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RESEARCH ARTICLE

Seasonal incidence and efficacy of certain low risk insecticides against *Amarasca devastans* distant on brinjal

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ABSTRACT

A field experiment was conducted to study the seasonal incidence and efficacy of certain low risk newer insecticides against *Amarasca devastans* on brinjal. The peak incidence of *A. devastans* was recorded during last week of October 2011 and in which the incidence had non-significant relationship with abiotic factors like maximum temperature, minimum temperature, relative humidity and rainfall but significant relationship with biotic factors like coccinellid beetles as well as spiders. Regarding the efficacy of insecticides, the results indicated that new group of insecticides like neonicotinoids showed higher efficacy in controlling *A. devanstans* population. Among all the treatments, imidacloprid 17.8 % SL and thiamethoxam 25 WG were highly effective in reducing the population of *A. devastans* on brinjal. Other combination treatments like azadirachtin + imidacloprid, azadirachtin + thiamethoxam, azadirachtin + spisosad, and azadirachtin + triazophos showed moderate efficacy in reducing the *A. devastans* population.

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INTRODUCTION

Brinjal (*Solanum melongena* L.) occupies a distinct place in the realm of vegetable crops being most popular and important vegetable crops grown in India and many parts of the world. It is popularly known as common man's vegetable. A variety of white brinjal is said to be good for diabetic patients for its medicinal properties. Among various constraints in the higher production of brinjal, it is infested by a large number of insect pests including shoot and fruit borer (*L. orbonalis*), leaf hopper (*A. devastans*) and whitefly (*Bemisia tabaci*), resulting in about 70 - 92 per cent loss in yield of brinjal (Rosaiah, 2001). Extensive use of second generation conventional insecticides to control the pests led to the development of resistance and resurgence in the target species and ecological disturbances. Therefore, the present day need emphasizes not only the use of different groups of chemicals that are eco-friendly but also give satisfactory control of insect pest population by their novel mode of action. Study on the seasonal incidence of *A. devastans* throughout the crop period in relation to abiotic and biotic factors gives basic information on population dynamics of *A. devastans* of brinjal. Hence this study was undertaken.

MATERIAL AND METHODS

The experiment was carried out under field conditions at the vegetable research farm of Institute of Agricultural Sciences, BHU, Varanasi on brinjal variety Punjab Barsati. For seasonal incidence study, 35 days old seedlings were transplanted in a bulk plot of 100 m^2 by adopting 75 cm x 50 cm

spacing. The insect population was recorded at weekly intervals from 25 plants from five random sampling spots in the bulk plot and each spot was having five plants. Meteorological data were collected and correlated the pest incidence with abiotic and biotic factors. For studying insecticides efficacy, field trail was laid out in RBD with 10 treatments including untreated control and replicated thrice. Plot size of 4 x 3 m was prepared and each plot was separated by a gap of 0.75 m for reducing drifting of insecticides during insecticidal spraying.

Insecticide molecules that are known to have novel mode of action *viz.*, spinosad, thiamethoxam, imidacloprid, triazophos and a neem oil formulation having azadirachtin 1500 ppm were tested at their respective recommended field concentrations alone and in combination with azadirachtin at half the dose of their respective field concentrations. A total of three insecticidal applications were given during crop growth period and these applications were given whenever needed. The pest incidence was recorded on one day before spraying as pre-treatment count and on one, five and ten days after spraying as post treatment counts. The *A. devastans* population of both nymphs and adults were counted during early morning hours on six leaves (2 each from top, middle and bottom canopy) from each of the 5 selected and tagged plants. The per cent field efficacy was calculated using Henderson and Tiltons formula.

RESULTS AND DISCUSSION

Seasonal incidence studies revealed that the initial population of *A. devastans* was noticed during the second week of October at 7 days after transplantation and thereafter, the population gradually increased from 8.08 to 68.24 per six leaves. The population of coccinellids and spiders during the peak incidence were 2.48 and 1.84 per plant, respectively. Peak incidence of *A. devastans* was observed during last week of October with a population of 68.24 per six leaves and thereafter declined gradually. These results were in accordance with Anitha and Nandinhalli (2008). Correlation studies showed that *A. devastans* population had non-significant relation with abiotic factors like maximum temperature (r = 0.054), minimum temperature (r = 0.062, relative humidity (r = - 0.339) and rain fall (r = - 0.483) but significant relationship with and coccinellid beetles (r = 0.916) as well as spiders (r = 0.973). The results of present study were in close agreement with Naik *et al*. (2009).

Regarding the field efficacy of insecticides against *A. devastans*, three sprays given in total as and when required and the results obtained are described below:

First insecticidal spray :

The *A. devastans* population varied from 4.62 – 5.64 in various test plots before first insecticidal spray. One day after spraying, among the all treatments imidacloprid 17.8% SL was observed to be effective compared to all other treatments by recording the highest field efficacy (51.11) followed by thiamethoxam (51.04). After fifth day of spray per cent field efficacy was again recorded to be highest with imidacloprid (79.37) treated plots followed by thiamethoxam (79.17) and triazophos (73.50). Even after 10th day the per cent field efficacy was continued to be highest in imidacloprid (66.18) treated plots followed by thiamethoxam (65.67). The mean efficacy of insecticides after 10th day of treatment in different plots varied from 37.16 - 66.18 (Table 1).

The data on overall mean efficacy of insecticidal

Table 1: Field efficacy of various insecticidal treatments on field population of *A. devastans* on brinjal (1st insecticidal spray)

Sl. No.	Treatments	Mean no. of population per six leaves before spray	* Mean population per six leaves and per cent field efficacy at different days after first insecticidal spray			
			1 day after spray	5 days after spray	10 days after spray	Over all mean
1.	Azadirachtin 1500 ppm	4.95	4.12 (20.05)	3.10 (41.19)	3.42 (37.16)	3.54 (32.80)
2.	Thiamethoxam 25 WG	5.14	2.62 (51.04)	1.13 (79.17)	1.94 (65.67)	1.89 (65.29)
3.	Imidacloprid 17.8% SL	5.03	2.56 (51.11)	1.08 (79.37)	1.87 (66.18)	1.83 (65.53)
4.	Spinosad 45 SC	5.37	3.82 (31.87)	2.54 (55.58)	3.12 (47.16)	3.16 (44.80)
5.	Triazophos 40 EC	5.21	2.78 (48.74)	1.47 (73.50)	2.12(62.19)	2.12 (61.74)
6.	Azadirachtin + Thiamethoxam	5.28	3.14 (42.87)	1.83 (67.45)	2.56 (55.90)	2.51 (55.40)
7.	Azadirachtin + Imidacloprid	4.98	2.94 (43.29)	1.62 (69.45)	2.34 (57.26)	2.30 (56.66)
8.	Azadirachtin + Spinosad	4.84	3.98 (21.01)	2.98 (42.18)	3.34 (37.24)	3.43 (33.47)
9.	Azadirachtin + Triazophos	5.64	3.48 (40.73)	2.08 (65.36)	2.98 (51.94)	2.84 (52.60)
10.	Untreated control	4.62	4.81	4.92	5.08	4.93
11.	SEm ±	–	(0.64)	(0.40)	(0.31)	–
12.	C.D. (P=0.05)	–	(1.90)	(0.92)	(1.20)	–

*Mean of three replications, Figures in parenthesis are per cent field efficacy values

treatments after first round of applications revealed that imidacloprid spray (65.53) was found to be superior to other treatments. The treatments thiamethoxam (65.29), triazophos (61.74), Azadirachtin + imidacloprid (56.66) and Azadirachtin + thiamethoxam (55.40) were also effective in reducing pest population.

The number of *A. devastans* population after first insecticidal treatments gradually reduced in all the treatments. These results were due to imidacloprid and thiamethoxam that are new broad spectrum neonicotinoids with high insecticidal activity against sucking pests (Samal and Patnaik, 2008).

Second insecticidal spray :

The mean field efficacy of the selected insecticidal treatments along with control after second spray has been presented in Table 2. The data recorded on one day after second spray applications indicated that imidacloprid showed highest field efficacy of 59.06 than other treatments. Plots treated with Azadirachtin 1500 ppm exhibited least effective in reducing *A. devastans* population. After fifth day of insecticidal sprays, the mean efficacy of various insecticidal treatments varied from 45.93 – 75.58. The per cent field efficacy was highest in imidacloprid (75.58) followed by thiamethoxam (75.56) treatment.

Table 2 : Field efficacy of various insecticidal treatments on field population of *A. devastans* on brinjal (2nd insecticidal spray)

Sr. No.	Treatments	Mean no. of population per six leaves before spray	* Mean population per six leaves and per cent field efficacy at different days after second insecticidal spray			
			1 day after spray	5 days after spray	10 days after spray	Over all mean
1.	Azadirachtin 1500 ppm	5.44	3.65 (33.67)	3.11 (45.93)	3.32 (45.68)	3.35 (41.76)
2.	Thiamethoxam 25 WG	3.96	1.65 (58.81)	1.02 (75.56)	1.44 (67.63)	1.37 (67.33)
3.	Imidacloprid 17.8% SL	3.84	1.59 (59.06)	0.98 (75.58)	1.38 (68.00)	1.31 (68.61)
4.	Spinosad 45 SC	5.14	3.35 (35.57)	2.58 (52.30)	2.62 (54.63)	2.85 (47.50)
5.	Triazophos 40 EC	4.14	1.81 (56.78)	1.37 (68.60)	1.61 (65.38)	1.59 (63.56)
6.	Azadirachtin + Thiamethoxam	4.58	2.17 (46.83)	1.73 (64.16)	1.98 (61.52)	1.96 (57.50)
7.	Azadirachtin + Imidacloprid	4.36	1.97 (55.33)	1.52 (66.92)	1.83 (62.24)	1.77 (61.63)
8.	Azadirachtin + Spinosad	5.36	3.51 (35.00)	2.82 (50.58)	3.08 (48.85)	3.13 (44.64)
9.	Azadirachtin + Triazophos	5.00	3.01 (44.48)	2.12 (62.47)	2.40 (60.14)	2.51 (55.69)
10.	Untreated control	5.18	5.24	5.46	5.82	5.50
11.	SEm ±	–	(0.38)	(0.51)	(0.73)	–
12.	C.D. (P=0.05)	–	(1.12)	(1.52)	(2.18)	–

* Mean of three replications, Figures in parenthesis are percent field efficacy values

Table 3: Field efficacy of various insecticidal treatments on field population of *A. devastans* on brinjal (3rd insecticidal spray)

Sr. No.	Treatments	Mean no. of population per six leaves before spray	* Mean population per six leaves and per cent field efficacy at different days after third insecticidal spray			
			1 day after spray	5 days after spray	10 days after spray	Over all mean
1.	Azadirachtin 1500 ppm	4.30	3.16 (30.47)	2.60 (44.65)	2.90 (39.64)	2.88 (38.25)
2.	Thiamethoxam 25 WG	2.42	1.24 (51.52)	0.69 (73.90)	1.02 (62.28)	0.98 (62.56)
3.	Imidacloprid 17.8% SL	2.30	1.08 (55.57)	0.65 (74.13)	0.98 (61.86)	0.90 (63.85)
4.	Spinosad 45 SC	3.60	2.26 (40.60)	1..68 (57.28)	2.14 (46.80)	2.02 (48.20)
5.	Triazophos 40 EC	2.59	1.32 (48.12)	0.87 (69.25)	1.29 (55.42)	1.16 (57.59)
6.	Azadirachtin + Thiamethoxam	2.96	1.78 (43.10)	1.08 (66.60)	1.57 (52.53)	1.47 (54.07)
7.	Azadirachtin + Imidacloprid	2.81	1.58 (46.80)	0.97 (68.40)	1.42 (54.77)	1.32 (56.65)
8.	Azadirachtin + Spinosad	4.06	2.62 (38.94)	1.92 (56.71)	2.45 (45.99)	2.33 (47.21)
9.	Azadirachtin + Triazophos	3.38	2.12 (40.65)	1.42 (61.54)	1.99 (47.31)	1.84 (49.83)
10.	Untreated control	5.62	5.94	6.14	6.28	6.12
11.	SEm ±	–	(0.72)	(0.68)	(0.47)	–
12.	C.D. 5%	–	(2.16)	(2.04)	(1.42)	–

* Mean of three replications, Figures in parenthesis are percent field efficacy values

After 10th day of application imidacloprid recorded as high as 68.61 per cent field efficacy and thiamethoxam (67.33) stood next in the order of efficacy. The overall mean per cent field efficacy after second insecticidal sprays indicated that imidacloprid treated plots showed higher mean efficacy and out of 10 treatments, Azadirachtin showed lower field efficacy in reducing *A. devastans* population. The overall mean efficacy highest observed in imidacloprid (68.61) treated plots. The next best were thiamethoxam (67.33) and triazophos (63.56) which also showed higher efficacy on *A. devastans*. This was probably due to its good contact and stomach action and it was strongly supported by Muthukumar and Kalyanasundaram (2003).

Third insecticidal spray :

The mean population per five plants in various test plots before third insecticidal spray was observed to be varying between 2.42 and 5.62, including untreated control (Table 3). One day after third spraying, imidacloprid and thiamethoxam showed as high as 55.57and 51.52 per cent field efficacy to other treatments, respectively. The observations on per cent field efficacy in various test plots receiving selected treatments and their combinations on fifth day and tenth day after spraying also exhibited the same trend of supremacy of imidacloprid and thiamethoxam treatments compared to others indicating as promisive treatments in reducing pest population significantly. After fifth day of treatment as high as 74.13 and 73.90 per cent efficacy was recorded with plots receiving imidacloprid and thiamethoxam sole treatments, respectively. Sole treatment of Azadirachtin 1500 ppm recorded only 44.65 per cent field efficacy after fifth day of third insecticidal treatments. The per cent field efficacy of thiamethoxam on 10th day after third insecticidal sprays was highest recording 62.28 followed by imidacloprid treatment recording 61.86 per cent field efficacy.

Thus, the overall mean per cent field efficacy after three sprays was recorded to be highest with imidacloprid (63.85) treated plots followed by thiamethoxam (62.56). The per cent field efficacy in other insecticidal treated plots were triazophos (57.59), azadirachtin + imidacloprid (56.65), azadirachtin + thiamethoxam (54.07), azadirachtin + triazophos (49.83), spinosad (48.20), azadirachtin + spinosad (47.21), azadirachtin (38.25). Among all the treatments, azadirachtin was found least effective against *A. devastans* compared to other treatments and these results are in accordance with Sarangdevot *et al*. (2006) on brinjal.

After three sprays of insecticides as sole and combination treatments it was observed that the combination treatments have showed only a moderate degree of field efficacy against shoot and fruit borer. Such low efficacy of combination treatments against shoot and fruit borer could be attributed to employing half the dose of recommended concentrations of both the combination insecticides as compared to field recommended doses of sole application of these insecticides. Also, the synergistic effect of these combination treatments could not be effective due to the habit and nature of damage of the pest as internal borer. However, the combination treatments showed significantly more per cent reduction of shoot damage over control. These results were in conformity with studies of Naik *et al*. (2009).

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