COPING WITH PESTS IN THE SOUTH AFRICAN SUGAR INDUSTRY

M KEEPING

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Current and possible future pests

Eldana saccharina

The pyralid moth, *Eldana saccharina*, has been established as an industry-wide pest in South African sugarcane since the early 1970s and the current annual loss due to this pest is now estimated at R50 million. Successful management of the insect has never been achieved and it is highly unlikely that eldana will ever be eradicated.

Several aspects of its life history make it difficult to control: the damaging stage of the life cycle, the larva, is cryptic due to its boring habit; the eggs are well concealed by laying females; the species has evolved effective defences (e.g. encapsulation) against parasitoids; it is multivotine, making it difficult to target a particular generation for control over a discrete period of time.

Chilo sacchariphagus

Chilo sacchariphagus occurs in Mozambique and, with the revival of the sugar industry in that country, the possibility exists for the pest to spread into other southern African sugar industries. Consequently, pheromone traps have been established in the northern regions of South Africa and Swaziland, to detect and monitor any spread into this country. A small culture of its natural parasitoid (*Xanthopimpla stemmator*) is being maintained for possible release against the pest.

White grub

White grub is a chronic pest in some parts of the sugar industry and reports of damage associated with white grub have increased. An industry-wide survey has been established to assess the extent of these pests.

Successful control of eldana (in particular) will require a multi-faceted or IPM approach; i.e. we need to use all suitable control measures in the most effective combination possible. However, it should be borne in mind that, although massive expenditure on the problem will not guarantee success, no expenditure will guarantee failure.

Varietal resistance

In terms of reducing the economic damage caused by pests, our primary aim is to breed varieties of sugarcane that are resistant to eldana, but are still high yielding. Presently, this is the most promising means of control of eldana.

There are two basic approaches to the development of resistant varieties at SASEX:

1. **The identification of resistant varieties produced by the Plant Breeding programme:** In this regard, the priority is to develop screening techniques which firstly are reliable, and allow improved confidence in selections, and secondly, fast, enabling more varieties to be screened (from earlier stages in the breeding programme), and providing a more complete history of resistance.

   The use of Near Infrared Reflectance (NIR) already shows promise for identifying various phenotypic markers (e.g. waxes, fibre, bud flavonoids) for resistance; this technology could be extended to other constituents such as silicon and rind. However, the usefulness of these constituents as NIR predictors of resistance is dependent on the degree of heritability and the influence of the environment on such traits.

   Since high fibre is associated with low sucrose yield, we need varieties that are resistant for reasons other than fibre. Hence, it is important to identify novel sources of resistance (e.g. epicuticular waxes, secondary plant compounds, plant kairomones) to broaden the base of resistance. Multiple resistance mechanisms would also provide a 'back-up' should any particular mechanism break down under field conditions.

   Self-trashing ability may confer some resistance in influencing the survival of eldana eggs and young larvae. Self-trashing varieties are still being tested against eldana; if the trait proves worthwhile, a genetic marker would assist in identifying varieties expressing it in the future.

2. **Genetic engineering of resistant varieties:** Resistance resulting from gene products involving only a single protein may be easier for the pest to evolve resistance to; consequently, it may be necessary to consider appropriate resistance management strategies that prevent the pest from developing resistance.

Insecticides

The commercial viability of insecticide use against eldana will depend on the balance between the cost of insecticides and their effectiveness in reducing damage. If properly used, insecticides have significant potential.

Although eldana breeds throughout the year, it may be possible to optimise the timing of insecticide application to coincide with peaks in the most susceptible stage of the life cycle (young larvae), which presumably follow soon after peaks in moth numbers. To achieve this, a more efficient local monitoring technique, using a pheromone trap, is being developed.

If insecticides are a viable control option, choice of insecticide will be important. Environmentally, less persistent insecticides are preferable, but the correct timing of application becomes more critical.

Biocontrol

Eldana feeds on a range of host plants. So where cane became available as a new food resource alongside its original habitat, eldana moved into and exploited this resource as well. Although 'reconstruction' of its original habitat may not induce eldana to move out of sugarcane and back into its original habitat, habitat management or reconstruction may enhance or re-establish field populations of potentially good biocontrol agents for eldana. Populations of effective predators could also be enhanced with laboratory reared individuals.

Although an effective control agent (parasitoid or predator) for eldana has not yet been found, this does not mean that one does not exist. An effective control agent could have a major impact. Research indicates that indigenous host plants, rather than crops where eldana is a pest, are the most likely species to support effective parasitoids with a long history of association with eldana. Hence, the strategy now is to concentrate searches for parasitoids on these.

Although importation of foreign agents is still an option, a more critical assessment of the potential of imported parasitoids, based on prior experience, is required.

Crop loss

Growers need some means of determining at what stage of crop growth or age the risk of further eldana damage is likely to become unacceptable in terms of projected loss in yield. This entails the development of a model which expresses the relationship between eldana damage, yield loss and crop age, allowing the prediction of crop loss at various ages, given an initial level of infestation.

Future challenges

It is important to understand that (as for pathogens and their host plants) the pest-host plant relationship is a dynamic one. In other words, we must always be aware of a number of possible eventualities: (1) pest populations go through cycles, which vary according to climatic and other conditions; (2) new pests may arise due to changing environmental conditions or accidental introduction; (3) existing low-level pests may become serious pests within a relatively short period; (4) existing pests may adapt to new control measures (e.g. new varieties).

This means that new challenges may arise quite unexpectedly and, to deal effectively with these, our pest management strategies need to be flexible, enabling timely intervention when new pest problems appear.