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Evaluation of different IPM modules against cotton jassid, *Amrasca biguttula biguttula* (Ishida) on okra under mid-hill conditions of Himachal Pradesh

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ABSTRACT

Investigations were carried out on evaluation of different IPM modules against cotton jassid, *Amrasca biguttula biguttula* (Ishida) infesting okra (cv P-8) crop consecutively for three years during the Kharif season of 2008-10 at the seed production farm of Department of Seed Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP. All the treatments/modules resulted in lower jassid population/plant as compared to control. The minimum average jassid (nymphs and adults) population (3.99/plant) was recorded in Module I in which treatment of okra seeds with thiamethoxam 70 WS @ 3 g/kg seed followed by foliar sprays of imidacloprid 200 SL @ 0.3 ml/l at 40 days after sowing (DAS), foliar spray of spinosad 45 SC @ 0.3 ml/l at 50 DAS, foliar spray of emamectin benzoate 25 WG @ 0.4g/l at 70 DAS and foliar spray of spinosad 45 SC @ 0.3ml/l at 80 DAS were carried out. This was followed by Module IV with 4.01 nymphs and adults per plant. Module II was found least effective with jassid population of 4.23 nymphs and adults per plant. Significantly minimum jassids (2.39 nymphs and adults/plant) were recorded after 20 days of sowing whereas maximum number of jassids (6.05/plant) was recorded after 40 days of sowing. Maximum seed yield (9.91 q/ha) was also recorded with Module I.

Keywords: Okra; IPM modules; Jassid; *Amrasca biguttula biguttula*; yield

INTRODUCTION

Okra, *Abelmoschus esculentus* (L) Moench is an important vegetable crop in Himachal Pradesh. In India it is grown in an area of 518.4 thousand hectare with a production of 6,259.2 thousand metric tons (Anonymous 2012). Productivity of okra is adversely affected by the attack of many species of insect pests including jassids, fruit borers, aphids and mites (Shivakumar et al 2003, Singh et al 2005). Amongst various insect pests attacking okra crop the jassid, *Amrasca bigutulla bigutulla* (Ishida) is considered to be one of the serious pests. The nymphs as well as adults

of jassid suck the cell sap from the leaves resulting in lower seed yield. The attack sometimes results in serious damage to the crop (Jotwani et al 1966). The pest attacks the crop throughout the seedling stage to the fruit setting during Kharif season. For management of sucking pests various synthetic insecticides are being used but their indiscriminate and regular use has increased environmental pollution and the risk to consumers due to presence of residues. This necessitated the evaluation of different types of bio-intensive modules against cotton jassid so that effective control measures can be developed and crop can be protected from damage caused by it.

MATERIAL and METHODS

The experiment was conducted on okra (cv P-8) crop consecutively for three years during Kharif season of 2008-10 at the seed production farm of Department of Seed Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP. The experiment was conducted in randomized block design with three replications. The crop was raised in a plot size of 4 x 3 m following appropriate agronomic practices (Anonymous 2005). There were five modules/treatments including control.

Module I (M_1): Seed treatment with thiamethoxam 70 WS @ 3 g/kg seed, foliar spray of imidacloprid 200 SL @ 0.3 ml/l at 40 days after sowing (DAS), foliar spray of spinosad 45 SC @ 0.3 ml/l at 50 DAS, foliar spray of emamectin benzoate 25 WG @ 0.4g/l at 70 DAS and foliar spray of spinosad 45 SC @ 0.3ml/l at 80 DAS.

Module II (M_2): Neem cake application @ 250 kg/ha at the time of sowing, sowing of maize at the borders as trap crop for conservation of natural enemies, foliar spray of neem formulation (Multineem) @ 3 ml/l at 30 DAS, foliar spray of *Verticillium lecanii* (Verticel) @ 4 g/l + milk @ 5 ml/l (spraying done in the afternoon) at 40 DAS, foliar spray of neem formulation (Multineem) @ 3 ml/l at 50 DAS and foliar spray of Bt (*Bacillus thuringiensis*) formulation 1 ml/l at 60, 70 and 80 DAS.

Module III (M_3): Seed treatment with thiamethoxam 70 WS @ 3 g/kg seed, foliar spray of neem formulation (Multineem) @ 3 ml/l at 40 DAS, foliar spray of endosulfan (1 ml/l) + neem formulation @ 3 ml/l at 50 DAS, foliar spray of spinosad 45 SC @ 0.3 ml/l at 60 DAS, foliar spray of Bt formulation @ 1 ml/l at 75 DAS and foliar spray of neem formulation @ 3 ml/l at 85 DAS.

Module IV (M_4): Seed treatment with thiamethoxam 70 WS @ 3 g/kg seed, foliar spray of endosulfan @ 2 ml/l at 25 DAS, foliar spray of endosulfan @ 2 ml/l at 35 DAS, foliar spray of cypermethrin @ 0.5 ml/l at 50 DAS, foliar spray of endosulfan @ 2 ml/l at 65 DAS and foliar spray of cypermethrin @ 0.5 ml/l at 80 DAS.

Module V (M_5): control

Population of jassids was recorded as per method of Krishnaiah et al (1979) at 3-leaf sample (second, third and fourth from the top) basis at 10 days interval after 20 days of sowing on five randomly selected plants in each plot and mean jassid population was calculated. The data on plant height, number of fruits/plant were recorded from five randomly selected plants per plot and total seed yield was recorded. The data on jassid population were subjected to analysis in randomized block design.

RESULTS and DISCUSSION

It is evident from Table 1 that the jassid population persisted throughout the cropping period and ranged between 2.39 and 6.05 mean number of nymphs and adults per plant at different intervals. All the treatments resulted in lower number of jassids per plant as compared to control. Among different treatments/modules minimum mean jassid population (3.99/ plant) was recorded in Module I. However it was also found at par with jassid population in M_2, M_3 and M_4. Module II was least effective with jassid population of 4.23 nymphs and adults/plant. Significantly lowest number of jassids (2.39/ plant) was recorded after 20 days of sowing as compared to rest of the sampling intervals. The highest number of jassids (6.05/plant) was recorded after 40 days of sowing after which population started decreasing. The root length recorded in different treatments was non-significant with each other. The shoot length was found highest in M_2 which was also at par with M_1. All the treatments resulted in significantly higher seed yield as compared to control. Maximum seed yield (9.91 q/ ha) recorded in Module I was statistically at par with Module III (M_3).

In the present investigations Module I in which okra seed was treated with thiamethoxam (3 g/kg seed) followed by foliar sprays of imidacloprid 200 SL @ 0.3 ml/l at 40 days after sowing (DAS), foliar spray of spinosad 45 SC @ 0.3 ml/l at 50 DAS, foliar spray of emamectin benzoate 25 WG @ 0.4g/l at 70 DAS and foliar spray of spinosad 45 SC @ 0.3ml/l at 80 DAS were carried out was found to be most effective in suppression of the jassid population which is in accordance with the findings of Verma and Kanwar (2009) who also reported that seed treatment with thiamethoxam and imidacloprid @ 3g/kg seed was an effective option to suppress the jassid population on okra for at least 40 days after sowing and would result in higher seed yield. Foliar application of imidacloprid (17.8 SL) @ 25 g ai/ha has been found very effective against jassids on okra (Preetha et al 2009). Thiamethoxam has also provided similar results against the jassid when used as foliar spray. Both the neonicotinoids were found better than conventional insecticide methyl

Table 1. Effect of different IPM modules on jassid population and seed yield of okra at Nauni, Solan, Himachal Pradesh (Pooled data of three years, 2008 to 2010)

Treatment/ module	Mean population* of jassids at indicated intervals Days after sowing (DAS)					Overall mean population of jassids	Root length (cm)	Shoot length (cm)	Seed yield (q/ha)
	20	30	40	50	60				
M_1	1.89 (1.53)	4.00 (2.02)	4.91 (2.25)	4.93 (2.23)	4.24 (2.06)	3.99 (2.02)	14.37	46.46	9.91
M_2	2.07 (1.59)	5.07 (2.13)	5.02 (2.27)	4.67 (2.17)	4.33 (2.04)	4.23 (2.04)	14.22	48.08	8.88
M_3	1.73 (1.47)	3.73 (1.97)	5.33 (2.32)	5.20 (2.28)	4.26 (2.04)	4.05 (2.02)	14.45	45.46	9.74
M_4	2.11 (1.61)	3.60 (1.95)	5.16 (2.29)	5.27 (2.29)	3.91 (2.02)	4.01 (2.03)	14.20	44.63	8.85
M_5	4.13 (2.12)	6.82 (2.58)	9.84 (2.68)	8.44 (2.86)	6.84 (2.61)	7.22 (2.57)	13.69	42.53	7.31
Mean	2.39 (1.66)	4.64 (2.13)	6.05 (2.36)	5.70 (2.37)	4.72 (2.15)	4.70 (2.14)			

*Figures in parenthesis are $\sqrt{x + 0.5}$ transformations

$CD_{0.05}$ for jassid population:

Treatment= 0.11
Days= 0.11
Treatment x Day = 0.25

$CD_{0.05}$ for root length= NS
$CD_{0.05}$ for shoot length= 2.17
$CD_{0.05}$ for seed yield= 0.59

demeton (125 g ai/ha). Jat and Jayakumar (2006) reported neem oil to reduce the leaf hopper population up to 20.4-42.5 per cent.

The insecticides evaluated in different modules in present studies belong to new groups of insecticides which have different mode of action and have been found effective at lower rates against insect pests of okra including jassids. They are selective against various insect pests and are also safer to the environment especially when used as seed dressers.

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