J. Biol. Control, 15(2): 133-137, 2001

Effect of plant extracts on the parasitization efficiency of *Trichogramma chilonis* Ishii

M. A. KHAN and S. TIWARI
Biological Control Laboratory, Department of Entomology
College of Agriculture, G. B. Pant University of Agriculture and Technology
Pantnagar 263 145, Uttaranchal, India

ABSTRACT: **In the present investigations a large array of plant species was evaluated for analysing their effect on the *Trichogramma chilonis* Ishii, for better understanding of the tritrophic interactions. The extracts of the eleven test plants were treated on the *Corcyra* eggs, which were subsequently exposed to the adult females of *T. chilonis* for parasitisation and further observations, were made regarding per cent parasitisation and per cent emergence. Among the various plants tested, egg cards treated with the most commonly available fern in Tarai region *Pteridium aquilinum* resulted in maximum mean per cent parasitism 78, while maximum mean per cent emergence 85.33 was observed in the cards treated with *Eucalyptus rostrata*.**

KEY WORDS: Parasitization, plant extracts, *Trichogramma chilonis*

Among the natural enemies, *Trichogramma* spp. are important egg parasitoids of a number of lepidopterous pests and are one of the most extensively used natural enemies. These parasitoids attack eggs of many lepidopterous pests such as sugarcane borers, *Chilo* spp. and *Scirpophaga excerptalis* (Walker); paddy stem borer, *Scirpophaga incertulas* (Walker); tomato fruit borer, *Helicoverpa armigera* (Hubner); Cutworms, *Agrotis* spp.; Cotton bollworm, *Pectinophora gossypiella* (Saunders) and *Earias* spp. and maize stem borer, *Chilo partellus* (Swinhoe).

New evidences have now suggested that volatile compounds released by plants, in addition to being highly detectable and reliable indicators of herbivore presence, it may also convey herbivore-specific information that allows parasitoids to discriminate even closely related herbivore species at long range (Moraes *et al.*, 2000). Similar investigations done by Calumpang *et al.* (1995) on the influence of morning glory, *Ipomoea triloba* L. extracts on the parasitization and arrestment behaviour of the *T. evanescens* clearly shows that parasitization of corn borer eggs was significantly higher when a mixture of the neutral and basic fractions of the hexane extract was used, the chemicals in *I. triloba* acted as strong directional or orientational cues for *T. evanescens*. Likewise, Ashmead *et al.* (1998) also reported of enhanced rate of parasitization by *T. evanescens* in presence of corn leaf extracts. Nordlund *et al.* (1984) found that species of *Geocoris*, Nabids, and Coccinellids were more numerous and predation of *Heliothis zea* eggs was greater in plots of corn than in nearby plots of tomato. Likewise, parasitism of *H. zea* eggs by *Trichogramma* spp. was significantly higher in tomato plants than it was in corn plants. Similarly, *Trichogramma* spp. found to be useful in regulating sugarcane pests but failed to control *Helicoverpa armigera* in crops

such as redgram and Bengal gram (Manjunath *et al.* 1989;Tiwari, 2000). Therefore, it is very pertinent to conclude that chemical cues released from associated host plants influence the behaviour of entomophagous insects. Thus, the present studies were undertaken to investigate upon the interaction between host plants and parasitoid *Trichogramma chilonis* by taking the extracts of some commonly found trees and plants.

MATERIALS AND METHODS

The factitious host, *Corcyra cephalonica* (Stainton) larvae were reared on broken maize grains mixed with yeast (2%) at 28±2°C and 60±5 per cent relative humidity. Fresh eggs of *C. cephalonica* (0-24h old) were exposed to UV radiation to kill the host embryo for fifteen minutes and used for culturing the *Trichogramma chilonis* in a B.O.D Incubator at 25±2°C and 70±5 per cent relative humidity. Clean, healthy (0-24h old) eggs of *C. cephalonica,* sterilized under UV light (15 minutes) were washed twice in hexane to remove any traces of scales and kairomones present on the surface of eggs. They were then pasted equidistantly on 2x5cm white sheet at the rate of 50 eggs per piece (here after referred to as cards). Thereafter, each of these cards was sprayed with plant extracts. Spraying

Table 1. The details of plants used in the study

Sl. No.	Plant	Family	Plant part(s) used	Conc. of the extract
1	Lantana *Lantana camara*	Verbenaceae	Leaves	0.02 gm/ml
2	Gular *Hibiscus rosasinensis*	Malvaceae	Leaves	0.02 gm/ml
3	Bottle brush *Callistemon lanceolatus*	Myrtaceae	Leaves	0.02 gm/ml
4	Fern *Pteridium aquilinum*	Dennstaedtiaceae	Fronds and pinnae	0.02 gm/ml
5	Nerium *Nerium indicum*	Apocynaceae	Leaves	0.02 gm/ml
6	Marigold *Tagetes patula*	Asteraceae	Flowers	0.02 gm/ml
7	Castor *Ricinus communis*	Euphorbiaceae	Leaves	0.02 gm/ml
8	Amaltas *Cassia fistula*	Leguminosae	Leaves	0.02 gm/ml
9	Eucalyptus *Eucalyptus rostrata*	Myrtaceae	Leaves	0.007 gm/ml
10	*Lagerstroemia speciosa*	Lythraceae	Leaves	0.02 gm/ml
11	Congress grass *Parthenium hysterophorus*	Asteraceae	Leaves	0.01 gm/ml

was done by glass atomizer and 0.5ml of spray liquid was used for each card. The sprayed cards were allowed to dry in shade for half an hour and were introduced into glass vials of 15x2.5cm. Each treatment was replicated three times. *Trichogramma* adults were anaesthetized using etherised carbon dioxide for 15 seconds as described by Navarajan Paul (1973) and later healthy, fast reviving females were transferred to each vial containing card at the rate of ten females per card (with 50 eggs). They were allowed to parasitize the host eggs for 24 hours and then egg cards (hereafter referred to as Trichocards) were shifted to fresh glass vials. On the 6th day, parasitization was recorded by observing blackened eggs. Whole set up maintained at 25±2°C and 70±5per cent relative humidity. Then the Trichocards were left for adult emergence and the emerged adults were counted on the 12th day for per cent emergence.

The plant species occurring in diverse habitats of Pantnagar were collected (Table 1). About 200 to 300g of shade dried and powdered plant parts were extracted with methanol. These extracts were concentrated to dryness at 50°C, trace of solvents from the residues were removed. The resulting black residues were diluted in water containing 0.1 per cent Teepol, to make the desired concentrations of the extracts.

RESULTS AND DISCUSSION

Among all the plant extracts tested, *T. chilonis* recorded highest mean parasitization

Table 2. Effect of plant extracts on the parasitism and emergence of *T. chilonis*

Extract	Conc. of the extract in (gm/ml)	Mean per cent parasitization	Mean per cent emergence
Lantana camara	0.02	10.66^{a}(21.40)	13.33^{a}(18.17)
Lagerstromia speciosa	0.02	43.33^{bcfgh}(50.76)	59.99^{bc}(41.11)
Hibiscus rosasinensis	0.02	29.33^{ab}(38.44)	38.66^{c}(32.72)
Callistemon lanceolatus	0.02	60.66^{c}(53.52)	64.66^{d}(51.24)
Pteridium aquilinum	0.02	78.00^{d}(59.20)	73.77^{e}(62.16)
Nerium indicum	0.02	62.00^{df}(54.33)	65.99^{f}(52.08)
Tagetes patula	0.02	75.33^{dc}(52.33)	62.66^{g}(60.48)
Ricinus communis	0.02	64.00^{dg}(54.73)	66.66^{f}(53.45)
Cassia fistula	0.007	60.66^{dh}(66.42)	83.99^{h}(51.17)
Eucalyptus rostrata	0.02	42.00^{dfhbfh}(67.48)	85.33^{i}(40.04)
Parthenium hysterophorus	0.01	48.00^{bfgh}(53.92)	65.33^{df}(43.88)
CD (P=0.01) SEM ± CV %		28.30 7.10 0.44	1.75 23.57 1.03

* Values in parentheses are angular transformed values.

* Means followed by same letters are significantly not different.

(78%) from cards treated with *P. aquilinum* extract. The highest adult parasitoids emergence (85.33 %) was recorded in case of cards treated with the extract of *E. rostrata,* followed by that of *C. fistula* (83.99%) emergence (Table 2). The results of the present study showed that the biochemical characteristics of plants especially that of leaves greatly influence the parasitoids behaviour, as evidenced by the work of Kashyap *et al.* (1991) who observed that methyl ketone in trichomes interfered with the parasitism by *Trichogramma* spp. The work done by Madhu *et al.* (2000) also showed that plant extracts do affect the parasitization by *T. brasiliense* and *T. japonicum.* Manjunath *et al.* (1989) also reported heavy parasitization of *H. armigera* eggs laid on marigold, predominantly by *T. chilonis,* which is in conformity with the present study. The Gas Chromatogram of marigold recorded the presence of hexadecane, octadecane, and pentadecane in the leaves of marigold (Madhu *et al.,* 2000), which could have contributed to the higher response of *T. chilonis.*

Likewise, few weeds, whose extracts were used in the present investigations, showed lower degree of parasitism hence, their presence in the crop field might prove inimical to the activity of the parasitoid, *T. chilonis.*

Thus, the plant extract showing higher rate of parasitism and emergence, could be very well utilized in enhancing the activity of the naturally occurring as well as released natural enemies by direct application of synthetic kairomones or by using crude extracts from host plants. They could also be applied on hosts in mass production of natural enemies using factitious hosts, which are otherwise not accepted for parasitization. However, detailed information on the hydrocarbon profiles of different plants and their impact on important natural enemies would help us to use compatible species for enhanced natural activity and also to develop crop varieties with favourable hydrocarbon profiles.

ACKNOWLEDGEMENTS

The authors are highly thankful to the G. B. Pant University of Agriculture and Technology, Pantnagar for providing necessary facilities and the Department of Biotechnology, Ministry of Science & Technology, Government of India, New Delhi and Indian Council of Agricultural Research, Krishi Bhawan, New Delhi for providing necessary facilities and financial assistance for the investigations.

REFERENCES

Ashmead, M. D. and Gabriel, B. P. 1998. Effect of semiochemicals on efficiency and parasitism by *Trichogramma evanescens* (Westwood), an egg parasitoid of Asian corn borer. *Asia Life Sciences,* 7: 131-140.

Calumpang, S. M. F., Medina, J. R., Oshawa, K. and Honda, H. 1995. Influence of three-lobed morning glory, *Ipomoea triloba* L. extracts on parasitization and arrestment behaviour of the parasitoid, *Trichogramma evanescens* Westwood. *Philippine Agriculturist,* **78**: 323-330.

Kashyap, R. K., Kennedy, G. G. and Farrar, R. R. Jr. 1991. Behavioural response of *Trichogramma pretiosum* Riley and *Telenomus sphingis* Ashmead to Trichome/methyl ketone mediated resistance in tomato. *Journal Chemical Ecology,* **17**: 543-556.

Madhu, S., Paul, A. V. N. and Singh, B. D. 2000. Synomonal effect of different plant extracts on parasitism by *Trichogramma brasiliensis* Ashmead and *T. japonicum* (Ashmead). *Shashpa,* 7: 35-40.

Majunath, T. M., Bhatnagar, V. S., Pawar, C. S. and Sithanantham, S. 1989. Economic importance of *Heliothis* spp. in India and an assessment of their natural enemies and host plants, pp. 192-228. In: Proceedings of Workshop on Biological Control of *Heliothis*: Increasing the Effectiveness of Natural Enemies. 11-15 Nov., 1985, New Delhi, India.

Moraes, C. M. de., Lewis, W. J. and Tumlinson, J. H. 2000. Examining plant parasitoid interactions in tritrophic systems. *Anais da Sociedade Entomologica do Brasil,* **29**: 189-203.

Nordlund, D. A. Chalfant, R. B. and Lewish, W. J. 1985. Response of *Trichogramma pretiosum* females to extracts of two plants attacked by *Heliothis zea*. *Agricultural Ecosystems and Environment*, **12**: 127-133.

Paul, A. V. N. 1973. Studies on egg parasites *Trichogramma australicum* Girault and *T. japonicum* Ashmead (Trichogrammatidae, Hymenoptera) with special reference to host parasite relationship. M.Sc. thesis, TNAU, Tamil Nadu, India.

Tiwari, S. 2000. Mass production of *Trichogramma chilonis* Ishii and inundative release of bioagents to develop BIPM Module against *Helicoverpa armigera* (Hubner) M.Sc. thesis, G. B. Pant University of Agriculture & Technology, Pantnagar, India.