Managing low genetic diversity in *Acanthocladium dockeri*

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Acanthocladium dockeri, or the Spiny Daisy, is the only species in the genus *Acanthocladium* (Asteraceae) and is endemic to Australia. Until recently it was thought to be extinct, but in August 1999 it was rediscovered about 6 km east of Laura in the mid-north of South Australia (Jusaitis and Bond 1999). Three populations were found within a radius of about 4 km, and a further population was discovered 70 km further south, near Brinkworth. All four populations (named Thornlea, Yangya, Hart and Rusty Cab) occur along roadsides, and the total number of plants was recently estimated at 2900 (Robertson 2002).

Each population is relatively small and compact in structure. Excavation of plants at each site revealed that plants multiplied vegetatively by root suckering (Jusaitis and Bond 1999; Figure 1). To date no seedlings have been observed at any population site. These observations raised the possibility that each population may be more or less clonal. At best, poor seed production and seedling recruitment, combined with an inherent capacity for vegetative proliferation, suggested that genetic diversity within each population was likely to be low.

We carried out allozyme studies which confirmed that *A. dockeri* is clonal, possessing only a single genotype at each of the four known population sites. Thus, the recent survey estimate of 2900 plants in four populations (Robertson 2002) considerably overestimated the true number of genetically distinct individuals. We also showed that even though *A. dockeri* flowers prolifically, very few viable seeds were produced. This extremely low level of sexual reproduction appears to be related to low pollen viability and germination. Approximately 0.2% of pollen grains were capable of germination. Grains that did germinate showed extremely slow, sometimes deformed growth of the pollen tube.

Poor seed set in an otherwise apparently healthy population can be an indicator of possible clonality or a lack of pollinators (Peakall and Sydes 1996). However, a range of pollinating insects were observed working flowers of *A. dockeri* at the Hart population, and so it is unlikely that pollination is a problem.

Implications for conservation management

The apparent lack of genetic diversity at each population site, extremely low levels of seed set, population growth by clonal reproduction rather than seedling recruitment, and degraded roadside habitats potentially menaced by weeds and grazing, all combine to threaten the long-term persistence of *A. dockeri*. With the low number of remnant populations, each comprising a single genetic clone (genet), the loss of any one population would result in a substantial (25%) reduction in the genetic diversity remaining within the species.

Therefore it is crucial to preserve all four remaining genets in their respective habitats, ensuring each population is secure and local threats are eliminated or controlled. Management actions for this vegetatively regenerating species should be designed to optimise vegetative recruitment (Coates *et al*. 2002) and prevent loss of habitat. As a first step, roadside markers have been installed at each *A. dockeri* population site to alert road-maintenance workers to the presence of a significant site requiring sensitive care and appropriate operational procedures.

Vegetative proliferation of shoots from an underground root of A. dockeri *exposed by digging. Photograph: Manfred Jusaitis*

A comprehensive *ex situ* collection encompassing the full extent of known genetic diversity is possible for this species because of the clear-cut geographical segregation of genets. A single plant could be taken from each population and multiplied through vegetative propagation. We also need to urgently find more populations which may contain new genets with superior fertility. If male fertile individuals are found, the introduction of fertile pollen into male sterile populations could help to reintroduce fertility to these populations.

The clonality of these *A. dockeri* populations also has important implications when planning plant translocation programs. There is little point in augmenting existing populations, given their clonal nature. Populations already appear to be at their optimal density given present levels of competition, and there seems to be nothing preventing them from expanding further. And with such poor seed set there is no advantage in mixing genetically distinct clonal populations. Preliminary trials showed no improvement in fecundity when clones from Hart and Thornlea were crossed together. Furthermore, we do not understand the potential consequences of mixing genotypes from different populations of *A. dockeri*. Therefore we recommended avoiding mixing genets in natural populations, until we understand such interactions better.

There may, however, be a valid argument for spreading risk or enhancing population security by developing new populations of *A. dockeri* through translocation to secure sites. Transplants may be derived either vegetatively (cuttings or tissue culture), or from seed collected at one or more populations. Seedlings will tell us more about the reproductive system of this plant, and may furthermore present an opportunity to introduce fertility back into the population. However, before starting large-scale translocations like this, the possible consequences of segregating *vs.* mixing genotypes or provenances should be evaluated using carefully planned experimental translocations designed specifically to study competitive, reproductive and genetic outcomes (Jusaitis 1997).

References

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Saving the Ridged Water-milfoil

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Last year, I came across an unusual plant in a small granitic rock pool on a parcel of unreserved Crown land controlled by the Loddon Shire Council. The area adjoins the southern boundary of the Terrick Terrick National Park and was formally a granitic gravel quarry. This management left the landscape with a 'pock-marked' appearance, creating numerous small ephemeral waterholes; ideal habitat for the annual aquatic herb Ridged Water-milfoil (*Myriophyllum porcatum)*. I was searching potential habitat for the species, and this find, although only 10 square metres in size, was particularly exciting as it increases the known populations in the Terrick Terrick National Park area by 50%.

Myriophyllum porcatum is perhaps one of the Victorian Riverina's most unique species. It is found in some of the Murray River's tributaries and small farm dams, and all the way up to the ephemeral granitic rock-pools on top of Terrick Terrick National Park. While this does not sound particularly extraordinary *per se,* what is special about *M. porcatum* is expressed in the Recovery Plan: "there are fewer than 250 plants remaining in approximately nine wild populations" in Victoria (Murphy, 2003; see Figure 1).

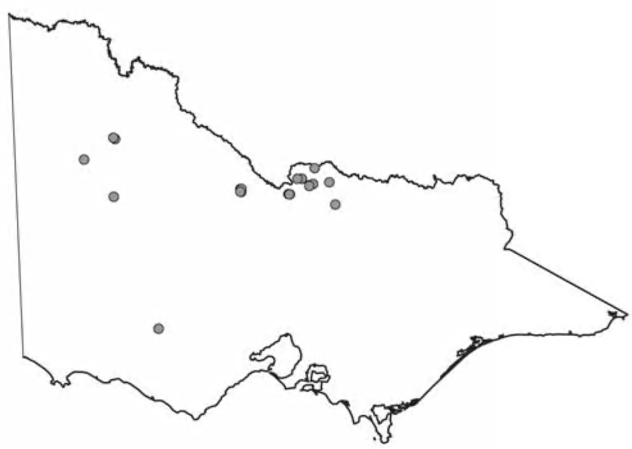

Figure 1: Known populations of Ridged Water-milfoil in Victoria.