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Management of coreid bug, *Paradasynus rostratus* Dist. on coconut palm in homesteads having mixed cropping

Ambily Paul*, C. Nandakumar and Hebsy Bai

Department of Agricultural Entomology, College of Agriculture, Vellayani, Trivandrum 695 522, Kerala, India
Email: ambilypaul@ymail.com

ABSTRACT: Chosen neem based botanicals and synthetic chemical pesticides were evaluated against the coreid bug, *Paradasynus rostratus* Dist., a major pest of coconut in Kerala. In laboratory tests, neem seed oil - garlic emulsion 2% and profenophos 0.05% proved effective. Since the alternative hosts, guava, cashew, cocoa and neem in the multiple cropping system play an important role in population build up of the pest, the effect of applying selected treatments on these alternative hosts on the pest population in the coconut was evaluated in a farmer's field. Application of neem seed oil - garlic emulsion 2% + profenophos 0.025% on alternative hosts was the most effective in reducing the extent of *P. rostratus* infestation in the surrounding coconut palms.

KEYWORDS: coconut, *Paradasynus rostratus*, pest management

INTRODUCTION

Seasonal and annual agricultural crops are intercropped in the coconut based farming system extensively in the homesteads of Kerala. Recently the main crop, coconut is seen attacked by a complex of pests, the coreid bug, *Paradasynus rostratus* Dist. being one among them. Paul (2006) established the role played by the alternative hosts *viz.*, guava, cashew, cocoa and neem on the population build up of the pest in coconut in the home stead cropping systems. Spraying of 0.1 per cent BHC, 0.05 per cent carbaryl (Kurian *et al.*, 1972), 0.1 per cent endosulfan (Ponnamma *et al.*, 1985) have been recommended for the control of *P. rostratus*. These treatments are not fully effective. Other methods were hence tried and the results are presented in this paper.

*Corresponding author

MATERIALS AND METHODS

Six plant based insecticides and five chemical insecticides (Tables 1 and 2) were evaluated through bioassay experiments in the laboratory and best treatments were subjected to further evaluation under field situation in typical homesteads of Kerala.

The insecticide spray materials were prepared by diluting the commercial formulation with required quantity of water. A stock fluid of neem oil - garlic was prepared by mixing 20 ml of neem oil with 50 ml of water containing 5 g of dissolved bar soap and then mixing this with garlic extract prepared by extracting 20 g of ground garlic in 30 ml water. One hundred ml of the stock solution was added to 900 ml of water to get one litre of 2% neem oil - garlic emulsion.

Laboratory evaluation

Spray fluids prepared in required strength were applied on guava fruits. For this experiment, single tender fruit along with the twig was cut from the plant and the cut end of the twig was inserted into water taken in a small conical flask to keep the freshness of the fruit. Those flasks with the twig were then kept in a jar which was closed with muslin cloth. Adequate replication was set up following the above procedure. In the laboratory, each twig was sprayed with required quantity of material using an atomizer and five replications were set up for each treatment. One lot sprayed with water alone was included in treatments as control. The sprayed fruits were made dry under fan and then exposed to five fourth instar nymphs of *P. rostratus* and kept enclosed in a glass jar. The nymphs were collected from a culture of the test insect maintained in the laboratory under ambient temperature and humidity. The percentage mortality was worked out as per Abbott's formula (Abbott, 1925).

Field experiment

The experiment was laid out in farmers field where the known alternative hosts of *P. rostratus viz.*, guava, cashew, cocoa and neem in appropriate stages and the main crop coconut were available in adequate numbers. There were four treatments (Table 3) and each treatment was replicated four times taking one tree as a replication. Alternative host sprayed with water alone was taken as control (four numbers). Unsprayed coconut trees around each sprayed alternative host in the experiment were identified for recording *P. rostratus* incidence and extent of damage. The trees were sprayed with respective pesticide to runoff level.

Four coconut palms around each treated alternative host were selected for taking observations. The first six bunches of the selected palms were tagged with 'sunpac' labels and numbered serially from the sixth bunch onwards to the top, so that the emerging bunches could be serially tagged. The infestation of coreid bug on the third bunche was assessed (Julia, 1978) and the total number of nuts in the bunch and number of nuts damaged by the pest were recorded. The percentage of infested nuts was calculated. The intensity of damage in the infested nuts was graded under six categories based on the methods suggested by Brown (1959): category I - nuts without

scars (uninfested), category II - nuts with 1 to 5 scars (negligible damage), category III - nuts with 6 to 20 scars (mild damage), category IV - nuts with greater than 20 scars in a single ring round the nut (moderate damage), category V - nuts with greater than 20 scars distributed more or less all over the nut (heavy damage), and category VI - nuts heavily scarred in which the endosperm failed to develop (severe damage). The difference between categories IV and V depends on whether the nut has been attacked during its development only once (category IV) or repeatedly (category V) resulting in lesser and greater reduction of kernel, respectively.

The yield Index (YI) was worked out as YI = W1X1 + W2X2 + W3X3 + W4X4 + W5X5 + W6X6 where W1 to W6 were the weights given to the number of damaged nuts in the respective classes and the weights were 6, 5, 4, 3, 2 and 1, respectively, in each damage category and X1 to X6 represented the number of nuts in each damage category, respectively.

RESULTS

Laboratory evaluation

The results of laboratory evaluation of botanicals and chemical insecticides are presented in Tables 1 and 2 respectively.

The number of feeding punctures in neem seed oil - garlic emulsion 4% and 2% and neem seed oil 4% and 2% treated fruits was negligible (Table 1). More feeding punctures were observed in NeemAzal 0.2%, NeemAzal 0.4% and Econeem 0.2% treated fruits and they were on par.

The mortality of coreid bug nymphs was more when released on neem seed oil -garlic emulsion 2 and 4% (46.67% each) treated fruits and it was on par with the treatments, Econeem 0.4% (30%), Achook 0.4% (30%) and Nimbecidine 0.4% (23.33%). Lower percentage mortality was recorded from neem seed oil 2% (20%), Neem Azal 0.4% (6.67%) and Econeem 0.2% (3.33%) treatments, which were on par.

Among the chemicals, profenophos 0.1% gave the highest kill of 86.12% (Table 2). It was on par with 0.05% profenophos. It was also on par with quinalphos 0.1%, chlorpyriphos 0.1%, triazophos 0.1% and acephate 0.1%. The lower doses of the above insecticides were significantly inferior to the above mentioned treatments. Profenophos 0.05% which ranks high may be chosen as the best treatment against *P. rostratus* since it is equally effective at the lower dose.

Field evaluation

Infestation level

The data are presented in Table 3.

Trees around guava: Lower infestation was observed in coconut palms around guava trees treated with profenophos 0.05% followed by coconut palms around plants treated with neem seed oil - garlic emulsion 2% + profenophos 0.025%. The

TABLE 1. Antifeedant effect and toxicity of neem based botanicals on *Paradasynus rostratus*

Treatment	% a.i.	Antifeedant action: No. of feeding punctures on guava fruits 24 h after release	Toxicity: Mortality % 48 h after release
Achook	0.2	4.00 (2.24)	0.00 (1.00)
Achook	0.4	4.33 (2.31)	30.00 (5.56)
Nimbecidine	0.2	3.67 (2.16)	0.00 (1.00)
Nimbecidine	0.4	1.67 (1.63)	23.33 (4.93)
Econeem	0.2	3.00 (2.00)	3.33 (2.08)
Econeem	0.4	4.33 (2.31)	30.00 (5.57)
NeemAzal T/S	0.2	2.33 (1.99)	0.00 (1.00)
NeemAzal T/S	0.4	2.67 (1.91)	6.67 (2.19)
Neem seed oil	2	0.67 (1.28)	20.00 (4.58)
Neem seed oil	4	0.33 (1.14)	23.33 (4.93)
Neem seed oil-garlic	2	0.33 (1.14)	46.67 (6.87)
Neem seed oil-garlic	4	0.00 (1.00)	46.67 (6.87)
CD (0.05)		0.31	3.07

Figures in parentheses are $\sqrt{x+1}$.

TABLE 2. Effect of synthetic insecticides on *Paradasynus rostratus*

Treatment	% a.i.	Percentage mortality observed after various intervals (h): 12	24	48	72
Triazophos	0.05	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	13.33 (3.39)
Triazophos	0.10	0.00 (1.00)	3.33 (1.77)	33.33 (6.01)	66.67 (8.11)
Quinalphos	0.05	6.67 (2.54)	13.33 (3.39)	26.67 (5.24)	43.33 (6.65)
Quinalphos	0.10	16.67 (3.72)	20.21 (4.01)	36.67 (6.04)	46.67 (6.90)
Chlorpyriphos	0.05	3.33 (1.77)	6.66 (2.19)	16.67 (3.72)	26.67 (5.24)
Chlorpyriphos	0.10	20.01 (4.49)	26.67 (5.24)	36.67 (6.13)	56.67 (7.59)
Profenophos	0.05	16.67 (3.72)	20.67 (4.24)	50.01 (7.08)	79.46 (8.97)
Profenophos	0.10	30.01 (5.52)	46.67 (6.90)	63.33 (7.94)	86.42 (9.35)
Acephate	0.05	0.00 (1.00)	6.67 (2.54)	16.67 (4.16)	43.33 (6.62)
Acephate	0.10	3.33 (1.77)	13.33 (3.39)	16.67 (4.16)	50.01 (7.08)
Control		0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
CD (0.05)		2.02	2.27	1.80	2.08

Figures in parentheses are $\sqrt{x+1}$.

infestation in palms around neem seed oil - garlic emulsion 2% treated guava trees and untreated guava did not differ significantly.

Trees around cashew: The infestation of the coreid bug was lower in neem seed oil -garlic emulsion 2% + profenophos 0.025% treatment which was on par with profenophos 0.05%. Higher infestation was observed in palms around cashew trees treated with neem seed oil - garlic emulsion 2% palms around untreated cashew.

TABLE 3. Extent of infestation of *Paradasynus rostratus* on coconuts around pesticide treated alternative hosts

Treatment	Mean of extent of infestation (%) at different months after spraying			
	Guava	Cashew	Cocoa	Neem
Neem seed oil – garlic 2 %	50.95 (7.18)	49.12 (7.07)	67.37 (8.26)	59.07 (7.73)
Profenophos 0.05 %	17.22 (4.26)	22.34 (4.83)	34.31 (5.93)	27.97 (5.38)
Neem seed oil - garlic 2% + Profenophos 0.025 %	23.01 (4.89)	17.47 (4.29)	30.07 (5.56)	25.46 (5.08)
Control	62.50 (7.86)	65.02 (8.13)	62.40 (7.99)	60.58 (7.84)
CD (0.05)	1.057	0.420	1.109	0.733

Values in parentheses are adjusted means transformed to their square root.

Trees around cocoa: Profenophos 0.05% and neem seed oil - garlic emulsion 2% + profenophos 0.025% significantly reduced the infestation in coconut around treated cocoa trees. The treatments were statistically on par. The infestation noticed in palms around neem seed oil - garlic emulsion 2% treated cocoa was statistically similar to those in coconut around untreated cocoa.

Trees around neem: Lower infestation was observed in coconut palms near neem trees treated with neem seed oil -garlic emulsion 2% + profenophos 0.025% and profenophos 0.05%. The infestation in coconut palms around neem treated with neem seed oil - garlic emulsion 2% was significantly higher and similar to those around untreated trees.

Impact on yield

The data are presented in Table 4.

Trees around guava: The highest yield index (YI) of 74 was obtained in coconut palms around guava sprayed with neem seed oil- garlic emulsion 2% + profenophos 0.025% followed by palms around guava sprayed with profenophos 0.05%(67). The YI of palms around guava plants sprayed with neem seed oil- garlic emulsion 2% alone was only 45.

Trees around cashew: A similar trend was seen in nut yield from palms around cashew tree treated with insecticides. The highest YI (56) was recorded in palms around cashew sprayed with neem seed oil- garlic emulsion 2% + profenophos 0.025%, followed by palms around cashew treated with profenophos 0.05% (35).

TABLE 4. Damage to mature nuts caused by *Paradasynus rostratus* and yield index in coconut palms around treated alternative hosts

Treatment	No. of nuts in each damage category						Yield Index (YI)
	I	II	III	IV	V	VI	
Guava							
NSG – 2 %	2	2	1	4	3	1	45
Profenophos - 0.05 %	8	3	1	0	0	0	67
NSG-2 % + profenophos 0.025 %	7	4	3	0	0	0	74
Control	1	1	2	1	3	3	31
Cashew							
NSG – 2%	0	0	4	0	2	2	22
Profenophos - 0.05%	5	1	0	0	0	0	35
NSG-2% + profenophos 0.025%	8	0	2	0	0	0	56
Control	0	1	0	0	0	3	8
Cocoa							
NSG – 2%	0	4	0	2	3	0	32
Profenophos - 0.05%	2	5	3	0	0	0	49
NSG-2% + profenophos 0.025%	8	0	0	0	0	0	48
Control	0	0	0	2	3	0	12
Neem							
NSG – 2%	0	2	0	0	2	5	9
Profenophos - 0.05%	8	2	0	1	0	0	61
NSG-2% + profenophos 0.025%	9	1	0	2	0	0	65
Control	0	0	2	4	2	0	24

NSG – Neem seed oil–garlic emulsion

Trees around cocoa: The YI was more or less similar in palms around cocoa treated with profenophos 0.05% (49) and neem seed oil- garlic emulsion 2% + profenophos 0.025%.The YI was less (32) in palms around cocoa treated with neem seed oil- garlic emulsion 2%.

Trees around neem: The highest YI of 65 was obtained in coconut palms around neem sprayed with neem seed oil - garlic emulsion 2% + profenophos 0.025% followed by palms around neem sprayed with profenophos 0.05%(61). The lowest YI was recorded in palms around neem sprayed with neem seed oil - garlic emulsion 2 % (9).

DISCUSSION

In the laboratory, neem seed oil – garlic emulsion 2% and profenophos 0.05% proved to be the best insecticides. Both the insecticides when applied alone and in combination on the alternative hosts reduced the infestation of the pest in the surrounding palms. An overall perusal of the results revealed that the application of combination of neem seed oil - garlic emulsion 2% + profenophos 0.025% on the alternative hosts was most effective in reducing the extent of coreid bug infestation.

The present study is in confirmation with the observations made by Mohan (2001). She observed lower infestation in coconut palms treated with neem seed oil - garlic 2% + endosulfan 0.1% compared to the other treatments. Efficacy of neem seed oil-garlic emulsion 2% against the coconut eriophyid mite had been reported earlier (KAU, 2002). The combination of both botanical and chemical was effective as neem has a potentiating effect on chemical pesticides (Singh and Singh, 1987). The antifeedant action of neem inhibited the feeding of the coreid bug which rendered it more susceptible to the toxic action of the chemical. Adoption of control measures on the alternative hosts against the coreid bug had an appreciable impact on the extent of damage and consequently yield of mature nuts. Categorization of the harvested nuts into different damage classes and YI of coconut palms revealed that the coreid bug caused only negligible to mild damage on coconut palms around alternative host sprayed with profenophos 0.05% and neem seed oil - garlic emulsion 2% + profenophos 0.025%. Thus the most effective and economic treatment against coreid bug proved to be neem seed oil - garlic emulsion 2% + profenophos 0.025%. The stratification of the coconut palm and other alternative hosts in the multiple cropping system greatly influences the nature and distribution of the bug. This was perhaps the most important factor in the development and establishment of an ecological niche for the coreid bug. Hitherto, spraying of insecticides on coconut is the measure adopted for managing the pest when infestation is severe. However, the single stem stand of the palm makes the control of a highly mobile insect like the coreid bug a difficult task. Lack of skilled climbers for conducting plant protection operations in coconut too makes this an expensive proposition. In this context, a viable strategy is to utilize the alternative hosts to contain the coreid bug. Moreover, the susceptibility of alternative hosts to coreid bug indicated their propensity as trap crops.

The effective implementation of the technology is dependent on a thorough knowledge of the phenology of the alternative hosts *viz.*, flushing, flowering and fruiting, which synchronize with the infesting stages in the coreid bug's life cycle. The life cycle of the pest, damage symptoms caused on alternative hosts and coconut as well as migration of the pest has to be studied and knowledge disseminated among the coconut farming community. Regular monitoring of alternative hosts should be done in the homesteads to detect population build up. The pest can be controlled on the alternative hosts by application of neem seed oil - garlic emulsion 2% + profenophos 0.025%. However, the use of profenophos has to be recommended with utmost care especially in the homesteads.

Integrated pest management seeks to integrate strategies that are practical, effective, economical and protective of both public health and the environment. The present study could establish plant protection operations on alternative hosts against coreid bug as a cost effective and viable option compared to those in coconut. This strategy would be an invaluable component for integrated management of the pest on coconut palms.

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