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The weed war... and the biological weapon

by Dr J. K. Scott*

Plants become weeds when they grow in the wrong place, or in such abundance as to be of nuisance to man. This is often because man has changed the plants’ original habitats, or aided their spread to new environments.

Yet weed species are not usually a problem in their countries of origin. The basis of most biological control studies is discovering why this difference exists.

Often the reason is because insects and diseases control a plant’s growth or reproduction. If suitable insects or diseases can be discovered they are tested to determine whether they only damage the weed species and not crop or pasture plants. Only then are such insects or diseases released into an area where the weed is problem.

Past biological control of weeds in Australia

The world’s best known example of biological weed control is the destruction of prickly pear in eastern Australia during the first half of this century. The first attempt at biological control was in 1903. This was not successful. By 1925 this cactus weed had covered more than 20 million hectares of farm land.

Researchers made further studies of the prickly pear in its natural habitat. This lead to the discovery of some 160 species of insects associated with the weed. Of these, 51 were imported into Australia between 1921 and 1935, and 13 became established. One species, the cactoblastis moth, was spectacularly successful and caused the collapse of vast areas of prickly pear by 1940 (Doed 1940, Mann 1970).

In more recent times a successful biological control programme has been launched against skeleton weed in eastern Australia. Three arthropods, the chondrilla gall mite, the chondrilla gall midge and the chondrilla root moth, as well as a rust fungus, have been released to combat the weed. The rust fungus was the most successful, especially against the narrow-leaved form of the weed. There are other forms of the weed: intermediate-leaved and broad-leaved. These are being examined in Europe for other varieties of rust and insects to introduce into Australia (Sheldon 1980). Marsden and others (1980) made a cost-benefit analysis of the skeleton weed control programme, assuming control of the weed and using the average price of wheat between 1970 and 1975. By calculating the area involved, the increased productivity and other economic factors, they estimated a probable return of 140 times the cost of the research.

Other biological control programmes have resulted in partial success against 15 other weeds before 1960 and partial success against five others since then (Waterhouse 1979). Most of this research effort has not involved Western Australia because the weeds investigated so far are not problems here. This State has a research programme on biological weed control but it was started only in recent years. During this time there have been three attempts to release insects to control weeds here. One was against Calotropis procera (rubber vine) and another was the release of the weevil Perapion antiquum against Emex spp. (doublegee). Neither of these programmes was successful. However, insects have been established successfully against Hypericum perforatum (St. John’s wort).

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Current and future biological control of weeds in Western Australia

Only one programme, aimed at doublegee and dock, is under way and this is discussed in another article in this issue.

Another weed which could be controlled in the near future is Echium plantagineum (Paterson’s curse or salvation Jane). Research workers at CSIRO have discovered four insects suitable for release on Paterson’s curse. One is a leaf-mining moth, two are flea beetles which eat leaves and one a root-boring beetle. However, there is conflict of opinion over the desirability of a biological control programme against Paterson’s curse. The flowers are ideal for honey production and occasionally, the plant itself serves as pasture for sheep. Presently there is an injunction against the release of insects. A future case in the South Australian Supreme Court involving CSIRO and beekeeping associations will decide the fate of biological control of this weed.

Other weeds which could be controlled by biological agents in the future are:

- Calotropis procera (rubber vine);
- Parkinsonia aculeata (parkinsonia);
- Rumex spp. (docks);
- Tribulus terrestris (caltrop).

However, successful control is many years away because of the research needed on these weeds and their biological control agents.

How effective is biological control of weeds?

Biological control programmes take a minimum of eight years from the decision to investigate a new weed, through to measurable success. The development of new herbicides often takes as long. If a biological control programme is successful then there are no further costs involved. The insects or diseases continue to control the weed. In contrast herbicides have to be applied at regular intervals.

The effect on a weed of attack by insects or infection with diseases is to lower the abundance or vigour of the plant. Unfortunately the degree of damage to the plant is not known beforehand. What researchers hope is that the insects or diseases will weaken the plants to the extent that competing species of plants are favoured. The gamble is that useful pasture or crop species will be encouraged as opposed to other weed species.

Another advantage of the use of biological control agents over herbicides is that they will seek out patches of weed not on agricultural land or patches of weed likely to be inaccessible to herbicides.

Biological control offers an excellent long-term solution to weed problems. But such problems are often more immediate, needing integrated control measures. Integrated control is the compatible combination of two or more effective methods to control a pest species. For weeds, this may include herbicides and biological control agents. In the long term, successful weed control will involve insects or diseases with sporadic increases in weed abundance controlled by herbicides or other means.

The possibility that insects or diseases will attack crops or other non-target plants after the weed’s abundance is reduced, is a cause of concern. Research workers at CSIRO have developed techniques to test a biological control agent’s ability to attack crops of other plants. All biological control agents released in Australia in recent years have gone through this screening process.

Obviously there are still some risks but so far no deliberately released biological weed control agents have become a problem in Australia.

In summary, the use of biological agents to control weeds is safe. It offers long-term possibilities of good control, but takes time to develop. However, the weed control is never total and occasionally herbicides and cultural methods may be needed.

References


Prickly pear, the subject of Australia’s first big biological control success.