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Effect of different insecticides on population of spider mites (Acari: Tetranychidae) on brinjal crop under field conditions

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Abstract
Spider mites are very notorious, polyphagous, cosmopolitan and economically important pest of vegetables, fruits and various other agricultural crops. They may cause discoloration, curling, yellowing and also webbing on the leaves, which ultimately reduced the yield. Hence the present study was carried out to determine the effectiveness of the four insecticides against spider mites. Brinjal crop was sown in the Research area of Department of Entomology, University of agriculture Faisalabad by using (RCBD) with four replications. Pretreatment data were taken and post treatment data were also recorded after 1, 3, and 7 days after spraying the insecticides. At the end of the experiment data was analyzed by analysis of variance (ANOVA) and means were compared by using LSD test at 0.05, level by using Statistix 8.1 software. After the application of insecticides results showed that all the treatments had almost similar impact on reducing the population of red spider mites but all insecticides showed a clear significant result as compared to control where maximum population of red spider mites (13.10 mites per leaf) observed. Among the insecticides minimum population of red spider mites was recorded in the plots treated with Chlorfenypyr 10%EC with 0.43 mites per leaf which followed by remaining other three treatments Abamactin+spiromesifen 2.5%EC , Fenoxypyroximate 5%SC and Abamactin 1.8%EC with 0.57 mites per leaf, 0.72 mites per leaf and 1.22 mites per leaf respectively. Also maximum No of fruits per plants (6.45 fruits per plant) were recorded from the plots treated with Chlorfenypyr 10%EC while minimum No of fruits were recorded from control treatment. But the impact of red spider mites on average weight and average size of fruits was Non-significant.

Keywords: spider mites, efficacy, insecticides, population

1. Introduction
Group of mites which feed on plants are known as phytophagous mites which are very dangerous polyphagous pest of various crops in which vegetables, fruits, ornamental plants, agronomic and cash crops are included [2] because these having rapid development, short life cycle and good fecundity rate. So, their population developed in a very short time and caused a huge loss [3]. Many pests attacked this important vegetable crop among these most dangerous and economically destructive pests are insects and mites. *Bemisia tabaci* (White fly, Gennadius.) *Aphis gossipy* (Aphid, Glover.), *Lucinodes orbonalis* (Brinjal Fruit and Shoot Borer, Guene.) *Amrasaca bigutulla*, (Jassid, Ishida.), Mexican bean beetle, *Epilachna varivestis* (Mulsan) were the most dangerous insect pests of Brinjal crop. Also red spider mites of brinjal crop cause a great loss of yield thorugh direct and indirect damage. These are very economically destructive sucking insect pests of brinjal crop in severe case cause losses more than 90% [20].

Mites belong to family Tetranychidae are also known as red spider mites. Red spider mites are a potentional major pest of various different horticultural, agronomic, industrial crops and ornamental banker plants [7]. This family consists of 1275 species yet now and seventy genera throughout all over the world. Also attain the status of most dangerous agriculture pest family among five families of phytophagous mites. In which hundred pests and among them ten sepcies attain the status of major pests included [2, 17]. The 2nd way in which spier mites causing loss is damaged the leaves by direct feeding, puncture the plant cells, form silken webs which hinders the process of photosynthesis in leaves also reduced the quality and quantity of the crop. These are very small creatures seen with hand lens easily on underside leaves of the plants in the form of large colonies [11]. In severe conditions their damage symptom is leaf

bronzing due to destruction of chlorophyll, sometimes caused complete defoliate the plants and ultimately death of the plant [16]. These are the direct effects of red spider mites while indirect effects is reduced the transpiration and photosynthesis by making silken web on the leaves [18] and also ultimately decreased the yield of many crop [6]. Leaves of plants showed yellowish and white spots that latterly turned into brown due to reduction of chloroplast parenchyma cells by continue feeding [5]. The third way of damage the crops is leaf chemistry, malformation of fruits and biochemical changes in their structure due to sucking of sap from fruits by *Tetranychus utricae* [4, 21]. Due to destruction of cholorphyll phytosynthesize reduced which ultimately caused the reduction in supply of food and plants go to the decline postion and at this tage mites go into a new dispersal phase from secondary phase and move towards the upper tender portion of the plant. Their life cycle is too short under favorable environmental conditions so, their population developed quickly [12, 13].

Conventionally the red spider mites controlled by using different insecticides because this is a most rapid, always easily available, less labourous, easy and efficient way to control the economic losses caused by pests in brinjal crop. Due to attack of red spider mites almost yield reduction in important vegetable crops observed from 13% to above than 30% [22]. Keeping in view the following facts the study will be carried out to find out the best effective insecticides against spider mite that act as insecticide and also good acaricide.

2. Materials and Methods

A single commonly growing variety of brinjal all over the Punjab in Pakistan that name was Nerralla growing on entomological research area of department of Entomology University of agriculture Faisalabad Pakistan. The experiment was conducted in randomized complete design (RCBD) with four replicates. Total net plot size was 281.25 sq. ft. The distances between plants of brinjal was kept 1ft and distance between rows was kept 1.5ft. Uniform agronomic practices applied in all treatments. Four insecticides Abamactin1. 8%EC, chlorfenypyr 10% EC, Fenoxypyroximate5%SC and Abamactin+spiromesifen 2.5% EC, were applied to check their impact against spider mites of brinjal at their recommended field dose rates. Their company generic name and also recommended field dose rate following

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Treatments	Active ingredients	Recommended dose
T1	Abamactin (1.8%EC)	200-250ml/ acre
T2	Fenoxypyroximate (5%SC)	200ml/acre
T3	Chlorfenypyr(10%EC)	250ml/acre
T4	Abamactin+spiromesifen(2.5%EC)	200-250ml/acre
T5	Control (Untreated Plot)	

The pesticides were applied by using manually hand operated knapsack sprayer. Before the application of insecticdes calliberation of knapsack sprayer was done and hollow cone nozzle was used. Control plots were remained untreated with insecticides and data was recorded by counting the mites from upper leaf of 1st plant, middle leaf of 2nd plant and lower leaf of 3rd plant of all treatment plots which were randomly selected. Pretreatment was recorded before the application of treatment and then population was recorded 1, 3, and 7 days after treatment.

2.1 Statistical analysis

At the end of the experiment data was analyzed with ANOVA (Analysis of Variance) by using statistix 8.1 software and means were compared by using fisher LSD test at the probability level 0.05.

3. Results

After first application of insecticides results showed that all the treatments having almost similar impact on reducing the population of red spider mites. But all these insecticides showed a clear significant result as compared to control where maximum population of red spider mites (13.10 mites per leaf) was observed. Among the insecticides minimum population of red spider mites was recorded in the plots treated with Chlorfenypyr 10% EC with 0.43 mites per leaf which followed by remaining other three treatments Abamactin+spiromesifen 2.5% EC, Fenoxypyroximate 5%SC and Abamactin 1.8%EC with 0.57 mites per leaf, 0.72 mites per leaf and 1.22 mites per leaf respectively (Table-1).

Table 1: Comparison of mean values of the data regarding population of red spider mites on brinjal crop under field conditions at the before the application of treatment and after 1st Application of treatments.

Treatments	Date of observations before applications of treatments				Date of observation after 1st applications of treatments		
	12.05.2017	18.05.2017	25.05.2017	02.06.2017	03.06.2017	05.06.2017	09.06.2017
T1	1.66 ± 0.75^{A}	1.26 ± 0.48^{A}	2.82 ± 0.23^{AB}	15.37 ± 3.59^{A}	6.73 ± 1.46^{B}	3.48 ± 0.25^{B}	1.22 ± 0.16^{B}
T2	0.90 ± 0.62^{A}	1.05 ± 0.59^{A}	2.65 ± 0.24^{AB}	11.42 ± 2.70^{A}	1.26 ± 0.12^{C}	1.16 ± 0.11^{BC}	0.43 ± 0.04^{B}
T3	0.48 ± 0.46^{A}	0.78 ± 0.30^{A}	1.95 ± 0.32^{B}	12.52 ± 1.37^{A}	1.76 ± 0.19^{C}	0.63 ± 0.07^{C}	0.72 ± 0.07^{B}
T4	0.20 ± 0.18^{A}	0.23 ± 0.23^{A}	3.60 ± 0.68^{A}	11.72 ± 0.96^{A}	1.85 ± 0.16^{C}	1.58 ± 0.13^{BC}	0.57 ± 0.18^{B}
T5	0.65 ± 0.37^{A}	0.81 ± 0.37^{A}	2.52 ± 0.43^{AB}	15.87 ± 1.27^{A}	12.42 ± 0.50^{A}	12.40 ± 2.06^{A}	13.10 ± 1.65^{A}
P Value	0.36^{NS}	0.42^{NS}	0.16^{NS}	0.48^{NS}	0.00**	0.00**	0.00**

NS= "Non-Significant" *= "(P<0.05) Significant" **= "(P<0.01) Highly Significant"
In mean comparison values each value is mean of all replications. Means which have similar alphabet showed non significant difference and vice versa. The probability level of Fisher's LSD test is 0.05.

After seven days of first treatments the effectiveness was slow down and again population of red spider mites were increases gradually. Now, again applied all treatments with the same concentration and results showed that similar reduction of red spider mites population as in first application of treatments (Table-2). Maximum number of population was observed in

control treatments that was significantly differ from remaining all other treatments and lowest population was observed chorfenapyr treated plot.

Table 2: Comparison of mean values of the data regarding population of red spider mites on brinjal crop under field conditions at the before the application of 1st treatment and after 2nd Application of treatments.

Treatments	Date of observations before 1st applications of treatments		Date of observation after 2nd applications of treatments		
	14.06.2017	21.06.2017	22.06.2017	24.06.2017	28.06.2021
T1	1.37±0.18^{B}	11.48±2.21ab	5.20±1.17b	1.95±0.75b	0.42±0.20b
T2	0.68±0.16^{B}	8.30±2.39b	0.67±0.22c	0.48±0.10b	0.05±0.05b
T3	0.92±0.09^{B}	9.78±1.64b	2.42±0.43bc	0.46±0.14b	0.20±0.04b
T4	0.72±0.17^{B}	8.67±1.18b	1.54±0.46c	0.30±0.10b	0.20±0.04b
T5	13.15±0.81^{A}	15.41±1.61a	13.27±1.76a	11.72±2.00a	10.57±0.24a
P Value	0.00**	0.02**	0.00**	0.00**	0.00**

NS= "Non-Significant" *= "(P<0.05) Significant" **= "(P<0.01) Highly Significant"
In mean comparison values each value is mean of all replications. Means which have similar alphabet showed non significant difference and vice versa. The probability level of Fisher's LSD test is 0.05.

The picking of brinjal in the second week of June showed minimum no fruits per plants were recorded 3.10 fruits per plant in Abamactin 1.8%EC treated plots while maximum no of fruits (6.30 fruits per plant) were recorded in the plots treated with Chlorfenypyr 10%EC(Figure-1) In the last picking of brinjal in the last week of June also showed maximum no of fruits per plants (6.45 fruits per plant) were recorded from the plots treated with Chlorfenypyr 10%EC while minimum no of fruits (3.50 fruits per plant) were recoded from the plots treated with Abamactin+spiromesifen 2.5%EC. 4.15 and 4.45 fruits per plants were recoded from the remaining plots treated with insecticides Fenoxypyroximate 5%SC and Abamactin 1.8%EC respectively (Figure-1).

Results revealed that average weight of fruits was statistically similar and showed non-significant difference among all the treatments and also as compared to control. While average fruits size 116.44g, 120.61g, 143.32g, g and 111.25g on the plots treated with insecticides Fenoxypyroximate 5%SC, Chlorfenypyr 10%EC, Abamactin+spiromesifen 2.5%EC, Abamactin 1.8%EC and untreated plots (Control treatment) (Figure-1). Also the non-significant impact of population of red spider was observed on average size of fruits in all pickings. While all the treatments also showed non-significant difference among all the treatments including control treatments. All the treatments showed statistically similar results with average fruit size 8.05cm, 7.28cm, 6.73cm, 6.57cm, and 6.25cm in the plots treated with Fenoxypyroximate 5%SC, Abamactin+spiromesifen 2.5%EC, Chlorfenypyr 10%EC, Abamactin 1.8%EC and control respectively (Figure-1).

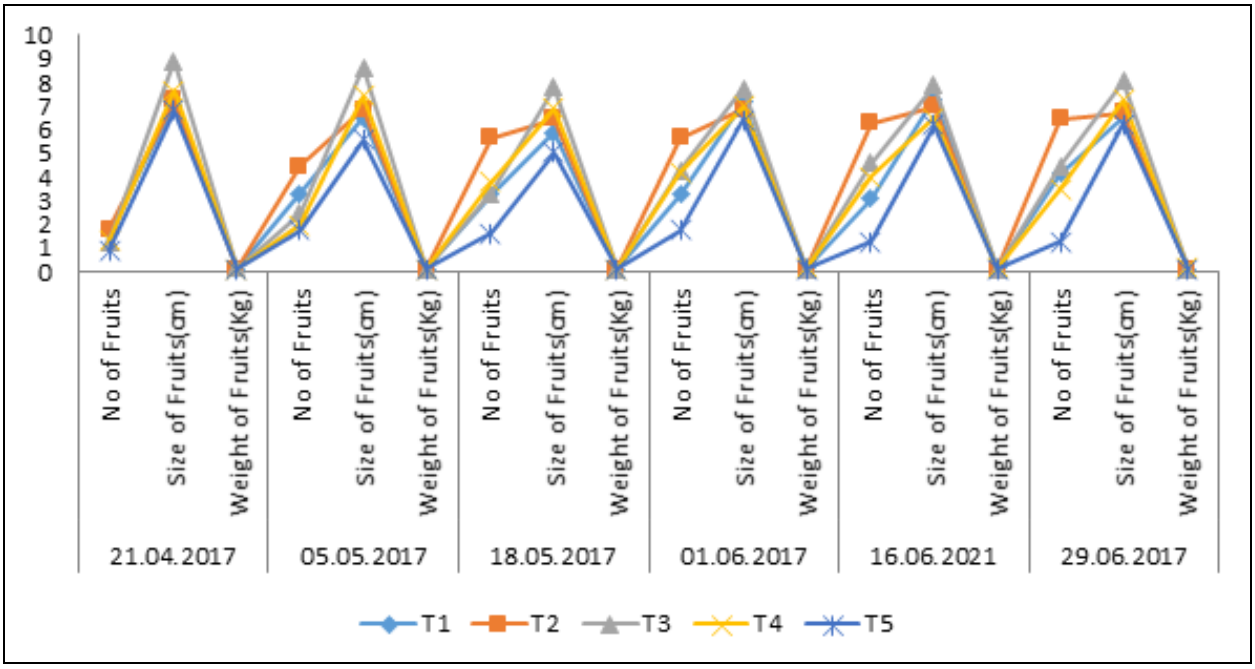

Fig 1: Comparison of mean values of data regarding Avarage No of Fruits, Avarage Size of Fruits and Average Weight of Fruits per plant.

4. Discussion

Also similar type of works carried out by Lagziri and Armani [10] in which six dose rates of abameactin from 2ppm to 9ppm and seven dose ratesof bifenthrin from 15ppm to 150ppm used as treatment. Results proved that after 24 hour application of abamactin at the dose rate of 9ppm showed 100% mortality while 5-7ppm showed highly knock down effect. In case of bifenthrin no significant mortality was observed at the rate 50ppm while at the rate of 150ppm showed more than 70% mortality. So, results proved that abamactin is highly toxic and effective as compared to bifenthrin against two spotted spider mite. Our results also

similar with this study and abamactin effectively managed the red spider mite as compared to control. Kavya [8] studied the acairicdal effect of eleven insecticides on red spider mite *Tetranychus urticae*. Results revealed that abamactin was most toxic to eggs of red spider mite while buprofrezin found to be less toxic. Various concnentrations of abamactin 0.01ppm, fenpryoximate 1.91ppm hexythiazox 8.69ppm, 7.24ppm and 6.90ppm toxic for nymphal and larval stages of red spider mite. Among all these fenpyroximate and abamactin proved to be more toxic to adults as compared to all remaining treatments. Kavya [9] also studied the efficacy of newer insecticides on *Tetranychus urticae*. 0.78 Mean mites per leaf and 1.05 mean mites per leaf was observed after three days of application prpargite and spiromesifen respectively. After seven days of application buprofrezin, chlorfenpyr, diafetnhuron, fenazquin, hexythiazox and prpargite successfully managed the red spider mite population below the economic injury level 0.9-1.33 mean mites per leaf. After 14 days of application of treatments all acaricides significantly redueced the mite population almost less than one mite per mean population of mite observed.

Similar type study carried out by Ali [1] at laboratory and field conditions to test the comparative efficacy of various insecticides against red spider mite *Tetranychus urticae* on bean crop. Spiromesifen, fenpyroximate, pyridaben, hexythiazox used as treatments and results found that 80 to moran than 90% moratlity caused by fenpyroximate, pyridaben and spiromesfien while less moratlity caused by hexythiazox was 17.31%. All acaricides scussesfullt managed the mite population on bean field. Results revealed in this experiment also verified by Patil [19] in which he studied the estimation of losses caused by red spider mites in brinjal crop under semi field condition by artificial releasing of mites. He also found that population of red spider mite reduced the number of fruits as compared to control treatments in which different number of mites released. So, this is confirmed that increase in population of red spider mites significantly impact the yield of brinjal crop. Judicial use of mititcides signficantly helps the farmers to increase their brinjal yield which improves their profit income and ultimately contribute in the economy of the country.

5. Conclusion

After every treatment all insecticides effectively reduced the mite population showed significant result as compared to control but overall among the treatments maximum population reduction was showed by Chlorfenypyr 10%EC. Impact of all treatments were non significant on average size and weight of fruits but significant on average no fruits per plant. Hence, proved chlofenapyr is excellent miticides against red spider mites at ETL level on brinjal crop to get maximum yield.

6. References

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