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Bioefficacy of New Insecticide Molecules Against Okra Jassids (*Amrasca biguttula biguttula* Ishida)

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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, against jassids of okra during Kharif 2013-2014 at College of Agriculture, Kolhapur. All the new insecticide treatments were observed to be effective in reducing jassid population on okra. Among the evaluated newer insecticides thiamethoxam 25 WG @ 25 g a.i./ha, proved to be most effective treatment against jassids recording 3.45 to 4.33/plant. The next best treatments in order to effectiveness for jassids 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, Jassids, Amrasca biguttula biguttula, 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.

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.*, jassid, 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

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grams per hectare 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 jassids 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 jassids 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 2^{nd} 7^{th} and 12^{th} 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 data based on mean of three observation of jassids per three leaves of plant recorded on one day before spray and two, seven, twelve, days after each spray are presented in Table 1.

The data on nymphal count of jassids recorded one day before spraying indicated that the jassids population was uniformly distributed in all plots and ranged from 12.98 to 16.53 jassids nymph per plant.

The data on average population of jassids recorded up to 12 days after first application of insecticide revealed that amongst all the treatment thiamethoxam 25 WG was the most effective against jassids which reduced the jassids population to the level of 4.33 jassids per plant and which was at par with acetamiprid 20 SP and lambda cyhalothrin 3 EC recorded 5.27 and 5.62 jassids per plant respectively. Among the remaining treatment acephate 75 SP, chlorontraniliprile 18.5 SC, emamectin benzoate 5 EC recorded 5.94, 6.26 and 6.66 jassids per plant respectively which did not differ from each other. The treatment with spinosad 45 SC was least effective in controlling jassids population.

The data of jassids population after second spray indicated that the population of pest in different treatment was significantly superior than the untreated control. The population of jassids in different treatments ranged between 3.51 to 8.48 jassids per plant as against 16.27 jassids per plant in untreated control. Among the all treatment thimethoxam 25 WG proved most effective by recording the lowest number of jassids population (3.51 nymph per plant).The next best treatment was acetamiprid 20 SP and lambda cyhalothrin 3EC recording 5.08 , 5.50, jassids per plant respectively which was at par with each other. Next best treatment was acephate 20 SP recorded 5.78 jassids per plant followed by chlorontraniliprile 18.5 SC, emamectin benzoate 5 EC recording 7.01, 7.83 jassids per plant respectively. The least effective treatment was spinosad 45 SC and recorded 8.48 jassids nymph per plant compared to all other insecticidal treatments.

The data on incidence of jassids recorded up to 12 days after third spray was significantly reduced due to all insecticidal treatments. The lowest population of jassids nymph per plant was noticed in thiamethoxam 25 WG (3.45 jassids per plant) which did not differ significantly from the population observed in acetamiprid 20 SP (5.08 nymph per plant) and lambda cyhalothrin (5.36 nymph per plant) these treatment were at par with each other and thus proved most efficacious in controlling the pest after third spray. The next best treatment was acephate 75 SP (6.73 nymph per plant) followed by chlorontraniliprile 18.5 SC (7.29 nymph per plant) and emamectin benzoate 5 EC (7.48 nymph per plant).

The treatment with spinosad 45 SC proved least effective recording maximum 7.95 nymph per plant.

Looking into data on jassids population recorded up to 12 days after all insecticidal applications it could be observed that insecticides caused the significant reduction in jassids population over the control after all third sprays. Among the insecticide evaluated, the treatment with thiamethoxam 25 WG proved best in reducing jassids population after all third spray recordings 3.45 and maximum 4.33 nymph of jassids per plant against 13.92 to 16.91 in untreated control. It was however, found statistically at par with acetamiprid 20 SP and lambda cyhalothrin at application of insecticide spray. The treatment with acephate 75 SP and chlorontraniliprile 18.5 SC found significantly superior over control recording 5.78 to 6.73 and 6.26 to 7.29 nymph per plant.

The treatment with spinosad 45 SC found least effective in controlling pest population and recorded 7.95 to 8.48 nymph per plant.

The result of present investigation are discussed with the findings of earlier workers.

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

Dandale *et al*. (2000) concluded that aphid population was significantly lower in the treatment of acetamiprid 20 SP @ 15 g a.i./ha while jassids population was found minimum in thiamethoxam 25 WG @ 50 and 25 g a.i./ha and was at par with acetamiprid 20 SP @ 15 and 10 g a.i./ha.

Kolhe *et al*. (2009) revealed that both concentration of acetamiprid 20 SP (0.003 and 0.006 %) and thiamethoxam (0.005 and 0.01 %) were most and equally effective against jassids, acetamiprid and thiamethoxam at all the concentrations recorded equal efficacy against jassids.

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

Sinha *et al*. (2007) reported that foliar spray of acetamiprid @ 20 gm a.i. /ha at 30 days of sowing was found effective in managing leaf hopper population of okra.

Sinha and Sharma (2008) reported that foliar spray either of thiamethoxam /acetamiprid @ 20 g a.i./ha effectively reduced leafhopper population.

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

Table 1
Bioefficacy of newer insecticide molecules against jassids (*Amrasca biguttula biguttula* Ishida) on okra

Sr. No.	*Insecticides*	*Dose/ha*	*Average number of jassids after each spray*				
			DBS	*I*	*II*	*III*	*Overall mean*
1.	Lambda cyhalothrin 3 EC	30 g a.i.	13.95*(3.80)	5.62(2.47)	5.50(2.44)	5.36(2.43)	5.49(2.44)
2.	Acetamiprid 20 SP	40 g a.i.	14.26(3.84)	5.27(2.39)	5.08(2.35)	5.08(2.36)	5.14(2.69)
3.	Thiamethoxam 25 WG	25 g a.i.	14.55(3.87)	4.33(2.16)	3.51(1.99)	3.45(1.95)	3.76(2.33)
4.	Chlorontraniliprile 18.5 SC	30 g.a.i	13.51(3.74)	6.26(2.59)	7.01(2.73)	7.29(2.78)	6.85(2.7)
5.	Flubendiamide480 SC	48 g a.i.	12.98(3.67)	6.99(2.73)	8.32(2.96)	7.49(2.82)	7.6(2.83)
6.	Emamectin benzoate 5 EC	50 g a.i.	13.00(3.67)	6.66(2.67)	7.83(2.88)	7.48(2.82)	7.32(2.79)
7.	Acephate 75 SP	292 g a.i	13.90(3.79)	5.94(2.53)	5.78(2.5)	6.73(2.68)	6.15(2.57)
8.	Spinosad 45 SC	75 g.a.i.	13.25(3.70)	7.99(2.96)	8.48(2.99)	7.95(2.87)	8.14(2.92)
9.	Untreated control	-	16.53(4.12)	13.92(3.79)	16.27(4.09)	16.91(4.16)	15.7(4.01)
10.	SE ±	-	NS	0.13	0.15	0.16	0.14
11.	**CD at 5%**	**-**	**NS**	**0.36**	**0.46**	**0.50**	**0.44**

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

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

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*				
			DBS	*I*	*II*	*III*	*Overall 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 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).

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

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 over control*
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**	**-**	**-**

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.

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