Universal Impact Factor0.9285:2012; 1.2210:2013

Index Copernicus
ICV 2011: 5.09
ICV 2012: 6.42
ICV 2013: 15.8

NAAS Rating
2012 : 1.3;
2013-2014:2.69

Received on:
9th July 2015

Revised on:
14th October 2015

Accepted on:
17th October 2015

Published on:
1st December 2015

Volume No.
Online & Print
70 (2015)

Page No.
37 to 42

IN VITRO SAFETY OF EMAMECTIN BENZOATE 5 SG TO *CHELONUS BLACKBURNI* CAMERON

P.KARTHIK[1], S. KUTTALAM[2] ,K.GUNASEKARAN[3] AND P.THANGACHAMY[4]

[1]RESEARCH ASSOCIATE, [2]PROFESSOR AND HEAD, DEPARTMENT OF AGRL. ENTOMOLOGY ,[4]SENIOR RESEARCH FELLOW AND [3]PROFESSOR AND HEAD, DEPARTMENT OF NANOTECHNOLOGY, TNAU,CBE.

Corresponding author's e-mail: karthikento@gmail.com

ABSTRACT:

Laboratory experiments were conducted at Insectary, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore during 2012-2013 to study the safety of emamectin benzoate 5 SG to the egg-larval parasitoid, *Chelonus blackburni* Cameron. The toxicity studies of emamectin benzoate to the adults of *C.blackburni* revealed that adult mortality increased gradually at different interval in all the insecticidal treatments and all the insecticides were toxic to *C. blackburni*. The least mortality of *C. blackburni* adults was observed in the lower dose of emamectin benzoate 5 SG (7 g a.i.ha^{-1}) which showed 13.33,23.33 and 33.33 per cent mortality at 6,12 and 24 HAT respectively, while the recommended dose of emamectin benzoate 5 SG (11 g a.i.ha^{-1}), emamectin benzoate 5 SG Proclaim® (11 g a.i.ha^{-1}), and emamectin benzoate (9 g a.i.ha^{-1}) recorded the per cent adult mortality of 23.33, 33.33 and 43.33 at 6 HAT respectively, 26.67, 36.67 and 46.67 at 12 HAT respectively and 16.33, 26.67 and 40.00 at 24 HAT, respectively. Among the emamectin benzoate 5 SG treatments, the highest mortality was accounted by emamectin benzoate 5 SG at 15 g a.i. ha^{-1} to the extent of 36.33, 40.00 and 50.00 per cent at 6, 12 and 24 HAT, respectively. While the standard check, spinosad at 75 g a.i.ha^{-1} registered the mortality percentage of 36.67, 46.67 and 56.67 at 6, 12 and 24 HAT, respectively.

KEY WORDS: *Emamectin benzoate, Safety, Chelonus Blackburni, Dry film method.*

INTRODUCTION:

While the use of insecticides remains an important component of integrated pest management (IPM), biological suppression of insect pests is also considered as an equally important tool. Hence, the protection and preservation of natural enemies of the pests are essential. Among the various entomophages, *Chelonus blackburni* are very important in egg larval parasitoid. The indiscriminate use of insecticides has affected the population of biocontrol agents, as all the conventional recommended insecticides are highly toxic to predators and parasitoids (Dhawan *et al.*, 1992 and 1994; Singh, 1994). The population of predators has declined by 68.4 per cent during the last two decades and many parasitoids have been eliminated (Dhawan and Simwat, 1996).

Aston *et al.* (2001) conducted field and laboratory studies with emamectin on a wide range of beneficial species relevant to both cotton and horticultural crops. Over all selectivity of emamectin makes it a useful tool in IPM systems.

Hazard ratings are based on disruption to population up to 24 h after application (Aston *et al.*, 2001).

Very low disruption	-	< 10% population reduction
Low disruption	-	10-20% population reduction
Moderate disruption	-	20-40% population reduction
High to very high disruption	-	> 40% reduction

Emamectin benzoate 5 SG with novel mode of action that is effective even at lower doses and safer to the natural enemies. Hence, the present study was undertaken to know the toxicity level of insecticides on *Chelonus blackburni* reviewed hereunder

MATERIALS AND METHODS:

Laboratory experiments were carried out at Insectary, Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore during 2012 - 2013 to study the toxicity of emamectin benzoate 5 SG to egg larval parasitoid¸ *Chelonus blackburni* Ishii. Safety of emamectin benzoate 5 SG (new formulation) which was compared with an available formulation of emamectin benzoate 5 SG (Proclaim®) which is a registered product of Krishi Rasayan Pvt. Ltd and other standard insecticide (spinosad). The adults of *C. blackburni* were obtained from Bio Control Laboratory, Department of Agricultural Entomology, T.N.A.U.

Dry film method

The bioassay method described by McCutchen and Plapp (1988) for *C. carnea* was adopted with modifications. Glass scintillation vials of 20 ml capacity and 1mm thickness were evenly coated with 0.5 ml of acetone solution with insecticidal solutions were prepared by dissolving 0.14, 0.18, 0.22 and 0.6 g of emamectin benzoate 5 SG, 0.22 g of emamectin Benzoate (Proclaim® at the recommended dose of 11 g a.i. ha^{-1}), and 0.16 ml of spinosad 45 SC, each in one litre of water which were equivalent to the field doses and dried by rolling for few seconds. Three-day-old adults of *Chilonus blackburni* Cameron were released into the vials at 10 per vial and covered with muslin cloth and secured with a rubber band. After 1h of exposure, they were released in test tubes (15 cm ht x 2.5 cm dia.) and honey solution (20%) was given as feed to the adults. Mortality observations were taken at 6, 12 and 24 h after treatment. For untreated check, only acetone was used. Per cent mortality of the adults was worked out.

$$\text{Per cent mortality} = \frac{\text{No. of adults dead}}{\text{Total number of wasps released}} \text{ x 100}$$

Statistical analysis

The data on percentage were transformed in to arcsine values and the population number into $\sqrt{X+0.5}$ before statistical analysis. The data obtained from laboratory experiments was analysed in completely randomized design. The mean values were separated using Duncan's Multiple Range Test (DMRT). The corrected per cent mortality was worked out using the formula (Abbott, 1925).

Where,

$$\text{Corrected per cent mortality} = \frac{P0 - Pc}{100 - Pc} \text{ X } 100$$

P0 - Observed mortality in treatment

Pc - Observed mortality in untreated check

RESULTS AND DISCUSSION:

Emamectin benzoate 5 SG @ 11 and 15 g a.i. ha^{-1} recorded 33.30 and 40.00 per cent mortality of *C. blackburni* respectively at 12 hours after treatment (HAT) and had no adverse effect on the mortality of adults (Fig. 1). However, it was relatively safe compared to standard check spinosad (46.67 %) and among the insecticidal treatments, the lowest per cent adult mortality was recorded by emamectin benzoate 5 SG at 7 g a.i. ha^{-1} at 6 HAT (13.33 %) , whereas spinosad 45 SC at 75 g a.i. ha^{-1} recorded the highest adult mortality (56.67 %) at 24HAT. This was in agreement with Govindan (2009) who recorded that lower

dose of emamectin benzoate 5 SG at 7, 9 and 11 g a.i. ha^{-1} caused 13.33, 13.33 and 14.33 per cent mortality respectively to *C. blackburni* at 24 HAT. All the emamectin benzoate 5 SG doses were less toxic to *C. blackburni* adults compared to standard insecticides.

While the recommended dose of emamectin benzoate 5 SG (11 g a.i.ha^{-1}), emamectin benzoate 5 SG Proclaim® (11 g a.i.ha^{-1}) and emamectin benzoate (9 g a.i.ha^{-1}) recorded the per cent adult mortality of 23.33, 33.33 and 43.33 respectively at 6 HAT, 26.67, 36.67 and 46.67 respectively at 12 HAT and 16.33, 26.67 and 40.00 respectively at 24 HAT (Table 1). Among the emamectin benzoate 5 SG treatments, the highest mortality was accounted by emamectin benzoate 5 SG at 15 g a.i. ha^{-1} to the extent of 36.33, 40.00 and 50.00 per cent at 6, 12 and 24 HAT, respectively. While the check, spinosad at 75 g a.i.ha^{-1} registered the mortality percentage of 36.67, 46.67 and 56.67 at 6, 12 and 24 HAT, respectively. Aiswariya (2010) revealed that emamectin benzoate 5 WSG at the recommended dose of 9 g a.i. ha^{-1} caused 33.33 per cent mortality at 48 h after treatment. All the emamectin benzoate doses were less toxic to *C. blackburni* adults compared to standard insecticides. All the emamectin benzoate treatment were observed no adverse effect on the mortality of adults. Hence, it was found to be harmless to *C. blackburni* (<50% mortality). Thilagam (2006) stated that flubendiamide at 60 g a.i. ha^{-1} was safe to C. *blackburni*. Suganyakanna (2006) reported that acetamiprid 20 SP caused significant adverse effect on the mortality of *C. blackburni* adults. In contrast, imidacloprid was found to be slightly toxic to *C. blackburni* (Preetha, 2007).

Selection of a suitable insecticide in an IPM program not only depends on its efficacy against the target pest but also on its toxicity to beneficial insects and its withering and persistence. Emamectin benzoate was not toxic to the egg parasitoid, *C. blackburni* at the recommended dose, thus can be used in IPM programs.

ACKNOWLEDGEMENT:

The authors are grateful to M/s Krishi Rasayan Exports Ltd for providing financial support and the chemicals used for this study.

REFERENCES:

Abbott, W.S. 1925. A method of computing the effectiveness of an insecticide. *J. Econ. Entomol.*, **18**: 265-267.

Aiswariya, K.K. 2010. *Bio efficacy, phytotoxicity and residues of emamectin benzoate 5 WSG against bollworms of cotton and fruit borers of okra.* Ph.D. (Ag) thesis, Tamil Nadu Agric. Univ., Coimbatore-3, India. 224p.

Aston, S., L. Streit, K. McKee and C. Clarke. 2001. Field selectivity makes emamectin suitable for IPM. **In:** *Proc.10th Australian Agronomy Conf.*, Hobart. pp 41-47 http://www.regional.org.all/au/asa/2001/p/12/aston.htm.

Dhawan, A.K. and G.S. Simwat. 1996. Status of natural enemies complex in cotton agro ecosystem and its impact on present pest scenario in Punjab. **In:** *First Indian Ecological Congress*, National Institute of Ecology, New Delhi. December, pp 23-31.

Dhawan, A.K., G.S. Simwat and D.N. Makwana. 1992. Impact of bollworm management with different insecticides on target and non-target insects, some plant characters and fibre quality of upland cotton variety F 286. *J. Cotton Res. Dev.*, **6**(2): 171-179.

Dhawan, A.K., G.S. Simwat and V.K. Madan. 1994. Impact of synthetic pyrethroids on the arthropod diversity and productivity of upland cotton, *Gossypium hirsutum*. *J. Cotton Res. Dev.*, **8**(1): 81-99.

Govindan, K. 2009. *Evaluation of emamectin benzoate 5 SG against bollworms of cotton and fruit borers of okra*. Ph.D.(Ag) thesis, Tamil Nadu Agric. Univ., Coimbatore-3, India. 224p.

McCutchen, B.F. and F.N. Plapp. 1988. Monitoring procedure for resistance to synthetic pyrethroids in tobacco boll worm larvae. **In**: *Proc. Beltwide Cotton Production Res. Conf.*, New Orleans, Jan. 3-8, 1988, National Cotton Council of America, Memphis Tenn., pp 356-358.

Preetha, G. 2007. *Impact assessment of chloronicotinyls on the management of sucking pests in cotton and bhendi ecosystem*.Unpub. Ph.D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India. 236p.

Singh, S.P. 1994. *Fifty years of AICRP on biological control, Project Directorate of Biological Control*, Bangalore. pp. 53- 67.

Suganyakanna, S. 2006. *Evaluation of acetamiprid 20 SP against sucking pest complex in cotton*. unpub. Ph.D. Thesis. Tamil Nadu Agric. Univ., Coimbatore-3, India. 190p.

Thilagam, P. 2006. *Evaluation of flubendiamide 480 SC against bollworm complex in cotton and leaf folder and stem borer in rice.* Unpub. Ph.D. Thesis. Tamil Nadu Agric. Univ., Coimbatore-3, India, 238p.

Table 1.Effect of emamectin benzoate 5 SG against egg larval parasitoid, *Chelonus blackburnii* Cameron

Treatments	6 HAT		12 HAT		24 HAT	
	Mortality %	Corrected % mortality	Mortality %	Corrected % mortality	Mortality %	Corrected % mortality
Emamectin benzoate 5 SG @ 7g a.i. ha^{-1}	13.33 (21.40)^{a}	13.33	23.33 (28.87)^{b}	20.65	33.33 (35.25)^{b}	31.03
Emamectin benzoate 5 SG @ 9g a.i. ha^{-1}	16.33 (23.83)^{b}	16.33	26.67 (31.08)^{c}	24.14	40.00 (39.22)^{c}	37.93
Emamectin benzoate 5 SG @ 11g a.i. ha^{-1}	23.33 (28.88)^{c}	23.33	33.33 (35.25)^{d}	31.03	43.33 (41.16)^{c}	41.37
Emamectin benzoate 5 SG @ 15g a.i. ha^{-1}	36.33 (37.72)^{e}	36.33	40.00 (39.22)^{e}	37.93	50.00 (44.99)^{d}	48.97
Emamectin benzoate 5 SG @ 11g a.i. ha^{-1} (Proclaim®)	26.67 (31.08)^{d}	26.67	36.67 (37.11)^{d}	34.48	46.67 (43.08)^{cd}	43.39
Spinosad 45 SC@ 75 g a.i. ha^{-1}	36.67 (37.06)^{e}	36.67	46.67 (43.08)^{f}	43.34	56.67 (48.83)^{e}	55.17
Untreated control	-	-	3.33^{a}	-	3.33	-

HAT- Hour after treatment In a column, means followed by a common letter are not significantly different by DMRT (P = 0.05)

* Values in the parentheses are arc sine $\sqrt{\text{per cent}}$ transformed values

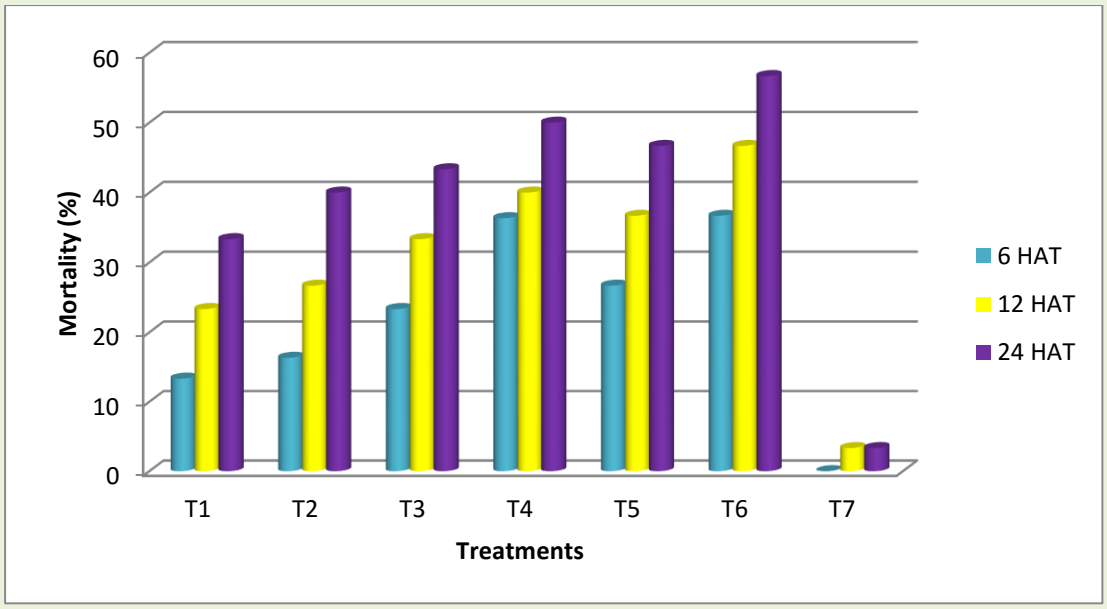

Fig. 1. Selective toxicity of emamectin benzoate 5 SG on *Chelonus blackburnii* Cameron

T1 - Emamectin benzoate 7g a.i. ha^{-1} T2 - Emamectin benzoate 9g a.i. ha^{-1}
T3 - Emamectin benzoate 11g a.i. ha^{-1} T4 - Emamectin benzoate 15g a.i. ha^{-1}
T5- Proclaim® 11 g a.i. ha^{-1} T6 - Spinosad 75g a.i. ha^{-1}
T7- Untreated check