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## EFFECTIVENESS OF NYLON NET FOR THE MANAGEMENT OF RHINOCEROS BEETLE INFESTING JUVENILE COCONUT (*COCOS NUCIFERA*) PALMS

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### ABSTRACT

An evaluation trial on 'Effectiveness of nylon net for the management of rhinoceros beetle infesting juvenile coconut (*Cocos nucifera*) palms' was initiated during April 2022 to December 2023 at ICAR-All India Coordinated Research Project on Palms, Regional Coconut Research Station, Bhatye (DBSKKV, Dapoli), Maharashtra, India. The trial is non-replicated and three to six years old 35 palms were selected for experiment. The pre-count observations on leaf and spindle damage of palms by rhinoceros beetle were recorded. Nylon net (Disco 3.4 × 3.4 cm size) cut in 10 feet length and loosely tied circular fashion on the base of spear with 3-4 adjacent fronds) at one months interval. Post treatment observations were recorded on leaf, spindle damage and number of adults beetle trapped on nylon net at monthly interval. The maximum leaf and spindle damage was found 28.5 and 17.1 per cent, respectively during pre-count observations in the months of April, 2022. However, minimum leaf damage (2.13%), spindle damage (2.42%) and adults beetle trapped on nylon net (0.16 nos.) were observed in December 2023. The average data indicated that the minimum leaf, spindle damage and adults trapped in T<sub>1</sub> - nylon net treatment were observed 6.72, 4.85 per cent and 0.52 nos., respectively. However, maximum leaf damage (35.25%) and spindle damage (34.4%) was observed in T<sub>2</sub> - Control treatment. The decline trends were observed from May, 2022 to December, 2023.

**Key words :** Coconut palms, Eco-friendly management, Leaf damage, Nylon net, Rhinoceros beetle, Spindle damage.

### Introduction

Rhinoceros beetle (subfamily Dynastinae), any of numerous species of beetles, some of which are among the largest beetles on Earth, named for the impressive hornlike structures on the frontal portions of males. These beetles have rounded, convex backs, and their coloration varies from black to mottled greenish gray. Some are shiny, almost metallic, whereas others may be covered with short, fine hairs, giving them a velveteen appearance. The coconut rhinoceros beetle, *Oryctes rhinoceros* (L.), has been a pest of coconuts and other palms in the South Pacific since its accidental introduction into Samoa from Sri Lanka in 1909 (Ramachandran *et al.*, 1963; Nair *et al.*, 1997; Lacey, 2017). It is found in several regions of

the world, its shape, size and color are generally consistent (Manjeri *et al.*, 2013). Adult beetles range from 1.2 to 2.5 inches in length (3.0 to 6.3 cm) and are dark brown or black. The ventral surface (underside) of males and females has reddish-brown hairs, but the female has a fuzzy grouping of these hairs at the tip of the abdomen. Both males and females possess a similarly sized horn used for leverage when moving within tightly-packed leaves or within the cavities they create in the crown of palms, the horn length is longer on average for males (Doane, 1913). Adult beetles damage the unopened spear leaves, spathes and inflorescences in contrast to the grubs which feed only on decaying organic matter. The damaged fronds show characteristic "V" or wedge-shaped cuts as they unfold, significantly reducing the photosynthetic

leaf area (Sadakathulla and Ramachandran, 1990) that results in more than 10% reduction in economic yield (Ramachandran *et al.*, 1963; Nair *et al.*, 1997). Juvenile palms (3–5 years old) are highly susceptible and an infestation of 39%–75% has been documented in Kerala, India (Sathiamma *et al.*, 2001). Besides the direct feeding injury, the bore holes serve as entry points for the lethal secondary attacks by the red palm weevil or by pathogens causing bud rot (Josephraj Kumar *et al.*, 2019). Despite the fact that *O. rhinoceros* is persistently active and reproduces throughout the year, its detection is often cumbersome due to its nocturnal habit and cryptic nature of residence within the palms (Manjeri *et al.*, 2013). There is need to find out the strategy for easy adoption and to manage this pest. Exclusion nets are commonly used as safer physical pest control tools in many agricultural commodities because of its easy-to-use and eco-friendly attributes. Hence, the present study was focused to explore a simple, cost-effective beetle exclusion barrier using nylon nets that can be deployed to suppress the attack of RB in palms.

### Materials and Methods

An experiment on ‘Effectiveness of nylon net for the management of rhinoceros beetle infesting juvenile coconut (*Cocos nucifera*) palms’ was conducted at ICAR-All India Coordinated Research Project on Palms, Regional Coconut Research Station, Bhatye (DBSKKV, Dapoli), Maharashtra (India) during April 2022 to December 2023. The trial is non-replicated and three to five years old 35 juvenile coconut palms in two separate coconut gardens selected at a spacing of 7.5m × 7.5m. Most susceptible coconut dwarf palms are infesting by rhinoceros beetle were selected for each treatment. The coconut gardens are raised by following all the recommended agronomic practices including nutrient, water and weed management practices except crop protection measures. The pre-count observations on leaf and spindle damage of palms by rhinoceros beetle were recorded. Nylon net (Disco 3.4 × 3.4 cm size) was purchased from fish market and cut it in 10 feet length and loosely tied circular fashion on the base of spear with 3-4 adjacent fronds at one months interval. Post treatment observations were recorded on leaf, spindle damage and number of adults beetle trapped on nylon net at monthly interval. The generated data were subjected to statistical analysis.

### Results and Discussion

The generated data depicted in Table 1 indicated that the maximum leaf and spindle damage was found 28.5 and 17.1 per cent, respectively during pre-count



**Plate 1 :** Rhinoceros beetle damaging coconut spindle.



**Plate 2 :** Nylon net around coconut spindle.

observations in the months of April, 2022. However, lowest leaf damage (2.13%), spindle damage (2.42%) and adults beetle trapped on nylon net (0.16 nos.) were observed in December 2023. The average data indicated that the minimum leaf, spindle damage and adults trapped in T<sub>1</sub>- nylon net treatment were observed 6.72, 4.85 per cent and 0.52 nos., respectively. However, maximum (35.25%) leaf damage, and (34.4%) spindle damage was observed in T<sub>2</sub>- Control treatment. The decline trends were observed from May, 2022 to December, 2023. The T<sub>1</sub>- treated palms with nylon net treatment was found significantly superior over T<sub>2</sub>- untreated control in respect of leaf and spindle damage by rhinoceros beetle in coconut. Nylon net act as a barrier for the insect pests, preventing attacks on the crop (Chouinard *et al.*, 2016).

**Table 1 :** Assessment of nylon net for the management of rhinoceros beetle (RB) infesting coconut palms.

Months	Leaf damage by RB (%)		Spindle damage by RB (%)		RB adults trapped on Net/palm (Nos.)
	T <sub>1</sub> - Treatment	T <sub>2</sub> - Control	T <sub>1</sub> - Treatment	T <sub>2</sub> - Control	
Pre count (April 2022)	28.5	27.2	17.1	16.6	-
May 2022	26.2	29.1	15.0	19.4	0.42
June 2022	20.9	30.5	14.3	22.2	0.97
July 2022	19.3	32.5	14.2	25.0	0.93
Aug., 2022	17.1	33.8	13.5	27.7	1.03
Sept.,2022	15.8	34.7	11.4	30.5	0.66
Octo., 2022	13.9	35.0	9.99	30.5	0.45
Nov., 2022	13.8	36.1	8.56	33.3	0.41
Dec., 2022	11.9	36.6	7.99	33.3	0.65
Jan., 2023	11.3	34.0	7.85	37.2	0.73
Feb., 2023	10.8	36.8	7.14	39.1	0.70
March 2023	10.4	40.2	6.42	40.5	0.77
April 2023	9.97	45.1	5.71	43.0	0.83
May 2023	8.96	47.2	5.13	45.5	0.88
June 2023	8.57	47.2	5.71	45.5	0.91
July 23	4.99	31.4	4.28	29.1	0.48
August 23	3.85	31.7	4.28	28.4	0.33
September 23	3.85	32.1	4.28	29.1	0.31
October 23	3.13	27.0	2.13	25.6	0.22
November 23	2.79	24.7	2.85	24.9	0.19
December 23	2.13	25.6	2.42	25.2	0.16
Mean ± SE	6.72 ± 1.07	35.25 ± 2.44	4.85 ± 0.54	34.4 ± 2.45	0.54
't'-value	4.02		3.83		
Result	Sig.		Sig.		

**Plate 3 :** Beetle trap on Nylon net.

In organic production systems, net enclosures for fruit trees are widely adopted for protecting the fruits against pest attack (Marliac *et al.*, 2015). Used nylon nets as a pest exclusion barrier guarded the young palms from beetle attack and additionally acted as passive trap by entrapping 20.6 beetles/week/120 palms without any insecticidal intervention (Sujithra *et al.*, 2022). Previous literature reported that exclusion nets have been the mainstay of plant protection measures in the recent years in various crops against diverse pests including: *Cydia pomonella* (L.) (Lepidoptera Tortricidae) (Tasin *et al.*, 2008) and aphids (Dib *et al.*, 2010) in apple orchards; *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae) in cherry, raspberry and blueberry crops (Charlot *et al.*, 2014; Cormier *et al.*, 2015; Rogers *et al.*, 2016), *Halyomorpha halys* (Stal), a pest of many fruit

crops (Candian *et al.*, 2018).

Similarly, the use of low-cost pest exclusion nets (PENs) that is, mosquito nets by smallholder farmers led to an effective control of *Plutella xylostella* in cabbage (Martin *et al.*, 2013). Quantity and quality enhancement of peaches and nectarines following the use of nets to protect them from fruit flies were documented (Nissen *et al.*, 2005). The nylon nets with mesh size of > 2 cm captured and entangled the adult beetles as the beetles tried and burrowed their way into the palm to feed. The net with 2cm × 2cm mesh size, that had higher adult beetle catch, was demonstrated in 36 juvenile palms during April 2022–December 2023. The palms initially had 28.5% damaged leaves that were reduced to 2.13% after wrapping with nylon net as pest exclusion barrier. On the contrary, the control palms had significant rise in per cent damaged leaves from 27.2% to 35.25% without net protection during the study period. Further loose wrapping of nylon nets allowed us to open and remove the entangled beetles at regular intervals. The physical method is very effective it also requires periodic maintenance like lifting and rewrapping to allow proper leaf opening during the palm growth.

### Conclusion

The nylon net has effective against the management of rhinoceros beetles in coconut juvenile palms and would help to reduce the further crop damage due to rhinoceros beetle in the region. It is safe, cheap and eco-friendly method for the management of rhinoceros beetle.

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