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EFFICACY OF DIFFERENT NEONICOTINOIDS AND BIO PESTICIDES ON OKRA AGAINST *BEMISIA TABACI*

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ABSTRACT

The current study was investigated at the Agricultural Research Institute Tarnab, Peshawar during 2020 in a Randomized Complete Block Design (RCBD) with three replications. The study aimed was determining the efficacy of different neonicotinoids insecticides and bio- pesticides against *Bemisia tabaci* on okra crop. Results revealed that significantly maximum number of whitefly (*Bemisia tabaci*) population reduction was recorded in imidacloprid (7.55plant^{-1}) treated plot followed by acetamiprid (8.88plant^{-1}) and bio-pesticides (11.99 plant^{-1}) while minimum population reduction was recorded in clothianidin (14.66 plant^{-1}) treated plot over checked plot after 1st application while similar observation was recorded after the 2nd application. In terms of CB ratio, highest CB ratio was recorded by imidacloprid treated plot followed by bio pesticide, acetamiprid and clothianidin while lowest CB ratio was recorded by acetamiprid. Similarly, the research work concluded that overall best performed by imidacloprid after 1st and 2nd application while minimum control was observed by clothianidin treated plot over the control treatment.

1. INTRODUCTION

Okra (*Hibiscus esculentus* L) usually called bhindi or lady's finger belongs to family *Malvaceae* (Bayer *et al*., 2003 and Naveed *et al*., 2009). Okra is grown in summer season crop of Pakistan, the cultivated area of okra was 232.05 hectares which produced 303.16 tons/year (Kashif *et al*., 2008). Many biotic and abiotic factors significantly decreased the okra production (Mani *et al*., 2005). The okra cultivated area of Sindh is about 35.06 thousand hec with an annually productivity of 219.7 thousand tones (Larik, 2002). Losses in yield and fruit quality was effected by sucking insect pest and fruit borers pests from sowing till harvesting.The main sucking insect pests viz., whiteflies, jassids, aphids, thrips and mites. Among all those sucking insect pests, whitefly, *Bemisia tabaci* severally damaged okra crop by sucking cap and in result produced honey dew which provides medium for sooty mould (Oliveira *et al.,* 2001). It's not only damaged plant through direct feeding in order to physiological disorder but it may carrier of different viruses (Oliveira *et al.,* 2001). The yield was decreased is 94.0% by whiteflies and 54.04% by aphids (Meenambigai *et al.,* 2017). For the management of whitefly different groups of insecticides have been recommended. Though, the synthetic insecticides use during the fruit bearing stage is challenging because the fruit is picked at regular intervals, making the opportunity that toxic residues might carriage a health hazard. Previously researcher has estimated lowest toxic and more environmentally nontoxic insecticides. For example, Mishra and Mishra (2002) described that the botanical insecticide, Neem seed kernel extract and Multi neem (neem oil) controlled infestation of this whiteflies (Acharya *et al.,* 2002).

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Keeping in view the above importance the current study was determining the effectiveness of different neonicotinoids and bio pesticides on okra against *Bemisia tabaci.*

2. MATERIALS AND METHODS

Study area

The experiment was conducted at the Agricultural Research Institute Tarnab, Peshawar during 2020.

Experimental design

Dibbling method was used for sowing the local okra variety with spacing 45 cm x 30 cm with 2 to 3 seeds per hill. For optimum plant density gap filling and thinning was done in order to prevent the competition between the plants. The experiment was performed out in randomized block design and triplicated with 4different treatments.

Methodology

The number of whiteflies were recorded a day before and after spraying 3, 7 and 14 days. The data were recorded from 3 leaves each from top, middle and bottom leaves from 5 randomly chosen and labelled plants from every plot without troubling the plants to reduce the observational errors. Whiteflies population was recorded from each net plot and the populace was worked out per three leaves.

Cost benefit ratio

To analyzed that among the tested treatments which was good to control of sucking insect pest as well economical one cost, benefit ratio was calculated with using following formula:

Cost benefit ratio = Value of yield over control

Total cost of plant protection

Statistical analysis

The data were subjected to the analysis of variance in order stated whiteflies population by number based. ANOVA was constructed by using STATISTIX 8.1 software.

3. RESULTS AND DISCUSSION

Efficacy of different insecticides against whiteflies (*Bemisia tabaci*) after 1st application

Results of the study on the effectiveness of targeted insecticides against whiteflies population are presented in Table 1. Before spraying showed significant difference among all the treatments. After 3 days of spray, maximum number of whitefly was recorded in control plot (33.00plant^{-1}) while minimum number of whitefly was recorded in imidacloprid treated plot (13.66plant^{-1}) followed by acetamiprid treated plot (14.33plant^{-1}), bio pesticides (18.33plant^{-1}) and clothianidin (19.33plant^{-1}) which were significantly different with each other respectively. Similarly, after7 days of spray, maximum number of whitefly was recorded in control plot (30.66plant^{-1}) while minimum number of whitefly was recorded in imidacloprid treated plot (4.00plant^{-1}) which was statistically significant with acetamiprid treated plot (5.33plant^{-1}) but significantly different with bio pesticide (7.33plant^{-1}) and clothianidin (11.33plant^{-1}).However, after 14 days of spray, maximum number of whitefly was recorded in control plot (29.00plant^{-1}) while minimum number of whitefly was recorded in imidacloprid treated plot (5.00plant^{-1}) which was statistically significant with acetamiprid treated plot (7.00plant^{-1}) but significantly different with bio pesticide (10.33plant^{-1}) and clothianidin (13.33plant^{-1}).The overall mean showed that maximum number of *Bemisia tabaci* was recorded in control treated plot (30.88plant^{-1}) while minimum number of *Bemisia tabaci* was recorded in imidacloprid treated plot (7.55plant^{-1}) followed by acetamiprid (8.88plant^{-1}), bio pesticide (11.99plant^{-1}) and clothianidin (14.66plant^{-1}) respectively.

Efficacy of different insecticides against whiteflies (*Bemisia tabaci*) after 2nd application

Table 2 showed that, before spraying showed significant difference among all the treatments. After 3 days of spray, highest number of whitefly was recorded in control plot (33.00plant^{-1}) while lowest number of whitefly was recorded in imidacloprid treated plot (5.67plant^{-1}) followed by acetamiprid treated plot (7.00plant^{-1}) which was significantly different with each other but significantly different with bio pesticides (10.00plant^{-1}) and clothianidin (17.00plant^{-1}) respectively. Similarly, after 7 days of spray, highest number of whitefly was recorded in control plot (35.00plant^{-1}) while lowest number of whitefly was recorded in imidacloprid treated plot (2.00plant^{-1}) which was significant different with acetamiprid treated plot (4.33plant^{-1}) but significantly different with bio pesticide (7.00plant^{-1}) and clothianidin (10.00plant^{-1}). However, after 14 days of spray, highest number of whitefly was recorded in control plot (28.00plant^{-1}) while lowest number of whitefly was recorded in imidacloprid treated plot (4.00plant^{-1}) which was significantly different with acetamiprid treated plot (7.00plant^{-1}), bio pesticide (10.00plant^{-1}) and clothianidin (15.00plant^{-1}). The overall mean showed that highest number of *Bemisia tabaci* was recorded in control treated plot (30.88plant^{-1}) while lowest number of *Bemisia tabaci* was recorded in imidacloprid treated plot (3.89plant^{-1}) followed by acetamiprid (6.11plant^{-1}), bio pesticide (9.00plant^{-1}) and clothianidin (14.00plant^{-1}) respectively. The current findings are in line with findings of Begum and Patil (2016), indicated that imidacloprid (17.8 SL) was effectively reduced against the leafhoppers and whiteflies. Similar observation was also recorded by Pawar et al., (2016) and Preetha et al., (2009). Pathania *et al.* (2020) observed similar results, which supports our findings. Kadam (2014) also reported that dinotefuran 20% SG and clothianidin 50% WDG were effective in suppressing *B. tabaci* in cotton, which is consistent with our findings. Said (2011) reported that Rani 20 SL and acetamiprid 20 SP were showed most effectiveness against sucking insect pest.

Economic analysis of different insecticides against whiteflies (*Bemisia tabaci*)

Similarly, as from the result, it is obvious that all the treatments showed significant maximum net return was recorded compare to control treatments. Among different tested treatments, imidacloprid treated plot showed maximum return (1: 15.80) followed by acetamiprid (1: 13.25), bio pesticide (1: 11.64) while minimum return was recorded in clothianidin treated plot (1: 6.59) over control plot. Similarly Said (2011) reported that Rani 20 SL and acetamiprid 20 SP were showed maximum yield as compared to other treatments.

4. CONCLUSION

Satisfactory control of *Bemisia tabaci* was achieved with imidacloprid, followed by acetamiprid, both of which are systemic neonicotinoids. Bio-pesticides exhibited intermediate effectiveness, while clothianidin was the least effective.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

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Table 1. Population reduction of *Bemisia tabaci* after 1st application in okra during 2020

Treatments	**Before Spraying**	**After Spraying**			**Overall mean**
		3DAS	**7DAS**	**14DAS**	
Acetamiprid	29.33[d]	14.33[b]	5.33[d]	7.00[d]	8.88
Imidacloprid	31.33[c]	13.66[d]	4.00[d]	5.00[d]	7.55
Clothianidin	30.00[d]	19.33[e]	11.33[b]	13.33[b]	14.66
Bio pesticide	32.33[b]	18.33[c]	7.33[c]	10.33[c]	11.99
Control	34.33[a]	33.00[a]	30.66[a]	29.00[a]	30.88
LSD	0.97	0.76	0.97	0.72	-

Mean in columns followed by same letters are non-significant 5% level of probability

DAS: Days after spraying

Table 2. Population reduction of *Bemisia tabaci* after 2nd application in okra during 2020

Treatments	Before Spraying	After Spraying			Overall Mean
		3DAS	7DAS	14DAS	
Acetamiprid	15.03[d]	7.00[d]	4.33[cd]	7.00[d]	6.11
Imidacloprid	10.66[e]	5.67[e]	2.00[d]	4.00[e]	3.89
Clothianidin	22.0[b]	17.0[b]	10.00[b]	15.00[b]	14.00
Bio pesticide	19.03[c]	10.0[c]	7.00[bc]	10.00[c]	9.00
Control	35.0[a]	33.0[a]	35.00[a]	28.00[a]	32.00
LSD	0.64	0.97	3.01	1.45	-

Mean in columns followed by same letters are non-significant 5% level of probability

DAS: Days after spraying

Table 3. Cost benefit analysis of different neonicotinoids and bio pesticides during 2020

Treatments	Marketable yield kg/ha A	Gross income Rs. B	Cost of control /ha C	Return over control Rs./ha D	Estimated net benefit Rs. /ha E=(D-C)	C: B F=(D/C)
Acetamiprid	1600	80000	3300	43750	40450	1:13.25
Imidacloprid	1800	90000	3400	53750	50350	1:15.80
Clothianidin	1200	60000	3600	23750	20150	1:6.59
Bio Pesticide	1500	75000	3300	38750	38420	1:11.64
Control	725	36250	-	-	-	-

Average price per kg=50/-