QUARANTINE SERVICES OFFERED BY THE PLANT PROTECTION RESEARCH INSTITUTE IN CONNECTION WITH BIOLOGICAL CONTROL OF ELDANA BORER

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Abstract

The hazard of unintentional importation of unwanted insects, weeds or pathogens and how this may occur is mentioned. A list is provided of those insects which have been introduced by the South African Sugar Association Experiment Station as possible biocontrol agents against the borer *Eldana saccharina* Walker, and which were quarantined by Plant Protection in Pretoria. Quarantine procedures and handling techniques are outlined, and special reference is made to insects involved in the eldana borer programme.

Introduction

The purpose of handling imported entomophagous insects under quarantine conditions is to prevent any concurrent introduction of undesirable species of phytophagous insects, hyperparasites, weed pests or plant diseases (De Bach[1]). Phytophagous insects all over the world tend to fill the ecological areas which are suitable for them. These insects are often restricted to certain areas by climatic barriers, and they are usually attacked by a complex of indigenous natural enemies which prevent pest populations from increasing above certain economically acceptable levels.

In cases where these natural enemies are eliminated by insecticides for instance, the phytophagous insects may become serious pests. The increasing use of insecticides during the past few decades has led to serious problems such as the build up of insect populations which are resistant to insecticides, secondary pests becoming major pests due to the elimination of natural enemies, fast recurrence of pests after spraying because natural enemies were destroyed, and pollution of the environment.

These problems led to more serious attempts at controlling insect pests by biological methods. Phytophagous insects become serious pests because mortality factors, such as natural enemies, may be wanting or absent. The aim of biological control, therefore, should be to augment natural enemies by importing parasites and predators which do not exist in South Africa. If possible such biological control agents should come from countries in which the pest species originated.

Importations should be controlled very carefully. Natural enemies collected in the field from other countries are usually conveyed together with their host and host plant material. This makes it possible for new pests, new strains of pests or pests with different adaptations from those occurring here to be introduced into South Africa. It is also possible that hyperparasites may be introduced with the consignment, and may seriously interfere with efficient biological control by the released parasite. Hyperparasites may attack indigenous natural enemies which would lead to outbreaks of the pest. Plant diseases could also be imported on plant material enclosed in shipments and this illustrates the need for introduced natural enemies to be handled under quarantine conditions. The Plant Protection Research Institute in Pretoria is therefore responsible for screening all introductions of insects.

Introduction by the South African Sugar Association Experiment Station of natural enemies which have been screened by the Plant Protection Research Institute.

Since 1977 the PPRI has been actively involved with the biological control programme of the South African Sugar Association Experiment Station against *Eldana saccharina* Walker. The following species have been received, screened and successfully reared for at least one generation at the quarantine laboratory in Pretoria before they were forwarded to the South African Sugar Association Experiment Station.

1. In July 1977 a tachinid, *Descampsina sesamiae* was introduced from India.
2. In January 1978 a trachinid, *Sturmiopsis inferens* was introduced from India.
3. In August 1978 a braconid, *Apanteles flavipes* was introduced from Brazil.
4. In November 1979 three trichogrammatids, *Trichogramma australicum, Trichogramma perkinsi* and *Trichogramma semifumatum* were introduced from Colombia.
5. Four consignments of eldana parasites were received from the Ivory Coast in 1980 and 1981. These consignments included *Telenomus* sp. *Trichogrammatoidea eldanae; Trichogramma* sp., *Uscana* sp. *Goniozus* sp. and *Syzeuctus* sp.
6. A consignment of tachinids was received from Ghana in November 1981. These were sent to the South African Sugar Association Experiment Station as puparia.
7. In February 1982 a consignment of *Trichogramma australicum* was received from Taiwan.

Procedures and Handling Techniques

Strict control by means of a permit system is exerted on the importation of insects. Permits must be obtained from the Division of Plant and Seed Control after consultations with the PPRI on the desirability of the insects and on the availability of quarantine facilities at PPRI.

The quarantine laboratory is the first line of defence against undesirable importations and a very important link between the foreign collecting of natural enemies and the production programme for dispersal. The success or failure of importation programmes often depends on the training, dedication and resourcefulness of quarantine personnel (De Bach[1]) who should be well disciplined and trained in handling procedures. All packaging including plant material and other possible carriers of harmful organisms must be incinerated or autoclaved.

1. *Segregation of field material*

   Imported material is usually put into sleeved cages to facilitate handling of the insects. Material collected in the field often consists of more than one species and/or strain, which must be separated. The four consignments from the Ivory Coast contained four egg parasites, and

techniques had to be developed to separate them. This was done on the basis of time of emergence from the eldana egg as this differed considerably between species.

2. *Techniques for rearing the insects*

The success of the importation of species of entomophagous insect depends on the ingenuity of quarantine personnel to devise methods to rear the insects within a very short time since they do not live very long. It often happens that quarantining is required for species about which little or nothing is known. For example the tachinids that were imported needed special treatment because single males and females had to be shaken together in a tube in bright sunlight before they would mate. The age of the males and females was also very important since day-old males mated better with freshly emerged females. Gravid females then had to be dissected and the maggots from them had to be placed on host larvae. Special techniques had to be devised to rear *Apanteles flavipes*. Cane had to be planted in Pretoria to provide suitable conditions for the adult parasite to parasitize host larvae in cane segments.

The rearing of *Telenomus* sp. from the Ivory Coast posed some problems because they parisitized only eldana eggs. The egg batches presented to *Telenomus* were never 100% parasitized and larvae that emerged from unparasitized eggs fed on the parasitized eggs and nearly destroyed the *Telenomus* culture. Techniques to sterilize eldana eggs had to be found and they are now frozen and subjected to UV irradiation before being presented to the parasites. The effect of factors such as temperature, relative humidity and photoperiod on rearing insects must all be considered.

3. *Host cultures*

An integral part of a quarantine laboratory is the maintenance of a number of insect cultures that may serve as hosts, or alternative hosts, for the imported parasites. Large numbers of hosts are necessary to rear these parasites; and host cultures should be part of the infrastructure of a quarantine station as it would take too long if a new culture was started for each importation.

3. Egg parasites like the *trichogrammatids* are usually reared on a number of alternative hosts such as *Phthorimaea operculella* and *Sitotroga cerealella*, so laboratory cultures of these are essential. For parasites such as *Telenomus*, which are host-specific, a culture of the natural host may be needed; alternatively the host eggs should be provided by the importer, which was the case when *Telenomus* sp. was imported from the Ivory Coast. Eggs from the South African Sugar Association Experiment Station at Mount Edgecombe had to be supplied to Pretoria on a regular basis.

Other host cultures which are maintained at PPRI are *Chilo partellus, Heliothis armigera* and *Galleria mellonella*. The different stages of these hosts are often used to rear introduced parasites. The tachinid parasites introduced for *Eldana saccharina* were successfully reared on *Chilo partellus* larvae while the eggs of *Heliothis armigera* were often used as an alternative host for egg parasites.

It may also become necessary to provide food plants for these host cultures when the insects concerned cannot be reared on an artificial diet.

4. *Recording*

Details of each importation must be carefully recorded, ie. country of origin, host range, distribution, percentage emergence, hyperparasites, and notes on biology and sex determination. Details of field releases and of their successes or failures are also very useful for further evaluation of the suitability of these parasites. Preserved specimens of all imported insects should be kept since a valuable collection of parasites with their biological details is established in this way.

Conclusion

It is clear that the quarantine laboratory plays a very important role in any biological control programme. The experience in rearing entomophagous insects as well as the infrastructure of rearing facilities and host cultures is essential for the successful importation of entomophagous insects. Such experience and infrastructure is available at the PPRI and has benefited the South African Sugar Industry. No less than 12 insect parasites and predators of eldana have been successfully imported into this country during the past few years.

REFERENCE

1. DeBach, P. (1970) ed. *Biological control of insect pests and weeds.* Chapman and Hall, London.