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# Relative toxicity of abamectin 1.9 EC to egg parasitoid, *Trichogramma chilonis* Ishii and egg larval parasitoid, *Chelonus blackburni* (Cam.)

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Laboratory experiments were conducted to assess the safety of Abamectin 1.9 EC along with spinosad, cypermethrin and endosulfan to the egg parasitoid, *Trichograma chilonis* Ishii and the egg larval parasitoid, *Chelonus blackburni* (Cam.). The results revealed that abamectin 1.9 EC at all the doses tested had lesser adverse effect on the emergence of the *Trichogramma* adults compared to cypermethrin and endosulfan and also to its parasitisation potential. Similarly, abamectin at all concentrations caused lower mortality of *C. blackburni* compared to cypermethrin and endosulfan. The highest dose of abamectin tested recorded only 6.7 per cent adult mortality at 12 h after treatment (HAT). After 24 h of exposure, the mortality rate progressively increased in abamectin treatments. But endosulfan and cypermethrin at 420g and 70g a.i $ha^{-1}$ registered the highest mortality of 53.3 and 76.7 per cent, respectively even at 6 HAT. The same trend was also noticed in adult emergence.

Key words: Abamectin, *Chelonus blackburni,* Insecticides, *Trichogramma chilonis.*

## INTRODUCTION

*Trichogramma chilonis* Ishii is a potential egg parasitoid of major lepidopteran pests and is being widely used as a component of BIPM especially in cotton eco system. It can be mass cultured in the laboratory and used for both inoculative and inundative releases (Gahukar, 1997). Like wise, *Chelonus blackburni* (Cam.) is an important egg larval parasitoid of cotton bollworms. Many insecticides used to control various insect pests in the field, are found to be highly toxic to *T. chilonis* (Ciociola *et al.*, 1999; Tiwari and Khan, 2002) and to *C. blackburni* (Rechav, 1974; Manisegarane and Kumarasamy, 1988). So safety evaluation of a chemical to important natural enemies is as important as that of toxicity evaluation before wide spread usage of that chemical. Abamectin is a broad spectrum insecticide derived from soil actinomycetes, *Streptomyces avermitilis* Burg., used widely for the management of almost all the crop pests (Lasota and Dybas,1991).

## MATERIALS AND METHODS

Experiments were conducted to test the toxicity of abamectin on parasitoids in Tamil Nadu Agricultural University during 2005. The experiment is done in completely randomized design with ten treatments and replicated four times. The treatments were abamectin 1.9 EC at 9, 11, 13, 15, 18.5 and 22.5g a.i $ha^{-1}$, spinosad 45 SC at 75g a.i $ha^{-1}$, cypermethrin 10 EC at 70g a.i $ha^{-1}$, endosulfan 35 EC at 420g a.i $ha^{-1}$ and untreated check. The different treatment doses were obtained by dissolving 1.0, 1.2, 1.4, 1.6, 2.0 and 2.4ml of abamectin 1.9 EC and 0.3ml of spinosad 45 SC, 1.5 ml of cypermethrin 10 EC and 2.4 ml of endosulfan 35 EC in one litre of distilled water and used for the safety tests. The mortality were recorded and corrected for the mortality in the control treatment wherever necessary and analysed in CRD in Irristat for ANOVA.

*Trichogramma chilonis:*

The egg parasitoid, *T. chilonis* was mass cultured in the Biocontrol Laboratory on the eggs of rice moth, *Corcyra cephalonica* (Stainton) as per the method described by Prabhu (1991). Fresh *C. cephalonica* eggs collected in early morning were sterilized under UV radiation of 15 W capacity for 20 min at a distance of 15 cm to avoid the emergence of *C. cephalonica* larvae. These eggs were pasted on paper cards of 20 x 30 cm size having thirty, 7 x 2 cm rectangles. These egg cards were placed in polythene bags along with nucleus card at 6:1 ratio for parasitization.

The parasitized egg cards were cut into one $cm^2$ bits and three days old hundred per cent parasitized eggs were sprayed with insecticides at different concentrations mentioned above, using an atomizer. For untreated check, only distilled water was sprayed. The treated egg cards were shade dried for 10 min and then kept in a test tube of 10 x 1.5 cm size. The number of parasitoids that

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emerged from each treatment was recorded after 48 h of treatment and per cent emergence was worked out. To find out the effect of insecticides on parasitization, fresh eggs were provided to the parasitoids at 6:1 ratio and the numbers of parasitized eggs were recorded after 48 h of treatment and the per cent parasitization was worked out.

*Chelonus blackburni*:

The bioassay method described by McCutchen and Plapp (1988) for *C. carnea* was adopted with modifications. Different concentrations of insecticide solution were prepared using water and acetone in the ratio of 20:80. Glass scintillation vials of 20 ml capacity evenly coated with one ml of insecticide formulations dissolved in acetone - water and dried by rotating the tube horizontally on a table with palm. Three day old adults of *C. blackburni* were released into the vials @10 per vial, covered with muslin and secured with a rubber band. After 24 h exposure, honey solution was provided as feed to the wasps. Mortality observations were made at 6, 12, 24 and 48 h after treatment and per cent mortality of the adults was worked out.

To find out the effect of insecticides on parasitization also, the bioassay method described by McCutchen and Plapp (1988) for *C. carnea* was adopted with modifications. Different concentrations of insecticide solution were prepared using water and acetone in the ratio of 20:80. Test tubes of 2.0 x 15 cm size were evenly coated with 1 ml of insecticide formulations dissolved in acetone - water and dried by rotating the tube horizontally on a table with palm. One day old *C. cephalonica* eggs (100) were placed inside the test tubes in the ratio of 1:10 (Parasitoid: Host). Three day old adults of *C. blackburni* were released into the vials at 10 per vial and covered with muslin and honey solution was given as feed to the wasps. After 24 h, the egg cards were transferred to plastic container containing broken cumbu grains. The number of parasitoids emerged from each treatment was recorded and per cent emergence worked out.

## RESULTS AND DISCUSSION

*Trichogramma chilonis:*

The results revealed that abamectin 1.9 EC at all the doses tested had lesser effect on the emergence of the adults (71.4 to 85.2 %) compared to cypermethrin (58.6%) and endosulfan (64.4%). Like wise, abamectin did not significantly affect the parasitization by *T. chilonis*. The highest per cent parasitization was recorded in untreated check (95.8 %) followed by abamectin at 9g a.i ha$^{-1}$ (81.9 %) whereas, abamectin at higher dose 22.5g a.i ha$^{-1}$ (68.5%) reduced the parasitization to some extent.

The insecticides are classified as harmless (<50% mortality), slightly harmful (50-79% mortality), moderately harmful (80 - 89% mortality) and harmful (>90% mortality) (Nasreen *et al.*, 2000). In the present study, the mortality of the egg parasitoid ranged from 14.8 to 28.6 per cent for abamectin at different doses tested, and as such falls under the category, harmless (<50% mortality). This is in line with the finding of Nian *et al.* (1997) who reported that even the most toxic $B_1$ component of abamectin recorded only 21 per cent mortality. According to Aston *et al*. (2001) *Trichogramma* when exposed to 9 h lapsed residues showed no effect on the population, but showed a mortality of 18 per cent on direct application.

Spinosad recorded 80.2 per cent adult emergence and 77.3 per cent parasitisation and thus harmless. The adult emergence (64.4%) and parasitisation (56.5 %) were moderately affected by endosulfan. Cypermethrin allowed only 58.6 per cent adult emergence and 45.4 per cent parasitisation which come under slightly harmful category. The present results on spinosad were in consonance with the findings of Elzen *et al*. (1998) who reported that spinosad at 75 g a.i.ha$^{-1}$ was safer to egg parasitoid *T. chilonis* than other insecticides like endosulfan. The mortalities caused to *T. chilonis* by some of the new chemicals like indoxacarb (80 g a.i. ha$^{-1}$), betacyfluthrin (18.75 g a.i. ha$^{-1}$), lambda cyhalothrin (25 g a.i. ha$^{-1}$) and spinosad (75 g a.i. ha$^{-1}$) were 87.2, 82.4, 81.4 and 50.0 per cent, respectively (Dhawan, 2000). When compared to these values, abamectin is far safer than the conventional insecticides.

*Chelonus blackburni*:

The results of the dry film bioassay method conducted to test the contact toxicity of abamectin to *Chelonus* adults revealed that abamectin at all concentrations caused lower mortality compared to cypermethrin and endosulfan. The highest dose of abamectin 1.9 EC recorded the least per cent adult mortality (6.7 %) at 6 h after treatment (HAT). After 12 h of exposure, the mortality rate progressively increased in abamectin treatments. But, endosulfan and cypermethrin registered the highest mortality of 53.3 and 76.7 per cent, respectively at 6 HAT itself, and at 24 HAT, endosulfan and cypermethrin recorded cent per cent mortality, whereas abamectin even at the highest concentration (22.5g a.i ha$^{-1}$) recorded 40.0 per cent mortality at 48 HAT which was at par with abamectin (18.5g a.i ha$^{-1}$) and spinosad (75g a.i ha$^{-1}$), respectively (Table 1).

In the present study, the contact toxicity of abamectin

Table 1 : Relative toxicity of abamectin 1.9 EC against *Trichogramma chilonis* and *Chelonus Blackburni*.

(Mean of four observations)

| Treatments | *T.chilonis* | | *C. blackburni* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Per cent mortality (Hours after treatment) | | | | | | |
| | % adult emergence | % parasitization | 6 | 12 | 24 | 48 | Corrected 24 | Corrected 48 | % adult emergence |
| Abamectin 1.9 EC @ 9g a.i ha$^{-1}$ | 85.2$^{b}$ (67.40) | 81.9$^{b}$ (64.83) | 0.0 (0.99)$^{a}$ | 0.0 (0.99)$^{a}$ | 10.0 (18.40)$^{b}$ | 23.3 (28.86)$^{b}$ | 14.8 | 6.9 | 90.2$^{b}$ (71.87) |
| Abamectin 1.9 EC @ 11g a.i ha$^{-1}$ | 83.8$^{bc}$ (66.29) | 81.3$^{bc}$ (64.39) | 0.0 (0.99)$^{a}$ | 0.0 (0.99)$^{a}$ | 13.3 (21.40)$^{c}$ | 30.0 (33.20)$^{c}$ | 22.2 | 10.3 | 85.4$^{c}$ (67.55) |
| Abamectin 1.9 EC @ 13g a.i ha$^{-1}$ | 81.6$^{cd}$ (64.62) | 78.5$^{cd}$ (62.38) | 0.0 (0.99)$^{a}$ | 0.0 (0.99)$^{a}$ | 13.3 (21.40)$^{c}$ | 30.0 (33.20)$^{c}$ | 22.2 | 10.3 | 82.9$^{c}$ (65.63) |
| Abamectin 1.9 EC @ 15g a.i ha$^{-1}$ | 78.5$^{e}$ (62.38) | 74.3$^{ef}$ (59.55) | 0.0 (0.99)$^{a}$ | 3.3 (10.51)$^{b}$ | 16.7 (24.07)$^{d}$ | 30.0 (33.20)$^{c}$ | 22.2 | 13.8 | 78.1$^{d}$ (62.08) |
| Abamectin 1.9 EC @ 18.5g a.i ha$^{-1}$ | 75.2$^{f}$ (60.14) | 71.7$^{fg}$ (57.88) | 0.0 (0.99)$^{a}$ | 3.3 (10.51)$^{b}$ | 20.0 (26.53)$^{e}$ | 36.7 (37.25)$^{d}$ | 29.6 | 17.2 | 75.6$^{d}$ (60.42) |
| Abamectin 1.9 EC @ 22.5 g a.i ha$^{-1}$ | 71.4$^{g}$ (57.68) | 68.5$^{g}$ (55.86) | 0.0 (0.99)$^{a}$ | 6.7 (14.96)$^{c}$ | 26.7 (31.08)$^{g}$ | 40.0 (39.22)$^{d}$ | 33.3 | 24.1 | 68.3$^{e}$ (55.74) |
| Spinosad 45 SC @ 75g a.i ha$^{-1}$ | 80.2$^{de}$ (63.59) | 77.3$^{de}$ (61.56) | 0.0 (0.99)$^{a}$ | 6.7 (14.96)$^{c}$ | 23.3 (28.86)$^{f}$ | 36.7 (37.26)$^{d}$ | 29.6 | 20.7 | 75.6$^{d}$ (60.42) |
| Cypermethrin 10 EC @ 70g a.i ha$^{-1}$ | 58.6$^{i}$ (49.95) | 45.4$^{i}$ (42.36) | 76.7 (61.14)$^{c}$ | 90.0 (71.68)$^{e}$ | 100.0 (89.43)$^{h}$ | 100.0 (89.43)$^{e}$ | 100.0 | 100.0 | 31.7$^{g}$ (34.26) |
| Endosulfan 35 EC @ 420g a.i ha$^{-1}$ | 64.4$^{h}$ (53.37) | 56.5$^{h}$ (48.74) | 53.3 (46.91)$^{b}$ | 76.7 (61.12)$^{d}$ | 100.0 (89.43)$^{h}$ | 100.0 (89.43)$^{e}$ | 100.0 | 100.0 | 48.8$^{f}$ (44.30) |
| Untreated check | 94.9$^{a}$ (77.05) | 95.8$^{a}$ (78.33) | 0.0 (0.99)$^{a}$ | 0.0 (0.99)$^{a}$ | 3.3 (10.51)$^{a}$ | 10.0 (18.43)$^{a}$ | - | - | 100.0$^{a}$ (90.00) |

In a column means followed by a common letter are not significantly different at P = 0.05 by DMRT
Figures in parentheses are arcsine $\sqrt{P}$ where P is per cent mortality

at various doses to *C. blackburni* revealed that abamectin was harmless to the adults and only recorded 6.7 -40.0 per cent mortality while cypermethrin and endosulfan recorded 53.3 - 100 per cent mortality of *C. blackburni.* Spinosad recorded lower mortality of adults and higher parasitization than others and is also classified as harmless. Cypermethrin recorded the adult emergence of only 31.7 per cent while endosulfan recorded 48.8 per cent. However**,** Manisegarane and Kumarasami (1988) reported that endosulfan at 700 g a.i.ha$^{-1}$ was relatively safer to *C. blackburni*. The results of the effect of abamectin 1.9 EC on *C. blackburni* adult emergence are presented in Table 1. The adult emergence was cent per cent in untreated check, where as it was 90.2 to 68.3 per cent, when abamectin was applied at 9 to 22.5g a.i ha$^{-1}$. Cypermethrin recorded the lowest adult emergence of 31.7 per cent but spinosad was at par with abamectin at 13 and 15g a.i ha$^{-1}$. The abamectin is found to be a safer chemical when compared to endosulfan and cypermethrin to *T. chilonis* and *C. blackburni.*

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