Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(4): 162-166

Received: 20-05-2018
Accepted: 21-06-2018

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Bio-efficacy of newer insecticides against sucking insect-pests on brinjal (*Solanum melongena* L.)

VG Kharade, DS Mutkule and VM Sakhare

Abstract

The present field experiment were conducted to evaluate "Bio-efficacy of newer insecticides against sucking insect-pests on brinjal" under field condition during *kharif* season of 2017 at Oilseed Research Station, Latur, Maharashtra, India. The treatments of different insecticides *viz.*, imidacloprid 0.0044 per cent, dimethoate 0.04 per cent, quinalphos 0.05 per cent, emamectin benzoate 0.002 per cent, chlorantraniliprole 0.0074 per cent and indoxacarb 0.019 per cent were evaluated against jassid, *Amrasca biguttula biguttula* and whitefly, *Bemisia tabaci* revealed that imidacloprid 0.0044 per cent was found most effective treatment in reducing the population of jassid (1.03 jassids/3 leaves) and whitefly (1.32 whiteflies/3 leaves) respectively. Followed by dimethoate 0.04 per cent which was found to be statistically at par with chlorantraniliprole 0.0074 per cent.

Keywords: Bio-efficacy, newer insecticides, jassid, whitefly

Introduction

Brinjal (*Solanum melongena* L.) is an important vegetable crop grown in all the seasons. It is one of the prominent vegetable crop in India. Nutritionally per 100 gm. of edible portion of brinjal fruit contains calories (24.0mg), sodium (3.0mg), moisture content (92.7%), copper (0.12mg), carbohydrates (4.0%), potassium (2.0mg), protein (1.4g), sulphur (44.0mg), fat (0.3g), chlorine (52.0mg), fiber (1.3g), vitamin A (124.0 I.U.), oxalic acid (18.0mg), folic acid (34.0µg), calcium (18.0mg), thiamine (0.04mg), magnesium (15.0mg), riboflavin (0.11mg), phosphorus (47.0mg), B-carotene (0.74µg), iron (0.38mg), vitamin C (12.0mg), zinc (0.22mg) and amino acids (0.22). It has also been recommended as an excellent remedy for those suffering from liver complaints (Shukla and Naik, 1993) [14]. India is second largest producer of brinjal in the world next to China. In India, brinjal covered 10290 thousand hectare area and produced 175008 thousand MT with a productivity 17.01 MT per ha during 2016-17(Anon., 2017) [1]. Whereas, Maharashtra it occupied 22.14 thousand hectare and produced 438.28 thousand MT during 2016-2017(Anon., 2017) [1].

According to Nayer *et al*. (1995) [11] listed 53 insects attacking brinjal. Among the pests, shoot and fruit borer (*Leucinodes orbonalis* Guen.), whitefly (*Bemisia tabaci* Gennadius), leaf hopper (*Amrasca biguttula biguttula* Ishida) and epilachna beetle (*Henosepilachna viginctioctopunctata* (F.) cause severe damage. Infestation of jassid, whitefly and shoot and fruit borer results in about 70-92 per cent loss in yield of brinjal (Rosaiah, 2001) [13]. Of late, the intense attack of sucking pests particularly, aphid, jassid, whitefly, mealy bug and lace wing bug is found to play an important role in the reduction of yield (Swaminathan *et al*., 2010) [16]. The loss caused by sucking pests varies from 10-15 per cent depending on the intensity of infestation (Munde *et al*., 2011) [10]. Jassids both nymphs and adults suck the cell sap usually from the ventral surface of the leaves and while feeding inject toxic saliva into plant tissues, affected leaves turn yellowish and curl. Whiteflies are the milky white minute flies, nymph and adults suck the cell sap from the leaves. The affected leaves are curled and dried and show a stunted growth (Singh *et al*., 2008) [12]. Various methods have been tried for the control of sucking insect-pests. But use of chemical method is an important approach for their control because of its quick action, effectiveness and adaptability to various situations. Several insecticides have been recommended and used for the effective management of brinjal insect-pests. But according to several reports many of these label claimed insecticides could not achieved effective results. These label claimed insecticides with some new insecticides should have to be evaluated against sucking insect pests of brinjal.

Materials and Methods

The studies on "Bio-efficacy of newer insecticides against sucking insect-pests on brinjal (*Solanum melongena* L.)" were conducted during *kharif* season 2017 at Oilseed Research Station, Latur, Maharashtra, India. The experiment was laid out in randomized block design (RBD), with seven treatments and three replications. Mauli variety of brinjal seedlings were transplanted in 16.2 m^2 area with spacing of 90 cm (R-R) × 60 cm (P-P). The treatments of different insecticides *viz.*, Imidacloprid 0.0044 per cent, Dimethoate 0.04 per cent, Quinalphos 0.05 per cent, Emamectin benzoate 0.002 per cent, Chlorantraniliprole 0.0074 per cent and Indoxacarb 0.019 per cent were applied on appearance of sucking pests and subsequent spray were given at 15 days interval using manually operated knapsack sprayer. The observations on total number of jassids and whiteflies was recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before treatment and 1, 3, 7, 10 and 14 days after first, second and third application of insecticides.

Results and Discussion

The bio-efficacy data regarding sucking insect-pests *viz*., Jassid, *Amrasca biguttula biguttula* and whitefly, *Bemisia tabaci* during *kharif* 2017 (Pooled) on brinjal.

Jassid (*Amrasca biguttula biguttula)*

Data pertaining to effect of different insecticides on population of Jassid, *Amrasca biguttula biguttula* after first, second and third spray (pooled three spray) are presented in Table 1 and depicted in figure 1 revealed that the population of jassids was uniformly distributed in all plots before spray as the data was statistically non-significant. After application of insecticidal treatments revealed significant results during significant results among three insecticidal treatment during 1^{st}, 3^{rd}, 7^{th}, 10^{th} and 14^{th} day after spray as well as overall pooled data.

At 1 day after spray the lowest number of jassid was found in the treatment of imidacloprid 0.004 per cent (0.73 jassids/3 leaves) which was significantly superior over other treatments. The next best treatments were dimethoate 0.04 per cent and chlorantraniliprole 0.0074 per cent recorded 1.67 and 1.84 jassids/3leaves respectively. These two insecticides were found to be at par with each other. The other treatments *viz*., emamectin benzoate 0.002 per cent, indoxacarb 0.019 per cent and quinalphos 0.05 per cent recorded 2.71, 2.91 and 2.96 jassids/3leaves respectively, wherein quinolphos showed comparable results with earlier indoxacarb 0.019 per cent and emamectin benzoate 0.002 per cent treatments. Highest jassids were found in untreated control plot (8.93 jassids/3 leaves).

Almost similar trends were seen on third day after spraying. At 7 day after spraying, no change in the trend was observed in which imidacloprid 0.0044 per cent recorded significantly lowest population of jassids to the tune of 0.60/three leaves followed by dimethoate 0.04 per cent and chlorantraniliprole 0.0074 per cent (1.42 and 1.64 jassids/3leaves) respectively. These two insecticides were found to be at par with each other. However, emamectin benzoate 0.002 per cent (2.49 jassids/3 leaves), indoxacarb 0.019 per cent (2.65 jassids/3 leaves) and quinalphos 0.05 per cent (3.00 jassids/3leaves) observed to be the next effective treatments.

Likewise on 10 and 14 days after spraying, imidacloprid 0.0044 per cent recorded significantly lowest population of jassids (1.29 and 1.84/3 leaves). Followed by dimethoate 0.04 per cent (2.40 and 3.33 jassids/3 leaves) which was found to be at par with and chlorantraniliprole 0.0074 per cent (2.76 and 3.75 jassids/3 leaves). The next treatments were emamectin benzoate 0.002 per cent recorded (3.73 and 4.78 jassids/3 leaves) and indoxacarb 0.019 per cent (4.07 and 5.07 jassids/3leaves) for minimizing the population of jassids. The treatment quinalphos 0.05 per cent were noted subsequently effective insecticides with 4.29 and 5.71 jassids/3 leaves at 10 and 14 days after spray, respectively.

Overall Pooed

Glance through the pooled analysis, it is revealed that all the insecticides *viz.*, imidacloprid 0.0044 per cent, dimethoate 0.04 per cent, chlorantraniliprole 0.0074 per cent, emamectin benzoate 0.002 per cent, indoxacarb 0.019 per cent and quinalphos 0.05 per cent evaluated against jassid population were proved their significance dominance over control.

It is evident from pooled data (Table 1 and presented graphically in figure-1) of three spraying of insecticide revealed significant results among the treatments. The significantly lowest jassid population was observed in the application of imidacloprid 0.0044 per cent (1.03 jassids/3 leaves) followed by dimethoate 0.04 per cent (2.07 jassids/3 leaves), chlorantraniliprole 0.0074 per cent (2.35 jassids/3 leaves), emamectin benzoate 0.002 per cent (2.77 jassids/3 leaves), indoxacarb 0.019 per cent (3.40 jassids/3 leaves) and quinalphos 0.05 per cent (3.81 jassids/3 leaves).

In previous findings, Dahatonde *et al*. (2014) [3] recorded superiority of imidacloprid over chlorantraniliprole and indoxacarb as well as Bharati and Shetgar (2016) [2] also reported effectiveness of imidacloprid over dimethoate and emamectin benzoate and other insecticides which is match with the present investigation results. Besides these, Kumar and Kumar (2017) [8], Indirakumar *et al*. (2017) [4], Kumar *et al*. (2017) [9], Jadhav *et al*. (2017) [5] evaluated imidacloprid as a most effective treatment for jassids over other insecticides, which strongly supports the present findings.

Table 1: Bio-efficacy of various insecticides against jassid in brinjal (Pooled 1^{st}, 2^{nd} and 3^{rd} spray)

	Treatments	Dose (gm/ml) in 10 lit. water	Mean population of Jassids /3 leaves on						Over all Pooled
			1 day before spraying	Days after spraying					
				1	3	7	10	14	
T1	Imidacloprid 17.8 SL	02.50	6.27 (2.60)*	0.73 (1.11)	0.67 (1.08)	0.60 (1.05)	1.29 (1.33)	1.84 (1.53)	1.03 (1.22)
T2	Dimethoate 30 EC	13.20	6.73 (2.69)	1.67 (1.46)	1.53 (1.42)	1.42 (1.37)	2.40 (1.70)	3.33 (1.96)	2.07 (1.58)
T3	Quinalphos 25 EC	20.00	6.00 (2.54)	3.09 (1.89)	2.96 (1.85)	3.00 (1.87)	4.29 (2.19)	5.71 (2.49)	3.81 (2.05)
T4	Emamectin benzoate 5 SG	04.00	6.27 (2.60)	2.71 (1.79)	2.51 (1.73)	2.49 (1.72)	3.73 (2.05)	4.78 (2.29)	3.24 (1.91)
T5	Chlorantraniliprole 18.5 SC	04.00	6.60 (2.66)	1.84 (1.53)	1.76 (1.50)	1.64 (1.46)	2.76 (1.80)	3.75 (2.06)	2.35 (1.65)
T6	Indoxacarb 14.5 SC	13.33	6.00 (2.54)	2.91 (1.84)	2.71 (1.79)	2.65 (1.77)	4.07 (2.14)	5.07 (2.36)	3.40 (1.97)
T7	Untreated Control	--	6.67 (2.66)	8.93 (3.05)	9.15 (3.08)	9.63 (3.16)	10.18 (3.24)	10.51 (3.30)	9.67 (3.36)
S.E. ±		--	0.133	0.095	0.080	0.093	0.101	0.105	0.094
C.D. at 5%		--	N.S.	0.291	0.248	0.288	0.311	0.323	0.291
C.V. (%)		--	8.78	9.026	7.830	9.139	8.486	7.937	8.483

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)

N.S.: Non-significant

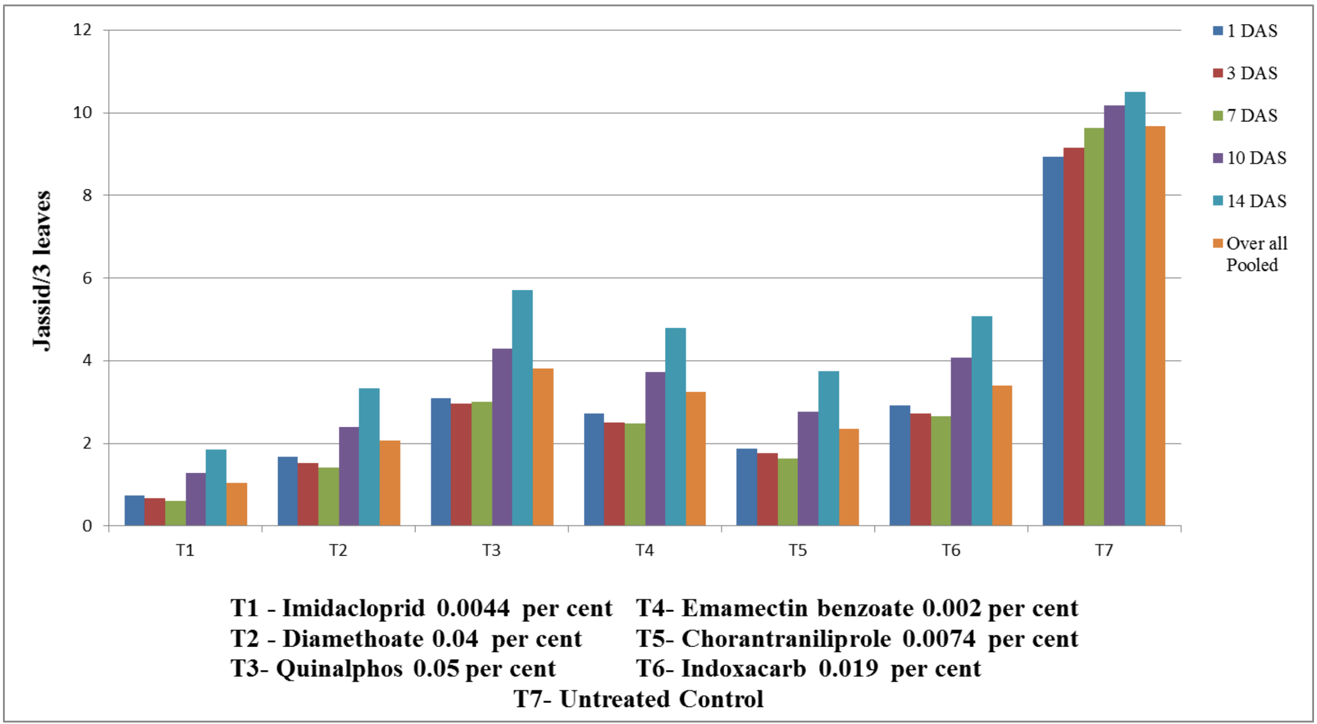


Fig 1: Bio-efficacy of various insecticides against jassid in brinjal (Pooled 1st, 2nd and 3rd spray)

Whitefly (*Bemisia tabaci*)

It is indicative from the data presented in the Table 2 and depicted in fig. 2 that mean whitefly population before application of treatment was consistent among different treatments as the data are statistically non-significant whereas, all the insecticides were found to be significantly superior over untreated control in reducing the population of whitefly at 1, 3, 7, 10 and 14 days after application of insecticides as well as overall pooled data.

After one day of spraying, imidacloprid 0.0044 per cent recorded significantly lowest population of whitefly to the tune of 0.93/3 leaves. Followed by dimethoate 0.04 per cent (2.00 whitefly/3 leaves) and chlorantraniliprole 0.0074 per cent (2.13 whitefly/3 leaves). These two treatments were found statistically at par with each other. emamectin benzoate 0.002 per cent (3.29 whitefly/3 leaves), indoxacarb 0.019 per cent (3.58 whitefly/3 leaves) and quinalphos 0.05 per cent (4.18 whitefly/3 leaves) were recorded next best treatments. Highest whiteflies were found in untreated control plot (10.09 whitefly /3 leaves). Almost similar trends were seen on third day after spraying. At 7 day after spraying, no change in the trend was observed significantly m inimum population of whitefly (0.73/3 leaves) was recorded from the plots treated with imidacloprid 0.0044 per cent, followed by dimethoate 0.04 per cent (1.73 whitefly/3 leaves) and chlorantraniliprole 0.0074 per cent (1.89 whitefly/3 leaves). These two insecticides were found statistically at par with each other. The next efficient treatments in minimizing whitefly population were emamectin benzoate 0.002 per cent (2.89 whitefly/3 leaves) and indoxacarb 0.019 per cent (3.22 whitefly/3 leaves). After this treatments quinalphos 0.05 per cent (3.98 whitefly/3 leaves) are also effective treatments for minimizing the population of whitefly.

Likewise on 10 and 14 days after spraying, imidacloprid 0.0044 per cent recorded significantly lowest population of whitefly (1.56 and 2.58/3 leaves). Followed by dimethoate 0.04 per cent (2.91 and 4.44 whitefly/3 leaves) which was found to be at par with chlorantraniliprole 0.0074 per cent (3.07 and 4.47 whitefly/3 leaves). The next treatments were emamectin benzoate 0.002 per cent recorded (4.27 and 5.71 whitefly/3 leaves) and indoxacarb 0.019 per cent (4.51 and 5.65 whitefly/3leaves) for minimizing the population of whitefly. The treatment quinalphos 0.05 per cent were noted subsequently effective insecticides with 5.11 and 6.47 whitefly /3 leaves at 10 and 14 days after spray, respectively.

Overall Pooed

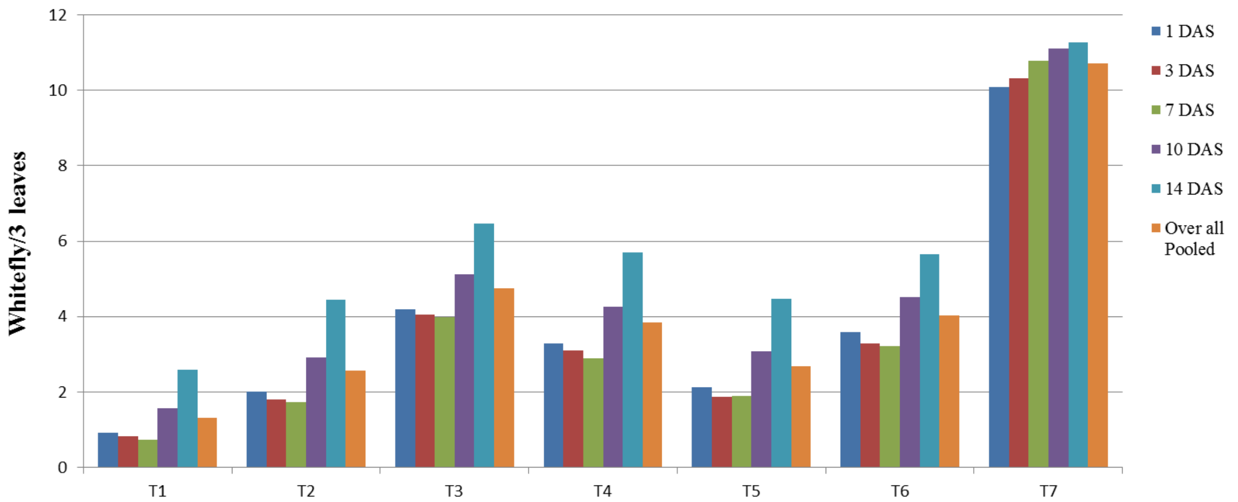
The average number of whitefly population estimated after three sprays presented in Table 2 and depicted in figure 2 revealed significant results among the treatments. The significantly lowest whitefly population was found in the treatment of imidacloprid 0.0044 per cent (1.32 whiteflies/3 leaves) which was followed by dimethoate 0.04 per cent (2.57 whiteflies/3 leaves) as well as chlorantraniliprole 0.0074 per cent recorded (2.68 whiteflies/3 leaves). The next effective treatment was emamectin benzoate 0.002 per cent recorded 3.84 whiteflies per three leaves and found similar with the result of indoxacarb 0.019 per cent (4.04 whiteflies/3 leaves). The comparatively higher number of whitefly was observed in the treatment of quinalphos 0.05 per cent (4.75 whiteflies /3 leaves) while, the highest number of whitefly was estimated in control plot (10.71 whiteflies/3 leaves).

In earlier findings Bharati and Shetgar (2016) [2] and Kumar *et al.* (2017) [9] reported superiority of imidacloprid against whitefly in brinjal, while Kumar and Kumar (2017) [8] found higher efficacy of imidacloprid against whitefly in okra, Kar (2017) [7] and Jha and Kumar (2017) [6] recorded superiority of imidacloprid in tomato. The above results reported different crops against whitefly but proved better which also found supports the present investigation.

Table 2: Bio-efficacy of various insecticides against whitefly in brinjal (Pooled 1st, 2nd and 3rd spray)

Treatments		Dose (gm/ml) in 10 lit. water	Mean population of whitefly/3 leaves on						Over all Pooled
			1 day before spraying	Days after 1st spraying					
				1	3	7	10	14	
T1	Imidacloprid 17.8 SL	02.50	7.93 (2.90)*	0.93 (1.20)	0.82 (1.15)	0.73 (1.11)	1.56 (1.43)	2.58 (1.75)	1.32 (1.286)
T2	Dimethoate 30 EC	13.20	7.87 (2.89)	2.00 (1.58)	1.80 (1.51)	1.73 (1.49)	2.91 (1.84)	4.44 (2.22)	2.57 (1.83)
T3	Quinalphos 25 EC	20.00	7.53 (2.82)	4.18 (2.14)	4.05 (2.12)	3.98 (2.11)	5.11 (2.37)	6.47 (2.64)	4.75 (2.70)
T4	Emamectin benzoate 5 SG	04.00	7.80 (2.87)	3.29 (1.94)	3.09 (1.89)	2.89 (1.84)	4.27 (2.18)	5.71 (2.49)	3.84 (2.32)
T5	Chlorantraniliprole 18.5 SC	04.00	7.67 (2.84)	2.13 (1.62)	1.87 (1.53)	1.89 (1.55)	3.07 (1.88)	4.47 (2.23)	2.68 (1.87)
T6	Indoxacarb 14.5 SC	13.33	7.73 (2.87)	3.58 (2.02)	3.29 (1.94)	3.22 (1.93)	4.51 (2.24)	5.65 (2.46)	4.04 (2.41)
T7	Untreated Control	--	7.67 (2.84)	10.09 (3.20)	10.31 (3.26)	10.78 (3.33)	11.11 (3.38)	11.29 (3.41)	10.71 (3.31)
S.E. ±		--	0.172	0.112	0.103	0.105	0.109	0.137	0.112
C.D. at 5%		--	N.S.	0.345	0.316	0.324	0.335	0.423	0.345
C.V. (%)		--	10.391	9.459	9.247	9.532	8.605	9.664	9.301

*Figures in parentheses are square root transformed values ($\sqrt{x + 0.5}$)
N.S.: Non-significant



T1 - Imidacloprid 0.0044 per cent T4- Emamectin benzoate 0.002 per cent
T2 - Diamethoate 0.04 per cent T5- Chorantraniliprole 0.0074 per cent
T3- Quinalphos 0.05 per cent T6- Indoxacarb 0.019 per cent
T7- Untreated Control

Fig 2: Bio-efficacy of various insecticides against whitefly in brinjal (Pooled 1st, 2nd and 3rd spray)

Conclusion

The present study concluded that among the seven treatments, all the insecticide treatments were more effective than control in reducing the Jassid, *Amrasca biguttula biguttula* and whitefly, *Bemisia tabaci* population and imidacloprid 0.0044 per cent was extremely effective to control of Jassid and whitefly population on brinjal.

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