

Integrated Pest Management in Coconut

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Introduction

Coconut palm is a perennial crop cultivated in India and other parts of the world. More than 547 pests have been reported on coconut palm world wide, at various stages of crop growth. Among the 65 pests recorded in India, the coconut rhinoceros beetle, *Oryctes rhinoceros* (L.), the Asian red palm weevil, *Rhynchophorus ferrugineus* Fab., the coconut leaf eating caterpillar, *Opisina arenosella* Wlk., and the cockchafer beetle, *Leucopholis coneophora* Burm are the major pests occurring in most of the coconut growing tracts. The other minor pests include scale insects, mealy bugs, coried bug, defoliating caterpillars and termites which occasionally assume in damaging proportions. Rodents like rats, bandicoots etc., also affect the coconut palm.

Integrated Pest Management

It is essentially a system of management of pest population utilizing all suitable techniques (such as cultural, chemical and biological) harmoniously and blending them in a compatible manner so as to minimise the pest population to levels below those causing economic injury.

Effective steps for the management of pests

In order to manage the pests effectively, farmers must be made

aware of the pests, their seasonal occurrence, clean cultivation, use of biocontrol agents and danger of misuse of pesticides. This can be achieved by providing community programmes so that management of the pests can be done in a federal approach. In this way we may be able to tackle the pests effectively. Application of insecticides by spray, root feeding and stem injection with highly toxic chemicals needs care while administering and suitable waiting period must be observed to avoid the pesticide residues in the produce.

Major Pests and Their Management

1. The coconut rhinoceros beetle, *Oryctes rhinoceros* (L.) (coleoptera: scarabaeidae)

The rhinoceros beetle is one of the most important pests of coconut and oil palms in South and South East Asia (Ho & Toh, 1982, Zealang & Alfiler, 1986). Adult rhinoceros beetles burrow into the growing point of palms and feed on unopened fronds, causing damage of inflorescences and reduction in photosynthetic area resulting in decreased or delayed fruit production (Zealany, 1979; Liao & Ahmad, 1991; 1993). Prolonged attacks can kill mature palms by defoliation and young palms if the growing point is destroyed. The wounds produced by the beetle provide entry points for diseases and the palm weevils, *Rhynchophorus ferrugineus* Olivier and *R. vulneratus* Panzer (Bedford, 1980; Jacob & Bhumannavar, 1991).

O. rhinoceros breeds in decaying organic matter, such as felled

rotting palms and manure pits and usually becomes a major problem in newly planted or replanted oil palm plantations. Eggs are laid on the breeding sites, and the grubs feed on these materials for about six months. Then the pupation takes place in cocoon (Fig. 2[4]).

Nematode infections in *Oryctes* seems to be rather common in Africa. Surany (1960) reported that the genus of nematode commonly met with on *Oryctes* is Rhabdites. Attempts have been made to rear and infest these nematodes in *Oryctes* larvae in Fiji and Seychelles with limited success. Isolations of nematodes were made from the third instar grubs of *O. rhinoceros* collected from Agathi Island in the Lakshadweep. Suspensions made from the material, when injected into healthy grubs produced mortality (Kurian *et al*; 1969).

Aggregation pheromones have been identified for the *O. rhinoceros* as ethyl-4-methylactanoate (Hallett *et al*; 1995). These chemicals are commercially available with M/s Chem Tica International Apdo 159 - 2150 San Jose, Costa Rica and M/s Pesticide India Ltd., Udaipur.

Integrated Pest Management for *O. rhinoceros* includes the following:

I Sanitation method

(i) Crown cleaning - Once in a year crown has to be cleaned to avoid the colonisation of insects.

(ii) Extraction of adult beetles with beetle hook and filling bore holes with Mancozeb + sand mixture (3g + 1kg).

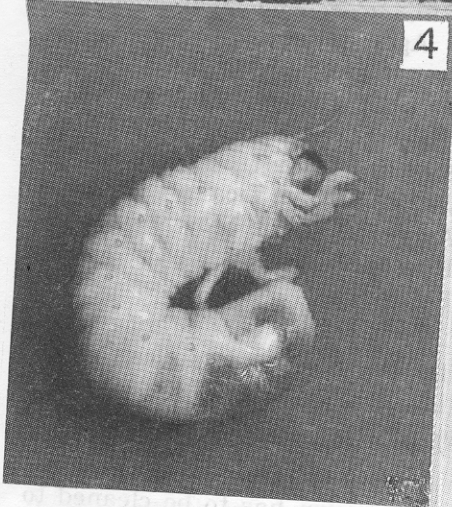
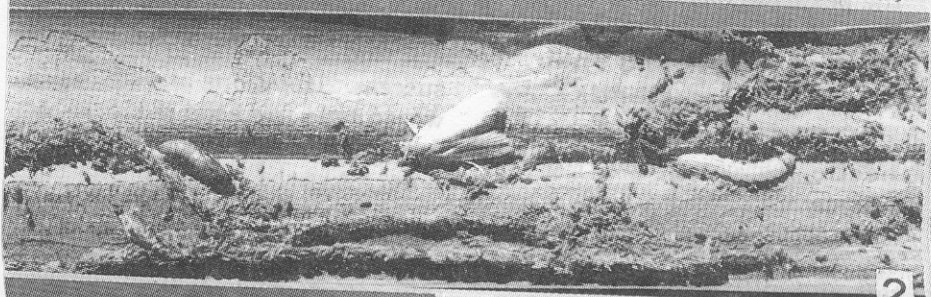
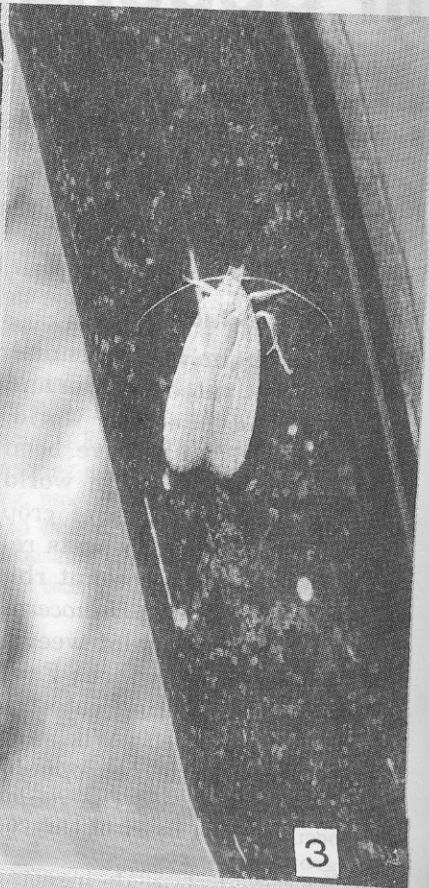


Fig.1.

1. Leaf eating caterpillar, *Opisina arenosella* infested palms 2. Larva of *O.arenosella* feeding in coconut leaf
 3. Adult of *O.arenosella* 4. Third instar grub of *Leucopholis coneophora* 5. Adult beetles of *L.coneophora*

(iii) Treatment of breeding sites with 0.01% carbaryl 50 WP (dissolve sevin 50 WP 1 g in 5 litre water.)

II Prophylactic method:

(i) After crown cleaning, treat the crown with carbaryl: r - HCH 8G (Sevidol 4: 4G) + sand mixture at 1:8 ratio. This can be applied during pre and post monsoon period at 45 days interval.

III Biological method:

(i) Application of green muscardine fungus, *Metarhizium anisopliae* @ 5×10^{11} spores/M³ in the breeding sites for biological suppression of all stages.

(ii) Release of baculovirus infected rhinoceros beetle @ 10-15 beetles/ha. (Baculovirus infected beetles can be had from CPCRI Regional Station, Kayangulam).

(iii) Pheromone traps: Pheromone trap @ 5 traps/ha can be placed. The dispenser may be hanged in a plastic bucket having 2 litre of insecticide solution (1.5 ml Endosulfan 35 EC + 2 litre water) once in a week. Trapped beetles can be disposed off.

2. The Asian palm weevil, *Rhynchophorus ferrugineus* (Oliv.)

The Asian palm weevil is an important pest of coconut, oil palm and sago in South and South East Asia (Sivaprakasam *et al*; 1990).

In India, the red palm weevil, *R.ferrugineus* is a serious pest. Adults are attracted to wounded palms. Weevils lay eggs on spindle and tender leaf through injuries caused by rhinoceros beetle as well as through the natural splittings in the leaf base. The larvae tunnel into the tree trunk and feeds on the inner tissues. When the larva reaches the terminal bud of the crown region, it results in the death of the palm. In general palms of 5-20 years are susceptible. Life cycle is completed

within three months. Pupation takes place inside the trunk.

The external symptoms include the presence of small holes on the stem, oozing out of brown viscous fluid, extrusion of chewed up fibres, longitudinal splitting of leaf bases and yellowing and wilting of leaves of the inner and middle whorl. In severe case, the crown of the palm topples (Fig.2 [6]).

Aggregation pheromones have been identified for this weevil as 4 - methyl - 5 - nonanone (Hallet *et al*. 1993). Commercially this pheromone is available from the source which has been mentioned earlier.

The integrated pest management measure for the pest is as follows:

I. Sanitational & cultural method:

- (i) Crown cleaning
- (ii) Removal and destruction of dead palms to avoid the attraction of weevils from neighbouring areas.
- (iii) Avoid injury to palm.
- (iv) Injuries to be treated with coal tar + carbaryl (sevin)
- (v) When green leaves are to be cut, it can be done leaving a petiole length of 120 cm.
- (iv) Palms affected with bud rot/leaf rot and rhinoceros beetle are to be treated properly.

(II). Insecticidal treatment

(i) Prophylactic leaf axil filling with a mixture of sevidol 4:4G 25 g and sand 200g.

(ii) As a curative, inject 0.1% Endosulfan (2.8 ml/litre water)/ 0.1% dichlorvos (2.8 ml/litre water) or 1.0% sevin 50 WP (20 g/litre water) into the trunk. Drill a downward slanting hole and inject into the stem at about 1.5 m above ground level and plug with clay. (Before treating the palm, harvest the nuts and a waiting period of 45 days must be ob-

served for harvest of nuts.)

Eco-friendly method:

(1) Trapping: For trapping adult weevils, place the insecticide treated split coconut petioles (approx.250g) in a mud pot having fermented toddy (500ml).

(ii) Placement of pheromone sachets (as described earlier under 'rhinoceros beetle'.)

3. The coconut leaf eating caterpillar, *Opisina arenosella* Wlk. (Cryptophasidae: Lepidoptera).

The leaf eating caterpillar is a serious pest of the coconut palm in India, Sri Lanka and Myanmar. It is distributed in the coastal and backwater area. The pest outbreak occurs during summer months. The caterpillar lives in galleries made of silken threads and their faecal matter on the lower surface of the leaflets. The life cycle is completed in two months. Continuous feeding on the green tissues [Fig.1 (1 & 2)] results in the reduction in photosynthetic area and the leaves dry up giving a burnt up appearance. Infestation results in reduced yield.

Integrated management of this pest includes:

I. Mechanical method: Cutting and burning the heavily affected outermost 2-3 leaves.

II. Biological method: Release of larval parasitoids such as *Goniozus nephantidis* Mues. (Bethyridae), *Bracon hebetor* Say (Braconidae) and pre-pupal parasitoids like *Elasmus nosatoi* Habu (Chalcididae) at fixed norms.

The dose is to be fixed based on the target stages of the pest present at the time of observation. The norms fixed for the release are @ 20.5%, 49.4% and 31.9% respectively for larval, pre-pupal and pupal stages. If all the three stages of the pest is noticed

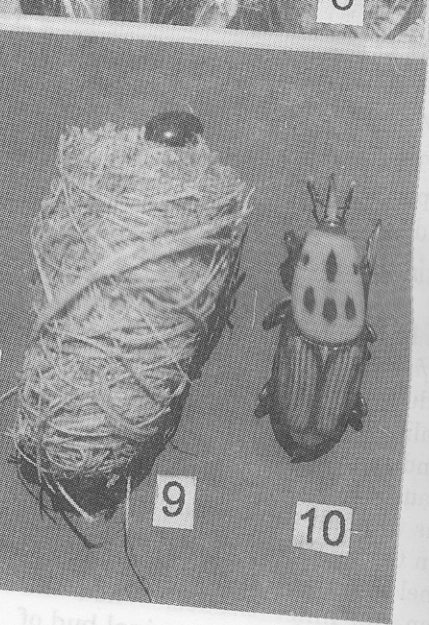
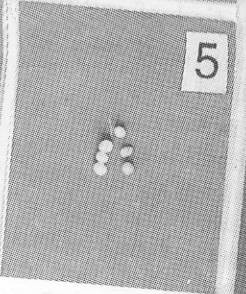
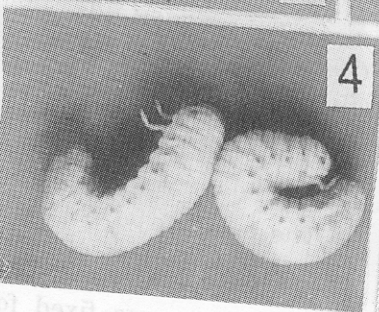
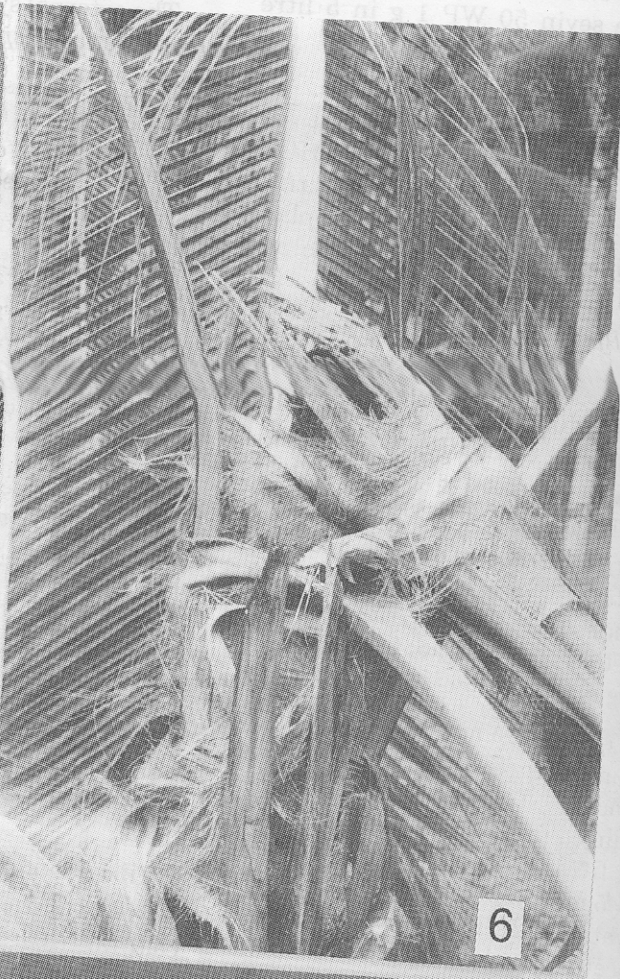
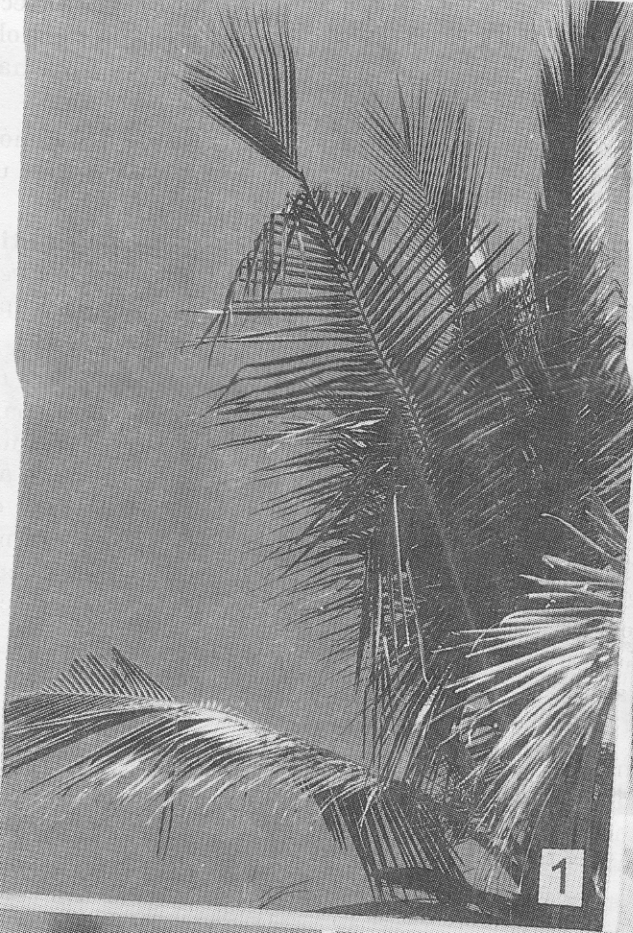


Fig.2
 1. Feeding damage of *O. rhinoceros* 2. Adult beetles of *O. rhinoceros* 3. Pupa, 4. Grub 5. Eggs of *O. rhinoceros*
 6. Red palm weevil affected palm 7. Eggs 8. Grub 9. Pupa 10. Adult weevil of red palm weevil

40%g larval, pre-pupal and pupal parasitoids are to be released to have a good biological suppression of the pest.

III. Chemical method:

(i) Spraying with dichlorvos 0.02%g (1 ml in 2 litre water)/malathion 0.05% (1 ml/litre water)/endosulfan 0.05% (1.5 ml/litre water)phosalone (zolone) (1.5 ml/litre water).

(ii) Root feeding of monocrotophos: Select a fresh and live root, cut sharply an angle to get maximum surface area and insert the root in the monocrotophos solution (monocrotophos 36 EC 10 ml + 10 ml water) in a polythene bag. This is recommended for coastal areas.

(iii) Stem injection of 10 ml monocrotophos 36 EC for maidan areas (method as described under red palm weevil). As indicated earlier, before root feeding and stem injection of pesticide, harvest the nuts and a waiting period of 45 days must be observed for harvest.

4. The coconut cockchafer beetle, *Leucopholis coneophora* Burm. (Melolonthinae: scarabaeidae: coleoptera).

Leucopholis and other related species of cockchafers attack roots of coconut and other intercrops adversely affecting the vigour of the palm and yield. The grub occurs in sandy and sandy loam soils feeding on the root of coconut resulting in yellowing of the leaves and loss of yield.

The beetles lay eggs in soil and immature grubs feed on the grass roots and soil organic matter. The second and third instar grubs are voracious feeders and feed on growing tender roots. Larval stage lasts for a longer period. The insect pupates inside the soil and emerges from the soil on receipt of monsoon showers.

Sekhar (1958) reported mortality among the pre-pupae of *L. coneophora*. Dissected specimens revealed the presence of nematodes. Entomopathogenic nematodes are isolated from the infected grubs. Commercial formulation of *Heterorhabditis* sp. has been screened for the closely related species *L. burmeisteri* and this species did not show much mortality. Attraction of male beetles to emerging females of *L. coneophora* under field conditions indicated the evidence of release of sex pheromone by female beetles.

Integrated pest management schedule for white grub includes -
I. Eco-friendly method:

(i) Ploughing during pre and post-monsoon period to expose the pests for predation and also to collect and destroy the grubs.

(ii) Collection and destruction of adult beetles during emergence (i.e May/June and September/October) on receipt of monsoon showers.

(iii) Installation of light traps to monitor and catch the beetles.
II. Chemical method:

(i) Application of phorate 10 G (Thimet 10 G) @ 100g/ palm twice during pre and post-monsoon season.

Conclusion

Several constraints have been identified in the management of coconut pests, which include (i) the lack of awareness of the pest (ii) lack of periodical monitoring of the pest and (iii) lack of co-ordinated efforts on crop protection on community basis. Effective management of these pests can be achieved by adopting crop protection measures on a community basis. Keeping in view of the toxicological problems of the insecticides it is suggested to

maximise the use of biocontrol agents for the management of pests by following the intergrated approach.

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