R. P. F. III

FINAL REPORT

1. Institute Code No. **ENT. II(299)**

2. I. C. A. R. Code No.
Pl-81/16-ICI-H10/2110

3. Name and Address of Research Institute/Centre:

Central Plantation Crops Research Institute
KASARGOD 670 124, Kerala

4. Project Title:

INVESTIGATIONS ON MEALY BUGS ASSOCIATED WITH CACAO

5. Name and Designation of Project Leader:

C.P. Radhakrishnan Nair
Scientist S-2 (Agrl. Entomology)

6. Name(s) and Designation(s) of Project Associates including Project Leader and work to be done:

Sl. No.	Name and Designation	Time spent	Work done
1.	Dr. C.P. Radhakrishnan Nair Scientist S-2	30 Man months (during 1981-85)	As Project Leader all items envisaged

7. Location of Research Project with complete address (Division/Section/Sub-Centre)

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
REGIONAL STATION, VITTAL 574 243, KARNATAKA.

8. Date of start

1981 March

9. Date of termination

1985 June

10. (a) Objectives (Not more than 150 words)

The project aims at collecting detailed information on all mealy bugs associated with cocoa, with regard to the following items viz.,

i) identification of various species of mealy bugs
ii) assessment of their economic status
iii) bio-ecology of major species
iv) studies on natural enemies and biological control trial using exotic predator Cryptolaemus montrouzieri and
v) Comparative studies on available chemical control methods

(b) Practical Utility including background information (Not more than 150 words)

(i) Background Information

In earlier investigations to identify the pest problems of cocoa in India, the mealy bug Planococcus lilacinus Ckll. was found to be the consistent and major insect pest of the crop. The pest infests all tender plant parts causing serious economic damage. Various chemical control methods have been reported earlier. Adult needs evaluation of these methods would help in formulating effective economic pest control schedule.

(ii) Justification

The present investigations will help to identify various species of mealy bugs on the crop. The available information on the items envisaged is highly insufficient to formulating efficient pests control programme. Hence, the investigations envisaged would be highly beneficial to the farmers, besides, their academic value in future years.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

KASARAGOD-670 124, KERALA

R P F III 1986

Project No. Ent.II(299)

Technical Programme: Date of Start: 1981

1. Collection and identification of various species of mealy bugs on cocoa from various agroclimatic locations

2. Studies on seasonal incidence of major species and their symbiont ants

3. Nature of association of each mealy bug species with cocoa

4. Studies on natural enemies and trial with exotic predatory beetle, *Cryptolaemus montrouzieri*

5. Role of mealy bugs in cushion abortion and cherelle wilt

6. Evaluation of various insecticidal application methods

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

KASARAGOD-670 124, KERALA

R P F III 1986

Project No. Mat.XI(299)

12. Final Report: 19 81 —19 85 Date of Start: 1981

The programme of work envisaged were carried out in different years and the results of various items are given below under respective headlines.

Survey and identification of various species of mealy bugs and their attendant ants:

During 1981 and 1982 an extensive survey was conducted in various cocoa growing areas of Kerala, Karnataka and Tamil Nadu to identify various species of mealy bugs on cocoa and their attendant, symbiont ants. Four species of mealy bugs were found on cocoa. The most predominant species was Planococcus lilacinus CKll. The other mealy bug species recorded were Pseudococcus citri Risso., Ferrisia virgata CKll. and Icerya aegyptiaca D. The relative abundance of various mealy bug species is given in Table-1.

Table 1. Relative abundance of various species of mealy bugs

Mealy bug species	Frequency of occurrence in 92 samples
Planococcus lilacinus	71
Planococcus citri	11
Ferrisia virgata	7
Icerya aegyptiaca	3

P. lilacinus and P. citri were found to infest all tender plant parts such as flushes, cherelles, pods and cushions. F. virgata was found in majority cases infesting cushions and rarely cherelles. I. aegyptiaca was seen only on ventral surface of foliage adjacent to leaf veins.

Various species of symbiont attendant ants associated were Cataglyphis aenescens Fab., Technomyrmex sp., Solenopsis geminata F., Anoplolepis longipes and Monomorium sp. The first two species were the major symbionts.

2. Seasonal abundance of mealy bugs and symbionts:

Incidence and intensity of mealy bug infestation along with associated symbionts were studied during the summer and post-monsoon seasons from different location during 1982. The pest incidence in various locations ranged between 42.40 to 70.29% during summer whereas during post-monsoon period it varied between 15.20

to 43.33%. The intensity of mealy bug was high during summer in all locations and was low during post-monsoon period. Table-2 indicates details on incidence i.e. percentage of plant population affected by mealy bugs, average intensity of infestation and relative abundance of various ants.

Table 2. Seasonal abundance of mealy bugs (various locations)

Location	Survey 1982					
	% of plant population with infestation		Average intensity of infestation		Ants associated in the order of abundance	
	I	II	I	II	I	II
Dakshina Kannada	60.33	15.20	71.67	17.11	AB	BACD
Coorg	42.40	-	60.09	-	AB	-
Calicut	45.20	19.17	61.76	17.68	BA	BA
Wynad	64.17	37.77	61.48	17.44	AD	AB
Kottayam	70.29	43.33	66.45	19.04	ABD	ABD
Trivandrum	68.00	39.14	59.94	27.30	ABC	AB
Kanyakumari	49.33	-	52.15	-	BA	-

I Summer
II Post-monsoon

A - Oecophylla
B - Technomyrmex
C - Solenopsis
D - Anoplolepis

3. Pattern of population build-up of mealy bug P. lilacinus and symbionts

Monthly observation recorded in a garden at Vittal showed that the pest build up starts with the cessation of rains in September-October and reaches a peak in April-May. The pest incidence ranged from 3.75% in July to 71.22% in May during an observational period of 22 months. The intensity of infestation on various plant parts also exhibited a similar trend. The pest build up started in the main trunk and inner canopy during the post-monsoon period and as population increased the infestation spread to the outer canopy areas in summer months. A shift in the occurrence of the symbiont ants was also noticed evidently. During initial build up of the population the ant species, Technomyrmex sp. was a dominant species. As the population build up of pest advanced, Oecophylla smaragdina displaced the black ant Technomyrmex sp.

A significant correlation existed between spread of mealy bug incidence and the symbiont ant Oecophylla. But there was no significant correlation between pest incidence and occurrence of other symbiont ants (Table 3).

Table 3. Correlation between percentage incidence of P. lilacinus and attendant ants and their interaction

Ant species	Mealy bug incidence (percentage)	Species interaction among ants	
		B	C
Camponotus sericeus (A)	+0.42*	-0.96**	-0.04 NS
Technomyrmex (B)	-0.34 NS	-	0.25 NS
Solenopsis geminata (C)	-0.20 NS	-	-

* P= 0.05 ** P= 0.05 NS. Not significant

Association of Mealy bugs with symbiont ants

Over a period of observation for 27 months in two locations viz., Vittal and Karukachal to study the spread of mealy bug infestation in relation to the build up of attendant ant population, a positive correlation could be established. The correlation between pest incidence and ant incidence in both the locations was highly significant. r = 0.79** and 0.99** respectively for Vittal and Karukachal. This explains that the activity of symbiont ants promotes the colonisation and dispersal of mealy bugs from tree to tree. The incidence of ants in a garden is always higher than that of mealy bugs.

Rescheduling the time of application of insecticides to manoeuvre the pest population by spot application of insecticides:

An experiment was in progress for a period of 27 months at two locations with a view to reschedule the recommendation on insecticidal control. The pest population was monitored at various periods and spot applications of insecticides, monocrotophos/fenthion at 0.05% were given at appropriate periods. Whenever pest incidence was over 15%, insecticides were applied. The analysis of the data showed that spot application of insecticides were highly effective in maintaining the population at a low level. The percentage of pest incidence before and after the insecticidal application showed significant differences (Table 4).

Table 4. Table of means showing per cent incidence of P. lilacinus during pre-treatment and post-treatment periods

	Vittal	Karuthachal
Pre-treatment period	31.8	37.75
Post-treatment period	11.4	13.71
't' value	5.44**	3.81*

** Significant at P=0.01
* Significant at P=0.05

Bait to trap Oecophylla

Three materials viz., Jaggery, dry fish and mealy bug infested pods were tried to bait the red ants. The preference of these were in the order of dry fish to jaggery to pod with mealy bugs. Dry fish attracted significantly more number of ants. Baiting done for a continuous period of 10 days showed that the catches were more during the first five days.

Observation on cushion abortion and cherelle wilt

Observations on cushion abortion due to mealy bug infestation showed that during post-monsoon period of 1984 on an average 23.6 per cent of cushions were aborted due to the pest incidence. Another round of observations during summer of 1985 showed that the pest affected 26.7 to 60.1% of cushions and cherelles. An insecticidal spray given to a set of mealy bug infested cherelles could retain 67.5 per cent of pods in healthy condition. Observation on a set of unsprayed cherelles indicated that 92.6% of mealy bug affected cherelles wilted in 15 days time.

Studies on natural enemies

Observations on natural enemy complex of cocoa mealy bugs revealed the presence of a coccinellid beetle predator Pullus sp. and a lycaenid caterpillar, Spalgis epius. The activity of these predators were low during post monsoon period. They were active during summer months. Observation of a total of 73 samples showed that 21.9% and 31.5% samples were infested by Pullus sp. and Spalgis epius.

Studies with exotic predatory beetle
Cryptolaemus montrouzieri

In an unsprayed plot at Vittal four consignments of 300 each the predatory beetle were released during 1984 April-May and 1985-April-May. Subsequent observations did not show either the sign of establishment of the predator or a reduction in the pest incidence. The symbiont ant, Oecophylla was foundetrimental to the predatory beetle in the field.

Evaluation of various method of insecticidal application:

The assessment of efficacy of different methods of insecticidal application viz., foliar application, stem banding and soil drenching using the commonly used insecticide dimethoate, indicated that though other methods were given control of the pest population, foliar application of dimethoate 0.05% gave maximum control of mealy bugs and was significantly superior to other methods tried (Table 3).

Table 3. Table of means showing percentage reduction in infestation over pre-treatment during different occasions after insecticidal treatment.

	3rd day	7th day	15th day	30th day
Foliar spraying	68.00 (89.97)	71.90 (90.35)	74.56 (98.91)	69.51 (87.73)
Drenching	24.56 (17.28)	28.56 (22.86)	21.98 (14.00)	13.23 (5.22)
Banding	36.03 (37.95)	44.41 (48.97)	36.98 (39.47)	23.54 (15.95)
Control	0 (0)	0 (0)	0 (0)	0 (0)
CD(P=0.05)	18.94			

(Figures in parenthesis indicate values after retransformation)

13. Approximate expenditure incurred in the Project: (Give reasons for variation, if any, from original estimated co

Manpower:

Scientific	Rs.60,000	Chemicals	Rs. 2,000
Technical	Rs.12,000	Experimental material	Rs. 2,000
Supporting	Rs. 6,000	Contingencies	Rs. 3,000

14. Publications and material (one copy each to be supplied with this proforma)

a) Research papers

b) Popular articles

Not to be published

c) Reports

Annual reports of Institute for 1991,92,93,94 and 1995

d) Seminars and workshops (Relevant to the Project) in which the Scientists have participated:

Plantation Crops Symposium-V December 1992-Kasaragod

e) Material developed (such as new varieties of crops or breeds of farm animals, implements, products, etc.)

Involved a new pest control strategy for management of cocoa pests by rescheduling the insecticidal application

15. Details (Nos. etc.) of Field/Laboratory Note books and final material and their location

Log book	One	
Field book	One	Kept in Entomology Section, [illegible] Station, Vittal
Laboratory notebook	Two	

16. Comments/suggestions of Project Leader regarding possible future line of work that may be taken up arising of this project:

Control of symbiont ants may be taken up. This will be possible with use of synthetic baits and repellants. Ant control shall make the chances of a biocontrol programme more bright.

17. Signatures with name of Project Leader and Associates:

C. P. Radhakrishnan Nair

18. Signature (with comments, if any) of Head of ~~Division/Section~~/Station:

Joint Director
Central Plantation Crops Research Institute
Regional Station, P.O. VITTAL (S. K.)

19. Signature (with comments, if any) of Director: