BIO-ECOLOGICAL STUDIES ON CACAO MEALY BUG, *PLANOCOCCUS LILACINUS* CKLL.

C. P. RADHAKRISHNAN NAIR[1] AND M. R. G. K NAIR[2]

ABSTRACT

The biology, seasonal abundance, nature and spread of infestation, association with ants, and nature of damage caused by the cacao mealy bug *Planacoccus lilacinus Ckll.* (Homoptera: Pseudococcidae) were studied. Life cycle of the female mealy bug was completed in 20 to 25 days and of male in 17 to 20 days. The peak period of infestation occurred during summer months, and with the onset of rains the population declined. There was significant positive correlation between temperature and pest incidence, and significant negative correlation between pest incidence and rainfall and relative humidity. The pest caused wilting of cherelles to an extent of 85.35 per cent, abortion of cushions, and stunted growth of seedlings. A new strategy for the control of the pest has been suggested.

INTRODUCTION

Cacao (*Theobroma cacao* L.), is susceptible to infestation by a large number of insects in different countries. In India, more than 54 insect species have been reported as pests of cacao (Nair, 1981). Among the various insects found on cacao, the mealy bug *P. lilacinus* is the most destructive (Nair, 1976). This bug is widely distributed in Sri Lanka, Philippines, Java and Papua New Guinea (Entwistle, 1972). It is persistent on cacao in India and at times attains high numerical densities causing serious damage to the crop. The biology, nature of damage, host range, seasonal abundance, nature and spread of infestation and association with various symbionts have been studied, and the observations made are presented in this paper.

MATERIAL AND METHODS

The mealy bug culture was maintained on sprouted potato in the laboratory. To study the life history of the mealy bug, a

1 Central Plantation Crops Research Institute, Regional Station, Vittal-574 243, Karnataka.

2 College of Agriculture, Vellayani-695 522, Trivandrum Dt., Kerala.

known number of newly emerged crawlers were introduced on sprouted potato. The nature of oviposition and incubation period were studied by periodic observations. The period taken by the crawlers to become adult male or female was recorded. The larval and pupal duration, and male longevity were studied using 10 individuals in each case. Fecundity was studied both by counting the number of eggs present in gravid females after dissection, and also by counting the total number of crawlers produced by gravid females each day, using 10 females in each case. Sex ratio was determined by observing the development of 160 crawlers.

The nature of damage, host range, nature and spread of infestation and the association with symbionts were studied by periodical field observations. For studying the seasonal abundance, the population of the pest was assessed in terms of the percentage of shoots, cushions and pods infested by the pest at monthly intervals on 25 plants for 21 months, avoiding insecticide sprays on these plants. The data were correlated with meteorological factors such as maximum and minimum temperatures, relative humidity and rainfall. The symbiont ants were got identified by the Commonwealth Institute of Entomology, London.

Results and Discussion

Life Cycle: The adult female had a mean pre-oviposition period of 2.7 days, oviposition period of 9.0 days and post-oviposition period of 2.6 days. The female bug laid eggs within a mass of tangled waxy strands without forming an ovisac. Observations on fecundity showed that the number of eggs laid ranged from 47 to 286, averaging 144.3 per female. The number of eggs as revealed by dissection of a gravid female ranged from 275 to 361 with an average of 313 4 eggs. Probably due to starving and other unnatural conditions in the laboratory, all the eggs were not laid by the females.

The eggs hatched in less than six hours after oviposition. The nymphal period lasted 20 to 25 days in females with an average of 22.8. In males it lasted 17 to 20 days with an average of 18.7. The male nymph had a pupal period which lasted 4 to 5 days with an average of 4.5. The adult male had a longevity of 2 to 3 days

with an average of 2.2. The female had a longevity of 12 to 16 days with an average of 14.3. Observations on sex ratio showed that on an average, 57.5 per cent of the crawlers developed into females.

The eggs were oval with rounded ends and yellowish brown when freshly laid; crawlers were light brown in colour and elongated on emergence. Within a day or two they settled and began feeding. After settling, the body produced white mealy secretions. A full grown crawler was 1.80 mm long and 1.12 mm broad. The pupa measured on an average 1.20 mm in length and 0.45 mm in width. It had distinct body parts, such as head, thorax and abdomen. The antennae were not free. Pupa had a pair of conspicuous red compound eyes.

The adult female was oval with flat ventral and humped dorsal sides. The body was completely covered with waxy secretions. It measured on an average 3.90 mm in length, 2.25 mm in width. The male had well defined head, thorax and abdomen, and measured 2.55 mm in length and 0.55 mm in width. It had a pair of transparent and membranous wings.

Nature of damage: *P. lilacinus* infested all tender parts of the plant such as shoots, terminal buds, cushions, cherelles and pods. On the shoots, the mealy bug preferred to infest the growing tip. The feeding resulted in the suppressed growth of tender leaves which became deformed into tender hair-like processes, giving the shoot tip the appearance of a brush. The jorquetting of the plant was also adversely affected. Colonization and feeding in the cushion resulted in its abortion. The infestation on the cherelles caused wilting and they ultimately dropped. Observations recorded on 10 plants from October to May 1979–1980, indicated that shedding of cherelles occured to an extent of 85.35 per cent. On an average, 77.82 per cent of the young cherelles infested by *P. lilacinus* dropped within one month of infestation. On larger pods, the site of infestation turned brownish. Irregular minute cracks and pitting developed on the pod surface.

Alternate host plants: *P. lilacinus* was found to feed on *Glyricidia maculata* and crotons, besides cashew and coffee reported earlier (Nair, 1975).

Population fluctuation of *P. lilacinus*: Studies on the population fluctuation of *P. lilacinus* in relation to meteorological factors were carried out at Karukachal (Kottayam District, Kerala). The lowest levels of population were observed during June, July and August. From August onwards there was a gradual increase in the population reaching peak levels during April and May. The lowest levels of 3.01 to 10.88 per cent infestation of plant parts was observed from June to August and highest levels of 48.12 to 60.48 per cent during April and May.

Studies showed a significant positive correlation (r=0.854) between maximum temperature and mealy bug infestation; minimum temperature also had significant positive correlation (r= 572). Higher temperatures favoured the population build up. There was significant negative correlation between mealy bug infestation and climatic factors like rainfall and relative humidity (r=0.506 and –0.418 respectively).

The mealy bug population started its first congregation on the inner canopy levels and on the cushions on main trunk, soon after the monsoon rains in September-October. As the temperature became very congenial for its rapid multiplication in summer months, the infestation spread to the outer canopy as well.

Attendant ant species and nature of spread of infestation by *P. lilacinus:* Observations on the symbiont ant species and the pest in a cacao garden at Vittal, Dakshina Kannada, Karnataka, indicated that on an average, 66,18 per cent of the plant population showed mealy bug infestation during May, and 5.75 per cent during July. It was observed that the build-up from August to January was more or less static with the highest incidence during this period at less than 25 per cent. Various species of attendant ants associated with *P. lilacinus* in this region were, *Oecophylla smaragdina* Fab., *Technomyrmex* sp., *Anoplolepis longipes*J., and *Solenopsis geminata* F. The first two were the major species found in all cacao gardens in the area. The ant activity was maximum after January.

These observations warrant the need for developing new strategies for the control of mealy bug, such as the use of poison

baits for ant control, indirect control of the pest build-up, and the spot application of insecticides to the first pockets of infestation during post-monsoon period. These may help in avoiding the blanket application of insecticides which is recommended at present for the control of the pest.

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REFERENCES

ENTWISTLE, P. F. (1972). *Pests of cocoa.* Longman, London, 779 p.

NAIR, M. R. G. K. (1975). *Insects and mites of crops in India.* Indian Council of Agricultural Research, New Delhi, 404 p.

NAIR, C. P. R. (1976). Survey of pests of cacao in India. *Ann. Rep. Central Plantation Crops Research Institute, Kasaragod,* pp. 195-196.

NAIR, C. P. R. (1981). "Investigations on insect pests of cacao (*Theobroma cacao* L) in Kerala with special reference to the mealy bug, *Planococcus lilacinus* Ckll. (Homoptera: Pseudococcidae)". Unpubl. Ph.D. Thesis, Kerala Agricultural University.

DISCUSSION

EAPEN GEORGE (A. V. Thomas & Co.): Would you comment on the identification of plants infested in Sept. October for mealy bug control, i.e. before spread and subsequent crop loss in April–May?

C. P. R. NAIR: The build up of the insect starts soon after the monsoon in October–November. Along with this the symbiont ants also build up. The spot application of insecticide can be done at this stage on the initial foci of infestation. Hence we may be able probably to avoid repeated blanket application which is practised at present.

N. MURALEEDHARAN (UPASI): Have you recorded any parasites?

C. P. R. NAIR: Only the predator *Spalgis epius* has been recorded so far.

N. M.: Is your recommendation on the new control strategy based on field trials?

C. P. R. NAIR: The new strategy is only a proposal for consideration.