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Bioefficacy of New Insecticide Molecules Against Okra Aphids (*Aphis gossypii* Glover)

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Abstract: *An investigation was undertaken with an objective to evaluate the field bioefficacy of certain newer insecticides* viz., *lambda cyhalothrin 3 EC, acetamiprid 20 SP, thiamethoxam 25 WG, chlorontraniliprile 18.5 SC, flubendiamide 480 SC, emamectin benzoate 5 EC, acephate 75 SP and spinosad 45 SC, aphids of okra during* Kharif *2013-2014 at College of Agriculture, Kolhapur. All the new insecticide treatments were observed to be effective in reducing aphid population on okra. Among the evaluated newer insecticides thiamethoxam 25 WG @ 25 g a.i./ha, proved to be most effective treatment against aphids recording 1.97 to 3.33/plant. The next best treatments in order to effectiveness for aphids were acetamiprid 20 SP, lambda cyhalothrin 3 EC and flubendamide 480 SC. The treatment with spinosad 45 SC, acetamiprid 20 SP and emamectin benzoate 5 EC observed relatively safe to natural enemy. Whereas the new insecticide molecules were also found to be moderately safe.*

Keywords: *Bioefficacy, Aphids,* Aphis gossypii, *New Insecticide Molecules*

INTRODUCTION

Abelmoschus esculentus commonly known as bhendi or lady's finger, belongs to family Malvaceae. Vegetables are important constituent of our daily diet. Tender fruits of okra are used as vegetable or in culinary preparations as sliced and dried pieces.It is also used for thickening gravies and soups, because of it's high mucilage content. They are also good source, vitamins, proteins, carbohydrates, minerals, iron, calcium, potassium and acids *viz*., rhamnose (22%), galacturonic acid (27%) and amino acid (11%). It is an important vegetable crop cultivated all over India with a major share in state of Maharastra, West Bengal, Uttarpradesh, Karnataka, Gujrat and Madhya Pradesh (Shinde *et al.* 2007). The important pests of okra reported by Kale *et al*. (2005) are jassid (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), okra fruit and shoot borer (*Earias* sp.), white fly (*Bemisia tabaci* Genn), spidermite (*Tetranychus cinnabourinus* and *Tetranychus necoaleclonicus*), thrips (*Thrips tabaci* L.) and root knot nematode (*Meloidogyne incognita* and *Meloidogyne javanica*). Jassid and aphid infestation affect the early growth stage of the crop and cause reduction in yield. Aphid and thrips reduce the vigour of the plants.

One of the important limiting factors in cultivation of okra is the damage caused by insect pests of 72 insect species recorded, the sucking pest *viz*., leafhopper, aphid, whitefly, cause significant damage to the crop. There is a need to eliminate ineffective chemicals and include effective use newer chemical with lesser dose to reduce side effects (Anitha and Nandihalli, 2008). Use of new group of insecticide as spray formulation emerged most promising, low cost, less polluting with least interference in natural equllibrium. Newer group of insecticides offer great scope as they maintain high toxicity to insects at lower doses and are not persistent as conventional group of insecticide. Therefore, there is clear need to use newer chemicals with lesser dose of few grams per hectare

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maintaining the high toxicity to insect-pests. These may offer the promise of meeting quality and quantity production and will reduce the use of older and persistent crop protection chemicals and thus less environmental load.

MATERIAL AND METHOD

Experimental site

The research work was carried out in *Kharif* season of 2013 at the experimental farm of Entomology section, College of Agriculture, Kolhapur to evaluate the insecticides against aphids in okra variety Phule Utkarsha. There were nine treatments with three replications each in randomized block design. The insecticidal sprays were applied with the help of manually operated knapsack sprayer. The quantity of spray fluid required for treating the crop per plot was calculated by spraying untreated control plot with water. The quantity of each insecticidal formulation was worked out and mixed in required quantity of water. Care was taken to cover all plant parts thoroughly while spraying and to avoid drift to the neighbouring plots. Care was also taken to wash the pump with water while switching from one insecticide to another.

Test chemicals

Investigation was made on the bioefficacy of newer insecticides *viz*., lambda cyhalothrin, acetamoprid, thiamethoxam, chlorontraniliprile, flubendiamide, emamectin benzoate, acephate and spinosad against *Aphis gossypii* infesting soybean and impact of these chemicals on ladybird beetle. The test samples of the chemicals were available at the Department.

Observations

Observations were recorded on randomly selected five plants per plot. Numbers of aphids were recorded from three leaves of randomly selected plants one upper, one middle and one lower. Observations were recorded just before the spray (as per treatments count) and post treatments count was made at 2nd 7th and 12th days after each insecticidal spray and data were pooled by superimposition for each spray separately. Data obtained were statistically analyzed.

Natural enemy population count was taken simultaneously with regular observation. The number of lady bird beetle was recorded on five tagged plants at 1 day before spraying and 2, 7 and 12 days after each spraying.

At each picking, the weight of healthy fruits was recorded on net plot basis which was later computed to hectare basis and then subjected to statistical analysis.

Statistical analysis

The values of mean per cent damage were first transformed to their corresponding arcsine values and then statistically analyzed as a randomized block design. Critical difference (CD) was determined at the probability level of 5 per cent to decide the significance of individual treatment effect.

RESULTS AND DISCUSSION

The result obtained after each successive spraying with respect to their effectiveness against the okra aphids are presented in Table 1.

Effect of various insecticidal treatments under investigation based on the mean surviving population of aphids per three leaves recorded on two, seven and twelve, days after each spraying are presented in the Table 1 and graphically depicted in Fig. 1.

The average number of aphids per plant prior to insecticidal treatment application ranged from 11.31 to 12.78 in different experimental plot.

The data showing means of the three observations recorded on two, seven and twelve days after first spraying revealed that all the insecticidal treatment were significantly superior over control. The treatment with thiamethoxam 25 WG was most effective and significantly superior over rest of the treatment and recorded lowest population 1.97 per cent aphids per plant as against 10.15 in untreated control. It was however, statistically at par with acetamiprid 20 SP (2.73 aphid per plant) and lambda cyhalothrin (3.23 aphid per plant). The treatment with flubendamide 480 SC recording 4.33 aphids per plant. The next best treatment found was chlorontraniliprile 18.5 SC

Table 1
Bioefficacy of newer insecticide molecules against Aphids (*Aphis gossypii* Glover) on okra

Sr. No.	*Insecticides*	*Dose/ha*	*Average number of aphids after each spray*				*Overall mean*
			DBS	*I*	*II*	*III*	
1.	Lambda cyhalothrin 3 EC	30 g a.i.	11.94* (3.52)	3.23 (1.92)	4.33 (2.19)	2.99 (1.86)	3.51 (1.99)
2.	Acetamiprid 20 SP	40 g a.i.	12.20 (3.56)	2.73 (1.79)	3.45 (1.95)	2.70 (1.78)	2.92 (1.84)
3.	Thiamethoxam 25 WG	25 g a.i.	12.78 (3.64)	1.97 (1.56)	3.33 (1.98)	2.13 (1.61)	2.51 (1.71)
4.	Chlorontraniliprile18.5 SC	30 g.a.i	11.67 (3.48)	5.27 (2.39)	5.96 (2.53)	5.61 (2.46)	5.61 (2.46)
5.	Flubendiamide480 SC	48 g a.i.	11.74 (3.49)	4.33 (2.16)	5.66 (2.48)	4.82 (2.30)	4.93 (2.31)
6.	Emamectin benzoate 5 EC	50 g a.i.	11.40 (3.44)	6.33 (2.60)	6.66 (2.67)	6.37 (2.61)	6.45 (2.62)
7.	Acephate 75 SP	292 g.a.i	11.31 (3.43)	6.70 (2.68)	7.26 (2.78)	6.76 (2.68)	6.89 (2.71)
8.	Spinosad 45 SC	75 g.a.i.	12.10 (3.54)	6.55 (2.65)	7.58 (2.83)	6.73 (2.69)	6.96 (2.72)
9.	Untreated control	-	12.64 (3.62)	10.15 (3.25)	12.74 (3.64)	13.72 (3.76)	12.20 (3.55)
10.	**SE ±**	**-**	**NS**	0.13	0.12	0.16	0.13
11.	**CD at 5%**	**-**	**NS**	0.41	0.38	0.48	0.42

*Figures in parentheses are square root of (X+0.5) transformed values.

recording 5.27 aphids per plant followed by emamectin benzoate 5 EC recording 6.33 aphids per plant and spinosad 45 SC recording 6.55 aphids/ plant. However, these treatments were significantly superior over untreated control. The least effective treatment was the acephate 75 SP recorded 6.70 aphids per plant.

The average aphid population up to 12 days after second spraying in different treatment was significantly lower than that of untreated control. Among the insecticide tested, treatment with thiamethoxam 25 WG emerged as the most effective treatment in controlling the pest by recording minimum number of 3.33 aphids per plant. The next best treatment found was acetamiprid 20 SP and lambda cyhalothrin 3 EC recorded 3.45 and 4.33 aphids per plant. It was at par with each other in reducing aphid population. The treatment with flubendamide 480 SC, chlorontraniliprile 18.5 SC, and emamectin benzoate 5 EC recorded aphids population 5.66, 5.96, 6.66 per plant, respectively and they were also not differ from each other. The treatment with spinosad 45 SC found least effective in controlling pest population and recorded 7.58 aphids per plant.

It could be seen from the data on an average population of aphid recorded up to 12 days of third spraying that all the insecticidal treatments were significantly superior over untreated control. The treatment with thiamethoxam 25 WG was the most promising one which significantly reduced aphid population to the level of 2.13 aphids per plant. It was however, statistically at par with acetamiprid 20 SP (2.70 aphid per plant) and lambda cyhalothrin 3 EC (2.99 aphid per plant), the next best treatment found flubendamide 480 SC recorded 4.82 aphids per plant. Among the remaining treatment chlorontraniliprile 18.5 SC, emamectin benzoate 5 EC and spinosad 45 SC recorded 5.61, 6.37 and 6.73 aphids per plant respectively. The treatment with acephate 75 SP was proved least effective in reducing aphid population.

The data on average population of aphids recorded up to 12 days after first to third spray. It could be clearly seen that amongst the various insecticides evaluated, the treatment with thiamethoxam 25 WG appeared to be most effective against aphids and recorded 1.97 to 3.33 aphids per plant against 10.13 to 13.72 aphids per plant in untreated control. The treatment with thiamethoxam 25 WG observed significantly superior over all the remaining treatment in each spraying.

The present finding in respect of thiamethoxam 25 WG are similar to those reported by Anitha and Nandihalli. (2009) that reported effectiveness of thiamethoxam 25 @ 0.2 g /lit and recorded lowest aphid population than acetamiprid 20 SP 0.2 g/lit.

Reddy and Gowdar (2006) reported that acetamiprid 20 SP was found most effective in reducing the okra sucking pests population.

Dandale *et al*. (2001) concluded that aphid population was significantly lower in the treatment of acetamiprid 20 SP @ 15 g a.i./ha.

Krishna kumar *et al.* (2001) reported that thiamethoxam @ 0.4 g/ litre was consistently and significantly superior in controlling sucking pests.

These reports are in consonance with the results of the present investigation.

Lady bird beetle

Impact of insecticides on natural enemies was assessed on the basis of number of surviving individual left over on plant at 15 days after each spray. The data recorded on the number of surviving population of lady bird beetle are presented in Table 2.

The observation of surviving population of beetles at 15 days after first spraying revealed significantly reduction of coccinellids over control. It was ranged between 1.64 to 3.07 beetles per three leaves. The treatment with spinosad 45 SC recorded maximum number of beetles (3.07 beetles/plant) which was at par with acetamiprid 20 SP (3.00 beetles /plant) and emamectin benzoate 5 EC (2.83 beetles/plant). The next promising treatments was thiamethoxam 25 WG also appear to be comparatively safer recording significantly more number of beetle (2.29/plant) than the remaining insecticides treatment. The treatment with acephate 75 SP registering significantly lowest number of beetles (1.64 beetles/plant) over untreated control (4.07 beetles/plant).

Table 2
Impact of newer insecticide molecules on lady bird beetle

Sr. no	*Insecticides*	*Dose/ha*	*Average number of lady bird beetles after each spray*				*Overall*
			DBS	*I*	*II*	*III*	*mean*
1.	Lambda cyhalothrin 3 EC	30 g a.i.	5.19* (2.38)	2.11 (1.61)	2.23 (1.64)	2.63 (1.78)	2.37 (1.67)
2.	Acetamiprid 20 SP	40 g a.i.	5.51 (2.45)	3.00 (1.86)	3.11 (1.86)	3.2 (1.92)	3.10 (1.88)
3.	Thiamethoxam 25 WG	25 g a.i.	5.31 (2.41)	2.29 (1.66)	2.44 (1.70)	2.91 (1.84)	2.54 (1.73)
4.	Chlorontraniliprile18.5 SC	30 g a.i	4.36 (2.20)	1.90 (1.54)	1.77 (1.50)	2.05 (1.59)	1.90 (1.54)
5.	Flubendiamide480 SC	48 g a.i.	4.84 (2.31)	2.03 (1.59)	2.03 (1.58)	2.23 (1.63)	2.09 (1.6)
6.	Emamectin benzoate 5 EC	50 g a.i.	5.45 (2.43)	2.83 (1.82)	2.98 (1.86)	3.00 (1.86)	2.93 (1.84)
7.	Acephate 75 SP	292 g a.i.	4.15 (2.15)	1.64 (1.46)	1.77 (1.50)	1.77 (1.5)	1.72 (1.48)
8.	Spinosad 45 SC	75 g.a.i.	5.64 (2.47)	3.07 (1.88)	3.25 (1.93)	3.47 (1.98)	3.26 (1.94)
9.	Untreated control	-	5.84 (2.51)	4.07 (2.13)	4.19 (2.16)	4.22 (2.17)	4.16 (2.15)
10.	SE ±	-	NS	0.07	0.06	0.07	0.06
11.	**CD at 5%**	**-**	**NS**	**0.20**	**0.18**	**0.22**	**0.20**

*Figures in parentheses are square root of (X+0.5) transformed values

Table 3
Bioefficacy of newer insecticide molecules on okra fruit yield

Sr.No.	*Treatments*	*Dose/ha*	*Mean Yield of okra fruit (q/ha)*	*Increase over control (q/ha)*	*Percent increase overcontrol*
1.	Lambda cyhalothrin 3 EC	30 g.a.i	45.2	17.8	64.37
2.	Acetamiprid 20 SP	40 g.a.i	41.9	14.5	52.91
3.	Thiamethoxam 25 WG	25 g.a.i	41.6	14.2	51.82
4.	Chlorontraniliprile18.5 SC	30 g a.i	42.4	15	54.74
5.	Flubendiamide480 SC	48 g.a.i	43.6	16.2	59.12
6.	Emamectin benzoate 5 EC	50 g.a.i.	46.5	19.1	69.70
7.	Acephate 75 SP	292 g a.i	40.4	13	47.44
8.	Spinosad 45 SC	75 g.a.i	48.3	20.9	76.27
9.	Untreated control	-	27.4	-	-
10.	SE ±	-	0.95	-	-
11.	**CD at 5%**	**-**	**2.85**	**-**	**-**

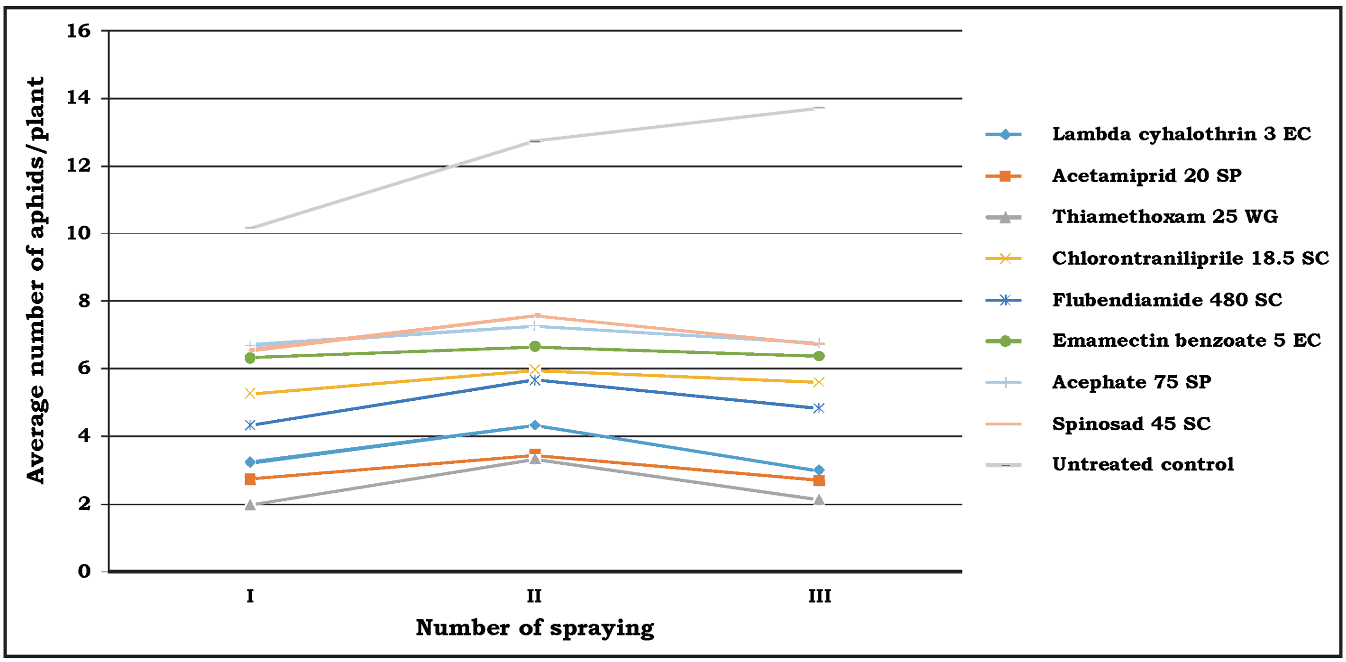

Figure 1: Bioefficacy of newer insecticide molecules against aphid (*Aphis gossypii* Glover) on okra

Up to 12 days after second spray a little increase the population of beetles was observed in all treatments including untreated check. The population of coccinellid in different treatment plot ranged from 1.77 to 3.25 beetles per plant. The maximum number of beetles was recorded from the plot treated with untreated control. In different treated plot spinosad 45 SC (3.25 beetles/plant) which was maximum number of beetles and which was at par with acetamiprid 20 SP (3.11 beetles / plant) and emamectin benzoate 5 EC (2.98 beetles per plant). Were as minimum number of beetles was recorded from the plot treated with acephate 75 SP (1.77 beetles/plant).

The population of beetles after the third spray was significantly lower in insecticidal treatment than the untreated control. Among the insecticide evaluated, the maximum number of 3.47 beetles per plant was recorded in the treatment with spinosad 45 SC which was at par with acetamiprid 20 SP (3.20

beetles/plant) and emamectin benzoate 5 EC (3.00 beetles/plant). The treatment with thiamethoxam 25 WG recorded 2.91 beetles per plant which was significantly superior over remaining treatments. The less number of beetles found in acephate 75 SP (1.77 beetles/plant) indicating the harmfulness to the beetles.

Thus, from data on population of coccinellid beetles after each of application it is evident that spinosad 45 SC, acetamiprid 20 SP and emamectin benzoate 5 EC safest to the predatory beetles compared to the rest of treatments recorded significantly more number of beetles at first, second and third application.These treatment recorded an average of 2.93 to 3.26 beetles per plant during the course of insecticidal treatment. Spinosad 45 SC has also been safest to the species of coccinellid. The treatment with acetamiprid 20 SP and emamectin benzoate 5 EC was also found safer to the coccinallids than thiamethoxam 25 WG and lambda cyhalothrin 3 EC.

Dhanalakshami and Mallapur (2008) reported that emamectin benzoate, spinosad and acetamiprid were found safe to natural enemies.

In the present study population of natural enemies in insecticides treated plots was low as compared to untreated control and results corroborate with the findings of above research workers.

Yield of okra

The observations on the yield data are presented in the Table 3. All the insecticidal treatments recorded significantly higher yield of okra as compared to untreated control. Among the treatments, spinosad 45 SC @ 75 g a.i. /ha recorded significantly higher yield (48.3 q/ha) as compared to all other insecticidal treatments. The treatment with emamectin benzoate 5 EC, lambda cyhalothrin 5 EC and flubendamide 480 SC were the next in the order of yield. Significant differences did not exist among rest of the treatments. Treatment with spinosad 45 SC @ recorded 76.27 per cent increase in yield over untreated control as compared to 47.44 per cent in treatment with acephate 75 SP. Untreated check recorded an yield of 27.4 q/ha.

CONCLUSION

Conclusion has been drawn from the results obtained. The treatment thiamethoxam 25 WG was found significantly superior and showed promising against aphids infesting okra during *Kharif* season. The studies on impact of new insecticides on natural enemy *viz*., lady bird beetle indicated that spinosad 45 SC, acetamiprid 20 SP and emamectin benzoate5 EC were relatively safe to natural enemy.

REFERENCES

Anitha,K.R., B.Nandihalli, (2008), Seasonal incidence of sucking pests in okra ecosystem. *Karnataka J. Agric. Sci.* 21(1) 137-138.

Anitha, K.R. and B.Nandihalli., (2009), Bioefficacy of newer insecticides against leafhopper and aphid in okra, *Karnataka J. Agric. Sci.* 22 (3 spl. issue) : 714-715.

Dandale, H.G., N.G.V. Rao., P.Tikar., and S.A.Nimbalkar, (2000), Efficacy of spinosad against cotton bollworms in comparison with some synthetic pyrethroids. Pestology, 24 (11): 6-10.

Dhanalakshmi, D.N., C.P. Mallapur., (2008), Evaluation of promising molecules against sucking pests of okra. Annals of Plant Protection Sciences, 16 (1) : 29-32.

Kale, J.V., W. Wadnerkar, P.R. Zanwar, and P.D. Sangle, (2005), Bioefficacy of newer insecticide against insect pests of okra. Pestology., 29(8) : 9-12.

Krishnakumar, N.K., P.N Krishnamoorthy and S.G.Eswarareddy, (2001), Imidacloprid and thiamethoxam for the control of okra leafhopper, *Amrasca biguttula biguttula* (Ishida). Pest Management in Hortic. Ecosystems, 7(2): 117-123.

Reddy and Gowdar (2006), Bioefficacy of Acetamiprid 20 SP against sucking pests of okra. *Agric.Sci.Digest*, 26 (4): 235-240.

Shinde, B.D., M.B.Sarkate., P.W.Nemade , and Y.R. Sable, (2007), Bioefficacy of botanical, microbial and synthetic insecticides against okra fruit borer, Pestology., 31(3) : 19-22.