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Efficacy of selected insecticides and neem products against white fly (*Bemisia tabaci* (Gennadius)] of okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
The present field study was conducted during *kharif* 2017 from august 3rd week to November determine the efficacy of selected insecticides and neem products against [*Bemisia tabaci* (Gennadius)] of okra [*Abelmoschus esculentus* (L.) Moench]" at Central agriculture field, SHUATS (Sam Higginbottom University of Agriculture, Technology and Sciences), Allahabad, Uttar Pradesh (India). results revealed that efficacy of selected insecticides and neem products against whitefly revealed that maximum mean pest population recorded in control and all the treatments were found effective in reducing the population of whitefly as compared to control, Imidacloprid 17.8SL was the most effective treatment indicating recorded lowest population of whitefly followed by Thiamethoxam 25WG, Acetamiprid 20% SP, Dimethote30EC, Lambda cyhalothrin5%EC, Neem oil and NSKE 5% was less effective among all insecticides. Fruit yield and C: B ratio were high in Imidacloprid 17.8 SL (1:4.05).

Keywords: Insecticides, neem oil, NSKE 5%, white fly

1. Introduction
Okra (*Abelmoschus esculentus* L.) is an annual crop in the family Malvaceae and one of the most important vegetable crops in tropical and sub-tropical areas of the globe. In the sub-Himalayan region of north-east India, okra is cultivated at a commercial scale, but insect and mite pest damage constitute a limiting factor in successful production (Ghosh *et al*., 1999) [1]. One of the important limiting factors in the cultivation of okra is insect pests. Many of the pests occurring on cotton are found to ravage okra crop. As high as 72 species of insects have been recorded on okra (Srinivasa and Rajendran, 2003) [12] of which, the sucking pests comprising of Aphids (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius) and causes significant damage to the crop. Krishnaiah (1980) [5] reported about 40-56 percent losses in okra due to leafhopper. There is a reduction of 49.8 and 45.1 per cent in height and number of leaves respectively due to attack of whitefly Subsequently, the spider mite, *Tetranychus cinnabarinus* has assumed the status of major pest and caused 17.46 percent yield loss in okra.

The adults suck the sap of the leaves and transmit the yellow vein mosaic virus disease of okra. The field studies carried out by Obnesorge (1981) [8] in Jordan on the population dynamics revealed that the density of pest was lowest in kharif and winter crops. Different groups of insecticides have been recommended to control this white fly However, the use of synthetic insecticides during the fruit bearing stage is problematic because the fruit is picked at frequent intervals, creating the possibility that toxic residues could pose a health hazard Previous research has evaluated less toxic and more environmentally safe insecticides. For example, Mishra and Mishra (2002) [7] reported that the botanical insecticide Neem seed kernel extract and Multineem (neem oil) regulated populations of this white fly. Acharya *et al*. (2002) [1] studied the efficacy of the insecticides imidacloprid and dimethoate are reported they were safer to use in the presence of coccinellid predators. The objective of this study was to determine the efficacy of some insecticides and neem oil against white fly.

2. Materials and methods
The experiment was conducted during the kharif season 2017 at Central field, SHUATS, Allahabad. The okra seeds of variety vnr 22 (komal) were sown by dibbling method with

spacing of 45 cm×30 cm by placing 2-3 seeds per hill. Gap filling and thinning was done to maintaining the optimum plant density and prevents competition among the plants. The experiment was laid out in randomized block design with eight treatments and three replications. The observations on the number of whiteflies were made, a day before followed by 3rd, 7th, 14th days after spraying of insecticides that are selected and data were recorded from three leaves each from top, middle and bottom leaves from the five randomly selected and tagged plants from each plot without disturbing the plants to minimize the observational errors. Population of white fly was recorded from each net plot and the population was worked out per three leaves. The data were subjected to statistical analysis. the results were expressed as white fly population by number based. F test, c.d values are calculated in computer by using wasp software that was provided by ICAR in its web site.

3. Results and Discussion

Table 1: Efficacy of selected insecticides and neem products against Whitefly on okra during kharif 2017.

S. NO	Treatments	Number of whiteflies/3 leaves								
		First spray				Second spray				
		1DBS	3DAS	7DAS	14DAS	1DBS	3DAS	7DAS	14DAS	Overall mean
1	Untreated	7.11 (2.76)	8.00 (2.82)	8.203 (2.86)	8.50 (2/91)	10.30 (3.20)	10.32 (3.21)	11.52 (3.42)	12.54 (3.54)	9.575 (3.09)
2	Neem oil (Azadirachtin)	7.33 (2.70)	4.10 (2.02)	3.208 (1.70)	5.36 (2.31)	6.86 (2.61)	4.20 (2.04)	4.34 (2.08)	4.84 (2.20)	4.325 (2.07)
3	NSKE 5%	8.21 (2.86)	7.20 (2.68)	7.026 (2.64)	7.02 (2.64)	7.78 (2.79)	4.62 (2.14)	4.52 (2.12)	4.96 (2.22)	5.885 (2.42)
4	Thiamethoxam 25%wg	9.13 (3.02)	2.22 (1.48)	1.531 (1.23)	3.53 (1.87)	6.20 (2.48)	1.82 (1.35)	2.19 (1.47)	2.53 (1.59)	2.305 (1.51)
5	Dimethoate 30%EC	8.33 (2.88)	2.86 (1.69)	2.104 (1.44)	4.01 (2.00)	6.46 (2.54)	2.16 (1.46)	3.15 (1.77)	3.93 (1.98)	3.053 (1.74)
6	Imidacloprid 17.8%SL	7.52 (2.74)	1.46 (1.20)	1.092 (1.04)	2.59 (1.60)	6.02 (2.45)	1.43 (1.22)	1.22 (1.10)	1.46 (1.20)	1.525 (1.23)
7	Acetamiprid 20% SP	7.53 (2.74)	2.61 (1.61)	1.920 (1.38)	3.80 (1.94)	6.28 (2.50)	1.92 (1.38)	2.76 (1.66)	3.22 (1.79)	2.717 (1.64)
8	Lambda cyhalothrin 5%EC	7.86 (2.80)	2.64 (1.62)	2.267 (1.50)	4.50 (2.12)	6.72 (2.59)	2.92 (1.70)	3.98 (1.99)	4.12 (2.02)	3.597 (1.89)
F- test		NS	S	S	S	NS	S	S	S	S
S. Ed. (±)		0.002	0.109	0.187	0.247	0.170	0.238	0.309	0.319	0.960
C. D. (P = 0.05)		0.144	0.437	0.667	0.746	0.144	0.662	0.437	0.575	2.288

Figures in parentheses are square root transformed values; NS=Non significant, S= Significant

Results of the study on the efficacy of selected insecticides against whitefly population are presented in Table 1. The overall mean result represented in the table reveals that all the treatments were significantly superior over control. Among all the treatments Imidacloprid (1.52 whiteflies/3leaves) is most effective and recorded lowest population followed by Thiamethoxam (2.30 whiteflies/3leaves), followed by Acetamiprid (2.71 whiteflies/3leaves) and Dimethoate (3.05 whiteflies/3leaves) are at par with each other, next treatment followed by lambdacyhalothrin (3.59 whiteflies/3leaves), Neem oil (4.32 whiteflies/3leaves), while Nske 5% (5.88 whiteflies/3leaves) is least effective among all the treatments.

These findings are in accordance with the findings of Begum and patil (2016) [2] reported that imidacloprid 17.8SL was the most effective treatment indicating reduction in population of leafhoppers and whiteflies Similarly, Pawar *et al*., (2016) [9] reported that, mean population of aphids, Jassids, and whiteflies after three sprays revealed that imidacloprid was effective and superior, the next best were thiamethoxam. Preetha *et al*., (2009) [10] reported that imidacloprid was found effective against whiteflies, the other neonicotinoid, thiamethoxam also provided similar levels of protection as that of imidacloprid. Sarkar (2016) [11] performance of insecticides against whitefly was recorded in imidacloprid treated plots with lowest mean population. Kalyan *et al*, (2012) [6] also reported that treatment with imidacloprid, thiamethoxam, and acetamiprid significantly reduced the whitefly population to the safe limit at 7 days post treatment. Gosh (2014) [4] reported that imidacloprid provided the best suppression of populations of white fly followed by microbial toxin *saccharopolyspora spinosa.*

4. Conclusions

Satisfactory white fly control was achieved with imidacloprid, thiamethoxam, Acetamiprid which are systemic and belong to the neonicotinoids group fallowed by dimethoate, lambda cyhalothrin, neem oil, and the least effective was NSKE 5%.

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