J. Indian Soc. Coastal agric. Res., 22(1&2), 168-171, 2004

Integrated Pest Management of Rhinoceros Beetle, *Oryctes Rhinoceros* L. in the Oil Palm Plantations

K. N. PONNAMMA, N. LALITHA, N. B. BEENA and A. SAJEEB KHAN

Central Plantation Crops Research Institute
Kasaragod - 671 124, Kerala

The oil palm, *Elaeis guineensis*, is an introduced crop in India and is one of the cheap and richest sources of vegetable oil. Rhinoceros beetle, *Oryctes rhinoceros* is the major pest of oil palm. Moreover, injury made by rhinoceros, beetle is a predisposing factor for infestation by red palm weevil , fungi and bacteria on the palms. Twenty hectare of oil palm plantation (replanted area) was selected as the operational area at the Oil Palm India Ltd., Seed Garden, Vettimattom, Idukki dist., Kerala (1994 planting). Integrated Pest Management Practices such as, setting of pheromone traps (Rhino lure) @ one trap per 2ha, re-release of *Oryctes virus* infected adult beetles, and application of *Metarhizium anisopliae* in the breeding sites (cowdung pits, decaying oil palm trunks) were executed in the operational area. As a result of the Integrated Pest Management practices executed substantial reduction in the pest incidence was noticed. Per palm damage on leaf, spindle, petiole and bunches came down, respectively, from 7.16, 6.96, 0.33 and 59.85 to 0.17, 0.02, 0.25 and nil. Management of rhinoceros beetle in the plantation abruptly reduced the secondary infestation by red palm weevil on the bunches.

*(**Key words**: Rhinoceros beetle, Integrated pest management, Oryctes virus, Metarhizium)*

The red oil palm, *Elaeis guineensis* Jacq., a richest source of vegetable oil, is an introduced crop in India. At present oil palm is extensively cultivated in Kerala, Karnataka, Tamil Nadu, Goa, Maharashtra and Little Andaman. Rhinoceros beetle, *Oryctes rhinoceros* L. (Plate. 1) (*Coleoptera: Scarabaeidae*), is a major pest of oil palm in all the oil palm growing areas. Adult beetles bore into the palms at the base of the spear cluster to chew the tender tissues causing the spindle to break at the base and droop. The entry holes of the beetles can be recognized by the presence of chewed-up tissues. The damaged green leaves present a geometric cut pattern and the leaves, which emerge subsequently, become shortened, broken and distorted (Plate 1). In addition to this, adult beetles are found boring and chewing the female inflorescences even when they are inside the spathe. As a result, in most of the cases, the fruits in the upper portion of the bunches become undersized and dried (Plate 2). Moreover injury made by rhinoceros beetle is a predisposing factor for infestation by red palm weevil (Plate 3), fungi and bacteria on the palms (Ponnamma *et al.*, 2001). The peak period of visit to the palm crown by the beetle beetle is from June to August. The concept of Integrated Pest Management (IPM) has to play a vital role in modern agriculture. IPM schedule, incorporating sanitational, mechanical, prophylactic, curative, biological and attractant measures are required for the control of the beetle (Pillai *et al.*, 1993). The present studies (Feb., 2000 – Feb., 2003) deal with the integrated pest management of Rhinoceros beetle in a heavily infested oil palm plantation incorporating field sanitation, treatment of breeding places with the entomopathogen, *Metarhizium anisopliae*, trapping the floating population of beetles using the pheromone, rhinolure, and re-release of *Oryctes* virus infected adult beetles.

MATERIALS AND METHODS

Twenty hectare of oil palm plantation (replanted area) having 2250 oil palm seedlings (1994 planting) was selected at the operational area at Oil Palm India Ltd., (OPIL) Seed Garden, Vettimattom, Idukki dist., Kerala. Twenty percent of the palms (450) were selected (at random) as sample palms for assessing (pre-treatment and post-treatment) the extent of damage done on leaf, spindle, petiole, and inflorescence, and on bunch by rhinoceros beetle. Old oil palm logs and stumps and the cowdung pits in the farmers gardens adjacent to the plantation formed the breeding sites of rhinoceros beetle. After the collection of pre-treatment data, various IPM practices were executed in the operational area.

Metarhizium anisopliae

The fungus, *Metarhizium* (Plate 6) was mass multiplied in coconut water (Plate 7) adopting the method developed by Danger *et al.* (1991). Treatment of breeding sites was being done at quarterly intervals. The oil palm logs, in which different stages

Plate 1. Nature of Damage by Rhinoceros Beetleon Oil Plam

Plate 2. Infestation by Rhinoceros Beetle on Oil Palm Bunches

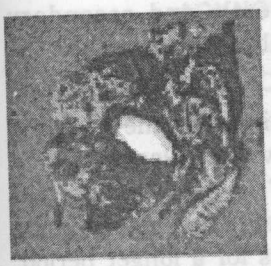

Plate 3. Infestation by Red Palm Weevil on Oil Palm Bunches

Plate 4. Pheromone Trap (Rhinolure)

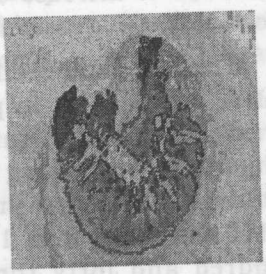

Plate 5. *Oryctes* Virus Infection

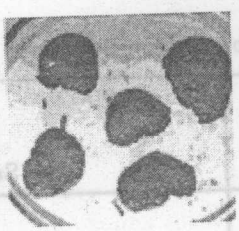

Plate 6. Grubs and Pupae Infested with *M. Anisopliae*

Plate 7. Culture

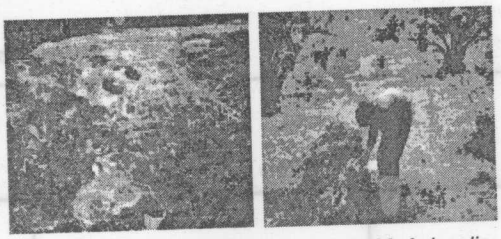

Plate 8. Treating Oil Palm Logs with *M. Anisoplia*

of the beetles were available, were cut open and were treated (Plate 8) with the fungal culture (after diluting to 20 percent). The fungal culture was also treated in cowdung pits surrounding the plantation. Persistence of the pathogen was assessed by site occupancy studies and causal organism was confirmed.

Pheromone

The present studies deal with the potential benefit of the aggregation pheromone (Rhinolure-980 mg) for integrated pest management of *O. rhinoceros* in oil palm plantations (Plate 4). Pheromone - PO 466 Sime RB Pheromone (I lure – ethyl-4-methvloctanoate – 980 mg) manufactured by Chem. Tica International, Costa Rica[1], was used. The traps were set @ one trap per two hectare (Total-10 traps). The beetles caught were collected and sexed at weekly intervals. The sachets were replaced when the liquid filled inside had evaporated fully.

***Oryctes* virus**

Multiplication and maintenance of the culture were done using rhinoceros grubs maintained in steam sterilized oil palm mesocarp waste. Infected grubs (Plate 5) were dissected out and the midgut was macerated in phosphate buffer. The buffer having the virus was used for inoculating adult beetles. Beetles trapped in pheromone traps and beetles reared under laboratory conditions were used

[1] Name of manufacture does not suggest any preference in favour of the firm

for inoculation with *Oryctes* virus and released in the oil palm plantations. Release of inoculated beetles was done at frequent intervals @ 10 beetle per ha.

Post-treatment observations was taken at six monthly intervals. Data were compiled and statistically analyzed compared with the pre-treatment observations.

RESULTS AND DISCUSSION

A total of 60.9 m^2 of breeding material was treated with 60440 ml of the fungal culture. Persistence of *Metarhizium* was ascertained from site occupancy studies. During the progress of the experiment 100 percent mortality was noticed compared to 12.11 percent of the pre-treatment condition. Subsequently the *Metarhizium* infection was found to increase considerably subsiding the infection by *Oryctes* virus.

A total of 1665 beetles (1143 females and 522 males), were caught in pheromone traps within a period of 36 months, which resulted in a very high reduction in the floating population of beetles. The number of females caught per month ranged from 5 to 117 and males from 1 to 69. One thousand one hundred and forty three beetles, if they had remained in the field, would have caused heavy economic loss to the oil palm seedlings. One thousand three hundred and seventy five beetles (922 females and 453 males) inoculated with *Oryctes* virus were released in the operational area.

As a result of the Integrated Pest Management practices executed in the oil palm plantations of OPIL, Seed Garden, Vettimattom, substantial reduction in the pest incidence was noticed. At OPIL, Vettimattom the extent of damage (per palm) on leaf, spindle, petiole and bunches came down, respectively, from 7.16,. 6.96, 0.33 and 59.85 to 0.16, 0.06, 0.17 and nil. The analyzed data revealed that reduction obtained in the post treatment observations in the sample palms was very significant in leaf damage, spindle break and leaf cut (Table 1 and Fig. 1). Management of rhinoceros beetle in the plantation abruptly reduced the infestation by rhinoceros beetle and secondary infestation by red palm weevil on the bunches.

It was observed that the propagules of *Metarhizium anisopliae* established in the breeding medium well and could survive for a longer period and infected the grubs. The easy and rapid transmission of the virus disease could maintain the pest population at lower levels for a longer period. The pheromone is compatible with other control

Table 1. *Pre- and post-treatment observation of sample palms*

	2000		2001		2002		2003
	1 Feb	2 Sept.	3 Feb	4 Sept.	5 Feb	6 Sept.	7 Feb.
			Leaf cut				
Mean	7.16	1.25	0.77	0.32	0.2	0.17	0.16
SD	4.32	1.64	0.96	0.73	0.5	0.444	0.37
t-value		27.13	30.62	33.12	33.12	34.13	34.24
		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
			Petiole hole				
Mean	6.76	1.82	0.3	0.27	0.19	0.28	0.18
SD	4.15	2.08	0.54	0.58	0.48	0.59	0.45
t-value		22.55	32.68	32.83	33.32	32.78	33.38
		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
			Spindle cut				
Mean	0.35	0.19	0.09	0.16	0.06	0.03	0.06
SD	0.83	0.43	0.29	0.43	0.25	0.17	0.24
t-value		3.68	6.17	4.34	7.09	8.03	7.11
		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

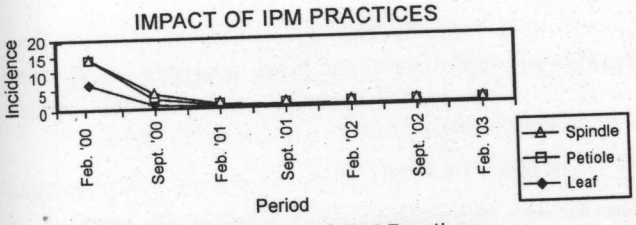

Fig. 1. *Impact of IPM Practices*

techniques without causing any harm to the natural enemy complex. To sum up, maintenance of field sanitation, mass multiplication and treatment of *M. anisopliae* in the breeding sites, re-releasse of *Oryctes* virus infected beetles, and collection of beetles using pheromone traps could all be used in a coordinated manner to form IPM methods which can be adopted for the efficient management of rhinoceros beetle in plantations as proved in the present experiment.

ACKNOWLEDGEMENT

The authors are thankful to Dr. P. Rethinam, former Director, NRC for Oil palm, Pedavegi and Dr. P. Thomas Varghese, SIC, NRC for Oil palm, Palode for providing the facilities.

REFERENCES

Danger, T. K., Geetha, L., Jayapal, S. P. and Pillai, G. B. (1991). Mass production of the entomopathogen, *Metarhizium anisopliae* in coconut water wasted from copra making industry. *Journal of Plantation Crops* **19:** 54-59.

Pillai, G. B., Sathiamma, B. and Danger, T. K. (1993). Integrated control of rhinoceros beetle. In *Advances in Coconut Research and Development*, M. K. Nair, H. H. Khan, P. Gopalasundaram & E.V.V. Bhaskara Rao (eds.), pp.455-463, Indian Society for Palnatation Crops.

Ponnamma, K. N., Lalitha, N. and Sajeeb Khan, A. (2001). Oil palm mesocarp waste -A potential breeding medium for rhinoceros beetle, *Oryctes rhinoceros* L. *Inernational Journal of Oil Palm* **2**(1): 37-40.