BIOLOGICAL CONTROL OF *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE) IN SUGARCANE IN SOUTH AFRICA: 15 YEARS OF RESEARCH

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A review of progress of the South African Sugar Association Experiment Station's 15-year old biological control programme against *Eldana saccharina* Walker is given. Two approaches to controlling this borer, a 'new association' and 'modified' classical biocontrol approach, are summarised. Constraints identified as limiting the successful establishment of 10 egg, 12 larval and 2 pupal 'new association' parasitoids obtained from the USA, Colombia, Bolivia, Mexico, Indonesia, Taiwan, Germany, Switzerland, India and South Africa, include:

Host incompatibility

The egg parasitoids *Trichogramma braziliensis*, obtained from *Helicoverpa zea* and *Diatraea* spp.; *Trichogrammatoidea armigera* from *Helicoverpa armigera*; *T. cryptophlebia* from *Cryptophlebia leucotreta* and *Telenomus* sp. from *Diatraea* sp. showed no interest in *E. saccharina* eggs presented to them in the laboratory. A similar lack of response was observed with larvae presented to the tachinids *Sturmiopsis inferens, Metagonistylum minense* collected from *Diatraea* sp., and *Lydella* sp. collected from *Eureoma loftini* and the braconids *Cotesia flavipes* from *Chilo partellus* and *Digonogastra kimballi* and *Macro-centrus prolificus* from *Diatraea* sp. and *E. loftini*.

A 'half-way' point in host acceptability was also encountered. The tachinid *Lixophaga diatraeae* and the braconids *Rhaconotus roslinensis* and *Allorhogas pyralophagus* accepted *E. saccharina* larvae as hosts but, in each succeeding laboratory generation on the new host, fewer offspring were obtained. This led to the assumption that the new host lacked some component necessary for the parasitoids to successfully colonise and live on *E. saccharina*.

Climatic incompatibility

The only new association larval parasitoid that completely accepted *E. saccharina* as a host, the tachinid *Paratheresia claripalpis*, could not be established in South African sugarcane fields, despite thousands being released in different regions of the sugarcane belt. The founder colonies of this parasitoid were collected in Brazil and Colombia. Using the computer program CLIMEX, it was clear that the areas where these parasitoids were collected in their home countries did not match the climate of our sugar belt.

Poor ecological and biological life history knowledge

In most instances, *E. saccharina* egg batches have plant material covering their abaxial and adaxial surfaces. Only the eggs on the perimeters of the batches are therefore exposed for possible parasitism. Field observations proved this. When parasitised egg batches were found, only the eggs on the edges of the batches were parasitised. At 26°C, it takes seven days for a young *E. saccharina* larva to hatch. The trichogrammatids used in the new association approach took an average of nine days to emerge from parasitised eggs. The Scelionids took 14 days at the same temperature. When young *E. saccharina* larvae hatch they are scavengers, and have been seen to eat any unhatched eggs in the batches from which they emerge, as well as empty chorions of the same batch. Because they emerge earlier than the parasitoid, it is highly likely that *E. saccharina* larvae destroyed any parasitised eggs before the parasitoids had emerged.

Incorrect parasitoid searching ability

E. saccharina eggs are difficult to find in the field situation. They are cryptically hidden in the lower third of the cane plant. All the egg parasitoids used were collected from hosts which do not conceal their eggs, and which lay their eggs on green leaf material normally in high light intensity areas. The parasitoids were thus not searching areas where *E. saccharina* would normally lay eggs.

Hyperparasitism

The Eulophid, *Tetrastichus howardii*, belongs to a group that are known to be parasitoids and hyperparasitoids. *T. howardii* was very effective at parasitising *E. saccharina* pupae in the laboratory. It was also tested against *Paratheresia claipalpis* pupae, tachinid pupae obtained from trash caterpillar larvae and the cocoons of *Cotesia sesamiae*, a braconid parasitoid of *Sesamia calamistis*. In all cases *T. howardii* acted as a hyperparasitoid, and because of this was not released into South African sugarcane fields.

The three egg and seven larval 'modified' classical biocontrol parasitoids that could be reared in the laboratory had constraints such as parasitising ability, host habitat differences and differing host behaviour in different habitats, to overcome. Initial incorrect host identifications added further constraints. Research undertaken against this indigenous insect pest thus shows that biological control is difficult.

Knowledge of constraints as identified during this programme has permitted more sound research decisions to be made in the current biological control approach. It has also provided other workers with identified constraints before embarking on similar projects, thus enabling them not to repeat steps unnecessarily.

Keywords: biological control, *Eldana saccharina*, parasitoids