with known distribution of *U. fenshamii* (red squares); *U. ameliae* (blue triangle); and *U. lowriei* (yellow cross). **b**, South eastern Australia showing known distribution of *U. barkeri* (mauve circles), with *U. grampiana* shown with green diamonds.

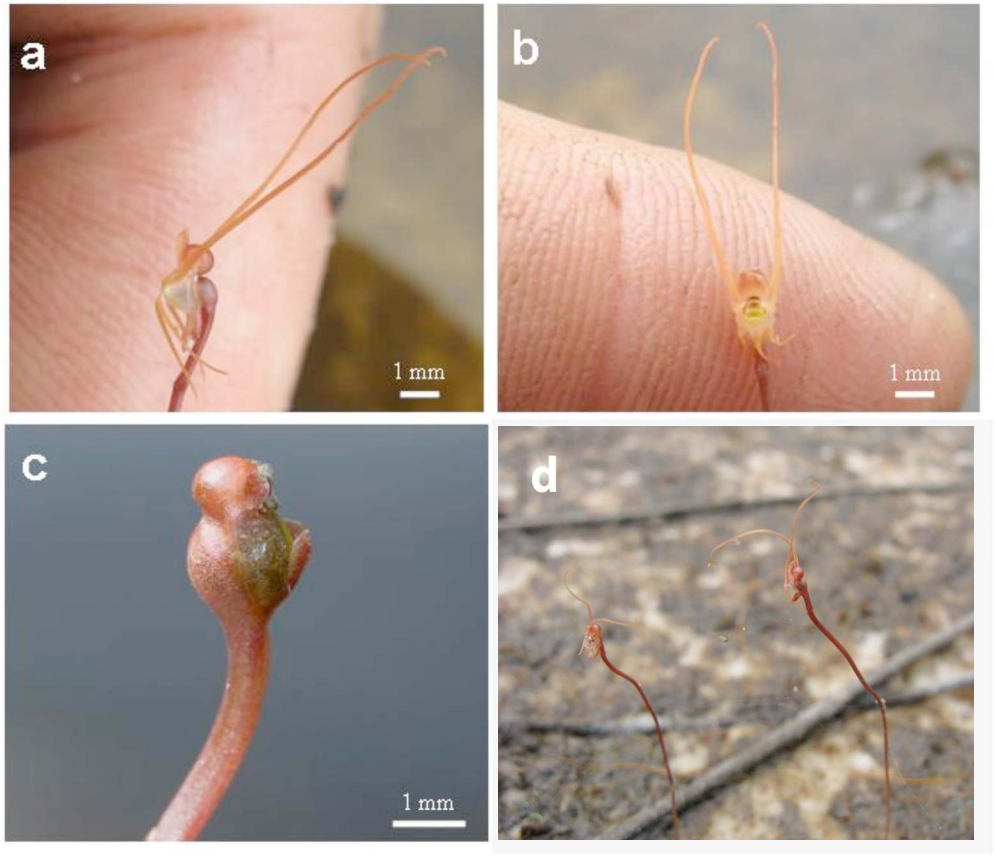

Fig. 8. *Utricularia lowriei* floral form **a**, lateral view; and **b**, frontal view; **c**, mature seed capsule (lateral view); **d**, emergent inflorescences *in situ* at type locality. Scale bars shown.

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