



Opisina arenosella Wlk

THE
LEAF EATING
CATERPILLAR
OF
COCONUT PALM



CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
KASARAGOD 671 124, KERALA, INDIA

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FOREWORD

About 100 species of insect pests have been reported to damage the coconut palm at all stages of its growth in India. Among them the black headed caterpillar, *Opisina arenosella* is one of the key pests, manifesting in devastating forms in certain periods. As this pest feeds on the chlorophyll contents of the leaflets by making galleries, insecticidal spray generally does not reach the target pest. The use of systemic insecticides is to be advocated judiciously so as to avoid residue toxicity in the nut.

There is surmounting pressure from environmental scientists, biologists and from the public at large to use chemical control measures as a last resort only and instead, use biological method for controlling pests of crops. Pesticides, though give a knock-down effect on the pest population, are not a long term solution to crop health. In view of the nontargetic effect, they are also harmful to beneficial insects including parasites and predators of pests and pollinating insects. Besides, environmental pollution and the hazardous nature of the pesticides are also to be taken into consideration. It is also reported that some of the pesticides are losing their effectiveness because of development of newer strains of pests which are resistant to the relevant pesticide. Evolving resistant lines though is a permanent solution, it is time consuming. Hence, the use of parasites and predators for the biocontrol of the crop pests is being increasingly advocated.

CPCRI has made considerable progress in the biocontrol of leaf eating caterpillar of coconut. The Integrated Pest Management technology developed at this Institute against *Opisina arenosella* of coconut for the last two decades is found to be very effective in the management and control of this pest. This Technical Bulletin is a brief account of the available technology developed in the biocontrol of this pest. I hope that the information given in this Bulletin would prove to be very useful not only to the farming community but also to the research workers and developmental agencies.



(M.K. NAIR)
Director

OPISINA ARENOSELLA WLK., THE LEAF EATING CATERPILLAR OF COCONUT PALM

1. Introduction

The coconut palm with its luxuriant green foliage offers an abundant supply of food to a large number of caterpillar pests. *Opisina arenosella* Wlk., *Contheyla rotunda* H., *Latoia lepida* (Cram.), *Macroplectra nararia* M., *Gangara thyraxis* M., and *Suastus gremius* Fab, are some of the important pests, whose caterpillars devour the foliage. Of these *O. arenosella* causes severe damage to the coconut palm foliage, which leads to reduced yield.

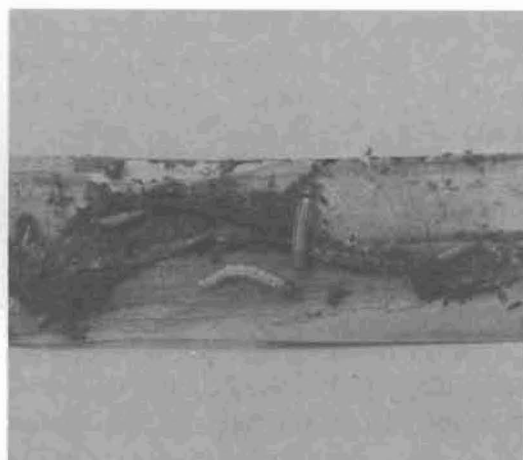
O. arenosella, the leaf eating caterpillar or the black headed caterpillar is one of the key pests of the coconut palm. It is an outbreak pest which quite often assumes severe proportions in certain tracts. The caterpillars live in galleries on the lower surface of the leaflets.

2. Damage

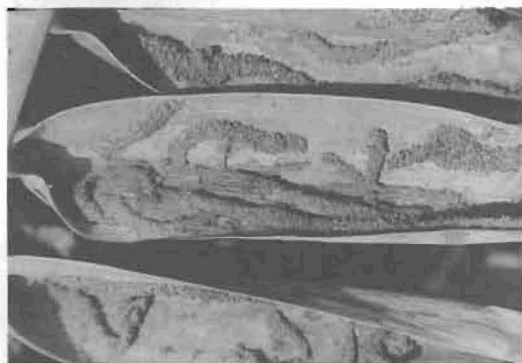
The caterpillars construct galleries out of silken webs reinforced with the excreta and the scraps of leafbits. Hiding in these

galleries, the caterpillars feed on the chlorophyll containing parenchymatous tissues. Only the upper epidermis is left in tact. These portions get dried presenting a scorched up appearance to the foliage.

Palms of all ages are susceptible to infestation by *O. arenosella* caterpillars.



Portion of infested leaf with larval and pupal stages of the pest



Portion of infested leaf with larval gallery

Damage is normally confined to the outer whorls of leaves. But, during sporadic outbreaks under severe infestation, all the leaves of the palms are affected. In such cases even the green petioles, spathes and nuts are also not spared. Usually, the infestation is confined initially to a few palms only in a plantation, but under severe outbreaks most of the palms are damaged, presenting a burnt up appearance to the entire plantation. Very severe damage results in drooping of the leaves and bunches. Damage to the leaves affects the photosynthetic efficiency of the palm which leads to severe decline in yield.

3. Diagnostic symptoms

Dried up/green patches on the upper epidermis of leaves, presence of larval galleries, moult and pupal cocoons on the lower surface of the leaves are the major symptoms of infestation. Where the infestation is old, the affected leaves are left only with the midrib of the leaflets.

4. History of the pest

Green (1900) recorded this pest from Sri Lanka for the first time. In India, the earliest record of the pest on the coconut palm was in 1909 from Bapatla, Andhra Pradesh. However, this pest was recorded on Palmyra palm from Coimbatore, Tamil Nadu during 1907.

In India, Ananthanarayanan (1929, 1934), Ayyar (1940), Nirula (1955, 1956), Nirula *et al.* (1951), Rao (1923, 1926), Rao, Cherian and Ananthanarayanan (1948) studied the occurrence of the pest, its host plants and biology and evolved control measures. Since 1960, detailed investigations were taken up on the ecology and management of the pest with due emphasis on the biological methods of pest suppression (Pillai and Nair, 1981, 1982 and 1983).

5. Distribution

O. arenosella was known as a severe pest on coconut palms in India and Sri Lanka. It was also recorded from Bangladesh and Myanmar (CIE 1966; Cock and Perera, 1987). In India, the pest was recorded from Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu and West Bengal. The pest occurs in severe proportions in several places of South India along the East and West coast, particularly. It appears in several locations in

a discontinuous manner. It occurs throughout the year in all locations from mild to medium intensities, but under favourable conditions, the pest multiplies very rapidly resulting in sporadic outbreaks damaging the entire coconut plantations, as was noted in the coastal belts of Karnataka and Kerala and in some of the interior tracts of Kerala, Tamil Nadu etc.

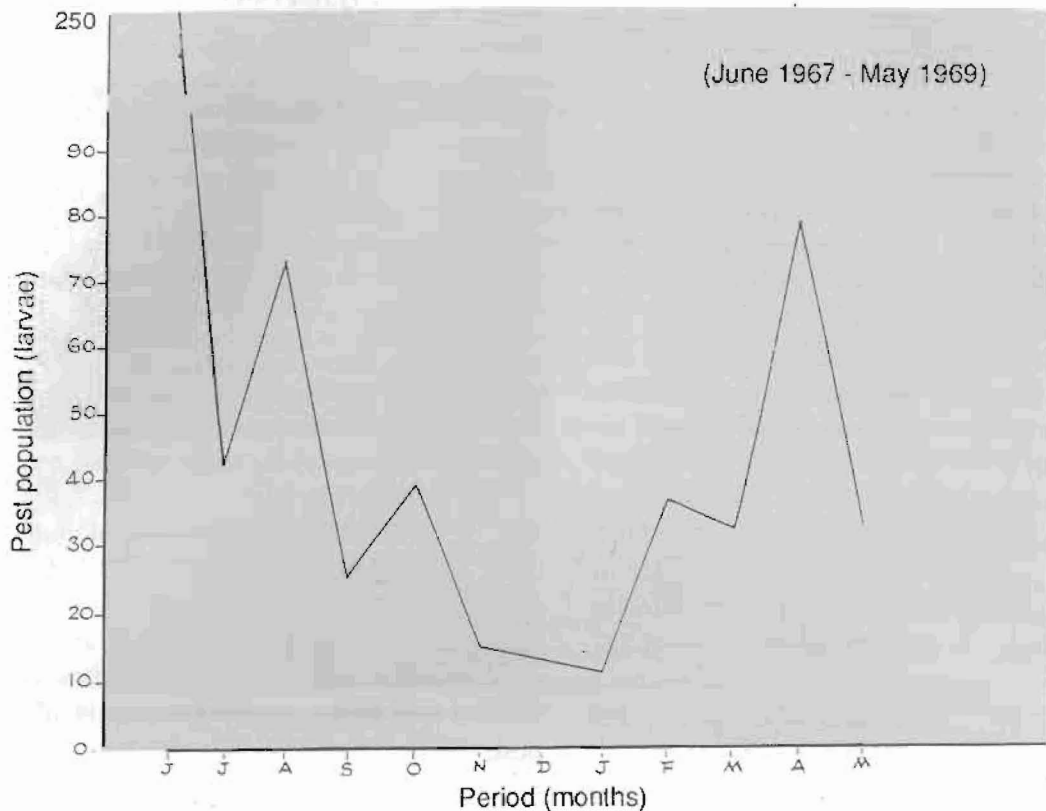
6. Host plants

Palms such as coconut, palmyra (*Borassus flabellifer*), talipot (*Corypha umbraculifera*), wild date (*Phoenix sylvestris*) and some ornamental palms are the recorded host plants of the pest. Coconut palm is the principal host plant, but it has adapted to palmyra palms in areas where coconut palms are scarce. Also when the coconut palms are severely injured, they infest the palmyra palms, as was noted in some tracts of Karnataka and Tamil Nadu.

7. Seasonal occurrence

On the West Coast of India, the pest occurs throughout the year with high population from February to May. In cases of delayed south-west monsoon, this may extend even up to June causing severe deprecations to the coconut plantation. A fall in the population occurs during the rainy months. Climatic factors effected significant population fluctuation of the pest in the field. Relative humidity is directly correlated with the pest population, which explains the greater prevalence of the pest in the coastal, backwater and river belts and in certain interior tracts adjacent to paddy fields and other open spaces.

On the East Coast also maximum population occurs during April, May and June



Average population of *Opisina arenosella* Wlk.

and minimum during the north-east monsoon period from September to December.

8. Description

Meyrick (1905) first described this pest.

Adult: A medium sized moth, female 10-15 mm long and a wing expanse of 20-25 mm. Head and thorax light greyish-ochraceous in colour. Forewings elongated, pale grey with some finely scattered blackish scales. Abdomen stout and pointed at the tip.

Male moth smaller than the female with a slender abdomen ending in a short brush of scales and a conspicuous tuft of hairs at the base of the hind wing.

Egg: Oval, 0.6 to 0.7 mm long and 0.3 to 0.4 mm wide. Creamy white in colour initially, but turn pinkish before hatching.

Larva: Cylindrical and slightly compressed with a posterior tapering end. Head small, brown or black and curved inwards. Body with reddish stripes dorsally, one on the median side and two each on lateral sides. Newly hatched larva pale white, but later changes to green. The final instar larva is about 15 mm long.

Pre-pupa: Inactive late larval instar with a silken covering surrounding the entire larva. About 13 mm long.

Pupa: Somewhat flattened dorso-ventrally, with blunt anterior and tapering posterior ends. Light to dark brown and about 9 mm long.

9. Life history

Female moths lay eggs on the lower surface of the leaflets mostly near the tip, very close to the old larval gallery. Egg stage is completed on an average in five days. The emerging larva voraciously feeds on the chlorophyll containing tissues of leaflets. The larval period is completed in eight instars in about 42 days, including a distinct pre-pupal period. The pupal period is about 12 days. Egg to adult stage is completed in 2 to 2½ months. The male moths live for an average period of seven days and the females five days. A single female lays about 137 eggs.

10. Control

10.1 Mechanical: Early to mild stages of infestation can be reduced by cutting and



Mechanical control - cutting and burning of infested leaves

burning the badly infested leaves or leaflets.



Spraying of the infested palms with dichlorvos 0.02%

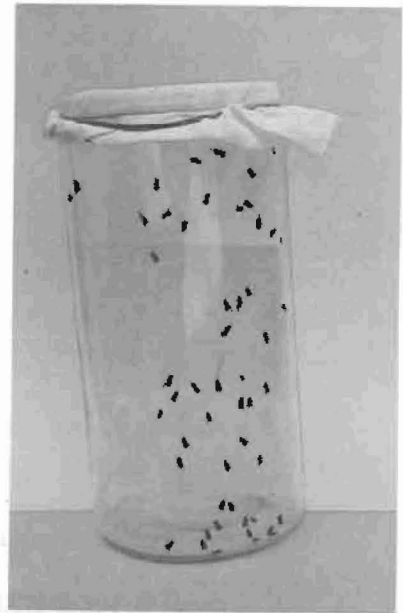
10.2 Insecticidal: In cases of epidemic outbreak spray the palms once with 0.02% dichlorvos. Spray the undersurface of the leaves to give a thorough coverage to the galleries of the pest. Use only insecticides that are safe to the natural enemies of the pest.

10.3 Biological: Parasitoids, predators and pathogens effect significant suppression of *O. arenosella* in the field. Among the parasitoids, release only the efficient parasitoids such as the larval *Goniozus nephantidis* (Bethyridae), the pre-pupal *Elasmus nephantidis* (Elasmidae) and the pupal *Brachymeria nosatoi* (Chalcididae). The major desirable attributes of these parasitoids are their greater searching ability, capacity to withstand high temperature, production of higher proportions of female progeny, occurrence throughout the year, abundance during the peak period of the host and presence in all the pest - infested areas. These parasitoids could be mass - multiplied and released at fixed norms in *O. arenosella* infested coconut plantations. Assessment of the pest population was felt necessary for

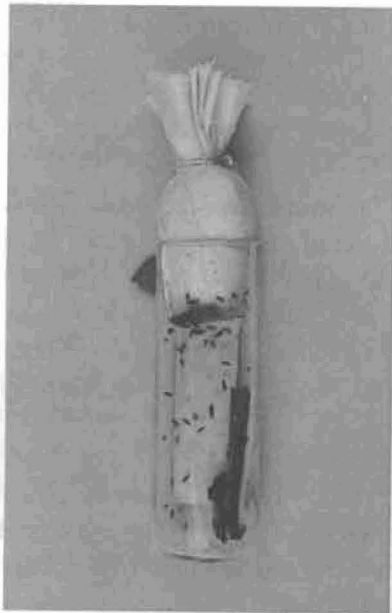
evolving suitable control measures, particularly for the release of known doses of the larval and pupal parasitoids/predators. For this purpose, a sampling technique was evolved.



Goniozus nephantidis



Brachymeria nosatoi



Elasmus nephantidis

10.3.1 Sampling technique

Population of *O. arenosella* was observed in different intensities during different periods of the year and also in different pockets of infestation (Sathiamma, George and Kurian, 1972). Maximum population occurs during April-June, medium during February-March and September-October and low during November-January. In an infested tract population is to be assessed on 20% sample palms. In each of the sample palms, population of larvae and pupae of the pest and the associated parasitoids/predators present on 41-60% leaflets of 20% leaves from the lower or middle whorl are to be counted (George *et al.*, 1982). Observations are to be recorded at fortnightly intervals, and population estimated based on the following formula :

Period	Sampling formula
February - March	$Y = 22.59 + 5.75X$
April - June	$Y = 38.40 + 9.70X$
July-October	$Y = 20.57 + 6.20X$
November - January	$Y = 6.36 + 8.99X$

where 'X' is the pest count in the sample leaflets and 'Y', the estimated population. This technique was found appropriate for estimation of field population of *O. arenosella* and its natural enemy complex.



Release of parasitoids on infested palms

10.3.2 Norms for release of parasitoids

Experiments have clearly revealed that laboratory - reared parasitoids could be effectively utilised for the biosuppression of *O. arenosella* population in the field. Arbitrary release often failed to bring about effective control of the pest and at other times the released parasitoids were unable to reach the proper target stage of the host. Hence, dosages were worked out for the field release of the three effective parasitoids of *O. arenosella*. For this purpose, separate count of larval (instar-wise), prepupal and pupal stages of *O. arenosella* present on leaves of coconut palms is to be made and population of each of the stages of the pest to be estimated using the sampling technique and formulae developed for the same. The dose is to be fixed based on the target stages of the host present at the time of observation. The norms fixed for the release are @ 20.5%, 49.4% and 31.9%, respectively, for *G. nephantidis*, *E. nephantidis* and *B. nosatoi*, in relation to the target stage of the pest, at fortnightly intervals (Sathiamma *et al.*, 1986). The larval parasitoid may be released when the pest is at the third instar stage or above, prepupal parasitoid at the late larval stage and pupal parasitoid at the early pupal stage. The parasitoids are to be released on the infested

leaves with fresh symptoms of damage and with live stages of the pest, which will ensure direct contact with the pest and establishment of the parasitoid. This would also avoid wastage of the released parasitoids.

Releases may be repeated till the pest population is suppressed. Release of the larval/prepupal parasitoids alone can bring about nearly 83% reduction in population of the pest. When the pest is in a multi-stage condition, a combined release of all the three species of parasitoids is required @ 40% each in relation to population of each of the target stages of the pest.

10.3.3 Techniques for laboratory mass multiplication of parasitoids

The parasitoids of *O. arenosella* could be multiplied in the laboratory using the techniques developed at the Biocontrol Laboratory of CPCRI Regional Station, Kayangulam.

i) *G. nephantidis*

One or two medium to late instar caterpillars of *O. arenosella* are introduced into clean, dry glass vials (7.5 x 2.5 cm) and 1-3 day old mated females of *G. nephantidis* 1-2 numbers are released into the vials. Parasi-

toid lays its eggs on the host's body, the emerging larvae feed on the host and pupate. The adult parasite emerges from the brood in 10-14 days. The parasitoid could be parasitized individually in small glass vials and many such parasitized larvae could be transferred to bigger glass bottles or conical flasks for emergence. The brood is female-biased. This can also be reared on larvae of *Corcyra cephalonica*.

ii) *E. nephantidis*

One or two fully grown late last instar caterpillars (prepupal stage) of *O. arenosella* are introduced into clean, dry glass vials (7.5 x 2.5 cm) and 1-2 day old *E. nephantidis* mated females, 2-3 numbers, are to be released into the vials, when the host caterpillars commenced spinning silken cocoons. After egg laying on the host, the parasites can be transferred to other glass vials containing appropriate stage of the host caterpillars. The parasite larvae emerging from eggs feed on the host and pupate. Adult emergence takes place in about 11 days. The brood is normally female-biased. *E. nephantidis* is highly host-specific and stage-specific, and adequate supply of host caterpillars has to be ensured for taking up laboratory multiplication of this parasitoid.

iii) *B. nosatoi*

Thirty to fifty adults of *B. nosatoi* comprising both sexes are to be sorted out and released into a cylindrical glass jar, 17.5 x 6.75 cm, the mouth of which is covered with muslin cloth. Honey is to be provided as small droplets on a piece of wax coated paper or butter paper, as food for the parasites. The jar containing parasites is to be kept in dim sunlight for 10-15 minutes daily for about 3-4 days after which only the host pupae are to

be offered for parasitisation.

Fresh pupae of *O. arenosella* (lab-reared) are to be carefully removed with cocoons and silken galleries intact or leaf bits containing pupae within cocoons and silken galleries and placed on a piece of card board, 12 cm long and 6 cm wide. The card board piece containing several pupae is to be inserted into the horizontally placed glass jar containing the mated parasites for parasitisation. The host pupae can be exposed for a period of 4-6 hours for parasitisation. The parasitised pupae have to be transferred to a similar glass jar or conical flask and kept for emergence of adult parasites. Normally adult emergence commences 12 days after oviposition and continues up to 20 days between 22-30°C temperature and 45-80% RH.

Nucleus cultures of parasitoids are made available, on request, to the Zonal Parasite Breeding Stations located in Andhra Pradesh, Orissa, Karnataka, Kerala, Maharashtra and Tamil Nadu, where *O. arenosella* is a problem.

10.3.4 Predators

Among the predators, the immature and adult stages of the carabid beetles *Parena nigrolineata* and *Calleida splendidula*, the chrysopid predator *Ankylopteryx octopunctata candida* and the spiders *Cheiracanthium* spp. and *Sparassus* sp. prevalent on *O. arenosella* infested coconut palms exert a significant degree of biological suppression of the pest in the field. Conservation of these predacious fauna is relevant in this connection and use only less toxic insecticide spray in the field.

11. Integrated Pest Management (IPM)

IPM would be very effective in bringing down the population of *O. arenosella* during severe infestation. This involves :

- i) Pre-release assessment of the pest population and its natural enemies based on the population counts from 41-60% leaflets of 20% leaves from the lower whorl of 20% sample palms.
- ii) Cut and burn the badly affected leaves/leaflets.
- iii) One spray of dichlorvos 0.02% initially, if the pest is in its active larval stage.
- iv) Release the bethylid, elasmid and

chalcidid parasitoids depending on the target stages of the pest at fortnightly intervals, till the pest population is suppressed. If spraying is necessary, care should be taken to release the parasitoids, only after three weeks of spraying.

- v) Post-release assessment of the pest and its natural enemy population on 20% sample palms.
- vi) If the infestation is very severe with damage to most of the leaves, adequate manuring and irrigation are to be resorted to in the affected plantation so as to rejuvenate the palms.