

BIOLOGICAL CONTROL OF COCONUT PESTS

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Coconut, Cocos nucifera L., occupies about 412,000 ha (1 million ac) of land in Sri Lanka, and is a major plantation industry. Its contribution to the national economy is well documented and has been about 5% of the total GDP in 1982. Sri Lankans consume as much as 116 coconuts per annum, which provide about 22% of the daily caloric intake. It is also the main source of dietary fat and appears to be the sole source of fat for the lower income groups.

The coconut palm is attacked by a number of insect pests. The coconut caterpillar, Opisina arenosella, (Lep. Cryptophasidae), (earlier referred to as Nephantis serinopa), the Red Weevil, Rhynchoporus ferrugineus (Col. Curculinidae), the Coconut Scale, Aspidiotus destructor, (Hom. Diaspididae) and the Black Beetle, Oryctes rhinoceros (Col. Scarabaeidae) are the important pests at the moment. The coconut leaf miner, Promecotheca cuningi (Col. Hispidae) caused extensive damage to coconut plantations about a decade ago but is under very satisfactory control. The Nettle Grub, Parasa lepida (Lep. Limacodidae), the Bag worm, Manatha albipes (Lep. Psychedae) the Yellow Spotted locust, Aularchis miliaris (Ortho. Acrididae) and the termites Odontotermis spp. are minor pests of coconut.

Generally, pest control is taken to mean insecticide spraying. The stature and geometry of adult coconut palms preclude such traditional crop protection measures as spraying of insecticides. It was therefore necessary for the scientists to develop alternative methods of pest control in coconut. At the Coconut Research Institute (CRI) of Sri Lanka, a programme of biological control using naturally - occurring parasitic and predatory insects was launched in the 1950's. This is perhaps

the first documented, organised attempt of biological control in Sri Lanka.

Biological control affords a number of advantages. It is a low cost method, ideal for small holders, which constitute about 70% of the coconut holdings. The permanency of the control achieved, and the lack of harmful undesirable effects on the environment with no danger to man and other non-target organisms are factors which merit serious consideration.

Since inception, the biological control programmes at the CRI has developed a gamut of activities. Some of the important developments are documented below:

1. The Coconut Caterpillar, Opisina arenosella

The Coconut Caterpillar is a serious pest of coconut, particularly prevalent in the Southern, Eastern and the Western Provinces. Outbreaks are often noticed during periods of dry weather. The damage is caused by the caterpillar stage, which feeds on the green tissue of the leaf resulting in dried brownish patches. At the same time, the caterpillars make galleries out of frass. When a large number of caterpillars are present heavy feeding would result in a large proportion of the leaf turning brown. The caterpillar pupates in the leaf, and the adult moth facilitates spread of the pest.

In 1940's and early 50's, the pest was controlled by spraying insecticides. This was an expensive and a laborious process. The biological control programme was launched with the breeding and release of the pupal parasite, Trichospilus pupivora. Since then, research has identified several different parasitic hymenopterous insects which attack different development stages of this pest.

These are as follows:

Larval parasites - Perisierola nephantidis
(Bethyliidae)
Eriborus trochanteratus
(Ichneumonidae)
Bracon hebator
(Braconidae)

Pupal parasites - Trichospilus pupivora
(Eulophidae)
Antrocephalus pandens
(Chalcidae)

Egg parasite - Trichogramma braziliensis
(Trichogrammatidae)

The Coconut Research Institute established two insectories, one at Lunuwila and the other at Mylambavelly in the Eastern Province to multiply these parasites. The parasites are bred on alternate hosts such as Prodenia litura (Lep. Noctuidae) or Corcyra cephalonica (Lep. Galleridae), which can be raised without much effort. The parasites are packed in glass tubes well before their emergence from the cocoons, and despatched by post to affected estates in wooden boxes. The despatch is so timed that when the tubes reach the estate, the adult parasites would have just emerged and ready for release in the field.

In the case of the coconut caterpillar, it has become necessary to regularly release the parasites to augment the field population. The results achieved have not been entirely successful. At present, techniques are being developed to use biological control as a part of the integrated control that is being attempted on the coconut caterpillar.

2. The Coconut Leaf Miner, Promecotheca cumingi

This pest was inadvertently introduced to Sri Lanka in 1970, and was detected at Dehiwala. The adult female lays eggs on the underside of coconut leaflets and the resulting larvae feed on the leaf tissue while lodged between the upper and the lower epidermis in a mine. An estimated 30,000 ac was rapidly invaded by the pest. The attack was so devastating that the total destruction of the coconut industry seemed a distinct and imminent possibility.

The control of this pest is now recorded as a remarkable event in the annals of pest management in Sri Lanka. A nucleus culture of about 10 hymenopterous parasites was imported to the country from Fiji. This consisted of the larval parasite, Dimmockia javanica (Eulophidae) and the larval and pupal parasite, Pediobius parvulus (Eulophidae). These were bred in the laboratory on the pest larva and released in the field. Dimmockia javanica was the most successful parasite.

The modus operandi of this parasitic insect is spectacular. Once released in affected areas, they would walk on the leaf surface and seek, by instant, the larvae of Promecotheca which live in a mine in between the two surfaces, in the leaflet. Once located, the parasite would deposit its eggs on the body of Promecotheca larva by piercing the epidermis using the fine sword-like ovipositor (Fig.1). Parasite larvae would emerge from the eggs and would devour Promecotheca larva thereby controlling the pest. At the same time, the parasite multiplies.

In a couple of years the pest had all but disappeared as dramatically as it came and the coconut industry was saved from total destruction at a very low cost, which was estimated at about 1% of the annual export earnings from coconut products.

3. The Coconut Scale, Aspidiotus destructor

The Coconut Scale is a sucking insect found on the underside of the leaflets. In outbreaks, large areas become yellow due to the damage done to the leaflets by the scale insects. The CRI developed a biological control programme for this pest by harnessing the activity of naturally-occurring predatory insects. During the mid 1980's, large numbers of the predatory lady bird beetles Chilocorus nigritis, and Pullus xerampelinus were multiplied in the laboratory and released in the field. The different development stages of the lady bird beetle devour the scale insects, thereby controlling it. At present, the scale pest is kept in a very satisfactory state of control. Whenever a slight outbreak of the pest is encountered, the predatory lady bird beetles also follow, thereby keeping the pest under control.

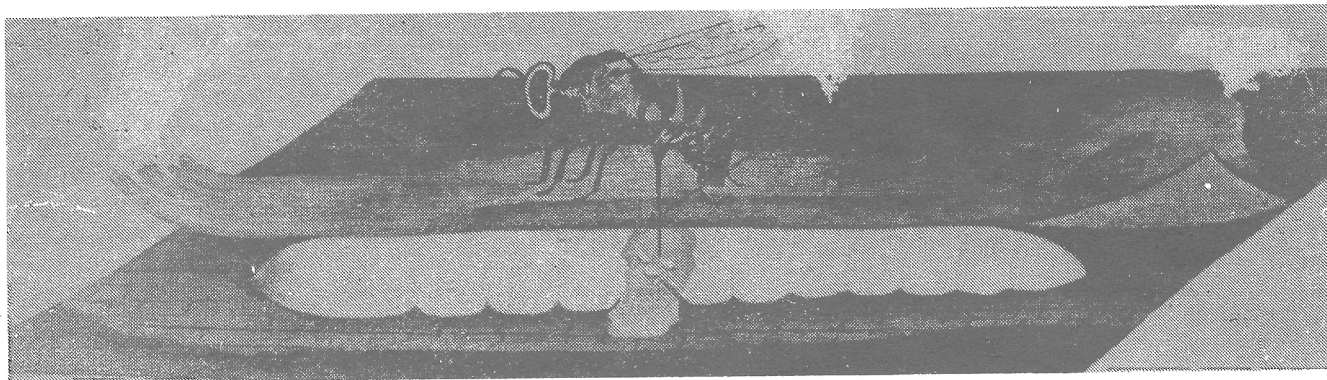


Fig. 1 - Parasitization of Promecotheca larva

The parasite uses its ovipositor to pierce the leaf surface and deposit eggs in the body of the pest larva

4. The Black Beetle, *Oryctes rhinoceros*

The Black beetle is a common pest of coconut. The adult is a large beetle, about 40 mm in length. It is shiny black on the upper side and could easily be identified by the characteristic backwardly curved horn on the head. Damage is caused by the adult when it feeds on the unopened tender fronds. When these damaged fronds eventually grow out, the leaves appear neatly cut with a scissor.

The pest breeds in coconut logs and in other decaying vegetable matter. The grayish white larvae, which when fully grown up would be about 40-45 mm, could be seen in breeding places.

A biological control programme was developed recently to control this pest. This involves the use of a fungus, *Metarhizium anisopliae* and a virus *Baculovirus oryctes*. The use of a nematode is also being investigated.

The fungus would attack the larvae and cause death. At the same time, it multiplies and the fungal spores are spread by wind and adult beetles. The virus causes a pathological condition in the gut of the larvae thereby killing it. In the field, the virus is transmitted quickly, mainly by the adult beetles.

5. Control of *Chromolaena odorata* (earlier called *Eupatorium odoratum*)

Chromolaena odorata is a pernicious weed in coconut lands. When allowed to grow rank, cultural operations and coconut collection

become very difficult.

The CRI introduced an insect in mid 1970's in an attempt to control this weed. The caterpillar stage of the lepidopterous insect, *Parauchaetes pseudoinsulata* (Arctiidae) is a defoliator and has been observed to be a voracious feeder of the weed. When the caterpillars are present in large numbers the weeds are readily defoliated. Although defoliation in itself cannot kill the weed, repeated action by the insect weakens the plant, often reducing it to wood only. If the climatic conditions are adverse to the weed, it often dies after defoliation. Complete success has not been achieved yet.

Circumstances have compelled the use of biological control in coconut pest management. This has proved to be of commendable foresight, as has been evidenced from the results obtained so far. The advantages and the value of these methods have been amply demonstrated. Biological control is relatively cheap and easy to apply compared to the other control methods such as insecticide application. Sometimes, however, biological control is a relatively slow process to produce quick results, but nevertheless, the results are longer lasting. It has also to be done under supervision. The advantages of biological control outweighs the disadvantages, particularly in a crop like coconut. It is because of this that continuous research is being carried out to improve biological control techniques and to find more biological control agents.