

Hand pollination of a single female wild asparagus *Asparagus prostratus* plant near Ferrybridge in Dorset, using pollen taken from plants in Cornwall, southwest England

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SUMMARY

Hand pollination of an isolated female wild asparagus *Asparagus prostratus* plant using pollen taken from males in two distant colonies proved successful with 44 berries (73% overall pollination success rate) producing 92 seeds. The subsequent germination of the planted seeds the following spring was high (90%). A re-introduction project using these propagated plants is likely to be carried out in suitable habitat close to the female plant in 2008.

BACKGROUND

Morphological and genetic evidence has shown that perennial wild asparagus, *Asparagus prostratus*, can be treated as a separate species to garden asparagus, *Asparagus officinalis*, of which until recently it was considered a subspecies. This adds weight to the argument that wild asparagus, a UK SAP (Species Action Plan) and Red Data Book species generally protected under the Wildlife and Countryside Act 1981, should be specifically protected; wild asparagus is classed as 'endangered' in the UK (Cheffings & Farrell 2005). The National Trust is the lead partner for the SAP, as most wild asparagus plants in the UK can be found on Trust-owned land. As a result, the Trust and other key partners are endeavouring to ensure the maintenance of the geographic range in Britain and Ireland, and also the restoration of small populations of fewer than 10 plants.

Endemic to Western Europe, dioecious wild asparagus is found on coastal dunes and cliff tops in open grassy vegetation. Wild asparagus occurs in the Channel Isles, on the northern Spanish and western French coasts, in Belgium, Holland, Ireland, and previously in Germany. On mainland Britain it is found at

28 sites, of which several are small populations. These include five in Cornwall, one in Dorset, three in Glamorgan and one in Pembrokeshire. The larger colonies have reasonably stable populations, while the small ones have populations in decline. Factors which may account for declines include lack of management e.g. under grazing allowing dense grass swards to dominate; over-grazing; visitor trampling eroding cliff-top habitats; invasion of habitat by Hottentot fig *Carpobrotus edulis*; a low rate of vegetative spread; and the perpetual problem of loss of genetic variation (anon 1998). Although there is no direct evidence, field observations strongly suggest that natural pollination of the plants by insects tends to be very low. This is due to several factors including: few pollinators; low flower production; unfavourable (low) temperatures with damp and windy weather during the flowering season; and the fact that the plants of different sexes can be spatially isolated. This means that sexual reproduction is limited, although wild asparagus also slowly spreads through vegetative reproduction from the rhizomes.

Low pollination levels in wild asparagus results in low numbers of seed and this is also suggested as a reason for population declines.

This is a recurring cycle, with small populations less and less likely to undergo natural pollination as their numbers decline. For this reason, at a site in southern England with a single known surviving female plant it was decided to attempt hand pollination using pollen from male plants from two distant colonies.

ACTION

Study site: At a locality between Ferrybridge (also known as Ferry Bridge) and Small Mouth in Dorset, southern England, the wild asparagus population comprised a single female plant. The nearest males available for cross-pollination were over 300 km away at sites in Cornwall in the extreme southwest of the country. This female plant (Fig. 1) is a survivor from a previously large population present at nearby Portland. In May 2005 'wild asparagus workshops' (King *et al.* 2007) were held and discussions led to this pollination project, which it was hoped would fulfil one of the aims of the wild asparagus SAP, by pollinating the female Dorset plant and then using the seeds produced to propagate young plants for restoration of this colony.



Figure 1. The Dorset female plant with flowers to be pollinated, June 2006 (Photo: Bryan Edwards\DERC)

Hand pollination: The project employed a contractor (funded by Natural England and the National Trust) to pollinate the Dorset plant using a hand pollination method trialled previously during the wild asparagus workshops, and to subsequently record results, extract seed for propagation, and monitor the germination of new plants. Male flowering spikes were collected from donor sites in Cornwall: Tubby's Head (near St Agnes

approx. 320 km west of Ferrybridge) and Cadgwith (on the Lizard Point approx. 330 km west-south-west of Ferrybridge).

Six to eight flowering shoots (mostly those with 'ripe anthers') from a single male from each of the two donor sites were cut near to the ground and transported by car (on 2 June 2006 from Tubby's Head, and 9 June 2006 from Terrick Colt, Cadgwith) on the same day to the Dorset female to pollinate her. The male shoots were not rooted or grown but were kept in a vase of water during the journey. Due to the heat within the car, any slightly closed flowers opened up. Once the hand pollination had been undertaken the male shoots were left lying by the female plant - ants (Formicidae) were observed to be attracted to the flowers at the donor sites, so it was thought the same might be the case at the Dorset site and therefore that they might further assist pollination. Each individual pollinated flower from the Tubby's Head male was marked with a short length of red cotton thread tied around the pedicel (flower stalk), and those pollinated from the Cadgwith locality with blue cotton thread likewise.

Monitoring: All resultant berries were monitored until they ripened and turned bright red in the early autumn, when they were harvested. Berries were harvested on 4 and 13 September and those from different males were kept separate to elucidate any differences in pollination success rates and future germination. Seeds were stripped from their berries, rinsed and sown in seed trays in potting compost (John Innes no. 2) the day after harvesting, and put in a cold frame in shaded conditions for the winter. The success of the pollination was measured by calculating the percentage of fruiting berries. Germination success of the seeds being propagated was monitored during the following spring (2007).

CONSEQUENCES

Berry and seed production: Results of the hand pollination and subsequent germination of seeds produced are summarised in Table 1. A total of 44 berries developed (73% overall pollination success rate); 19 were pollinated from the Tubby's Head male (63% success) and 25 from the Cadgwith male (83% success). Figure 2 shows two mature fruits that developed from hand pollinated flowers.

The total number of seeds produced within these berries was 92, with little variation in the

Table 1. Summary of results of hand pollination of wild asparagus at Ferrybridge in 2006 and subsequent seed germination in spring 2007.

Male donor site	Berries produced	Flowers producing berries (%)	Number of seeds produced	Average number of seeds/berry	Number of young plants	Germination success (%)
Tubby's Head	19	63	43	2.26	40	93
Terrick Colt near Cadgwith	25	80	49	1.96	43	88
Total/averages	44	73%	92	2.09	83	91%

numbers between the two pollen donor sites: Tubby's Head had an average of 2.26 seeds per berry, whilst Cadgwith had 1.96. Most berries contained one or two seeds, with some larger berries containing four or five seeds. These numbers are lower than the average from data presented at the wild asparagus pollinator workshops (2.5 seeds per berry) possibly because of the prolonged hot, dry weather that prevailed after the pollination in June 2006 (assumed to be favourable) at these localities.



Figure 2. Dorset female plant with fruits, September 2006. The cotton thread attached to the pedicel indicates that the flowers were hand pollinated (Photo: Bryan Edwards\DERC)

Germination: The seeds germinated in spring 2007. Germination success was high (93% derived from Tubby's Head pollen; 88% from Cadgwith). The sexes of these plants will not be identifiable until the plants flower, which although no data is currently available is considered to be in two years at the earliest,

but probably within 2-3 years given present knowledge of the growth and time to reach maturity.

Project promotion: The project received positive press coverage; including pieces in four national newspapers, which it is hoped will help to increase the profile of the plants.

Conclusions: The hand pollination of the lone Dorset female wild asparagus plant using pollen derived from males from distant colonies in Cornwall was deemed a great success. A re-introduction project as part of the UK SAP using plants propagated from the resultant seeds is likely to be carried out in suitable habitat close to the Dorset female plant in 2008.

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