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Population Density of Cotton Whitefly *Bemisia tabaci* and Mites *Tetranychus urticae* on Brinjal and Their Chemical Control

[1]Farman Ali, [2]Hayat Badshah, [3]Anees-ur-Rehman and [1]Syed Bilal Shah
[1]Department of Plant Protection, NWFP Agricultural University, Peshawar, Pakistan
[2]Entomology Division, Nuclear Institute for Food and Agriculture, Peshawar, Pakistan
[3]Entomology Section, Agricultural Research Institute, Tarnab, Peshawar, Pakistan

Abstract: A study was conducted to evaluate seasonal abundance and efficacy of insecticides and miticides against brinjal pests i.e., cotton whitefly (*Bemisia tabaci*) and mites (*Tetranychus urticae*) at Agricultural Research Institute Tarnab Peshawar in June 2003. For density evaluation, plants were randomly selected for each pest. These plants were regularly monitored on weekly basis throughout the cropping season. During monitoring *B. tabaci* was first noticed in mid May and increased gradually up to the end of July with a peak (24.33/leaf), while decreased from first week of August until it vanished up to the end of September. *Tetranychus urticae* was first observed in late May and reached its peak (24.50/leaf) in early July and finally halted in the second week of September. Five insecticides and three acaricides were sprayed three times at 25 days interval against these pests. Efficacy of the insecticides/acaricides lasted for up to 15 days after spray. Confidor 20 SL was significantly better than the other insecticides against *B. tabaci* where the lowest population range, 1.18-3.03/leaf was recorded. Thiodan 35 EC provided next better protection against the pest. Pyrida 15 EC was the most effective miticide against *Tetranychus urticae* by lowering its population up to 1.12-2.65/leaf. Agrifol 20 EC and Ethion 46.6 EC gave next better control. While Ripcord 100 g L^{-1} EC failed to show its effectiveness against *Tetranychus urticae*.

Key words: Brinjal, cotton whitefly, mites, insecticides, Lorsban+Pyrida, Thiodan+Ethion, Tamaron+Agrifol, Ripcord, Confidor

INTRODUCTION

Brinjal (*Solanum melongena*, Solonaceae) also known as egg plant or aubergine is, probably native to India and has been cultivated for long time. It is a warm season crop and thrives best in areas where day temperature ranges from 80 to 90°F and night temperature from 70 to 80°F[1]. It is an important nourishing summer vegetable and is a rich source of iron. In NWFP, Pakistan, area under this crop was 1081 ha and the total production was 11710 tonnes with an average yield of 10833 kg ha^{-1}[2].

The crop seedlings are normally transplanted in March-April and remain on fruiting till October. Due to long cropping season the crop is exposed to the attack of a large number of insect and mite pests, which inflict considerable losses in crop vigor and yield.

Dhamdhere *et al.*[3] monitored the pest complex of brinjal during the summer and kharif seasons. They identified 6 hemipterous, 3 lepidopterous, 2 coleopterous and 1 mite pest. Further more they reported that cotton whitefly (*Bemisia tabaci*) *Amrasca biguttula biguttula* and *Aphis gossypii* were active during both crop seasons, *Tetranychus telarius* appeared during the latter stages of the both growing season and was active until harvest. The author also reported *Epilachna* sp. *Urentius echinus, Tricentrus bicolor*, *Centrococcus insolitus* and *Mylabris pustulata* as pest of brinjal. While grasshoppers, weevils, lepidoptera and flea beetles were recorded as minor pests of the crop.

Keeping in view the importance of the aforementioned pests and the damage they cause, the present study was initiated with the hope to record the population density of these two pests of brinjal throughout the cropping season and to evaluate the efficacy of different insecticides and acaricides for the control of these pests.

MATERIALS AND METHODS

A study on the population density of major insect and mite pests of brinjal and their chemical control was conducted at Agricultural Research Institute, Tarnab Peshawar, Pakistan. Seedlings were collected from farmer's field and were transplanted to experimental plots in March 2003. Plant to plant and row-to-row distance was kept 0.4 and 1.4 m, respectively. Research project was consisting of the following two experiments.

Corresponding Author: Hayat Badshah, Entomology Division, Nuclear Institute for Food and Agriculture, Peshawar, Pakistan

Population density: To study seasonal abundance of cotton whitefly and mite pests of brinjal, an experiment was designed on an area of 10.5x18 m, which was further divided into three sub-plots (replicates). After transplantation of seedlings brinjal crop was regularly monitored on weekly basis to record densities of these pests on brinjal. To evaluate densities of cotton white flies 10 plants (3 leaves from each upper, middle and lower portion of plant) were randomly selected from each sub-plot, while 5 plants (3 leaves each from upper, middle and lower portion of plant) were chosen for injurious mite. Both white flies and mites were recorded on the under sides of the leaves. Cotton white flies were counted visually while mites were counted with the help of magnifying lens. The samples were collected and identified through taxonomic keys as well as by Prof. Dr. Farman Ullah, Taxonomist at Department of Plant Protection, NWFP Agricultural University, Peshawar, Pakistan.

Chemical control: To grade the efficacy of five insecticides and 3 miticides against the brinjal pests an experiment was laid out in a Randomized Complete Block Design. This experiment was consisted on 6 treatments including a check (3.5x6 m each). Each treatment was replicated three times.

These insecticides/acaricides were sprayed three times in the whole cropping season at 25 days interval with the help of knap sack sprayer. First spray was carried out on May 30, followed by second and third spray on June 25 and July 20, 2003, respectively. Observations were recorded one day before and 1, 3, 7, 10 and 15 days after each spray for various pests. Densities of cotton whiteflies were recorded on 15 leaves randomly taken per treatment per replication. While densities of mites were recorded on 5 leaves randomly selected from each treatment per replication. Data were then subjected to statistical analysis using MSTAT-C package.

RESULTS AND DISCUSSION

Population density of Cotton whitefly (*Bemisia tabaci*, Guen) and mites (*Tetranychus urticae*) pests of brinjal as well as the efficacy of various pesticides was evaluated against these pests.

Population density

Cotton whitefly (*Bemisia tabaci*, Guen): Incidence of cotton whitefly on brinjal was first observed in the mid May (Table 1). Its population gradually increased until it peaked (24.33/leaf) at the end of July and decreased gradually until it reached a negligible level during the third week of September. Abundance of the whitefly was more prevalent from first week of July to second week of August. The pest revealed a consistent occurrence on brinjal plants. The present findings can be compared with the results of some of the past workers[4-6] also reported that *Bemisia tabaci* was reported[4-6] as a serious pest of brinjal crop.

Two-spotted spider mite (*Tetranychus urticae*): Mites appeared during the last week of May, that increased slowly up to mid June and then at a faster rate until it reached its peak (24.50/leaf) during the first week of July. However from the second week of July its population density declined until it completely disappeared in the beginning of second week of September (Table 1). Abundance of mites was more prevalent from second week of June till the end of July. *Tetranychus* spp was reported as pest of the brinjal crop[3,7,8].

Control

Cotton whitefly *(Bemisia tabaci*): Tables 2-4 show the effectiveness of various insecticides against cotton whitefly. All the five insecticides significantly controlled the population density of whitefly up to 15 days as compared to the check plot. The lowest number of the pest was recorded in Confidor treated plot i.e. form 1.18-3.03/leaf after all the three sprays. It was followed by Thiodan (1.47-5.25/leaf), Ripcord (1.60-5.96/leaf), Lorsban (1.645-6.34/leaf) and Tamaran (1.76-6.69/leaf) as compared to the check plot (3.28-19.08/leaf). All insecticides were highly effective on 24 h after spray after which their efficacy went on decreasing till the minimum on 15th day after spray application. However the density of whitefly was still lower in the treated plots as compared with those in the check plot. After second and third spray the same tendency was apparent for all the insecticides. The present study can be compared with the findings of Jarande and Dethe[9], who reported that imidachloprid was effective in reducing the incidence of whiteflies on birnjal and increased seedling height and total leaf chlorophyll over those of untreated plants. Others used different insecticides and recommended the most effective among them.

Two spotted spider mite (*Tetranychus urticae*): Population density of mites after 3 sprays has been given in Table 5-7. It is obvious that all the three miticides provided significant control of mites up to 15 days after spray application followed by a fair level of control by Confidor while Ripcord remained ineffective against mites and did not show significant difference from the untreated

Table 1: Population density of pest species in brinjal field during 2003

	Mean number of pest/leaf on dates									
Pest	15/5	22/5	29/5	5/6	12/6	19/6	26/6	3/7	10/7	17/7
Bemisia tabaci	0.39P	0.6OP	1.02N	1.36M	2.56L	4.93I	5.92H	8.18G	11.4E	14.3D
Tetranychus urticae	0.00	1.3L	4.93 I	5.80H	6.73G	10.40E	17.70B	24.50A	18.0B	13.5C
	Mean number of pest/leaf on dates									
Pest	24/7	31/7	7/8	14/8	21/8	28/8	4/9	11/9	18/9	25/9
Bemisia tabaci	18.2B	24.40A	16.80C	9.59F	4.7J	3.47K	2.43L	1.01N	0.63O	0.05Q
Tetranychus urticae	12.8D	7.60F	3.24J	3.08J	2.4K	0.86M	0.33N	0.00	0.00	0.00

Means not followed by the same letter(s) are significantly different at p≤0.05 LSD value for *B. tabaci* means = 0.2171
LSD value for *T. urticae* means = 0.3796

Table 2: Mean number of cotton whitefly (*Bemisia tabaci*)/leaf after first spray

		Post spray data after					
Treatments	Pre-spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	1.20	0.50MN	0.61MN	1.16JK	2.13G	3.88C	1.65BC
Thiodan 35 EC+Ethion 46.6 EC	0.93	0.47M-O	0.57MN	1.02JK	2.02G	3.26D	1.47D
Tamaran SL 600+Agrifol 20 EC	1.26	0.50MN	0.67LM	1.21IJ	2.15FG	4.28B	1.76B
Confidor SL 20	1.00	0.24O	0.37NO	0.91KL	1.59H	2.82E	1.18E
Ripcord 100 g L^{-1} EC	1.06	0.45M-O	0.59MN	1.15I-K	1.97G	3.84C	1.60C
Control	1.13	1.16I-K	1.28I	2.39F	4.26B	7.33A	3.28A
Mean	1.09	0.55E	0.68D	1.30C	2.35B	4.23A	

Means not followed by the same letter(s) are significantly different at p≤0.05 LSD value for treatment means = 0.1132
LSD value for days means = 0.1034 LSD value for interaction = 0.2532

Table 3: Mean number of cotton whitefly (*Bemisia tabaci*)/leaf after second spray

		Post spray data after					
Treatments	Pre-spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	7.66	2.04OP	2.88L-O	4.79HI	6.0FG	6.82EF	4.50BC
Thiodan 35 EC+Ethion 46.6 EC	7.46	1.19PQ	1.48PQ	3.08K-N	4.35H-J	5.22GH	3.06D
Tamaran SL 600+Agrifol 20 EC	7.85	3.97I-K	3.50JK-M	3.80I-L	5.23GH	6.17FG	4.53B
Confidor SL 20	7.33	0.75Q	1.24PQ	2.08N-P	2.64M-O	3.68J-L	2.08E
Ripcord 100 g L^{-1} EC	8.10	1.93OP	2.55M-O	3.44J-M	5.84FG	6.48EF	4.06C
Control	7.53	7.35DE	7.95D	9.88C	12.62B	16.35A	10.83A
Mean	7.65	2.87D	3.27D	4.51C	6.11B	7.45A	

Means not followed by the same letter(s) are significantly different at p≤0.05 LSD value for treatment means = 0.4506
LSD value for days means = 0.4113 LSD value for interaction = 1.008

Table 4: Mean number of cotton whitefly (*Bemisia tabaci*)/leaf after third spray

		Post spray data after					
Treatments	Pre-spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	14.66	2.35N-P	3.64LM	6.97J	9.01E-H	9.73EF	6.34BC
Thiodan 35 EC+Ethion 46.6 EC	15.00	2.08OP	2.86M-O	5.06K	7.51IJ	8.73GH	5.25D
Tamaran SL 600+Agrifol 20 EC	14.86	3.06MN	4.59KL	8.24HI	9.97E	7.60IJ	6.69B
Confidor SL 20	14.73	1.57P	1.73P	2.02OP	4.68K	5.17K	3.03E
Ripcord 100 g L^{-1} EC	14.94	2.19N-P	3.62M	5.55K	8.97F-H	9.46E-G	5.96C
Control	14.86	14.57D	18.64C	19.53BC	20.44B	22.22A	19.08A
Mean	14.84	4.308D	5.84C	7.89B	10.10A	10.48A	

Means not followed by the same letter(s) are significantly different at p≤0.05 LSD value for treatment means = 0.4361
LSD value for days means = 0.3981 LSD value for interaction = 1.297

Table 5: Mean number of mites, *Tetranychus urticae*/leaf after first spray

		Post spray data after					
Treatments	Pre-spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	4.82	0.66M	0.68M	1.00LM	1.53JK	1.73IJ	1.12D
Thiodan 35 EC+Ethion 46.6 EC	5.34	0.99LM	1.26KL	1.74IJ	2.78G	2.83G	1.92C
Tamaran SL 600+Agrifol 20 EC	5.86	0.83LM	1.22KL	2.22H	3.05G	3.13G	2.09C
Confidor SL 20	4.73	1.06LM	2.06HI	4.22F	4.73E	5.31D	3.47B
Ripcord 100 g L^{-1} EC	4.93	5.29D	5.26D	6.86C	7.28A-C	7.49A	6.43A
Control	5.86	5.33D	5.51D	6.90BC	7.35AB	7.69A	6.55A
Mean	5.15	2.36E	2.66D	3.82C	4.45B	4.70A	

Means not followed by the same letter(s) are significantly different at p≤0.05 LSD value for treatment means = 0.2067
LSD value for days means = 0.1887 LSD value for interaction = 0.4623

Table 6: Mean number of mites, *Tetranychus urticae*/leaf after second spray

		Post spray data after					
Treatments	Pre spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	9.84	1.20O	1.58NO	2.47L-N	3.83I-K	4.21I-K	2.65D
Thiodan 35 EC+Ethion 46.6 EC	10.34	2.31M-O	3.54J-L	4.22IJK	5.47F-H	6.34F	4.37C
Tamaran SL 600+Agrifol 20 EC	10.40	2.64L-N	3.86I-K	4.39H-J	5.86FG	6.40F	4.63C
Confidor SL 20	9.75	3.15K-M	4.91G-I	5.75FG	9.31E	9.17E	6.45B
Ripcord 100 g L^{-1} EC	10.00	10.083DE	14.97C	18.45B	24.75A	25.38A	18.73A
Control	10.38	10.517D	14.94C	18.44B	25.65A	25.86A	19.08A
Mean	10.11	4.983D	7.30C	8.95B	12.48A	12.89A	

Means not followed by the same letter(s) are significantly different at $p \leq 0.05$ LSD value for treatment means = 0.5048
LSD value for days means = 0.4608 LSD value for interaction = 1.129

Table 7: Mean number of mites, *Tetranychus urticae*/leaf after third spray

		Post spray data after					
Treatments	Pre spray	1 day	3 days	7 days	10 days	15 days	Mean
Lorsban 40 EC+Pyrida 15 EC	15.83	0.90D	1.26KL	2.00I-K	2.75G-I	3.41GH	2.06D
Thiodan 35 EC+Ethion 46.6 EC	15.60	1.52J-L	2.47I	3.46G	5.13F	4.69F	3.45C
Tamaran SL 600+Agrifol 20 EC	14.75	1.54J-L	2.52HI	3.57G	5.34F	4.63F	3.52C
Confidor SL 20	15.33	2.35IJ	3.44G	4.85F	6.77E	6.78E	4.83B
Ripcord 100 g L^{-1} EC	16.20	15.31A	13.48CD	13.51CD	13.86CD	14.36BC	14.10A
Control	15.66	15.45A	13.18D	13.73CD	13.93CD	15.18AB	14.29A
Mean	15.56	6.17C	6.06C	6.85B	7.96A	8.17A	

Means not followed by the same letter(s) are significantly different at $p = 0.05$ LSD value for treatment means = 0.3970
LSD value for days means = 0.3624 LSD value for interaction = 0.8877

plot. The lowest population density/leaf of mites after all the three sprays ranged from 1.12-2.65 by Pyrida, followed from 1.92-4.37 by Ethion, 2.09-4.63 by Agirfol, 3.47-6.45 by Confidor and 6.43-18.73 by Ripcord as compared to 6.55-19.08/leaf in the check plot. All miticides after 1st spray were superior after three days of spray. After this the density increased until the effect of miticides became minimum on 10th and 15th day but still better than the check. The same tendency was apparent after second and third spray. The effectiveness of the presently tested miticides/insecticides is not clearly traceable in the literature, however in India it was reported that one spray of dicofol followed by 1 spray of endosulphan controlled *Tetranychus* spp.[10]. Dicofol resulted in highest percent reduction of mites over the control[11]. In present findings dicofol (Agrifol) has also given significant control of mites over control. Since Pyrida is a new product hence presently no literature is available on it.

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