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MANGO HOPPER MANAGEMENT USING SELECTED INSECTICIDES

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ABSTRACT

An experiment was conducted during 2022-23 mango cropping season with twelve treatments including an untreated control replicated thrice, in lac research station, BARI, Chapainawabganj. Treatments comprised of chlorpyriphos + cypermethrin 55 EC @ 1 ml/L of water; pryiproxifen + fenpropathrin 20 EC @ 1 ml/L of water; deltamethrin 2.5 EC @ 0.5 ml/L of water; chloropyfios + betacypermethrin 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; dinotefuran + 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. All insecticidal treatments have found superior over untreated control for the management of mango hopper. Imidacloprid 20 SL was found the best among all other treatnents for the management of mango hopper. The effectiveness of newer insecticides for the management of mango hopper was imidacloprid + lambda-cyhalothrin 20 SC, lambda-cyhalothrin 2.5 EC, monomihypo + imidacloprid 80 WG, dinotefuran + pymetrozine 80 WDG, deltamethrin 2.5 EC, chlorpyriphos + cypermethrin 55 EC, indoxacarb + emamectin benzoate 25 WDG, cartap + acetamiprid 95 SP, chloropyfios + betaCypermethrin 60 EC and cypermethrin 10 EC, respectively. The highest number of fruit retention was recorded in imidacloprid (1.83 fruits 10^{-1} inflorescences/tree) followed by imidacloprid + lambda-cyhalothrin (1.63 fruits 20^{-1} inflorescences/tree) and lambda-cyhalothrin (1.55 fruits 20^{-1} inflorescences/tree) at mature stage. Gradual increase in number of mango hopper was found in untreated control. Overall results suggested that spraying of imidacloprid 20 SL @ 0.5ml/L of water performed better for controlling mango hopper and economic fruit retention compared to imidacloprid + lambda-cyhalothrin and lambda-cyhalothrin.

Keywords: Fruit, mango hopper, chemical insecticide, treatment.

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INTRODUCTION

Mango (*Mangifera indica* L.) is a very important and popular fruit in the world. It is one of the choicest fruit of the subcontinent and known as the king of all fruits. Its popularity is mainly due to its excellent aroma, delicious taste and high nutritional value being rich in vitamins A and C. Its origin is believed to have been cultivated in South Asia for the last four thousand years (Salunkhe and Desai 1994). Now it is a commercially cultivated important fruit of this subtropical region particularly Bangladesh, India, and Pakistan. But production of mango is enormously handicapped by the ravages of insect pests from seedling to their maturity. More than 300 insect pests have been recorded to attack mango crop in different regions of world (Patel *et al.* 2004). Among the mango pests, Mango hopper is one of the most serious and widespread pests throughout the country, which causes heavy damage to mango crop. Both the nymphs and adults of the hoppers puncture and suck the sap from tender shoots, inflorescences, and leaves of mango crop, which cause non-setting of flowers and dropping of immature fruits, thereby reducing the yield. Hoppers also excrete a secretion, called honey dew (Rahman and Kuldeep 2007). In moist weather, it encourages the development of fungi like *Meliola mangiferae* (Earle), resulting in growth of sooty mould on dorsal surface of leaves, branches, and fruits. This black coating interferes with the normal photosynthetic activity of the plant, ultimately resulting in non-setting of flowers and dropping of immature fruits. This damage is called honey dew disease. 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. Use of insecticides has been the common practice to reduce hopper population in different mango-growing regions of the world. Several insecticides have been recommended for mango hoppers (Sharanabasappa *et al.* 2018, Kadavkar *et al.* 2021). Keeping this view in mind, the present investigation was carried out to evaluate some selected insecticides against mango hopper.

MATERIALS AND METHODS

This trial was conducted at the mango orchard of Lac Research Station, Chapainawabganj during the mango fruiting season of 2022-23 in a randomized complete block (RCB) design incorporating 12 treatments including an untreated control with 3 replications. One mango tree was considered as one treatment replication. Around 15 years old mango trees (BARI Aam-3) were used for the study. The treatments were as follows:

Table 1. Treatments details used for the management of mango hopper trial

Treatment	Insecticide used	Formulation	Doses/L of water	No. of application & method
T_1	Chlorpyriphos + Cypermethrin	55 EC	1 ml	2 & Foliar spray
T_2	Pryiproxifen + Fenpropathrin	20 EC	1 ml	2 & Foliar spray
T_3	Deltamethrin	2.5 EC	0.5 ml	2 & Foliar spray
T_4	Chloropyfios + betaCypermethrin	60 EC	1 ml	2 & Foliar spray
T_5	Lambda- Cyhalothrin	2.5 EC	1 ml	2 & Foliar spray
T_6	Monomihypo + Imidacloprid	80 WG	0.5 g	2 & Foliar spray
T_7	Dinotefuran + Pymetrozine	80 WDG	0.5 g	2 & Foliar spray
T_8	Imidacloprid + Lambda-Cyhalothrin	20 SC	0.5 ml	2 & Foliar spray
T_9	Indoxacarb + Emamectin Benzoate	25 WDG	0.1 g	2 & Foliar spray
T_{10}	Cartap + Acetamiprid	95 SP	1.5 g	2 & Foliar spray
T_{11}	Imidacloprid	20 SL	0.5 ml	2 & Foliar spray
Untreated control		-	-	Only water spray

Selected 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 following to assigned spray schedule (Table 1). Each treatment of this trial was applied twice as a full cover spray such as the first application was made within 10 days of flowering while the second spraying 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 inflorescences for pre-treatment observation and were recorded one day before and post-treatment. The observations on survival population were recorded at 7, 14 and 21 days after application with the help of a one meter long nylon sweeping net. First spray was done on 13 February 2023 and the second spray was after 1 month (14 March, 2023). Each mango tree was 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 was statistically analyzed through the analysis of variance using Web Agri Stat Package (WASP 1.0). Means were separated by critical difference (CD) values at 5% level of significance. The insect population data were transformed to square root ($\sqrt{x + 0.5}$) values.

RESULTS AND DISCUSSION

The evaluation of different insecticides against mango leaf hopper in mango crop is presented in (Table 2, Table 3). The results revealed that all the treatments were significantly effective in controlling mango leaf hopper as compared to control. The data regarding the effectiveness of different treatments are described in detail below:

Efficacy of insecticides after first spray: The overall result after first spray has showed that the treatment T_{11}: Imidacloprid 20 SL was found as the most effective with the highest hopper reduction (83.06%) over untreated control which was followed by T_8: Imidacloprid + Lambda-Cyhalothrin 20 SC (82.02%); T_5: Lambda-Cyhalothrin 2.5 EC (79.43%); T_6: Monomihypo + Imidacloprid 80 WG (77.95%); T_7: Dinotefuran + Pymetrozine 80 WDG (76.92%) and T_3: Deltamethrin 2.5 EC (76.47%). The lowest reduction (71.15%) over control was found in T_2: Pryiproxifen + Fenpropathrin 20 EC followed by T_4: Chloropyfios + BetaCypermethrin 60 EC (73.07%); T_{10}: Cartap + Acetamiprid 95 SP (75.22%); T_9: Indoxacarb + Emamectin benzoate 25 WDG (75.29%) and T_1: Chlorpyriphos + Cypermethrin 55 EC (75.96%) treated trees.

Table 2. Efficacy of selected insecticides against mango hopper after first spray

Treatments	Mean population of mango hopper/ inflorescences/tree First spray				Mean	(%) reduction over untreated control
	Pre count	7 DAS	14 DAS	21 DAS		
T_1: Chlorpyriphos + Cypermethrin	10.71 (3.34)	2.61 (1.76)	3.11 (1.90)	4.02 (2.12)	3.25 (1.93)	75.96%
T_2: Pryiproxifen + Fenpropathrin	10.83 (3.36)	3.19 (1.92)	3.69 (2.04)	4.83 (2.30)	3.90 (2.09)	71.15%
T_3: Deltamethrin	11.11 (3.40)	2.60 (1.76)	3.02 (1.87)	3.92 (2.10)	3.18 (1.91)	76.47%
T_4: Chloropyfios + BetaCypermethrin	11.02 (3.39)	3.00 (1.87)	3.35 (1.96)	4.58 (2.25)	3.64 (2.03)	73.07%
T_5: Lambda- Cyhalothrin	10.82 (3.36)	2.31 (1.67)	2.45 (1.71)	3.60 (2.02)	2.78 (1.81)	79.43%
T_6: Monomihypo + Imidacloprid	11.06 (3.40)	2.47 (1.72)	2.62 (1.76)	3.85 (2.08)	2.98 (1.86)	77.95%
T_7: Dinotefuran + Pymetrozine	10.86 (3.37)	2.52 (1.73)	2.81 (1.81)	3.90 (2.09)	3.12 (1.90)	76.92%
T_8: Imidacloprid + Lambda-Cyhalothrin	10.81 (3.36)	2.12 (1.61)	2.17 (1.63)	2.99 (1.86)	2.43 (1.71)	82.02%
T_9: Indoxacarb + Emamectin benzoate	10.78 (3.35)	2.83 (1.82)	3.21 (1.92)	3.97 (2.11)	3.34 (1.95)	75.29%
T_{10}: Cartap + Acetamiprid	11.02 (3.39)	2.65 (1.77)	3.18 (1.91)	4.23 (2.17)	3.35 (1.96)	75.22%
T_{11}: Imidacloprid	10.79 (3.36)	1.97 (1.57)	2.03 (1.59)	2.86 (1.83)	2.29 (1.67)	83.06%
Untreated control	11.06 (3.40)	12.45 (3.59)	13.61 (3.75)	14.50 (3.87)	13.52 (3.74)	-
CV (%)	3.56	15.76	14.11	11.16	7.81	-
CV (0.05)	NS	0.91	0.90	0.91	0.52	-

DAS- Days after spraying, Figures in parenthesis are √x + 0.5 transformed values, In a column means having dissimilar letter(s) differ significantly as per 0.05 level of probability, CV = Coefficient of Variation, CD = Critical Difference.

Efficacy of insecticides after second spray: Similar trend was recorded after second spray of application. The overall result showed that the treatment with T_{11}: Imidacloprid 20 SL was found as the most effective with the highest hopper reduction (69.89%) over untreated control which was followed by T_8: Imidacloprid + Lambda-Cyhalothrin 20 SC (68.64%); T_5: Lambda- Cyhalothrin 2.5 EC (65.21%); T_6: Monomihypo + Imidacloprid 80 WG (64.04%); T_7: Dinotefuran + Pymetrozine 80 WDG (62.70%) and T_3: Deltamethrin 2.5 EC (62.29%). The lowest reduction (54.09%) over control was found in T_2: Pryiproxifen + Fenpropathrin 20 EC followed by T_4: Chloropyfios + BetaCypermethrin 60 EC (58.52%); T_{10}: Cartap + Acetamiprid 95 SP (60.95%); T_9: Indoxacarb + Emamectin benzoate 25 WDG (61.12%) and T_1: Chlorpyriphos + Cypermethrin 55 EC (61.70%) treated trees.

Table 3. Efficacy of selected insecticides against mango hopper after second spray

Treatments	Mean population of mango hopper/ inflorescences/tree — Second spray				Mean	(%) reduction over untreated control
	Pre count	7 DAS	14 DAS	21 DAS		
T_1: Chlorpyriphos + Cypermethrin	9.47 (3.15)	3.80 (2.07)	4.71 (2.28)	5.24 (2.39)	4.58 (2.25)	61.70%
T_2: Pryiproxifen + Fenpropathrin	9.26 (3.12)	4.42 (2.21)	5.56 (2.46)	6.49 (2.64)	5.49 (2.44)	54.09%
T_3: Deltamethrin	9.36 (3.14)	3.70 (2.04)	4.62 (2.26)	5.21 (2.38)	4.51 (2.23)	62.29%
T_4: Chloropyfios + Beta Cypermethrin	9.68 (3.19)	4.10 (2.14)	4.95 (2.33)	5.83 (2.51)	4.96 (2.33)	58.52%
T_5: Lambda-Cyhalothrin	8.74 (3.03)	3.45 (1.98)	4.03 (2.12)	5.02 (2.34)	4.16 (2.15)	65.21%
T_6: Monomihypo + Imidacloprid	9.20 (3.11)	3.57 (2.01)	4.22 (2.17)	5.10 (2.36)	4.30 (2.19)	64.04%
T_7: Dinotefuran + Pymetrozine	9.38 (3.14)	3.61 (2.02)	4.57 (2.25)	5.21 (2.38)	4.46 (2.22)	62.70%
T_8: Imidacloprid + Lambda-Cyhalothrin	8.73 (3.03)	3.22 (1.92)	3.77 (2.06)	4.24 (2.17)	3.75 (2.06)	68.64%
T_9: Indoxacarb + Emamectin benzoate	9.10 (3.09)	3.93 (2.10)	4.81 (2.30)	5.22 (2.39)	4.65 (2.26)	61.12%

Treatments	Mean population of mango hopper/ inflorescences/tree Second spray				Mean	(%) reduction over untreated control
	Pre count	7 DAS	14 DAS	21 DAS		
T_{10}: Cartap + Acetamiprid	9.67 (3.18)	3.75 (2.06)	4.78 (2.29)	5.48 (2.44)	4.67 (2.27)	60.95%
T_{11}: Imidacloprid	9.38 (3.14)	3.07 (1.88)	3.63 (2.03)	4.11 (2.14)	3.60 (2.02)	69.89%
Untreated control	9.51 (3.16)	11.35 (3.44)	11.98 (3.53)	12.55 (3.61)	11.96 (3.52)	-
CV (%)	4.34	12.07	11.16	14.03	8.24	-
CV (0.05)	NS	0.88	0.97	1.38	0.71	-

DAS- Days after spraying, Figures in parenthesis are √x + 0.5 transformed values, In a column means having dissimilar letter(s) differ significantly as per 0.05 level of probability, CV = Coefficient of Variation, CD = Critical Difference.

Thus, these results were consistent with Adnan *et al.* (2014), Chaudhari *et al.* (2017), 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 insecticides on fruit retention: Efficacy of selected insecticides on fruit retention at the pea stage, marble stage and mature stage were presented in Table 4.

Table 4. Efficacy of selected insecticides on fruit retention

Treatment	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: Chlorpyriphos + Cypermethrin	6.11	3.11	1.30	36.99	7.24	42.85
T_2: Pryiproxifen + Fenpropathrin	5.81	3.30	1.36	30.26	13.79	49.45
T_3: Deltamethrin	6.19	3.25	1.35	38.78	12.06	48.35
T_4: Chloropyfios + Beta Cypermethrin	6.04	3.33	1.36	35.42	14.82	49.45
T_5: Lambda-Cyhalothrin	8.51	3.45	1.55	90.80	18.96	70.32

Treatment	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_6: Monomihypo + Imidacloprid	8.30	3.30	1.46	86.09	13.79	60.43
T_7: Dinotefuran + Pymetrozine	6.52	3.20	1.39	46.18	10.34	52.74
T_8: Imidacloprid + Lambda-Cyhalothrin	8.70	4.03	1.63	95.06	38.96	79.12
T_9: Indoxacarb + Emamectin benzoate	6.33	3.13	1.26	41.92	7.93	38.46
T_{10}: Cartap + Acetamiprid	6.33	3.40	1.06	41.92	17.24	16.48
T_{11}: Imidacloprid	8.93	4.53	1.83	100.22	56.20	101.09
Untreated control	4.46	2.90	0.91	-	-	-
CV (%)	3.63	7.27	6.46	-	-	-
CV (0.05)	0.42	0.42	0.15	-	-	-

The highest number of fruit retained in imidacloprid (T_{11}) sprayed tree which was followed by imidacloprid + lambda-cyhalothrin (T_8), lambda-cyhalothrin (T_5) and the lowest was in untreated control trees. Accordingly, the highest percent fruit retention over untreated control (101.09%) was recorded in imidacloprid (T_{11}) sprayed trees which were followed by (79.12%) imidacloprid + lambda-cyhalothrin (T_8) and (70.32%) lambda-cyhalothrin (T_5) sprayed tree. This finding was in agreement with Kumar *et al.* (2020) who reported that imidacloprid resulted in the highest number of fruit retained and percent fruit retention over untreated control.

CONCLUSION

Two sprays of the treatment with imidacloprid 20 SL @ 0.5 ml/L of water was found as the most effective against mango hopper followed by imidacloprid + lambda-cyhalothrin 20 SC @ 0.5 ml/l of water. The highest percent fruit retention was also obtained from imidacloprid 20 SL @ 0.5 ml/L of water over untreated control trees.

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