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Kairomonal Effects of bio-active plant extracts on spider population and parasitization of yellow stem borer eggs by *Trichogramma japonicum*

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ABSTRACT: **Host location and acceptance by egg parasitoids can be mediated by various allelochemicals. In this study, we tested the response of *Trichogramma japonicum* Ashmead to bioactive plant extracts of easily available plants against *Scripophaga incertulas* (Walker). An experiment was laid in free choice conditions at Raipur (Chhattisgarh agro-ecosystem) in randomized block design with seven treatments including control. There was continuous increment in parasitization by *T. japanicum* for up to 15 days. Parasitization *T. japanicum* was enhanced significantly in *Tagetes erecta* (Marigold) treated plots (48.5%) followed by *Ocimum sanctum* (Tulsi) (42.6%) and was minimum in *Azadirachta indica* (Neem) treated plots (18.8%). *Tagetes erecta* (Marigold) spray on rice crop elicited a positive response in spider population, with the highest average number of spiders (5.80), followed by control 3.66%. The other treatments showed repellent action on spider population.**

KEY WORDS: Bio-active plant extracts, parasitization, spider population, *Trichogramma japonicum*, yellow stem borer.

INTRODUCTION

The yellow stem borer, *Scirpophaga incertulas* (Wlk.) is one of the major pests causing considerable losses in both *Kharif* and summer season under Raipur condition (Patel, 1972). Incidence of this pest is higher in summer season causing up to 20 per cent yield loss whereas in *Kharif* season, the loss is 2-5 per cent (Gangrade *et al.*, 1978). To overcome the problems created by indiscriminate use of chemical pesticides, biopesticides including biological agents and bio-active plant extracts are to be given great importance in managing the yellow stem borer. Several parasitoids and predators have been reported to attack *S. incertulas* in different stages of its life cycle. The most vulnerable stage of the pest is the eggs as they remain exposed to natural enemy attack. Of the several egg parasitoids reported, *Trichogramma* spp. are of importance. Spiders are general predators which prey on the stem borer adults. Some of the plant extracts are reported to increase or decrease the efficiency of natural enemies either by acting as attractants arrestants or repellents. The information on the effect of plant extracts on these important natural enemies of yellow stem borer is lacking in the literature. So an attempt was made to test the effect of extracts of commonly available plants on the efficacy of these natural enemies.

MATERIALS AND METHODS

Stem borer females were kept in glass jars containing fresh rice leaves for oviposition. Fresh eggs were removed from these leaves and 50 eggs were tagged on 5 plants in each plot and simultaneously the plant extracts were sprayed @0.5% in each treatment (*i.e.*, *Azadirachta indica* (Neem), *Ocimum sanctum* (Tulsi), *Vinca rosea* (Sadasuhagan), *Tagetes erecta* (Marigold), *Cymbopogan flexuosus* (Lemongrass)). On the same day, *T. japonicum* @ 1,00,000/ha was released. After 7 days, 50 eggs of *S. incertulas* treated with plant extracts were tagged as per earlier schedule. The numbers of parasitized eggs were recorded five times at 3 days interval.

$$\% \text{ Parasitized eggs} = \frac{\text{No. of parasitized eggs}}{\text{Total No. of eggs (50) at one place}} \times 100$$

After spray of the plant extracts in different treatments, the number of spiders was recorded in each experimental plot including control. The appearance of predators on different treated plots was also observed, to study their preference to different bioactive plant extracts. For preparation of stock solution, fresh leaves of 1 kg of each plant indicated above were crushed in the mixer and then boiled in 1 litre of water till the quantity of water became 1/4th (*i.e.* 250 ml) and filtered, Pure filtrate of 5ml was dissolved in one litre of water. The strength of 0.5 per cent was made followed by spraying both on the leaves and in the field.

An experiment was laid in free choice conditions under randomized block design with seven treatments and three replications with a plot size of 3m x 5m (15m^2). The data were subjected to analysis of variance after appropriate statistical transformation.

RESULTS AND DISCUSSION

Results from the present investigation revealed that after three days of treatment, there was significant increase in parasitization in *Tagetes erecta* (Marigold) + *T. japonicum* treatment (32.8%) followed by *Ocimum sanctum* (Tulsi) + *Trichogramma* (25.73%) and *Vinca rosea* (Sadasuhagan) (19.2%), whereas *Cymbopogan flexuosus* (Lemongrass), *Azadirachta indica* (Neem) and *Trichogramma* alone (without plant extracts) recorded 11.32%, 11.06% and 11.60% parasitized eggs, respectively. A similar trend was observed in the egg parasitization during all dates after treatment with highest parasitization in *Tagetes erecta* (Marigold) followed by *Ocimum sanctum* (Tulsi) > *Vinca rosea* (Sadasuhagan) > *Trichogramma* alone> *Cymbopogan flexuosus* (Lemongrass) > *Azadirachta indica* (Neem) > control. But there was a gradual increase in parasitism in all the treatments with the progression of time (Table 1). *Azadirachta indica* (Neem) and *Cymbopogan flexuosus* (Lemongrass) with *Trichogramma* resulted in less parasitization than that in the plots treated with *Trichogramma* alone which indicates *Azadirachta indica* (Neem) and *Cymbopogan flexuosus* (Lemongrass) had some negative effect on parasitization. There might be some repellent compounds, which deter parasitization by *Trichogramma* of yellow stem borer. *Tagetes erecta* (Marigold) showed better results with a maximum of 48.5 per cent parasitization indicating some kairomonal effect of *Tagetes erecta* (Marigold) on the activity of *Trichogramma*.

Altieri (1981) recorded increased activity of *Trichogramma* egg parasitoids after spraying infested soybean, tomato, cowpea and cotton crops with maize and *Amaranthus* sp. extracts. Usha Rani (2003) recorded highest attraction to parasitoids after spraying extracts from yellow stem borer infested stems of rice. Shankarganesh and Khan (2003) found highest parasitization by *T. chilonis* in response to extracts from *Saccharum officinarum* (61.33%) and *Oryza sativa* (54.66%).

Effect of bio-active plant extracts on predatory spiders

The results revealed that spider population was maximum (5.8) in *Tagetes erecta* (Marigold) treated plots. The spider population was low in *Cymbopogan flexuosus* (Lemongrass) (1.44), *Azadirachta indica* (Neem) (1.99), *Ocimum sanctum*

Table 1. Parasitization of stem borer eggs by *T. japonicum* on plants treated with various plant extracts

Treatment	Mean % parasitization				
	Days after treatment				
	3	6	9	12	15
Azadirachta indica + *T. japonicum*	11.06 (19.247)	14.00 (21.878)	15.46 (23.08)	17.46 (24.63)	18.80 (24.96)
Ocimum sanctum + *T. japonicum*	25.73 (30.318)	35.20 (36.370)	38.26 (38.19)	40.26 (39.37)	42.60 (40.85)
Vinca rosea + *T. japonicum*	19.20 (25.947)	24.00 (29.310)	26.92 (31.23)	28.90 (32.01)	30.90 (33.77)
Tagetes erecta + *T. japonicum*	32.80 * (34.874)	36.53 * (37.110)	40.00 * (39.18)	43.72 * (41.35)	48.50 * (44.33)
Cymbopogan flexuosus + *T. japonicum*	11.32 (19.629)	17.70 (24.880)	20.00 (26.52)	21.40 (27.54)	23.20 (28.76)
T. japonicum alone	11.60 (19.832)	20.00 (26.500)	20.52 (26.88)	24.80 (29.88)	25.70 (38.40)
Control	0 (4.054)	0 (4.054)	0 (4.054)	0 (4.05)	0 (4.054)
Gen. Mean	(21.73)	(25.73)	(27.02)	(28.41)	(29.60)
SEM ±	(1.894)	(1.510)	(1.548)	(1.547)	(1.183)
LSD (P=0.05)	(5.38)	(6.454)	(4.770)	(4.76)	(3.640)

Figures in parentheses are arc sin transformed values

Table 2. Mean number of spiders observed after spraying bio-active plant extracts

Treatment	Mean number	Response
Azadirachta indica (Neem) + *T. japonicum*	1.99(1.577)	-ive
Ocimum sanctum (Tulsi) + *T. japonicum*	2.55(1.7305)	-ive
Vinca rosea (Sadasuhagan) + *T. japonicum*	3.44(1.973)	-ive
Tagetes erecta (Marigold) + *T. japonicum*	5.80 *(2.492)	+ive
Cymbopogan flexuosus (Lemongrass) + *T. japonicum*	1.44(1.354)	-ive
T. japonicum alone	3.33(1.955)	-ive
Control	3.66(2.004)	_
General mean	(1.878)	_
SEM ±	(0.118)	_
LSD (P=0.05)	(0.364)	_

Figures in parentheses are square root transformed values; * significant at 5%

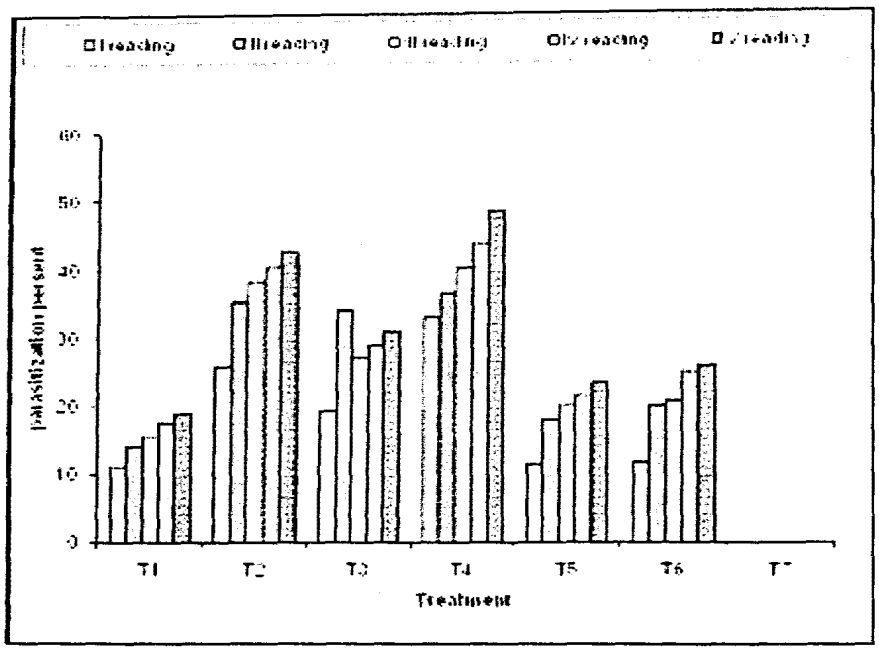

Fig. 1. Percentage of parasitized eggs by *T. japonicum* recorded 5 times at 3 days interval

T1- *Azadirachta indica* (Neem) + *T. japonicum*, T2- *Ocimum sanctum* (Tulsi) + *T. japonicum*, T3- *Vinca rosea* (Sadasuhagan) + *T. japonicum*, T4- *Tagetes erecta* (Marigold) + *T. japonicum*, T5- *Cymbopogan flexuosus* (Lemongrass) + *T. japonicum*, T6-Only *T. japonicum* T7-Control

(Tulsi) (2.55), *Trichogramma* alone (3.33), *Vinca rosea* (Sadasuhagan) (3.44) as compared to control (3.66) indicating that all the bio-active plant extracts had repellent or adverse effect on spider population except *Tagetes erecta* (Marigold) which attracted higher number of spiders compared to control (Table 2).

Raguraman and Rajesekaran (1996) reported that *Azadirachta indica* (Neem) treatments resulted in better recolonization of the predatory wolf spider, *Lycosa prseudoannulata* treated plots than monocrotophos. Anonymous (2000) reported spraying with n-tricosane (1%) scale extract of *H. armigera* and *Corcyra cephalonica* (both 1.2%) enhanced predation of *H. armigera* by *C. carnea* larva. Chakroborty (2003) reported *Azadirachta indica* (Neem) treatments were quite safe to natural enemies and integration of *Azadirachta indica* (Neem) with synthetic chemical treatments was moderately safe to natural enemies. However, contribution of natural enemies in checking pest population build up appeared to be only marginal. Schmutterer (1987) reported adverse effects of *Azadirachta indica* (Neem) extracts might be attributed to its strong repellent, antifeedent and growth regulatory activity. Thus *Tagetes erecta* (Marigold) bio-active plant extracts had no ill effect on spider population.

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