

Bio-efficacy of bio-pesticides against jassid, *Empoasca kerri*, Pruthi infesting groundnut

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ABSTRACT

An experiment was conducted to evaluate the bio-efficacy of bio-pesticides against jassid, *Empoasca kerri* Pruthi infesting groundnut at Instructional Farm, College of Agriculture, Junagadh during Summer season of 2014-15. The results revealed that thiamethoxam 0.01 per cent and acetamiprid 0.004 per cent were found most effective treatments against the pest. Among the bio-pesticides, combination of *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent was found most effective against jassid. While the combinations of *V. lecanii* @ 1.0 kg/ha + thiamethoxam 0.005 per cent was found moderately effective against jassid. Thiamethoxam 0.01 per cent recorded the highest pod yield of groundnut (1344 kg/ha) followed by acetamiprid 0.004 per cent (1275 kg/ha). As far as economics of various insecticides are concerned, thiamethoxam 0.01 per cent gave the highest cost benefit ratio (1:17.82) followed by *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent (1:13.96).

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the major oilseed crops cultivated in 7.9 million ha, contributing 45 per cent of oilseed production in India. Among the major groundnut growing states, Gujarat occupies an area of about 18.43 lakh hectare with production of 49.17 lakh ton and productivity of 2668 kg/ha during 2013-2014 (Anonymous, 2014). Groundnut oil is considered as stable and nutritive as it contains just the right proportion of oleic and linoleic acids. The kernels

contains up to 50 per cent of a non drying oil, 40-50 per cent fat, 20-50 per cent protein and 10-20 per cent carbohydrate (Mehta, 2002). More than 100 species of insect and mites are known to attack groundnut (Nandagopal, 1992). Among the various insect pests attacking this crop, jassid commonly known as leaf hopper, causes extensive damage and it is found to be serious on groundnut crop. Leaf hoppers are the major pest of importance on groundnut crop specially when raised under summer conditions and bunch varieties are severely infested (David and Ramamurthy, 2011).

Leafhoppers suck the sap from the leaves and petioles and mainly it prefers the first three terminal leaves and feeding symptoms induce yellowing of foliage that begins at the tip, known as hopper burn (Khan and Hussain, 1965). A heavy infestation on young plants causes stunting and leaf tip turn yellow with a typical 'v-shape' marking. On close examination of infected plants, nymphs can be seen on the underside of infected plants.

Perusal of literature reveals that insecticidal recommendations are available for protecting this crop against this pest, but they are highly toxic to the natural enemies and cause environmental pollution. For managing sucking insects, entomopathogenic fungi are appropriate microbial agents as they infect the insect cuticle directly through contact and do not require to be ingested for infection to set in. In India, pathogenicity of *Beauveria bassiana* has been reported to *Empoasca kerri* on bean leaf surface under field condition (Magalhaes *et al.*, 1988). Since the biocontrol is the major component of in Integrated Pest management, it was felt necessary to evaluate some safer pesticides, *B. bassiana* and *Verticillium lecanii* for their efficacy against Groundnut jassid.

MATERIAL AND METHODS

With a view to test the bio-efficacy of bio-pesticides against jassid, *E. kerri*, a field trial was conducted during summer season of 2014-15 at Instructional Farm, College of Agriculture, Junagadh on groundnut variety GG-2. Ten treatments were tested in Randomized Block Design with three replications. The crop was sown at the spacing of 30 cm x 10 cm having gross and net plot size of 5.0 m x 2.4 m and 4.0 m x 1.8 m, respectively. All the recommended agronomical practices were followed for raising the crop. All the pesticides were applied in the form of foliar spray with the help of knapsack sprayer. First sprays was carried out at the time of substantial population of jassids, followed by second sprays at 15 days after first sprays. Ten plants were randomly selected from each net plot by examining three quadrifoliate leaves per plants (top, middle and bottom regions of plant). Observations of jassid were recorded before 24 hours and 1, 3, 5, 7 and 9 days after spray from each treatment. The data on population of jassid was converted into per cent mortality by using a modified formula given by Henderson and Tilton (1955).

Table 1 : Bio-efficacy of different insecticides against jassid infesting groundnut after first spray

Sr. No.	Treatments	Per cent mortality of jassid				
		1DAS	3DAS	5DAS	7DAS	9DAS
1.	<i>Verticillium lecanii</i> @ 2.0 kg/ha	24.27 (16.89)	25.44 (18.46)	26.82 (20.35)	29.66 (24.48)	30.62 (29.95)
2.	<i>Beauveria bassiana</i> @ 2.5 kg/ha	26.30 (19.63)	27.93 (21.93)	28.63 (22.96)	31.84 (27.83)	32.06 (28.18)
3.	Thiamethoxam 25 WG 0.01%	66.60 (84.22)	64.15 (80.99)	61.93 (77.86)	56.21 (69.08)	52.61 (63.12)
4.	Acetamiprid 25 SP 0.004%	60.49 (75.73)	60.14 (75.21)	57.37 (70.93)	54.43 (66.16)	51.24 (60.81)
5.	<i>V. lecanii</i> @ 1.0 kg/ha + Thiamethoxam 25 WG 0.005%	37.50 (37.05)	36.80 (35.89)	35.94 (34.45)	37.64 (37.30)	37.22 (36.58)
6.	<i>V. lecanii</i> @ 1.0 kg/ha + Acetamiprid 25 SP 0.002%	34.52 (32.11)	34.11 (34.44)	32.86 (29.44)	34.18 (31.56)	34.78 (32.54)
7.	<i>B. bassiana</i> @ 1.25 kg/ha + Thiamethoxam 25 WG 0.005%	39.88 (41.11)	39.49 (40.44)	37.72 (37.44)	40.06 (41.42)	39.70 (40.80)
8.	<i>B. bassiana</i> @ 1.25 kg/ha + Acetamiprid 25 SP 0.002%	36.43 (35.26)	34.93 (32.78)	34.38 (31.88)	35.34 (33.46)	36.21 (34.89)
9.	Azadirachtin @ 0.000375%	29.09 (23.64)	29.45 (24.18)	30.71 (26.08)	33.84 (31.01)	33.74 (30.84)
	S.E. ±	1.97	2.00	2.00	1.99	2.05
	C.D. (P=0.05)	5.89	6.00	6.00	5.97	6.15
	C.V. %	8.63	8.85	9.01	8.79	9.19

Arcsine transformation

Figures in parentheses () original values

DAS-Days after spraying

RESULTS AND DISCUSSION

Data presented in Table 1 indicated that the differences in mortality per cent of jassid in different treatments after 1, 3, 5, 7 and 9 days of spraying was found statistically significant. After one days of insecticidal spray, azadirachtin @ 0.000375 per cent recorded 23.64 per cent mortality of jassid which was statistically at par with *B. bassiana* @ 2.5 kg/ha (19.63 %). Whereas, *V. lecanii* @ 2.0 kg/ha recorded the least mortality (16.89 %). In case of chemical insecticides,

thiamethoxam 0.01 per cent recorded the highest mortality of jassid (84.22 %) followed by acetamiprid 0.004 per cent that recorded 75.73 per cent mortality of jassid after one days of spraying. After one days of insecticidal spray, *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent was found the most effective which showed 41.11 per cent mortality and it was statistically at par with *V. lecanii* @ 1.0 kg/ha + thiamethoxam 0.005 per cent and *B. bassiana* @ 1.25 kg/ha + acetamiprid 0.002 per cent which showed 37.05

Table 2 : Bio-efficacy of different insecticides against jassid infesting groundnut after second spray						
Sr. No.	Treatments	Per cent mortality of jassid				
		1DAS	3DAS	5DAS	7DAS	9DAS
1.	<i>Verticillium lecanii</i> @ 2.0 kg/ha	25.36 (18.34)	25.83 (18.98)	27.42 (21.20)	29.69 (24.38)	29.54 (24.30)
2.	<i>Beauveria bassiana</i> @ 2.5 kg/ha	26.11 (19.36)	27.77 (21.71)	28.64 (22.97)	31.98 (28.06)	32.89 (29.48)
3.	Thiamethoxam 25 WG 0.01%	66.57 (84.19)	62.48 (78.66)	59.61 (74.41)	55.42 (67.78)	52.96 (63.71)
4.	Acetamiprid 25 SP 0.004%	61.79 (77.66)	59.58 (74.36)	56.39 (69.35)	54.19 (65.76)	51.82 (61.79)
5.	<i>V. lecanii</i> @ 1.0 kg/ha + Thiamethoxam 25 WG 0.005%	36.22 (34.91)	36.74 (35.78)	36.23 (34.93)	38.13 (38.13)	37.79 (37.55)
6.	<i>V. lecanii</i> @ 1.0 kg/ha + Acetamiprid 25 SP 0.002%	34.69 (32.39)	33.80 (30.94)	32.23 (28.44)	34.47 (32.03)	33.57 (30.57)
7.	<i>B. bassiana</i> @ 1.25 kg/ha + Thiamethoxam 25 WG 0.005%	40.33 (41.88)	39.13 (39.83)	37.62 (37.27)	39.41 (40.31)	39.30 (40.11)
8.	<i>B. bassiana</i> @ 1.25 kg/ha + Acetamiprid 25 SP 0.002%	36.23 (34.94)	29.68 (24.51)	34.48 (32.05)	34.35 (31.84)	35.86 (34.32)
9.	Azadirachtin @ 0.000375%	27.92 (21.93)	29.60 (24.40)	30.39 (25.59)	33.24 (30.05)	33.54 (30.53)
	S.E. ±	1.85	1.80	1.81	1.84	1.86
	C.D. (P=0.05)	5.56	5.41	5.43	5.53	5.56
	C.V. %	8.14	8.16	8.23	8.19	8.33

Arcsine transformation

Figures in parentheses () original values

DAS-Days after spraying

Table 3 : Economics of different treatments for the control of jassid on groundnut					
Sr. No.	Treatments	Yield (kg/ha)	Gross realization (Rs./ha)	Net realization (Rs./ha)	C:B ratio (CBR)
1.	<i>Verticillium lecanii</i> @ 2.0 kg/ha	832	49875	4545	1: 3.78
2.	<i>Beauveria bassiana</i> @ 2.5 kg/ha	833	49900	4570	1: 3.32
3.	Thiamethoxam 25 WG 0.01%	1344	80775	35445	1: 17.82
4.	Acetamiprid 25 SP 0.004%	1275	76790	31460	1: 8.35
5.	<i>V. lecanii</i> @ 1.0 kg/ha + Thiamethoxam 25 WG 0.005%	1065	63925	18595	1: 11.66
6.	<i>V. lecanii</i> @ 1.0 kg/ha + Acetamiprid 25 SP 0.002%	946	56885	11555	1: 4.65
7.	<i>B. bassiana</i> @ 1.25 kg/ha + Thiamethoxam 25 WG 0.005%	1145	68800	23470	1: 13.96
8.	<i>B. bassiana</i> @ 1.25 kg/ha + Acetamiprid 25 SP 0.002%	995	59805	14475	1: 5.63
9.	Azadirachtin @ 0.000375%	948	56985	11655	1: 5.72
10.	Control	755	45330	--	--

and 35.26 per cent mortality of jassid, respectively. Whereas, *V. lecanii* @ 1.0 kg/ha + acetamiprid 0.002 per cent showed 32.11 per cent mortality of jassid. More or less similar observations were recorded on 3, 5, 7 and 9 days of insecticidal spraying.

Critical examination of the data on per cent mortality of jassid at different interval after both the sprays indicated that bio-pesticides alone were found least effective against jassid up to three days of application. However, these bio-pesticides recorded comparatively higher per cent mortality of jassid after seven and nine days of application. So, both the fungal bio-pesticides alone showed increasing trend in the pest mortality with the duration. Similar trend in mortality of this pest in different treatments was observed in second spray (Table 2). The present investigations are in confirmation with the results of Magalhaes *et al.* (1988) and Karena (2012) who reported that *B. bassiana* @ 2.0 kg/ha and *V. lecanii* @ 2.0 kg/ha were found effective against jassid, *E. kerri*. The present findings are also concurrence with the results of Saradava (2004) and Sutaria *et al.* (2010) who suggested that the thiamethoxam 0.05 per cent and acetamiprid 0.004 per cent were found the most effective against *E. kerri* on groundnut and soybean, respectively.

Data presented in (Table 3) indicated that the pod yield of groundnut in different treatments was significantly higher over control. The highest pod yield (1344 kg/ha) was obtained from the treatment of thiamethoxam 0.01 per cent which was followed by acetamiprid 0.004 per cent (1275 kg/ha). The pod yield data of various combinations of bio-pesticides with insecticides was found highest in the treatment combination of *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent (1145 kg/ha) and *V. lecanii* @ 1.0 kg/ha + thiamethoxam 0.005 per cent (1065 kg/ha). The bio-pesticides alone were not much effective and recorded the yield to the tune of 948 to 832 kg/ha.

Two applications of thiamethoxam 0.01 per cent gave the maximum net realization (Rs. 35445) followed by acetamiprid 0.004 per cent (Rs./ha 31460), *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent (Rs./ha 23470), *V. lecanii* @ 1.0 kg/ha + thiamethoxam 0.005 per cent (Rs./ha 18595), *B. bassiana* @ 1.25 kg/ha + acetamiprid 0.002 per cent (Rs./ha 14475) and *V.*

lecanii @ 1.0 kg/ha + acetamiprid 0.002 per cent (Rs./ha 11555). Based on cost benefit ratio, it was superior in thiamethoxam 0.01 per cent (1:17.82), followed by *B. bassiana* @ 1.25 kg/ha + thiamethoxam 0.005 per cent (1:13.96), *V. lecanii* @ 1.0 kg/ha + thiamethoxam 0.005 per cent (1:11.66) and acetamiprid 0.004 per cent (1:8.35).

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