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Evaluation of *Trichogramma* species for the suppression of lepidopteran insect predator, *Eublemma amabilis* Moore, in lac culture on *Flemingia macrophylla*

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ABSTRACT: **The lepidopteran predator, *Eublemma amabilis* Moore, is a major pest of lac and causes colossal losses to the lac crop to the magnitude of about 40 per cent. Three species of trichogrammatid egg parasitoids, namely, *Trichogramma achaeae* Nagaraja and Nagarkatti, *T. exiguum* Pinto and Platner and *T. ostriniae* Pang et Chen were evaluated in the present study on lac crop raised on the bushy host plant, *Flemingia macrophylla* O. Kytze and were found extremely useful as a substitute for chemical pesticides. All the three egg parasitoids were able to suppress the population of *E. amabilis*. The reduction in the population of *E. amabilis* was 77 to 86 per cent in case of *rangeeni* crop and 52 to 72 per cent in case of *kusmi* crop with a dose of 20 egg parasitoids per bush. In general, trichogrammatids were found more effective in case of *rangeeni* lac than *kusmi*. All the three parasitoids were found equally effective in suppressing the population of *E. amabilis*.**

KEY WORDS: Egg parasitoids, *Eublemma amabilis*, *kusmi*, *rangeeni*, *Trichogramma*

INTRODUCTION

Lac, the resinous secretion of *Kerria lacca* Kerr (Homoptera: Tachardidae), is industrially valued as a product of commerce. Lac crop is damaged extensively by a number of insect predators and parasitoids. Amongst them, the predators, *Eublemma amabilis* Moore (Lepidoptera: Noctuidae) and *Pseudohypatopa pulverea* (Meyr.) (Lepidoptera: Blastobasidae) alone cause around 40 per cent loss (Glover, 1937). *Flemingia macrophylla* O. Kytze (Family: Leguminosae), having the potential to sustain both the *kusmi* and *rangeeni* biotypes of lac insects, has been identified as a suitable bushy host plant for the cultivation of lac. Management of lac insect pests is required for effective lac crop production on the bushy host plants. Several pest management practices are currently in practice in lac ecosystem with special emphasis on chemical control. A number of selective insecticides have been recommended for use in lac ecosystem, but insecticides have their inherent disadvantages. Therefore, the need was felt to evaluate other viable alternatives that may minimize the use of chemical pesticides and give effective suppression of the predators of lac insect. Various species of *Trichogramma* (Hymenoptera: Trichogrammatidae) have been reported to parasitize the eggs of *E. amabilis* and *P. pulverea* (Bhattacharya *et al.*, 2003; Sushil *et al.*, 1995, 1999,

2000). Under the present study, three species of egg parasitoids, *viz. Trichogramma achaeae* Nagaraja and Nagarkatti, *T. exiguum* Pinto and Platner and *T. ostriniae* Pang et Chen were evaluated in lac culture raised on *F. macrophylla* bushes for the management of *E. amabilis*.

MATERIAL AND METHODS

An established plantation of the bushy lac host plant, *F. macrophylla*, planted at a spacing of 1 x 1 m was utilized for the experiment. Three plots having 30 bushes of *F. macrophylla* in each were selected for raising lac culture of which one plot was for *kusmi*, one for *rangeeni* and the third was control. All the bushes were pruned about six inches above the ground level during the month of January. Attempts were made to maintain uniformity in size, leaving only 5-6 healthy tillers. Brood lac (twigs having encrustations of gravid female lac insects) of both the biotypes *kusmi* and *rangeeni* were inoculated @ 15g per meter length of shoot separately in each of the three plots. Uniform coverage was ensured by inoculating only the proper quantity of brood lac and by rotating the brood lac on the twigs. The brood lac was left on the bush for thirty days to ensure the emergence of *E. amabilis* adults. The experiments were carried out during the rainy and winter season lac crops as this period (July–January, 2005-2006) corresponds to the peak period of pest infestation.

The three egg parasitoids, *Trichogramma achaeae, T. exiguum* and *T. ostriniae*, were reared on *Corcyra cephalonica* eggs in the laboratory at a temperature of 25±2° C and 65±5 per cent humidity. The eggs of *C. cephalonica* were spread uniformly on paper cards having a thin layer of gum. Trichocards were prepared by releasing *Trichogramma* adults into a test tube consisting of uniformly spread eggs of *C. cephalonica* on cards. The trichocards consisting of egg parasitoids @ 15 and 20 eggs per card were stapled on the under surface of the leaves of *F. macrophylla* plants. Two releases of egg parasitoids were carried out, 30 and 60 days after lac crop inoculation on both *kusmi* and *rangeeni* biotypes. The experimental bushes selected for each treatment were kept at sufficient distance (10 meters away) from each other to avoid any possible intermixing. Each treatment was replicated five times and five plants of *F. macrophylla* each for *kusmi* and *rangeeni* were kept 20 meters away from the site of release of egg parasitoids as control.

Twigs bearing lac insect encrustation measuring 50–60 cm were collected from each bush as samples at the time of crop maturity and caged in 60-mesh nylon net bags for trapping the adult predators, which emerged from the lac encrustation. The caged samples were kept hanging from a wire stand in open air at room temperature (30±5° C) for providing sufficient aeration. The samples were kept for 30 days and monitored for the emergence of parasites and predators. After a period of 30 days, the bags were opened and the number of *E. amabilis* emerged from the caged lac encrustation was quantified. The population of *E. amabilis* was converted to number per meter lac encrustation to ensure uniformity. The data were analysed by using ANOVA single factor analysis. The incidence of *E. amabilis* under each treatment along with each replicate was analysed along with yield data. The level of significance was assessed on CD values.

RESULTS AND DISCUSSION

Effect on *Eublemma amabilis*

The infestation of *E. amabilis* was found to be significantly less in the bushes where egg parasitoids were released. In case of rainy season *rangeeni* lac crop (July to October), the percentage reduction in the number of *E. amabilis* was found to be 56.55 to 85.90% in comparison to control in case of *T. achaeae* released bushes, while in *T. exiguum* and *T. ostriniae* treated bushes per cent reduction was 42.29 to 79.19% and 50.67 to 77.30%, respectively (Table 1). Tricho cards @20 egg parasitoids per bush were able to cause more suppression (P d" 0.05%) than 15 egg parasitoids per bush. *T. achaeae* and *T. exiguum* were able to cause the highest level of suppression, 85.90 and 79.19 per cent, respectively, with the release of 20 egg parasitoids per bush. In case of *kusmi* lac crop (July to January, 2005-06), the mean number of *E.*

Table 1. Effect of release of egg parasitoids on the incidence of *E. amabilis* and consequent increase in yield (rainy season crop *rangeeni* biotype)

Egg parasitoid	Number released per bush	Mean number of *E. amabilis* per meter lac encrustation	Percentage reduction in the incidence of *E. amabilis*	Yield of broodlac (input: output ratio)	Percentage increase in yield over control
T. achaeae	15	3.21	56.55	1.90	53.23
	20	1.04	85.90	4.28	245.16
T. exiguum	15	4.27	42.29	1.40	12.90
	20	1.54	79.19	5.02	304. 80
T. ostriniae	15	3.65	50.67	1.58	27.42
	20	1.68	77.30	6.40	416.12
Control		7.4		1.24	
CD (P = 0.05)		1.11		1.00	

Table 2. Effect of release of egg parasitoids on the incidence of *E. amabilis* (winter season crop *kusmi* biotype)

Egg parasitoid	Number released per bush	Mean number of *E. amabilis* per meter lac encrustation	Percentage reduction in the incidence of *E. amabilis*
T. achaeae	15	2.4	52
	20	2.2	56
T. exiguum	15	1.8	64
	20	1.8	64
T. ostriniae	15	2.0	60
	20	1.4	72
Control		5.0	
CD (P = 0.05)		2.02	

amabilis differed significantly from control. However, there was no significant difference between the two dosages evaluated with all the three species and also between the species. The suppression of *E. amabilis* was found to be 52–72 percent (Table 2) with the three egg parasitoids. *T. ostriniae* contributed for the maximum reduction in the insect predator population. The differential behavior of *kusmi* and *rangeeni* biotypes in terms of incidence and suppression of *E. amabilis* may be due to difference in crop duration, settlement behavior and amount of resin secreted. The pattern of settlement in case of *rangeeni* crop is sparse in respect to *kusmi* and there are sufficient cells exposed leaving intercellular spaces. This enables the trichogrammatid egg parasitoids to search out the eggs of the lepidopteran predators easily.

Effect on lac crop yield

In case of *rangeeni* lac crop, with the release

of *T. achaeae*, *T. exiguum* and *T. ostriniae* @15 egg parasitoids per plant, the increase in yield was 13 to 53 per cent. However, the dose of egg parasitoids @20 eggs per plant indicated higher yield, which varied from 245 to 416 per cent (Table 1). Thus, in case of yield, there was significant difference between the two doses in all species. However, it is evident from earlier studies that the yield of lac crop depends on a series of plant as well as environmental factors. The winter season *kusmi* lac crop was affected at an advanced stage due to heavy fungal attack, hence the yield could not be considered in this study. There was no significant difference in suppression of *E. amabilis* among different species of egg parasitoids tested. However, from the point of view of suppression of *E. amabilis* and increase in yield, 20 eggs per bush were found to be appropriate. The study clearly indicates that these egg parasitoids can be considered for effective management of *E. amabilis*. The population of the other lepidopteran insect predator, *P. pulverea*, was negligible and hence discarded in the present study.

The results are in conformity with the earlier observations carried out by Sushil *et al.* (1995, 1999, 2000) and Bhattacharya *et al.* (2003) with other egg parasitoids. These egg parasitoids can be successfully utilized as a substitute for the chemical pesticides currently in use and will be environmentally acceptable as well.

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