

Efficacy of Certain botanicals against the grubs of coconut rhinoceros beetle, *Oryctes rhinoceros* (L). (Scarabaeidae: Coleoptera)

V Suhasini¹, G Balamurugan², S Arivudainambi³, T Rani⁴

Department of Entomology

^{1,2,3,4}Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu, India.

Abstract- To manage the grubs of *O. rhinoceros* which are developing in Farm yard manure an experiment was conducted in Laboratory condition by using neem cake, leaf powder of *Annona squamosa*, *Adathoda vasica*, *Glyricidia maculata*, *Annona squamosa* + *Adathoda vasica*, *Annona squamosa* + *Glyricidia maculata*, *Adathoda vasica* + *Glyricidia maculata*, *A. squamosa* + *A. vasica* + *G. maculata*. High rate of mortality of the grubs was recorded in Neem cake followed by *A. squamosa* and combination of *A. squamosa* + *Adathoda vasica* + *Glyricidia maculata* pupal mortality and adult emergence were observed considerably.

Keywords- *O. rhinoceros*, botanicals, larval mortality, pupal mortality, adult emergence.

I. INTRODUCTION

Rhinoceros beetle, *Oryctes rhinoceros* L. is one of the serious pest of the coconut palm (Catley, 1969). Coconut palm is growing in more than 90 countries of the world. Traditional area of coconut cultivation in India are the states of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, West Bengal, Maharashtra the islands of Lakshadweep and Andaman and Nicobar (Coconut development board, 2015). The adult beetle bores into the unopened fronds and inflorescence. Larva of *O. rhinoceros* develops in manure pit but adults bore into the unopened fronds and spathes. The fully opened fronds showing characteristics of diamond shaped or V-shaped cut. It also attacks inflorescence and causes 26% loss of the fruits in a bunch (Ponnamma et al., 2001). Treatment with insecticides is problematic and addition of insecticides to the farm yard manure may not support organic farming. Botanicals contain plant compound which is safer to soil and human also.

In the present study a laboratory bioassay was conducted with certain botanicals laboratory condition.

II. MATERIALS AND METHODS

Rearing of *O. rhinoceros*

To start the culture, around 50 numbers pupae of *O. rhinoceros* were collected from the heaps of farmyard manure at the animal house, Department of Animal Husbandry, Annamalai University. Collected pupae were placed into round plastic basins of 30cm diameter and 10cm deep, which contained 1kg of a mixture of powdered cow dung and coir pith dust @ 5:1 ratio and the mouth of the basins were covered using khada cloth and secured tightly by elastic bands. The culture was maintained under the laboratory at 26±2°C temperature and 70±5% relative humidity. From pupae to adult, it took an average of 34 days. Emerged adults were differentiated based on the abdominal characters such as presence of fuzzy hairs at the tip of the abdomen (female) and smooth and shiny abdomen (male). The sexed adults were released @ 1:1 ratio into transparent round plastic rearing containers of 20 x 20cm in size (diameter and height). Two pairs of adults were introduced per container and ten such containers were maintained in the laboratory. The mouths of the containers were closed with perforated lids. The rearing containers were filled with a layer (3cm thick) of fine sand then by a layer (5cm thick) of coir dust before the introduction of adults. Fresh pieces of coconut frond and pineapple slices were provided as food for adults and reared until death. The average longevity of adults under the laboratory condition was seventy days. After ten days, two cups (100g capacity each) of semi dried farmyard manure were kept per container, as the substrate for egg laying. Once in a week the containers were cleaned. The contents were examined carefully and the eggs laid were separated and incubated until hatching. The eggs were observed under 10x. Average fecundity recorded was 52 eggs/ female. It took an average of 10 days to hatch.

Newly hatched grubs were reared in the laboratory for ten days on semi dried farmyard manure, and then transferred to the heaps of farm yard manure maintained in the pot-culture yard to rear the grubs under semi field conditions. Farmyard manure heaps were prepared for a height of 2.5 feet with a diameter of 3 feet and covered all the sides using nylon mesh. Water was sprinkled daily over the heaps to maintain optimum moisture. Grubs were maintained under semi field conditions until pupation and then recycled as described

earlier. Whenever needed grubs of same ages were used in the experiments.

Preparation of Botanicals for bioassay

Neem cake bought from the organic agriculture shop at Chidambaram was powdered using pulveriser and passed through mesh (size 16mm) to get fine powder. Fresh leaves of *Annona squamosa* L. (Sugar apple) (Family: Annonaceae), *Adathoda vasica* Nees (Malabar nut, adulsa (Family: Acanthaceae) and *Glyricidia maculata* (Jacq.) Steud. (madre) (Family: Leguminosae) were collected from nearby places. The collected leaves were washed with running tap water to remove dirt and shade dried for one week. Then by using Wiley mill, the leaves were powdered and passed through a sieve of 16mm mesh. Leaf Powder was packed in a poly zip lock covers and stored in airtight conditions.

Laboratory bioassay (Poison food technique)

One kg of semi dried farmyard manure placed in a plastic container of 30cm diameter and 10cm deep and botanicals neem cake, *A. squamosa*, *Adathoda vasica* and *Glyricidia maculata* mixture of *Annona squamosa* + *Adathoda vasica*, *Annona squamosa* + *Glyricidia maculata*, *Adathoda vasica* + *Glyricidia maculata*, *A. squamosa* + *A. vasica* + *G. maculata* each separately at appropriate rates and thoroughly mixed with manure. Grubs of 3rd instar obtained from the mass rearing were released (5number/replication) into containers and maintained under laboratory condition at $26\pm 2^{\circ}\text{C}$ temperature and $70\pm 5\%$ relative humidity. Experiments were replicated three times. Observations were made on mortality of the grubs once in 24h up to adult emergence.

Analysis was done with ANOVA table under completely randomised block design and the means values were compared by following Duncan's multiple range test (DMRT) @ $P = 0.05$ (Gomez and Gomez, 1984). Necessary data transformation was made before analysis and the computer based OPSTAT package was used for the calculation.

III. RESULTS AND DISCUSSION

The effect of neem cake powder, *A. squamosa*, *A. vasica*, *G. maculata*, *Annona squamosa* + *Adathoda vasica*, *Annona squamosa* + *Glyricidia maculata*, *Adathoda vasica* + *Glyricidia maculata*, *A. squamosa* + *A. vasica* + *G. maculata* against 3rd instar grubs of *O. rhinoceros* is presented in Table 1.

The highest percent cumulative larval mortality was 80.00 in neem cake and followed by *A. squamosa* which caused 66.66 per cent larval mortality. Then the highest pupal mortality was recorded in *Adathoda vasica* + *Glyricidia maculata* (53.33%) and was followed by *A. vasica*, *Glyricidia maculata*, *Annona squamosa* + *Adathoda vasica* + *Glyricidia maculata* and the lowest pupal mortality recorded in *Annona squamosa* (13.33%). Zero per cent adult emergence was noted in neem cake and *Annona squamosa* + *Adathoda vasica* + *Glyricidia maculata* and highest adult emergence recorded in untreated check. Our findings are partially in accordance with the finding of Mohan and Padmanaban (2013) who reported LC50 (96 hours value) for the larvae of *Oryctes rhinoceros* were 29.5% for neem cake powder. Our findings are in corroboration with the report of Sreelatha and Geetha (2012) who explained *A. squamosa* leaf powder as an effective material in causing larval mortality, pupal mortality and adult formation. Our results are in contradiction with the reports of Sreelatha et al., (2011) who showed higher mortality of larvae and pre-pupae by using leaf powders of *G. maculata* and *A. vasica*.

Table 1. Efficacy of certain botanicals against 3rd instar of *O. rhinoceros*

Dose (g/kg of feed)	Percent cumulative larval mortality	Percent cumulative Pupal mortality	Percent cumulative Adult emergence
Neem cake @ 100g/kg of feed	80.00 (63.40) ^f	20.00 (26.55) ^{bc}	0.00 (0.00) ^a
<i>Annona squamosa</i> @ 100g/kg of feed	66.66 (54.96) ^{ef}	13.33 (17.70) ^b	20.00 (26.55) ^c
<i>Adathoda vasica</i> @ 100g/kg of feed	20.00 (26.55) ^b	46.66 (43.06) ^a	13.33 (17.70) ^{bc}
<i>Glyricidia maculata</i> @ 100g/kg of feed	40.00 (39.21) ^{cd}	40.00 (39.21) ^{de}	13.33 (17.70) ^{bc}
<i>Annona squamosa</i> + <i>Adathoda vasica</i> @ 100g/kg of feed	33.33 (34.99) ^c	26.66 (30.77) ^{cd}	20.00 (26.55) ^c
<i>Annona squamosa</i> + <i>Glyricidia maculata</i> @ 100g/kg of feed	60.00 (50.74) ^e	26.66 (30.77) ^{cd}	6.66 (8.85) ^{ab}
<i>Adathoda vasica</i> + <i>Glyricidia maculata</i> @ 100g/kg of feed	20.00 (26.55) ^b	53.33 (46.90) ^a	13.33 (17.70) ^{bc}
<i>Annona squamosa</i> + <i>Adathoda vasica</i> + <i>Glyricidia maculata</i>	46.66 (43.06) ^d	40.00 (39.21) ^{de}	0.00 (0.00) ^a
Untreated check	0.00 (0.00) ^a	0.00 (0.00) ^a	100.00 (90.00) ^d
SEd	3.34	5.64	8.34
CD(0.05)	7.08	11.95	17.66

*Mean of 3 replications

Values in parenthesis are arc sine transformed

Values with various alphabets differ significantly

REFERENCES

- Catley, A. 1969. The coconut rhinoceros beetle *Oryctes rhinoceros* (L.) [Coleoptera: Scarabaeidae: Dynastinae]. Pest Articles and News Summaries, 15(1):18-30.
- Coconut Development Board. 2017b. "Coconut Cultivation". Coconut Development Board, Government of India, www. <https://en.wikipedia.org/wiki/Coconut>. Accessed on 03 March, 2017.
- Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural Research. John Wiley & Sons Singapore, 680p.
- Mohan, K. and A.M. Padmanaban. 2013. Bio toxicity assay of neem (*Azadirachta indica*) products and distillery effluent on the third instar larvae of coconut rhinoceros beetle, *Oryctes rhinoceros*. International Journal of Pharmacology and Bio Sciences, 4(4): 102 – 110.
- Ponnamma, K.N., P. Rethinam, N. Lalitha and A.S. Khan. 2001. Nature and extent of damage by rhinoceros beetle on oil palm bunches. International journal of Oil Palm, 2(2): 31-33.
- Sreelatha, K. B., K. Rakhi, V.S. Aswathi, V.V. Nair, G.R. Chikku, V. Vipin and M. Anuja. 2011. Laboratory evaluation of insecticidal activity of *Adathoda vasica* (Acanthaceae) and *Glyricidia maculata* (Leguminosae) on the third instar larvae of *Oryctes rhinoceros* L. (Coleoptera: Scarabaeidae). Journal of Biopesticides, 4(2):144-149.
- Sreelatha, C. and P.R. Geetha. 2012. Pesticidal effects of *Annona squamosa* L. on male *Oryctes rhinoceros* Linn. (Coleoptera: Scarabaeidae) in relation to reproduction. Current Biotica, 6(1): 8-21.