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Bio-efficacy of Insecticides against Okra Leafhopper, *Amrasca biguttula biguttula* (Ishida)

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A B S T R A C T

A field experiment was conducted to study the efficacy of newer insecticides against okra leafhopper, *Amrasca biguttula biguttula* (Ishida) during *Kharif* 2018 at AHRS, Bhavikere, UAHS, Shivamogga Karnataka. The results revealed that, Acetamiprid 20% SP @ 0.3 g/l was found to be most effective against leafhopper with higher per cent reduction of leafhopper population (83.06 per cent), followed by Imidacloprid 17.8 % SL @ 0.5 ml/l, Acephate 75 % SP @ 1 g/l, and Afidopyropen 50 DC @ 2ml /l which recorded 82.91, 77.48, and 76.59 per cent reduction in the pest population, respectively. The next best treatments were Azadirachtin 0.03% @ 2 ml/l (65.85%), Diafenthiuron 50% EC @ 1 ml/l (65.60%), Chlorfenapyr 10% EC @ 1 ml/l (56.98%) and fenazaquin 10% EC @ 2 ml/l (53.41%).

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench is one of the most important vegetable crop which has its own importance with an account of its taste, flavour and nutritional values as human food. In India, it is an important vegetable crop grown throughtout the year. India stands first in area and production, occupying an area over 0.51 m hectares with an annual production of 6.21 m.MT. In Karnataka, it is grown in an area of 11.14 thousand hectares with an annual production of 96.27 thousand metric tonnes (Anon, 2018-19).

One of the important limiting factors in the cultivation of okra is infestation of insect pests. As many as 72 species of insects have been recorded on okra (Srinivas Rao and Rajendran, 2003). Krishnaiah (1980) reported about 40-56 per cent losses in okra due to leafhopper infestation. Leafhoppers were important pests in the early stage of the crop which desap the plants, make them weak and reduce the yield. Failure to control them in the initial stages was reported to cause and yield loss to the tune of 54.04 per cent (Chaudhary and Dadeech, 1989). To minimize the losses caused by insect pests in okra several insecticides have been recommended by many workers (Samuthiravelu and David, 1991 and Manjanaik *et al.,* 2002). Chemical control is the most promising method which fit in the integrated pest management (IPM) because of its abilities in controlling insect pests very quickly and chemicals are easily available in the market when compare to other conventional methods of pest control.

Recent advances in research are being directed towards development of safer and effective insecticides which are relatively safer to natural enemies and reduce the pesticide load in the environment. These newer insecticides have an advantage in pest management as they are economical, non-hazardous, required in less quantity and hence imparts minimum disturbance to the ecosystem. Keeping this in view, the present studies were undertaken to test the Bio-efficacy of different insecticides against okra leafhopper, *Amrasca biguttula biguttula* during 2018.

Materials and Methods

A field experiment was conducted at Agricultural and Horticultural Reaserch Station, Bhavikere, UAHS, Shivamogga Karnataka during 2018-19 to evaluate the efficacy of different insecticide molecules against okra leafhopper, *A. biguttula biguttula*. The experiment was laid out in randomized block design with nine treatments and three replications. The Arka Anamika cultivar was sown with spacing of 60 x 30 cm in a plot size of 4.2 m x 3.6 m. The details of experiment are presented in table 1. All the recommended package of practices was followed except the plant protection measures against sucking pests.

The first spray was taken up when the crop was uniformly infested with pest population. Observation on number of leafhoppers was made, before and after treatment imposition at one, three, seven and fourteen days on five randomly selected plants. From each plant three leaves from top, middle and bottom canopy leaves were used. Second spray was taken up based on the rebuild up of the pest populations. Further, the per cent reduction of insect population in respective treatments over the control was calculated. The per cent reduction of insect population in respective treatments over control was computed by using following formulae,

Per cent reduction over control

$$= \frac{\text{Pest population in control} - \text{Pest population in treatment}}{\text{Pest population in control}} \times 100$$

The statistical analysis of the data was done by using analysis of variance (ANOVA) with Web Agri Stat Package (wasp-2) developed by ICAR, Central Costal Agriculture Research Institute, Goa. Data were transformed by square root transformation before subjecting to DMRT. The interpretation of data was done by using the critical difference was calculated at 0.05 probability level. The level of significance was expressed at 0.05 probability. After analysis, data was tabulated for interpretation of result.

Results and Discussion

There was no significant difference in the leafhopper population among all the treatments a day before imposition of treatments with a population range of 5.77 to 6.13 leafhoppers / 3 leaves (table 2).

One day after imposition of treatment, the treatment acetamiprid recorded least pest population of 1.60 leafhoppers/ 3 leaves followed by imadacloprid (2.22 leafhoppers / 3 leaves). Although the treatments fenazaquin and chlorfenapyr recorded higher leafhopper population (5.37 and 5.07 leafhoppers / 3 leaves, respectively) but were the superior over untreated control (7.2 leafhopper / 3 leaves).

At three days after spraying, acetamiprid and imidacloprid were found superior by recording 1.50 and 1.80 leafhoppers / 3 leaves, respectively. Fenazaquin recorded highest population count of 5.06 leafhoppers / 3 leaves, followed by chlorofenapyr which recorded 4.91 leafhoppers / 3 leaves. However, all the treatments were significantly superior over untreated control.

Seven days after spraying, lowest population was recorded in acetamiprid (1.10 leafhoppers / 3 leaves) followed by imidacloprid (1.20 leafhoppers / 3 leaves). The next best treatments were afidopyropen (1.93 leafhoppers/3 leaves), acephate (2.20 leafhoppers / 3 leaves), azadiracthin (2.40 leafhoppers / 3 leaves) and diafenthiuron (2.70 leafhoppers / 3 leaves).

At fourteen days after spraying there was a gradual increase in leafhoppers population in all the treatments. Acetadmiprid recorded least leafhopper population of 1.40 leafhoppers / 3 leaves and it was found to be on par with imidacloprid (2.10 leafhoppers / 3 leaves). However, all the treatments were significantly superior over the untreated control.

Second spray

The pre treatment counts made a day before spraying indicated that there was no significant difference among the treatments. However, the leafhopper population ranged from 6.21 to 14.94 leafhopper / 3 leaves.

One day after imposition of treatment, the treatment acetamiprid recorded least pest population of 2.88 leafhoppers / 3leaves followed by imadacloprid (3.20 leafhoppers / 3 leaves). Although the treatments Fenazaquin and chlorfenapyr recorded higher leafhopper population of (9.10 and 8.84 leafhoppers / 3 leaves, respectively) and were superior to untreated control (15.94 leafhoppers / leaves).

At three days after spraying, acetamiprid and imidacloprid were found best by recording least population of 1.64 and 1.92 leafhoppers / 3 leaves, respectively, followed by acephate and afidopyropen. Fenazaquin recorded a highest population count of 5.84 leafhoppers/3 leaves, followed by chlorfenapyr (5.26 leafhoppers /3 leaves). However, all the treatments were significantly superior over untreated control (16.74 leafhoppers / 3 leaves).

Seven days after spraying, lowest population was recorded in acetamiprid (2.84 leafhoppers/3 leaves) and imidacloprid (3.42 leafhoppers / 3 leaves) treated plots. The next best treatments were acephate (3.64 leafhoppers / 3 leaves), afidopyropen (3.96 leafhoppers / 3 leaves), diafenthiuron (5.44 leafhoppers / 3 leaves) and azadiracthin (5.27 leafhoppers / 3 leaves).

At fourteen days after spraying there was a gradual increase in leafhoppers population in all the treatments. Among chemicals, acetadmiprid recorded least leafhopper population (3.9 leafhoppers / 3 leaves) and it was found to be on par with imidacloprid (4.2 leafhoppers / 3 leaves).

Pooled mean

The mean leafhopper, *Amrasca biguttula bigutttula* population after first and second spray of insecticides across the treatments indicated that least population of 2.28 leafhoppers per leaf was recorded in acetamaprid followed by imidacloprid and acephate with the population of 2.30 and 3.03 leafhopper per leaf. Whereas, untreated control recorded the highest population of 13.46 leaf hopper per 3 leaves (Table 2).

Among the treatments, highest per cent reduction of 83.06 per cent was recorded in acetamaprid treated plot followed by imidacloprid (82.91 %), acephate (77.48 %), afidopyropen (76.59 %) and diafenthiuron (65.60 %).

It is evident from the data that all the treatments were effective in reducing the leafhopper population. The mean data of two sprays indicated that, acetamiprid recorded the least count of leafhopper (2.28 leafhoppers / 3leaves). The next best treatments were imadacloprid (2.30 leafhoppers / 3leaves), acephate (3.03 leafhoppers / 3 leaves) and afidopyropen (3.15 leafhoppers / 3leaves). The per cent reduction in leafhopper population in different treatments was in the order of acetamiprid > imadacloprid > acephate > afidopyropen > diafenthiuron > azadirachtin > fenazaquin > chlorfenapyr.

The high efficacy of acetamiprid followed by imadacloprid, against the leafhopper population as revealed in the present studies were in line with the findings of Anand *et al.*, (2013) who reported that acetamiprid found significantly superior by recording least leafhopper population. Also the efficacy of imadacloprid was in accordance with Raghuraman and Birah (2011) who reported that imadacloprid was very effective against leaf hoppers on okra.

It could be concluded, to overcome the loss caused by the leafhopper Acetamiprid 20% SP @ 0.3 g/l and imidacloprid 17.8%@ 0.5 ml/l SL proved to be the most promising insecticides with minimum population of leafhopper followed by Acephate 75 % SP @ 1 g/l, and Afidopyropen 50 DC @ 2ml /l can be used in the management of leafhopper in okra.

Table.1 Insecticides evaluated against okra leafhopper, *Amrasca biguttula biguttula*

Sl.No.	Treatments	Trade name	Dosage (ml or g/ltr)
T_1	Acetamiprid 20% SP	Pride	0.3g/l
T_2	Imidacloprid 17.8 %SL	Confidor	0.5ml/l
T_3	Chlorfenapyr 10 % EC	Intripride	1ml/l
T_4	Diafenthiuron 50 % WP	Pegasus	1gm/l
T_5	Fenazaquin 10 % EC	Magister	2ml/l
T_6	Azadirachtin 0.03% EC	Nimbecidine	2ml/l
T_7	Afidopyropen 50 DC	Inscalis	2ml/l
T_8	Acephate 75 %SP	Lancer	1.0 gm/l
T_9	Untreated control	-	-

Table.2 Bio-efficacy of insecticides against leafhopper, *Amrasca biguttula bigutttula* on okra during *Kharif* 2018-19

Treatments	Dosage (g or ml/l)	Number of leafhoppers / 3 leaves										Mean	Per cent reduction over control
		1st spray					2nd spray						
		1 DBS	1 DAS	3 DAS	7 DAS	14 DAS	1 DBS	1 DAS	3 DAS	7 DAS	14 DAS		
Acetamiprid 20% SP	**0.3g/l**	**5.97 (2.44)**	**1.60 (1.23)^{e}**	**1.50 (1.18)^{g}**	**1.10 (1.37)^{e}**	**1.40 (1.40)^{f}**	**6.23 (3.76)^{f}**	**2.88 (1.81)^{f}**	**1.64 (1.26)^{f}**	**2.84 (1.64)^{f}**	**3.90 (1.97)^{f}**	2.28	83.06
Imidacloprid 17.8 %SL	**0.5ml/l**	**6.01 (2.45)**	**2.22 (1.58)^{d}**	**1.80 (1.43)^{ef}**	**1.20 (1.55)^{d}**	**2.10 (1.69)^{e}**	**7.71 (3.70)^{e}**	**3.20 (1.92)^{ef}**	**1.92 (1.37)^{ef}**	**3.42 (1.87)^{ef}**	**4.20 (2.04)^{f}**	2.30	82.91
Chlorfenapyr 10 % EC	**1ml/l**	**5.77 (2.40)**	**5.07 (2.20)^{bc}**	**4.91 (2.24)^{b}**	**4.03 (2.12)^{b}**	**5.57 (2.46)^{b}**	**14.80 (3.84)^{b}**	**8.84 (3.04)^{b}**	**5.26 (2.27)^{b}**	**6.40 (2.52)^{bc}**	**7.80 (2.79)^{bc}**	5.79	56.98
Diafenthiuron 50 % EC	**1ml/l**	**6.01 (2.45)**	**4.10 (2.02)^{c}**	**3.40 (1.80)^{d}**	**2.70 (1.78)^{b}**	**3.20 (1.92)^{d}**	**9.62 (3.94)^{c}**	**7.21 (2.77)^{c}**	**4.28 (2.04)^{c}**	**5.44 (2.31)^{cd}**	**6.90 (2.62)^{cd}**	4.63	65.60
Fenazaquin 10 % EC	**2ml/l**	**5.93 (2.41)**	**5.37 (2.31)^{b}**	**5.06 (2.24)^{b}**	**4.57 (2.24)^{c}**	**5.27 (2.35)^{bc}**	**14.94 (3.86)^{b}**	**9.10 (3.09)^{b}**	**5.84 (2.40)^{b}**	**7.18 (2.64)^{b}**	**8.20 (2.85)^{b}**	6.27	53.41
Azadirachtin	**2ml/l**	**6.13 (2.45)**	**4.90 (2.19)^{bc}**	**3.20 (2.00)^{c}**	**2.40 (2.12)^{b}**	**3.90 (2.12)^{c}**	**8.59 (3.93)^{d}**	**6.80 (2.69)^{c}**	**4.00 (1.99)^{c}**	**5.27 (2.26)^{d}**	**6.40 (2.52)^{d}**	4.60	65.82
Afidopyropen 50 DC	**2ml/l**	**5.68 (2.46)**	**2.90 (1.70)^{d}**	**2.20 (1.53)^{e}**	**1.93 (1.55)^{d}**	**2.37 (1.69)^{e}**	**7.90 (3.72)^{e}**	**4.51 (2.22)^{d}**	**2.81 (1.67)^{d}**	**3.96 (1.98)^{e}**	**5.20 (2.29)^{e}**	3.15	76.59
Acephate 75 %SP	**1g /l**	**6.10 (2.40)**	**2.80 (1.67)^{d}**	**1.90 (1.37)^{f}**	**2.20 (1.64)^{d}**	**2.70 (1.78)^{de}**	**6.21 (3.90)^{f}**	**3.95 (2.09)^{de}**	**2.46 (1.57)^{de}**	**3.64 (1.93)^{e}**	**4.80 (2.18)^{ef}**	3.03	77.48
Untreated control	**-**	**6.13 (2.24)**	**7.20 (2.56)^{a}**	**8.60 (2.67)^{a}**	**10.4 (2.86)^{a}**	**11.3 (2.96)^{a}**	**14.60 (3.86)^{a}**	**15.94 (4.05)^{a}**	**16.74 (4.08)^{a}**	**17.41 (4.15)^{a}**	**20.2 (4.50)^{a}**	13.46	-
SE.m.±	**-**	**-**	**0.18**	**0.18**	**0.19**	**0.26**	**0.51**	**0.33**	**0.26**	**0.33**	**0.388**		**-**
CD(p=0.05)	**-**	**-**	**0.55**	**0.54**	**0.59**	**0.80**	**1.53**	**0.99**	**0.80**	**1.01**	**1.16**	**-**	**-**
CV %	**-**	**-**	**7.48**	**8.06**	**9.7**	**10.86**	**8.01**	**8.28**	**9.42**	**9.53**	**8.95**	**-**	**-**

DBS – Day before spraying DAS – Days after spraying

Means followed by same letter do not differ significantly by DMRT (P = 0.05) Figures in the parenthesis are $\sqrt{x + 0.5}$ transformed values

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