

***Bulbine fraseri* Kunth (Asphodelaceae) reinstated and distinguished from *B. bulbosa* (R.Br.) Haw. in eastern Australia**

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Summary

Horsfall, P.F. & Albrecht, D.E. (2020). *Bulbine fraseri* Kunth (Asphodelaceae) reinstated and distinguished from *B. bulbosa* (R.Br.) Haw. in eastern Australia. *Austrobaileya* 10(4): 612–620. *Bulbine fraseri* Kunth, a species long placed in synonymy under *B. bulbosa* (R.Br.) Haw. is reinstated for populations occurring on cracking clay plains in parts of Queensland, New South Wales and South Australia. A summary of the morphological features distinguishing the two species is provided, along with a description, illustrations, habitat information and a distribution map for *B. fraseri*.

Key Words: Asphodelaceae; *Bulbine*; *Bulbine fraseri*; *Bulbine bulbosa*; Australia flora; New South Wales flora; Queensland flora; South Australia flora; taxonomy; Eromanga Sea

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Introduction

The genus *Bulbine* Wolf includes approximately 75 species, the majority occurring in sub-Saharan Africa (Byng 2014). Seven species are currently recognised for Australia (CHAH 2019). Watson (1986) divided the Australian species into two informal groups based on longevity and flower size. The perennial “*Bulbine bulbosa* group” was studied in detail utilising cytology, morphology and breeding experiments. This work ultimately led to the recognition of two segregate species, *B. vagans* E.M.Watson and *B. glauca* E.M.Watson. Unlike *B. bulbosa*, these two species, and an additional species *B. crassa* D.I.Morris & Duretto described subsequently, all lack tuber development.

Even with the segregation of these three species from *Bulbine bulbosa*, the latter remains a morphologically and cytologically variable species (Watson 1987). Watson (1986, 1987) drew attention to the morphological distinctness of Queensland (Qld) populations from Hughenden, Blackall

and Springsure, and intimated that they may require “taxonomic segregation” based on their ovoid tuber, partly spreading stamens, acute staminal hairs and longer style.

Recent study of specimens of *Bulbine bulbosa* at the Queensland Herbarium (BRI), together with examination of populations in the field have confirmed the morphological distinctiveness of these Qld populations and revealed additional characters that distinguish them from *B. bulbosa* s.str. Examination of specimens at the Australian National Herbarium (CANB), National Herbarium of Victoria (MEL) and the State Herbarium of South Australia (AD) has also revealed that the distribution of this entity occurs beyond Qld, extending into western New South Wales (NSW) and at least north eastern South Australia (SA).

After consideration of nomenclatural issues and examination of type material it was concluded that the name *Bulbine fraseri* Kunth should be applied to these populations. As a detailed description of this species does not exist currently, one is presented below, in addition to information on its distribution and ecology. A summary of the morphological features distinguishing it from *B. bulbosa* s.str. is also provided.

Materials and methods

This study involved examination of herbarium specimens at BRI and CANB, in addition to dried and spirit specimens in the personal collection of PFH. Images of selected specimens housed at MEL and AD were also examined. Live plants were studied in the field in the Prairie – Muttaborra and Injune areas of Qld, and also in cultivation. All floral measurements are based on fresh, and rehydrated dried specimens. Dimensions are inclusive, i.e. 1.0–1.7 is given as 1–1.7.

Taxonomy

Bulbine fraseri Kunth, *Enum. Pl. [Kunth] 4: 565 (1843)*. **Type citation:** “Nova Hollandia (New South Wales) Fraser legit.” **Type:** “cultivated at Glasgow, Scotland, from a tuber collected in NSW in 1828 by C. Fraser” (lecto: K [right hand specimen on sheet corresponding to *Bot. Mag.* 57: t. 3017 (1830)], *vide* Watson 1987: 468).

Blephanthera hookeri Raf., *Fl. Tellur.* 2: 59 (1837). **Type citation:** “Hooker bot. m.. 3017.” **Type:** “cultivated at Glasgow, Scotland, from a tuber collected in NSW in 1828 by C. Fraser” (lecto: K [right hand specimen on sheet corresponding to *Bot. Mag.* 57: t. 3017 (1830)], *vide* Watson 1987: 468); non *Bulbine hookeri* Kunth, *Enum. Pl. [Kunth] 4: 566 (1843)*.

Geophytic perennial herb, glabrous apart from the stamens. *Tuber* erect in young plants, becoming oblique and finally horizontal in older mature plants, globose in young plants, becoming ovoid to semi-conical and finally cylindrical in older mature plants, sometimes branched, to 12 cm long and 3.5 cm diameter but more commonly *c.* 5 cm long and 3 cm diam., commonly 7–10 cm below ground-level. *Roots* fleshy, brittle, to *c.* 30 cm long and 6 mm wide proximally. *Leaves* forming a basal rosette, succulent, becoming flaccid as plants lose moisture, erect and slightly arching when turgid, with a delicate membranous honey-comb-like pith filled with clear mucous sap at least initially, 27–80 cm long, to 1.4 cm wide at the base, attenuate, smooth, canaliculate, green or faintly

glaucous, paler at the very base, basal leaf margins membranous and translucent, veins not raised externally. *Inflorescences* erect, 1–4 per rosette, 50–120 cm long, unbranched (but occasionally fasciating), flowering progressively up the inflorescence; *scapes* terete, stout, often faintly glaucous; *bracts* lanceolate to subulate, 5–25 mm long, with translucent margins broadening towards the somewhat saccate base, clasping subtending pedicel towards base, fully obscuring young flower buds at apex of inflorescence; *pedicels* spreading, often upturned distally when fruiting, increasing in length and thickness with age, to 40 mm long in fruit. *Flowers* 24–46 mm diameter; *tepals* 6, in 2 whorls of 3, pale to bright yellow with a green central vein on the abaxial surface, sometimes orange-red at the apex; *outer tepals* elliptic, 10.5–22 mm long, 3.5–8 mm wide, entire; *inner tepals* obovate, 10–21 mm long, 5.5–11 mm wide, with minute irregular teeth. *Stamens* 6, the 3 opposite the outer tepals variously orientated – one spreading, the other two erect, leaning towards another stamen or spreading; the 3 opposite the inner tepals all spreading; *filaments* 4.5–9 mm long, yellow, tapering to the anther, obviously compressed near base, with fine acicular acute yellow hairs at least on the distal half; *filament hairs* obscuring at least the basal half of each anther abaxially and with some hairs emerging from between basal lobes of each anther adaxially, increasing in density and length (to *c.* 3 mm long) toward the filament apex, distributed along the filament margins proximally, encircling the filament distally; *anthers* 3–4.5 mm long, yellow, with a pair of basal lobes one third to one half the anther length, attached at the sinus between the lobes, versatile, initially vertical usually becoming horizontal at dehiscence, shrivelling and gently curved post-dehiscence. *Ovary* 1.5–2.5 mm long, 1.5–2.4 mm diameter, 3-locular, 4 ovules per locule, pale creamy yellow to pale green-yellow; *style* aduncate, 6.5–13 mm long (straightened), ± yellow, usually longer than the staminal filaments and protruding through the staminal ring, narrowing towards the apex; *stigma* entire. *Capsule* irregularly globose to broadly or transversely ellipsoid

and abruptly constricted at the pedicel, 5.5–10 mm high, 4.6–8 mm diameter, light green, thinly fleshed. *Seed* 2.8–4.3 mm long, very dark brown to almost black, dull, 3-angled in transverse section, outer face slightly convex, inner 2 faces flat to slightly convex, sometimes slightly tuberculate on one or more faces; *testa* very finely reticulate. **Figs. 1–5.**

Selected specimens examined: Queensland. BURKE DISTRICT: 13 km E of Hughenden, Flinders Highway, Jul 1985, *Williams 85050* (BRI). SOUTH KENNEDY DISTRICT: Mt Coolon Road, 1.3 km E of Power line (14.5 km W of North Goonyella), Mar 1995, *Champion 1187* (BRI); 101 km SW of Mt Coolon, Mar 1995, *Fensham 2689* (BRI); 14 miles [22.5 km] NE of Durdham Downs Station, Aug 1964, *Adams 1248* (BRI, CANB). GREGORY NORTH DISTRICT: 7.5 km S of the Westerton turnoff between Westerton & Warbreccan, Sep 1984, *Chinnock 6079* (AD, BRI, CANB). MITCHELL DISTRICT: S boundary of Edgbaston Reserve, NE of Aramac, Apr 2012, *Bean 31742* (BRI); Isisford district, Feb 1997, *Fensham 3084* (BRI); Kooroorinya Race Track Reserve, c. 50 km S of Prairie, Aug 2016, *Horsfall PFH4700* (BRI). BURNETT DISTRICT: E 116, Narayan, Mar 1973, *s. coll.*, (BRI [AQ487548]). GREGORY SOUTH DISTRICT: 1.5 km SSW of Hammond Downs Homestead, Apr 1984, *Purdie 2099* (BRI, CANB). WARREGO DISTRICT: Coongoola, c. 40 km S of Wyandra, Apr 1936, *Blake 11240* (BRI). MARANOVA DISTRICT: Roma Southern Road, 0.7 km W of Bungeworgorai Creek crossing SSW Roma, Nov 2005, *Eddie CPE987* (BRI). DARLING DOWNS DISTRICT: Oakey rail line, S side of Oakey – Cutella Road, Nov 2001, *Menkins 83* (BRI). **New South Wales.** NORTH FAR WESTERN PLAINS: Tibooburra Road, 5 km SE from Gorge Loop Road (SE of Sturt NP), Nov 2010, *Purdie 7879* (BRI, CANB, NSW). NORTH WESTERN PLAINS: 32 km from Brewarrina on the Goodooga Road, May 1982, *Craven 7447 & Whitbread* (CANB); Meadow plains Road, Come-by-Chance, Feb 1995, *Tann s.n.* (CANB). SOUTH WESTERN PLAINS: 48 km S of Ivanhoe, Oct 1963, *Mulham S91* (CANB); Bundyulumbah, W of Wanganella, Feb 1976, *Mulham W840* (CANB, NSW). **South Australia.** LAKE EYRE BASIN: Coopers Creek, *s.dat.*, *s. coll.* (MEL). NORTH EAST: Throughout Mulyungarie Station toward Quinyambie, Apr 1989, *Bates 18199* (AD).

Distribution and habitat: *Bulbine fraseri* is widely distributed in Qld south of approximately Hughenden and extends southward into western NSW and north-eastern SA (**Map 1**). Most populations occur within the region formerly inundated by the Eromanga Sea that is characterised by heavily weathered marine sediments dating from the Middle Triassic to late Cretaceous (Wecker 1989).

Bulbine fraseri occurs predominantly in climatic areas classified as hot, persistently dry grasslands (Stern *et al.* 2000). All documented populations occur in grasslands on heavy (red, brown or black cracking clay) soil plains, typically dominated by *Astrebla* spp., *Dichanthium sericeum* (R.Br.) A.Camus, and/or *Iseilema* spp. Scattered trees (e.g., *Eucalyptus coolabah* Blakely & Jacobs, *Acacia harpophylla* F.Muell. ex Benth., *A. pendula* A.Cunn. ex G.Don) and shrubs (*Eremophila* spp., *Capparis* spp., *Acacia* spp.) are sometimes present. Associated herbs include *Atriplex* spp., *Daucus glochidiatus* (Labill.) Fisch., C.A.Mey. & Ave-Lall., *Goodenia* spp., *Sclerolaena* spp., *Sida* spp., *Plantago* spp., *Ptilotus* spp. and *Solanum* spp. The soil type at a collection location in SA (Mulyungarie Station, *Bates 18199*) needs rechecking as it is atypical, being described as a rich red loam.

Phenology: Flowering plants can be found at any time of the year depending on the timing of rains. At Kooroorinya Reserve near Hughenden in Qld, flowering plants were observed approximately five weeks after rain.

Typification: Watson (1987) lectotypified *Bulbine fraseri* Kunth and *Blephanthera hookeri* Raf. on the same specimen at K corresponding to *Bot. Mag.* 57: t. 3017. *Blephanthera hookeri* is the earlier name but it is preoccupied in *Bulbine* by *Bulbine hookeri* Kunth, a name that is currently treated as a synonym of *Bulbine glauca* (Raf.) E.M.Watson (Watson 1987). Thus, the earliest available name is *Bulbine fraseri* Kunth.

Fraser did not accompany Allan Cunningham through what is now known as Cunningham's Gap, west to the Darling Downs on the 1828 expedition from the Moreton Bay penal colony. While he had accompanied Cunningham in the ascent of Mt Barney, he returned to Moreton Bay on 11 August 1828, with Cunningham passing through the newly discovered gap on 25 August 1828 (Feeken 1970). So if the time line provenance of the material that Fraser sent to Kew is correct, then it was perhaps collected by Cunningham

or others present and passed onto Fraser. If this is the case, then the material likely originated from somewhere west of the Main Range near the eastern distribution limit for the species north of Oakey.

Notes: *Bulbine fraseri* differs from *B. bulbosa* for a range of characters outlined in **Table 1**. These include a more elongated horizontal tuber in mature plants, spreading stamens (at least those opposite the inner tepals), longer acute acicular staminal filament hairs that occur along a great length of the filaments, longer and more deeply lobed versatile anthers that are attached well above the base, a longer style and larger seeds. In addition, *B. fraseri* tends to have more widely spreading and often distally upturned fruiting pedicels (typically more ascending in *B. bulbosa*) and the thickened roots connected to the tuber are less strongly tapered than in *B. bulbosa*. These thickened roots may act as an additional storage organ and are possibly the

contractile organ that move the plants lower into the substrate. This also appears to be the case for *B. bulbosa* (PFH pers. obs.).

Even with *Bulbine fraseri* segregated from *B. bulbosa*, the latter remains a morphologically variable species, most obviously in the size and stature of plants. Watson's (1986) study also indicates that *B. bulbosa* is a cytologically variable species with 4x (24-chromosome), 8x (48-chromosome) and 12x (72-chromosome) karyotypes known. Many populations of *B. bulbosa s.str.* are less robust than *B. fraseri*; however, some are of a comparable size. *Bulbine fraseri* can produce very large inflorescences, with over 100 flowers per inflorescence counted at the Strathroy Road population near Hughenden. Inflorescence fasciation has been observed in some *B. fraseri* populations. The effected inflorescences continued to elongate, flower and set seed, and approximately 300 flowers were counted on one fasciated inflorescence.



Fig. 1. Flowers of *Bulbine fraseri* (Horsfall PFH4700, BRI) left and *B. bulbosa* (cultivated plant from Chatsworth – Wickliffe Road, 4.5 km N of Chatsworth, Victoria) right, both with the tepals removed. Photo: P.F. Horsfall.



Fig. 2. Typical flower of *Bulbine fraseri* showing stamen arrangement (*Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.



Fig. 3. Typical tuber growth sequence (L to R) in *Bulbine fraseri* from seedling to maturity of five different plants. Note the typical horizontal orientation starting at the second tuber from the left and the growth rings on the large right-hand tuber, indicating an age of at least eight years (population voucher *Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.



Fig. 4. Variation in tuber growth of *Bulbine fraseri*, showing from L to R: a single tuber with four individual shoots, a conglomerate of small tubers, tuber dividing in the same manner as *B. bulbosa*, cylindrical tuber dividing three ways (population voucher *Horsfall PFH4700*, BRI). Note that none of the tubers were growing vertically when removed from the ground. Photo: P.F. Horsfall.



Fig. 5. Population of *Bulbine fraseri* at Kooroorinya Reserve, Qld showing habit and habitat (population voucher *Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.

Bulbine fraseri appears to be more habitat-specific than *B. bulbosa*, with records indicating a close association with grasslands on cracking clay plains. *Bulbine bulbosa* on the other hand occurs on a range of soil types (including sandy loam, clay loam and lithosols), and in various landscape positions (e.g., plains, hillslopes, mountains, creeks, swamps) and structural vegetation types (e.g., woodlands, forests, herbfields, grasslands). On a continental scale occurrences of *B. fraseri* are generally further west and/or north than those of *B. bulbosa*. In contrast, *B. bulbosa s.str.* occurs in south-eastern SA, Victoria, Tasmania, eastern NSW and just extends into the very south-eastern edge of Qld (e.g., Stanthorpe, CANB 107739).

Bulbine fraseri exhibits considerable variation in tuber size and shape, which to a considerable degree is age-related (Fig. 3). Tubers vary from occasionally ovoid to more commonly semi-conical and cylindrical. Long tubers have slight depressions along their length indicating seasonal growth. As the oldest growth wanes the tuber reduces, then withers and rots off. Other less commonly observed tuber variation is illustrated in Fig. 4.

Hoverflies were commonly observed working the flowers of *Bulbine fraseri* at the Strathroy Road (SSE of Hughenden, Qld) and Injune (Qld) field sites. Small native bees were also observed working *B. fraseri* flowers at Injune.

Populations of *Bulbine bulbosa s.lat.* from Hughenden, Blackall and Springsure that were included in Watson's (1986) study are all referable to *B. fraseri*. Watson placed these three populations in the *B. bulbosa s.lat.* 8x (48-chromosome) karyotype group along with populations of *B. bulbosa (s.str.)* from NSW, ACT, Victoria and SA. She also commented on the tendency for some inhomogeneity in the sets of four chromosomes of the Qld populations, indicating that structural change is taking place.

Conservation status: Least Concern (IUCN 2012). *Bulbine fraseri* can be locally abundant and has been observed at Kooroorinya

Reserve (SSE of Hughenden, Qld) in their many thousands (Fig. 5). Even on grazed land plants can be abundant, exemplified by the population along Strathroy Road, where plants in August 2016 were so thick that it was like looking across a field of Canola mixed with Mitchell grass and annual forbs.

Acknowledgements

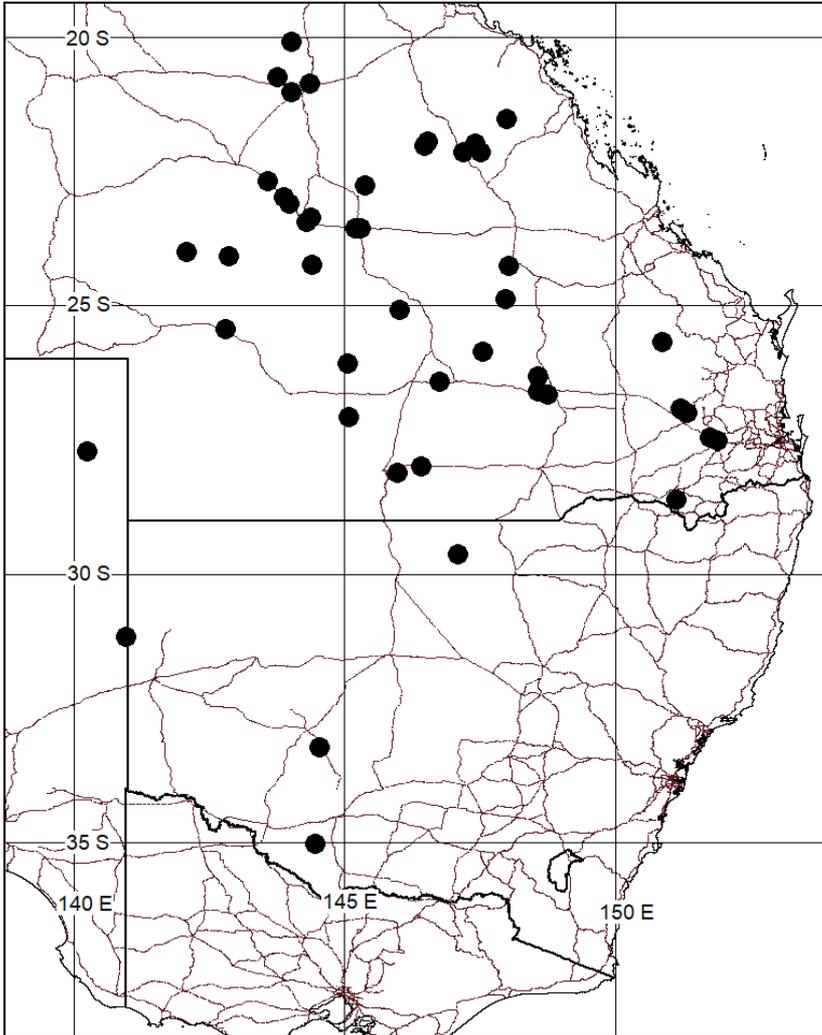
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Table 1. Morphological comparison of *Bulbine fraseri* and *B. bulbosa*

Character	<i>Bulbine fraseri</i>	<i>Bulbine bulbosa</i>
Tuber	Becoming oblique and finally horizontal in older mature plants, ovoid to semi-conical and finally cylindrical in older mature plants, sometimes branched, commonly 5 cm long	Erect, globose to depressed ovoid, to c. 2 cm long
Leaves	Glabrous	Glabrous or sparsely papillose to scabrous, particularly on margins
Outer tepals	10.5–22 mm long × 3.5–8 mm wide	10–20 mm long × 3–5 mm wide
Inner tepals	10–21 mm long × 5.5–11 mm wide	9–18 mm long × 4–9 mm wide
Stamen orientation	The 3 opposite the inner tepals all spreading, the 3 opposite the outer tepals variously orientated	All stamens erect with anthers bunched
Filament hairs	Acicular, acute, the longer hairs 2–3 mm long, distributed along at least the distal half of each filament and sometimes extending to within 1 mm filament base	Weakly clavate, obtuse, < 2 mm long, clustered below anthers, rarely with a few very reduced hairs below to midpoint of filament
Anthers	3–4.5 mm long, with a pair of basal lobes 1/3 to 1/2 anther length, filament inserted at least 1 mm from anther base, versatile, initially vertical usually becomes horizontal at dehiscence, shrivelling and gently curved post-dehiscence	2–3(–3.5) mm long, with a pair of short basal lobes to c. 1/4 anther length, filament inserted with c. 0.5 mm of anther base, not versatile, mostly erect, straight to weakly curved and maintain their shape post-dehiscence but sometimes slightly twisted about vertical axis
Style (straightened)	6.5–13 mm long	3–5.5 mm long
Seed	2.8–4.3 mm long	1.4–3 mm long



Map 1. Distribution of *Bulbine fraseri* in Australia based on herbarium specimens housed at AD, BRI, CANB and MEL. Map courtesy of A.R. Bean (BRI).