

The genus *Aponogeton* L.f. (Aponogetonaceae) comprises over 40 species of rhizomatous or tuberous, fresh-water aquatics from Africa, Asia and Australia, nine of which are recorded in southern Africa (Van Bruggen 1998; Glen & Cook 2003; Cook 2005). For many years, just two species, the familiar *waterblommietjies* or pond blossoms, *A. angustifolius* Aiton and *A. distachyos* L.f., were known from the southwestern Cape, where they inhabit ponds, rivers and ditches at low and middle elevations. In 1983, however, Cape Town botanist Deidre Snijman collected an unidentified *Aponogeton* sp. from a vernal pool on the Bokkeveld Mountains in Northern Cape, South Africa. This attractive little species produces flowers with delicate, membranous tepals in dainty, floating inflorescences that bear a remarkable resemblance to those of *A. ranunculiflorus* Jacot Guill. & Marais, a species endemic to the Drakensberg of southern Lesotho and KwaZulu-Natal (Jacot Guillarmod & Marais 1972). This similarity in appearance led Goldblatt & Manning (2000) to identify the Bokkeveld material with *A. ranunculiflorus*, despite the significant disjunction between the two locations. Examination of fresh material of the Bokkeveld plants collected in the spring of 2007, however, revealed that the two are quite distinct.

Soon after the collection of fresh material from the Bokkeveld, a group of wetland ecologists working on biological monitoring in the southwestern Cape encountered an *Aponogeton* resembling *A. ranunculiflorus* in pools near Elim on the Agulhas Plain. These plants proved to match the Bokkeveld plants in all essential respects, thus extending the known range of the new species considerably. Subsequently, Cape Town botanist John Rourke mentioned that he had encountered what appeared to be the same species in a vernal pool on the West Coast near Philadelphia, some 20 km north of Cape Town, as long ago as 1976. A trip to this locality confirmed its occurrence there, and most recently biologist Nick Helme collected the species from a vernal pool near Darling.

This interesting new species is described here as *Aponogeton fugax*, in allusion to its delicate, short-lived flowers.

***Aponogeton fugax* J.C.Manning & Goldblatt, sp. nov.**

Geophyton aquaticum ex tubere globoso vel bilobo 10–15 mm diam., foliis 5 ad 8 submersis linearibus arcuatis vel sinuosis usque ad  $600 \times 0.8$ –2.0 mm viridibus vel usitate aeneis, inflorescentia fluitanti bifida ex spicis binis utraque 4–5 mm longa 3(4)-flora, constante, spatha ampulliformi rostrata 10–12 mm longa, omnibus floribus fertilibus inodoris, tepalis duobus inaequalibus albis ad basem colore ex carneo albis exterior 5–7 mm diam., late ovato-cordato, interiore  $\pm 1$  mm diam., staminibus 4 suberectis, filamentis  $\pm 2$  mm longis ad basem connatis, antheris  $\pm 1$  mm longis, carpellis 2 subglobosis 2-ovulatis, stylo erecto vel suberecto  $\pm 1.5$  mm longo, folliculis anguste ellipsoideo-fusiformibus  $5-7 \times 2$  mm, seminibus 2 in quoque folliculo fusiformibus 4.5–5.5 mm longis laevis nitidisque.

TYPE.—Western Cape, 3419 (Caledon): Farm Modervlei southwest of Elim, pond on southern edge of Bredasdorp road just west of Voëlvele homestead, (–DB), 28 September 2007, Manning & K. Roux 3114 (NBG, holo.; K, MO, PRE, iso.).

Aquatic geophyte. *Tuber* globular, or bilobed and testicular, 10–15 mm diam., pale brownish. *Leaves* 5–8, submerged, arching or sinuose, linear, elliptical in section, up to  $600 \times 0.8$ –2.0 mm, leathery, aerenchymatous, pale green or more usually bronze-coloured. *Inflorescence* floating, forked, forming 2 opposed spikes, each 4–5 mm long, 3(4)-flowered; peduncle filiform, widening slightly below inflorescence, up to 800 mm long, elastic. *Spathe* flask-shaped with elongate beak, completely enclosing young inflorescence, 10–12 mm long, operculate, basally circumscissile, caducous. *Flowers* unscented, dorsal and subsecund, alternate, all fertile; tepals 2, very unequal, rotund or broadly ovate-cordate, cucullate, membranous, translucent white flushed pinkish at base, evanescent, outer tepal largest, 5–7 mm diam. in lowermost flower but decreasing in size acropetally and up to 4 mm diam. in uppermost flower, inner tepal scale-like,  $\pm 1$  mm diam. *Stamens* 4, suberect; filaments connate basally, subterete,  $\pm 2$  mm long, translucent white; anthers  $\pm 1$  mm long at dehis-



FIGURE 11.—*Aponogeton fugax*, Manning & Goldblatt 3105 (NBG). A, flowering and fruiting plant; B, spathe; C, inflorescence; D, flower; E, gynoecium; F, follicles; G, seed. Scale bar: A, 10 mm; B–D, F, 2 mm; E, 0.75 mm; G, 1 mm. Artist: J. Manning.

cence, brownish green; pollen yellow. *Carpels* 2, subglobose, 2-ovulate; style erect or suberect,  $\pm 1.5$  mm long. *Follicles* narrowly ellipsoid-fusiform,  $5\text{--}7 \times 2$  mm with straight beak  $1.5\text{--}2.0$  mm long, 2-seeded, thin-textured. *Seeds* fusiform,  $4.5\text{--}5.5$  mm long, yellowish brown, smooth and shining. Flowering time: (late July) August–September. Figure 11.

*Distribution and ecology:* *Aponogeton fugax* is known from several scattered locations in the southwestern Cape

(Figure 12): from vernal pools on the Farms Avontuur and Willemsrivier on the Bokkeveld Mountains near Nieuwoudtville in Northern Cape; from two vernal pools on the West Coast north of Cape Town in Western Cape; and from several temporary and permanent waterbodies that form part of the drainage basin of the Uintjieskuil and Nieuwejaars Rivers on the Agulhas Plain southeast of Elim. Plants grow in silt or clay in shallow water, about 10 cm deep on the Bokkeveld but up to 120 cm deep on the West Coast and Agulhas Plain, with the leaves



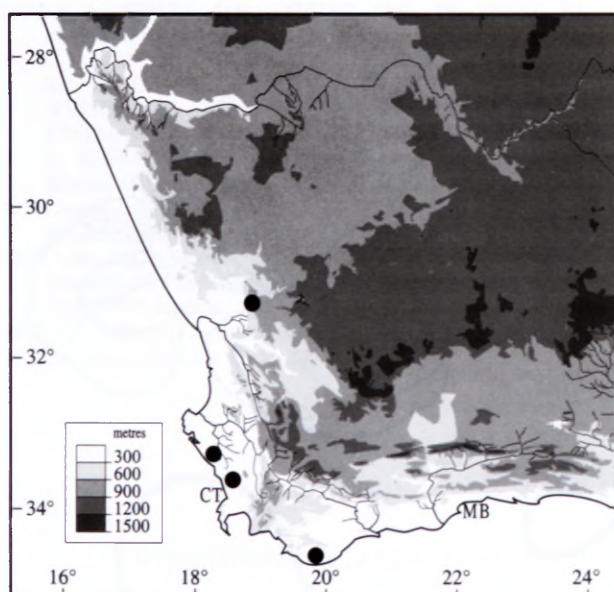


FIGURE 12.—Known distribution of *Aponogeton fugax*.

completely submerged and trailing. The Bokkeveld and West Coast plants, and those in Waskraalvlei near Elim grow in waterbodies that dry out completely as soon as two months after flowering, whereas in Uintjieskuil the plants form part of a permanent aquatic community in a deep waterbody over one metre deep. The scattered distribution of *A. fugax* is closely matched by the small, annual, hygrophilous grass genus *Prionanthium* Desv., with a single species each endemic to the Bokkeveld Escarpment, the West Coast, and the Cape Flats and Overberg (Davidse 1988).

The inflorescence of *Aponogeton fugax* floats on the surface of the water, with the outermost tepals of the lowermost flower on each of the paired spikes acting as buoyancy floats, one on each side. The tepals in the Bokkeveld population are especially delicate and surface tension spreads the lower two tepals out flat on the water surface, whereas in the southern populations all the tepals remain suberect and the inflorescence is thus  $\pm$  cupped. The flimsy tepals do not persist in fruit and the infructescence sinks to the bottom as it matures.

*Aponogeton fugax* occurs in several different aquatic plant communities, in many instances in the company of other narrow Western Cape endemics. On the Bokkeveld it is found together with *Spiloxene aquatica* (Hypoxidaceae) and *Romulea multisulcata* (Iridaceae), and on the West Coast it occurs with *Cadiscus aquaticus* (Asteraceae) and *Crassula natans* (Crassulaceae). On the Agulhas Plain, *A. fugax* is known from at least four localities. At the type locality, the species grows together with *Crassula natans*, *Limosella grandiflora* (Plantaginaceae) and *Aponogeton distachyos*; further south in Waskraalvlei it grows in shallow water on clay in a dense population of the aquatic sedge *Isolepis striata*; on the Uintjieskuil farm it has been found in a small farm dam together with *Nymphoides thunbergiana* (Gentianaceae), species of *Potamogeton* (Potamogetonaceae) and *Oxalis natans* (Oxalidaceae), the latter a range extension for this rare species; and in the Melkbospan area it was found in temporary water between tussocks of *Chondropetalum tectorum*

(Restionaceae), *Eragrostis plana* (Poaceae) and *Eleocharis limosa* (Cyperaceae). It appears therefore that the species has a relatively wide ecological range, from temporary to permanent water, and on various substrates, from limestone to ferricrete to shales.

The delicate, short-lived flowers and submerged leaves raise the possibility that careful examination of other vernal pools along the West Coast, such as those around Hopefield, may reveal additional populations of *Aponogeton fugax*. We have, however, failed to locate any early collections of the species in BOL or SAM, where we would have expected to find evidence of the species from the Cape Peninsula and surrounding Cape Flats should it ever have occurred here in view of the extensive holdings in these herbaria of aquatics from Isoetesvlei and other vernal pools on the Flats. We therefore conclude that *A. fugax* did not grow on the Peninsula and surrounding Cape Flats in historical times.

Small differences between the known populations suggest that they have been isolated for some time. The Agulhas plants have narrower leaves, at most up to 1 mm wide, slightly firmer tepals that remain suberect, and styles that are erect and parallel. The leaves of the Bokkeveld plants are broader, up to 2 mm wide, the tepals are very membranous, such that the lowermost are drawn onto the water by surface tension, and the styles are divergent. The West Coast plants are similar to those from the Bokkeveld, with leaves up to 2 mm wide and flowers with slightly divergent styles. These morphological differences between the southern and western populations indicate that they have been isolated from one another long enough to have diverged genetically. The morphological differences between the populations are consistent with either long-distance dispersal or with vicariance events. Considerably greater areas of the coastal plains were exposed during lower sea levels during Pleistocene glaciations, and the concomitant cooler climates would almost certainly have resulted in more temporary pools than persist today, providing a greater number of suitable habitats for the species than currently available, as well as continuity between the western and southern populations.

Agricultural transformation of the Western Cape lowlands places this species at high risk and only some of the Bokkeveld locations are currently conserved.

**Diagnosis and relationships:** *Aponogeton fugax* is a very distinct species in the genus, characterized by its long, shoelace-like leaves and short, paired spikes bearing three (rarely four), subsecund flowers in two rows on the adaxial side. Each flower has two, very unequal, membranous tepals, four stamens, and two, bi-ovulate carpels. *A. fugax* is the only species of *Aponogeton* known in which this reduction in stamens and carpels has been observed (Cook 2005), and the reduced numbers of stamens and carpels, together with the anisopetalous perianth, are significant autapomorphies for the species.

The bifid spikes and secund, distichous flowers with spreading tepals longer than the stamens are unusual in the genus but are shared with the other two southern African winter rainfall species, *Aponogeton angus-*



*tifolius* and *A. distachyos* (Obermeyer 1966), and the second flowers in particular suggest a relationship with them. Both of these species, however, have leaves with floating blades,  $\pm$  fleshy tepals, and six or more stamens per flower. In addition, the seeds of these two species are characterized by a distinctive, spongy testa, whereas the seeds of *A. fugax* are smooth, like those of other species in the genus.

Although the dainty, floating inflorescence with membranous tepals of *Aponogeton fugax* bears a striking superficial resemblance to that of *A. ranunculiflorus* from tarns on sandstone in the high southern Drakensberg of KwaZulu-Natal and Lesotho, the two species differ in their vegetative morphology and in fundamental details of their inflorescence and flowers. The leaves of *A. ranunculiflorus* are fusiform, 3.5–4.0 mm in diameter and only 50–100 mm long; the simple, highly condensed spike comprises heteromorphic flowers, with the lower sterile and reduced to solitary tepals, the central flowers with paired, equal tepals, and the uppermost flowers lacking a perianth. The fertile flowers have 6 stamens and 3 carpels each, and the follicles are globose and  $\pm$  2 mm in diameter. The congested, heteroflorous spike of *A. ranunculiflorus* and the globose follicles are evidently autapomorphies for the species. The spirally inserted flowers of *A. ranunculiflorus* preclude any direct alliance with *A. fugax* and its relationships appear to lie rather among other species with spirally inserted flowers, notably *A. stuhlmannii* Engl. and *A. vallisnerioides* Baker (Jacot Guillarmod & Marais 1972). The congruence in the appearance of the inflorescence between *A. fugax* and *A. ranunculiflorus* is remarkable but the numerous fundamental differences in inflorescence form, floral insertion, and structure of the flowers themselves indicate that it is best interpreted as the result of convergent evolution and not as an indication of close affinity.

#### *Additional specimens examined*

##### *Aponogeton fugax*

NORTHERN CAPE.—3119 (Calvinia): Farm Meulsteenvlei [Willemsrivier], west of Nieuwoudtville, (–AC), 7 September 1983, *D. Snijman* 749 (NBG); Farm Willemsrivier, west of Nieuwoudtville, vernal pool alongside R27, 800 m, (–AC), 23 September 2007, *Manning, Goldblatt & L.J. Porter* 3105 (NBG, MO); northeastern edge of Kromvlei on Farm Avontuur 641, 15 km NW of Nieuwoudtville, (–AC), 5 August 2008, *Helme* 5520 (NBG); large pan on Farm Inhoek 637, (–AC), 5 August 2008, *Helme* 5521 (NBG).

WESTERN CAPE.—3318 (Cape Town): Darling, seasonal pan 0.3 km E of Darling Golf Course, (–AD), 22 July 2008, *N.A. Helme* 5517 (NBG); Philadelphia, Farm Tierhoogte, pool on western edge of N7 opposite farm entrance, (–DA), 2 October 2007 [sterile], *Manning & Rourke* 3115 (NBG).

##### *Aponogeton ranunculiflorus*

LESOTHO.—2929 (Underberg): Sehlabathebe National Park, Matsa a Mafikeng, 2 450 m, (–CC), *F.K. Hoener* 2150 (NU); Sehlabathebe National Park, 2 250 m, (–CC), 17 January 1983, *G.C. Matthews* 981 (NBG).

KWAZULU-NATAL.—2929 (Underberg): within  $\frac{3}{4}$  km of Lesotho border at Sehlabathebe National Park, down from the Devil's Knuckles, (–CC), 14 January 1979, *F.K. Hoener* 2164 (NU); vicinity of Tarn Cave above Bushman's Neck, 8000 ft [2 400 m], (–CC), 21 November 1983, *Hilliard & Burt* 16824 (NU).

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#### REFERENCES

- COOK, C.D.K. 2005. *Aquatic and wetland plants of southern Africa*. Backhuys, Leiden.
- DAVIDSE, G. 1988. A revision of the genus *Prionanthium* (Poaceae: Arundineae). *Bothalia* 18: 143–153.
- GLEN, R.P. & COOK, C.D.K. 2003. Aponogetonaceae. In G. Germishuizen & N.L. Meyer, *Plants of southern Africa: an annotated checklist*. *Strelitzia* 14: 971. National Botanical Institute, Pretoria.
- GOLDBLATT, P. & MANNING, J.C. 2000. Cape plants. A conspectus of the Cape flora of South Africa. *Strelitzia* 9. National Botanical Institute, Cape Town & Missouri Botanical Garden.
- JACOT GUILLARMOD, A. & MARAIS, W. 1972. A new species of *Aponogeton* (Aponogetonaceae). *Kew Bulletin* 27: 563–565.
- OVERMEYER, A.A. 1966. Aponogetonaceae. *Flora of southern Africa* 1: 85–92.
- VAN BRUGGEN, H.W.E. 1998. Aponogetonaceae. In K. Kubitzki, *The families and genera of vascular plants. IV Flowering Plants. Monocotyledons*: 21–25. Springer, Berlin.

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