Strategies for the improvement of pathosystems


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A pathogen seldom eliminates its host species from a particular ecosystem and biocontrol agents seldom attain desired levels of weed control in agronomic systems. Molecular manipulation of biological control agents may increase the impact of these pathogens on pest populations. Virulence enhancements include development of binary pathogen systems, excretion of common metabolites inhibitory to normal plant metabolism, or resistance to pesticides such as glyphosate. In addition, herbicide resistance also facilitates the application of biological control agents in tank mixes. Moreover, molecular techniques enhance pathogen management. Directed mutations in structural or pathogenicity genes result in modification of host range or pathogen survival. Molecular markers such as pesticide resistance and DNA fingerprints expedite pathogen identification, as well as verification of the efficacy of a particular biocontrol agent.

Are pathogens better than insects for use against summer annual weeds such as Heliotropium europaeum?

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Summer annual weeds present particular problems for potential biological control agents and any other natural enemies by showing highly unpredictable abundance in both time and space during the growing season and passing much of the year as a dormant soil-seed-bank. Many of their natural enemies either pass long dormant stages in their life cycle or attack alternative hosts. Given the need for agent specificity, what kinds of insects or pathogens can a) survive the long dormant periods, b) track weed outbreaks and c) respond to these outbreaks with a rapidity necessary to inflict lasting control? Forty-five years ago CSIRO started a biological control programme against the toxic pasture weed Heliotropium europaeum (common heliotrope; Boraginaceae). Three insects and two fungi later, although we are still awaiting some impact on the weed, we have learnt much about agent potential. Insects, initially given priority, all failed to either pass specificity testing or to establish. Pathogens, belatedly considered as more likely agents, have also been shown to require particular characteristics necessary to track and respond to the weed. For example, the sexual cycle in Uromyces heliotropii, necessary to track its host through dormancy, prevents a rapid response to high host abundance. Only asexual Cercospora spp. have the capacity to produce infestation-destroying epidemics. The poster summarized the history of this programme and compared the effectiveness of two contrasting pathogens for the biological control of this annual weed.