

Paterson's curse

This case study is the primary source of information on potential pollination services for the industry. It is based on data provided by industry, the ABS and other relevant sources. Therefore, information in this case study on potential hive requirements may differ to the tables in the Pollination Aware report (RIRDC Pub. No. 10/081) which are based on ABS (2008) *Agricultural Commodities Small Area Data, Australia 2005-06*.

Introduction

Paterson's curse (*Echium plantagineum*), also known as 'Salvation Jane' in South Australia, is a winter annual from the Mediterranean that was introduced to Australia from Europe during the mid-nineteenth century and which quickly became a problematic and invasive weed. Paterson's curse reduces the value of pastoral land and natural environments, is toxic to grazing animals, can reduce the market value of hay and grain and is believed to be responsible for many human health issues associated with the large pollen quantities it produces as well as the rough hairy texture of the leaves and stems which can cause skin irritation (Gov.ACT 2009).

The plant is an erect herb, commonly 60cm high but growing up to 150cm with vegetation growing as a rosette and producing distinctive trumpet-shaped flowers that are predominantly purple in colour, however, white, pink and blue flowering plants

are sometimes found (Gov.ACT 2009).

The plant is currently cultivated overseas in Europe, the UK, Canada and the USA for seed oil (which is high in omega-3 and omega-6 fatty acids) and breeding research is achieving toxin-free plant varieties (Duke 2004). There is potential to introduce low-toxin or toxin-free varieties into Australia both for cultivation (for seed oil) and for cross breeding with wild varieties to reduce their toxicity in the long term. As honey bees are particularly attracted to Paterson's curse, there could exist major economic benefits for the agricultural industry and for the honey bee industry: the production of honey free of toxic pyrrolizidine alkaloids; the generation of an industry where honey bees are required for crop pollination; and finally, as a predictable floral nectar resource for apiarists (Duke 2004).

Paterson's curse in Australia

Paterson's curse is a significant problem in Australia, covering approximately 33 million hectares of land mostly across the southern states and costing the agricultural industry as much as \$300 million each year (CSIRO 2006).

The plant thrives in the Australian climate, particularly in regions where climate is dominated by winter rainfall and areas that have experienced disturbance, such as pastoral land. The plant is also a prolific seeder, often producing more than 5,000 seeds per

plant per year. These seeds may remain dormant for up to five years and will accumulate in the soil over a number of years with 30,000 seeds per square metre having been reported in some cases (Naughton et al. 2006). Additionally, the plant can be found at any time of the year in all stages of growth, with a high tolerance to drought and an ability to adapt to a large range of soil moisture levels (DPI.Tas 2008).



Pollination in Paterson's curse

Paterson's curse has been described as self-compatible, meaning that pollen tube growth in the ovule will occur from both self- and cross-pollination. Autogamy (self-pollination) is possible, although it is not predominant in Paterson's curse with the majority of seed developed through pollination by insects, in particular the honey bee (Duke 2004).

A study conducted in Canberra by Davis (1992) measured the types of floral visitors to Paterson's curse flowers and the

degree of pollination achieved between bagged and non-bagged treatments. Honey bees were the dominant floral visitors and made up 93.5% of all foraging insects recorded on unbagged flowers during the experiment. Additionally, the experiment demonstrated significantly lower numbers of pollen tubes (usually none) in the permanently bagged flowers compared to those that were open to honey bees and also showed that flowers were equally well pollinated by bees foraging for both pollen and nectar.

Potential for Paterson's curse

Despite the many costs associated with Paterson's curse, there is scope to transform the noxious weed into an economically valuable cultivated crop, low in or completely absent of the harmful pyrrolizidine alkaloids it contains (Duke 2004). The plant is already cultivated overseas in Europe, the UK, Canada and the USA where breeding research is achieving toxin-free plant varieties and the market for the seed oil (which is high in omega-3 and omega-6 fatty acids) is growing (Duke 2004). In Australia, the University of Sydney is undertaking research to try and transform the noxious weed into a cropping alternative.

If low-toxin or toxin-free varieties were developed and introduced into Australian farming systems, not only could the crop be harvested for its seed oil and other valuable commercial products but crossbreeding with wild varieties of Paterson's curse could be seen as a possible solution to the weed problems by reducing the gene pool for high-toxin-producing varieties.

Paterson's curse is already a very attractive floral resource to honey bees and subsequently a valuable resource to the honey

industry, with the large amounts of pollen generated during flowering which is necessary to build up bee numbers in a short amount of time and a high quality of nectar which provides an early flow of honey to apiarists (Gov.ACT 2009). It could be projected, that given the significant contribution honey bees make to the generation of seed set (Davis 1992), in the long term the honey bee industry could aid in the crossbreeding of non-toxic cultivated varieties with the wild toxin-containing plants.

Crossbreeding and reducing the toxicity of wild Paterson's curse would not only have major economic benefits to the agricultural industry with the production of fodder safe for stock to eat and higher quality seed oil, but would also have major economic benefits for the honey bee industry. These include: the production of Paterson's curse honey which is free of pyrrolizidine alkaloids (an issue which has received attention for human health reasons); the generation of an industry where honey bees are required for crop pollination; and, a predictable floral nectar resource for apiarists (Duke 2004).



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Conclusion

Paterson's curse is a weed that is widespread in Australia and thrives in Australian climatic and soil conditions. Attempts to control the weed are often unsuccessful and eradication in the long term is not feasible at this stage, meaning a new approach to the problem is required. The way in which the plant thrives in the Australian environment could be seen as part of its potential as a cultivated crop and which would have major economic benefits for Australia.

The purpose of this case study was to raise awareness to the potential economic benefits for Australia with the introduction of cultivated Paterson's curse, in particular to the honey bee industry which would not only benefit from the cultivated crops but would aid in the crossbreeding to reduce the gene pool of toxic wild species and indirectly provide economic benefits for other industries such as agriculture.

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The full report and 35 individual case studies are available at www.rirdc.gov.au.





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