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A REVIEW ON MANAGEMENT FOR THE MANGO HOPPER IDIOSCOPUS CLYPEALIS, BY USING DIFFERENT CHEMICAL INSECTICIDES IN DIFFERENT AGRO-CLIMATIC CONDITIONS.

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Abstract

An experiment was conducted in the Rama Agricultural Farm, Kanpur, during 2024 to manage the mango hopper, Idioscopus clypealis L, using three chemical insecticides, Imidacloprid (0.3%), Endosulfan (0.5%), and Cypermethrin (0.4%), and natural Neem oil (3%) with three replications of each. All the treatments were significantly effective in managing mango hopper in comparison to the control. Imidacloprid showed the highest efficacy in percentage of reduction of hopper population (92.50 ± 9.02) at 72 hours after treatment in case of 2nd spray. It also showed the highest overall percentage of reduction (88.59 ± 8.64) of hopper population and less toxicity to natural enemies including green ant, spider, and lacewing of mango hopper. In case of biopesticide, azadirachtin based Neem oil was found effective against mango hopper as 48.35, 60.15, and 56.54% reduction after 24, 72, and 168 hours of spraying, respectively, which was comparable with Cypermethrin as there was no statistically significant difference after 168 hours of spray. Natural enemies were also higher after 1st and 2nd spray in case of Neem oil.

Introduction

Mango (Mangifera indica Linn) is the most popular fruit in the world and it is the choicest fruit in the sub-tropical region. It is known as the king of all fruits. It contains excellent flavor, delicious in taste and is rich in vitamin A and C. Its origin is South Asia and belongs to family Anacardiceace. Because of its sweet, refreshing and aroma it has now became a commercial crop in the sub-tropical region. India is prominent exporter of fresh in the world. The country has exported 46510.27 MT of fresh mangoes to the world for the worth of Rs 406.45 crores during the 2018-19. Despite of the production various kind of pests attack the crop which hampers the production and the quality of the fruits.

There are nearly 260 insects and mite pests on mango reported from Indian subcontinent of which 30 pests are serious, capable of causing losses to crop growth and yield **(Kapadia, 2003).**

Among the various pest, mango hopper **Amritodus atkinsoni** (Lethierry), **Idioscopus clypealis** (Lethierry) **I. niveosparsus** (Lethierry) and **I. nitidulus** (Walker) is a serious pest of mango at flowering and fruiting stages which cause yield loss up to 100% **(AU Chaudhari et al 2017).**

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Mango hoppers have incomplete metamorphosis and pass three life stages such as egg, nymph and adult. 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. In moist weather, it encourages the development of fungi like Meliolamangiferae (Earle), resulting in growth of sooty mould fungus 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 **(Shawkat Islam Shawan et al 2018).**

But non judicious application of highly toxic and persistent insecticides is causing several problems such as disrupting natural enemy complexes, development of insecticide resistance, secondary pest outbreak, pest resurgence, and environmental pollution . To solve these problems farmers can shift from the unilateral reliance on insecticide use to alternative approaches. In this situation, biodegradable substitutes are now being strongly conceived by all scientists of the world. Biologically active natural plant products may play a significant role in this regard as they are environmentally safe, biodegradable, and cost effective. A large number of investigators isolated and identified several chemical compounds from leaves and seeds of many plant species and screened out many insect feeding deterrents and growth inhibitors [4]. Among them Neem based products have extensively been used and have proved their pest control efficacy against several insect pests both in field and storage. However, exploration on the use of botanicals against mango pests is scanty **(S. M. Adnan et al 2014).**

Hoppers lay egg singly on floral shoots, buds and tender leaves which hatch in a week. After hatching, large number of nymphs and adults puncture and suck the sap of tender parts such as panicles, inflorescence, leaves and fruit, resulting into weakening of inflorescence and which ultimately affects fruit set. Heavy puncturing and continuous draining of the sap may cause curling and drying of inflorescence. They also damage the crop by excreting honey dew which facilitates the development of sooty mold, a fungus, which affects photosynthesis activity of leaf. If the timely interventions are not taken, the quality of the fruit is affected and may cause considerable yield loss **(Gundappa et al 2016).**

Methods and Material

Experiment-1: Efficacy of Insecticides against Mango hoppers and Fruit Yield.

The three species of Idiocerine leaf hoppers namely Amritodus atkinsoni Leth., Idioscopus clypealis Leth and I. neveasparsus have been recognized as the most noxious insects. The hoppers cause a loss of 20-100% of inflorescence (Haseeb, 2006). Present investigation therefore, was conducted to test the efficacy of new insecticides against mango hoppers. The statistically designed field trial was conducted at Horticultural Research Farm, Mondouri, B.C.K.V. during 2004-2005. There were 7 treatments including untreated control with three replications. Treatments were imidacloprid (0.005% & 0.01%), thiamethoxam (0.008 &

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0.016%), monocrotophos (0.05% & 0.10%) and control. Two round of sprayings of each treatment were applied at prebloom stage and at 31 days after first spray. Prespray observation of hopper population (nymphs & adults) were recorded from randomly selected ten inflorescences/tree. Post spray observations were recorded on 3, 7 and 15 days after each spraying. The survival hopper population and yield were subjected to statistical analysis.

Management of mango hopper with newer molecules and biopesticides under ultra high density planting system.

The present study was carried out in Ultra High Density Planting of mango which accommodates 674 plants per acre with the spacing of 3 m x 2m at R & D farm of Jain Irrigation Systems Limited at Udumalpet, Tamil Nadu during 2014-15. The bioefficacy of pesticides on the containment of mango hopper was carried out both under pot culture and field conditions

(a) Pot culture experiment

One year old mango grafts of variety Alphonso planted in polybag was taken for this study. The hopper nymphs of 4th instar (20 numbers) were released in each plant on tender leaves. The plants released with hoppers were covered with fine nylon net bag to avoid escape of hoppers. The hoppers were allowed to settle on plant for one day and then the treatments were sprayed on plants with hoppers using 2 lit spray pumps as in Table 1. The treatments were replicated thrice. The plants were examined for presence of live hoppers 24 and 48 hrs after spray treatment. Based on the data collected, the mortality of hoppers in individual treatment was worked out.

(b) Field experiment

The field experiment was laid out in Randomized Block Design with 14 treatments including untreated control which was replicated thrice. Each treatment comprises of eight trees per replication and as such a total 336 trees of variety Alphonso with 5 years age and uniform canopy were selected from UHDP orchard. Two rounds of pesticides were sprayed at 21 days interval with the help of knapsack sprayer (½ liter of spray fluid per tree was used). The population of hopper from 10 inflorescence selected at random was recorded before and 1,3,7 and 14 days after I & II spray application as suggested by (**Girish Kumar and Giraddi)** and Borad and Rathod .

Efficacy of different chemical and botanical insecticides in controlling mango hopper.

The experiment was carried out in the IPM laboratory of the Entomology Department, Bangladesh Agricultural University, Mymensingh, during February, 2014 to May, 2015.Since it is a laboratory-based study where different insecticide with different concentrations were applied in the same insect and the source of experimental data was homogenous in nature, the experiment was designed and analyzed in Completely Randomized Design (CRD).The chemical sample were collected from different agro-chemical company in Bangladesh.

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Collection of mango hopper and mango inflorescences

The mango hoppers (Amritodusatkinsoni L.) and mango inflorescences (tender) were collected from the entomological field laboratory and horticultural field of Bangladesh Agricultural University, Mymensingh.

Insecticides used in the experiment

Five insecticides viz. three chemicals with 3 different concentrations and two botanicals with 3 different concentrations were evaluated for their efficacy against mango hopper (A. atkinsoni L.). The three chemical insecticides (Acetamiprid 20 SP, Q-fos 25 EC and Confidor 70 WG) were applied at three different concentrations viz. 0.001%, 0.00125% and 0.0025%; and the two botanical insecticides (Neem extract and Mahogoni extract) were applied with 3 concentrations of 0.50%, 1.0% and 1.5% for each insecticide.

Result

Table No.-1. Efficacy of insecticides against hoppers on mango and fruit yield (after second spray).

	Av. No of Hopper/10 panicles*				Mean	Yield		
Treatment Dosage(%)	**Pre-treatment**	**3 DAS**	**7 DAS**	**15 DAS**		**No. of fruit/tree**	**Yield/tree**	**C.B ratio**
Imidacloprid (0.005%)	60.20	11.2 (3.44)	10.1 (3.27)	15.3 (3.29)	11.95	150.0 (12.25)	44.60 (6.71)	2.60
Imidacloprid (0.010)	56.66	3.9 (2.12)	6.5 (2.67)	8.9 (3.8)	6.09	170.0 (13.04)	58.7 (7.68)	2.84
Imidacloprid (0.008)	58.00	8.1 (2.94)	8.9 (3.07)	13.2 (3.72)	9.15	165.8 (12.85)	54.9 (4.73)	2.83
Imidacloprid (0.016)	61.66	2.9 (1.85)	4.8 (2.32)	7.1 (2.78)	4.53	180.0 (13.42)	72.0 (8.50)	2.89
Imidacloprid (0.050)	54.95	15.2 (4.01)	12.8 (3.68)	18.3 (4.36)	14.53	138.7 (11.76)	40.9 (6.42)	2.39
Imidacloprid (0.01)	47.00	11.6 (3.48)	10.4 (3.30)	15.6 (4.01)	11.97	142.0 (11.93)	40.83 (6.42)	2.44
Control	60.66	66.3 (8.19)	68.9 (8.34)	40.5 (6.42)	56.36	76.0 (8.71)	20.3 (4.53)	
S.Em(±)		1.63 4.87	1.68 5.13	1.51 4.52	1.28	0.30 0.94		

* Mean of 3 replications.

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Table No.-2: Bio-efficacy of pesticides on the mortality of mango hoppers in pot culture

				Mortality of hopper Hours after Treatment(HAT)		
S.No.	**Treatment**	**Concent-ration%**	**Dosage**	**24**	**48**	**Mean Mortality (%)**
1.	Imidacloprid 17.8 SL	0.007	0.4 ml/l	93.33 (75.04)	100 (90)	96.67
2.	Dimethoate 30% EC	0.05	1.6 ml/l	85 (67.21)	95 (77.08)	90.00
3.	Dichlorvos 76% EC	0.05	0.6 ml/l	91.67 (73.22)	96.67 (79.48)	94.17
4.	Acephate 75 SP	0.075	1g/l	91.67 (73.22)	96.67 (79.48)	94.17
5.	Malathion 50% EC 0.075	0.075	1.5 ml/l	91.67 (73.22)	96.67 (79.48)	94.17
6.	Emamectin Benzoate 5% SG	0.002	0.4g/l	88.33 (70.03)	91.67 (73.22)	90.00
7.	Thiomethoxam 25% WG	0.0025	0.1g/l	88.33 (70.03)	98.33 (82.58)	93.33
8.	Neem oil 1%	-	10ml/l	73.33 (58.91)	76.70 (61.14)	75.02
9.	Buprofezin 25% SC	0.05	2ml/l	73.33 (35.26)	83.33 (65.91)	78.33
10.	NSE 5%	-	50gm/l	33.33 (35.68)	36.67 (37.27)	35.00
11.	Pungam Oil 1%	-	10ml/l	81.67 (64.65)	93.37 (75.04)	87.50
12.	Lecanicillium lecanii 1.15% WP	0.5	5g/l	90 (71.57)	90 (71.57)	90.00
13 .	Beaveria bassiana 1.15% WP	0.5	5g/l	45 (42.13)	60 (50.77)	52.50
14.	Control	-		0.00 (0.54)	0.00 (0.54)	0.00
S.Ed				4.56	4.90	

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CD (P=0.05				9.27	8.27	

Values in parentheses are arc sine transformed values.

In each column values with similar alphabet do not vary significantly at P=0.05

Table No.-3:Bio-efficacy of pesticides against mango hoppers under Ultra High Density Planting under field conditions

S.No.	**Treatment**	**Concent-ration%**	**Dosage**	**1**	**3**	**7**	**14**	**Mean Mortality %**
1.	Imidacloprid 17.8 SL	0.007	0.4 ml/l	92.19 (73.77)	94.34 (76.24)	99.1 (84.57)	95.77 (78.14)	95.35
2.	Dichlorvos 76% EC	0.05	0.6 ml/l	66.39 (54.57)	71.4de (57.67)	85.95cde (67.99)	74.41abc (59.61)	74.54
4.	Acephate 75 SP	0.075	1g/l	83.12 (65.74)	92.05 (73.62)	91.16 (72.7)	28.31 (32.15)	73.66
5.	Malathion 50% EC 0.075	0.075	1.5 ml/l	77.78 (61.87)	84.04 (66.45)	78.94 (62.68)	28.22 (32.09)	67.24
6.	Emamectin Benzoate 5% SG	0.002	0.4g/l	75.59 (60.39)	85.96 (67.99)	96.33 (78.96)	60.74 (51.2)	79.68
7.	Thiomethoxam 25% WG	0.0025	0.1g/l	92.46 (74.06)	95.04 (77.14)	97.05 (80.11)	91.42 (72.97)	93.99
8.	Neem oil 1%	-	10ml/l	84.34 (66.69)	78.06 (62.07)	80.78 (64)	75.67 (60.45)	79.71
9.	Buprofezin 25% SC	0.05	2ml/l	63.52 (52.84)	70.41 (57.05)	90.59 (72.14)	76.45 (60.97)	75.24
10.	NSE 5%	-	50gm/l	25.61 (30.4)	57.36 (49.23)	59.11 (50.25)	19.13 (25.94)	40.31
11.	Pungam Oil 1%	-	10ml/l	65.81 (54.22)	77.47 (61.67)	83.86 (66.32)	77.85 (61.92)	76.25
12.	Lecanicillium lecanii 1.15% WP	0.5	5g/l	78.39 (62.3)	85.72 (67.79)	91.98 (73.55)	88.09 (69.81)	86.04

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13 .	Beaveria bassiana 1.15% WP	0.5	5g/l	56.58 (48.78)	80.48 (63.78)	91.21 (72.75)	83.43 (65.98)	77.92
14.	Control	-		0 (4.05)	0 (4.05)	0 (4.05)	0 (0)	0.00
S.Ed				7.58	4.66	4.45	11.19	
CD (P=0.05				15.58	9.59	9.15	23.02	

Values in parentheses are arc sine transformed values.

In each column values with similar alphabet do not vary significantly at P=0.05

Table No.-4 Mean performance of three selected chemical insecticides on the mortality of mango hopper

Insecticides	**Average mortality of Mango hopper (%) at 3-time intervals**		
	1 HAT	**3 HAT**	**24 HAT**
Acetamiprid 20 SP	11.11 b	43.33 a	85.56 a
Q-fos 25 EC	12.22 ab	46.67 a	80.56 a
Confidor 70 WG	13.89 a	45.56 a	85.00 a
Lsd (0.05)	2.42	5.572	5.807
SE	0.85	1.96	2.04
Max.	13.89	46.67	85.56
Min.	11.11	43.33	80.56
Mean	12.41	45.18	83.71

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Table No. -5 Mean performance of different concentrations of chemical insecticides on the mortality of mango hopper

Concentrations (%)	Average mortality of Mango hopper (%) at 3 times interval		
	1 HAT	**3 HAT**	**24 HAT**
0.001	10.00 b	30.56 c	73.33 c
0.00125	11.67 b	45.00 b	82.78 b
0.0025	15.56 a	60.00 a	95.00 a
Lsd (0.05)	2.417	5.572	5.807
SE	0.8486	1.956	2.039
Max.	15.56	60.00	95.00
Min.	10.00	30.56	73.33
Mean	12.41	45.19	83.70

Table No.- 6 Mean performance of the selected two botanical insecticides on the mortality of mango hopper

Insecticides	Average mortality of Mango hopper (%) at 3 times interval		
	1 HAT	**3 HAT**	**24 HAT**
Neem extract	6.67	17.22	31.11
Mahogoni extract	5.56	13.33	25.00
Lsd (0.05)	2.79	3.29	4.51
SE	0.96	1.13	1.56
Max.	6.67	17.22	31.11
Min.	5.56	13.33	25.00
Mean	6.11	15.27	28.05

Table No.-:7 Effect of interaction between chemical insecticides and their three concentrations on the mortality of mango hopper

Interaction (Insecticide* Conc.)	Average mortality of Mango hopper (%) at 3-time intervals		
	1 HAT	**3 HAT**	**24 HAT**
I1C1	10.00	26.67	76.67
I1C2	10.00	43.33	86.67
I1C3	13.33	60.00	93.33
I2C1	10.00	31.67	70.00
I2C2	11.67	48.33	78.33

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I2C3	15.00	60.00	93.33
I3C1	10.00	33.33	73.33
I3C2	13.33	43.33	83.33
I3C3	18.33	60.00	98.33
Lsd (0.05)	4.187	9.652	10.06
SE	1.470	3.388	3.531
Max.	18.33	60.00	98.33
Min.	10.00	26.67	70.00
Mean	12.41	45.18	83.70

Here, I1,Acetamiprid 20 SP; I2, Q-fos 25 EC; I3,Confidor 70 WG; C1,0.001%; C2, 0.00125%; C3, 0.0025%; HAT, Hour after treatment; SE, Standard Error

Table No.-8 Mean performance of different concentrations of the botanical insecticides on the mortality of mango hopper

Concentrations (%)	**Average mortality of Mango hopper (%) at 3 times interval**		
	1 HAT	**3 HAT**	**24 HAT**
0.5	2.500 b	11.67 b	23.33 b
1.0	5.833 b	14.17 b	28.33 ab
1.5	10.00 a	20.00 a	32.50 a
Lsd (0.05)	3.404	3.979	5.524
SE	1.179	1.378	1.912
Max.	10.00	20.00	32.50
Min.	2.500	11.67	23.33
Mean	6.11	15.28	28.05

Table No.-9 Mean performance of the interaction between insecticides and their concentrations on the mortality of mango hopper

Interaction (Insecticide*Conc)	**Average mortality of Mango hopper (%) at 3 times interval**		
	1 HAT	**3 HAT**	**24 HAT**
I1C1	3.33 b	13.33 bc	26.67 abc
I1C2	6.667 ab	15.00 bc	31.67 ab
I1C3	10.00 a	23.33 a	35.00 a
I2C1	1.667 b	10.00 c	20.00 c
I2C2	5.000 ab	13.33 bc	25.00 bc
I2C3	10.00 a	16.67 b	30.00 ab
Lsd (0.05)	4.814	5.627	7.811

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SE	1.667	1.948	2.705
Max.	10.00	23.33	35.00
Min.	1.667	10.00	20.00
Mean	6.11	15.27	28.05

Here, I1, Neem extract; I2, Mahogoni extract; C1, 0.5%; C2, 1.0%; C3,1.5%

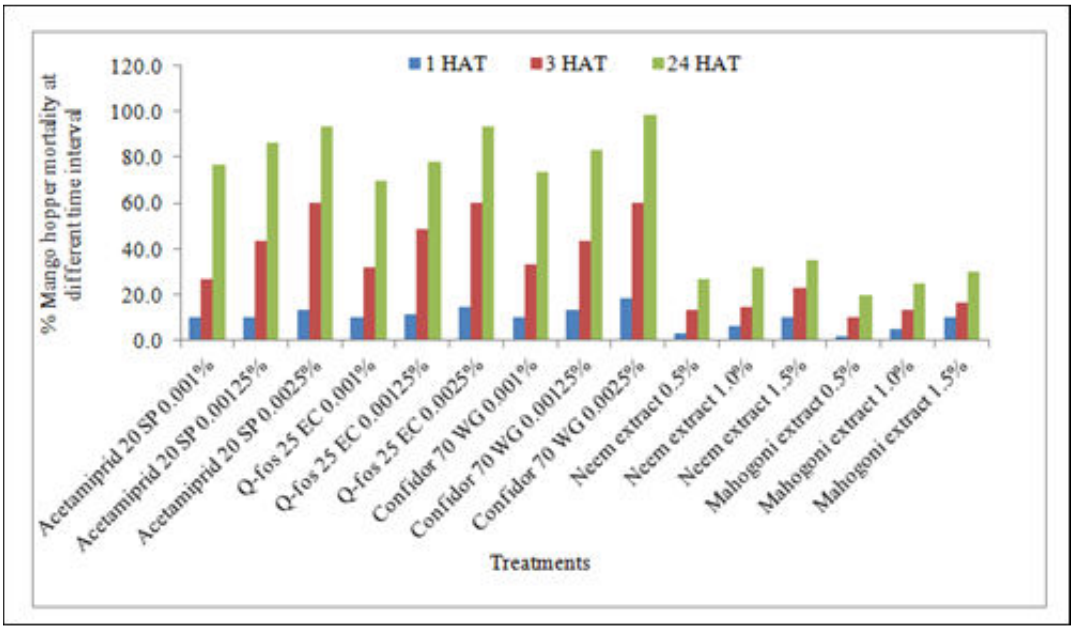

Figure No-1 Susceptibility of mango hopper to different insecticides with different concentrations.

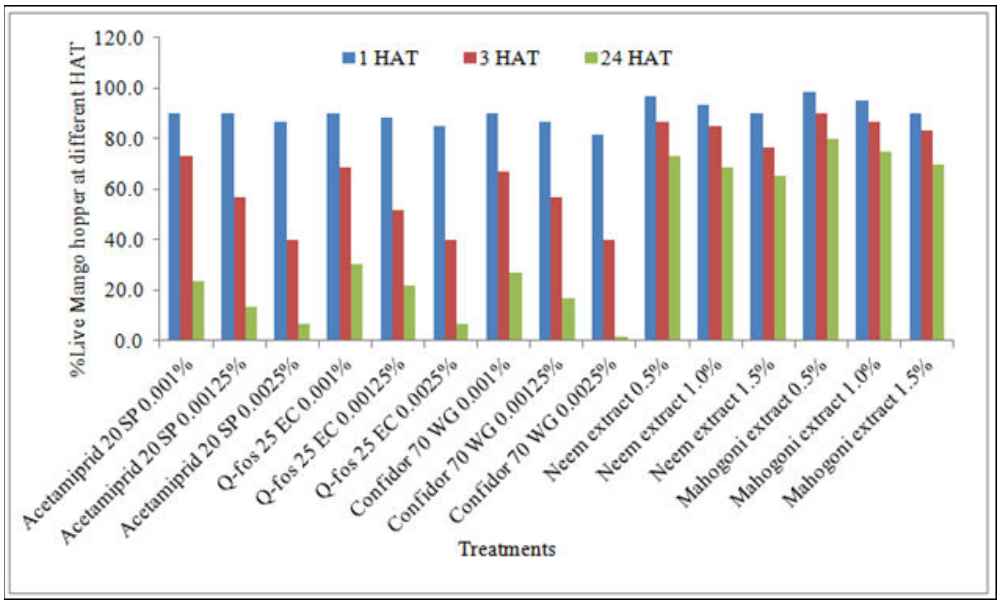

Figure No.- 2 Live mango hopper (%) at different hours after treatment with different concentrations of different insecticides.

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Discussion

According to the investigation **A. Samanta (2009)** all the treatments were significantly superior in reducing hopper population as well as increasing yield as compared to untreated control. The best result was observed in case of thiamethoxam 0.016% recorded lowest mean hopper population (4.53) and highest yield (180 fruits/tree & 72 kg/ tree) as well as highest cost-benefit ratio (2.89) followed by imidacloprid 0.01% (mean hopper population 9.15, yield 170 fruits/tree & 58.7 kg/ tree, cost-benefit ratio 2.84). Monocrotophos 0.10% was statistically on par with imidacloprid 0.005%, thiamethoxam 0.008% in terms of mean hopper population. Considering the efficacy, thiamethoxam 0.016% found to be superior. Similar results on the control of insect were observed by **Nath and Singh (2008).** In general, insecticidal application increased C : B ratio as also found out by **Srivastava and Mohapatra (2003).**

The investigation shows with those of **AU Chaudhari (2017)** in pot cultivation the maximum mortality of mango hoppers in imidacloprid 17.8 SL at 0.007% as compared to other insecticides tested with mortality of 93.33 and 100 percent recorded at 24 and 48 hours after treatment respectively. This treatment was followed by dichlorvos 0.05%, acephate 0.075% and malathion 0.075% with mean mortality of 94.17 percent and found on par among each other both at 24 and 48 hours after treatment. The treatment thiamethoxam 0.0025%, dimethoate 0.05%, buprofezin 0.05% showed lesser efficacy at 24 HAT which escalated at 48 HAT. Among the botanicals tested, pungam oil 1% showed the maximum mean mortality of 87.50% followed by neem oil which recorded 75.02 percent. Neem Seed Extract NSE 5% was least effective with 35 percent mortality. Among the entomopathogens Lecanicillium lecanii was more effective with 90 percent mean mortality as compared to Beaveria bassiana which recorded the lowest mean mortality of 52.50 percent.

The investigation under field conditions indicated that the percent mean mortality of mango hoppers was at par in most of the insecticide treatments except diclorvos and buprofezin at 1day after application. The treatment with imidacloprid 17.8 SL @ 0.007% recorded maximum mean mortality 95.35 percent effecting a mortality of 92.19, 94.34, 99.10 and 95.77 percent at 1,3,7,and 14 days after spraying respectively which was followed by thiamethoxam which showed a mean mortality of 93.99 percent with respective hopper mortality of 92.46,95.04,97.05 and 91.42 percent on 1,3,7 and 14 DAS. Emamectin benzoate though recorded a mortality of 75.59, 85.96 and 96.33percent on 1, 3, and 7 DAS respectively was less efficacious on 14th day with a mortality of 60.74 percent. Among the chemical insecticides Emamectin benzoate was next efficacious to imidacloprid and thiamethoxam on 1, 3, and 7 DAS in hopper mortality. The least mean mortality was reported in malathion with 67.24 percent. Buprofezin, an insect growth regulator was also less effective as compared to imidacloprid and thiamethoxam. The results obtained are in accordance with the reports of Adnan et al who showed a higher overall percentage of reduction (88.59 ± 8.64) of hopper population in imidacloprid treatment.

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Among the botanicals tested, neem oil 1% showed higher mean mortality of hopper (79.71%) followed by pungam oil 1% superior to neem seed extract (NSE) 5% which showed the least mean mortality of 40.31 percent. Similar finding on the efficacy of neem oil was also reported by Adnan, et al [1] wherein neem oil was found effective against mango hopper with a mortality of 48.35,60.15 and 56.54 percent after 24,72 and 168 hours of spraying.

Among the entomopathogens, Lecanicillium lecanii showed higher mean percent mortality of 86.04 percent which was on par with imidacloprid and thiamethoxam on 1, 3, and 14 DAS. Beaveria bassiana was also on par with Lecanicillium lecanii after 3, 7 and 14 DAS with mean percent mortality of 77.92. The result obtained was well supported by Singh [13] who reported that the sole application of Lecanicillium lecanii at the dose of 5g/l had lower hopper population of 1.7 per panicle.

According to the investigation Shawkat Islam Shawan (2018) the mortality of mango hopper was significantly different among three different concentrations of Acetamiprid 20 SP and ranged from 26.67% to 60.0% at 3 HAT, 76.67% to 93.33% at 24 HAT. Among the three concentrations of Acetamiprid 20 SP the highest mortality of mango hopper was found at 0.0025% concentration at 24 HAT and lowest at 0.001% concentration at 1 HAT. Q-fos 25 EC @ 0.0025% has high efficacy in controlling mango hopper. Among the three concentrations of Confidor 70 WG, the highest mortality of mango hopper 98.33% was found at 0.0025% concentration at 24 HAT and lowest mortality (10.0%) at 0.001% concentration. The highest mortality of mango hopper 35.0% and 30.0% were found with the application of Neem extract and Mahogoni extract for 1.5% concentration at 24 HAT and lowest 3.33% and 1.67% were found for 0.5% concentrations at 1 HAT respectively. Although all the insecticides had a remarkable effect on mango hopper.

Conclusion

All the treatments were effective in controlling the hopper population over the untreated. The chemical pesticides imidacloprid and thiamethoxam showed superior effectiveness whereas among the botanicals pungam oil and neem oil had moderate efficacy. The entomopathogens Lecanicillium lecanii which showed higher percent mortality of hopper was superior to Beaveria bassiana. It can be concluded that incorporating botanicals and entomopathogens Lecanicillium lecanii along with effective insecticides, the sole dependency on chemical pesticides can be eliminated.

It can be further concluded for chemical insecticides that, Confidor 70 WG can be recommended firstly followed by Acetamiprid 20 SP and Q-fos 25 EC. For the treatment with botanical insecticides, the highest mortality of mango hopper was found for Neem extract at 24 HAT and minimum mortality for Mahogoni extract at 1 HAT. Average mortality for Neem extract was for Mahogoni extract at 24 HAT. In respect of ecological aspect, botanical insecticides are more eco friendly with our environment than the chemical insecticides. The effectiveness of all the three

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chemicals and two botanical insecticides against mango hopper increased considerably with the increase of concentrations and times through mortality percent observation.

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