Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2105

ISSN: 2320 – 7051
Int. J. Pure App. Biosci. **3 (5):** 101-106 (2015)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Efficacy of some novel insecticide molecules against incidence of whiteflies (*Bemisia tabaci* Genn.) and occurrence of Yellow Mosaic Virus (YMV) disease in urdbean

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ABSTRACT

Field efficacy of different new insecticide molecules was evaluated against whiteflies and Yellow mosaic virus disease in urdbean at RARS, Lam, Guntur, Andhra Pradesh for two consecutive seasons i.e. during Rabi 2010-11 and 2011-12. Among the test insecticides, spiromesifen 240 SC @ 0.4 ml/lt followed by buprofezin 10 EC @ 1.0 ml/lt werefound as the most effective treatments with more than 75 per cent mean reduction in nymphal population of whiteflies and with below 20 per cent incidence of YMV.Among the four neonicotinoid molecules, acetamiprid 20 SP @ 0.2 g/ltwas found promising against whiteflies. Triazophos 40 EC @ 1.25 ml/lt was found onpar with the neonicotiniods such as imidacloprid 200 SL @ 0.3 ml/lt, thiamethoxam 25 WG @ 0.2 g/lt and thiacloprid 21.7 SC @ 1.25 ml/lt. All the treatments were found significantly superior over the untreated control in reducing the incidence of YMV in blackgram. However,upto 20 to 40 per cent incidence of YMV was observed in treated plots also, hence adoption of integrated approach is essential for the management of YMV, rather than relying upon chemical insecticides alone.

Key words: *Whitefly, YMV, spiromesifen, buprofezin, neonicotinoids, Urdbean*

INTRODUCTION

Pulses occupied a prime position in food and nutritional security of human beings. India is the largest producer and consumer of pulses in the world, accounting for about 25 per cent of the global production, 27 per cent of the global consumption and about 33 per cent of the world's area under pulses[18]. Urdbean (*Vigna mungo* (L.) Wilczek.) Which is commonly known as Black gram is a short duration and highly remunerative pulse crop grown in most parts of the country traditionally as kharif crop. But in Andhra Pradesh it is being cultivated mostly as *rabi* (winter) crop both in uplands and rice fallows. Though, urdbean is being grown throughout the year in varied agro-climatic conditions, the productivity was low, becauseof various biotic and abiotic stresses.Blackgram is ravaged by an array of insect pests from sowing to harvest in the field as well as in storage[11]. Among them, sucking pests such as thrips and whiteflies are of major importance in Andhra Pradesh which occur at early stages of crop growth and they not only reduces the plant vigour but also acts as vectors for deadly viral diseases.

Cite this article: MahaLakshmi, M.S., Sreekanth, M., Adinarayana, M. and Rao, Y.K., Efficacy of some novel insecticide molecules against incidence of whiteflies (*Bemisia tabaci* Genn.) and occurrence of Yellow Mosaic Virus (YMV) disease in urdbean, *Int. J. Pure App. Biosci.* **3(5):** 101-106 (2015). http://dx.doi.org/10.18782/2320-7051.2105

The Sweet potato whitefly, *Bemisia tabaci* (Gennadius) has become a major threat to agriculture worldwide, among various field, fibre, and vegetable and ornamental crops. Whiteflies cause damage to plants directly by sucking the cell sap from leaves and also induce some physiological disorders by injecting some phytotoxins into leaves. White flies also affects the host plants indirectly by producing a sticky secretion known as honeydew, which acts as a substrate for development of sooty moulds on leaves that hinders the photosynthesis. Besides, whitefly also acts as vector for many of viral diseases in various crops. In urdbean, Mung bean yellow mosaic virus, a member of Gemini virus group which cause a disastrous disease, Yellow mosaic virus disease (YMV) is transmitted by whiteflies[12]. Yield losses due to this disease varied from 5 to 100 per cent depending upon the crop age, disease severity, susceptibility of cultivars andpopulation of whitefly[16]. It also infects mungbean, soybean, mothbean, cowpea and some hosts of the family Malvaceae and Solannceae[4]. The infection not only drastically reduces yield but also severelyimpairs the grain size and quality. So far, no realistic measures areavailable to control the YMV disease except either using resistant variety or controlling the vector, whiteflies.

Broad-spectrum insecticides such as organophosphates, carbamates and pyrethroids have been used to control the whitefly since long time. But, they are highly toxic to humans and beneficial organisms and their injudicious use lead to development of resistance and development of biotypes in *B. Tabaci* and control failures were observed with those insecticides in recent past[14]. Now, several new insecticide molecules with novel modes of action that specifically target the pest with low mammalian toxicity and safer to natural enemies and environment are available which have to be evaluated for their efficacy against whiteflies in urdbean.

Therefore, keeping the above in view, newer insecticide molecules with different modes of action were evaluated in the present study against whiteflies and occurrence of YMV in urdbean under field conditions.

MATERIALS AND METHODS

Field trials were conducted to evaluate the efficacy of different insecticides against whiteflies and YMV at RARS, Lam, Guntur for two consecutive seasons i.e. during Rabi 2010-11 and 2011-12 in blackgram and the mean data was presented hereunder. The YMV susceptible variety, LBG 623 was selected and the crop was sown at a spacing of 30 cm X 10 cm during first fortnight of October during both the years. The trial was laid out in a Randomised Block Design, with eleven treatments including untreated control which replicated thrice with a plot size of20 sq.m. The agronomic practices were adopted as per the recommended practices of ANGRAU, Hyderabad, Andhra Pradesh. The first schedule spraying was given at 10 days after sowingand repeated at 10 days interval and a total of three sprays were imposed. Spraying was done during the morning hours when the air was still using a knapsack sprayer and proper care was taken for thorough coverage of entire experimental plot by using the spray fluid @ 500 lt/ha. Two blanket sprays were given with selective insecticides to protect the crop against pod borers at 35 and 50 days after sowing in all the experimental plots to avoid yield losses due to pod damage. Three trifoliate leaves each from top, middle and bottom canopies were taken into a polythene cover from five plants in each treatment. The samples were taken to the laboratory and the live nymphal population count was taken using stereo zoom microscope. Data on pest population was recorded one day before spraying as pre treatment count and post treatmental counts were taken at 3, 5 and 7 days after spraying. The observations were recorded from five randomly selected plants in each plot leaving the border rows. Per cent disease incidence of YMV was recorded from the whole plot at 60 days after sowing from all the treatments.

The percentage reduction in the population of whiteflies over untreated check in different treatments was calculated using the modified Abbot's formula[6] (Fleming and Retnakaran, 1985) as given below. The yield from each net plot was harvested separately and the seed yield was recorded. The data thus obtained was subjected to ANOVA after using proper transformations.

Per cent reduction in population over control =
[1- (Post treatment population in treatment/Pre treatment population in treatment) X
(Pre treatment population in control/Post treatment population in control) X 100].

RESULTS AND DISCUSSION

Incidence of whiteflies

The mean data pertaining to the efficacy of different treatments in reducing the whitefly population showed that, spiromesifen 240 SC was the most effective treatment among all the test insecticides which recorded around 80 per cent reduction in nymphal population of whiteflies over untreated control. However, it was found statistically at par with buprofezin 10 EC (75.41 per cent reduction), but significantly superior over the remaining treatments (Table.1). Spiromesifen 240 SC is a new chemical option for whitefly and spider mites control belonging to spirocyclic tetronic acid derivatives, a novel class of insecticides. The effectiveness of spiromesifen may be due to its activity towards the developmental stages of the pest which results in improper moulting of nymphal stages and prevents adult emergence and it also reduces the fecundity in adults[13]. The present findings are in agreement with Palumbo[15] and Fanigliulo *et al*[5]., who reported that spiromesifen 240 SC was highly effective against whiteflies.The next best treatment in reducing the whitefly nymphal population was buprofezin 10 EC with around 75 per cent mean reduction over untreated control and it was found statistically and significantly superior over the remaining treatments (Table.1). Earlier, Ali *et al*[1]., reported that buprofezin 25 WP was most effective followed by acetamiprid 20 SP when compared to diafenthiuron 500 EC and imidacloprid 300 SL against nymphal population of whiteflies in cotton.

In the present study, the insecticides belonging to neonicotiniod group such as imidacloprid 200 SL, acetameprid 20 SP, thiamethoxam 25 WG and a newly introduced molecule, thiacloprid 21.7 SC were tested for their efficacy against whiteflies. Among the four neonicotinoid molecules, acetamiprid 20 SP was found promising with more than 55 per cent reduction in nymphal population of whiteflies over untreated control. However, it was failed to differ significantly with thiacloprid 21.7 SC and thiamethoxam 25 WG which recorded nearly 45 per cent reduction in nymphal population over untreated control (Table.1). But acetameprid 20 SP was found significantly superior over imidacloprid 200 SL which recorded less than 40 per cent reduction in whitefly population over untreated control (Table.1). The present results were in harmony with Horowitz *et al*[9]., who reported that acetamiprid 20 SP was 10-18 fold more potent than imidacloprid 200 SL against whiteflies on cotton under controlled conditions. Similarly, Khattak *et al*[10]., also reported that imidacloprid 200 SL was less effective compared to acetamiprid 20 SP, diafenthiuron 500 EC and thiamethoxam 25 WG against whiteflies in mungbean.The low level of suppression of imidacloprid 200 SL may be attributed to development of resistance in whitefly population due to its injudicious and indiscriminate use in different crops. In accordance to the present results, AmitSethi and Dilawari[2] reported that the whitefly population of Guntur region showed moderate levels of resistance to triazophos 40 EC, imidacloprid 200 SL and endosulfan.

In the present study, spinosad 45 SC and fipronil 5 SC which were proved very effective against thrips in different crops were also included to assess their efficacy against whiteflies. The results obtained in the present investigation evidently indicating that spinosad 45 SC and fipronil 5 SC were less effective in suppressing the whitefly population in blackgram. Since, they were able to proffer around 30 per cent reduction only in whitefly nymphal population over untreated control (Table.1). The present results are in agreement with Venkateswara Rao[20] who reported the lesser efficacy of spinosad 45 Sc and fipronil 5 SC against whiteflies.

A conventional organo phosphorous insecticide i.e. triazophos 40 EC and a botanical, azadirachtin 10,000 ppm were included as standard checks in the present study. Both were found significantly superior to spinosad 45 SC and fipronil 5 SC in reducing the whitefly population over untreated control. Triazophos 40 EC was found statistically at a par with all the neonicotiniods except acetamiprid 20 SP with more than 40 per cent reduction in whitefly population over untreated control, while azadirachtin 1000 ppm was found on par with imidacloprd 200 SL (Table.1). The present results are in conformity with Cheema *et al*[3]., who reported that triazophos 40 EC proved better over thiamethoxam 25 WG in reducing the whitefly population under controlled conditions in blackgram. But both triazophos 40 EC and azadirachtin 10000 ppm were found significantly less effective when compared to the newer insecticide molecules such as spiromesifen and buprofezin against whiteflies.

Incidence of YMV

The incidence of Yellow mosaic virus (YMV) disease was recorded at 60 days after sowing. Spiromesifen 240 SC @ 0.4 ml/lt (17.77 per cent) was found significantly superior over the rest of the treatments in reducing the incidence of YMV except with buprofezin 10 EC @ 1.0 ml/lt (18.43 per cent) which recorded below 20 per cent incidence of YMV in urdbean. The remaining insecticidal treatments showed more or less similar efficacy against YMV without significant differences. However, all the treatments were found significantly superior over the untreated control in reducing the incidence of YMV in urdbean (Table.1).The results obtained in the present study were in accordance with Seetharamu *et al*[17].,who reported that the incidence of YMV was low in insecticide treated plots compared to the untreated plots. Similarly, Ghosh *et al*[7]., reported that imidacloprid and thiamethoxam were more effective in reducing the incidence of YMV when compared to conventional insecticides such as dimethoate, monocrotophos and azadirahtin in mungbean.

Yield

Among the different treatments, seed yield was numerically highest from sipromesifen 240 SC (0.4 ml/lt) treated plots, but it was found statistically on par with buprofezin 10 EC @ 1.0 ml/lt, spinosad 45 SC@ 0.3 ml/lt, fipronil 5 SC @ 1.0 ml/lt and thiacloprid 21.7 SC @ 1.25 ml/lt and significantly superior over the rest of the treatments (Table.1).The incidence of thrips as well as leaf curl disease was almost negligible in spinosad 45 SC and fipronil 5 SC treated plots when compared to all the other treatments though they were proved less effective against whiteflies, hence the seed yield from was on par with spiromesifen 240 SC and buprofezin 10 EC (Table.1).The other treatments in descending order in terms of yield were thiamethoxam 25 WG @ 0.2 g/lt, acetamiprid 20 SP @ 0.2 g/lt, imidacloprid 200 SL @ 0.3 ml/lt and triazophos 40 EC @ 1.0 ml/lt which were failed to differ significantly among themselves. But all the treatments were found to give significantly superior yield over azadirachtin 10000 ppm @ 5.0 ml/lt and untreated control which recorded the lowest seed yield (Table.1). The seed yield was low from the experimental plots with high incidence of YMV which was in accordance with earlier reports. A strong negative correlation was observed between the severity of YMV and total seed yield[8]. Similarly, Singh and Awasthi[19] also reported that yield attributes in mungbean decreased with increased level of YMV incidence.

Table.1: Mean efficacy of newer insecticides against whiteflies and yellow mosaic virus disease in blackgram over two years (Rabi 2010-11 and rabi 2011-12):

S.No.	Treatments	Mean reduction in nymphal population of whiteflies (%)	YMV incidence (%)	Yield (q/ha)
T1	Imidacloprid 200 SL @ 0.3 g/lt	38.65 (38.46)	28.85 (32.41)	9.16
T2	Acetamiprid 20 SP @ 0.2 g/lt	57.02 (49.06)	20.40 (26.77)	9.33
T3	Thiamethoxam 25 WG @ 0.2 g/lt	45.15 (42.23)	21.94 (27.89)	9.36
T4	Thiacloprid 21.7 SC @ 1.25 ml/lt	50.22 (45.15)	30.38 (33.31)	9.74
T5	Buprofezin 10 EC @ 1.0 ml/lt	75.41 (60.32)	18.43 (25.39)	11.05
T6	Spiromesifen 240 SC @ 0.4 ml/lt	80.47 (63.81)	17.77 (24.91)	11.57
T7	Spinosad 45 SC @ 0.3 g/lt	29.98 (33.20)	31.76 (34.10)	10.73
T8	Fipronil 5 SC @ 1.0 ml/lt	29.50 (32.86)	30.85 (33.57)	10.42
T9	Triazophos 40 EC @ 1.25 ml/lt	42.92 (40.95)	28.46 (32.09)	8.39
T10	Azadirachtin 3000 ppm @ 5 ml/lt	35.23 (36.43)	32.90 (34.73)	5.58
T11	Control	--	58.32 (47.02)	4.59
	F test	Sig.	Sig	Sig.
	SEm ±	2.04	0.98	0.69
	CD	6.03	2.89	2.03
	CV % (p=0.05)	13.50	7.03	13.10

* figures in ( ) are arc sine transformed values

CONCLUSION

From the present study, it was clearly evident that, though the newer insecticide molecules with novel modes of action were able to control the whiteflies very effectively, they could not able to protect the crop absolutely from the incidence of YMV. Hence, the management of YMV should be done through integrated approach, rather than relying upon chemical insecticides completely. However, spiromesifen 240 SC and buprofezin 10 EC were found most effective in reducing whitefly population in urdbean.

Acknowledgement

Authors are extremely thankful to ANGRAU, Hyderabad for providing land, inputs and man power for conducting the trials.

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