

Six new species of *Utricularia* (Lentibulariaceae) from Northern Australia

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Abstract

Six new species of *Utricularia* (Lentibulariaceae) are recognised from northern Australia. Descriptions of the new species *Utricularia albertiana* R.W.Jobson & Baleeiro, *U. bidentata* R.W.Jobson & Baleeiro, *U. hamata* R.W.Jobson & M.D.Barrett, *U. magna* R.W.Jobson & M.D.Barrett, *U. papilliscapa* R.W.Jobson & M.D.Barrett, and *U. limmenensis* R.W.Jobson (Lentibulariaceae) are provided. Diagnostic features for all six species are illustrated, and distribution, habitat, and conservation status are discussed.

Introduction

The monsoon tropics of Australia is an area of globally significant species diversity of the carnivorous plant genus *Utricularia* L., with more than 49 species known (Taylor 1989; Jobson and Baleeiro 2015; Jobson et al. 2017). Although some species have widespread extralimital distributions, or are widespread across northern Australia, a high proportion of species are geographically localised, particularly those belonging to subg. *Polypompholyx* (Lehm.) P.Taylor sensu Muller and Borsch (2005) (Taylor 1989; Reut and Jobson 2010; Jobson et al. 2003, 2017). This paper describes an additional six species found in the Kimberley region of Western Australia, and / or the 'Top End' of the Northern Territory; all but one are apparently restricted to one or other of these two regions.

The six species named here possess bladder-traps with a single unbranched dorsal appendage and lack scales on their peduncles and are therefore considered members of subg. *Polypompholyx*. Accessions representing five of the taxa were included in a recent molecular phylogeny that showed four of the species, namely *Utricularia albertiana* R.W.Jobson & Baleeiro, *U. bidentata* R.W.Jobson & Baleeiro, *U. magna* R.W.Jobson & M.D.Barrett, and *U. papilliscapa* R.W.Jobson & M.D.Barrett, are placed within sect. *Lasiocaula* (Jobson et al. 2017). All of these species are from the Northern Kimberley region of Western Australia, with *U. bidentata* also found at Edith River in the Northern Territory.

Recognition as distinct species is supported by morphological (this paper) and molecular phylogenetic results (Jobson et al. 2017). *Utricularia albertiana* and *U. magna* were previously thought to be Kimberley forms

of the Northern Territory species *U. dunstaniae* F.E.Lloyd and *U. arnhemica* P.Taylor, respectively. However, in the molecular phylogeny the former was placed sister to the likewise Kimberley endemic *U. antennifera* P.Taylor with both these species possessing similar appendages on bladder-traps (Taylor 1989). In the same study, *U. magna* was placed sister to a clade containing *U. papilliscapa* (sp. nov. this study), *U. tridactyla* P.Taylor and *U. kenneallyi* P.Taylor with all possessing hairs or papillae near the base of the peduncle (Taylor 1989; Jobson et al. 2017).

Utricularia bidentata was previously included under a broad concept of *U. kimberleyensis*, however molecular data indicates that *U. kimberleyensis sensu lato* is possibly composed of three taxa (Jobson et al. 2017) and morphological data tend to corroborate their distinction.

Utricularia hamata R.W.Jobson & M.D.Barrett and *U. limmenensis* R.W.Jobson are currently only known from the north Kimberley region of Western Australia and the Roper Gulf region of the Northern Territory, respectively. Jobson et al. (2017) placed *U. hamata* within sect. *Pleiochasia*, while *U. limmenensis* was also included in the section following a post publication alignment and phylogenetic analysis of a representative DNA sample (R.W. Jobson unpubl. data). In these studies, *U. hamata* was found to be sister to *U. hamiltonii* P.Taylor, while *U. limmenensis* was close to *U. albiflora* R.Br. and *U. terrae-reginae* P.Taylor. Both *U. hamata* and *U. limmenensis* possess a non-inflated hollow peduncle which is a key characteristic of clade B of sect. *Pleiochasia* in Jobson et al. (2017).

Morphological differences are compared between the newly described entities and their closely allied species, with notes on their distribution, ecology and conservation status provided. Preparation of an identification key representing all Australian species of *Utricularia* is currently underway and will be included in a future taxonomic revision of the genus in Australia (R.W. Jobson, in prep.).

Taxonomy

1. *Utricularia albertiana* R.W.Jobson & Baleeiro *sp. nov.*

Diagnosis: Previously confused with *U. dunstaniae* F.E.Lloyd from the Northern Territory and differs in having spur apex rounded/obtuse, central corolla lower lip lobe longer than the spur, calyx lower lip almost as long as the spur, and trap dorsal appendage usually present.

Type: AUSTRALIA: Western Australia: Gardner: [precise locality withheld for conservation reasons], 27 April 2014, R. W. Jobson 2308 & P.C. Baleeiro (holo: NSW852554; iso: PERTH).

Utricularia sp. Bearded (R.W.Jobson 2308) *sensu* Jobson et al. (2017).

Small annual, affixed subaquatic herb. *Rhizoids* numerous, capillary, simple, up to 8 mm long, 0.2 mm thick, from base of peduncle, with 1–3 from nodes of stolon. *Stolons* few, capillary, 0.1–0.15 mm thick, branched, up to 25 mm long, internode length 5–8 mm long. *Leaves* few, one or two from base of peduncle and two from stolon nodes, petiolate; lamina obovate or narrowly obovate 0.5–1.3 mm wide, 1.5–3.5 mm long, single nerve, apex rounded. *Traps* few at base of peduncle, one or two at nodes of stolon, and singly on internodes, ovoid, 0.85–1.4 mm long, mouth lateral, with dorsal appendage reduced to a slight bump or 0.5–1.0 mm long, lateral appendages long capillary or highly reduced, ventral wings absent, stalk 1–2.5 mm long. *Inflorescence* erect, solitary 60–120 mm long; peduncle terete, sparsely papillose near the base, glabrous above, solid, 0.35–0.5 mm thick. *Scales* absent. *Bracts and bracteoles* similar, basifixed, sparsely glandular, ovate with apex subacute, slightly gibbous at base, c. 1.3 mm long. *Flowers* 1, 4–5 mm long (excluding erect appendages); pedicels erect or apically curved, slightly or strongly dorsiventrally flattened, 2–10 mm long. *Calyx* lobes unequal; upper lobe c. 2 mm long, 1.2 mm wide, oblong, strongly convex with apex rounded; lower lobe c. 1.2 mm long, 0.7 mm wide, ovate, slightly convex with apex bifid. *Corolla* reddish-brown to apricot; upper lip erect, 4.5–5 mm long, obovate, strongly convex, glandular on inner upper surface; lower lip 5-lobed with lateral pair filiform, erect, canaliculate, papillose on inner surface, 40–50 mm long, of the three central lobes, two outer lobes absent, central lobe descending, subulate, 2–5 mm long, usually two or three times the length of the spur; palate glabrous, with raised rim; spur inflated, broadly scrotiform, mostly glabrous, glandular at rear of base, slightly longer than the calyx lobe, apex bilobed with each lobe ± rounded/obtuse. *Staminal filaments* slightly curved, c. 0.8 mm long, anther thecae sub-distinct. *Ovary* ovate, adnate to calyx lobe, c. 1 mm long; style c. 0.5 mm long; style short; stigma with lower lip ovate, sharply reflexed, upper lip short, truncate. *Capsule* ovoid, c. 1.2 mm diam.; walls thin, dehiscing by a single, ventral, longitudinal, marginally thickened slit. *Seeds* ovoid 0.16–0.2 mm long. *Pollen* 6-colporate, c. 24 × 27 µm (R.W. Jobson 2308 & P. Baleeiro). **Figs 1, 2.**

Additional specimens examined: WESTERN AUSTRALIA: GARDNER: [localities withheld for conservation reasons]: *C.R. Dunlop* 5320, 27 Feb 1980 (MEL); *C.R. Dunlop* 7862, 15 Apr 1988 (DNA); *A.C. Beaglehole* 58874 & *E.G. Errey*, 22 Aug 1978 (PERTH).

Etymology: The specific epithet honours Prof. Victor A. Albert, botanist and evolutionary biologist in the Department of Biological Sciences at the University at Buffalo, State University of New York, who has contributed immensely to our understanding of the genus *Utricularia*.

Phenology: Flowers and fruits recorded between February and April. No other information available.

Distribution and ecology: Known from three locations in the Northern Kimberley region, WA. The type location is at King Edward River, while a second collection site is c. 50 km to the west (*Dunlop* 5320). Found growing in shallow pools on sandstone pavement and outcrops with *Eriocaulon* sp., *Drosera* spp., and sedges (Fig. 2c, d).

Conservation status: Known from two collections on the King Edward River and a third collection from a tributary of the Mitchell River, in non-conservation protected areas. Given the limited botanical knowledge of these watercourses, *U. albertiana* is likely to be more widespread than currently appears. However, after three decades of extensive Kimberley surveys, this species has not been observed anywhere except the disjunct sandstone block that runs from King Edward / Lawley River, up to Kalumburu, and the isolated Theda block further to the south (MDB pers. obs.). This suggests that *U. albertiana* is likely to be highly localised. It is therefore recommended that this species be listed in Western Australia as a candidate for declaration as rare flora (Priority One – Poorly-known species, requiring urgent study to assess conservation status and determine potential threats).

Notes: In his monograph, Peter Taylor (1989) recognised the Kimberley form of *U. dunstaniae* (*Beaglehole* 58874) as conspecific with the type specimen from near Darwin, NT. In his description of the species the corolla spur is described as narrowly scrotiform with apex bilobed, the lobes obtuse [= *U. albertiana*] or subacute [= *U. dunstaniae*]. A recent molecular phylogenetic study that included specimens from two of the three known populations of *U. albertiana* and three of *U. dunstaniae* from the Darwin region (which were found to fit the morphology of the type specimen), placed *U. albertiana* as strongly supported sister species to *U. antennifera* P.Taylor, while *U. dunstaniae* sensu str. was placed sister to the Cape York endemic *U. lowriei* R.W.Jobson (Jobson 2013; Jobson et al. 2017). *Utricularia albertiana* is easily distinguished from *U. antennifera* by its central corolla lower lip lobe being longer than the spur and the absence of two adjacent lobes (Taylor 1989). In *U. antennifera*, although all three lobes are present, they are short and deltoid in shape. The spur of *U. antennifera* differs from that of *U. albertiana* in being inflated from the base, but is similar in having an apex emarginate with rounded/obtuse lobes. The traps of *U. albertiana* and *U. antennifera* are similar in having a simple capillary dorsal appendage, but differ in the position of mouth relative to that of the stalk; lateral versus sub-terminal, respectively. Habitat differences are also apparent with *U. albertiana* always occurring in pools over sandstone 5–10 cm deep (subaquatic) while *U. antennifera* grows in wet soils (terrestrial) at depths never more than 1 cm under the wettest conditions (MDB, pers. obs.).

2. *Utricularia bidentata* R.W.Jobson & Baleeiro *sp. nov.*

Diagnosis: Similar to *U. kimberleyensis* C.A.Gardner but differs in having two white, prominently raised central ridges at the base of the lower corolla lip that are longer than the two outer ridges, and a peduncle that is sparsely papillose towards the base.

Type: AUSTRALIA: Northern Territory: Edith Falls, Nitmiluk, 17 April 2015, *R.W. Jobson* 2682 & *W. Cherry* (holo: NSW909576; iso: DNA).

Utricularia sp. Fanged (*R.W. Jobson* 2682) *sensu* Jobson et al. (2017).

Small to medium-sized probably annual, terrestrial herb. *Rhizoids* capillary, simple, up to 50 mm long, tapering from 1.1 mm thick at base to 0.6 mm near apex, numerous from base of peduncle. *Stolons* few, filiform, solid, 10–20 mm long, 1.0–1.2 mm thick. *Leaves* few, from base of peduncle, and 2 or 3 at stolon node, petiolate; lamina obovate, 20–30 mm long, 10–16 mm wide, single nerve, apex rounded. *Traps* stalked, globose, few at base of peduncle and 1 at nodes and internodes of stolon, ± uniform, ovoid, 1.0–1.5 mm long; mouth basal, with similarly shaped, short, simple dorsal and two lateral appendages, 0.3–0.5 mm long; margin of ventral wing appendage crenate, 0.8–1.0 mm long. *Inflorescence* erect, 80–250 mm long, solitary or rarely in pairs; peduncle terete, glabrous above, sparsely papillose below, solid, 0.4–0.5 mm thick. *Scales* absent.

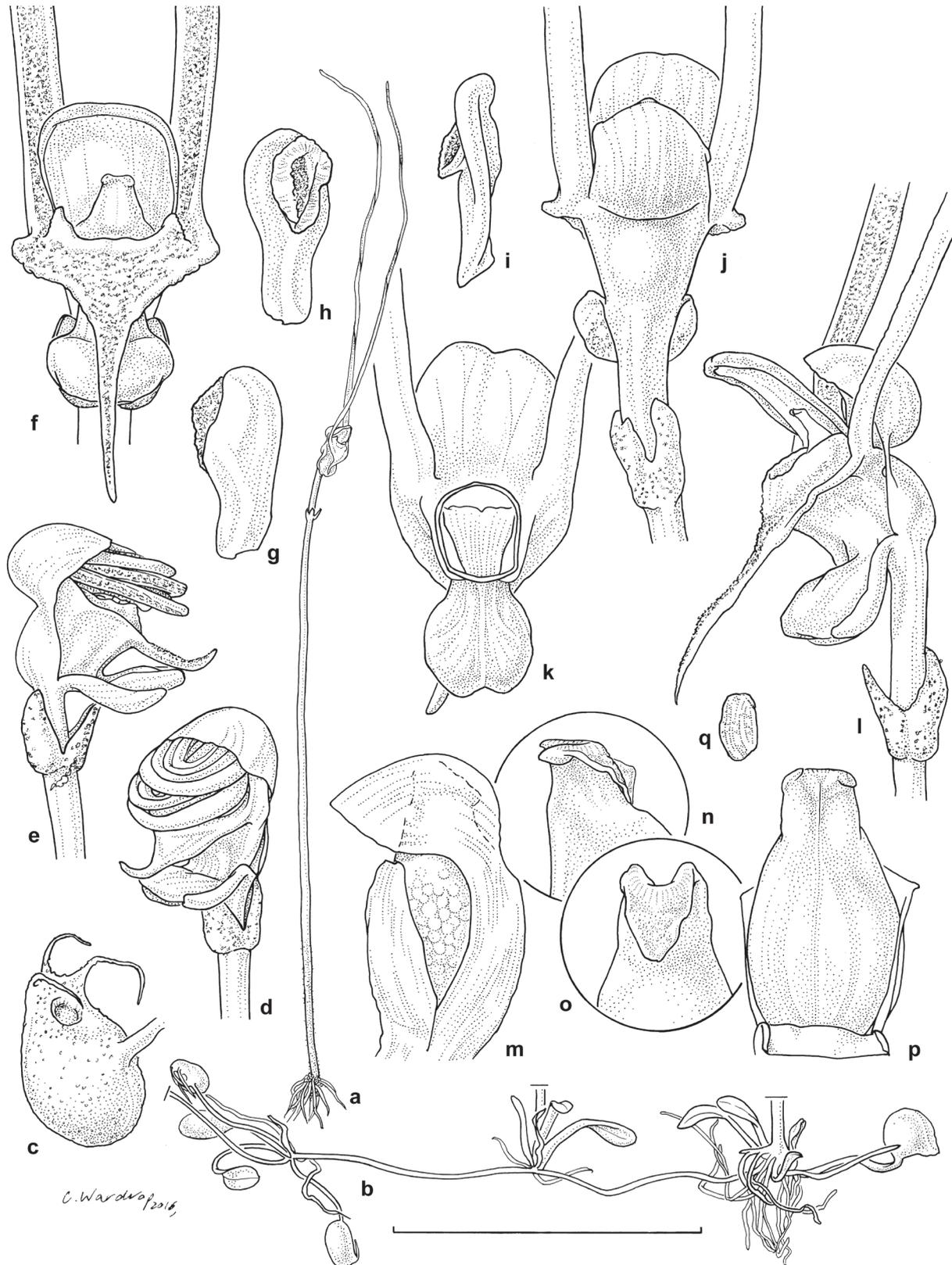


Fig. 1. *Utricularia albertiana*. **a**, habit; **b**, stolon with vegetative parts and peduncle base *in situ*; **c**, bladder-trap lateral view; **d**, flower bud $\frac{3}{4}$ view; **e**, bud side view; **f**, flower frontal view; **g**, stamen dorsal view; **h**, stamen frontal view; **i**, stamen lateral view; **j**, flower dorsal view; **k**, flower with calyx removed; **l**, flower lateral view; **m**, fruit lateral view; **n**, stigma lateral view; **o**, stigma ventral view; **p**, fruit ventral view; **q**, seed. Scale bar: a = 20 mm; b = 6 mm; c = 2 mm; d–f, j–l = 3.3 mm; g–i, q = 2 mm; m, = 3 mm; n, o = 2.5 mm; p = 3 mm. Material used: *Jobson 2308 & Baleeiro* (NSW852554).

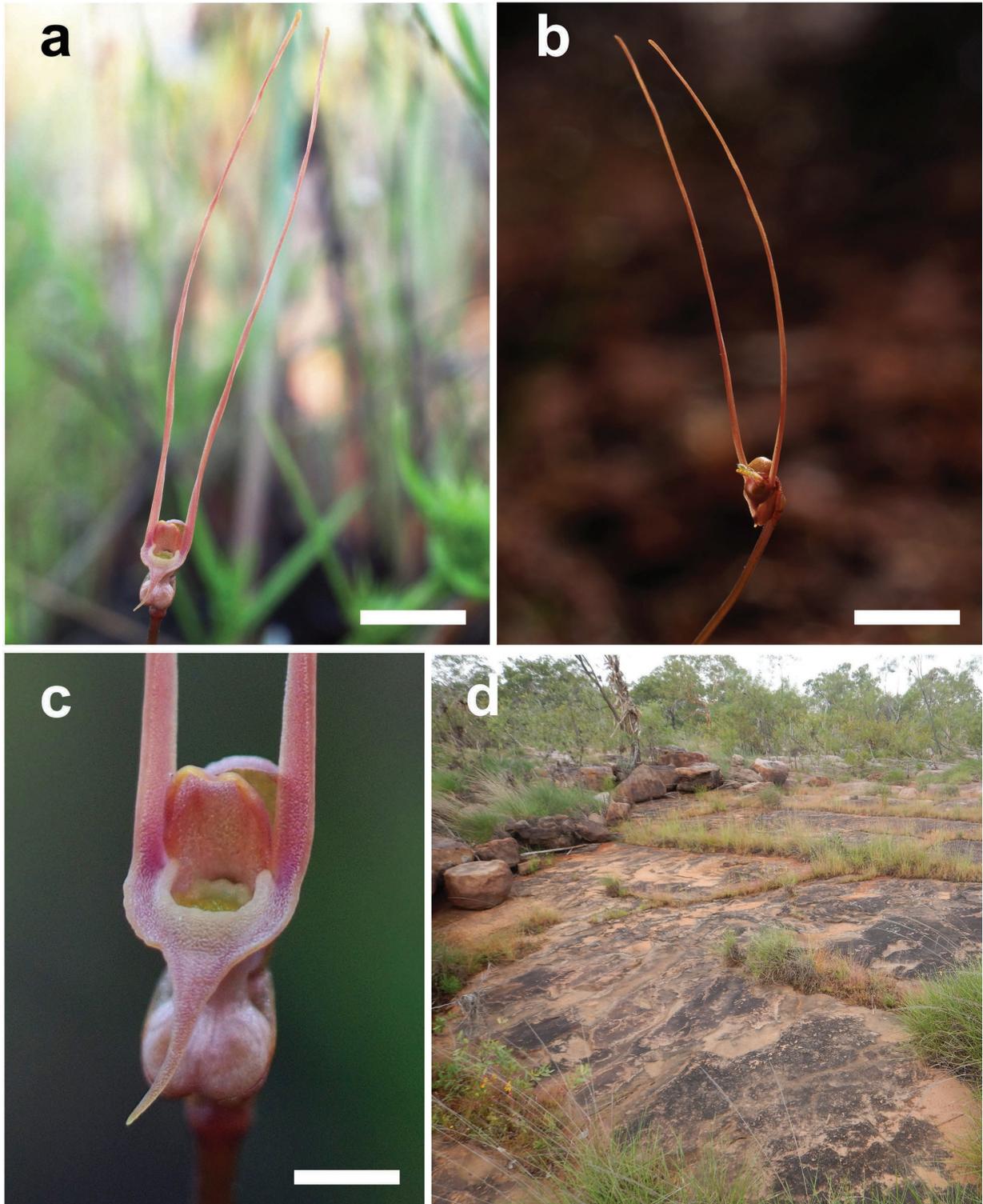


Fig. 2. *Utricularia albertiana*. **a**, flower frontal view close-up; **b**, flower frontal view showing appendages; **c**, flower lateral view; **d**, habitat at type site. Scale bars: a, b = 6 mm; c = 1 mm. Images: a, W. Cherry; b–d, R.W. Jobson (all type location).

Bracts and bracteoles similar, 1.6–1.8 mm long, basiolute, basally connate, superior part 0.8–1.0 mm long, narrowly ovate with apex acute, inferior part 0.6–0.8 mm long. *Flowers* 1–3, single on an elongated raceme axis, pedicels erect, filiform, slightly tapering apically, 5–15 mm long. *Calyx* lobes unequal; upper lobe c. 3 mm long, 1.7 mm wide, broadly ovate with apex rounded; lower lobe c. 2.3 mm long 1.6 mm wide with apex emarginate. *Corolla* 13–15 mm long; *upper lip limb* white tinged with purple, 4.5–6 mm long, constricted below the middle, superior part obovate with apex emarginate, inferior part ovate, sparsely glandular on margin; *lower lip limb* purple with darker streaks emanating from the base towards the limb apex, obtrullate in outline, 11.5–12.5 mm long, slightly 3-lobed with apex rounded, with two prominently raised white ridges projecting apically beyond the ridges on either side, each slightly hooked near the apex, with 2 slightly raised purple/white ridges on either side; palate sparsely glandular, with raised margin; *spur* cylindrical from a conical base, constricted at the middle, tapering to a narrowly rounded or truncate apex, at c. 110° to the lower-lip limb. *Staminal filaments* curved, c. 1.3 mm long, anther thecae sub-distinct. *Ovary* globose, c. 1.5 mm long; style short (half as long as ovary); stigma with lower lip transversely elliptic, upper lip smaller, deltoid. *Capsule* globose, 3.1 mm diam., walls thin, dehiscing by a single, ventral, longitudinal, narrowly thickened slit. *Seeds* obovoid, c. 0.4 mm long, 0.19 mm wide. *Pollen*: 3-colporate, c. 28 × 28 µm (R.W. Jobson 2682 & W. Cherry). **Figs 3, 4.**

Additional specimens examined: NORTHERN TERRITORY: Edith Falls, R.M. Barker 342, 28 Apr 1983; Edith River [Falls], D.E. Murfet 5573 & A. Lowrie, 3 Mar 2007 (AD); Edith River [Falls], D.E. Murfet 5578 & A. Lowrie, 3 Mar 2007 (AD). WESTERN AUSTRALIA: GARDNER: [localities withheld for conservation reasons]: A.S. George 14515, 23 Apr 1977 (PERTH); R.W. Jobson 2278 & P.C. Baleeiro, 26 Apr 2014 (NSW924532); R.W. Jobson 2295 & P.C. Baleeiro, 27 Apr 2014 (NSW924536); A.C. Beauglehole 53950, 27 Jun 1976 (PERTH); K.F. Kenneally 6202, 28 Apr 1977 (PERTH); P.R. Foulkes 243, 31 May 1985 (PERTH); R.L. Barrett RLB 262, 12 Apr 1992 (PERTH).

Etymology: The specific name is from the Latin *bi-* (two) and *dentatus* (toothed) and refers to the two white, prominently raised ridges that project forward from the palate resembling two sharp teeth.

Phenology: Flowers and fruit observed from March to June.

Distribution and ecology: Widespread across the Kimberley region from Broome to Mitchell Plateau, WA, with localised disjunct occurrences at Nitmiluk, NT. Although the disjunction between WA and NT populations involves ~800 km, habitat is similar, with plants infrequent along edges of rocky or sandy creeks, among grasses and sedges (Fig. 4c, d).

Conservation status: Although *U. bidentata* is widely distributed across the Kimberley region, occurrences are infrequent (RWJ pers. obs.). In the NT, collections are thus far restricted to small patches along non-conservation protected creeks in the Nitmiluk area. The patchy and infrequent nature of *U. bidentata* may have contributed to the limited number of collections, but it is also possible that the populations are highly localised. It is therefore recommended that this species be listed in WA and NT as Data deficient, requiring further study to assess conservation status and determine potential threats.

Notes: This species was previously confused with *U. kimberleyensis* C.A.Gardner, with the most salient difference involving colour of the palate spot (yellow / orange vs cream), and size of the two central ridges at the base of the corolla lower lip (not raised relative to adjacent ridges vs prominently raised relative to adjacent ridges). The two species tend to differ in habitat, with *U. bidentata* often occurring on soils with a high clay content, including cracking clay plains, while *U. kimberleyensis* typically grows in alluvial silt on sand flats derived from sandstone. Both species occur within 2 km of each other at Theda Station in the north Kimberley (MDB pers. obs.) and largely overlap in overall distribution. The phylogenetic study of Jobson et al. (2017) placed accessions of *U. bidentata* within clade F3, sister to a group containing *U. dunlopii* P.Taylor and *U. wannanii* R.W.Jobson & Baleeiro, while *U. kimberleyensis* was placed in the sister clade F2 and was itself sister to *U. georgei* P.Taylor. With exception of *U. uniflora* R.Br, both clades F2 and F3 contain species characterised with the inferior parts of the bracts and bracteoles connate. Taxonomic descriptions and illustrations of *U. kimberleyensis* provided in Taylor (1989), and Lowrie (2013), combine both *U. bidentata* and *U. kimberleyensis*. For this reason a redescription of *U. kimberleyensis*, based on specimens matching the type sheet C.A. Gardner 1412, Charnley River, Western Australia (holo: PERTH; iso: NSW), is currently underway (Jobson, in prep).



Fig. 3. *Utricularia bidentata*. **a**, habit; **b**, lower peduncle section showing glands; **c**, stolon with vegetative parts and peduncle base *in situ*; **d**, bracts and bracteoles; **e**, flower lateral view; **f**, flower frontal view; **g**, flower dorsal view; **h**, stamen lateral view; **i**, stamen frontal view; **j**, spur; **k**, upper lip frontal view; **l**, bladder-trap lateral view; **m**, leaf; **n**, seed; **o**, immature fruit showing calyx; **p**, mature fruit. Scale bar: **a** = 60 mm; **b**, **l** = 2 mm; **c**, **e**, **f**, **g** = 10 mm; **d**, **h**, **i** = 2.5 mm; **j**, **m** = 6 mm; **k**, **o**, **p** = 4 mm; **n** = 1 mm. Material used: **a**, **n** = Murfet 5573 & Lowrie (AD206600); **b**–**m** = Jobson 2682 & Baleeiro (NSW927127).

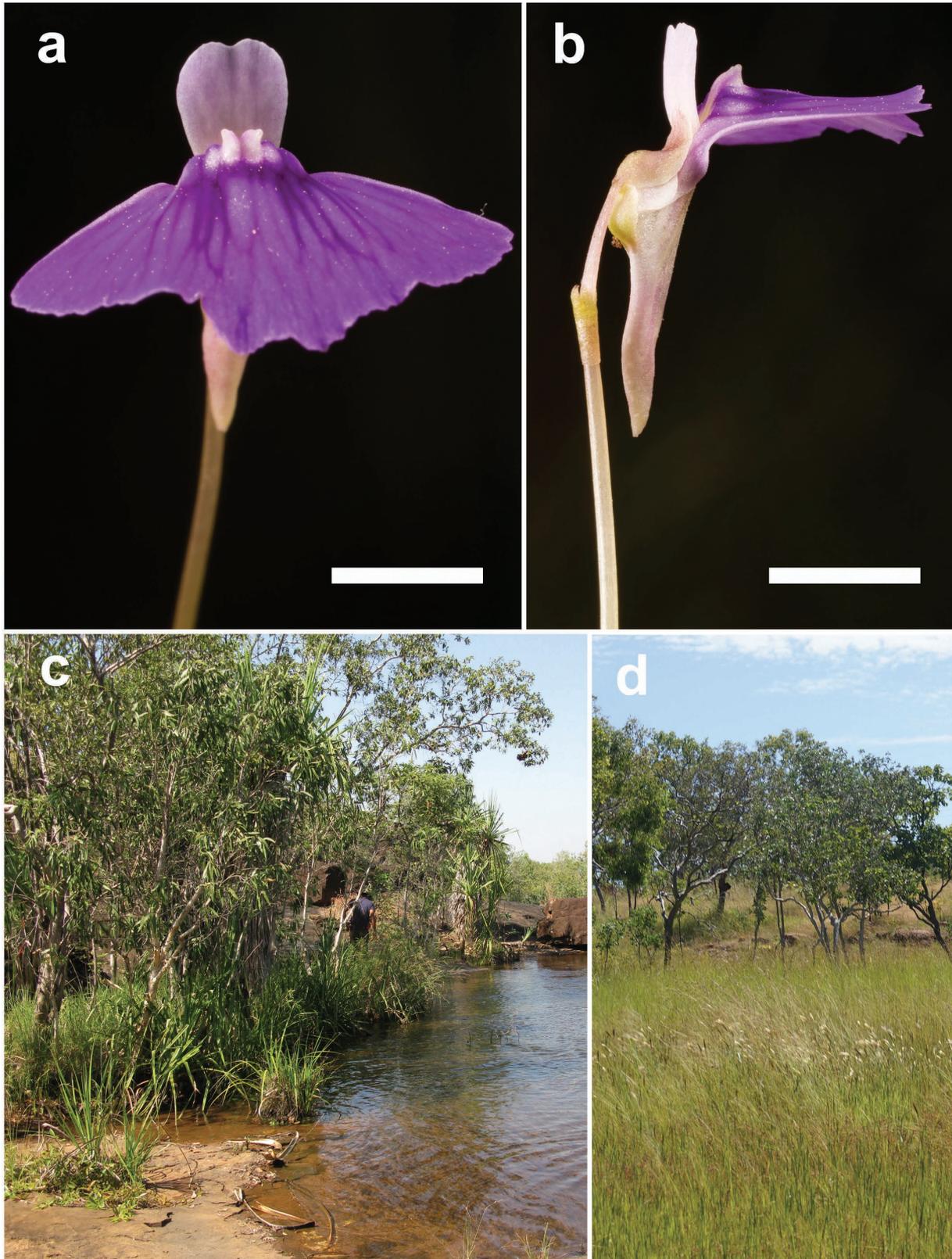


Fig. 4. *Utricularia bidentata*. **a**, flower frontal view; **b**, flower lateral view; **c**, rocky creek-side habitat in Kimberley, WA; **d**, creek-side grassland habitat at type site, Edith River, NT. Scale bars: a, b = 6 mm. Images: a, b, W. Cherry; c, d, R.W. Jobson.

3. *Utricularia hamata* R.W.Jobson & M.D.Barrett *sp. nov.*

Diagnosis: Similar to *U. hamiltonii* F.E.Lloyd but differs in having bifid lateral trap appendages, a white corolla, 2-lobes of upper lip limb rounded, corolla lower lip limb obovate, spur broadly conical, curved upwards with apex yellow.

Type: AUSTRALIA: Western Australia: Gardner: [precise locality withheld for conservation reasons], R. W. Jobson 2670 & W. Cherry, 16 Apr 2015 (holo: NSW909471; iso: PERTH).

Utricularia sp. Theda (M.D.Barrett 2056) *sensu* Jobson et al. (2017).

Utricularia sp. Theda (M.D.Barrett MDB 2056) Western Australian Herbarium in FloraBase, <http://florabase.dpaw.wa.gov.au/> [accessed April 2018].

Small to medium sized possibly perennial, terrestrial or affixed subaquatic herb. *Rhizoids* capillary, simple, up to 3 mm long, tapering from 0.9 mm thick at base to 0.04 mm near apex, numerous from base of peduncle. *Stolons* few, filiform, 10–15 mm long, 0.15–0.22 mm thick. *Leaves* few, from base of peduncle, and 1 at stolon node, linear-lanceolate, lamina not obvious, 6–12 mm long, 0.2–0.7 mm wide, single nerve, apex acuminate, total length 10–20 mm long. *Traps* stalked, ovoid, \pm uniform, few at base of peduncle and 1 or 2 at nodes, one on internodes of stolon, 1.5–2.8 mm long; mouth lateral, with dorsal appendage simple, capillary c. 2 mm long, and lateral appendages bifid from near the base, capillary, c. 2 mm long, wings absent. *Inflorescence* solitary, usually 40–100 mm long (up to 300 mm long when growing in deeper water); peduncle erect at anthesis, brittle, hollow, terete, glabrous, 0.4–1.0 mm thick, deflexed towards apex post anthesis. *Scales* absent. *Bracts and bracteoles* equal, basifixed, narrowly oblong with apex acute 1.7–2.2 mm long. *Flowers* solitary, pedicels erect, filiform, slightly tapering apically, 8–15 mm long. *Calyx* lobes unequal, membranous; upper lobe c. 3–4 mm long, 2.5–3 mm wide, broadly ovate with apex rounded; lower lobe c. 2.5–3 mm long, 3–3.5 mm wide with apex emarginate. *Corolla* 6.0–10 mm long, white, with yellow ridges at base of lower lip; *upper lip limb* 4.2–6.5 mm long, white with four purple streaks above middle, constricted near middle, superior part narrowly obovate with apex bifid with lobes rounded at apex, inferior part broader, ovate; *lower lip limb*, 5–9 mm long, obovate, apex rounded or truncate, tinged light mauve near the base, with two slightly raised yellow ridges at base; palate pubescent; *spur* broadly conical, slightly curved, apex emarginate, lobes rounded, about half as long as the lower-lip limb. *Staminal filaments* slightly curved, c. 1.7 mm long, anther thecae distinct. *Ovary* globose, c. 1.7 mm long; style short, 0.5 mm long; stigma with lower lip semicircular, upper lip minute, deltoid. *Capsule* globose, c. 5 mm diam., walls thin, membranous, appears to dehisce by a single, ventral, longitudinal, unthickened slit (or possibly indehiscent). *Seeds* obovoid, c. 0.6 mm long, 0.35 mm wide. *Pollen*: 6-colporate, c. $34 \times 37 \mu\text{m}$ (R. W. Jobson 2670 & W. Cherry), or 6- and 3-colporate (M.D. Barrett MDB 2056). **Figs 5, 6.**

Additional specimens examined: WESTERN AUSTRALIA: GARDNER: [localities withheld for conservation reasons]: M.D. Barrett MDB 2056, 25 Apr 2008 (PERTH); M.D. Barrett MDB 3091, 22 Aug 2010 (PERTH); R.L. Barrett RLB 3302 & M.D. Barrett, 23 Feb 2006 (PERTH); M.D. Barrett MDB 2777, 25 Mar 2010 (PERTH); R. Butcher RB 1975 & A.N. Start, 5 Jun 2014 (PERTH).

Etymology: The specific epithet is from the Latin *hamatus* (shaped like a hook, hooked, crooked) and refers to the deflexing of the peduncle post anthesis.

Phenology: Flowers and fruits in February to June.

Distribution and ecology: Known from only three sites in the Kimberley, WA. In the north Kimberley (type location) it grows either as an emergent in deep pools of creek-line (20–30 cm) with sandstone substrate, or as a terrestrial on shallow sandy edges with *Eriachne* sp., *Fimbristylis* spp., *Utricularia* sp. (Fig. 6d). At the Harding Range in the West Kimberley, it was found in a shallow creek on a sandstone pavement. In the Central Kimberley it was found growing within a herbfield flat with *Melaleuca viridiflora*, in a wetland/chute area, with red-brown to dark brown clayey soil (R. Butcher pers. comm.).

Conservation status: This rarely collected species is known from three sites. It is listed as a priority one taxon in Western Australia under its manuscript name *U. sp. Theda* (M.D. Barrett MDB 2056). Due to all known sites occurring on non-conservation managed lands, we recommend that this conservation listing is maintained.

Notes: The phylogeny of Jobson et al. (2017) places the four accessions of *U. hamata* sister to a clade containing accessions of the Northern Territory *U. hamiltonii*. Accessions from both clades share the affixed aquatic habit, although the smaller stature of *U. hamiltonii* limits it to very shallow habitats. They also share an upper lip with four short vertical purple streaks just above the middle, and the deflexing of the peduncle post anthesis. The most salient differences between *Utricularia hamata* and *U. hamiltonii* include the shape of the flower with lower corolla lip limb obovate versus quadrate, and upper corolla lip bifid with lobes apically rounded vs deeply divided with lobes apically acute.

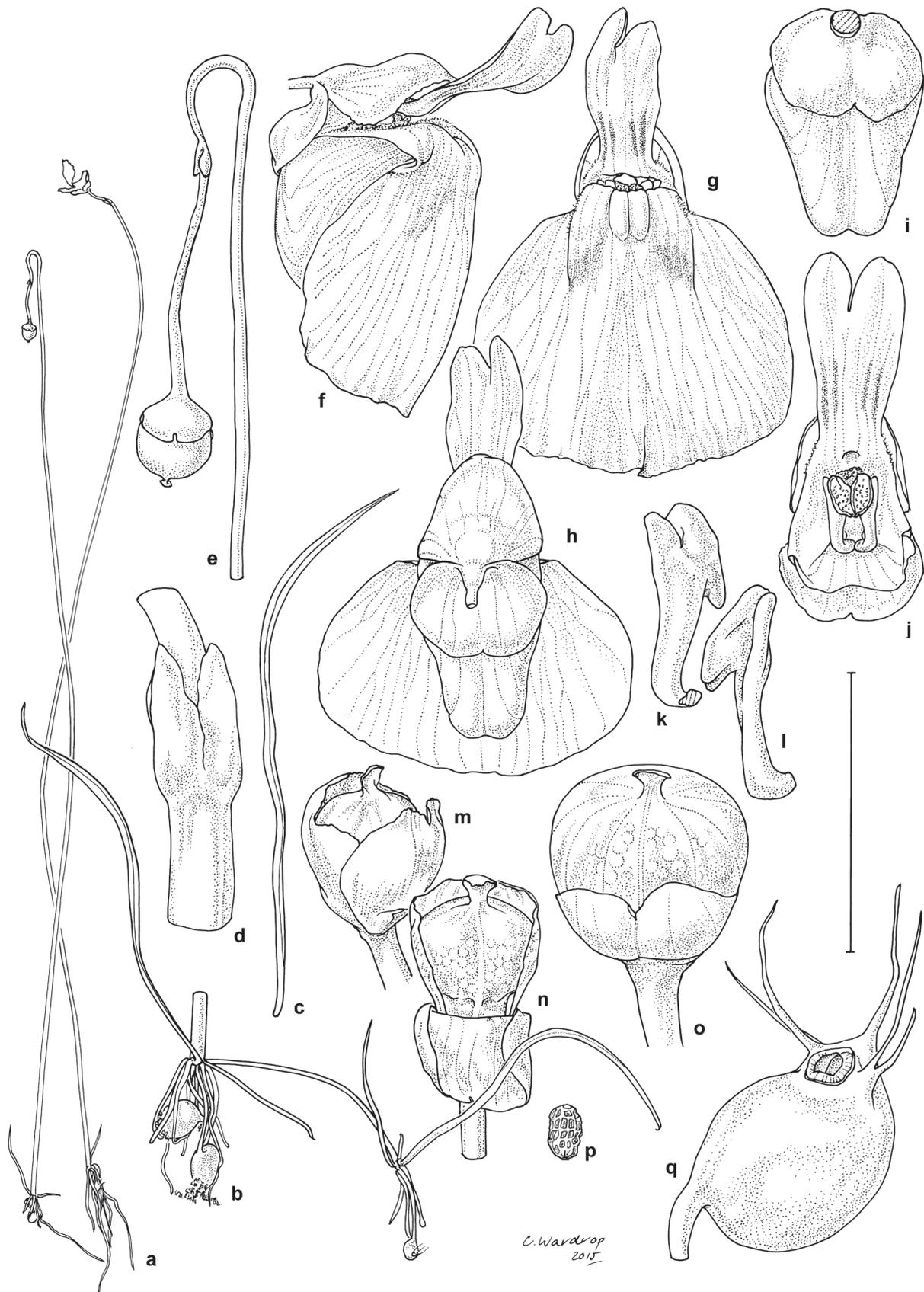


Fig. 5. *Utricularia hamata*. **a**, habit; **b**, stolon with vegetative parts and peduncle base *in situ*; **c**, leaf; **d**, bracts and bracteoles; **e**, peduncle and pedicel with mature fruit capsule; **f**, flower lateral view; **g**, flower frontal view; **h**, flower dorsal view; **i**, spur; **j**, upper lip frontal view; **k**, stamen dorsal view; **l**, stamen lateral view; **m**, immature fruit showing calyx; **n**, immature fruit dorsal view; **o**, mature fruit; **p**, seed; **q**, bladder-trap ventral view. Scale bar: **a** = 75 mm; **b**, **c**, **e** = 15 mm; **d**, **q** = 3 mm; **f**–**j** = 6 mm; **k** & **l** = 2.4 mm; **m**–**o** = 6 mm; **p** = 2 mm. Material used: *Jobson 2670 & Cherry* (NSW924836 spirit, NSW909471 sheet).

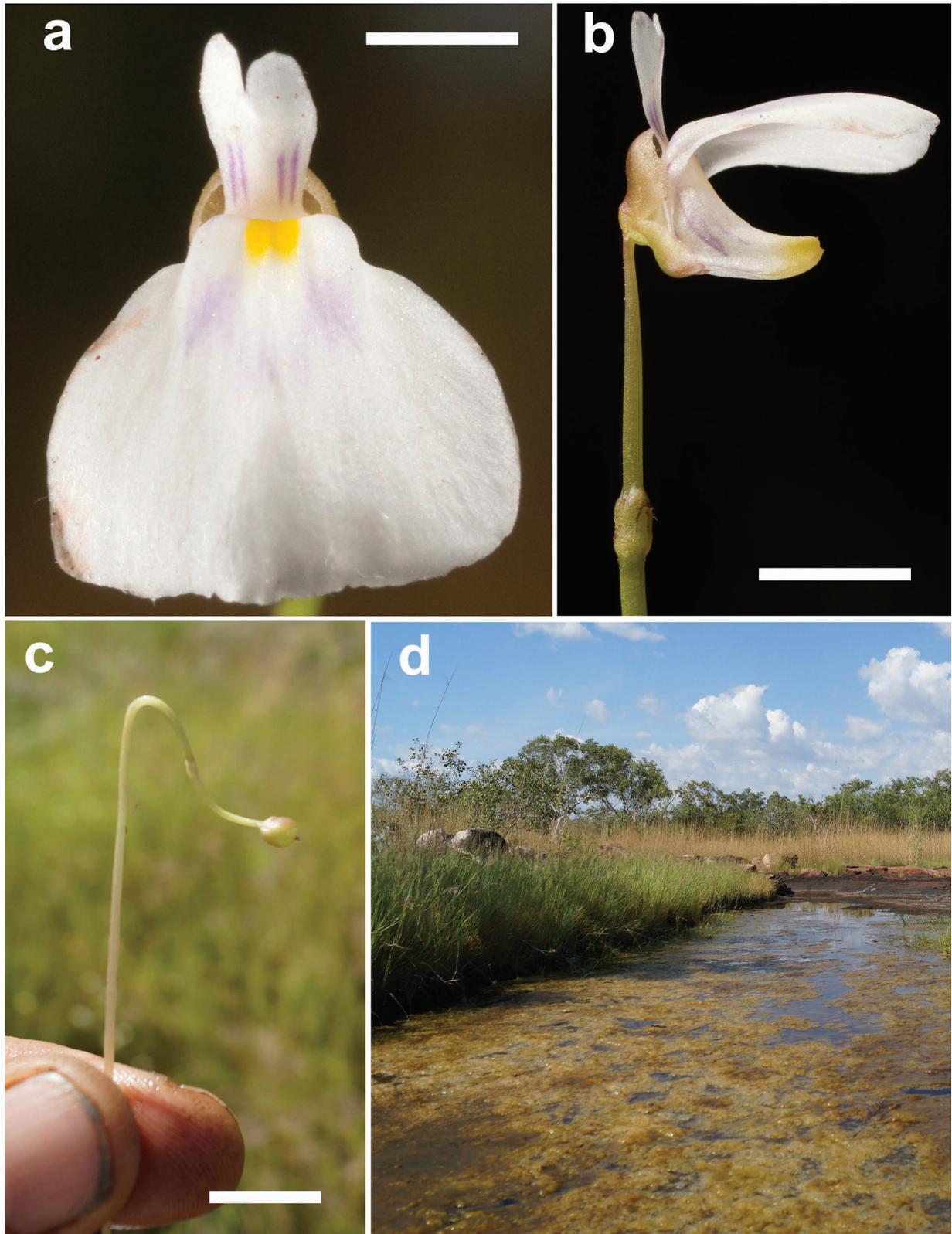


Fig. 6. *Utricularia hamata*. **a**, flower frontal view; **b**, flower lateral view; **c**, peduncle with mature capsule; **d**, creek habitat at type site. Scale bars: a = 3 mm, b = 5 mm, c = 2 mm. Images: a, b, W. Cherry; c, d, R.W. Jobson (*Jobson 2670 & Cherry*).

Utricularia hamata superficially resembles *U. fistulosa* P.Taylor in flower colour (white), bladder-trap form, habit (affixed-aquatic), and occupies similar aquatic habitats across the Kimberley region (Taylor 1989). *Utricularia hamata* differ from *U. fistulosa* in having upper lip with four vertical purple streaks vs entirely white, lower lip longer than the spur vs shorter than the spur, bladder-trap lateral appendages bifid vs simple, inflorescence single flowered vs multi-flowered, and deflexing of the peduncle post-anthesis vs peduncle and pedicel remaining upright during maturation of the seed capsule (Taylor 1989).

4. *Utricularia magna* R.W.Jobson & M.D.Barrett *sp. nov.*

Diagnosis: Similar to *U. tridactyla* P.Taylor but differs in having a light-mauve corolla, a shallowly 3-lobed corolla lower lip with lobes broadly rounded at the apex, corolla upper-lip superior part obovate, bladder-traps usually to c. 7.2 mm (rarely to 10 mm) long.

Type: AUSTRALIA: Western Australia: Gardner: [precise locality withheld for conservation reasons], M.D. Barrett MDB 2858, 30 Apr 2014 (holo: PERTH; iso: NSW934866).

Utricularia sp. Sandstone (M.D.Barrett 1335) R.W. Jobson *sensu* Jobson et al. (2017).

Medium-sized probably annual, terrestrial herb. *Rhizoids* capillary, simple, up to 20 mm long, tapering from 0.4 mm thick at base to 0.09 mm near apex, numerous from base of peduncle. *Stolons* few, filiform, hollow, 20–30 mm long, 0.2–0.3 mm thick. *Leaves* numerous, from base of peduncle, and 1 or 2 at stolon node, petiolate; lamina obovate or linear-obovate, 5–10 mm long, 0.1–0.22 mm wide, single nerve, apex rounded. *Traps* stalked, globose, numerous at base of peduncle and 1 at nodes and internodes of stolon, ± uniform, ovoid, 1.2–7.2(–10) mm long; mouth basal, with a short broad dorsal-lateral deeply fimbriate appendage, 1–3 mm long, sometimes folded downwards adnate to the mouth; ventral wing appendage deeply fimbriate, 3–5 mm long. *Inflorescence* erect, 150–270(–300) mm long, solitary or in pairs; peduncle terete, glabrous above, sparsely papillose below, solid, 0.5–0.1 mm thick. *Scales* absent. *Bracts and bracteoles* 0.8–1.4 mm long, unequal, basifixed, slightly gibbous at base, bracts lanceolate with apex acute, bracteoles shorter, ovate with apex rounded. *Flowers* 1–4, in pairs on an elongated raceme axis, pedicels erect, filiform, slightly tapering apically, 8–25 mm long. *Calyx* lobes unequal; upper lobe c. 3 mm long, 2.2 mm wide, broadly ovate with apex rounded; lower lobe c. 1.7 mm long, 1.2 mm wide with apex emarginate. *Corolla* light purple or light mauve, 12–13 mm long; *upper lip limb* 3.5–4 mm long, constricted near middle, superior part obovate with apex emarginate or bilobed, inferior part ovate, ciliate on margin; *lower lip limb*, obtrullate in outline, 6–7.5 mm long, shallowly 3-lobed with apex rounded, with two prominently raised yellow (becoming white towards base) ridges at base, with 2 slightly raised light mauve ridges on either side, bordered by 2–4 darker streaks around edge; palate shortly pubescent, with raised margin; *spur* cylindrical from a conical base, slightly restricted at the middle, tapering to a narrowly rounded or truncate apex, at c. 90° relative to the lower lip limb. *Staminal filaments* curved, c. 1.5 mm long, anther thecae sub-distinct. *Ovary* globose, c. 1.5 mm long; style short (half as long as ovary); stigma with lower lip transversely elliptic, upper lip smaller, deltoid. *Capsule* globose, 3.5 mm diam., walls thin, dehiscing by a single, ventral, longitudinal, broadly thickened slit. *Seeds* obovoid, c. 0.5 mm long, 0.22 mm wide. *Pollen*: 3-colporate, c. 28 × 28 µm (M.D. Barrett MDB 1335 & R.L. Barrett, CANB592223). **Figs 7, 8.**

Additional specimen examined: WESTERN AUSTRALIA: GARDNER: [localities withheld for conservation reasons]: M.D. Barrett MDB 1335 & R.L. Barrett, 19 Jan 2003 (PERTH; CANB); R.L. Barrett RLB 6713 & M.D. Barrett 26 Mar 2010 (PERTH).

Etymology: The specific epithet is from the Latin *magnus* (big, great, large) and refers to the unusually large bladder-traps (Fig. 8c).

Phenology: Flowers and fruits recorded in January and April. Seed-set has been observed in both Barrett MDB 2858 and Barrett MDB 1335 & Barrett.

Distribution and ecology: Known only from the southern edge of Prince Regent Nature Reserve, where it is restricted to sandstone pavements (Fig. 8d).

Conservation status: *Utricularia magna* is a very localised species and although at least one known site is within the Prince Regent National Park, we recommend that this species be listed in WA as rare flora (Priority Two – Poorly Known Taxa), requiring further study to assess conservation status and determine potential threats.

Notes: This species was previously confused with *U. arnhemica* P.Taylor from the Northern Territory, based mainly on bladder-trap size (Lowrie 2013). Three accessions of *U. magna* were included in the plastid phylogeny of Jobson et al. (2017) as *U. sp. Sandstone* (M.D.Barrett 1335) R.W.Jobson and were placed within clade F, sister to a clade containing *U. papilliscapa*, *U. tridactyla* and *U. kenneallyi*, while *U. arnhemica* s.s. was placed within clade E.

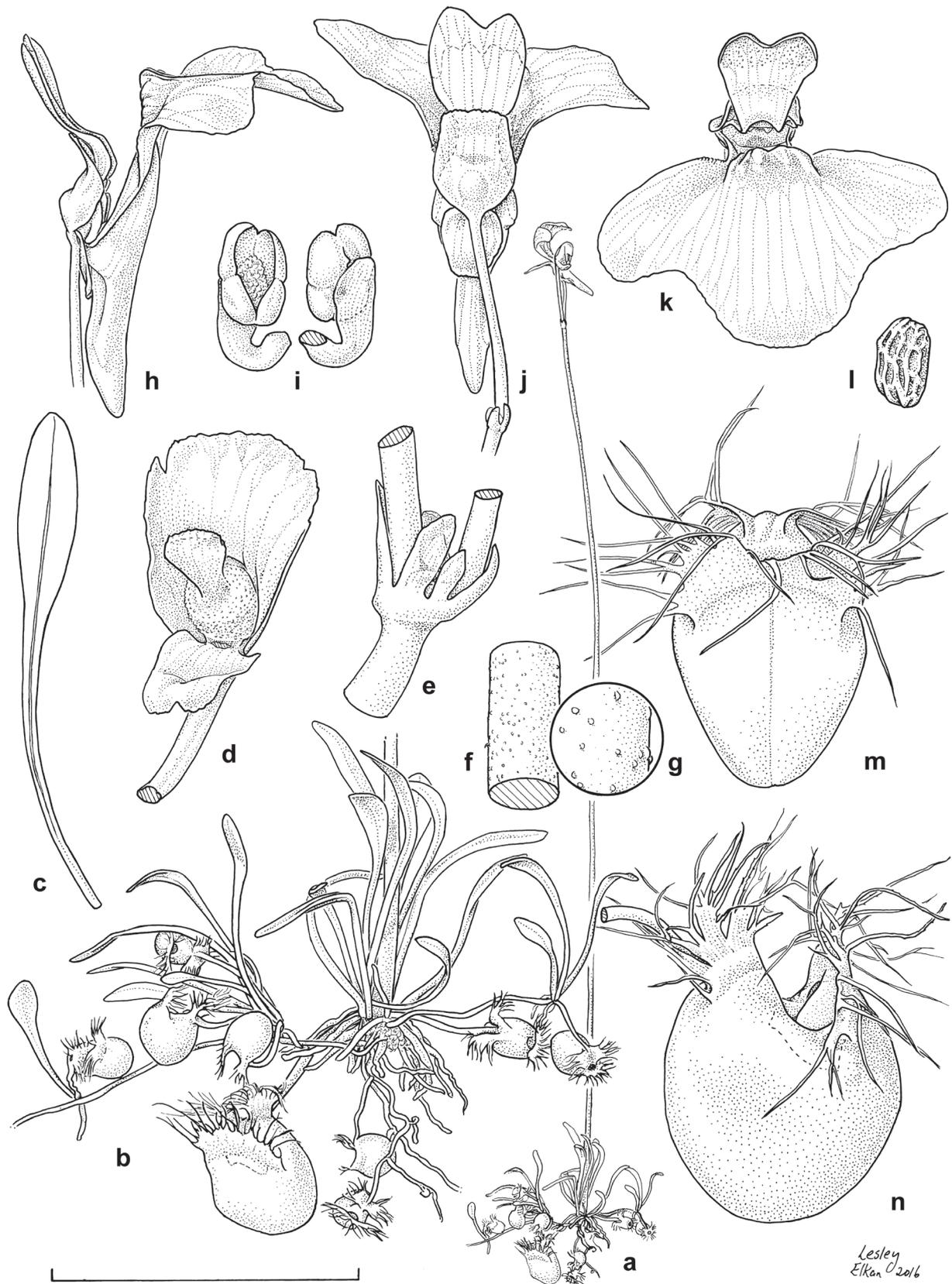


Fig. 7. *Utricularia magna*. **a**, habit; **b**, stolon with vegetative parts and peduncle base *in situ*; **c**, leaf; **d**, calyx with immature fruit; **e**, bracts and bracteoles; **f**, lower peduncle section showing glands; **g**, glands close-up; **h**, flower lateral view; **i**, stamens; **j**, flower dorsal view; **k**, flower frontal view; **l**, seed; **m**, bladder-trap frontal view; **n**, bladder-trap lateral view. Scale bar: **a** = 40 mm; **b** = 12 mm; **c**, **h**, **j**, **k**, **m**, **n** = 8 mm; **d** = 4 mm; **e**, **f**, **l** = 3 mm; **g**, **l** = 1 mm. Material used: **a**, **b**, **h**, **j**, **l**, Barrett MDB 1335 & Barrett (CANB00592223); **c**–**g**, **i**, **m**, **n**, Barrett MDB 2858 (NSW934866).

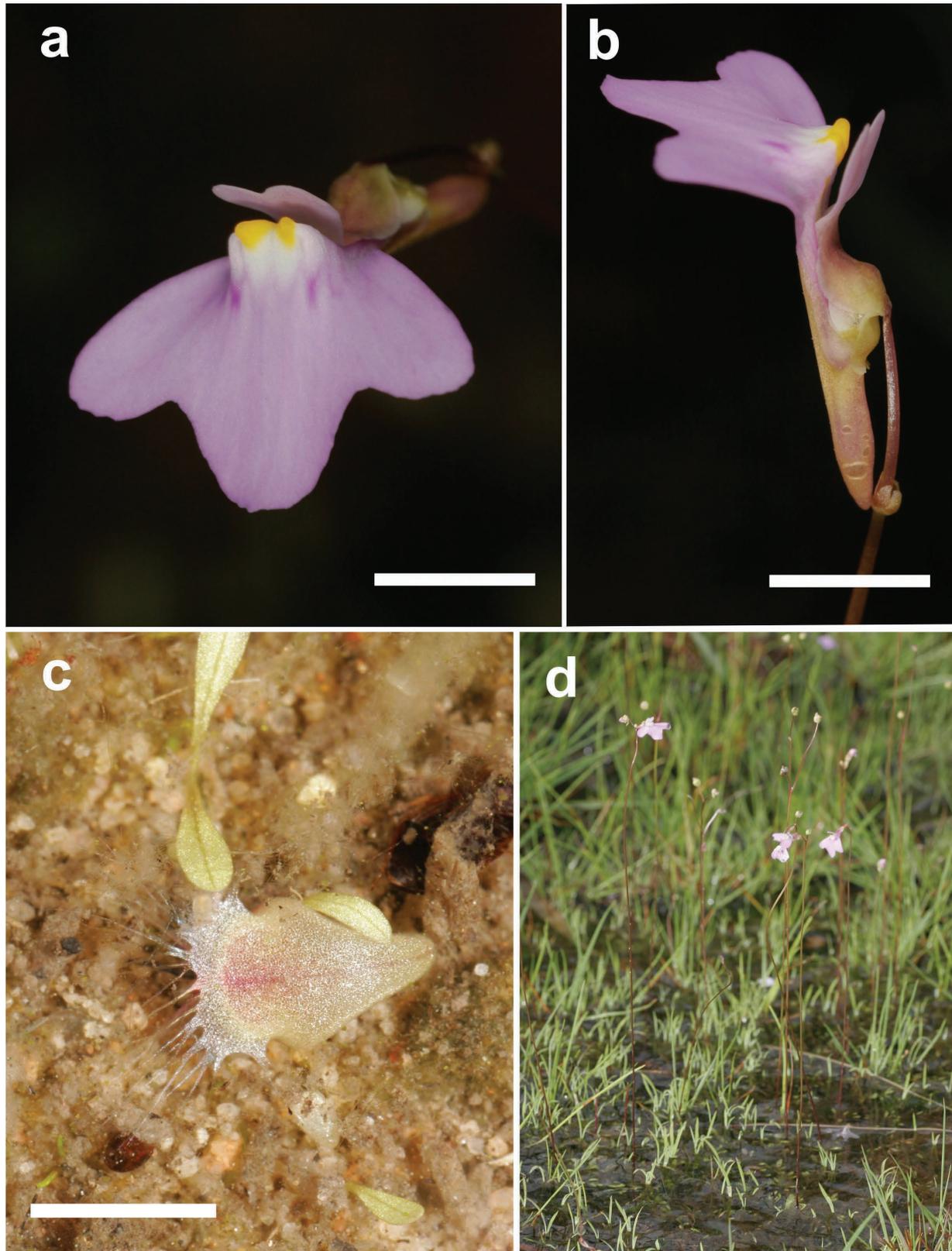


Fig. 8. *Utricularia magna*. **a**, flower frontal view; **b**, flower lateral view; **c**, bladder-trap; **d**, habit and habitat at type site. Scale bars: a, b = 3 mm, c = 5 mm. Images: M.D. Barrett.

5. *Utricularia papilliscapa* R.W.Jobson & M.D.Barrett *sp. nov.*

Diagnosis: Similar to *U. tridactyla* P.Taylor but differs in having lower peduncle densely papillose, a corolla light pink, a more shallowly 3-lobed lower lip with palate a yellow patch at base, corolla upper lip superior part oblong and acutely bifid.

Type: AUSTRALIA: Western Australia: Gardner: [precise locality withheld for conservation reasons]: 14 April 2015, R. W. Jobson 2657 & W. Cherry (holo: NSW; iso: PERTH).

Utricularia sp. Papillose (R.W.Jobson 2657) *sensu* Jobson et al. (2017).

Small-sized annual, terrestrial herb. *Rhizoids* capillary, simple, up to 4 mm long, tapering from 0.1 mm thick at base to 0.05 mm near apex, numerous from base of peduncle. *Stolons* few, filiform, 80–100 mm long, 0.1–0.2 mm thick. *Leaves* few, from base of peduncle, and 2 or 3 at stolon node, petiolate; lamina elliptic, 1–2 mm long, 0.5–0.6 mm wide, single nerve, apex rounded, total length 4–6 mm long. *Traps* stalked, globose, few at base of peduncle and 1 or 2 at nodes, one on internodes of stolon, ± uniform, ovoid, 0.5–0.8 mm long; mouth basal, with a short dorsal appendage, c. 0.2 mm long, sometimes folded downwards adnate to the mouth; two lateral appendages c. 0.25 mm long; ventral wings, margin entire or shortly fimbriate, 1–1.5 mm long. *Inflorescence* erect, 45–140 mm long, solitary or two or more arising in succession; peduncle terete, papillose near base, glabrous above, solid, 0.2–0.4 mm thick. *Scales* absent. *Bracts and bracteoles* 0.5–0.7 mm long, equal, basifixed, gibbous at base, ovate with apex acute. *Flowers* 1–3, in pairs on an elongated raceme axis, pedicels erect, filiform, slightly tapering apically, 5–25 mm long. *Calyx* lobes subequal; upper lobe c. 1.5–1.6 mm long, 1.0–1.1 mm wide, broadly ovate with apex rounded; lower lobe c. 1.4–1.5 mm long 1.1–1.2 mm wide with apex truncate. *Corolla* light pink, 5.5–6.5 mm long; *upper lip limb* 2.5–3 mm long, white or sometimes streaked purple, constricted below middle, superior part oblong with apex acutely bifid, inferior part ovate; *lower lip limb* transversely obtrullate in outline, 5–6 mm long, deeply 3-lobed with apex rounded or truncate, with two prominently raised white (becoming violet near each apex), ± spreading ridges at base, half as long in centre, with yellow patch at base; palate glandular; *spur* subulate, slightly curved or straight, apex acute, about as long as the lower-lip limb. *Staminal filaments* curved, c. 1.1 mm long, anther thecae sub-distinct. *Ovary* ovoid, c. 0.8 mm long; style half as long as ovary; stigma lower lip semi-circular, upper lip smaller, deltoid. *Capsule* globose, 2.1 mm diam., dehiscing by a single, ventral, longitudinal, marginally thickened slit. *Seeds* obovoid, c. 0.15 mm long, 0.12 mm wide. *Pollen*: 3-colporate, c. 32 × 32 µm (R. W. Jobson 2657 & W. Cherry). **Figs 9, 10.**

Additional specimens examined: WESTERN AUSTRALIA: GARDNER: [localities withheld for conservation reasons]: C.R. Dunlop 5319, 27 Feb 1980 (PERTH, DNA); M.D. Barrett MDB 2901 & R.L. Barrett, 29 Mar 2010 (PERTH).

Etymology: The specific epithet refers to the densely papillose peduncle base.

Phenology: Flowers and fruits recorded from February to April.

Distribution and ecology: Known only from a few locations in the Northern Kimberley region of Western Australia. Found on shallowly inundated sandy skeletal substrate over sandstone pavement (Fig. 10c).

Conservation status: All three examined collections are from non-protected areas of the Northern Kimberley region, although an additional fourth collection was recently made within the Drysdale River National Park (R.L. Barrett pers. comm.). This species is likely to be widespread and locally abundant, but is probably restricted to sandstone pavement habitats. It has previously been confused with the more common species *U. leptorhyncha*. It is therefore recommended that this species be listed in WA as Data deficient, requiring further study to assess conservation status and determine potential threats.

Notes: *Utricularia papilliscapa* is similar to *U. tridactyla* P.Taylor but differs in having a corolla that is pink vs violet, a shallowly 3-lobed lower lip with lobes broadly rounded at the apex vs deeply 3-lobed with lobes narrowly oblong and rounded or sub-truncate at the apex. Jobson et al. (2017) included two *U. papilliscapa* accessions (Barrett MDB 2901 & Barrett; Jobson 2657 & Cherry), with a third, undescribed sister accession (Barrett MDB 2726 & Maier) from the Prince Regent River area, differing in having a forward-projecting fully pink lower lip with a non-raised palate, and a white upper lip with purple flecks. In comparison, the former two accessions share a pink lower lip with two v-shaped purple streaks with a raised palate, and a non-flecked white upper lip. Since Barrett MDB 2726 & Maier is morphologically distinct and known from a single collection, it is for the present excluded from the description of *U. papilliscapa* pending collection of additional material.

In the phylogeny, the three above mentioned accessions were strongly supported as sister to a clade containing *U. tridactyla* and *U. kenneallyi*. *Utricularia papilliscapa* was illustrated and described in Taylor (1989) within the description of *U. leptorhyncha*: *Utricularia papilliscapa* = (fig. 27: 2–6, 8, 10–14 from Dunlop 5319); *U. leptorhyncha* = (fig. 27: 1, 7, 9, 15, 16 from Craven 2493 fitting the type Adams 1722). It has also been illustrated and wrongly identified as *U. kenneallyi* in Lowrie (2013).

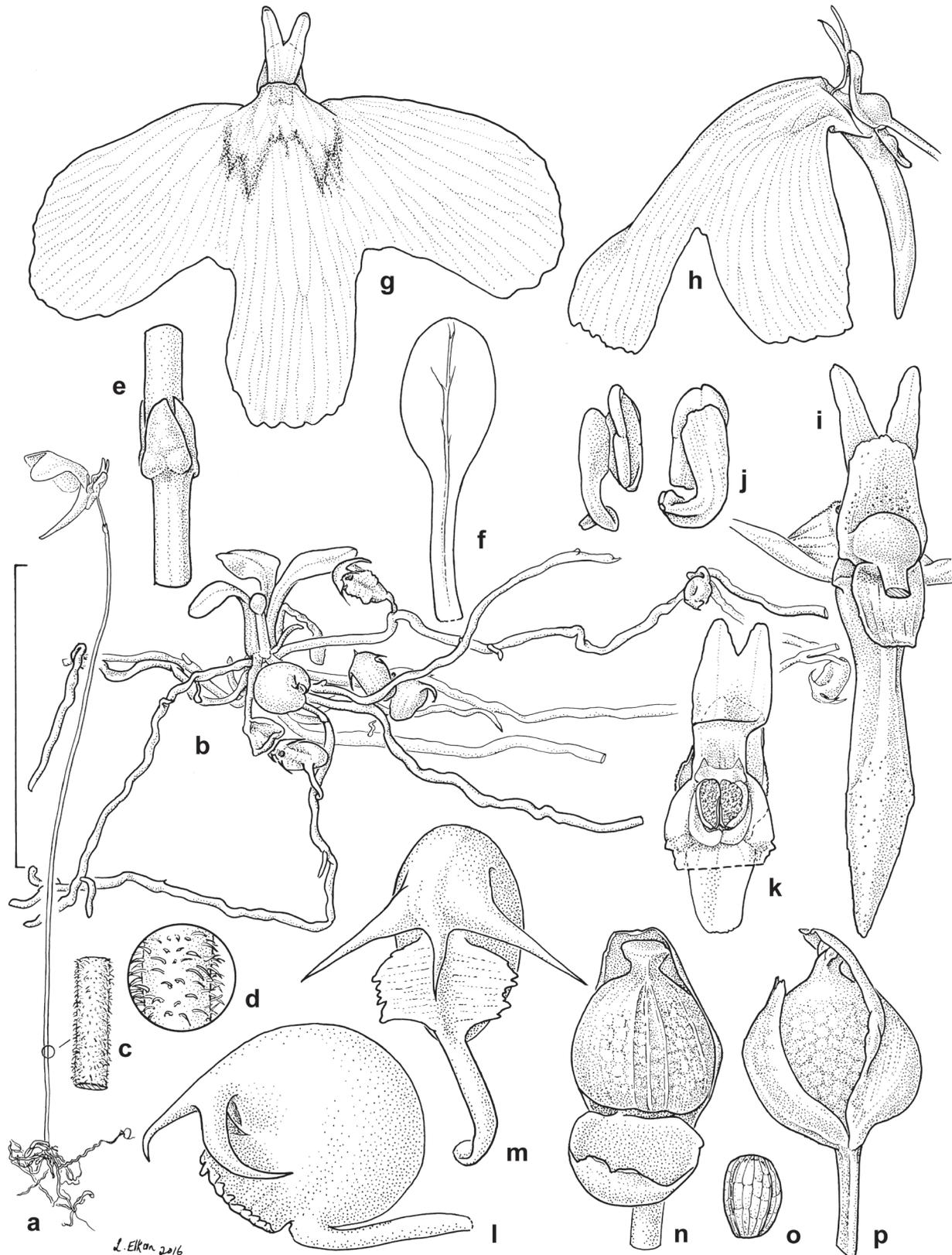


Fig. 9. *Utricularia papilliscapa*. **a**, habit; **b**, stolon with vegetative parts and peduncle base *in situ*; **c**, lower peduncle section showing papillae; **d**, papillae close-up; **e**, bracts and bracteoles; **f**, leaf; **g**, flower frontal view; **h**, flower lateral view; **i**, flower dorsal view; **j**, stamens; **k**, corolla upper lip frontal view; **l**, bladder-trap lateral view; **m**, bladder-trap ventral view; **n**, mature fruit; **o**, seed; **p**, mature fruit showing calyx. Scale bar: **a** = 20 mm; **b**, **i**, **k**, **n**, **p** = 4 mm; **c** = 3 mm; **d**, **l**, **m**, **o** = 1 mm; **e**, **f**, **j** = 2 mm; **g**, **h** = 8 mm. Material used: Jobson 2657 & Cherry (NSW924824 spirit).

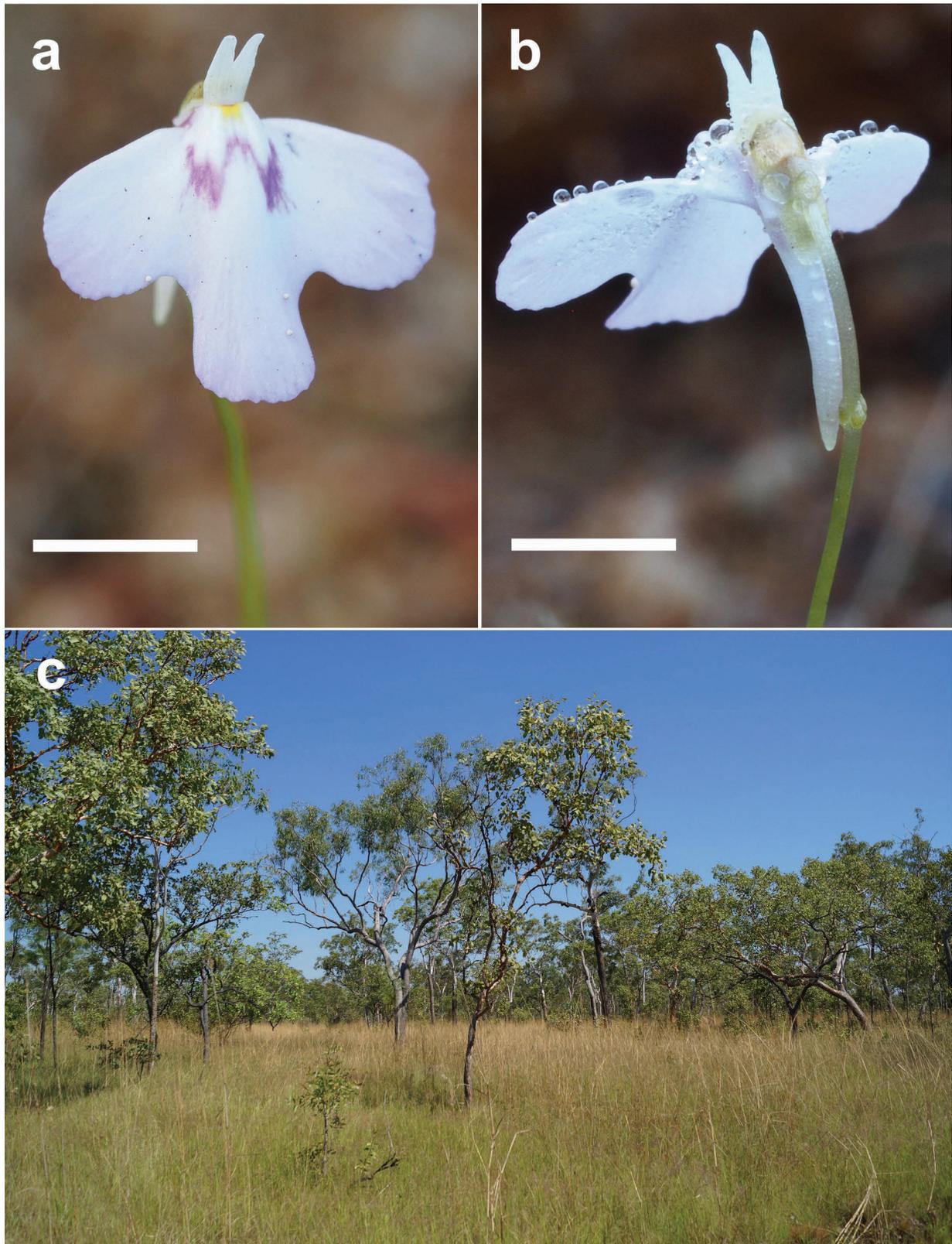


Fig. 10. *Utricularia papilliscapa*. **a**, flower frontal view; **b**, flower $\frac{3}{4}$ lateral view; **c**, wet grassland habitat at type site. Scale bars: a, b = 3 mm. Images: a, b, W. Cherry; c, R.W. Jobson (*Jobson 2657 & Cherry*).

6. *Utricularia limmenensis* R.W.Jobson *sp. nov.*

Diagnosis: Similar to *U. albiflora* R.Br. but differs in having a corolla pale violet, a narrow upper-lip limb slightly constricted near middle, corolla lower-lip limb strongly three-lobed, and spur long, cylindrical from base, curved towards apex, 1.3–2 times longer than lower lip.

Type: AUSTRALIA: Northern Territory: Roper Gulf: [precise locality withheld for conservation reasons], R. W. Jobson 3427 & D. Albrecht, 17 May 2017 (holo: NSW934855; iso: DNA, CANB).

Utricularia sp. Limmen (B.M.Stuckey 655 & I.D.Cowie) R.Jobson in Northern Territory flora online, <http://eflora.nt.gov.au/> [accessed February 2018]

Very small sized annual, terrestrial herb. *Rhizoids* capillary, simple, up to 3–5 mm long, tapering from 0.1 mm thick at base to 0.04 mm near apex, numerous from base of peduncle. *Stolons* few, filiform, 30–45 mm long, 0.2–0.25 mm thick. *Leaves* few, from base of peduncle, and 2 at stolon node, subulate, lamina not obvious, 8–11 mm long, 0.2–0.3 mm wide, single nerve, apex acute. *Traps* stalked, ovoid, ± uniform, few at base of peduncle and 1 or 2 at nodes, 1.2–1.5 mm long; mouth lateral, with dorsal appendage simple, capillary c. 1.3 mm long, and lateral appendages simple or bifid from near the apex, capillary, c. 1 mm long, ventral wings present with margin entire or crenate. *Inflorescence* solitary, 25–40(–50) mm long; peduncle erect, hollow, terete (thickening towards the apex), glabrous, 0.4–6.0 mm thick. *Scales* absent. *Bracts and bracteoles* ± equal, basifixed, ovate with apex rounded 0.7–1.0 mm long. *Flowers* solitary, pedicel slightly curved at anthesis, deflexed 90° post anthesis, filiform, slightly tapering apically, 2.2–4.2 mm long. *Calyx* lobes unequal; upper lobe 1.6–1.8 mm long, 1.4–1.6 mm wide, broadly ovate with apex rounded; lower lobe 1.4–1.6 mm long 1.1–1.3 mm wide with apex emarginate. *Corolla* 4.5–5.5 mm long, pale violet, with white ridges at base of lower lip; *upper lip limb* 2.5–3.1 mm long, slightly constricted near middle, superior part narrowly oblong 1.2–1.3 mm wide, with apex weakly emarginate, inferior part slightly broader, obovate 1.3–1.4 mm wide; *lower lip limb*, 2.1–2.4 mm long, obovate, apex three lobed, pale violet with four prominent, and two smaller outer, white raised ridges at the base, bordered by a yellow streak near the palate and a purple streak on the apical margin of the ridges; palate pubescent; *spur* cylindrical, slightly curved towards apex, 3.0–3.5 mm long, 1.3–2 times as long as the lower lip limb. *Staminal filaments* straight, c. 1.3 mm long, anther thecae sub-distinct. *Ovary* globose, c. 1.7 mm long; style short, 0.5 mm long; stigma with lower lip semicircular, upper lip minute, deltoid. *Capsule* globose, c. 3.1 mm diam., dehiscent by a single, ventral, longitudinal, and broadly thickened slit. *Seeds* obovoid, c. 0.5 mm long, 0.32 mm wide. *Pollen*: 3-colporate, c. 30 × 30 µm (R. W. Jobson 3427 & D. Albrecht). **Figs 11, 12.**

Additional specimen examined: NORTHERN TERRITORY: ROPER GULF: [locality withheld for conservation reasons]: B. Stuckey 655 & I. Cowie, 12 May 2010 (DNA).

Etymology: The specific epithet refers to the region within the catchment of the Limmen Bight River, from which Limmen National Park takes its name.

Phenology: Flowers and fruit observed in May. No obvious fragrance was detected emanating from fresh flower.

Distribution and ecology: Known from two collections in the Limmen Bight River catchment, NT. The two collection sites are located ~50 km apart: *Stuckey 655 & Cowie* within Limmen National Park, while *Jobson 3427 & Albrecht* is located on private property. At both sites it is found on sandy clay substrate along the drying edge of *Melaleuca viridiflora* Sol. ex Gaertn. dominated swamps with *U. simmonsii* Lowrie, Cowie & Conran and *Eriocaulon pygmaeum* Sm. (Fig. 12c, d).

Conservation status: Known only from two collections; one is protected within Limmen National Park, and a second, type collection from an unprotected site on private property. Although the type site did not show any obvious wild pig damage across the portion explored (c. 1/5 of the estimated 5 km total swamp circumference) (Fig. 12d), two nearby swamps were heavily impacted across much of their shoreline (R.W. Jobson pers. obs.). At present, *U. limmenensis* should be regarded as “Not Evaluated” following the IUCN (2014) guidelines, however, given the observed habitat damage at two potential nearby sites, we recommend threat status should be evaluated as soon as possible.

Notes: *Utricularia limmenensis* shares with *U. albiflora*, *U. triflora*, and *U. terrae-reginae* similar shaped white ridges at the base of the corolla lower lip, leaf tips that are acuminate, and trap ventral wings projecting vertically over the trap mouth (Taylor 1989). Despite these similarities, the latter two species are easily distinguished based on their larger size (60–170 mm tall) (Taylor 1989). However, *U. albiflora* is of a similar size to that of the likewise solitary flowered *U. limmenensis* (to c. 40 mm tall), although they differ in corolla colour (white/yellow vs pale violet with purple streaks), and spur size and shape (straight, shorter or slightly longer than the lower-lip vs curved, 1.3–2 times longer than the lower lip) (Figs 11, 12a, b). These two species also differ in bladder-trap structure with *U. limmenensis* possessing bifid lateral appendages, while in *U. albiflora* they are trifid. The distribution of *U. albiflora* is based on three collections at c. 15°S on the eastern coast of Cape York

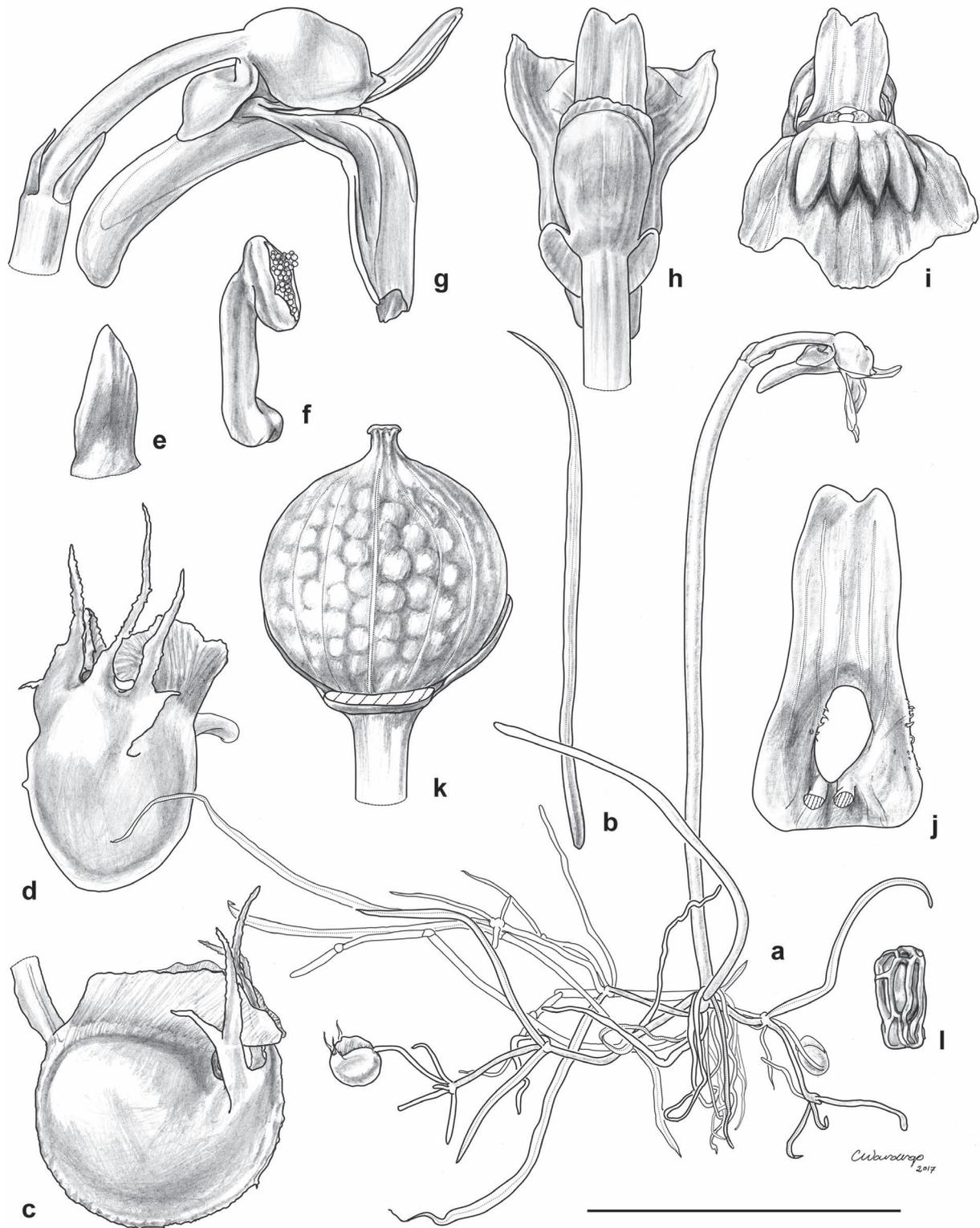


Fig. 11. *U. limmenensis*. **a**, habit; **b**, leaf, adaxial surface; **c**, bladder-trap lateral view; **d**, bladder-trap $\frac{3}{4}$ frontal view; **e**, bract; **f**, stamen; **g**, flower lateral view; **h**, flower dorsal view; **i**, flower frontal view; **j**, corolla upper lip; **k**, mature fruit; **l**, seed. Scale bar: **a** = 10 mm; **b** = 5 mm; **c**–**e** = 2 mm; **f**, **l** = 15 mm; **g**–**i**, **k** = 33 mm; **j** = 24 mm. Material used: (Jobson 3427 & Albrecht, NSW934855).

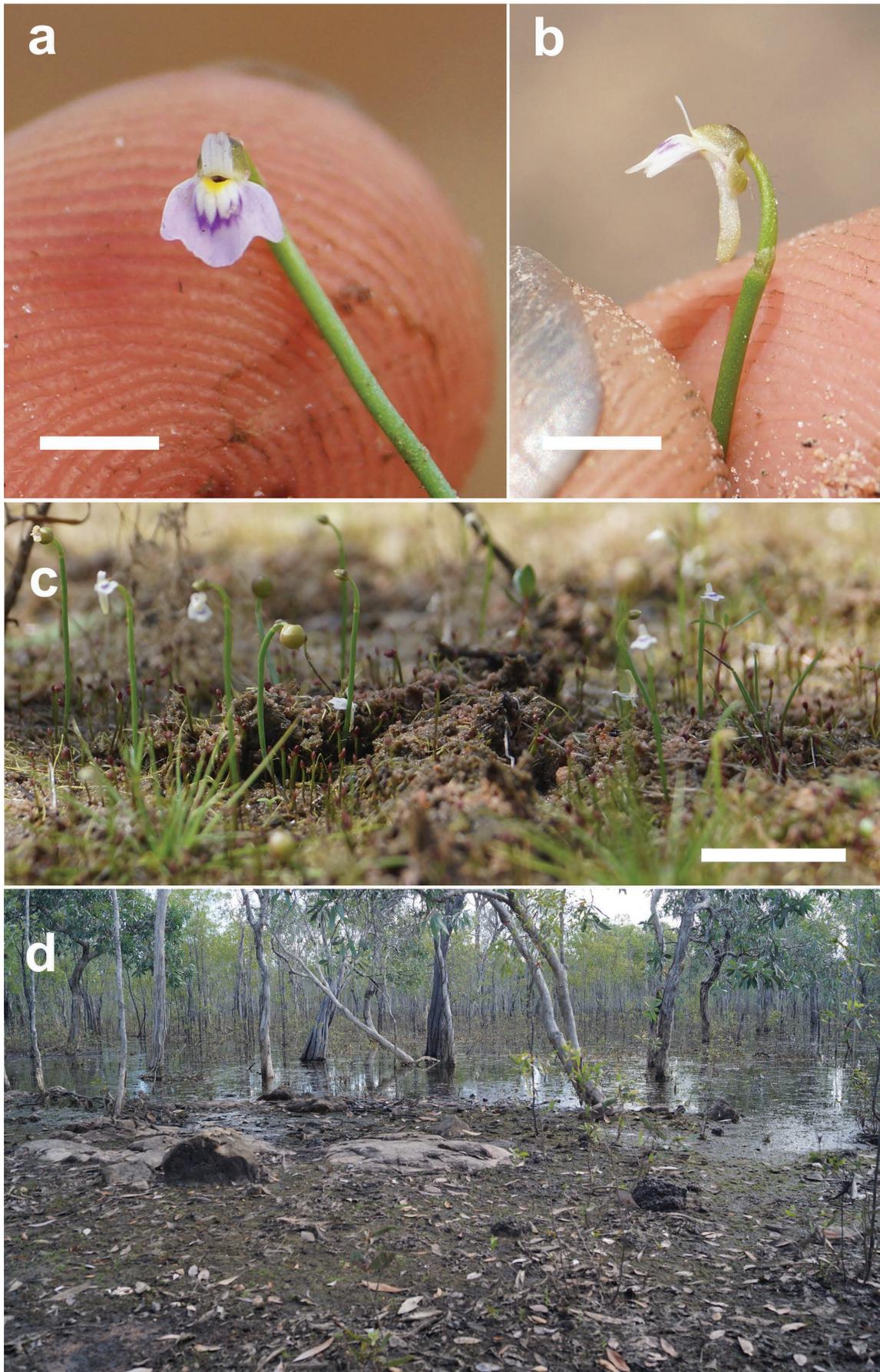


Fig. 12. *U. limmenensis*. **a**, flower frontal view; **b**, flower lateral view; **c**, habit, at type site also showing *U. simmonsii*; **d**, swamp verge habitat at type site. Scale bars: a, b = 2.5 mm, c = 20 mm. Images: R.W. Jobson (*Jobson 3427 & Albrecht*).

Peninsula, and a single poor fragmentary specimen *Gulliver 125* (MEL) with unripe fruits, from the southeast corner of the Gulf of Carpentaria, Qld (Taylor 1989). It is possible that this latter Gulf specimen represents an eastern population of *U. limmenensis*, however a search of the region between the lower reaches of the Norman and Gilbert Rivers is required to determine whether or not this is the case.

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