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EVALUATION OF DIFFERENT NEWER INSECTICIDES AGAINST MANGO HOPPER

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Abstract

The experiment was conducted during 2022-23 mango cropping season at Lac Research Station, Bangladesh Agricultultural Research Institute (BARI), Chapainawabganj to evaluate some newer insecticides against mango hopper, *Idioscopus spp.* (Hemiptera: Cicadellidae). The experiment was laid out in a randomized complete block design (RCBD) with three replications. The treatments comprised 12 treatments, viz. Chlorpyriphos+Cypermethrin 55 EC @ 1 ml/L of water, Cypermethrin 10 EC @ 1 ml/L of water, Diafenthiuron 50 EC @ 1.2 ml/L of water, Chlorpyriphos+Beta-cypermethrin 60 EC @ 1 ml/L of water, Lambda-Cyhalothrin 2.5 EC @ 1 ml/L of water, Monomihypo+Imidacloprid 80 WG @ 0.5 g/L of water, Nitenpyram+Pymetrozine 80 WDG @ 0.5 g/L of water, Imidacloprid+Lambda-Cyhalothrin 20 SC @ 0.5 ml/L of water, Indoxacarb+Emamectin Benzoate 25 WDG @ 0.1 g/L of water, Cartap+Acetamiprid 95 SP @ 1.5 g/L of water, imidacloprid 20 SL @ 0.5 ml/L of water and an untreated control. Each insecticide was sprayed twice, the 1st spray at 10 days of flowering and the second in 30 days after the 1st spray. All insecticidal treatments were found superior over untreated control for the management of mango hopper. Spraying Imidacloprid 20 SL @ 0.5 ml/L of water was found the most effective for the management of mango hopper, which offered the highest reduction (83.12% and 69.89%, after the first and second spray, respectively) of mango hopper population over control. This treatment also offered the highest fruit retention (100.22%, 56.2% and 101.09% at pea, marble and mature stages of fruit development, respectively) over control. Spraying Imidacloprid+Lambda-Cyhalothrin @ 0.5 ml/L of water offered the second highest efficacy both in terms of pest population reduction and fruit retention over control.

Keywords: *Mangifera indica*, fruit, mango hopper, insecticide

Introduction

Mango (*Mangifera indica* L.) is an important fruit crop in Bangladesh and occupies important place in horticultural wealth and economy of the country. Of the many aspects responsible for low mango yields, pests and diseases are considered the

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major factors. More than 300 insect pests have been recorded to attack mango crops in different regions of the world (Patel *et al.*, 2004). Fruits are utilized at all stages of development, i.e., from immature stage to mature stage and during this period fruits are attacked by several insect-pests (Kumar *et al.*, 2005). The pests include leaf hopper, mealy bug, inflorescence midge, fruit fly, scale insects, shoot borer, leaf webber and stone weevil, causing considerable crop damage (Hati *et al.*, 2005). Among the mango pests, mango hoppers are the most serious and extensive pests across the country (Verghese, 2000) and become a serious pest at flowering and fruiting stages (Kumari *et al*., 2014) which can cause yield loss up to 80-100 percent (Rahman and Kuldeep, 2007). Mango hopper is a great menace nowadays for mango cultivation. The hoppers cause a loss of 20-100% of inflorescence (Haseeb, 2006) and the severely infested plants bear only a few fruits or no fruit at all. Mango hoppers (nymphs and adults) puncture and suck the sap from different growing parts of shoots, inflorescences and mango leaves which cause dropping of immature fruits (Adnan *et al*., 2014). This pest is causing irreparable loss to mango trees by making the plants sick, yellow, weak and fruitless. Hoppers also secrete honeydew which favours the growth of sooty mould on leaves, shoots and inflorescences of mango trees. This black coating interferes with photosynthetic activity of affected plant parts resulting in no flowers and dropping of immature fruits. On heavily infested trees, crop losses of 50% or more have been recorded (Patel *et al.*, 2004). For the management of hopper incidence on mango, farmers mainly rely on insecticides. Many synthetic insecticides having different mode of actions have been recommended so far by different scientists for the management of mango hopper (Ghosh, 2013; Munj *et al.*, 2018; Ramesh and Virendra, 2014). This research work on mango hopper would provide significant information to protect mango flowers and leaves from the attack of this insect and increase the yield which will boost the farmer's economy as well as the country. There is very little scientific information on control of mango hopper and the use of insecticides in controlling it in Bangladesh. Some field studies were also conducted by the previous reporter (Hasan, 2003). Under this circumstance, the present research work was carried out to evaluate some new insecticides against mango hopper.

Materials and Methods

The study was conducted at the mango orchard of Lac Research Station, Chapainawabganj, BARI, Bangladesh during the mango fruiting season of 2022-23. The experiment was laid out in a randomized complete block (RCB) design with 3 replications. One mango tree constituted one replication. Around 15 years old mango trees of var. BARI Aam-3 were used for the study. The experiment consisted of 12 treatments which are given in Table 1.

Table 1. Details of treatments used in insecticidal trial

Treatment	Chemical name	Trade name	Doses/L of water
T_1	Chlorpyriphos + Cypermethrin	Promix 55 EC	1 ml
T_2	Cypermethrin	Biddut 10 EC	1 ml
T_3	Diafenthiuron	Tens Care 50 EC	1.2 ml
T_4	Chlorpyriphos+ Beta- Cypermethrin	Lirifos Plus 60 EC	1 ml
T_5	Lambda-Cyhalothrin	Hector 2.5 EC	1 ml
T_6	Monomihypo + Imidacloprid	Killer 80 WG	0.5 g
T_7	Nitenpyram + Pymetrozine	Pulsor 80 WDG	0.5 g
T_8	Imidacloprid + Lambda-Cyhalothrin	Chaser 20 SC	0.5 ml
T_9	Indoxacarb + Emamectin Benzoate	Erdogan Super 25 WDG	0.1 g
T_{10}	Cartap + Acetamiprid	Safa 95 SP	1.5 g
T_{11}	Imidacloprid	Locker 20 SL	0.5 ml
T_{12} (untreated control)	-	-	-

Different new insecticides were applied as a full cover spray on mango trees from the ground using a power sprayer. Mancozeb (Indofil M-45) @ 2.0 g/L of water was sprayed after each spray of assigned spray schedule. Each treatment of this trial was sprayed twice as a full cover spray such as the first application was made within 10 days of flowering while the second in one month after the first application. Each insecticide was used at a pre-determined single dose. The efficacy of different insecticides was observed separately on the tree inflorescences. Adult mango hoppers were collected from the inflorescences. Pre-treatment observation was recorded one day before and post-treatment observations on survival population were recorded 7, 14 and 21 days after spray application with the help of a one meter long nylon sweeping net. First spray was done on 13 February and second spray (14 March) after 1 month of the first spray. Each mango trees were visually divided into 4 quadrant and mango hoppers were collected from each quadrant of the trunk and leaves by up-down and down-up (for trunk) and left-right and right-left (for leaves) movements of a single continuous sweep of the net. Collected mango hoppers were kept in properly labeled polythene bags and were counted later in the laboratory. Ten inflorescences were randomly selected in each tree and tagged before fruit setting. Fruits of the tagged inflorescences were counted at different stages (pea stage, marble stage and mature stage) in each tree to count fruit retention up to mature stage. The collected data were statistically analyzed through the analysis of variance using Web Agri Stat Package (WASP 1.0) (Jangam and Thali, 2004). Means were separated by Least Significant Difference (LSD) test at 5% level of significance. The insect population data were transformed to $\sqrt{(x + 0.5)}$ values.

Results and Discussion

The efficacy of different insecticides against mango leaf hopper in mango crop is presented in (Tables 2 and 3). The results revealed that all the treatments were found effective in controlling mango leaf hopper as compared to control. The data regarding the effectiveness of different treatments are described below in details:

The overall results after the first spray showed that the lowest average population of mango hopper/inflorescence was observed from T_{11} (2.28) which was statistically similar to T_8 (2.43) and T_5 (2.75) and the maximum average population of mango hopper/inflorescence was recorded in in T_2 (4.13) (Table 2). Among the insecticidal treatments, the treatment T_{11} was found the most effective with the highest reduction (83.12%) over untreated control followed by T_8 (82.01%), T_5 (79.94%) T_6 (77.94%) and T_7 (76.83%), respectively (Table 2). The insecticidal treatments followed the order of reduction over untreated control was T_3 (76.46%) > T_1 (76.16%) > T_9 (75.35%) > T_{10} (75.20%)> T_4 (72.53%)>T_2 (69.43%).

Similar trend was recorded on second spray of application (Table 3). The overall result after the 2nd spray showed that the lowest average population of mango hopper/inflorescence was noted in T_{11} (3.60) which was statistically similar to T_8 (3.74) and T_5 (4.05) and the maximum average population of mango hopper/inflorescence was recorded in in T_2 (5.44) (Table 3). The treatment T_{11} was found the most effective with the highest reduction (69.89%) over untreated control followed by T_8 (68.72%), T_5 (66.13%), T_6 (64.13%) and T_7 (62.70%), respectively. The insecticidal treatments followed the order of reduction over untreated control was T_3 (62.45%) > T_1 (62.04%) > T_9 (61.12%) > T_{10} (60.95%) > T_4 (58.61%) > T_1 (54.51%).

These results corroborate the results of Adnan *et al.* (2014), Chaudhari *et al.* (2017) and Shawan *et al.* (2018) who found imidacloprid as the most superior to all the insecticide treatments against mango hopper, whereas Kumar and Giraddi (2001) reported that imidacloprid and lambda-cyhalothrin were highly effective recording least population of mango hoppers up to 21 days after the spray, totally two sprays were required to manage the mango hoppers. Efficacy of new insecticides on fruit retention at the pea stage, marble stage and mature stage is presented in Table 4. The highest number of fruit retention was recorded in T_{11} (8.93/10 inflorescences) treatment which was followed by T_8 (8.70/10 inflorescences) and T_5 (8.43/10 inflorescences) and the lowest was in treatment T_{12} (4.46/10 inflorescences). Accordingly, the highest percent fruit retention over untreated control was recorded in T_{11} (100.22% in pea stage, 56.20% in marble stage and 101.09% in mature stage) which was followed by T_8 (95.06% in pea stage, 18.27% in marble stage and 75.82% in mature stage) and T_5 (89.01% in pea stage, 56.20% in marble stage and 101.09% in mature stage). This finding is in agreement with Kumar *et al.* (2020) who reported that the highest number of fruits retained and percent fruit retention was found in imidacloprid sprayed treatment over untreated control. Insecticides can encourage population growth of harmful insects by eradicating natural enemies that previously held them in control. The nonspecific nature of broad-spectrum chemicals makes them more likely to have such unintentionally effect on the abundance of both harmful and beneficial insects.

Table 2. Efficacy of some newer insecticides on the abundance of mango hopper after first spray

Treatments	Mean population of mango hopper/inflorescences/tree				Average	(%) reduction over untreated control
	First spray					
	Pre count	7 DAS	14 DAS	21 DAS		
T_1 = Promix 55 EC	10.89 (3.37)	2.63 (1.76)	3.04 (1.88)	4.01 (2.12)	3.22 (1.92)	76.16%
T_2 = Biddut 10 EC	10.82 (3.36)	3.25 (1.93)	3.92 (2.10)	5.21 (2.38)	4.13 (2.15)	69.43%
T_3 = Tens Care 50 EC	11.10 (3.40)	2.57 (1.75)	3.00 (1.87)	3.97 (2.11)	3.18 (1.91)	76.46%
T_4 = Lirifos Plus 60 EC	11.02 (3.39)	3.00 (1.87)	3.35 (1.96)	4.58 (5.08)	3.71 (2.05)	72.53%
T_5 = Hector 2.5 EC	10.79 (3.36)	2.22 (1.64)	2.30 (1.67)	3.67 (2.04)	2.71 (1.79)	79.94%
T_6 = Killer 80 WG	11.06 (3.40)	2.47 (1.72)	2.62 (1.76)	3.85 (2.08)	2.98 (1.86)	77.94%
T_7 = Pulsor 80 WDG	10.89 (3.37)	2.48 (1.72)	2.99 (1.86)	3.97 (2.11)	3.13 (1.90)	76.83%
T_8 = Chaser 20 SC	10.82 (3.36)	2.12 (1.61)	2.17 (1.63)	2.99 (1.86)	2.43 (1.71)	82.01%
T_9 = Erdogan Super 25 WDG	10.79 (3.36)	2.83 (1.82)	3.21 (1.92)	3.97 (2.11)	3.33 (1.95)	75.35%
T_{10} = Safa 95 SP	11.03 (3.39)	2.65 (1.77)	3.18 (1.91)	4.23 (2.17)	3.35 (1.96)	75.20%
T_{11} = Locker 20 SL	10.79 (3.36)	1.97 (1.57)	2.03 (1.59)	2.86 (1.83)	2.28 (1.66)	83.12%
T_{12} = Untreated control	11.06 (3.40)	12.45 (3.59)	13.61 (3.75)	14.50 (3.87)	13.51 (3.74)	-
CV (%)	10.42	15.41	14.79	6.72	10.05	-
LSD (0.05)	NS	0.03	0.0.03	0.03	0.04	-

DAS- Days after spraying, Figures in parenthesis are $\sqrt{(x + 0.5)}$ transformed values, CV = Coefficient of Variation, LSD = Least Significant Difference.

Table 3. Efficacy of some newer insecticides on the abundance of mango hopper after second spray

Treatments	Mean population of mango hopper/inflorescences/tree				Average	(%) reduction over untreated control
	Second spray					
	Pre count	7 DAS	14 DAS	21 DAS		
T_1 = Promix 55 EC	9.43 (3.15)	3.73 (2.05)	4.64 (2.26)	5.26 (2.40)	4.54 (2.24)	62.04%
T_2 = Biddut 10 EC	9.26 (3.12)	4.35 (2.20)	5.52 (2.45)	6.46 (2.63)	5.44 (2.43)	54.51%
T_3 = Tens Care 50 EC	9.39 (3.14)	3.67 (2.04)	4.60 (2.25)	5.22 (2.39)	4.49 (2.23)	62.45%
T_4 = Lirifos Plus 60 EC	9.69 (3.19)	4.10 (2.14)	4.95 (2.33)	5.83 (2.51)	4.95 (2.33)	58.61%
T_5 = Hector 2.5 EC	8.70 (3.03)	3.32 (1.95)	3.90 (2.09)	4.92 (2.32)	4.05 (2.13)	66.13%
T_6 = Killer 80 WG	9.21 (3.11)	3.57 (2.01)	4.22 (2.17)	5.10 (2.36)	4.29 (2.18)	64.13%
T_7 = Pulsor 80 WDG	9.41 (3.14)	3.58 (2.01)	4.59 (2.25)	5.22 (2.39)	4.46 (2.22)	62.70%
T_8 = Chaser 20 SC	8.74 (3.03)	3.22 (1.92)	3.77 (2.06)	4.24 (2.17)	3.74 (2.05)	68.72%
T_9 = Erdogan Super 25 WDG	9.11 (3.10)	3.93 (2.10)	4.81 (2.30)	5.22 (2.39)	4.65 (2.26)	61.12%
T_{10} = Safa 95 SP	9.67 (3.18)	3.75 (2.06)	4.78 (2.29)	5.48 (2.44)	4.67 (2.27)	60.95%
T_{11} = Locker 20 SL	9.39 (3.14)	3.07 (1.88)	3.63 (2.03)	4.11 (2.14)	3.60 (2.02)	69.89%
T_{12} = Untreated control	9.51 (3.16)	11.35 (3.44)	12.01 (3.53)	12.55 (3.61)	11.96 (3.52)	-
CV (%)	10.08	12.13	10.94	13.88	7.98	-
LSD (0.05)	NS	0.13	0.03	0.02	0.02	-

DAS- Days after spraying, Figures in parenthesis are $\sqrt{(x + 0.5)}$ transformed values, CV = Coefficient of Variation, LSD = Least Significant Difference

Table 4. Efficacy of some newer insecticides on fruit retention

Treatments	Mean number of fruits/10 tagged inflorescences/tree			(%) Fruit retention over untreated control		
	Pea stage	Marble stage	Mature stage	Pea stage	Marble stage	Mature stage
T_1 = Promix 55 EC	6.13	3.13	1.30	37.44	7.93	42.85
T_2 = Biddut 10 EC	5.76	3.33	1.36	29.14	14.82	49.45
T_3 = Tens Care 50 EC	6.19	3.16	1.43	38.78	8.96	57.14
T_4 = Lirifos Plus 60 EC	6.04	3.33	1.36	35.42	14.82	49.45
T_5 = Hector 2.5 EC	8.43	3.43	1.60	89.01	18.27	75.82
T_6 = Killer 80 WG	8.30	3.30	1.46	86.09	13.79	60.43
T_7 = Pulsor 80 WDG	6.56	3.23	1.46	47.08	10.21	60.43
T_8 = Chaser 20 SC	8.70	4.03	1.63	95.06	38.96	79.12
T_9 = Erdogan Super 25 WDG	6.33	3.13	1.26	41.92	7.93	38.46
T_{10} = Safa 95 SP	6.33	3.40	1.06	41.92	17.24	16.48
T_{11} = Locker 20 SL	8.93	4.53	1.83	100.22	56.20	101.09
T_{12} = Untreated control	4.46	2.90	0.91	-	-	-
CV (%)	3.63	7.44	6.74	-	-	-
LSD (0.05)	0.42	0.42	0.15	-	-	-

CV = Coefficient of Variation, LSD = Least Significant Difference

Conclusion

On the basis of the trial results, the two sprays, 1st spray at 10 days of flowering and the second in one month after the first application, of imidacloprid 20 SL (Locker) @ 0.5 ml/L of water were found to be the most effective against mango hopper followed by imidacloprid + lambda-cyhalothrin 20 SC (Chaser 20 Sc) @ 0.5 ml/L of water. The highest percent fruit retention was recorded from the two sprays of imidacloprid 20 SL (Locker) @ 0.5 ml/L of water over untreated control.

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