Natural Incidence of Baculovirus Disease of *Oryctes rhinoceros* in Kurunegala District

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ABSTRACT

Black beetle (*Oryctes rhinoceros*) is the most frequently occurring pest of coconut in Sri Lanka. Biological control using *Baculovirus* of *Oryctes rhinoceros* has been found effective in reducing the pest populations. It is naturally found among Black beetle populations in Sri Lanka. The study was aimed to determine the natural incidence of Baculovirus disease of *Oryctes rhinoceros* adult population in the Kurunegala district. Sixteen Coconut Development Officer Ranges (CDO) in Kurunegala district were used for the study. Two types of pheromone traps were used to collect the adults.

The disease was diagnosed by visual symptoms of the midgut. The results revealed that the natural incidence of Baculovirus disease in Kurunegala district varies from 20%to 40 % in different CDO ranges with an average of 30.3 %. There was no significant difference in percentage incidence of the disease among the CDO ranges in the district. Continuous release of virus infected beetle into field is proposed to increase the levels of the disease in the field.

KEY WORDS: *Baculovirus oryctes*, Biological control, Coconut, *Oryctes rhinoceros*

INTRODUCTION

Coconut (*Cocos nucifera* L) is of great importance to the economy of Sri Lanka, as it contributes 2% to the Gross Domestic Production (GDP) and earning of 8926 million rupees as foreign exchange (Anon, 2005). Out of total extent under Coconut in Sri Lanka, The "Coconut triangle" (North Western Province ;(Kurunegala and Puttalam Districts) and a part of Western Province (Gampaha District)) represents 61% of the country's coconut growing lands excluding coconut in the mixed stands and home gardens (Anon, 2005). The coconut palm is attacked by a large number of insect pests during different stages of its growth. The rhinoceros beetle, *Oryctes rhinoceros* (L), is one of the major pests of the coconut palm in Sri Lanka. Damage to coconut seedlings by black beetle is a very serious problem in coconut cultivation. Black beetle damage is widespread in the coconut plantations and a survey conducted by Peiris *et al* (2006) revealed that 72% coconut growers had black beetle damage in their lands, but only 52% of them were aware its severity. Field surveys have indicated that black beetle attack on coconut palms increase with human habitations and the creation of more decaying organic matter. (Ranasinghe, *et al*, 2006) Black beetle damage can be identified by geometric cuts in the leaf breaking of flag leaf and holes on petioles bases.

Current recommended management practices for black beetle are destruction of breeding grounds, extraction of beetles using a hook, application of used engine oil or coal tar and use of naphthalene balls or carbofuran granules. Sixty percent of the growers claimed that these methods moderately control the pest. (Peiris *et al* 2006).

Biological control of *Oryctes rhinoceros* have been found effective in many countries. The fungus *Metarhizium anisopliae* and the virus *Baculovirus oryctes* can infect the adult and larval stages and effectively reduce the pest population.

The Baculovirus was discovered in Malaysia in 1963 (Huger, 1966). The disease is highly specific and only the genus *Oryctes* and a few closely related genera are susceptible. The virus is transmitted between adults during mating and feeding on the palms and from larvae to adults as well as from adults to larvae in the breeding grounds. The virus multiplies in the nuclei of the cells. A particular feature of the disease is the very heavy tumor like growth (Hyperplasia) of virus filled cells in the mid gut of the adult beetle. A gut filled with virus appears macroscopically, as if it were filled with pus (marschall) since the early stage of infection. The disease exclusively infects the mid gut without involving other organs. The beetle remains capable of flying and mating although they produce plenty of viruses in their mid gut and spread it through their feces wherever they fly. The appearance of the mid gut is often indicative of the presence or absence of virus infection. Although the disease is present in Sri Lanka, the level of natural incidence is unknown. The study was carried out to determine the natural incidence of baculovirus disease in *Oryctes rhinoceros* population in Kurunegala District.

MATERIAL AND METHODS

Survey

The study was carried out from February to August 2006 in Kurunegala District; Sixteen CDO ranges in Kurunegala district were selected for collecting the beetles. They were Pannala, Alawwa, Dambadeniya, Narammala, Kurunegala, Wariyapola,, Nikaweratiya, Bingiriya, Kobeigane, Dummalasuriya,

Hettipola, Pothuhara, Mawathagama, Ganewatta, Ibbagamuwa, and Kuliyapitiya.

Collection of Beetles

Oryctes rhinoceros adults were collected using two types of pheromone traps. In each site one hectare of land area was selected and both types of traps were installed. Bucket trap was placed in the site by using a wooden pole and PVC tube trap was placed on ground. Beetles were collected at two-week intervals. The beetles were sexed and dissected immediately after collection. The female was identified by its triangular shape of the abdominal tip and dense bristles while the male had rounded tip without bristles.

Pheromone Traps

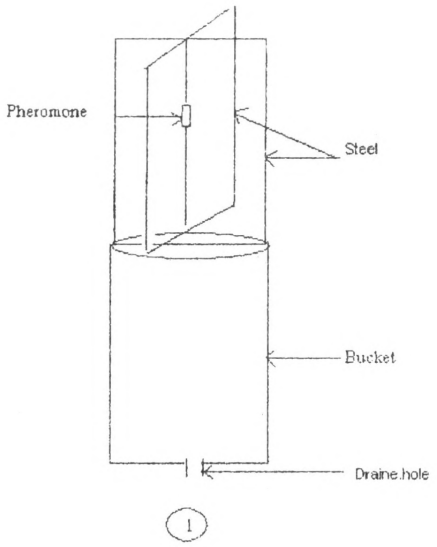

Figure 1-Diagram of a trap

Trap made of plastic bucket with two rectangular galvanizes steel. (Gauge 28)

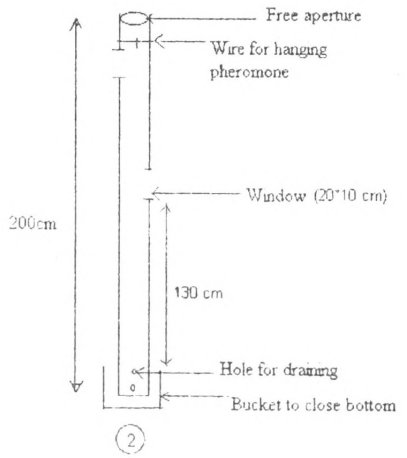

Figure 2- Diagram of a trap

Trap made of large PVC tube with two windows (Diameter = 15 cm, height =200cm) (in lieu of plastic bucket at the bottom of the PVC pipe a wooden stopper could also be used)

Diagnosis of Disease

Baculovirus disease in the beetles was diagnosed by visual examination of the mid gut. The procedure described by Zelazny (1978) was followed. Beetles were killed using chloroform. The legs and wings were removed with the help of scissors and the abdomen was incised (with the help of a scissor) along the outer margin of the dorsal side and cut across the dorsum making sure that the gut is spared. Beetles were secured with three pins on a paraffin wax block. All internal organs including fat bodies were removed leaving the alimentary cannel.

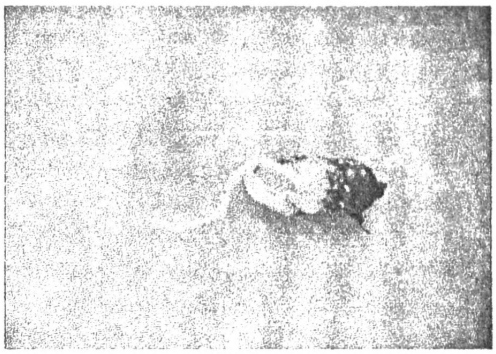

Figure 3 - A dissected beetle with a healthy gut

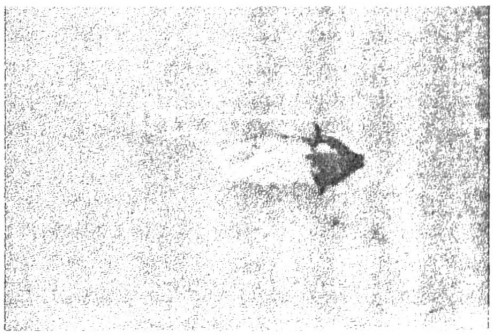

Figure 4 - A dissected beetle with a Virus infected gut

The beetle with thin brown and very flaccid, mid gut with little gut content was considered as healthy adults (Fig.3), where as beetle having a white swollen mid gut with considerable white pasty contents considered as virus infected (Fig 4).

RESULT AND DISCUSSION

A total of 892 beetles were collected during the study period and 30.3 % of the beetles were infected with the disease. A total of 410 males and 482 females were collected in traps. Out of them 32.2 % of males and 28.6 % of females were infected by the virus.

Highest *Baculovirus* disease incidence of 40 % was recorded in Ganewatta CDO range while lowest of 20 % was recorded in Kurunegala CDO range.

(Table1) The percentage of disease incidence ranges from 20 – 40 with a mean of 30.3.

Table 1- Percentage of *Baculovirus* virus infected beetles in different CDO ranges:

CDO range	No. trapped	No. infected	Percentage infection
Kurunegala	50	10	20
Dambadeniya	50	13	26
Narammala	50	15	30
Alawwa	52	20	38
Pothuhara	39	12	30
Mawathagama	48	18	37
Ganewatta	47	19	40
Ibbagamuwa	45	14	31
Bingiriya	98	22	22
Dummalasuriya	55	19	34
Hettipola	51	12	23
Kobeigane	63	14	22
Nikaweratiya	60	21	35
Pannala	66	20	30
Kuliyapitiya	52	20	38
Wariyapola	66	21	31
Total	**892**	**270**	**30.3**
CV value	**36.87**		

Four hundred and six beetles were captured in PVC tube traps and 486 were captured in bucket traps. Therefore capturing of black beetle was more effective in bucket traps.

Table 2- Results of analysis of variance:

Table 2- Results of analysis of variance: Source	Mean square	F value	Pr > F
CDO	176.96	1.39	0.1900
Sex	187.17	1.47	0.2308

There was no significant difference in the natural incidence of Baculovirus disease among different CDO ranges in Kurunegala District and between males and female (Table 2).The difference between the proportions of each sex of the beetles caught in traps agrees with that observed by Zelazny (1976). The similar study was conducted in Kerala in India showed that the percentage disease incidence ranges from 40.9- 75.0 with mean of 54.2(Mohan et al, 1983). They have used four methods to diagnose the Baculovirus disease and suggest that the most suitable methods for diagnosed baculovirus disease are Giemsa staining method and observing visual symptoms of the midguts. The results point that the incidence of Baculovirus disease among population of *oryctes* beetle in Kurunegala district is low. To increase the incidence continuous release of virus-infected adults to infested areas is proposed.

CONCLUSION

The percentage natural incidence of Baculovirus disease in *Oryctes rhinoceros* beetles among CDO ranges in the Kurunegala district was 30.3. There was no significant difference in natural incidence of Baculovirus disease among CDO ranges and sex of adults.

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