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BIOECOLOGY OF COCONUT WHITEGRUB *LEUCOPHOLIS CONEOPHORA* BURMEISTER IN KERALA

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ABSTRACT

Studies were carried out on the ecology, biology and population dynamics of *Leucopholis coneophora* Burmeister (Coleoptera: Scarabaeidae: Melolonthinae), a key pest of coconut in India. The adult emergence from soil was observed in the field after 4-5 rainy days irrespective of the amount of rainfall, combined with a sudden fall in soil temperature. In the field-collected samples the ratio of female to male was 1:8. Adults of both sexes were also found attracted to light traps in small numbers and their female to male sex ratio was 1:5. Out of several plant species screened in lab cages, the tender leaves of mango (257 mm^2/day) were preferred over cashew, banana, sapota and coconut.

An average fecundity of 23.08 (±1.985) eggs per female was observed in the lab. The incubation period was 23.94 (± 0.134) days and the I, II and III larval instars were completed in 40, 55 and 175 days respectively followed by the pupal period of 25 days. Feeding potential of III instar larvae has revealed that an average of 1.03g of fresh coconut root/larva was consumed in 24 hours. The phenology of the pest has been investigated and the peak population of the pest was observed in the field during the month of September.

INTRODUCTION

White grub *Leucopholis coneophora* is one of the key pests of coconut in the coastal Kerala and Karnataka. Nirula (1958) reported yellowing of the leaves and premature shedding of nuts due to the feeding of the white grub on coconut roots. The biology of *L. coneophora* along with two related spp. infesting arecanut namely *L. lepidophora* and *L. burmeisteri* were reported by Veeresh *et al.* (1982), Abraham and Mohandas, (1988) and Kumar and Veeresh (1990). Though the crop loss caused by white grub has been reported by Sekhar (1958) and Kurian and Abdulla Koya (1974), information on the feeding potential of white grub, phenology of the pest and adult emergence behaviour is not available. The present investigation on the bioecology of coconut white grub was undertaken with a view to formulate an integrated management schedule for the effective control of the pest.

MATERIALS AND METHODS

The investigations were carried out in sandy loam soil at CPCRI, Kasaragod, Kerala in a coconut monocropping system for a period of two years during 1990 and 1991. Adults emerging from the soil of a marked area were collected and counted between 20th May and 20th September during sunset hours. The field collected beetles were maintained in laboratory cages (30 x 30 x 30 cm). A glass trough (20 cm x 11 cm) was kept at the bottom of the cage filled with 10 cm soil. Freshly laid eggs were collected from the soil of these cages and placed in petriplates (9 cm x 1.5 cm) containing moist soil. The larvae upon hatching were removed to separate containers (6.5 cm x 9.5 cm) provided with moist soil (13.09% moisture) and roots of grass/coconut/sweet potato as food. After a period of one month they were transferred to earthen pots.

To assess the attraction of adults to light source two light traps were operated from 6 pm to 6 am with a mercury bulb (165 llm) in two white grub infested plots, throughout the experimental period. Data on the catches were tabulated.

For adult feeding studies the leaves of various plants grown in the vicinity of the Institute such as coconut, arecanut, oil palm, cashew, ficus, hibiscus, rose, banana, sapota, clove, guava, mango, jack, cocoa, neem, acacia, subabul and moringa were collected and placed in insect cages with adult beetles First the leaves were bulk screened and later those preferred for feeding were individually tested in batches of 10 adults to find out the quantity of feeding. The leaves were changed daily and feeding area, if any was plotted on a graph paper.

For estimating the feeding potential eight larvae of 2nd and 3rd instar grubs were individually caged in 1000ml beakers, three-fourth filled with moist soil. Each beaker was provided with a fresh tender coconut root replaced at an interval of 24 hours. Fresh roots were individually kept in four beakers without any grubs to serve as control. The weight of the root was taken before and after the feeding. The loss of weight in the root due to grub damage was calculated after taking into account the loss in the weight of roots kept in the control. This experiment was conducted for a period of 30 days and was repeated thrice.

For estimating the per palm field population of grubs in the soil to a specific depth, monthly samples consisting of 10 numbers were randomly collected from 200 palms and the life stages obtained therein were recorded. Thus the seasonal phenology of the pest was investigated. Emergence of the adult beetle was correlated with rainfall and soil temperature.

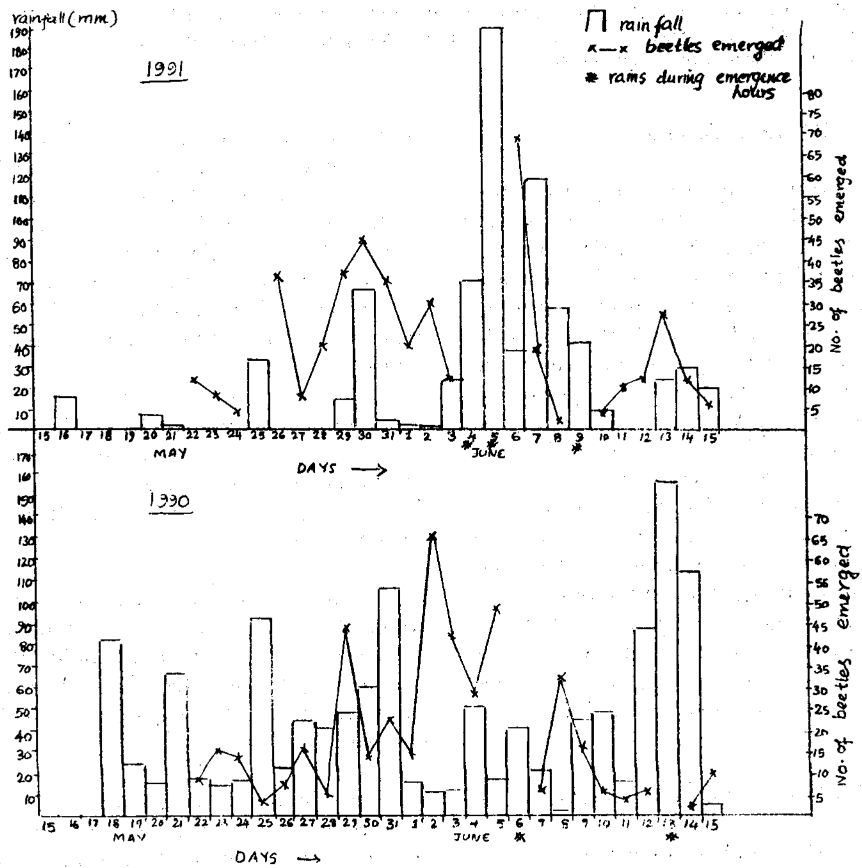

Fig. 1 **Adult emergence of *L. coneophora* in relation to rainfall during May-June**

RESULTS AND DISCUSSION

Adult emergence of *L. coneophora* started in the last week of May in both the years. The rainfall data when correlated with the adult emergence indicated the commencement of emergence after 3-5 rainy days irrespective of the amount of rainfall (Fig. 1). When the data pertaining to the month of May were scrutinized, it was found that there was a sharp decline in the soil temperature in the second fortnight from 35.5°C to 31.6°C. A combination of 3-5 rainy days and fall in soil temperature perhaps triggered the adult emergence (Fig. 2). In *Holotrichia serrata* the adult emergence and egg laying are dependant on rains in April-May irrespective of the soil moisture. Veeresh (1977) reported that saturation of atmospheric humidity

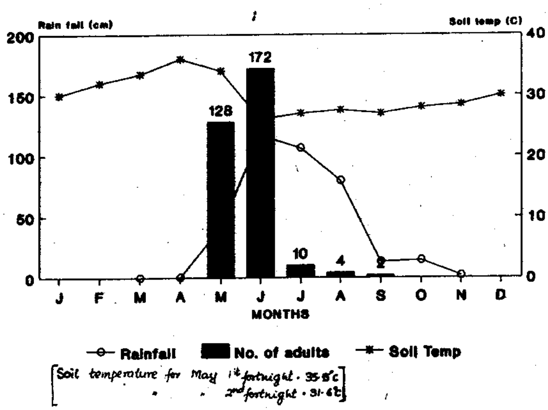

Fig. 2 *L. coneophora* adult emergence in relation to rainfall and soil temperature

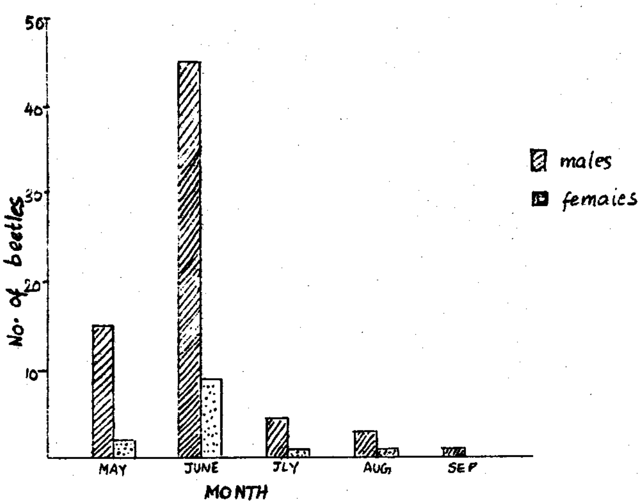

Fig. 3 No. of *L. coneophora* beetles collected in Light trap

seems to have more influence on adult emergence in these months than the moisture content of soil.

When a light trap with a light source of 165 llm mercury bulb was operated, a few adults were collected in the insect catches (Fig. 3). Sex ratio of female to male in the light trap collections was found to be 1:5. These observations of female attraction towards light traps are contradictory to the observations of Abraham and Mohandas (1988) who reported that females seldom flew or make emergence holes. During the adult emergence both males and females, were collected from the field and the sex ratio was 1:8. Abraham and Mohandas (1988) have reported female to male ratio as 0.099: 1 (i.e approx 1:10) under field conditions. The results obtained from the light trap catches are in agreement with the population dynamics of the pest.

Many species of white grubs are known for the congregation of their adult stages on a particualr host. For example, *Holotrichia* sp. has been reported to congregate on the leaves and branches of neem trees immediately after emergence (Gupta, 1973; Veeresh, 1977; Raodeo and Deshpande, 1987). However, in *L. coneophora* congregation of adults on any food plant has not been observed. Moreover, earlier workers reported that adults do not feed on any food plant. (Sekhar, 1958; Nirula, 1958; Veeresh *et al.*, 1982; and Abraham and Mohandas, 1988). With a view to identifying a plant as a preferred host, so that a suitable bait formulation can be evolved at a later stage, a number of species occurring in the neighbouring localities of coconut gardens were screened. Out of several species tested in the laboratory cages maximum feeding of 257 mm^2/day was recorded on the tender leaves of mango. Other host plants in order of preference are cashew, banana, sapota and coconut (Table I.).

The preoviposition period lasted for 10 days, followed by a 4-day egg laying period. Fecundity was observed to be 23.08 (±1.985) egg/female. The incubation period on an average was 23.94 (± 0.134) days. The biology is in confirmation with the observations made by earlier workers with three larval instars of 40, 55 and 175 days respectively followed by a pupal stage of 25 days.

Formation of egg laying chamber in *L. coneophora* was reported by Abraham and Mohandas (1988). However, in the present study, no such egg laying chamber was observed. Eggs were found loosely scattered in soil at a depth of 10-15 cm both in the field and laboratory.

The experiments conducted on the feeding potential of 2nd and 3rd instar larvae have revealed that an average of 0.52g and 1.03 g of fresh root was consumed by a single 2nd and 3rd instar grub respectively in 24 hours (Table II.). Since the 1st instar feeds mainly on grass roots damage caused to coconut root is negligible. A single second instar stretching for a period of 55 days consumes about 28 g of

Table II. Feeding potential of *L. coneophora* grubs

Batch No.*	Amount of coconut root (g) consumed/24 hour/grub	
	2nd instar	3rd instar
1	0.46	1.04
2	0.54	0.98
3	0.56	1.07
Mean	0.52	1.03

* Number of grubs per batch = 8

Table I. Feeding potential of *L. coneophora* adults

Batch No.*	Area of leaf fed (mm^2) / beetle / day				
	Mango	Cashew	Banana	Sapota	Coconut
1	200	95	78	58	50
2	325	96	88	50	53
3	300	103	86	66	53
Mean	275	98	84	58	52

* Number of beetles per batch = 10.

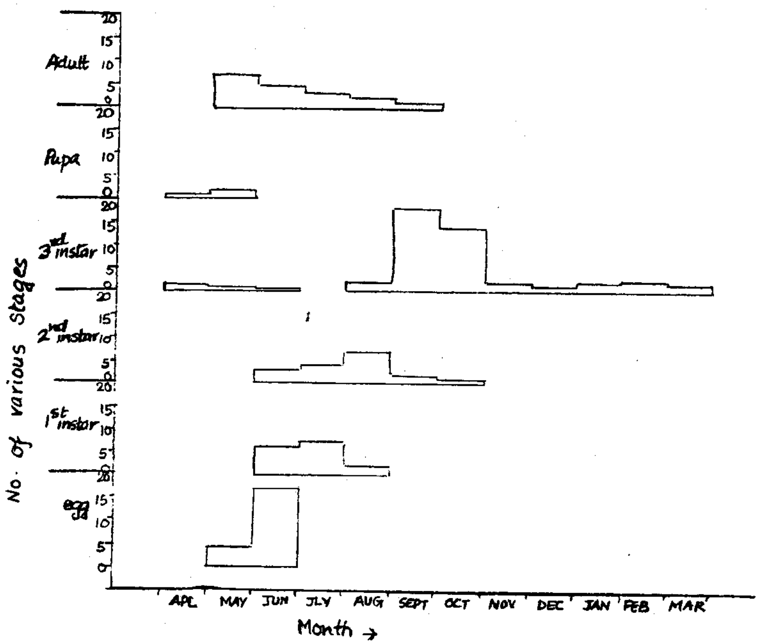

Fig. 4 Seasonal phenology of *L. coneophora* (per palm population)

coconut root, whereas the 3rd instar which lasts for a period of 175 days, consumes about 180g of coconut root.

The seasonal phenology of *L. coneophora* studied for a two years period is presented in Fig. 4. This clearly indicated that this species has a one year life cycle under field conditions which is in conformity with the findings of Abraham and Mohandas (1988). There is preponderance of 1st and 2nd instar grubs from the month of June till September. The 3rd instar appears in field samples from August in small numbers and its presence continues upto April. It overlaps with other early instars and reaches a peak in the month of September.

The results indicated the possibility of forecasting adult emergence and trapping the adults by light trap, food plants etc., for inclusion in the integrated pest management schedule. Detailed account on seasonal phenology has clearly shown the distribution of grub stages in the season. This will help in formulation of better chemical control schedules against the pest.

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DISCUSSION

C.K. SARASWATHY AMMA : How long will the adult beetle survive?

CHANDRIKA MOHAN : The adult survives for 29 days (range 19-36 days).

K.R. VIJAYAKUMAR : If the pest is serious in coconut, why such a study was not undertaken earlier?

CHANDRIKA MOHAN : Biology of this pest was worked out by previous workers. However, the detailed biology work was not carried out.

A. MANOHAR RAO : Only rainfall has been taken into study, why other weather parameters not taken into account because irrespective of rainfall the adults have emerged?

CHANDRIKA MOHAN : Adults will not emerge irrespective of rainfall. Some 3-5 rainy days are required to trigger the mechanism of emergence. Apart from rainfall, soil temperature was also considered in this study. Other weather parameters like atmospheric temperature and humidity did not show any correlation to emergence.

D.P. VERMA : The maximum population of male and female was observed in June. Whether you suggest to resort to chemical control to be adopted in June. Whether spraying of pesticides around the coconut root will help to prevent the damage by this pest?

CHANDRIKA MOHAN : Only adult beetle population was found in peak in June. We cannot apply chemical control for adults as the beetles are not congregating on any food plant. Moreover, the adults remain burried in soil during day time, and so chemical control of adults is not feasible. Chemical spraying of pesticides around the root zone is not very effective and economical. For soil treatments granular formulations of systemic insecticides are better than spray formulation for the whitegrub control