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SUSTAINABLE CONTROL OF LEAF HOPPER (*Amrasca biguttula biguttula* Ishida) ON GRAPE VINE (*Vitis vinifera* L.)

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Leaf hopper (*Amrasca biguttula biguttula* Ishida.) causes heavy damage to grape vine (*Vitis vinifera* L.)**.** The pest causes a limiting factor in the commercial production of grapes and many other crops in West Bengal. It was observed that spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 100, 120 and 140 a.i. g /ha, one dose of spinetoram 12% SC w/v (11.7%w/w), sulfoxaflor 24% w/v (21.8% w/w) SC, emamectin benzoate 5% SG and buprofezin 25% SC @ 30, 90, 11 and 250 a.i. g /ha, respectively were sprayed to compare their efficacy against leaf hopper. The spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 140 g a.i./ha provided to be the best control of leaf hopper and spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha. Same trends have also been reflected in yield of grapes. The tested insecticides were also found very safe to predators *i.e. Menochilus* sp., *Syrphus* sp. and *Chrysoperla* sp. of grapes insect-pests.

Keywords: Fruits; insect growth regulator; safe pesticides; predators; sustainability.

1. INTRODUCTION

Grapes (*Vitis vinifera* L.) are one of the most remunerative fruit crop in India. The crop is susceptible to various insect pests of which leaf hopper/Jassid (*Amrasca biguttula biguttula* Ishida.) causes heavy damage. Leaf hopper, a phytophagous insect, is a limiting factor in the commercial cultivation of grape vine and many other crops in West Brngal. Its infestation begins at the early stage of crop growth [1]. Infestation by hoppers creates a burnt appearance to the plants and development of sooty rnould interferes with the photosynthetic activity of the infested crops. Similarly, severely infested orchards present a sickly sight. Subba et al. [2] recorded highest leaf hopper population during 3rd

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to 16th standard week. Ghosh and senapati [3] reported highest population (4.63/leaf) during April-May and positively correlated with temperature gradient, relative humidity and rainfall. Most of the conventional chemicals viz. organochlorines and organophosphates are broad spectrum, persistent in nature, and having long residual action [4,5]. Subba et al. [2] found that acetamiprid is the most effective against jassid/ leaf hopper control. Ghosh [6] found that dinotefuron 20 SG, fipronil 5% SC, and imidacloprod 70 WG provided best suppression of jassid (90.29 %, 89.34 % and 78.42 % control respectively). Ghosh [6] again reported that the highest reduction of jassid population noticed from the treatment with imidacloprid 17.8% SL @ 50 a.i. g/ha. No significant work is reported on hopper management with safer insecticides, and insect growth regulator (lGR). A new insecticide, buprofezin discovered by Nihon Nohyaku Co. [7,8], showed activities on planthoppers, leafhoppers, green-house whitefly, scale insects etc.. This insecticide showed excellent control effect on *Trialeurodes vaporariorum* in vinylhouse [9]. Slow-acting property of buprofezin observed on the brown plant hopper [10] and the twenty-eight-spotted epilachna, *Henosepilachna vigintioctopunctata* [11]. Slight ovicidal action of buprofezin was also observed for the early stage eggs of brown plant hopper [12]. Almost all larvae died in the presence of buprofezin showed abnormal rnolting on brown plant hopper [12]. Ghosh [13] reported that buprofezin, an important insect growth regulator (IGR), provided best hopper population suppression and safer to natural enemies.

Ghosh and Chakraborty [14] reported that pest control by using bio-control agent is an important component of Integrated Pest Management (IPM). Ghosh et al. [15] reported that lady bird beetle / coccinellid beetle *Menochilus sexmaculatus* was an important predator of aphid and jassid and its feeding activity was found throughout the year. Coccinellid beetle, as the generalized predatory agent have gained great interest for biological control in West Bengal, India [16,17].

2. MATERIALS AND METHODS

2.1 Study Period and Location

The experiment was conducted in Taldanga village, Bankura near college of Agriculture, Bankura, under Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India during 2015 and 2016. The grape crop was cultivated on upland with good irrigation and drainage facility.

2.2 Treatment Details

Eight treatments were taken including one untreated check. With these treatments, three treatments contained mixed formulations of spinetoram 10% w/w + sulfoxaflor 30% w/w WG of different doses. These insecticides are also used as single formulation such as spinetoram 12%SC w/v (11.7%w/w) and sulfoxaflor 24% SC w/v (21.8% w/w). The other insecticides used are emamectin Benzoate 5% SG and buprofezin 25% SC. These insecticides are recommended for use against this jassid pest.

List 1: The details of the treatments are as follows:

Sl. No.	Treatments	Dose (g a.i./ha)
1.	Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	100
2.	Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	120
3.	Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	140
4.	Spinetoram 12%SC w/v (11.7%w/w)	30
5.	Sulfoxaflor 24% SC w/v (21.8% w/w)	90
6.	Emamectin Benzoate 5% SG	11
7.	Buprofezin 25% SC	250
8.	Untreated	Fresh water spray (500 L/ha)

2.3 Lay out of the Field Experiment

Period of experiment : January to May, during both year (2015 and 2016)
Variety of grapes : Arka N
Plot size : 10 X 5m (50 sq.m.)
Design of experiment : Randomized Block Design (RBD)
Number of spray : Two
Date of spray : First year: First spray: 23.03.2015 & second spray: 03.04.2015; and first spray: 16.03.2016 & second spray: 26.03.2016.
Application method (type of sprayer) : ASPEE Knapsack Sprayer with hollow cone nozzle
Spraying volume : 500 L/ha
Picking : Multiple

2.4 Data Recording of Bio-efficacy against Pest

The insecticides sprayed two times at an interval of 10 days for both the years starting with the initiation of the pests. Four apical twigs from five randomly selected plants were chosen to count the number of leaf hopper. The hopper population was counted one day before first spray and post treatment counts and at 3, 7 and 10 days after each application. The population of natural enemies was recorded before and after spray. Hand lens (10X) were used for recording all the observations. The yield data was recorded at every picking. The data were subjected to analysis of variance after making necessary transformation and expressed on the basis of pest population/twig (Sheoren, 1998). Yield data was also recorded.

3. RESULTS AND DISCUSSION

Three doses of Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG @ 100, 120 and 140 a.i. g /ha, one dose of Spinetoram 12% SC w/v (11.7%w/w), Sulfoxaflor 24% w/v (21.8% w/w) SC, Emamectin Benzoate 5% SG and Buprofezin 25% SC @ 30, 90, 11 and 250 a.i. g /ha respectively were sprayed to work out their efficacy against leaf hopper. One untreated check (controlled treatment) was taken for observing natural infestation of target pests. Two round spraying has been done where first round was initiated during third week of March during 2015 and second week of March during 2016 and subsequent spraying has been done at 10 days interval. The data on the result of field efficacy of the treatments against leaf hopper is presented in Table 1 and Table 2 and the natural enemy population has been presented in Table 3.

In 2015, the pooled efficacy of different treatment schedules against leaf hopper of grapes has been presented in Table 1. All the treated plots with chemicals were significantly superior in their performance over the untreated plot. spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 140 g a.i./ha provided the best control of leaf on grape and spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha was statistically at par with it. Same trends have also been reflected in yield of grapes. The maximum yield (7.25 kg/plant) was obtained from the plots treated with the highest tested dose of spinetoram 10% w/w + sulfoxaflor 30% w/w WG (140 g a.i./ha) which was at par (6.74 kg/plant) with spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha. The yield increase was also of high order, like spinetoram 12%SC w/v (11.7%w/w) @30 g a.i./ha (6.52 kg/plant), sulfoxaflor 24% w/v (21.8% w/w) SC @ 90 g a.i./ha (6.45 kg/plant), emamectin benzoate 5% SG @ 11 g a.i./ha (6.44 kg/plant), spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 100 g a.i./ha (5.94 kg/plant), and buprofezin 25% SC @ 250 g a.i./ha (5.73 kg/plant).

In 2016, the pooled efficacy of different treatment schedules of spinetoram 10% w/w + sulfoxaflor 30% w/w WG against leaf hopper of grapes have been presented in Table 2. All the treated plots with chemicals were significantly superior in their performance over that of untreated plots. Spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 140 g a.i./ha provided the best control of leaf hopper of grape and spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha was statistically at par with it. Same trends have also been reflected in yield. The maximum yield (7.64 kg/ha) was obtained from the plots treated with the highest tested dose of spinetoram 10% w/w + sulfoxaflor 30% w/w WG (140 g a.i./ha) which was at par (7.64 kg/plant) with spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha (7.24 kg/plant). The yield increase was also of high order like sulfoxaflor 24% w/v (21.8% w/w) SC @ 90 g a.i./ha (6.95 kg/plant), spinetoram 12%SC w/v (11.7%w/w) @ 30 g a.i./ha (6.90 kg/plant), emamectin benzoate 5% SG@ 11 g a.i./ha (6.72 kg/plant), spinetoram 10% w/w + sulfoxaflor 30% w/w WG 100 g a.i./ha (6.48 kg/plant), and suprofezin 25% SC @ 250 g a.i./ha (5.85 kg/plant).

It was observed that all the treated plots had more or less higher population of all the three predators. There were no significant differences among the treated plots and untreated control.

Overall observation revealed that all the treatments provided better control of leaf hopper pest in comparison with untreated control. Among the treatments, spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 140 g a.i./ha, and spinetoram 10% w/w + sulfoxaflor 30% w/w WG @ 120 g a.i./ha proved to be most effective control of leaf hopper and were statistically at par. All the treatments were safer to the predators. Ghosh et al. [15,18,19] reported that lady bird beetle / coccinellid beetle *Menochilus sexmaculatus* was an important predator of leaf hopper etc., and its feeding activity was found throughout the year. The insecticides may be recommended for the farmers.

Table 1. Effect of different insecticidal treatments against Leaf hopper (*Amrasca biguttula biguttula*) of Grape and Fruit yield (2015)

Treatments	Dose (g a.i./ha)	Leaf Hopper population/ twig before 1st spray	Leaf hopper population at different intervals (days) after spraying/per plant						Fruit Yield (Kg/Plant)
			Different days after 1st application			Different days after 2nd application			
			3rd	7th	10th	3rd	7th	10th	
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	100	4.0	2.3 (1.67)*	2.9 (1.84)	3.2 (1.92)	1.9 (1.55)	2.7 (1.79)	3.5 (2.00)	5.94
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	120	4.3	1.0 (1.22)	0.0 (0.71)	0.3 (0.89)	0.0 (0.71)	0.0 (0.71)	0.3 (0.89)	6.74
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	140	3.8	0.3 (0.89)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.3 (0.89)	7.25
Spinetoram 12%SC w/v (11.7%w/w)	30	3.3	2.7 (1.79)	3.1 (1.90)	3.3 (1.95)	2.3 (1.67)	3.4 (1.97)	4.1 (2.14)	6.52
Sulfoxaflor 24% w/v (21.8% w/w) SC	90	4.0	1.0 (1.22)	0.0 (0.71)	0.1 (0.77)	0.0 (0.71)	0.0 (0.71)	0.3 (0.89)	6.45
Emamectin Benzoate 5% SG	11	3.7	4.3 (2.19)	5.9 (2.53)	6.3 (2.61)	5.0 (2.35)	6.2 (2.59)	6.4 (2.63)	6.44
Buprofezin 25% SC	250	3.7	3.2 (1.92)	4.3 (2.19)	5.7 (2.49)	4.7 (2.28)	5.3 (2.41)	6.0 (2.55)	5.73
Untreated	---	4.0	5.3 (2.41)	6.7 (2.68)	6.9 (2.72)	7.4 (2.81)	7.7 (2.86)	8.3 (2.97)	5.12
CD at 5%		**NS**	**0.76**	**0.49**	**0.62**	**0.74**	**1.01**	**0.78**	**0.64**

Value in the parenthesis are square root transformed value; N.S. = Not significant.

Table 2. Effect of different insecticidal treatments against leaf hopper (*Amrasca biguttula biguttula*) of grapes and fruit yield (2016)

Treatments	Dose (g a.i./ha)	Leaf hopper population/twig before 1st spray	Leaf hopper population at different intervals (days) after spraying/per plant						Fruit Yield (Kg/Plant)
			Different days after 1st application			Different days after 2nd application			
			3rd	7th	10th	3rd	7th	10th	
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	100	4.3	1.9 (1.55)*	2.1 (1.61)	2.4 (1.70)	1.1 (1.26)	1.7 (1.48)	2.5 (1.73)	6.48
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	120	5.0	0.3 (0.89)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.1 (0.77)	7.24
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	140	5.3	0.1 (0.77)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.1 (0.77)	7.64
Spinetoram 12%SC w/v (11.7%w/w)	30	4.7	3.3 (1.95)	3.7 (2.05)	4.1 (2.14)	2.3 (1.67)	3.2 (1.92)	3.9 (2.10)	6.90
Sulfoxaflor 24% w/v (21.8% w/w) SC	90	5.0	0.3 (0.89)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.0 (0.71)	0.1 (0.77)	6.95
Emamectin Benzoate 5% SG	11	4.7	4.0 (2.12)	4.9 (2.32)	5.6 (2.47)	4.7 (2.28)	5.3 (2.41)	5.7 (2.49)	6.72
Buprofezin 25% SC	250	5.3	2.9 (1.84)	3.3 (1.94)	4.1 (2.14)	3.1 (1.90)	3.8 (2.07)	4.2 (2.17)	5.85
Untreated	---	5.3	5.6 (2.47)	6.1 (2.57)	6.7 (2.68)	7.0 (2.74)	7.4 (2.81)	7.7 (2.86)	5.34
CD at 5%		**NS**	**0.54**	**1.01**	**0.68**	**0.24**	**0.49**	**0.72**	**0.92**

Value in the parenthesis are square root transformed value; N.S. = Not significant.

Table 3. Effect of different treatments on some important insect predators found in Grapes field during Jan-May 2016

Treatments	Dose (g a.i./ha)	No. of predators per 10 branches		
		Menochilus sp.	*Syrphus* sp.	*Chrysoperla* sp.
Spinetoram10% w/w + Sulfoxaflor 30% w/w WG	140	3.34	4.22	2.88
Spinetoram10% w/w + Sulfoxaflor 30% w/w WG	280	3.40	4.12	2.96
Spinetoram 10% w/w + Sulfoxaflor 30% w/w WG	140	3.33	4.03	2.90
Spinetoram 12%SC w/v (11.7%w/w)	30	3.34	3.89	2.88
Sulfoxaflor 24% SC w/v (21.8% w/w)	90	3.44	4.09	2.88
Emamectin Benzoate 5% SG	11	3.28	4.01	2.69
Buprofezin 25% SC	250	3.38	3.92	2.67
Untreated	---	3.40	4.12	2.88
CD at 5%		**NS**	**NS**	**NS**

**Figures in parentheses are square root transformed values; N.S = Not significant.*

4. CONCLUSION AND RECOMMENDATION

It is evident from the present investigation that spinetoram 10% w/w + sulfoxaflor 30% w/w WG is effective against leaf hopper of grapes @ 120 - 140 g a.i./ha. Considering the efficacy of the product as well yield of grape, spinetoram 10% w/w + sulfoxaflor 30% w/w WG @120 g a.i./ha can be recommended as effective economical rate for controlling leaf hopper. Similar trend followed in the experiments done during 2016. It is evident from this study that all the treatments are safer to three important predators recorded in gapes field *i.e. Menochilus* sp., *Syrphus* sp. and *Chrysoperla* sp.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Faleiro JR, Rai S. Determination of Vulnerable stage of crop growth of leaf hopper attack on okra. Indian Journal of Entomology. 1985;47 (2):238-239.
2. Subba B, Ghosh SK, Banerjee D, Jasudasu GS. Seasonal incidence of Jassid Infesting tomato (*Lycopersicon esculentum* L.) and their sustainable management. Annals of Plant and Soil Research. 2015;17:19-22 (Special Issue).
3. Ghosh SK, Senapati SK. Biology and seasonal abundance of jassid infesting brinjal in terai region of West Bengal. Environment and Ecology. 2003;21(3):716-719.
4. Subba B, Pal S, Mandal T, Ghosh SK. Population dynamics of white fly (*Bemisia tabaci* Genn.) Infesting tomato (*Lycopersicon esculentum* L.) and their sustainable management using bio-pesticides. Journal of Entomology and Zoology Studies. 2017; 5(3):879-883.
5. Nayar KK, Ananthakrishnan TN, David BV. General and Applied Entomology. 1992;Pp., 430-431.
6. Ghosh SK. Management of sucking pest, jassid (*Amrasca devastans*) and thrips (*Thrips palmi*) on lady'sfinger (*Abelmoschus esculentus* L.) by using safe insecticides. Int. J. Curr. Microbiol. App. Sci. 2020;9 (11):2340-2352.
7. Ikeda K, Kanna H, Yasui M. Synthesis and biological activity of 1,3,5-thiodiazine

derivetives. IUPAC Pestic. Chem. 1983;Pp., 141-144.

8. Shibuya M. Applaud, a new selective insecticide. Jpn. Pestic. Lnform. 1984;44:17-21.
9. Naba K, Nakazawa K, hayashi H. Long-term effect of buprofezin spray in controlling tlre green-house whitefly, *Trialeurodes vaporariorarr* Westrvood, in vinyl-house tomatoes. Appl. Ent. Zool. 1983;18:284-286.
10. Kajihara O, Asai T, Ikeda K, Lim SS. Buprofezin, a new insecticide for control of brown planthopper, *Nilaparvata lugens*. Proc. lnt. Conf. Plant prot. Trop. 1982;Pp., l-7.
11. Yasui M, Fukada M, Maekawa S. Action of buprofezin against the twentyeight-spotted ladybird, *Henosepilachna vigintioctopunctata* Fab. Proc. 27th Annu. Meet. Jap. Soc. Appl. Ent. Zool. 1983;Pp., 98 (in Japanese).
12. Asai T, Fukuda M, Maekawa S, Ikeda K, Kanna H. Studies on the mode of action of buprofezin, nymphcial and ovicidal activities on the brown plant hopper. Appl. Ent. Zool. 1983;18:550-552.
13. Ghosh SK. Sustainable management of mango hopper (*Amritodas atkinsony* Leth. and *Idioscopus niveosparsus* Leth. Together) by using insect growth regulator (IGR), buprofezin 25 SC. Uttar Pradesh J. Zool. 2013;33(2):119-128.
14. Ghosh SK, Chakraborty K. Incidence and abundance of predatory beetle with special reference to *Coccinella septempunctata* in sub-Himalayan region of north-east India. International Journal of Plant, Animal and Environmental Sciences. 2012;2(3):157-162.
15. Ghosh SK, Laskar N, Senapati SK. Seasonal incidence of predator *Menochilus sexmaculatus* Berliner on brinjal and harmful effect of insecticides on the predator. Indian Journal of Agriculture. Research. 2007;41 (2):102-106.
16. Ghosh SK. Studies on the pest constraints of brinjal/eggplant (*Solanum melongena* L.) and their management under terai region of West Bengal, India. Ph.D. Thesis awarded by BCKV-Agriculture University, West Bengal, India. 1999;Pp., 43-44.
17. Chakraborty K, Ghosh SK. Incidence of *Coccinella septempunctata* in brinjal with some pesticides. Current advances in Agricultural Sciences. 2010;2 (2):129-130. (Short Communication).
18. Ghosh SK. Evaluation of safe insecticides against sucking pests, jassid (*Amrasca bigutula bigutula* Ishida) and aphid (*Aphis gossypii* Glov.) infesting chilli (*Capsicum annum* L.) crop. Journal of Entomology and Zoology studies (JEZS). 2020;8(5):1428-1433.
19. Ghosh S. K, Chakraborty K. Integrated field management of jassid (*Amrasca biguttula biguttula* Ishida.) infesting ladysfinger *Abelmoschus esculentus* (L.) Moench using bio-pesticides. International Journal of Science, Environment and Technology. 2015;4(2):459-467.