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Relative efficacy of newer insecticides against sucking insect pests of brinjal (*Solanum melongena*)

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Abstract
Relative efficacy of different bio-pesticides and newer insecticides treatments against sucking insect pest on brinjal was evaluated in field condition at the Horticulture Farm of Rajasthan College of Agriculture, MPUAT, Udaipur during kharif from August 2015 to January 2016. The result showed that the three applications of Imidacloprid 17.8 SL (0.5 ml /lit) was found significantly most effective, which caused maximum population reduction per cent of sucking insect pest of brinjal aphid, 78.10, jassid, 76.55, and whitefly, 82.21 per cent. It was followed by fipronil 5 SC (1 ml /lit) with 74.00, 72.00, 74.37 and emamectin benzoate 5 SG (0.2 g/lit) with 70.82, 70.35, 71.00 per cent mean population reduction. NSKE 5 % was found least effective aphid, jassid and whitefly with 55.00, 53.82, 53.33 It was followed by azadiractin 3000 ppm was found least effective aphid, jassid and whitefly with 58.72, 59.75, 64.80 and Spinosad 0.1 ml /lit, was found least effective aphid, jassid and whitefly with 61.76, 69.69, 67.30 the treatments and caused lowest mean reduction population of aphid, jassid, whitefly. The highest marketable yield of 28.69 kg /plot was recorded in case of Imidacloprid 17.8 SL (0.5 ml /lit). It was followed by fipronil 5 SC (1 ml / lit), and emamectin benzoate 5 SG (0.2 g/lit), which yielded 27.69, 24.43 kg/plot and respectively. NSKE 5 %, azadiractin 3000 ppm, and Spinosad 0.1 ml /lit yielded the lowest marketable of 15.90, 18.06, 22.93 and 23.51kg/plot.

Keywords: Biopesticides, and newer insecticides sucking insect pest on brinjal

Introduction
Brinjal (*Solanum melongena* L.) also known as egg plant that belong to family Solanecae, is a rich source of minerals (calcium, magnesium, phosphorus, sodium, potassium, chlorine and iron), vitamins and also has some medicinal importance [1]. is native to India and an important vegetable crop grown throughout the world. The crop is infested by 26 species of insect pests and mites from germination to harvest [2]. the sap sucking insect and mite pests are cosmopolitan in distribution causing damage to the crop directly fruit infestation up to 70 per cent [3] 37.32 per cent [4] and 32.42 per cent [5] have been reported on this crop [6]. reported as 20 to 89 per cent losses due to infestation by the shoot and fruit borer, jassid, and aphid. Sucking pests also act as vectors of different diseases in brinjal such as little leaf by jassids and sooty mold by aphids and whiteflies. Conventional insecticides have been recommended for the management of sucking pests in brinjal but some of them have shown resistance to these pests besides causing environmental pollution. Highly effective newer insecticides with novel modes of action are being introduced in the market. These insecticides are required only in small quantities as compared to the conventional insecticides [7, 8]. Imidacloprid has been found effective against sucking pests in many commercial crops [9-11] another molecule.

Material and Methods
The investigation was carried out Horticulture Farm of Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* (August 2015 to January 2016). Geographically, Udaipur is located at 23.4 °N longitude and 75 °E latitude at an elevation of 579.5 MSL in the state of Rajasthan. The experiment was laid out on the evaluate relative efficacy of newer insecticides against sucking insect pests of brinjal. The total area of 10.8×21 m^2 was laid out in uniformly sized plots measuring 3.6 m x 3 m (10.8 m2) with 21 plots for experiments. The brinjal variety "Kavach" was used for the experiment. Five plants were randomly selected and tagged from each plot. The percentage infestation was work out on the number basis of populations of aphids, jassids and whiteflies were recorded from five randomly selected plants, 1 day before spray application and 3, 5 and 7 days after each spray.

Statistical analysis

The relative efficacy of different treatments against sucking insect pests was analyzed by analysis of variance. The population data were subjected to the [12]. Method to estimate the reduction in pest population after treatments as under:

$$\text{Per cent reduction in population} = 100\left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

Where,

T_a = Number of insects after treatment
T_b = Number of insects before treatment
C_a = Number of insects in untreated check after treatment
C_b = Number of insects in untreated check before treatment.

Result and Discussion

After two sprays of newer insecticides the treatment for the management of aphid, jassid and whitefly revealed that imidacloprid (0.5 ml /lit) was most effective followed by fipronil (1 ml /lit), emamectin benzoate (0.2 g/lit), and spinosad (0.1 ml /lit). The treatment azadiractin (3000 ppm) proved least effective. The maximum reduction per cent of aphid population was recorded in the treatment with imidacloprid (62.10) followed by fipronil (59.34) and emamectin benzoate (57.30). The minimum reduction was found to be in the plots treated with Spinosad (51.80), azadiractin (50.17) and NSKE (47.87).

The maximum reduction jassid population was recorded in the Imidacloprid (61.04) followed by fipronil (58.49) and emamectin benzoate (57.01) treated plots. The minimum reduction was found to be in the plots treated with Spinosad (56.59), azadiractin (50.63) and NSKE (47.19). Earlier, [13] and [10] reported that imidacloprid was most effective against aphids, thrips, and jassids. The better efficacy of imidacloprid in the present trial confirms to the findings of [14].

The maximum reduction of whiteflies population was recorded in the Imidacloprid treatment (65.06) followed by fipronil (59.58) and emamectin benzoate (57.42) treated plots. The minimum reduction was found in the plots treated with spinosad (55.12), azadiractin (53.61) and NSKE (48.83). [15]. reported that imidacloprid 17.8 % SL (55.45%) was highly effective followed by Triazophos 40 EC (54.19 %). Combination treatments like azadiractin + thiamethoxam, azadiractin + imidacloprid, azadiractin + Triazophos and azadiractin + spinosad showed moderate efficacy and azadiractin at 1500 ppm (43.26 %) was the least effective. and emamectin benzoate 5SG @ 125 g/ha, spinosad 45SC @ 160 ml/ha less effective against whitefly (*Bemisia tabaci*). And maximum reduction of jassid, *Amrasca biguttula biguttula* (Ishida) and whitefly, *Bemisia tabaci* (Genn.) in the imidacloprid (90.04%, 91.52%) and acephate (87.80%, 89.71%) treatments, respectively. Karkar *et al* (2014) reported that the spray of Neem seed kernel extract (NSKE) @ 5% and Neem oil @ 0.3% were effective against sucking pests (aphid, leaf hopper and whitefly).

The fruit yield was maximum (28.69 kg /plot) in the treatment of imidacloprid. The yield was minimum (18.06 kg /plot) in NKSE treatment. The fruit yield drastically reduced in untreated check plots (15.90 kg /plot).

The descending order of effectiveness of treatments on the basis of mean pest population reduction was: imidacloprid > fipronil > emamectin benzoate > spinosad >azadiractin > NSKE.

Table 1: Relative efficacy of newer insecticides against aphids

S. No.	Treatments.	Dose/ lit.	PTP/ plant	Mean reduction in aphids population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5DAS	7DAS
T_1	Emamectin benzoate 5 SG	0.2 g/lit	3.67 (13.00)	50.78 (60.02)	54.94 (67.00)	53.13 (64.00)	55.55 (68.00)	57.30 (70.82)	55.66 (68.18)
T_2	Imidacloprid 17.8 SL	0.5 ml /lit	3.81 (14.00)	58.30 (72.39)	61.35 (77.02)	60.15 (75.23)	60.82 (76.24)	62.10 (78.10)	60.31 (75.47)
T_3	Fipronil 5 SC	1 ml /lit	3.63 (12.66)	53.56 (64.72)	56.22 (69.09)	54.93 (66.98)	55.86 (68.50)	59.34 (74.00)	56.80 (70.01)
T_4	Spinosad 45 SC	0.1 ml /lit	3.49 (11.49)	48.45 (56.01)	50.78 (60.01)	49.56 (57.92)	51.44 (61.15)	51.80 (61.76)	50.82 (60.10)
T_5	Azadiractin (Margosan1%)	3000 ppm	3.54 (12.00)	43.47 (47.33)	48.45 (56.01)	45.19 (50.33)	49.23 (57.36)	50.02 (58.72)	50.17 (58.97)
T_6	NSKE	5%	3.81 (13.99)	41.17 (43.33)	41.55 (44.00)	41.55 (44.00)	45.00 (50.00)	47.87 (55.00)	46.72 (53.00)
T_7	Untreated control (water spray)	-	3.92 (14.85)	-	-	-	-	-	-
	S. Em +_	-	0.134	1.030	1.215	1.129	1.085	1.276	1.179
	CD at 5%	-	0.413	3.247	3.829	3.556	3.418	4.021	3.716

* Figure in parentheses is retransformed per cent values.
DAS: Days after spray

Table 2: Relative efficacy of newer insecticides against jassid

S. No.	Treatments.	Dose/ lit.	PTP/ plant	Mean reduction in jassids population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5DAS	7DAS
T_1	Emamectin benzoate 5 SG	0.2 g/lit	2.41 (5.33)	49.61 (58.00)	53.73 (65.00)	54.33 (66.00)	55.79 (68.39)	57.01 (70.35)	54.04 (65.52)
T_2	Imidacloprid 17.8 SL	0.5 ml /lit	2.74 (7.00)	56.08 (68.85)	59.12 (73.66)	57.96 (71.86)	59.42 (74.11)	61.04 (76.55)	59.19 (73.77)
T_3	Fipronil 5 SC	1 ml /lit	2.55 (6.00)	52.46 (66.87)	55.08 (67.23)	56.19 (69.04)	56.97 (70.28)	58.05 (72.00)	58.49 (72.69)
T_4	Spinosad 45 SC	0.1 ml /lit	2.61 (6.33)	46.72 (53.00)	48.83 (56.67)	46.92 (53.34)	50.37 (59.32)	56.59 (69.69)	52.93 (63.67)
T_5	Azadiractin (Margosan1%)	3000 ppm	2.34 (5.00)	45.57 (51.00)	45.96 (51.67)	45.00 (50.00)	48.56 (56.20)	50.63 (59.75)	49.85 (58.43)
T_6	NSKE	5%	2.46 (5.55)	43.92 (48.11)	45.19 (50.33)	43.85 (48.00)	45.85 (51.49)	47.19 (53.82)	45.00 (50.00)
T_7	Untreated control (water spray)	-	3.09 (9.08)						
	S. Em +_	-	0.156	0.757	1.059	1.066	1.220	0.736	0.809
	CD at 5%	-	0.479	2.387	3.337	3.360	3.844	2.321	2.548

* Figure in parentheses is retransformed per cent values.
DAS: Days after spray

Table 3: Relative efficacy of newer insecticides against whiteflies

S. No.	Treatments.	Dose/ lit.	PTP/ plant	Mean reduction in whiteflies population (%)					
				First spray			Second spray		
				3 DAS	5 DAS	7 DAS	3 DAS	5DAS	7DAS
T_1	Emamectin benzoate 5 SG	0.2 g/lit	3.76 (13.00)	51.17 (60.68)	53.54 (64.68)	54.94 (67.00)	54.34 (66.02)	57.42 (71.00)	54.94 (67.00)
T_2	Imidacloprid 17.8 SL	0.5 ml /lit	3.63 (12.66)	59.82 (74.72)	62.99 (79.37)	61.54 (77.30)	63.49 (80.08)	65.06 (82.21)	62.06 (78.05)
T_3	Fipronil 5 SC	1 ml /lit	3.81 (14.00)	55.19 (67.42)	57.85 (71.68)	58.29 (72.38)	58.83 (73.22)	59.58 (74.37)	58.34 (72.45)
T_4	Spinosad 45 SC	0.1 ml /lit	3.49 (11.66)	47.50 (54.35)	52.14 (62.34)	53.28 (64.25)	53.87 (65.23)	55.12 (67,30)	53.22 (61.83)
T_5	Azadiractin (Margosan1%)	3000 ppm	3.54 (12.00)	46.34 (52.33)	50.38 (59.34)	50.64 (59.77)	51.15 (60.65)	53.61 (64.80)	50.17 (58.97)
T_6	NSKE	5%	3.81 (13.99)	45.77 (51.34)	48.83 (56.67)	46.91 (53.33)	43.47 (47.33)	46.91 (53.33)	48.06 (55.33)
T_7	Untreated control (water spray)	-	3.92 (14.85)	-	-	-	-	-	-
	S. Em +_	-	0.134	0.838	1.116	0.875	1.152	1.206	1.441
	CD at 5%	-	0.413	2.641	3.515	2.757	3.629	3.801	4.541

* Figure in parentheses is retransformed per cent values.
DAS: Days after spray

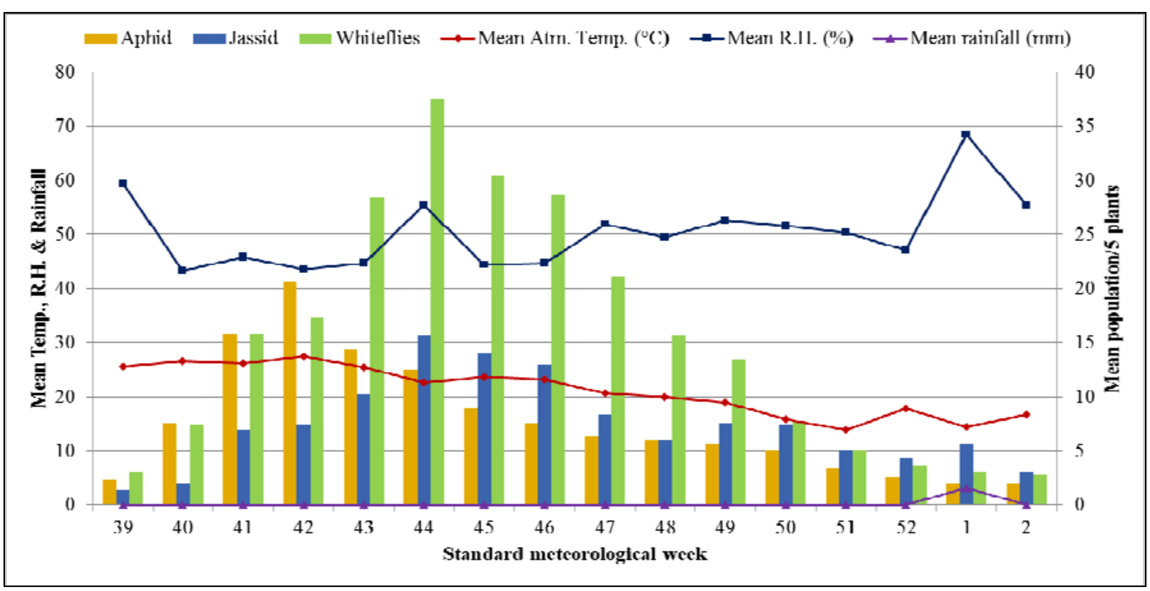

Fig 2: Influence of abiotic factors on the incidence of sucking insect pests of brinjal

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