

## Management of Rhinoceros Beetle *Oryctes rhinoceros* L. in Coconut Gardens by Biocontrol Method

C.P.R. Nair, P. Rajan, Chandrika Mohan and Murali Gopal

### INTRODUCTION

The rhinoceros beetle, *Oryctes rhinoceros* L. (Coleoptera: Scarabaeidae) is a major pest of coconut with ubiquitous distribution. It infests coconut palm at all stages. The adult beetle bores into the unopened spear leaf and also the inflorescence in severe cases of pest attack. Damage by the pest causes reduction in yield to the extent of nearly 6%. The injury by this pest leads to subsequent infestation by red palm weevil and invasion by fungal pathogens which are fatal to the palm.

Biological control using the fungal pathogen *Metarhizium anisopliae* and viral pathogen *Oryctes rhinoceros* virus (OrV) (earlier known as *Oryctes* baculovirus) is the most important component in the IPM of this pest (Nair *et al.*, 1997). Mohan *et al.* (1983) reported 54% natural virus infection in adult beetles for the first time in India. The biological suppression by OrV has been successfully field demonstrated in many parts of the world (Purrini, 1989; Mohan *et al.*, 1989; Mohan and Pillai, 1993; Jacob, 1996). OrV is a self-perpetuating pathogen and is mainly transmitted through the contaminated food. Release of OrV in an already infected contiguous area in Kerala also showed significant reduction in pest population in 3 years. (Biju *et al.*, 1995). *Metarhizium anisopliae*, also known as the green muscardine fungus is pathogenic to all stages of *Oryctes rhinoceros* (Nirula *et al.*, 1956). Methods for mass production of this fungal pathogen using cheaper substrates like cassava chips rice bran mixture (Mohan and Pillai, 1982) and coconut water (Danger *et al.*, 1991) were developed at CPCRI by earlier investigations.

Large scale field demonstration of biocontrol of *Oryctes rhinoceros* using the fungal

and viral pathogens was carried out in an area of 1,000 ha homestead coconut gardens in Krishnapuram village (Alappuzha Dist., Kerala) and 1,400 ha in Mogral Puthoor (Kasaragod Dist., Kerala) during 1999-2002. The operational areas were divided into clusters of 100 ha, and in each cluster 25 ha area in the centre was selected for recording observations.

*M. anisopliae* was mass multiplied in coconut water as per method developed by Danger *et al.* (1991). All the breeding sites in the operational areas were treated with *Metarhizium* spore suspension @  $5 \times 10^{11}$  spores/m<sup>3</sup> in June-July during the demonstration period. *Oryctes rhinoceros* virus culture maintained in the biocontrol laboratory of CPCRI, Regional station, Kayamkulam was used for mass multiplication of the virus for field release. The viral culture was mass produced in *Oryctes* grubs. Viral inoculum for infecting adults for field release was prepared by homogenizing mid gut of infected grubs (1g of infected mid gut homogenized in 100 ml of phosphate buffer). *Oryctes* adults were infected by oral feeding the inoculum with a syringe or allowing the adults to wade through the inoculum for half an hour. The beetles were then kept in plastic boxes under starvation for 12-24 hours and released in the field preferably at dusk. The microbial agents were released only during the first and second year of the demonstration. In each cluster a total of 600 infected beetles were released over a period of first two years in four representative release sites so as to effect uniform spread of the viral inoculum in the breeding sites/native beetle population.

Pre treatment observation on damage by rhinoceros beetle in various clusters in Krishnapuram revealed that leaf damage due to the pest ranged from 17.0 to 28.0% with an average incidence of 21.7 % and spindle damage ranged between 14.0 to 25.0% with an average of 18% (Fig 43.1 and 43.2 and Table 43.1). Observations on leaf and spindle damage during the post treatment period showed steady decreasing trend.

**Table 43.1.** Average percentage leaf and spindle damage percentage at Krishnapuram (1999-2002)

Period	Damage by rhinoceros beetle (%) (n = 10)	
	Leaf	Spindle
Pre-treatment (1999)	21.66 ± 3.6	18.00 ± 3.74
Post-treatment (2002)	5.40 ± 1.35	3.70 ± 1.42
Percent reduction over pre treatment	75.1%	79.44%
t statistic (P = 0.05)	14.07*	15.90*

\*significant at P = 0.05 (table t value 2.262)

There was a reduction of 75.1% leaf damage and 79.4% spindle damage in a period of three years in the demonstration area at Krishnapuram.

At Mogral Puthur, the pre treatment observations on pest incidence recorded an average of 36.0% leaf damage, 12.0% spindle damage and 16.0% spathe damage (Table 43.2). Post-treatment observations on the above parameters recorded from the sample clusters

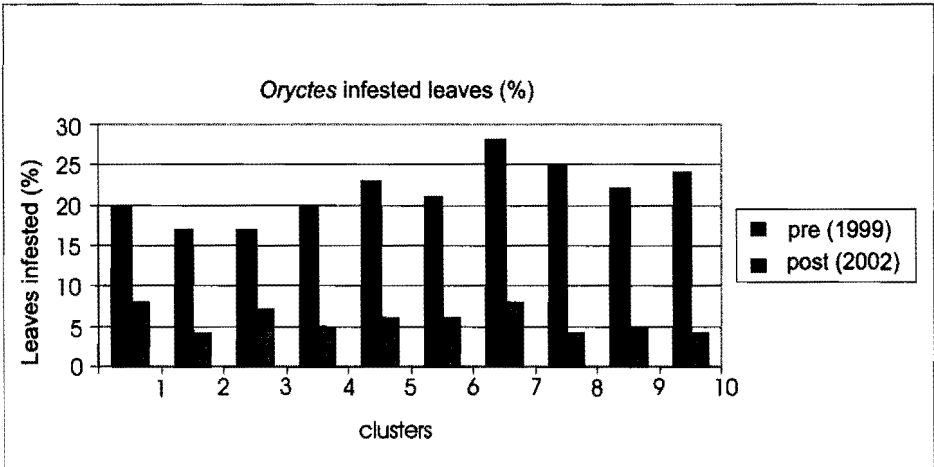


Fig. 43.1. Leaf damage by *Oryctes* at demonstration area (Krishnapuram)

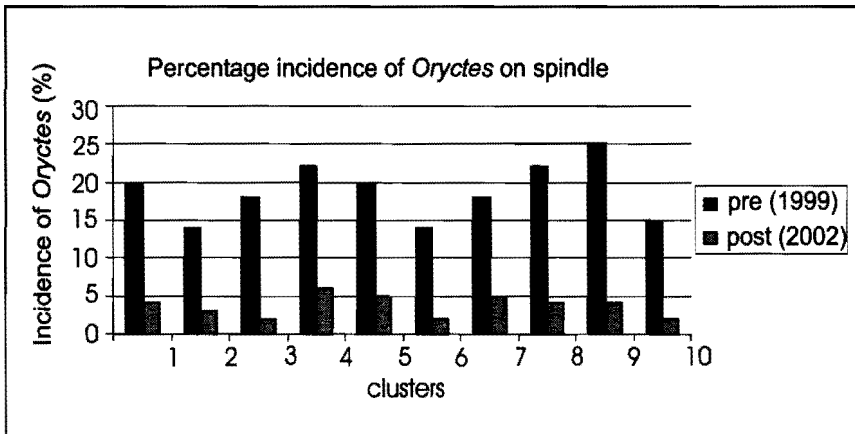


Fig. 43.2. Spindle damage by *Oryctes* at demonstration area (Krishnapuram)

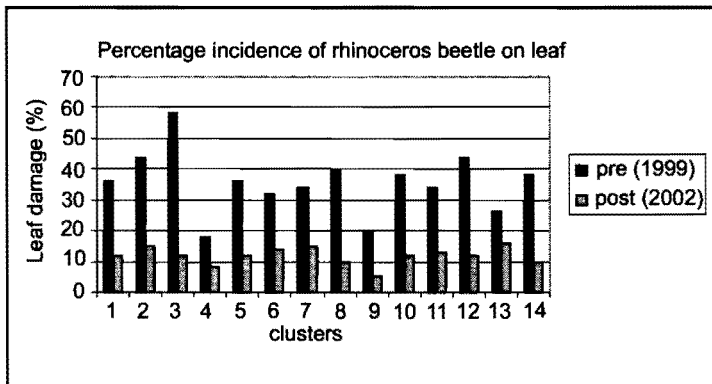
after three years showed high reduction in pest incidence. On an average there was 66.6% reduction in leaf damage, 95.8% reduction in spindle damage and 62.5% reduction in spathe damage (Fig. 43.3, 43.4, 43.5 and Table 43.2).

**Table 43.2.** Incidence of rhinoceros beetle in Mogral Puthoor (1999-2002)

Period	Damage by rhinoceros beetle (%) (n = 14)		
	leaf	spindle	spathe
Pre-treatment (1999)	36.0±10.03	12.0±3.38	16.0±5.08
Post-treatment (2002)	12.0±3.24	0.58±0.2	6.0±1.42
Percent reduction over pretreatment	66.6	95.8	62.5
t statistic (P = 0.05)	8.05*	12.74*	8.03*

\*significant at P=0.05 (table t value 2.16)

The impact of re-release of *Oryctes rhinoceros* virus in the mainland of India had been demonstrated in smaller areas earlier in Thrissur District (Biju *et al*, 1995). Release of the viral pathogen of the pest over large and contiguous areas has not been so far done in the mainland. The demonstration has resulted in significant reduction in the pest damage by the combined use of two potential biocontrol agents of rhinoceros beetle. The results suggest necessity for similar demonstrations concurrently over contiguous areas in major coconut growing states of India so that effective management of the pest is achieved without disrupting the ecosystem. Large-scale adoption and popularization of the technology is viable and advantageous in the wake of organic farming getting popularized in coconut plantations that accommodate a variety of intercrops and animal components serving the food requirements of millions in the world.



**Fig. 43.3.** Percentage leaf damage by rhinoceros beetle at demonstration area (Mogral Puthoor)

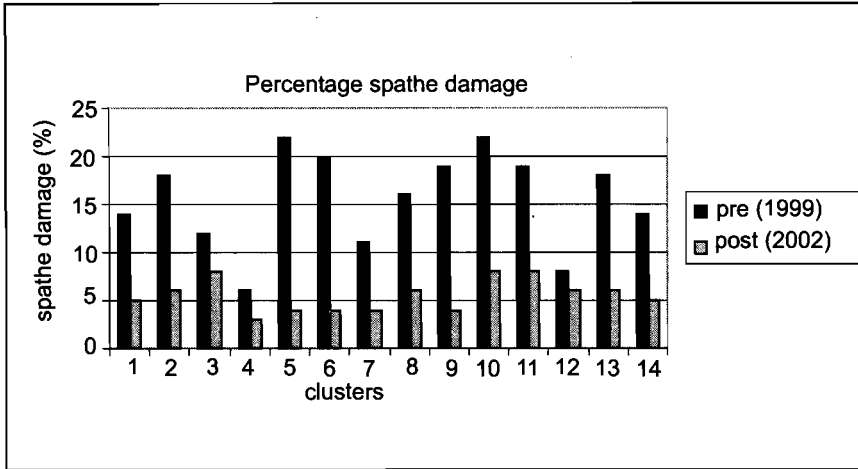


Fig. 43.4. Percentage of spathe damage by rhinoceros beetle at the demonstration area (Mogral Puthur)

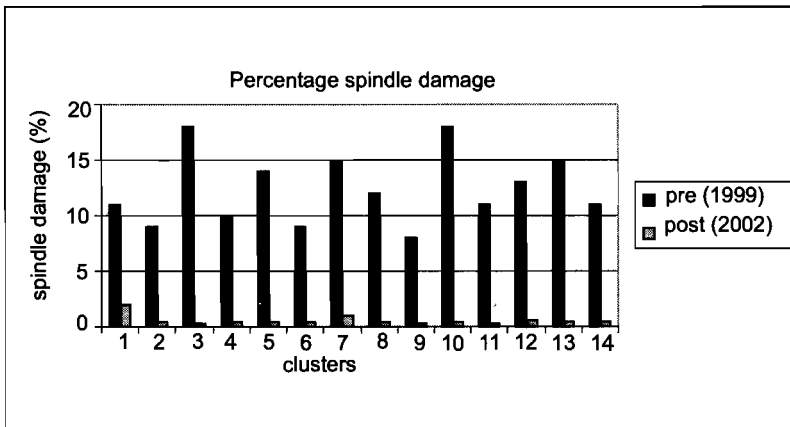


Fig. 43.5. Percentage incidence on spindle by rhinoceros beetle at the demonstration area (Mogral Puthur)

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