PESTS

K. Dhileepan and **S.A. Jacob**
CPCRI, Research Centre, Palode, Thiruvananthapuram, Kerala 695 562, India

Introduction

In equatorial Africa, which is the native home of oil palm (*Elaeis guineensis* Jacq.), except for the incidence of Hispid beetle *Coelaenomenodera minuta*, no other major insect pests are noticed. However, in all the other countries, where oil palm is an introduced crop, pest problems have been frequent and severe. In India also, oil palm is infested by a wide range of fauna which include insects, birds and mammals (Dhileepan 1989, 1990).

INSECT PEST COMPLEX

In India, since the import of germplasm is in the form of seeds/sprouts, possibilities for introduction of the pest species from other countries are limited. But many of the pest species of related palm species such as coconut and areca palm, have got adapted to oil palm. Survey of oil palm plantations and nurseries in India indicated that about 59 species of insects attack oil palm (Dhileepan, 1988, 1991a, 1991b, 1992). Eight out of 20 species of insects infesting oil palm nursery are known pests of areca palms. Among the 49 species of insects infesting adult oil palms, 14 species are known pests of coconut and 19 species are known pests of areca palms. Insect pests of oil palm in India are more or less same as those reported from Malaysia and other South-East Asian countries.

Pest of oil palm nursery

1. The spindle bug

The spindle bug *Carvalhoia arecae* Miller & China (Miriidae: Heteroptera), primarily a serious pest of areca palms, has in recent years attained the pest status in oil palm also. However, intensity of infestation by C. *arecae* in oil palm is comparatively lesser than in areca palms. The nymphs and adult bugs suck the sap from the spindle and the unfolding leaves, resulting in linear necrotic lesions (Fig. 1). Infestation by *C. arecae* in the oil palm nursery was noticed only in Kerala, where the intensity of infestation ranged from 11.8 to 31.8 per cent. At Palode spindle bug infestation was noticed throughout the year, and the

Fig. 1. Spindle bug infested leaf

incidence was highest during the month of June. In the nursery, the spindle bug infestation was higher when the seedlings were maintained under areca garden than under oil palm plantation.

The tussock caterpiller

The tussock caterpiller *Dasychira mendosa* Hb. (Lymantriidae : Lepidoptera) a polyphagous insect, is a known pest of areca palm, cacao and other crops. They also infest oil palm, especially in the nursery at Palode and Shimoga. The larvae feed on the young and mature leaves, causing considerable defoliation. The percentage of seedlings defoliated ranged from 3 to 11 at Palode and around 20 at Shimoga. In Kerala, though infestation by *D. mendosa* was noticed throughout the year, the highest incidence was recorded during the months of June-July, coinciding with the onset of rains.

Other insects infesting nursery

Pseudococcids (*Dysimicoccus brevipes* and *Palmicultor* sp.) and Margarodids (*Icerya aegyptiaca*) infest the spear leaves of oil palm seedlings. Aphids *Mysteroneura* setariae and *Schizaphis rotundiventris* colonizing on the under-surface of older leaves, and Pseudococcid *Pseudococcus citriculus* encrusting spear leaves are the potential pests. Occasionally *Spodoptera litura* also causes defoliation in Kerala and Andhra Pradesh. Cockchafer beetles (*Apogonia* sp. and *Adoretus* sp.) and grasshoppers make short feeding holes in the older leaves of the seedlings. Other insects infesting oil palm nursery include *Gangara thyrsis, Paratettix* sp., *Proutista moesta*, termites, and *Ricania speculum*.

Pest of adult palms

In the adult palms, the rhinoceros beetle *Oryctes rhinoceros* (L.) and the red palm weevil *Rhynchophorus ferrugineus* (Oliver) are the major pests, while Limacodids and Psychids causing frequent defoliation and Coccoids infesting fruit bunches are minor pests. Termites and Pseudococcids are the potential pests (Table 1).

The rhinoceros beetle

The rhinoceros beetle *Oryctes rhinoceros* (L.) is primarily a serious pest of coconut palm, and in recent years has attained the pest status in oil palm also (Dhileepan, 1988). Infestation by *O. rhinoceros* was noticed in the oil palm plantations in Kerala, Karnataka, Andhra Pradesh, Maharashtra and Gujarat states, as well as in the Little Andaman Island (Table 2). The adult beetle which bores through into the spear leaves, resulting in snapping of the fronds at the feeding sites (Fig.2). However, unlike in coconut, damage to inflorescence was not noticed in oil palm. In the oil palm plantations, failed female inflorescences, dead palm trunks, persistent leaf axils and empty bunch heaps, act as breeding sites for the pest. However, intensity of infestation by *O. rhinoceros* in oil palm is relatively less than that in coconut.

The red palm weevil

Infestation by the red palm weevil *Rhynchophorus ferrugineus* (Oliver) was noticed in majority of the oil palm plantations in Kerala, usually resulting in death of the palms. However, intensity of infestation by *R. ferrugineus* in oil palm was less frequent when compared with that in coconut palm. Damage is due to the feeding activity of the grubs, usually 12-87 per palm, which bore through

Table 1. Important insect pests of oil palm in India

Insect pest	Family	Nature of damage	Category
COLEOPTERA			
Oryctes rhinoceros (L.)	Scaraebaeidae	Adults bore into fronds and spindle	+++
Rhynchophorus ferrugineus (Oliver)	Curculionidae	Grubs feed on soft tissues of stem and meristem and kill the palm	+++
HETEROPTERA			
Carvalhoia arecae M. & C.	Miriidae	Adults and nymphs infest spears in the nursery and cause spindle necrosis	+++
HOMOPTERA			
Pinnapsis aspidistrae (Signoret)	Diaspididae	Encrust ripe and unripe fruit bunches	++
Hemiberlesia lataniae (Signoret)	Diaspididae	- do -	++
Chrysomphalus aonidum Linn.	Diaspididae	Encrust fruit bunches and leaves	++
Dysmicoccus brevipes (Cockerell)	Pseudococcidae	Infest male and female inflorescences and ripe fruit bunches	++
Palmicultor sp.	Pseudococcidae	Infect spear and unfolding leaves	++
LEPIDOPTERA			
Dasychira mendosa Hb.	Lymantriidae	Larvae cause defoliation in nursery	+++
Manatha albipes Moore	Psychidae	Larae cause defoliation in adult palms	+
Metisa Sp.	Psychidae	Defoliation due to frequent out-breaks	+++
Eumeta sp.	Psychidae	- do -	++
Thosea andamanica Holloway	Limacodidae	Defoliation due to frequent out-breaks	+++
Darna Jasea (Swinhoe)	Limacodidae	Larvae cause occasional defoliation	+
ISOPTERA			
Odondotermes sp.	Termitidae	Feed on the roots, inflorescences, spear and fruit bunches.	++

+++ Major pests ; ++ Minor pests ; + Potential pests.

Table 2. Intensity of infestation by *Oryctes rhinoceros* in the oil palm plantations in India.

State	area (ha)	% infestation
Kerala	3860 ha	1.5 - 13.5
Andhra Pradesh	1050 ha	0.3 - 15.0
Karnataka	1020 ha	3.6 - 63.6
Gujarat	2 ha	15.0 - 20.0
Little Andamans	1593 ha	<0.01

and feed on the softer tissues of stem and meristem. Palms infested by *R. ferrugineus* show gradual wilting and drying of outer whorl of fronds. In some cases, rotting of spear was also noticed. Except for the stray incidence at Manvi (Karnataka) and Eluru (Andhra Pradesh), infestation by *R. ferrugineus* has not been reported from other oil palm growing areas of this country.

Fig. 2. Rhinoceros beetle infestation

Scales and mealybugs

Around 20 species of Coccoids (Pseudococcids, Diaspids, Coccids and Margarodids) were reported in India (Dhileepan, 1991b, 1992). Among them Diaspids *Hemiberlesia lataniae* (Signoret), *Chrysomphalus aonidum* Linn. and *Pinnapsis aspidistrae* (Signoret), and Pseudococcid *Dysmicoccus brevipes* (Cockerell) infesting oil palm fruit bunches are of economic importance (Table 1). At Chithara and Kulathupuzha plantations in Kerala, 3.1 to 10.7 per cent of the unripe bunches and 39.5 to 100 per cent of the ripe bunches were infested by Coccoids. However, the actual economic loss due to this pest, particularly the quality of oil is yet to be assessed. The pseudococcid *Palmicutor* sp. infested the spear cluster and unfolding leaves of the newly planted oil palm in Shimoga in Karnataka State, resulting in yellowing of unfolding leaves and stunted growth of the palm.

Nettle caterpillers and case worms

So far, nine species of caseworms (Psychids) and three species of nettle caterpillers (Limacodids) infesting oil palm were recorded (Dhileepan, 1991b, 1992). Among them Psychid *Manatha albipes* Moore causing occasional defoliation in Yeroor plantation is of economic importance (Table 1). In Little Andaman Island, Psychids Metisa sp. and *Eumeta* sp., and *Limacodid Thosea andamanica* Holloway, attained major pest status, causing severe defoliation (Fig 3) due to frequent out-breaks. Infestation by Psychids and Limacodids was restricted mostly to outer whorl of fronds and occasionally in the middle whorl of fronds.

Termites

In Andhra Pradesh, termite *Odontotermes* sp. infested the spear leaves, male inflorescence and fruit bunches in the main field. Termite attack was noticed in 22.7percent of the field planted palms in Andhra Pradesh, and was restricted to oil palm plantations with red soil and without adequate irrigation. In Karnataka, two species of termite, *Pericapritermes* sp. and *Hypotermes* sp. feed on the root of the seedlings maintained in polybags, resulting in stunted growth of the seedlings.

Other sap feeding insects

In the young oil palm plantations at Palode, infestation by *Carvalhoia arecae* was noticed only when under-planted in areca

Fig. 3. Psychid infested oil palm

garden; while no incidence was noticed when planted in cleared forests or under-planted in coconut garden. Occasional infestation by *C. arecae* was also noticed in the young field-planted palms at Charmadi, Karnataka State. In Little Andamans, the aphid *Astegopteryx rhaphides* (Van der Goot) encrusted the oil palm and coconut leaves during summer months. Among the other sap feeding insects, *Proutista moesta* (Westwood), which is noticed in all the oil palm growing areas, attains importance, as they are known to be vector of MLOs (Mycoplasma like organism) causing root (wilt) disease of coconut and yellow leaf disease of areca palms in Kerala.

Pest incidence in relation to intercrops

In Andhra Pradesh and Karnataka States, the pest incidence varied depending upon local crops as well as upon the intercrops. In Karnataka, Pseudococcid (*Palmicultor* sp.) infestation was more prevalent, when oil palm was grown near sapota (*Achras sapota*) trees. Similarly, oil palm nurseries located near sugarcane fields had a very high incidence of aphid infestation. In Andhra Pradesh, defoliation by *Spodoptera litura* was noticed when oil palm was grown near tobacco fields or when tobacco was grown as an intercrop with oil palm. In both Karnataka and Andhra Pradesh, infestation by *O. rhinoceros* in oil palm was more severe, when under-planted in coconut gardens, than as a pure crop. However, raising other intercrops like sorghum, maize, mulberry, lilly, onion, chilly, banana, groundnut etc., as practised in Andhra Pradesh, did not cause any pest problem to oil palm (Dhileepan, 1992).

Strategies for pest management

Oil palm is an entomophilous crop, and hence the pollinating weevil *Elaeidobius kamerunicus* Faust was introduced and established in all the oil palm plantations in India (Dhileepan and Nampoothiri, 1989. Indiscriminate application of pesticides will adversely affect the weevils, thereby the normal fruitset as well. Hence use of pesticides is to be restricted, unless it is essential.

Biological control

In nature, the rhinoceros beetle is suppressed by entomopathogens like *Baculovirus oryctes* (virus) and *Metarhizium anisopliae* (fungi). Re-release of Baculovirus of *Oryctes* in the oil palm plantation at Palode minimized the pest incidence. The spindle bug *Carvalhoia arecae* is also naturally suppressed by an entomopathogen *Aspergillus candidus* Link, during the rainy season, which is the peak period of pest incidence (Dhileepan et al., 1990). Various Diaspide infesting oil palm at Palode and Yeroor are naturally suppressed by Coccinellid predator *Chilocorus nigrita*. Introduction of *C. nigrita* to the other oil palm plantations like Chithara and Kulathupuzha appear promising. In Little Andaman, the Diaspid *Aspidiotus destructor* infesting oil palm leaves are naturally suppressed by Coccinellid *Chilocorus coelosimilis*.

Cultural control

i) Field sanitation and elimination of breeding sites like dead palm trunks, empty bunch heaps, etc., within the plantations are essential for the management of both red palm weevil and rhinoceros beetles.

ii) When the infestation by rhinoceros beetle is very high, especially in young plantations, hand picking of the adult beetles using hooks is very effective.

iii) For red palm weevils, use of attractants incorporating fermented sugarcane juice, acetic acid, oil palm petioles, yeast, etc., to collect and kill the adult weevils is recommended.

iv) Regular weeding of the oil palm plantation will minimize the damage by cockchafers, grasshoppers and burrowing rodents.

Chemical control

i) For rhinoceros beetles, placing 3-4 napthalene balls in the youngest spear axils at weekly intervals is recommended.

ii) For spindle bug, when the intensity of infestation is very high, placing 1-2 phorate sachets (0.2 g ai) in the axils of the new leaves is advised.

iii) For palms with advanced stage of infestation by red palm weevil, stem injection of 5-8 ml of monocrotophos is advised.

Vertebrate pests of oil palm

The following vertebrate pests have been found damaging oil palm fruits and crop in the field.

Birds

Crows - *Corvus splendens protegatus; Corvus macrorhynchus culminatus* .
Mynah - *Acridotheres tristis tristis*
Babbler - *Turdoides affinis affinis*
Parrots - *Psitticula krameri manillensis*

Rodents

Black rat - *Rattus rattus wroughtoni*
House rat - *Rattus rattus rufescens*
Lesser bandicoot - *Bandicota bengalensis*
Larger bandicoot - *Bandicota indica*
Indian gerbil - *Tatera indica cuvieri*
Western Ghat squirrel - *Funambulus tristriatus*

Porcupines - *Hystrix india*

Larger mammals

Wild boar - *Sus scrofa*

Birds feed on the mesocarp and cause fruit loss upto 2.8 t/ha/year (Dhileepan, 1989). Rodents tunnel into the bole of the young seedlings and kill them. Wild boar dig up newly planted seedlings and chew them up.

Schedule V of wild life protection act 1972 as amended up to date, classifies crows, fruit bats, mice and rats as vermins and all other wild vertebrates in Indian territory are protected under wild life protection law. In order to maximise oil palm production, it is essential to minimise, divert, scare or stop these pests from the plantation. Oil palm seedlings and young palms upto the age of three years are more prone to rodents and wild boar damage after which the palm becomes sturdy and resistant to their attack. Since any one of these methods is completely fool-proof, a management practice based on an integrated approach is outlined below:

Fruit bunch covering against avian pests

Covering the bunches with different materials such as wire nets, reed baskets, plaited coconut leaf baskets and senile oil palm leaf are effective in preventing the fruit damage. But senile oil palm leaf covering is more practical and economical as the material is readily available and involves only the labour charge and cost of rope bits (Fig. 4) (Table 3).

Table 3. Cost of protection of oil palm fruit bunches from birds using different treatments

Treatments	Cost of material (ready for use)	No. of times used	Material cost per bunch (90-91 rates)	Labour charge for fixing per bunch	Total cost per bunch	Efficiency (% of FFB protected	Defects if any.
1. Wire net: 60 x 90 cm 1/2" x 22 gauge binding wire	7.91	3	2.96	1.10	4.06	80-90	Birds may peck through
2. Reed basket locally made fixed with rope	15.40	3	5.40	1.10	6.50	100	2-3 additional leaves have to be cut for fixing
3. Plaited coconut leaf basket locally made fixed with rope	3.30	1.2	3.15	1.10	4.25	80-85	birds may peck through
4. Senile oil palm leaf tied with rope	0.40	1	0.40	1.10	1.50	95-100	leaves become too brittle if kept before 3 months

Labour charge : Rs. 40/- per day

Fig. 4. Covering of fruit bunches against avian pests

Wild boar scaring device

A local wild boar scaring device (Fig. 5) has been improved to scare away wild boar from entering into nurseries and young oil palm plantations. The device consisted of (i) 18 gauge g.i. wire (ii) guide hooks (iii) crushing slabs (iv) poles of approximately 1 meter high (v) junction box having the scaring crux (vi) 4" long oval plays and (vii) 5 g cracker made of gunpowder.

The project area is fenced with the 18 gauge g.i. wire at 8" height on two lines parallel from ground supported on the poles and kept in position with the help of guide hooks. The poles are positioned at 3 to 10 m spacing depending upon the terrain of the land. Junction boxes are made with the help of 4 poles, two crushing slabs, the two oval plays and cracker. This may be spaced at 5 to 15 meters apart depending on the landscape, boundaries, roads etc. The two fencing lines arriving at the junction boxes from oppisite sides are joined on to the oval plays and pulled closer and held in position with the help of a crushing slab hung from a third play kept on the first two plays. Underneath this crushing slab a cracker is kept. When the animal hits the fence, it will cause the first plays to pull apart and the crushing slab with the cracker hung will fall on to the crushing slab kept directly underneath, making the cracker burst. The method has been found very effective in scaring awary the animals.

Rodent control:

Among rats, the burrowing type is more serious which tunnel into the bole of the seedling which may cause even the death of seedlings. Different baits such as acute poison

Fig. 5. Wild boar scaring device

baits (zinc phosphide, aluminium phosphide etc.), anticoagulants (warfarin, fumarin, bromadiolone, brodifacum), and traps such as iron live traps, snap traps, deathfall trap, bow trap etc. may be used as an integrated approach to minimise the rodent damage to the crop.

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