Making biological control less hit-and-miss

Biological control—the use of organisms to control others that have become a nuisance to Man—has had its successes both in Australia and overseas. Australian scientists have been looking for biological control agents for many pests for much of this century. Even so, not all introductions have proved successful, and such investigations are expensive. So any procedure that increases the chances of success will also yield financial savings.

Dr Tony Wapshere of the CSIRO Division of Entomology has put forward a procedure that he successfully used when looking for control agents for skeleton-weed—that scourge of our southern wheat belts. He is the Officer-in-Charge of the Division's Biological Control Unit at Montpellier in southern France.

With the wisdom of hindsight, Dr Wapshere's method may look like little more than common sense. In the past, searches for biological control agents have often concentrated on organisms—usually insects—that have successfully controlled the noxious weed in some other country. But such organisms have not always thrived under the different Australian conditions.

Dr Wapshere's approach was different. He argued that the greatest array of organisms that attack the plant most effectively will occur at the plant's evolutionary centre, where its population is most diverse. Often this evolutionary centre will be in a region with a climate similar to that where the plant has become a problem weed. So there is the place to start looking for biological control agents.

Screening all possible ones occurring there would often be an enormous task, so Dr Wapshere suggests that it's best to discover which ones seem to be damaging the plants the most and to concentrate on these.

This approach certainly should work for finding agents to control weeds like Paterson's curse (*Echium lycopsis*), which is considered a problem over large areas of south-eastern Australia. Its centre of evolution is in southern Portugal—an area with a climate very similar to south-eastern Australia's. However, the approach had to be modified for skeleton-weed, whose evolutionary centre is located in rather colder southern Russia.

Under such circumstances, Dr. Wapshere suggests, the organisms to concentrate on are those that do the most damage at the evolutionary centres, and that also occur in regions with climatic conditions similar to the weed-infested region. It's therefore necessary to carefully survey the environmental conditions of the weed-infested region before even starting to look for biological control agents.

In southern Russia, only four of the nine organisms that damage skeleton-weed most, and yet attack no other plants, also occur in the small widely separated pockets in mediterranean Europe and the Middle East with climates similar to the southern Australian wheat belts. Three of these four have been successfully introduced into Australia, apparently with great success. One, the rust fungus *Puccinia chondrilla*, spread throughout the Australian range of skeleton-weed in only one season—an unprecedented occurrence in biological control.

Finding an effective biological control agent is useless if the organism attacks other plants, especially crops. The common approach to testing their safety is to bring them into contact with a very large number of different plants in the laboratory. If these aren't attacked, the organism is considered safe.

Dr Wapshere favours a simpler technique. The organisms were originally selected in the field because they seemed to affect only the weed species. They are most likely to attack close relatives of the weed species. So all potential agents should first be tested on the locally occurring species most closely related. Those passing this test must then be tested against other relatives of the weed, and subsequently, as a further safety check, against unrelated species. Those attacking the most closely related test plant are tested to see if they have a broad host range. If so, they are discarded.

A protocol for programs for biological control of weeds. A. J. Wapshere. *PANS* 1975, **21**, 295–303.

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