# PRODUCTION

Biocontrol:

## Nature's checks against ag pests

By Gord Leathers

If you travel west of Brisbane, Australia to the village of Boonarga, you may be surprised to find they've erected a monument in their town hall to the memory of a hero who rescued rangeland agriculture from certain disaster. Their champion is barely the size of a corn kernel, a tiny red grub with unassuming black spots. It's the larva of the Cactoblastis moth, the little David that brought to an end the most spectacular and most devastating escape in the history of agriculture.

The villain in this tale is the prickly pear cactus, which first hit the shores of Botany Bay almost 200 years ago, brought in by Capt. Arthur Phillip of the British First Fleet. Phillip hoped to establish a dye industry based on the South American cochineal insect. The cochineal feeds on the prickly pear and at maturity is ground up and a bright-red dye is extracted. It was used to color British military uniforms and, up until then, Spain and Portugal had held the corner on the cochineal dye market.

Other species of prickly pear were also brought in as hedge plants and as possible rangeland fodder for the fledgling livestock industry. Tough, hardy and drought resistant, the prickly pear held great potential to supplement animal feed during dry times in a parched land.

That's when the prickly pear began its slow, creeping conquest of western Australia. It grew very well in its new home and the hedges flourished. Excess pieces of the plants were broken off and dumped in the bush where they quietly took root and started growing, because the plant could reproduce vegetatively and produce seeds. Windblown lobes of cactus began finding their way into the deep ranges, where they thrived. The ripe fruits were eaten greedily by indigenous emus, which spread the seeds far and wide. By 1925 some 60 million acres of rangeland were under three to six feet of prickly pear cactus and subsequently abandoned. Cost of control was $25 to $100 an acre on land that was worth a great deal less.

In 1925 two entomologists went to visit the prickly pear on its home turf. The idea was to find out what kept the cactus in check and whether that would work in Australia. Cactoblastis cactorum, a moth from Argentina, laid its eggs on the cactus. The larva would hatch and begin feeding on the lobes. As they burrowed into the soft flesh they would open up the cactus to bacterial and fungal infections and the once-impervious cactus would weaken and die.

In March 1926, two million Cactoblastis eggs were sent to 19 localities in eastern Australia. The moth was an immediate success and by 1940 only small pockets of the prickly pear remained. Occasional flare-ups of the cactus are now quickly contained by naturally occurring populations of the moth and what constitutes balance in the New World is keeping cacti in check in the cattle country of Australia.

This is a textbook example of biological control: a natural enemy, a disease or an infection is introduced into a pest population to keep it in check. This is exactly what happens in a natural ecosystem where the wild versions of both our agricultural species and their pests live in some constantly shifting form of balance. In the perverse ecology of agriculture the checks and balances have been disrupted and the annual boom in food results in an annual boom in pest numbers. With weeds, the annual clearing of competing plants does the same thing. Farmers have to impose an artificial stability on this wobbly system by using pesticides, crop rotation and biological control.

There are two fundamental types of biological control, classical and epidemic. The prickly pear story is an example of the classical approach, where a control agent is released into the system and it keeps the pest in check over the long term. There is still prickly pear cactus in Australia but the

Cactoblastis moth keeps the numbers to well below the economic threshold. It's been doing this for over 60 years at no cost to farmers. The classical approach is working well here too, with such pests as leafy spurge, controlled by a species of flea beetle, and the nodding thistle, for which we imported a seed-eating weevil.

The classical approach works well in rangeland and pasture where the ground is mostly left alone. In crops, however, the level of ecological interference is high, the stability is low and biological control is something of a new frontier. Work with a wasp that controls orange wheat blossom midge is under way in Saskatoon and the results look promising. Another wasp is being used to check populations of cabbage seed pod weevil, a coming threat to Manitoba canola, and the results are promising there too.

Another approach is the more subtle disruption of mating, by raising males, sterilizing them with gamma rays and then releasing them to mate with wild females. These unsuccessful matings produce no eggs and the pest dies out. This has been very successfully done to control codling moths, a serious pest of apples and pears in the orchards of British Columbia.

Another new idea for controlling orange blossom wheat midge is ready for testing in Saskatchewan. The female midge emerges from the ground and emits a sexual pheromone to attract a male. They mate and she lays her eggs in the wheat flower. A chemical ecologist from Simon Fraser University has isolated and synthesized the pheromone. The proposed next step is to wait for the midges to emerge and then cover the area in a pheromone fog that will completely confuse the males and make it impossible for them to find the females. If they can't find the females they can't mate and no mating means no eggs. The trials have been postponed due to the drought but will proceed when the climate is right.

Other work in Saskatoon pits a soil bacterium against wild oats and green foxtail and the results are very good. The bacterium stunts the root growth of these two weeds and makes them unable to compete with the field crops. Since they don't get a good start they simply can't finish. The bacteria doesn't affect the crop and it disappears over the course of the year. Since the mode of attack is twofold, the bacterium is harder to deal with than a pesticide. Resistance is useless.

Biological control can be a powerful new tool in the farmer's arsenal, but it's no silver bullet either. Pests, both insects and weeds, are tough and resilient with a long genetic history of survival under the conditions we provide for them. The real trick to managing pests is to hit them from all angles: pesticide one moment, predators another; tillage one year and crop rotation the next. In these ways we can keep our pests off balance and still minimize the impact on the environment and on the farmer's pocketbook. ❑