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Evaluation of buprofezin 70 DF an insect growth regulator for eco-friendly management of jassid (*Amrasca bigutulla bigutulla* Ishida) in okra, *Abelmoschus esculentus* (L.) Moench

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ABSTRACT: Field experiments were carried out for two seasons in 2012 to evaluate the efficacy of a new formulation of buprofezin (buprofezin 70 DF) against jassid (*Amarasca biguttula biguttula* Ishida) in okra, *Abelmoschus esculentus* (L.) Moench. The insecticide was applied at 200 and 150 g a.i./ha at the ETL level of the insect (2 Jassids/leaf) and the performance of the same was compared with imidacloprid 17.8 SL @ 20 g a.i./ha, acephate 75 SP @ 562.5g a.i./ha and an untreated control. Results revealed that both the dosages of buprofezin 70 DF were significantly superior over the untreated control at 5 % level of significance. Buprofezin 70 DF at 200 and 150 g a.i./ha performed better over the other treatments with 88.81 and 85.96 % reduction during first season and 89.60 and 84.73% reduction during second season, respectively. Buprofezin , an insect growth regulator which had less or no hazardous effects on human health and environment and thus it can be incorporated in Integrated Pest Management programme in okra cultivation.

Keywords: *Amrasca bigutulla bigutulla*, Buprofezin, Insect growth regulator, Jassid, Management, Okra

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an important vegetable crop under the family Malvaceae which is grown for its green tender fruits which are used as a vegetable in a variety of ways. The crop is used as a soup thickener and the immature fruits may be boiled as vegetable and served with rice and other food types. It is very rich in calcium, ascorbic acid, and iodine which help control goitre as well as rich in protein and mineral matter (Rathod and Singh, 1990; Som, 2007). The roots and stems of okra are used for cleaning cane juice (Chauhan, 1972). Matured fruits and stems containing crude fibre are used in paper industry. The pods are also an excellent source of vitamin C (30 mg/100 g), calcium (90 mg/100g), iron (1.5 mg/100 g) and other minerals like magnesium and potassium, vitamin A and B, fats and carbohydrates (Aykroud, 1963). Okra grows in tropical and warm temperate climates. It is an annual or perennial plant that is very resistant to heat and drought and can tolerate poor soils. In India total area and production under okra is reported to be 530.8 thousand hectare and 63.50 lakh tonnes during the year 2012-13 (Anonymous, 2013). Insect pests are one of the important reasons among the several factors for low productivity of okra which cause yield reduction due to attack at different crop stages. Like other *Malvaceae* crops, okra is susceptible to a variety of insect pests like jassid, aphid, white fly, shoot and fruit borer etc. that hamper the yield drastically (Kumar *et al*., 2002). Among sucking insects, Jassid (*Amarasca biguttula biguttula*) is one of the major insect pest feeding on okra crop and remains active throughout the year excluding winter season (Mandal *et al*., 2006). It destroys the crop by sucking the cell sap mostly on lower surface of okra leaves of the plants and causes to hopper burn and 50% yield loss (Bindra and Mahal, 1979; Bindra and Mahal, 1981) and also causes 49.8% and 45.1% reduction of plant height and number of leaves respectively, due to the attack of jassid (Dandapani *et al*., 2003). Control strategies for jassid are extensively dependent on the use of synthetic chemical insecticides. However, recognition of detrimental effect of pesticide such as insects resistance to insecticide, secondary pest outbreak, non-target effects, environmental pollution etc. have prompted the development of alternative control strategies and environmentally safer chemicals such as insect growth regulators (IGRs) (Mukhopadhyay, 2003). Buprofezin is especially effective against homopteran pests, such as planthopper, with very low risks to environment including human beings (Wang *et al.,* 2008). Therefore, the experiment was conducted to evaluate the effectiveness of buprofezin 70 DF an insect growth regulator

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for eco-friendly management of Jassid (*A. bigutulla bigutulla*) as strategic research for possibility of incorporating this in Integrated Pest Management Programme in okra cultivation.

MATERIALS AND METHODS

The field experiments were conducted during the rabi and kharif season of 2012 at Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal to evaluate the bio-efficacy of buprofezin 70 DF against Jassid (*A. bigutulla bigutulla*). The soil of the experimental site was sandy loam with high per cent of sand and low percent of clay. The climatic condition of the experimental site was typical to new alluvial zone of West Bengal. The experiments were carried out in Randomized Complete Block Design consisting five treatments including control with four replications. The variety Arka Anamika was taken for experimentation during rabi season and Krantee 5003 was chosen for kharif as the respective varieties are very popular among the local farmers for cultivation during respective seasons. All recommended agronomic practices like seed rate, spacing, fertilizer application and application of irrigation water were followed except plant protection measures. Five treatments namely, Buprofezin 70 DF @ 150g a.i./ha (T_1), Buprofezin 70 DF @ 200g a.i./ha (T_2), Imidacloprid 17.8 SL @ 20g a.i./ha (T_3), Acephate 75 SP @ 562.5g a.i./ha (T_4) and untreated Control (T_5) were allotted randomly in plots. The spraying of insecticides was done based on the economic threshold level (2 jassids/leaf). The observations of jassids (*A. bigutulla bigutulla*) population were recorded at before spraying and seven (7d) and fifteen (15d) days after spraying. The population of jassids were recorded from three leaves per plant *i.e.*, from top, middle and bottom portion of the plants on five randomly selected plants in each plot avoiding border effect. Reduction over control was calculated by the following formula:

Reduction over control (%) = Population in control plots — Populations in treatment plot / Population in treatment plot x 100

The data on population of the pests were subjected to square root transformation before statistical analysis following Gomez and Gomez (1984) to test the significance of treatment effects.

RESULTS AND DISCUSSION

First season: Upon attaining the ETL level (2 insects / leaf) of the jassid population, spray the insecticide Buprofezin (70% DF) under discussion was initiated. The distribution of jassid population / leaf / plant before spray was recorded uniform in the experimental plots. The reduction of jassid population 7 days after first spraying was recorded as 66.82 – 95.39% and after 15 days was 64.63 – 89.08%. Highest reduction of insect population after 7 days of spray was recorded

Table 1. Bioefficacy of buprofezin 70 DF against of Jassid *(Amrasca biguttula biguttula)* population on Okra (Season I).

Treatments	Number of Jassids / leaf before and after the spray									Overall mean	Overall reduction over control (%)
		1st spray				2nd spray					
	Pre Count	7d	Reduction over control (%)	15d	Reduction over control (%)	Pre Count	7d	Reduction over control (%)	15d	Reduction over control (%)		
T_1 (Buprofezin 70 DF @ 150g a.i./ha)	2.70 (1.79)#	0.30 (0.89)	91.71	0.57 (1.03)	85.15	1.23 (1.32)	0.62 (1.06)	85.43	0.73 (1.11)	82.19	0.55 (1.03)	85.96
T_2 (Buprofezin 70 DF @ 200g a.i./ha)	2.67 (1.78)	0.17 (0.82)	95.39	0.42 (0.96)	89.08	1.15 (1.28)	0.50 (1.00)	88.19	0.68 (1.09)	83.40	0.44 (0.97)	88.81
T_3 (Imidacloprid 17.8 SL @ 20g a.i./ha)	2.80 (1.82)	1.15 (1.28)	68.20	1.17 (1.29)	69.43	1.32 (1.35)	1.10 (1.26)	74.02	1.17 (1.29)	71.66	1.15 (1.28)	70.96
T_4 (Acephate 75 SP @ 562.5g a.i./ha)	2.73 (1.80)	1.20 (1.30)	66.82	1.35 (1.36)	64.63	1.40 (1.38)	1.35 (1.36)	68.11	1.33 (1.35)	67.61	1.31 (1.34)	66.84
T_5 (Untreated Control)	2.60 (1.76)	3.62 (2.03)	-	3.82 (2.08)	-	4.05 (2.13)	4.23 (2.18)	-	4.12 (2.15)	-	3.95 (2.11)	-
SEm(±)	0.06	0.04	-	0.05	-	0.04	0.03	-	0.03	-	0.02	-
CD at 0.05	NS	0.13*	-	0.16*	-	0.14*	0.10*	-	0.09*	-	0.06*	-

7d= Observation taken on 7 days after spraying, 15d= Observation taken on 15 days after spraying; * values indicate significance at 0.05; NS= non significant; #figures in the parenthesis indicate the square root transformed [√(x+0.5)] values.

Table 2. Bioefficacy of buprofezin 70 DF against of Jassid (*Amrasca biguttula biguttula*) population on Okra (Season II).

Treatments	Number of Jassids / leaf before and after the spray										Overall mean	Overall reduction over control (%)
	1st spray					2nd spray						
	Pre Count	7d	Reduction over control (%)	15d	Reduction over control (%)	Pre Count	7d	Reduction over control (%)	15d	Reduction over control (%)		
T_1 (Buprofezin 70 DF @ 150g a.i./ha)	1.25 (1.32)#	0.20 (0.84)	89.74	0.27 (0.88)	85.19	1.15 (1.28)	0.33 (0.91)	88.95	0.72 (1.10)	77.37	0.38 (0.94)	84.73
T_2 (Buprofezin 70 DF @ (200g a.i./ha)	1.52 (1.42)	0.15 (0.81)	92.31	0.20 (0.84)	88.89	1.12 (1.27)	0.22 (0.85)	92.82	0.47 (0.98)	85.26	0.26 (0.87)	89.60
T_3 (Imidacloprid 17.8 SL @ 20g a.i./ha)	1.40 (1.38)	0.58 (1.04)	70.09	0.62 (1.06)	65.74	1.33 (1.35)	0.63 (1.06)	79.01	1.10 (1.26)	65.26	0.73 (1.11)	70.47
T_4 (Acephate 75 SP @ 562.5g a.i./ha)	1.48 (1.41)	0.70 (1.10)	64.10	0.70 (1.10)	61.11	1.37 (1.37)	0.82 (1.15)	72.93	1.25 (1.32)	60.53	0.87 (1.17)	65.10
T_5 (Untreated Control)	1.42 (1.38)	1.95 (1.57)	-	1.80 (1.52)	-	2.82 (1.82)	3.02 (1.88)	-	3.17 (1.91)	-	2.48 (1.73)	-
SEm(±)	0.05	0.04	-	0.04	-	0.04	0.05	-	0.05	-	0.02	-
CD at 0.05	NS	0.13*	-	0.11*	-	0.14*	0.17*	-	0.14*	-	0.08*	-

7d= Observation taken on 7 days after spraying, 15d= Observation taken on 15 days after spraying * value indicate significant at 0.05; NS= non significant; # figures in the parenthesis indicate the square root transformed [√(x+0.5)] values.

95.39% for buprofezin 70% DF@ 200g a.i. /ha (T_2) followed by buprofezin 70% DF@ 150g a.i. / ha (T_1) and Imidacloprid 17.8% (w/w) @ 200ml a.i. /ha (T_3). After 25 days of first spray the crop was sprayed for second time. The insect populations observed before spray were subjected to differential insecticidal treatments, and were reduced differentially by 68.11 – 88.19% and 67.61 – 83.40% as were observed after 7 days and 15 days of the second spray respectively ascertaining buprofezin 70% DF@ 200g a.i. /ha as the best performer. The overall reduction over control of two sprays indicated that buprofezin 70 DF at 200 and 150 g a.i./ha performed better over the other treatments with 88.81 and 85.96 % reduction of this pest respectively (Table 1).

Second season: First spray of Buprofezin (70% DF) was undertaken with attainment of the ETL level (2 insects / leaf) in majority of plots by the jassid. On the date of spray, distribution of Jassid population before the spray was recorded more or less uniform in the experimental plots. Application of the insecticide noticeably reduced this insect population by 64.10 – 92.31% after 7 days of spraying. Due to impact of the treatments reduction over control of insect populations up to 15 days after spraying was recorded as 61.11-88.89%. Highest reduction (92.31%) was recorded 7 days after spraying for the treatment containing buprofezin 70% DF@ 200g a.i. /ha (T_2) which was followed by buprofezin 70% DF@ 150g a.i. / ha (T_1) and Imidacloprid 17.8% (w/w) @ 200ml a.i. /ha (T_3) whereas all the mentioned treatments were highly significant over the control (Table 2). The crop was sprayed for second time after 24 days following the first spray. Here too the treatment, T_2 (buprofezin 70% DF @ 200g a.i. /ha) performed best in reference to reduction of insect populations after 7 days of spraying and overall reduction of that up to 15 days of spraying (Table 2). The overall percent reduction over control of two sprays revealed that buprofezin 70 DF at 200 and 150 g a.i./ha performed better over the other treatments containing Imidacloprid and Acephate with 89.60 and 84.73% reduction of this pest respectively.

Data relating to the study on bio-efficacy of buprofezin 70% DF against Jassids in okra in two consecutive seasons have been presented in tables 1 and 2. It is clearly revealed from the two seasons experiment that the treatment, T_2 (buprofezin 70% DF@ 200g a.i. /ha) all along performed better than the rest of the treatments *i.e.* T_1 (buprofezin 70% DF@ 150g a.i. / ha), T_3- imidacloprid 17.8 SL @ 20g a.i./ha, T_4 - acephate 75 SP @ 562.5g a.i./ha, and T_5- untreated control. There are no reports regarding the efficacy of the formulation, Dry Flowable (DF) of buprofezin against Jassid in okra used in the present study (buprofezin 70% DF). However regarding the other formulations Kittiboonya *et al.* (2002) reported from Thiland regarding effective control of cotton leafhopper, *A. biguttula* (Ishida) with buprofezin 10% WP.

Nadeem *et. al* (2011) found buprofezin as most effective insecticide in Faisalabad, Pakistan against nymph population of whitefly may supported the present findings. Ramalakshmi (2012) reported from Guntur, Andhra Pradesh that buprofezin 25% SC caused significant reduction of cotton leafhopper (*A. devastans*) on cotton. There is no report regarding the use of buprofezin in okra. However, the literatur clearly indicates its efficacy against jassid in other crops which are in line with the findings of the present investigation. Moreover, the investigation also depicted the efficacy of the new formulation against jassid in okra.

Conclusion

It was concluded that the efficacy of a new formulation of buprofezin (buprofezin 70% DF) with its right rate of application in Okra, *Abelmoschus esculentus* to manage Jassid, one of the notorious pest faced by the okra growers. Works had been carried out by several researchers to test the efficacy of Buprofezin against jassid in other crops but the present study was first attempt on Okra in West Bengal with the present formulation of buprofezin. Two application of buprofezin 70% DF@ 200g a.i. /ha can successfully manage the okra jassid and thus it may be incorporated in Integrated Pest Management Programme in okra cultivation.

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