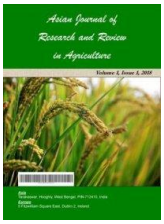

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Effect of Various Control Measures on Predator Incidence and Production Performance in Lac Insect (*Kerria lacca)*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In order to evaluate the efficacy of various predator control strategies and to see the influence of these measures on the production and profitability of Kusumi lac, a field study was undertaken in several sites of two lac-growing districts in Jharkhand, namely, Bokaro and Ranchi. Twenty lac farmers were divided into 4 groups: T_1 (Farmers' practice: no use of nylon net and/ or insecticide); T_2 (Use of insecticide); T_3 (Nylon netting) and T_4 (Nylon netting with insecticide application). The *Kusumi* lac growers were identified for the data collection on predator incidence, lac yield and B:C ratio. The results showed that the number of predators/m encrustation for the predators like *Eublemma amabilis* and *Pseudohypatopa pulverea* was significantly ($p<0.05$) reduced in T_4 after the third spray of the insecticide as compared to T_1 (7.5 vs. 22.0 for *Eublemma amabilis* and 8.0 vs. 41.0 for *Pseudohypatopa pulverea*). The overall incidence of predators was significantly ($p<0.05$) reduced in T_4 by 74.5% as compared to T_1. The yield of lac was significantly ($p<0.05$) reduced in T_1 as compared to T_4 (20.0 vs. 65.0 kg/5 plants). Higher B:C ratio was found in T_4 as compared other treatment groups. It can be concluded from the present study that the use of nylon netting (60 mesh) along with application of insecticide thrice (Ethofenprox 10 Ec. @ 2 ml/l) was significantly effective against the common predator insects of the lac and affected the productivity and profitability of the lac cultivation significantly.

Keywords: Lac; predator insects; resins; gums; control; production; economics.

1. INTRODUCTION

Lac, a natural polymer (resin) in produced by a tiny insect, [*Kerria lacca* (Kerr)] (Homoptera: Tachardiidae), which is cultured on tiny twigs of specific host species of trees, mainly *Schleichera oleosa* (kusum), *Butea monosperma* (palas) and *Zizyphus mauritiana* (ber) which are being

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exploited for commercial lac production in India. This agricultural profession of lac cultivation is a traditional and subsidiary source of income for a large number of farmers mainly in Jharkhand, Chhattisgarh, West Bengal, Odisha, North-Eastern states and other parts of the country. India, which is the highest producer of lac, contributes around 55% of the total world requirement. The country exports around 80-90% of its production. Jharkhand is the 'Lac State of India' which alone contributes about 59% of the national production. A survey of lac growers in Jharkhand shows that income from lac cultivation is 26.4% of farm income. Lac cultivation is a fairly remunerative activity to the grower, providing a net profit of Rs. 9,700 to 1.32 lakhs per annum per 100 trees, depending on the host species. Besides providing livelihood support to the growers, lac cultivation has other environment roles. Coupled with good price in recent years, good current and potential global demand for lac, there is enhanced interest level among farmers recently, to take up lac cultivation [1].

Lac culture is done as a cash crop, cultivated for commercial value of its products namely resin, dye and wax; and this crop is a low input high value crop and returns from lac cultivation are much higher, especially in drought situations when other major agricultural crops fail. Again, the lac insect itself is highly vulnerable to predators, diseases and natural elements, and no insurance mechanism exists to mitigate such risks [2]. Lac crop is prone to attack by a hoard of enemies that include insect parasitoids and predators. Among the inimical insect fauna, the two lepidopteran predators *Eublemma amabilis* Moore (Lepidoptera: Noctuidae) and *Pseudohypatopa pulverea* Meyr (Lepidoptera: Blastobasidae) are the key pests causing a loss of around 30–40% to lac crop. The larvae of *E. amabilis* and *P. pulverea* bore into the lac encrustations and feed on the lac insects and remain confined within the encrustation. Several control/suppression measures have been tried for this lepidopteran predator, i.e., *Eublemma amabilis* Moore, but all the measures have their own merits and demerits (Bhattacharya *et al.* 2007). Hand picking, shaking of lac insect-settled branches and nylon netting are simple method to contain the population of predators but difficult for adoption on large scale due to large tree size and also labour intensive [3]. Other researchers have also studied the effect of different biological [4,5], cultural and chemical [6,7] control measures of different lac predators on the productivity of lac. Rahman et al. [8] also emphasized for further investigation to find out a concrete control method. Therefore, the management of this insect predator has paramount significance for successful lac cultivation and increased production. Keeping the above in view, the present study was conducted in order to evaluate the responses of this lepidopteran predator of kusumi lac to various control measures in different locations.

2. MATERIALS AND METHODS

The present study was conducted in 20 different locations of two lac growing districts of Jharkhand, viz., Bokaro and Ranchi during 2012-13. A total of 12 farmers were purposively selected from Ranchi district and divided them into equal 4 groups as per the design of the experiment. Simultaneously, 8 farmers were also purposively selected from Bokaro district and divided them into 4 equal groups as in case of Ranchi district. The *Kusumi* lac growers were identified for the data collection on lac yield and incidence of predators like *Eublemma amabilis* and *Pseudohypatopa pulverea* and economic parameters like net return and B:C ratio. The data relating to the predator incidence and lac yield alongwith economics for various predator control measures in lac growers of the two districts were recorded during the study. The lac growers were divided into 4 groups: T_1 (Farmers' practice: no use of nylon net and/ or chemical insecticides); T_2 (Use of insecticide); T_3 (Nylon netting) and T_4 (Nylon netting with insecticide application). Various predator control measures used in the present study were use of nylon net (60 mesh) and 3 sprays (at 25^{th}, 40^{th} and 60^{th} day of inoculation) of Ethofenprox 10% EC (2 ml/l of water) along with their various combinations. The treatment effect was tested for its significance by employing one way ANOVA [9] using SPSS® [10].

3. RESULTS AND DISCUSSION

The response of the predators to different control measures was different (Table 1). Results revealed that the number/m encrustation for the predators like *Eublemma amabilis* and *Pseudohypatopa pulverea* was significantly ($p<0.01$) reduced in T_4 after the third spray of insecticide as compared to T_1 on the same day (7.6±0.9 vs. 22.0±0.7 for *Eublemma amabilis* and 6.0±0.8 vs. 41.0±0.7 for *Pseudohypatopa pulverea*). Similar findings were also reported after a laboratory study by Singh *et al* [3]. For *E.*

amabilis, application of Ethofenfrox 10% EC and application of only 60 mesh nylon netting had almost similar results. Whereas, in case of *P. pulverea*, application of 60 mesh nylon netting showed better result than only application of Ethofenprox 10% EC and the values were also differed significantly ($p<0.01$).

Table 2 depicted the predator incidence, lac yield and profitability of *Kusumi* lac cultivation under various predator control measures. The overall incidence of predators was significantly ($p<0.01$) reduced in T_4 by 73.7±0.6% followed by T_2 and T_3 as compared to T_1 after 60th day of inoculation. The yield of lac was significantly ($p<0.01$) reduced in T_1 as compared to T_4 (20.0±0.7 vs. 65.0±0.9 kg/5 plants). The present findings corroborated with the earlier studies [7]. Highest net return (Rs. 36232) was obtained in T_4 followed by T_2 and T_3 against the corresponding figure for T_1 (Rs. 9928). Similar results on B:C ratio were also found in T_4 and other treatment groups as compared to T_1 group.

Table 1. Influence of different control measures on incidence of various predator insects in *Kusumi* lac

Treatment groups	No. of predators/m encrustation					
	1st spray-25th day		2nd spray- 40th day		3rd spray- 60th day	
	E. amabilis	***P. pulverea***	***E. amabilis***	***P. pulverea***	***E. amabilis***	***P. pulverea***
T_1: Farmers practice: No use of chemicals and nylon netting	27.0±0.7^a	33.0±1.1^a	36.0±0.7^a	40.0±1.4^a	22.0±0.7^a	41.0±0.7^a
T_2: Technology option-I: Application of 3 sprays of Ethofenprox 10% EC @ 2ml/l	18.8±1.4^b	27.6±0.8^b	14.0±0.8^b	16.6±0.5^b	11.0±0.6^b	7.6±0.5^c
T_3: Technology option-II: Application of nylon netting (60 mesh)	20.4±1.3^b	30.0±0.7^b	18.2±0.6^c	14.6±0.5^b	12.6±0.5^b	11.0±0.7^b
T_4: Technology option-III: Application of both the 3 sprays of Ethofenprox 10% EC @ 2ml/l and nylon netting (60 mesh)	15.0±1.0^c	23.2±1.1^c	10.4±1.0^d	14.0±0.7^b	7.6±0.9^c	6.0±0.8^c

a-d: Means with different superscript differed significantly ($p<0.01$).

Table 2. Predator incidence, lac yield and profitability of *Kusumi* lac cultivation under various predator control measures

Treatment groups	Pest incidence (%)	Reduction in lac insect predators (%)	Yield(kg/ 5 plants)	Net return(Rs./ 5 plants)*	B:C ratio*
T_1: Farmers practice: No use of chemicals and nylon netting	33.2±0.9^a	0.0±0.0^a	20.0±0.7^a	9928	4.4:1
T_2: Technology option-I: Application of 3 sprays of Ethofenprox 10% EC @ 2ml/l	13.4±0.5^c	71.0±0.7^c	50.0±0.8^c	27432	8.3:1
T_3: Technology option-II: Application of nylon netting (60 mesh)	21.0±0.7^b	62.5±0.5^b	45.0±0.5^b	24432	7.6:1
T_4: Technology option-III: Application of both the 3 sprays of Ethofenprox 10% EC @ 2ml/l and nylon netting (60 mesh)	9.2±0.6^d	73.7±0.6^d	65.0±0.9^d	36232	9.8:1

a-d: Means with different superscript differed significantly ($p<0.01$).

** Considering sale price of lac @ Rs. 400/kg*

4. CONCLUSION

It can be concluded from the present study that the use of nylon netting (60 mesh) along with application of insecticide thrice (Ethofenprox 10% EC @ 2ml/l) was significantly effective against the common predator insects of the lac and affected the productivity and profitability of the lac cultivation significantly. However, similar studies on the combination of other predator control practices with common insecticides may be undertaken to outline most effective predator control measure in Jharkhand condition.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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