

## Efficacy of ecofriendly management against Rhinoceros beetle grubs in coconut

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### ABSTRACT

The Rhinoceros beetle *Oryctes rhinoceros* (L) is an important pest reported from all the coconut growing countries of the world. Application of chemical pesticides is expensive and may cause environmental pollution. Therefore an on farm trial was conducted by Krishi Vigyan Kendra, Palakkad, Kerala, India in an area of one hectare, in Thachampara, Kanjirappuzha, Pookkottukavu and Ottappalam areas in Palakkad district during *kharif* 2011-2012. Efficacy of three ecofriendly methods : application of common salt @ 2kg/palm, 2 times a year, filling the innermost two leaf axils with naphthalene balls + sand and incorporation of dry leaf powder of weed *Clerodendron infortunatum* Lin.@10% w/w basis in manure pits, and application of *Metarhizium anisopliae* @ 300 ml/l of water/m<sup>2</sup> area (10<sup>8</sup> spores/ml of water) in manure pits coconut basins and other breeding sites during wet conditions. Observations after three weeks of treatment showed 100% mycosis of *O. rhinoceros* grubs by *M. anisopliae* and after 6 months, reduction of pest attack from 85% to 10%. The farmer's practice and recommended practice were less effective with a final pest attack of 83% and 43% respectively. Therefore *M. anisopliae* can be effectively used as a bio control agent against rhinoceros beetle.

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### INTRODUCTION

The rhinoceros beetle, *Oryctes rhinoceros* L. (Scarabaeidae : Dynastinae) is one of the serious pests of coconut in all coconut growing countries including India. The adult beetles damage palms by boring into the center of the crown, where they injure the young, growing tissues and feed on the exuded sap (Bedford, 1980, 2013). The practice of application of insecticide /sand mixtures (1:1) once in three months in the top-most three leaf axil interspaces (Jayaraman,1985), or application of newer insecticides will create environmental pollution and will not be effective for the control of adult beetles due to its hard exoskeleton. Moreover the insecticidal control may lead to the outbreaks of leaf eating caterpillars. Although recommendations are available for the insertion of naphthalene balls into the frond axils (KAU, 2011), significant effect could not be obtained during monsoon periods. Since frequent application is required for these methods, the reduced availability and increased cost of labour for climbing charges for plant protection operations is a serious lacuna in IPM practices in coconut. Therefore an ecofriendly approach should be developed, such as use of biocontrol agents like

*Metarhizium anisopliae* (Bedford, 2013), which can be easily applied in the coconut basins and manure pits. The objective of the present study was to compare the efficacy of three bio control methods viz., 1) application of common salt @ 2kg/palm, 2 times a year 2) filling the innermost two leaf axils with naphthalene balls + sand and incorporation of dry leaf powder of weed *Clerodendron infortunatum* Lin.@10% w/w basis in manure pits and 3) application of *Metarhizium anisopliae* @300 ml/l of water/m<sup>2</sup> area (10<sup>8</sup> spores/ml of water) in manure pits, coconut basins and other breeding sites wet conditions for the control of coconut rhinoceros beetle.

### MATERIALS AND METHODS

An On Farm Trial was conducted with four treatments and four replications, during *kharif* 2011-2012 period, in an area of one hectare, in pest affected fields of Thachampara, Kanjirappuzha, Pookkottukavu and Ottappalam areas in Palakkad district, Kerala, India (North latitude 10° 46' and 10° 59', East longitude 76° 28' and 76°, Altitude of 76 m from mean sea level). Farmer- scientist interactions were conducted in all these areas and

awareness given about this new technology. The phyto-sanitation measures viz., cutting of dead standing coconut trees as close to the soil surface as possible, chopping and burning them were done in all these areas. The mechanical control measures viz., hooking out of the beetle and destroying was also carried out.

Efficacy of three bio control methods: Farmer's practice (Option-1), recommended practice by Kerala Agricultural University Package of Practices Recommendations (Option-2).and alternate practice (Option-3) with one absolute control for the management of coconut rhinoceros beetle was tested. Option 1 was the application of common salt @ 2kg/palm, 2 times a year. Option 2 was filling the innermost two leaf axils with 4 no.s of naphthalene balls + sand (Sadakathulla and Ramachandran, 1990; Singh, 1987) and

incorporation of dry leaf powder of weed *Clerodendron infortunatum* Lin. @10% w/w basis in manure pits 3 times/year. The naphthalene balls were replaced at 45-day intervals and were applied to the base of the inter-space between the leaf sheaths of the three top-most leaves in the crown. Option 3 was the application of the green muscardine fungus, *Metarhizium anisopliae* @ 300ml/l of water/m<sup>2</sup> area in manure pits and coconut basins and other breeding sites during wet climatic conditions (Swan,1984). One treatment was taken as absolute control where no treatments were given. Periodical observations at regular intervals on the damage by the beetle were recorded and the percentage of pest attack was calculated. Nut yield was also recorded and the B: C ratio was also found out. The data generated were subjected to Analysis of Variance (ANOVA) technique.

**Table 1.** Efficacy of different treatments on management of rhinoceros beetle in coconut

Options	Incidence of grubs in 1m <sup>2</sup> area (%)	Reduction over control (%)	Pest attack (%)	Reduction over control (%)	Nut yield (nuts/palm / year)	B: C ratio
<b>Common salt</b>	70.23	23	83.09	2	43	1.15
<b>Naphthalene balls + Sand + <i>Clerodendron infortunatum</i></b>	52.79	42	43.04	49	62	1.5
<b><i>Metarhizium anisopliae</i></b>	27.93	70	10.28	87	80	2.06
<b>Absolute control</b>	92.04	-	85.01	-	34	1.0
SE- for Treatments	11.26		6.3		3.8	0.94
CD – for treatments	31.21		18.01		8.9	0.45

\*Values in parenthesis are angular transformed values

## RESULTS AND DISCUSSION

Observations after three weeks of treatment showed 100 per cent mycosis of *O.rhinoceros* grubs by *Metarhizium* species. The results after six months (Table 1) indicated option -3 had a significantly higher effect than other two treatments with a reduction of grub incidence up to 70% over control. This result is in agreement with the observation by Gopal *et al.* (2006), that application of *M. anisopliae* reduced *O. rhinoceros* grubs up to an

extent of 72% in the field conditions. The incidence of grubs in one square meter area was reduced from 5 no.s /palm to zero in *Metarhizium* sp. applied fields. The pest attack was also significantly lower for *Metarhizium* sp. applied fields (10%) compared to 85% in control treatment. Moslim *et al.* (2006) also found that field application of *M. anisopliae* to rotting debris reduced the *O. rhinoceros* population by up to 80%. The yield was also higher for *Metarhizium* sp. applied fields with a higher B: C

ratio of 2.06. Since the application of *Metarhizium* sp. is by drenching in manure pits and coconut basins and other breeding sites, the cost of plant protection activities

was reduced. These results are in accordance with several researchers, who observed that introduction of biological control relying on the use of the fungus *M. anisopliae* showing positive effects (Soltani, 2010).

The farmer's practice and recommended practice were less effective with 83% and 43% pest attack and lower yield of 43 and 62 nuts/ palm/year. This experiment clearly showed that application of *M. anisopliae* can cause mycosis in the grubs of rhinoceros beetle. Management of the rhinoceros beetle is above all preventive, targeting mainly the breeding sites to reduce pest population. Application of this bioagent is quite easy and economical, compared to insecticides and affords effective protection against this pest. The growers can apply *M. anisopliae* easily, even in the homesteads. The effect of this pathogen at spore loads of  $10^3$ ,  $10^4$  and  $10^5$  per 10 g of substrate was tested on earthworms *Eudrilus* sp. and found that it was non-hazardous to the vermicomposting process as well as the earth worms (Gopal *et al.* 2006). Therefore *M. anisopliae* can be effectively used as a biocontrol agent against rhinoceros beetle. Quarantine measures by the restriction of offshoots movement impede the spread of the pest to new zones, cultural techniques target the control and the destruction of development sites and traps of different type attract adults. All these methods as an integrated pest management strategy can enormously reduce the population inside plantations.

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