INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE & TECHNOLOGY
© VISHWASHANTI MULTIPURPOSE SOCIETY (Global Peace Multipurpose Society) R. No. MH-659/13(N)
www.vmsindia.org

Effect of Newer Insecticides on Per Cent Parasitization of Irradiated and Unirradiated Eggs of *Corcyra Cephalonica* by *Trichogramma Chilonis*

Bhabani Mahankuda*, H. R. Sawai, P. A. Wawdhane, A. S. Ingle, K.I. Chaple
Section of Entomology, College of Agriculture, Nagpur(M.S.) – 440 010
Email- bhabanichinu94@gmail.com

Abstract
The present investigation was undertaken on parasitization capacity of *Trichogramma chilonis* on previously treated UV irradiated and unirradiated eggs of *Corcyra cephalonica* under laboratory condition in the Bio-control laboratory, Section of entomology, College of Agriculture, Nagpur (Maharashtra) during 2016. The results of different insecticides on parasitization potential of *T.chilonis* revealed that insecticides *viz.*chlorantaniliprole, diafenthiuron and thiomethoxam were found harmless and could be used safely before release of *T.chilonis* in the field. Whereas,clothianidin, flonicamid and azadirachtin were found slightly harmful towards parasitization capacity of *T.chilonis*. Amongst all the insecticides, Cartap hydrochloride and spiromesifen recorded highset reduction in parasitization and should not be used in field prior to release of the parasitoid.
(Keywords:- *Trichogramma chilonis* , *Corcyra cephalonica,* Thiomethoxam, Cartap hydrochloride, Spiromesifen)

Introduction:

Trichogramma are minute polyphagous wasps that are endoparasitoids of insect eggs. *Trichogramma* is one of around 80 genera from the family Trichogrammatidae, with over 200 species worldwide. *Trichogramma* are unique to the size limit of how small an insect can be, which would be determined by how few neurons they can fit in their central nervous system, yet exhibit a complex behavior to sustain their life. *Trichogramma* are small and very uniform in structure which causes difficulty in identifying the separate species. As females are all relatively similar, taxonomists rely upon examination of males to tell the different species apart using features of their antennae and genitalia. The first description of a *Trichogramma* species was in North America in 1871 by Charles V. Riley. He described the tiny wasps that emerged from eggs of the Viceroy butterfly as *Trichogramma minutum*. Currently, the number of *Trichogramma* species is over 200 but as of 1960 only some 40 species of *Trichogramma* had been described.

Trichogramma spp. is used widely in IPM on many important pests of crops including spiny bollworm, *Earias insulana* Boisd. (Lepidoptera: Phalaenidae), a major serious pest on cotton crop which decreased the cotton yield worldwide. Their effectiveness can be significantly lowered by insecticide applications that interfere with parasitism and parasite population growth. Negative effects of insecticides on populations of the parasitoid *Trichogramma* have been reported, whereas some studies showed that insecticides may increase the performance of natural enemies. Another study showed that the sub-lethal effects of insecticides can severely reduce the performance of biological control agents. Therefore the present study *i.e.* safety of newer insecticides against *Trichogramma spp.* is of much importance to know the safeness of new chemicals against performance of parasitoid *Trichogramma chilonis* for sustainable pest management.

Materials and methods:

The present investigation was carried out in the Biocontrol laboratory, Entomology section, College of Agriculture, Nagpur, Maharashtra during June-Dec of 2016-2017. The rearing of the host insect and parasitoid was done under controlled room temperature and relative humidity conditions ranging between 24 ± 2 ^{0}C and 60 ± 5%. Mass multiplication of *Trichogramma* was done in the laboratory to obtain healthy culture of the test parasitoid.

To obtain the eggs of *Corcyra cephalonica* throughout the experimental period, rearing of rice moth was done in the laboratory. The culture was maintained on Sorghum based artificial diet with following ingredients for one tray (15x30 cm). Ultraviolet irradiated and unirradiated eggs of *Corcyra cephalonica* were used for conducting the experiment. The treatments were given by following the method suggested by Santharam and Kumaraswami (1985).

To ascertain the effect of newer insecticides on percent parasitization of irradiated and unirradiated eggs of Corcyra *cephalonica* by *Trichogramma chilonis*. UV irradiated and unirradiated fresh eggs of *Corcyra cephalonica* were glued to the egg cards separately (@50eggs per card strip). The cards were cut into small strips of 5.0x 2.0cm and dipped in test insecticides for 5 seconds. For control, water was

used instead of insecticides. The treated egg cards were shade dried. The card strips containing UV exposed and unexposed eggs were kept separately in glass vials of about 15.0 x 2.5cm size @ one card strip per vial for each treatment and replication. Each treatment was then labelled properly with details such as name of the treatment, concentration of insecticides, date and time of application etc. The treated egg-cards were exposed to adults of *Trichogramma chilonis* (@5:1 host: parasitoid ratio) for 24 hrs for parasitization. Each treatment was replicated thrice and experiment was conducted in laboratory condition. The egg-cards were examined for parasitization after 5th day of parasitoid release and the number of parasitized eggs were counted under stereozoom microscope and per cent parasitization were worked by using following formula.

$$\text{Per cent parasitization} = \frac{\text{Number of eggs parasitised}}{\text{Total Number of eggs exposed}} \times 100$$

The per cent reduction in parasitism (RP) was determined for each insecticide by the equation,

RP (%) = (1-f/t) x100

Where,

f = average number of parasitized eggs in the insecticide treatment

t = average number of parasitized eggs in the control treatment. (Hassan et al. 2000)

On the bases of per cent mortality/per cent reduction in parasitization/adult emergence, insecticides were classified in different categories as suggested by IOBC/WPRS (Sterk *et al.*, 1999).

Toxicity Class	**Categorization**	**% mortality/ reduction either in parasitism or emergence**
Class 1	Harmless	<30
Class 2	Slightly harmful	30-79
Class 3	Harmful	80-99
Class 4	Harmful	>99

The data so obtained on percent parasitization, percent related to various parameters under study were subjected to statistical analysis after appropriate transformation for interpretation of the result.

Result and discussion:

A) Effect of newer insecticides on per cent parasitization of UV irradiated eggs of *Corcyra cephalonica* by *Trichogramma chilonis.*

The data contained in table 1 demonstrate that average no. of UV exposed eggs parasitized by *T.chilonis* under different treatment differed significantly in comparision to control (92.00 per cent). Maximum average no. of eggs parasitized were observed under thiamethoxam (84.66 percent) followed by diafenthiuron>chlorantraniliprole> flonicamid>azadirachtin>clothianidin>Spiromesifen>cartap hydrochloride with 81.33, 67.33, 62.00, 59.33, 52.00, 14.66, and 8.00 per cent respectively. The average no of eggs parasitized under thiamethoxam was statistically at par with diafenthiuron but significantly more than chlorantraniliprole, flonicamd, azadirachtin.

The result envisages that the insecticides thiamethoxam and diafenthiuron equally favoured greater per cent of egg parasitization followed by chlorantraniliprole, flonicamid, azadirachtin and clothianidin. However, spiromesifen and cartap hydrochloride greatly affected the paratisation by *T.chilonis*. The findings of present study are in accordance with the findings of Preetha et al.(2010) with 88.59 per cent parasitization in thiamethoxam 25 WG @25 g a.s/ ha.Ranjith et al. (2016) observed different rates of parasitization in diafenthiuron 50 WP NS (Natural source) and ES (Existing Source) *viz.* 82.06 per cent, 73.31, 70.12, 62.43, 66.30 per cent @ 0.8, 1.2, 1.6, 3.2, 1.6 g/l respectively. Khan et al.(2015) recorded lowest parasitism (2.4 per cent) in spiromesifen whereas no significant reduction in parasitization was recorded in chlorantraniliprole.Takada et al.(2001) observed cartap hydrochloride as highly toxic to all stages of the parasitoid. Kumar et al. (2016) reported parasitization of 0 to 8.67 per cent when treated with cartap hydrochloride (0.1%) along with Ha NPV (0.2%). Sattar et al. (2011) classified azadirachtin as slightly harmful towards parasitization (64.4%) by *T.chilonis*. Lyson et al.

(2003) also observed 50-60% parasitization in azadirachtin treated eggs of *E.kuhniella*. Neemazal® 3,000 ppm solution had relatively low residual toxicity to *T. cacoeciae* adults and was slightly harmful to the capacity of parasitism (Saber et al., 2005).

As per the IOBC classification, chlorantraniliprole (0.005%), diafenthiuron (0.06%) and thiamethoxam (0.04%) were categorized as "harmless" as they did not show any significant effects on per cent parasitization whereas clothianidin (0.02%), flonicamid (0.015%) andazadirachtin 1500ppm (0.05%) are categorized as "slightly harmful" towards parasitization by *T.chilonis*. Among all the insecticide cartap hydrochloride (0.1%) and spiromesifen (0.03%) showed maximum reduction in parsitisation by *T.chilonis* was categorized under "moderately harmful".

B) Effect of different insecticides on per cent parasitization of UV unirradiated eggs of *Corcyra cephalonica* by *Trichogramma chilonis*.

The data presented in table 1 revealed that significantly highest egg parasitization (94.00 per cent) was recorded in control (water spray) followed by thiamethoxam and diafenthiuron with 90.00 and 88.66 per cent respectively, which were found statistically at par. Among the remaining insecticides, chlorantraniliprole recorded 73.33 per cent parasitization followed by flonicamid, azadirachtin and clothianidin with 64.66, 63.33, 62.00 per cent parasitisaton, respectively.However spiromesifen and cartap hydrochloride supported minimum parasitization of 19.33 and 10.00 per cent, respectively.

The results revealed that the chlorantraniliprole (0.005%), diafenthiuron (0.06%) and thiamethoxam (0.04%) did not show any significant effects on per cent parasitization and categorized as "harmless" whereas clothianidin (0.02%), flonicamid (0.015%) and azadirachtin 1500ppm (0.05%) were categorized as "slightly harmful" towards parasitization by *T.chilonis*. Amongst all the insecticide cartap hydrochloride (0.1%) and spiromesifen (0.03%) showed maximum reduction in parsitisation by *T.chilonis* categorized as "moderately harmful".

The order of selectivity of insecticide towards parasitism in both UV irradiated and UV unirradiated eggs were almost same. The rate of parasitism was observed relatively higher in UV unirradiated as compared to the irradiated eggs.

Conclusion:

As per the results obtained from the present investigation, we conclude that chlorantraniliprole, diafenthiuron and thiomethoxam were found safe towards parasitization of *T.chilonis* on previously treated host eggs of *C.cephalonica*. Whereas, clothianidin, flonicamid and azadiracthin were found slightly harmful towards parasitization. In azadiracthin it may be due to its antifeedancy and oviposition detterent nature. Amongst all the insecticide cartap hydrochloride and spiromesifen caused highset reduction in per cent parasitization of *T.chilonis* and categorized as moderately harmful.

Considering ecofreindliness, it can be concluded from the present study that insecticides chlorantraniliprole, diafenthiuron and thiomethoxam were found most safe towards parasitization capacity of the parasitoid on previously treated host eggs and can be taken successfully during the IPM programmes.

References:

Hassan, S.A., N.Halsall, A.P. Gray, C. Kuehner, M.Moll, And F.M. Bakker, (2000). "A laboratory method to evaluate the side effects of plant protection products on *Trichogramma cacoeciae* Marchal (Hym.:Trichogrammatidae). In: Guidelines to evaluate side effects of plant protection products to non-target arthropods",(eds. M.P. Candolfi, S. Blümel, R. Forster, F.M. Bakker, C. Grimm, S.A. Hassan). IOBC/WPRS, Reinheim, Germany.,(107-119).

Khan, M.A., H.Khan, A. Farid and A. Ali,(2015). "Evaluation of toxicity of some novel pesticides to parasitism by *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae)",. J. Agric. Res., 53(1).

Kumar, Rakesh., Neerja Agrawal, Rohit Rana, Sonam Singh Chandel and Ashish Dwivedi, (2016). "Evaluation of Toxicity of Botanical and Microbial Insecticides to Egg Parasitoid *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae)",. J. Of PURE And Appl. Microbio., 10(1): (617-623).

Lyson, B., B.Helson, P. Bourchier, G.C. Jones and J.W. McFarlane, (2003). "Effects of azadirachtin-based insecticides on the egg parasitoid *Trichogramma minutum* (Hymenoptera: Trichogrammatidae)", The Canadian Entomologist.,15: (685-695).

Preetha, G., T. Manoharan, J. Stanley, S.Kutalam, (2010) "Impact of chloronicotinyl insecticide, imidacloprid on egg, egg-larval and larval parasitoid under laboratory Conditions", J. Pl.pro.res., 4(50).

Ranjith, M., S.V. Krishnamoorthy, M.Gajalakshmi, (2016)"Safety of newer molecule diafenthiruon 50 wp (ns) to hymenopteran parasitoids under laboratory conditions",. I.J.S.N., 7 (1): (159-164).

Saber, M., M.J. Hejazi, K. Kamali, and Moharramipour,(2005) "Lethal and sublethal effects of fenitrothion and deltamethrin residues on the egg parasitoid *Trissolcus grandis* (Hymenoptera: Scelionidae)",. J.Econ.Entomol.,98(1): (35- 40).

Santaram, G. and Kumarswami, (1985). "Effect of some insecticides on the emergence of parasitoid, *T.chilonis*ishii". Pesti. Res. J.,11(1): (99-101).

Sattar, S., R.A.S. Farmanullah, M. Arif, H. Sattar, and J.I. Qazi, (2011). "Toxicity of some new insecticides against *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae) under laboratory and extended laboratory conditions",. Pakistan J. Zool., 43(6): (1117-1125).

Sterk, G., S.A. Hassan, M.F. Baillod, F. Bakker, S.Bigler, H.Blumel, E.Bogenschutz, B.Boller, J. Bromand, J. Brun, J.N.M. Calis, C. Coremans-Pelseneer, C. Duso, A. Garrido, A. Grove, U. Heimbach,U. Hokkanen, J.Jacas, G. Lewis, L. Moreth,L. Polgar, L.Roversti, L. Samsoe-Petersen, B.Sauphanor, L.Schaub, A.Staubli, J.J.Tuset, A. Vainio, M. Van de Veire, Viggiani,E. Vinuela and H. Vogt, (1999). Results of the seventh joint pesticide testing programme carried out by the IOBC/ WPRS-Working Group 'Pesticides and Beneficial Organisms'. BioControl, 44: (99–117).

Takada, Y., S.Kawamura, and T. Tanaka, (2001). "Effects of Various Insecticides on the Development of the Egg Parasitoid *Trichogramma dendrolimi* (Hymenoptera: Trichogrammatidae)",. J. Econ. Entomol.,94(6): (1340-1343).

Table 1: Effect of newer insecticides on per cent parasitization of UV irradiated and unirradiated *Corcyra cephalonica* eggs by *Trichogramma chilonis*.

Treatment No.	Treatment Name	concentration	UV Irradiated eggs		UV Unirradiated eggs		Score
			per cent parasitization	Per cent reduction in parasitization over control	per cent parasitization	Per cent reduction in parasitization over control	
T_1	Chlorantraniliprole18.5 SC	0.005%	67.33 (55.12)	26.81 (31.18)	73.33 (58.89)	21.98 (27.90)	Harmless
T_2	Diafenthiuron 50 WP	0.06%	81.33 (64.38)	11.59 (19.82)	88.66 (70.27)	5.68 (13.94)	Harmless
T_3	Cartap hydrochloride 50SP	0.1%	8.00 (16.43)	91.30 (72.85)	10.00 (18.43)	89.36 (70.91)	Moderately harmful
T_4	Spiromesifen 22.9 SC	0.03%	14.66 (22.46)	84.06 (66.42)	19.33 (26.06)	79.43 (63.01)	Moderately harmful
T_5	Thiamethoxam 25 WG	0.005%	84.66 (66.89)	7.97 (16.32)	90.00 (71.57)	4.25 (11.83)	Harmless
T_6	Clothiandin 50 WDG	0.002%	52.00 (46.14)	43.47 (41.21)	62.00 (51.94)	34.04 (35.67)	Slightly harmful
T_7	Flonicamid 50 WG	0.015%	62.00 (51.94)	32.60 (34.82)	64.66 (53.49)	31.21 (33.96)	Slightly harmful
T_8	Azadirachtin (1500 ppm)	0.005 %	59.33 (50.36)	35.51 (36.57)	63.33 (52.71)	32.62 (34.82)	Slightly harmful
T_9	Control (Water spray)		92.0 (73.57)		94.00 (75.82)		
'F test'				Sig		Sig.	
S.E.(m)				1.83		1.98	
C.D at 5%				5.32		5.77