RESEARCH PAPER

Asian Journal of Bio Science, Volume **8** | Issue 2 | October, 2013 | 241-244
Received : 15.07.2013; **Revised :** 15.09.2013; **Accepted :** 06.10.2013

Bioefficacy of flubendiamide 39.35 % SC against chilli fruit borer (*Spodoptera litura* Fb)

MEENA U. PATIL[1]**,** A.V. KULKARNI[2] AND OMKAR GAVKARE[3]

[1]Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, AURANGABAD (M.S.) INDIA
[2]DBT-RBC Project, NARP Campus, Paithan Road, AURANGABAD (M.S.) INDIA
[3]Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, SOLAN (H.P.) INDIA
Email : omkargavkare@yahoo.com

A field experiment was conducted in Maharashtra, India, during chilli crop season in 2009 and 2010 to evaluate the efficacy of flubendiamide 39.35 per cent SC (Fame) at two concentrations (60 and 48 g a.i./ha), emamectin benzoate 5 per cent SG (10 g.a.i./ha), indoxacarb 14.5 per cent SC (50 g.a.i./ha), spinosad 45 per cent SC, (73 g.a.i./ha), novaluron 10 per cent EC (33.50 g.a.i./ha) and profenofos 50 per cent EC (750 g.a.i./ha). The results on bioefficacy of aforesaid insecticides showed that maximum reduction in mean larvae per plant as well as lowest fruit damage was recorded in flubendiamide 39.35 per cent SC @ 60 g.a.i./ha followed by flubendiamide 39.35 per cent SC @ 48 g.a.i./ha with more yield at high concentration with cost: benefit ratio 1: 7.12.

Key words : Bioefficacy, Insecticides, *Spodoptera litura,* Chilli

How to cite this paper : Patil, Meena U., Kulkarni, A.V. and Gavkare, Omkar (2013). Bioefficacy of flubendiamide 39.35 % SC against chilli fruit borer (*Spodoptera litura* Fb). *Asian J. Bio. Sci.*, **8** (2) : 241-244.

INTRODUCTION

India is the world's largest producer, consumer and exporter of chilli *Capsicum annuum* L. with largest area under cultivation. The chilli grown about in India is 7.921 millon ha and production is about 12.60 million tonnes (Anonymous, 2012) and particularly in Maharashtra, the crop is grown in an area of 99300 hectares with a production of 51214 metric tonnes (Anonymous, 2006).

The chilli plant is attacked by various insect pests and mite from seedling to fruiting stage. A survey carried out by Crop Life Foundation (2012) indicated that insect damage can lower the market value of chilli up to 88 per cent. Among various pests thrips, mites and fruit borers are major pests of chilli crop. Fruit borer, *Spodoptera litura* is highly polyphagous and cosmopolitan in distribution. As reported by Reddy and Reddy (1999) due to severe attack, fruit borers lead to 90 per cent flower and fruit drop in chilli. Chilli fruit borer larvae move from one fruit to the next. The entrance hole develops a dark scar damaged fruit may drop, ripen prematurely or become infected with disease (Berke, 2005). The insecticides have been used extensively for the control of these insect-pests for want of natural enemy complex. At present, repeated applications of synthetic pyrethroids are made for the control of *S. litura* and their indiscriminate use has led to the resurgence of whitefly, aphid and mite. With this back ground a field experiment was conducted to study the bioefficacy of a green labeled new molecule flubendiamide for the management of fruit borer.

RESEARCH METHODOLOGY

The present investigation was conducted at NARP campus, Aurangabad, Maharashtra India (latitude 19° 53' N, longitude 75° 23' E, altitude 582 m a. s. l.).The average maximum and minimum temperatures during the course of investigation were (27.2^{0}C) and (19.8^{0}C), with relative humidity of (86) per cent and a total rainfall of (165) mm. The trials were laid out during the year 2009 and 2010 in a Randomized Block Design having plot size 4 x 5 m. at experimental site. The seedlings were transplanted on 22th June 2009 and on 02th July 2010. Chilli variety, Tejasvini was raised as per recommended practice (Anonymous, 2008), except insect-pest management practices.Bioefficacy of eight insecticides, flubendiamide 39.35 per cent m/m SC @ 48 g.a.i./ha (Fame), flubendiamide 39.35 per cent m/m SC @ 60 g.a.i./ha(Fame),

Table A: Details of the insecticide formulations used for the experiment and application

Formulation	Common name	Company	Class	Mode of action	Dose g.a.i./ha
Fame 39.35 %SC®	Flubendiamide	Bayer Crop Science , Mumbai	Phthalic acid diamide	Disrupt $Ca2^{+}$ balance	48-60
Avaunt 15.8%EC®	Indoxacarb	Dupont Crop Protection, New Delhi	Oxadiazine	Sodium channel blocker	50
Tracer 45%SC®	Spinosad	Dow Agro Sciences, Mumbai	Spinosyn	Acetylcholine neurotransmission disruptor	73
Proclaim %SG®	Emamectin Benzoate	Syngenta India Limited , Pune	Avermectins	Suppress muscle contraction and cease feeding	10
Rimon 10%EC®	Novaluron	Indofil Chemicals Company, Mumbai	Insect growth regulator	Moulting Harmone Disruptor	33.5
Curacron 50%EC®	Profenofos	Syngenta India Limited , Pune	Organophosphorus	Acetylcholinesterase inhibitor	750

Year	First application	Second application
2009	27-08-2009	11-09-2009
2010	09-09-2010	24-09-2010

emamectin benzoate 5 per cent SG (Proclaim), indoxacarb 14.5 per cent SC (Avaunt), spinosad 45 per cent SC, (Tracer) novaluron 10 per cent EC (Rimon) and profenofos 50 per cent EC (Curacron) was determined for two years and each treatment was replicated three times. The insecticides were applied from the time of fruit bearing with the help of Knapsack sprayer up to the point of runoff at fortnightly intervals. Details of the insecticide formulations used for the experiment and application are as follows.

Observations on the number of larvae per plant and percent fruit damage per plot from ten randomly selected plants was recorded on one day before first spraying and five and ten days after each spray.

Data were subjected to analysis of variance (ANOVA) using CPCS-I software (Gomez and Gomez, 1984).

RESEARCH FINDINGS AND ANALYSIS

Before spraying of insecticides there was no significant difference among number of larvae per plant (Table 1). Five days after first spray, there was reduction in the number of larvae per plant which ranged from 0.47 to 0.97 per plant. All the insecticides treatment were found effective. Flubendiamide 39.35 per cent SC @ 60 g.a.i./ha recorded least number of larvae (0.47/plant) followed by flubendiamide 39.35 per cent SC @ 48 g.a.i./ha (0.63/plant). Spinosad 45 per cent SC @ 73 g.a.i./ha (0.83/plant), emamectin benzoate 5 per cent SG @ 10 g.a.i./ha (0.91/ plant), indoxacarb 14.5 per cent SC @ 50 g.a.i./ha (0.92/ plant), novaluron 10 per cent EC @ 33.5 g.a.i./ha (0.96/plant) and profenofos 50 per cent EC @ 750 g.a.i./ha (0.97/plant)

Table 1: Bioefficacy of flubendiamide 39.35% SC against chilli pod borer, Spodoptera litura (Pooled data of 2009 and 2010)

Treatments	Dosage g.a.i./ha	Mean number of larvae per plant			Mean number of larvae per plant	
		1 DBS	After first spray		After second spray	
			5 DAS	10 DAS	5 DAS	10 DAS
Flubendiamide 39.35 %SC	48	1.77 (1.66)	0.63 (1.27)	0.20 (1.09)	0.67 (1.30)	0.20 (1.10)
Flubendiamide 39.35 %SC	60	2.05 (1.74)	0.47 (1.21)	0.17 (1.08)	0.42 (1.19)	0.19 (1.09)
Emamectin benzoate 5%SG	10	2.08 (1.76)	0.92 (1.38)	0.47 (1.21)	0.88 (1.37)	0.48 (1.22)
Indoxacarb 14.5 %SC	50	1.90 (1.70)	0.92 (1.38)	0.51 (1.23)	0.89 (1.38)	0.48 (1.22)
Spinosad 45 %SC	73	2.15 (1.78)	0.83 (1.35)	0.43 (1.20)	0.88 (1.37)	0.45 (1.20)
Novaluron 10 %EC	33.5	2.34 (1.82)	0.96 (1.40)	0.75 (1.32)	0.90 (1.38)	0.76 (1.33)
Profenofos 50%EC	750	1.61 (1.61)	0.97 (1.40)	1.12 (1.46)	0.97 (1.40)	1.20 (1.48)
Untreated control		1.54 (1.59)	2.22 (1.79)	2.38 (1.84)	2.33 (1.82)	2.66 (1.91)
C.V. (%)		5.30	1.05	1.32	0.84	1.08
C.D. (P=0.05)		NS	0.26	0.30	0.20	0.25

Figures in parenthesis are square root transformed values, 1 DBS =One day before spray, DAS = Days after spray, NS=Non-significant were at par with each other. Ten days after first spray, larval population per plant ranged from 0.17 to 1.12 per plant and lowest larval population was recorded in flubendiamide 39.35 per cent SC @ 60 g.a.i./ha (0.17/plant) treatment. The highest larval population per plant was recorded in profenofos 50 per cent EC @ 750 g.a.i./ha (1.12/plant) treatment (Table 1).

Five days after second spraying the incidence of larval population of fruit borer, *Spodoptera litura* was recorded and it was found lowest in flubendiamide 39.35 per cent SC @ 60 g.a.i./ha (0.42/plant) followed by flubendiamide 39.35 per cent SC @ 48 g.a.i./ha (0.67/plant). Highest population of fruit borer, *Spodoptera litura* larvae was observed in profenofos 50 per cent EC @ 750 g.a.i/ha *i.e.* 0.97/plant. Ten days after second sprayings, the observations were the same only the number of larvae recorded per plant was declined (Table 1). Least mean fruit per cent damage was recorded in flubendiamide 39.35 per cent SC @ 60 g.ai/ha *i.e.* 3.13 followed by flubendiamide 39.35 per cent SC @ 48 g.ai/ha (4.17) (Table 2).

The efficacy of flubendiamide in present study is substantially supported by the findings of Sreenivas *et al.* (2008) who reported that application of flubendiamide @ 48 g a.i./ha was found reducing the larvae of *Spodoptera litura* to 0.47 larvae per row and *Heliothis armigera* to 0.40 larvae per plant after 10 days of spraying. In present study also flubendiamide 39.35 per cent SC @ 60 g.a.i./ha was found effective in reducing the incidence of fruit borer, *Spodoptera litura* and minimizing the per cent fruit damage which resulted with highest yield. These results are in concurrence with the findings of Ameta and Ajay (2008) and Tatagar *et al.* (2009) reported that flubendiamide 20 per cent WG was effective against *Helicoverpa armigera* and *Spodoptera litura*. Similar findings quoted by Mallikarjunappa *et al.* (2008) that flubendiamide 20 per cent WG @ 35 g.a.i./ha was the most effective in reducing the incidence of rice stem borer, *Scirpophaga incertulus* (Walkar) and leaf folder, *Cnaphalocrosis medinalis* (Guen.) which helped to get higher yield. Lakshminarayana and Rajashri (2006) and Ghosal *et al.* (2012) found that flubendiamide 20 per cent WG is highly effective against *Heliothis armigera* on cotton. Javaregowda and Naik (2005) reported that flubendiamide 20per cent WG provide adequate control of paddy pests. Masanori *et al.* (2005) indicated flubendiamide caused highest mortality of lepidopteron insects. Ameta *et al.* (2011) demonstrated that flubendiamide 480 SC at 100 ml/ha significantly reduces larval population and recorded significantly higher seed yield in pigeon pea. Ashok Kumar and Shivaraju, 2009 concluded that flubendiamide reduces the pod damage and enhances the yield.

Effect of different treatments on yield and yield attributes :

The data of which insecticides is more economic presented in Table 2. All insecticidal treatments recorded increase in yield over untreated crop, but flubendiamide (60 g a.i. /ha) treatment resulted in highest yield attributes and it was compared to untreated check (10.70 q/ha). Comparatively flubendiamide (60 g. a.i. /ha) was best followed by lower dose of flubendiamide (48 g.a.i. /ha) and next was spinosad (73 g.a.i./ ha) in terms of giving better yields. Tatagar *et al.* (2009) have also recorded higher yield of chilli under flubendiamide treatment against *S.litura*.

Data on the economics of different insecticides doses treatments used for the control of *S.litura* (Table 2) revealed that the cost: benefit ratio (C:B) varied from 1: 7.12 to 1: 5.08. It was lowest in case of profenofos highest in case of flubendiamide. It is also evident from these results that although flubendiamide was superior over rest of treatments in suppressing *S.litura* population, highest benefit-cost ratio was recorded in case of flubendiamide 60 g ai/ha followed by lower dose of flubendiamide 48 g ai/ha and spinosad 73 g ai/ha. Similar reports were also recorded *i.e.* maximum cost :benefit ratio in case of flubendiamide (1:5.12) treatment against *S.litura* (Tatagar *et al.*, 2009). Thus flubendiamide is having extremely strong insecticidal activity against lepidopteran insect pests and hence, the present study inferred that flubendiamide @60g a.i./ ha could be effectively used for the management of *S.litura*.

Table 2: Effect of flubendiamide 39.35 %SC on chilli fruit borer damage , yield and cost economics (Pooled data 2009 & 2010)

Treatments	Dosage g.a.i./ha	Mean percentage fruit damage	Yield q/ha	Gross return	Net return	C: B ratio
Flubendiamide 39.35 %SC	48	4.17 (11.78)	9.71	77680	65700	1: 6.48
Flubendiamide 39.35 %SC	60	3.13 (10.18)	10.70	85600	73580	1: 7.12
Emamectin benzoate 5%SG	10	4.97 (12.88)	9.19	73520	60790	1: 5.78
Indoxacarb 14.5 %SC	50	5.48 (13.53)	8.87	70960	57980	1: 5.47
Spinosad 45 %SC	73	6.12 (14.31)	9.20	73600	61100	1: 5.89
Novaluron 10 %EC	33.5	6.29 (14.52)	8.69	69520	56510	1: 5.34
Profenofos 50%EC	750	6.48 (14.75)	8.34	66720	53580	1: 5.08
Untreated control		8.18 (16.62)	6.76	54080		
CV (%)		0.45	0.29			
C.D. (P=0.05)		0.10	0.86			

Figures in parenthesis are arcsine transformed values

LITERATURE CITED

Ameta, O.P and Ajay, K. (2008). Efficacy of flubendiamide against *Helicoverpa armigera* (Hubner) and *Spodoptera litura (*Fabr.) in chilli. *Pestology*, **32**(5): 26-29.

Ameta, O.P., Sharma, U.S. and Jeengar, K.L. (2011). Efficacy of flubendiamide 480 SC against pod borers, *Helicoverpa armigera* (Hubner) and *Maruca testulalis* (L.) in Pigeonpea. *Indian J. Entomol*., **73**(3): 191-195.

Anonymous (2008). *Krushi Dainandini.* Marathwada Agricultural University, Parbhani, M.S. (INDIA).

Anonymous (2012). Department of Agriculture and Cooperation Agricultural Statistics at a glance (Horticulture Division). 176 pp.

Ashok Kumar, C.T. and Shivaraju, C. (2009). Evaluation of newer insecticide molecules against pod borers of black gram. *Karnataka J. Agric. Sci.*, **22**(3): 521-523.

Berke, T. (2005). *Suggested cultural practices for chili pepper.* Shanhua, Taiwan: AVRDC–The World Vegetable Center. AVRDC.

Crop Life Foundation (2012). Insecticides have boosted chili pepper production and farmer incomes in India. International Pesticide Benefits Case Study No. 68.

Ghosal, A., Chatterjee, M.L. and Manna, D. (2012). Studies on some insecticides with novel mode of action for the management of tomato fruit borer, *Helicoverpa armigera* Hub. *J. Crop & Weed*, **8**(2): 126-129.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical procedures for agricultural research.* John Wiley and Sons, NEW YORK, U.S.A.

Javaregowda and Naik, L.K. (2005). Bio-efficacy of flubendiamide 20% WDG (RIL -038) against paddy pests and their natural enemies. *Pestology*, **29**: 58-60.

Lakshminarayana, S. and Rajashri, M. (2006). Flubendiamide 20 %WG a new molecule for management of American bollworm, *Heliothis armigera* on cotton. *Pestology*, **30**: 16-18.

Mallikarjunappa, S., Kendappa, G.N. and Ganesh. (2008). Novel insecticide for the control of rice stem borer, *Scirpophaga incertulus* and leaf folder, *Cnaphalocrosis medinalis.* In Coleman memorial National Symposium Bhat. Flubendiamide 20 %WG –a on Plant Protection. Univeristy of Agriculturral. Science. GK.V.K. Bengaluru (KARNATAKA) INDIA 84 p.

Masanori, T., Hayani, N. and Fujioka, S. (2005). Flubendiamide a novel insecticide highly effective against lepidopteran insect pests. *J. Pesticide Sci.*, **30**: 354-360.

Reddy, M.R.S. and Reddy, G.S. (1999). An eco friendly method to combat *Helicoverpa armigera* (Hub.). *Insect Environ.*, **4**: 143-144.

Sreenivas, A.G., Sharanabasappa, Hosamani, A.C., Bheemanna, M., Suresh, B.K., Shivaleela and Patil, B.V. (2008). Efficacy of flubendiamide 480 SC against chilli fruit borers complex. *Pesticide Res. J.*, **20**(2): 243-246.

Tatagar, M.H., Mohan Kumar, H.D., Shivaprasad, M. and Mesta, R.K. (2009). Bioefficacy of flubendiamide 20 WG against chilli fruit borers, *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fb.). *Karnataka J. Agric. Sci.*, **22**(3) : 579-581.

■ WEBLIOGRAPHY

Anonymous (2006). *http://www.indianspices.com*/pdf/state_prd.pdf.