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Bio-efficacy of Flupyradifurone 200SL against sucking pest and their natural enemies on brinjal (*Solanum melongena* L)

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ABSTRACT

A study was conducted at instructional farm, College of Agriculture, Ganj basoda (M.P.) to test the bio-efficacy of Flupyradifurone 200SL against whitefly, Bemisia tabaci Gennadius and Jassid, Amrasca biguttula biguttulla Ishida on brinjal (Solanum melongena L.) .The two foliar spray of insecticides viz., Flupyradifurone 200SL @ 125,150,175 g.a.i ha^{-1} phosphomidon 40SL 300g.a.i.ha^{-1} for bio-efficacy as well as effect on natural enemies alongwith untreated control were conducted. The results revealed that the doses of Flupyradifurone 200SL@ 125,150,175 g.a.i ha^{-1} were effective for managing jassid and whitefly population on brinjal and the dose of Flupyradifurone 200SL @ 150 and 175g.a.i.ha^{-1} gave higher yield of brinjal fruits (73.17 and 75.07q ha^{-1}) respectively than rest of the treatment. Influence of foliar spray of Flupyradifurone 200SL on lady bird beetle population on brinjal was not recorded.

Keywords: Brinjal, *Bemisia tabaci Amrasca biguttula biguttulla*, Flupyradifurone, *Coccinella* spp

INTRODUCTION

The brinjal or eggplant (*Solanum melongena* L.) is one of the most popular and principal vegetable crops grown in India and other parts of the world. India is second largest producer of brinjal after china. In India, it is cultivated mainly in West Bengal, Orissa, Bihar, Gujarat and Madhya Pradesh states. In Madhya Pradesh, it is cultivated on 0.40 lakh hectare with an annual production of 1.016 lakh tones and a productivity of 24.97 MT (Metric Tonn) per hectare(Shaikh and Patel 2012).The fruits contain approximately, 92.0 per cent moisture, 6.0 per cent carbohydrate, 1.0 per cent proteins, 0.3 per cent fats and some minerals. They are fairly good source of calcium, phosphorus, iron and vitamin B. In India, the crop is damaged by more than 30 insect pests' right from germination to harvesting. **S**hoot and fruit borer is most destructive and ubiquitous but whitefly, *Bemisia tabaci* Gennadius and Jassid, *Amrasca biguttula biguttulla* are also an important sucking pest that causes a considerable damage to the brinjal plants (Mandal *etal*.2010)**.** Flupyradifurone 200SL is a new insecticide with a distinct spectrum of activity belonging to the class of butenolides. It interacts with nicotinic acetycholine receptors, a class of neurotransmitter-gated action channels which are involved in excitatory neurotransmission. In practical conditions, flupyradifurone can be considered safe to most beneficial insects (with the exception of predatory bugs), and particularly to pollinators. It is a systemic insecticide, flexible in application and mainly intended for sucking pests control such as was carried out to test the efficacy of different doses of flupyradifurone 200Sl, on brinjal pests and as well as its influence on natural enemies.

MATERIAL AND METHODS

A field experiments were conducted at Research Farm 'A' College of Agriculture, Ganj Basoda in winter season 2015-16 and 2016-17. The popular local variety was transplanted during winter season in a plot 4.5 m x6 m with 60x45 cm plant spacing using randomized block design with six treatments including untreated control and six replications. Three doses of flupyradifurone 200SL @125,150 and 175g.a.i. ha^{-1}, phosphomidon 40%SL @ 300g.a.i. ha^{-1} alongwith untreated control were evaluated. All the insecticide treatments consisted two foliar sprays applied at fortnight interval by initiating the first when sufficient pest population observed by using 500 liter water/ha as diluents with the help of knapsack sprayer. The observations on the dead adult population of whitefly, *Bemisia tabaci* Gennadius on brinjal were noted at 06 hours and one day after foliar sprays of each

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treatment form six leaves (3 middle + 3 lower) of five randomly selected tagged plants.The observations on the survival of nymphal population of whitefly, *Bemisia tabaci* Gennadius and survival of nmyphal and adult population of jassid , *Amrasca bigutulla bigutulla* Ishida on brinjal were observed before foliar spray application as pre –treatments count *i.e*. zero days and at 3 ,7 , 10 and 15 days after foliar spray applications as post treatment count. The post treatment count of 15thdays after foliar application was treated as the pre treatment count of next foliar spray application. These observations were worked out in square root transformation (√n+0.5) for statistical analysis. The yield of marketable fruits of brinjal was recorded from each picking during the period of two foliar spray applications; the yield for one-hectare area was worked out hypothetically.

RESULT AND DISCUSSION

Survived nymph population of white fly

Result (Table 1) indicated that minimum (3.26/ plant) mean survived population of white fly was found in plots treated with flupyradifurone 200SL @ 175g.a.i. ha^{-1} and maximum (4.36 per plant) untreated control at 3 days after spray. The treatment with same formulation @125, 150 g.a.i. ha^{-1} and phosphomidon 40%SL @ 300g.a.i. ha^{-1} were found at with par with each other. The similar trends have also been observed at 7 and 15 days after spray. However the flupyradifurone 200SL @ 175g.a.i./ha was noted minimum 2.77 nymph population per plant and it was significantly superior over phosphomidon 40%SL @ 300g.a.i.ha^{-1} but it was at par with same formulation @125 , 150 g.a.i.ha^{-1} at during 10 days after foliar spray.

Table 1: Bio-efficacy of flupyradifurone 200SL against whitefly on brinjal

Treatments	Dose gai ha^{-1}	Pooled mean of 2015-16 and 2016-17						
		Mean survived population of whitefly					Mean dead Adult population of whitefly	
		Pre spray count	3 DAS	7 DAS	10 DAS	15 DAS	6hrs AS	O DAS
Flupyradifurone 200SL	125	20.09 (4.54)	3.98 (2.10)*	2.92 (1.78)	2.94 (1.82)	5.19 (2.33)	7.36 (2.79)	11.70 (3.44)
Flupyradifurone 200SL	150	19.60 (4.48)	3.89 (2.00)	2.77 (1.75)	2.86 (1.82)	5.25 (2.38)	8.14 (2.93)	13.17 (3.70)
Flupyradifurone 200SL	175	9.71 (3.19)	3.26 (1.90)	2.58 (1.71)	2.77 (1.80)	4.78 (2.22)	8.54 (3.01)	13.33 (3.72)
Phosphomidon 40%SL	300	9.56 (3.17)	4.36 (2.12)	3.85 (2.03)	4.65 (2.19)	5.81 (2.49)	7.11 (2.75)	11.33 (3.43)
Untreated control		19.09 (4.42)	21.53 (4.69)	23.25 (4.87)	24.60 (5.00)	26.07 (5.14)	2.23 (1.65)	3.08 (1.90)
SEm±		0.08	0.13	0.11	0.12	0.18	0.09	0.16
CD (P=0.05)		NS	0.41	0.38	0.37	0.56	0.28	0.52

*DAS- Days after spray, *- square root √(x+0.5) transformed values, ODAS- One day after spray*

Dead adult population of whitefly

The mean population of dead adult whitefly after 6 hours of spray ranged from 8.54 to 2.23 per plant. The maximum (8.54 per plant) was noticed in plots treated with flupyradifurone 200SL @175g.a.i.ha^{-1} and it was on par with same formulation @125, 150 g.a.i. and phosphomidon 40%SL @ 300g.a.i.ha^{-1}. The similar trends have also been found one day after spray (Table 1).

Survived population of jassid

It is revealed that flupyradifurone 200SL @175g.a.i.ha^{-1} was found most effective (1.08/plant) for controlling of jassid population in comparison to different doses of same formulation and phosphomidon 40%SL @ 300g.a.i.ha^{-1} during 3rd days after spray. Similar performances of these insecticides have also been recorded at 7 and 10 days after spray. The significantly minimum (2.87/plant) population have observed in plot treated with

flupyradifurone 200SL @175g.a.i.ha^{-1} followed by flupyradifurone 200SL @150 and 125g.a.iha^{-1} during 15 days after spray. The maximum (4.43 per plant) jassid population was recorded in plot treated with phosphomidon 40%SL @ 300g.a.i.ha^{-1} (Table 2).

Table 2: Bio-efficacy of flupyradifurone 200SL against jassid on brinjal

Treatments	Dose gai ha^{-1}	Mean survived population of jassid (Pooled mean of 2015-16 and 2016-17)				
		Pre spray count	3 DAS	7 DAS	10 DAS	15 DAS
Flupyradifurone 200SL	125	9.29 (3.11)	1.66 (1.41)	1.24 (1.26)	1.81 (1.47)	3.17 (1.87)
Flupyradifurone 200SL	150	9.01 (3.08)	1.52 (1.36)	1.17 (1.23)	1.71 (1.45)	3.04 (1.86)
Flupyradifurone 200SL	175	9.04 (3.06)	1.08 (1.16)	0.75 (1.05)	1.62 (1.42)	2.87 (1.82)
Phosphomidon 40%SL	300	9.41 (3.05)	1.78 (1.45)	1.53 (1.35)	1.88 (1.49)	4.43 (2.20)
Untreated control		9.17 (3.09)	11 (3.36)	13.38 (3.71)	14.43 (3.84)	24.80 (5.02)
SEm±		0.18	0.18	0.15	0.09	0.12
CD (P=0.05)		NS	0.55	0.48	0.26	0.36

Survived population of Lady bird beetle

The maximum (0.65) per plant population (Eggs, grub and adults) of lady bird beetle was recorded from plot treated with flupyradifurone 200SL @125g.a.i.ha^{-1} and it was on par with flupyradifurone 200SL @150 ,175g.a.iha^{-1} and phosphomidon 40%SL @ 300g.a.i./ha during 3rd days after spray. The observation recorded at 7, 10 and 15 days after spray have also similar trends except phosphomidon 40%SL @ 300g.a.i.ha^{-1} (Table 3).

Table 3: Effect of Bio-efficacy of flupyradifurone 200SL on yield and natural enemies of insect pest on brinjal

Treatments	Dose gai ha^{-1}	Mean survived population of Lady bird beetle					
		Pooled mean of 2015-16 and 2016-17					yield
		Pre spray count	3DAS	7DAS	10DAS	15 DAS	(Q ha^{-1})
Flupyradifurone 200SL	125	2.02 (1.87)	0.65 (1.31)	0.49 (1.17)	0.2 (0.95)	0.23 (0.99)	68.74
Flupyradifurone 200SL	150	2.03 (1.90)	0.41 (1.16)	0.31 (1.06)	0.14 (0.86)	0.15 (0.89)	73.17
Flupyradifurone 200SL	175	1.94 (1.82)	0.33 (1.07)	0.27 (1.01)	0.11 (0.83)	0.13 (0.88)	75.07
Phosphomidon 40%SL	300	1.91 (1.85)	0.21 (0.96)	0.11 (0.82)	0.09 (0.80)	0.08 (0.81)	66.59
Untreated control		1.93 (1.87)	1.91 (1.88)	1.96 (1.89)	2.11 (1.92)	2.69 (2.02)	46.23
SEm±		0.09	0.06	0.11	0.09	0.11	2.68
CD (P=0.05)		NS	0.18	0.33	0.26	0.35	8.27

Fruit yield

The fruit yield ranged between 75.07 and 46.023 q ha^{-1}. The highest (75.07q ha^{-1}) fruit yield was recorded in plot treated with flupyradifurone 200SL @175g.a.i.ha^{-1} followed by flupyradifurone 200SL @150 and 125g.a.i ha^{-1} and phosphomidon 40%SL @ 300g.a.i. ha^{-1}. The lowest fruit yield was noted in untreated control (Table 3).Sharma *et al.* (2016) and Sinha and Nath (2012) reported significant control of insect pests of brinjal and enhanced yield many fold as compared to untreated control. Whitworth *et al.* (2016) reported significant control of aphids, *Melanaphis sacchari* on sorghum with flupyradifurone 200SL and its tank mix VINOD

combinations at Kansas University. Three evaluated doses of flupyradifurone 200SL performed the best in suppressing rosy apple aphids, *Dysaphis plantaginea* on apple up to 26 days post treatment (Alston and Lindstrom 2012). It was found most effective in suppressing jassids and whiteflies population on brinjal. Thus the report of Alston and Lindstrom(2012) agree with present findings. Rao *etal.* (2014) identifies novel chemistries of flupyradifurone 20SC @ 200g.a.i.ha^{-1} as effective alternatives to neonicotinoids in cotton ecosystem. Patil *et al.* (2013) reported that residual toxicity of flupyradifurone 200SL was up to 15th days found best for control of mulberry thrips without deleterious effect on silk worm growth. Prasanthi *et al.* (2017) and Wale *et.al.* (2017) strongly supported the present findings. Kumar *et al.*(2017) tested the efficacy of newer insecticides and found that thiamethoxam 25Wg @ 100g/ha was most effective insecticides in reducing the population of whitefly and registered higher fruit yield and corroborate to present observations.

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