Research Article

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Management of rhinoceros beetle (*Oryctes rhinoceros* L.) by biological suppression with *Oryctes* baculovirus in Andhra Pradesh

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Abstract

The large scale demonstrations on efficacy of *Oryctes* baculovirus in managing coconut rhinoceros beetle, *Oryctes rhinoceros* was carried out in 50 acres each at Borivanka, Kuttuma and Bhiripuram, villages in Srikakulam district and Nagullanka and Atreyapuram villages in East Godavari district of coastal Andhra Pradesh. The release of the virus infected beetles was initiated in April 2012 and continued up to June 2013 and the leaf and spindle damage were recorded at three months interval up to twelve months. Before the release of baculovirus infected beetles, per cent of leaf damage due to beetles ranged from 12.5 to 35.5 and spindle damage ranged from 33.3 per cent to 45 per cent. After one year of release of baculovirus infected beetles, leaf damage decreased and ranged from 6.8 to 18.5 per cent and the spindle damage also reduced and ranged from 7.5 to 13 per cent in the mass demonstration villages. In plantations of coconut where application of insecticides is hazardous, biological control with baculovirus infected beetles holds importance.

Keywords: Andhra Pradesh, baculovirus, coconut, demonstration, rhinoceros beetle

Introduction

Rhinoceros beetle, *Oryctes rhinoceros* (L.) is one of the major pests of coconut in India and other coconut producing countries causing direct and indirect losses to the crop. Beetle infestation results in reduced yield and fatal to seedlings, young or old palms in some situations. Adult stage of the beetle causes damage. It makes burrows and resides between leaf sheath, near the crown and cuts the leaf in unopened conditions. The affected frond, when fully opened, shows characteristic geometric cuts and holes are present on the unopened spindle leaves while unopened spathes show round to oblong holes. Yield loss of 5.5 to 9.1 per cent due to rhinoceros beetle attack in coconut was reported by Ramachandran *et al.* (1963). Nair *et al.* (2002) reported inflorescence damage by rhinoceros beetle under severe infestation and reported yield reduction up to 5.7 per cent. In addition to direct yield loss and mortality of seedlings, the damage by beetles paves way for the entry of red palm weevil or other pathogens (Bedford, 1980).

In the past, emphasis was on use of insecticides *i.e.*, chlordane 5 per cent or aldrin 5 per cent along with sand in the ratio of 1:1 at three month interval in the top-most leaf axil interspaces (Sadakathulla and Ramachandran 1990). Singh (1987) reported significant control of rhinoceros beetle when five naphthalene balls were placed in the frond axils of one coconut plant or one oil palm. However, in

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view of increased emphasis on non-chemical and less labour intensive methods in the pest management, the role of bio-control has gained prominence. The successful control of rhinoceros beetle with bio-agent baculovirus is cited as one of the major landmark examples used in the biological suppression of an insect pest. Baculovirus *oryctes* have been reported effective in some countries (Bedford, 1980; Caltagirone, 1981) and in India too (Mohan and Pillai, 1993; Babjan *et al*., 1995). Huger (1966) from Malaysia, for the first time, isolated *Oryctes* baculovirus. In spite of its successful control, lack of awareness in farmers about the baculovirus and its role in biological control of rhinoceros beetle is proving to be a set back. Hence, the present study was taken up to demonstrate the efficacy of biological control of rhinoceros beetle through the usage of baculovirus by large scale demonstrations in the major coconut growing districts of Andhra Pradesh.

Material and methods

Large scale demonstrations on efficacy of baculovirus in managing the coconut rhinoceros beetle was carried out in the Borivanka, Kuttuma and Bhiripuram villages in Srikakulam district and Nagullanka and Atreyapuram villages in East Godavari district of Andhra Pradesh. The demonstration area comprised 50 acres (approximately 20 ha) each in each village. The operational area was divided into clusters of 10 acres each for assessing the incidence of the pest. In each 10 acres cluster, the central area of 2 acres was selected for sampling the palms and release of the beetles. Ten per cent of the palms (60 palms) in the cluster area were observed and data on the leaf and spindle damage was recorded (Mohan *et al.*, 1989). Each village was considered as one treatment and the data recorded at three months interval was subjected to randomized block design analysis. The release of the beetles was initiated in April 2012 and continued up to June 2013 and the damage was recorded at three months interval for one year. The base culture of *Oryctes rhinoceros* (Orv) was obtained from ICAR-CPCRI, Kayangulam, Kerala and the culture was maintained in the bio control laboratory, HRS, Ambajipeta. A total of the 165,250,290 infected beetles were released in Borivanka, Kuttuma, and Bhiripuram, villages and 2,10,190 infected beetles were released in Nagullanka and Atreyapuram villages in the one year period. The field dissemination of *O. rhinoceros* virus (Orv) was done by releasing the infected adults in the field @ 10-15 number per ha once in three months, as per the procedure stated by Mohan *et al.* (1989). The data on reduction in leaf and spindle damage in the demonstration villages was recorded once in three months in the sample ten per cent palms, expressed as percentage and due care was taken to include young palms in data sampling.

Regular collections of rhinoceros beetle grubs and adults, starting from March 2012 to June 2013, were made from coconut gardens from the two districts. The common breeding sites like farmyard manure, dislodged coconut logs, decaying trunks and vermicompost pits were regularly scouted for grub collection and kept in moist sterilized coir waste to maintain baculovirus culture (Gopal and Sathiamma, 2000).

Results and discussion

Detailed observations of the data from the sample palms in demonstration plots recorded before the release of virus infected beetles showed high incidence of leaf damage ranging from 12.5 (Atreyapuram) to 35.5 per cent (Nagullanka), the spindle damage was also comparatively high in all the demonstration villages and ranged from 33.3 per cent (Atreyapuram) to 45.0 per cent (Nagullanka). The release of baculovirus infected *O. rhinoceros* beetles showed significant reduction in leaf and spindle damage at all the five demonstration sites throughout the period of observation. There was a steady decline in leaf damage with progression in time which correlated with the release of the virus infected beetles. The mean reductions in leaf damage after three, six, nine and twelve months of release of virus-infected beetles were 10.6, 10.0, 9.5 and 8.5 per cent respectively, at Atreyapuram village, 25.3, 22.0, 20.2 and 18.5 per cent respectively, at Nagullanka village, 12.5, 8.8, 8.5 and 6.8 per cent respectively, at Kuttuma village, 21.2, 12.0, 11.0, and 10.8 per cent respectively, at Borivanka village and 20.2, 10, 9.8 and 9.5 per cent respectively, at Bhiripuram village (Table 1).

Table 1. Per cent reduction in leaf damage by rhinoceros beetle in the demonstration villages after release of baculovirus infected beetles

Village	Date of release of virus infected beetles	Leaf damage - Means (%) of demonstration plots				
		Pre –release	Post –release			
			3 months	6 months	9 months	12 months
Atreyapuram	05.04.12	12.5	10.6	10.0	9.5	8.5
Nagulanka	05.05.12	35.5	25.3	22.0	20.2	18.5
Borivanka	29.06.12	19.4	21.2	12.0	11.0	10.8
Bhairipuram	28.06.12	18.7	20.3	10.0	9.8	9.5
Kuttuma	30.06.12	13.3	12.5	8.8	8.5	6.8
SEM±		0.7	0.6	1.1	0.4	0.8
CD (5%)		2.1	1.9	3.2	1.3	2.5
CV (%)		7.8	7.9	19.7	8.1	17.6

Similarly, the mean reductions in the spindle damage during the same time intervals were 20, 18.5, 12.8 and 7.5 per cent, respectively, at Atreyapuram village 35.2, 28.9, 16.5 and 10.5 per cent respectively, at Nagullanka village. In Kuttuma village, a reduction of 33.3, 19.5, 13.9 and 8.8 per cent respectively, in spindle damage was recorded. However, in the other two villages of Srikaulam district, an initial increase from 42 to 45.3 per cent after 3 months and later a decrease to 24.5, 15.8 and 12.5 per cent, respectively, at Borivanka village and at Bhiripuram village an initial increase from 37.3 to 39.2 per cent after 3 months and later a decrease to 22.6, 16.5 and 13 per cent, respectively, was recorded (Table 2). The reduction in spindle damage in the demonstration villages was much conspicuous as compared to the reduction in leaf damage. Similar results were reported by (Mohan *et al.,* 1989) in Minicoy, Lakshadweep where the reduction in leaf damage consequent to the release of virus infected beetles was much slower as compared to the rapid decline in spathe and spindle damage and any reduction in the pest population is reflected by a sharp drop in spathe damage (being few in number as against a slow decline, in reduction of leaf damage due to the gradual replacement of damaged leaves by healthy. In Minicoy, the overall reduction in leaf and spathe damage and fresh incidence on palm crown was to the extent of 83.0 and 96 per cent respectively, after three years of introduction of the baculovirus infected beetles. In Andrott also, the leaf damage came down to 7.7 per cent, spathe damage to 0.3 per cent and fresh incidence to zero, as compared to 55, 7.3 and 29.5 per cent respectively, of the pre-release condition. Babjan *et al*. (1995) also reported that re-release of baculovirus once in an already infected contiguous area at Chittilappilly, Thrissur, Kerala a remarkable decline in crop damage by rhinoceros beetle after three years of release from 34 per cent to 6.7 per cent and spathe damage from 13 per cent to nil was recorded. Among all the villages when leaf damage was compared between

Table 2. Per cent reduction in spindle damage by rhinoceros beetle in the demonstration villages after release of baculovirus infected beetles

Name of the Village	Date of release of virus infected beetles	Rhinoceros damage - Means (%) of demonstration plots				
		Pre-release	Post-release			
			3 months	6 months	9 months	12 months
Atreyapuram	05.04.12	33.3	20.0	18.5	12.8	7.5
Nagulanka	05.05.12	45.0	35.2	28.9	16.5	10.5
Borivanka	29.06.12	42.0	45.3	24.5	15.8	12.5
Bhairipuram	28.06.12	37.3	39.2	22.6	16.5	13.0
Kuttuma	30.06.12	37.3	33.3	19.5	13.9	8.8
SEM±		0.84	2.6	1.4	0.8	0.4
CD (5%)		2.5	7.7	4.3	2.5	1.1
CV (%)		4.8	17.2	14.0	12.2	7.8

pre and post release of virus infested beetles after one year the leaf damage decrease in Atreyapuram village was comparatively least (32 per cent) while a highest decrease of leaf damage of 49 per cent after 12 months was recorded in Kuttuma and Bharipuram villages in Srikakulam district. Among all the villages, when per cent spindle damage decrease was compared between pre and post release of virus infested beetles after one year, the spindle damage decreased in all the villages, and it ranged from 65 to 77 per cent showing the impact of baculovirus infected beetles in reducing the damage in coconut. Thus, the results revealed that phased release of baculovirus infected rhinoceros beetles repeatedly in already infected contiguous area would further reduce crop damage due to rhinoceros beetle.

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