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Efficacy of some biorational insecticides on cucurbit fruit fly (*Bactrocera cucurbitae* Coquillett) infesting sweet gourd

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Abstract

The cucurbit fruit fly is the most destructive insect pest of sweet gourd and capable of reducing marketable yield. In Bangladesh, farmers use different chemical insecticides to control cucurbit fruit fly, which often leads to different health issues. Concerning this situation, a study was conducted to evaluate the effectiveness of different biorational insecticides against cucurbit fruit fly at the experimental field of the Department of Entomology of Gazipur Agricultural University, during January to June 2023. Seven biorational insecticides namely, Neem oil, Mahogany oil, Bio-clean 5 SL (De-limonin 5%), Bio-action 1.5 SL (Matrine 1.5%), Biotrin 0.5 AS (Matrine 0.5%), Spinomax 44.03 SC (Spinosad 44.03% w/w), Biomax M 1.2 EC (Abamectin 1.2%) were used in this study along with an untreated control (using tap water only). The lowest rate of infestation by number (18.7%) and weight (17.1%), the lowest larval count per fruit at immature stage of sweet gourd (121.0) and mature stage (290.0) was found in Neem oil treated plot. The highest yield (23.8 ton/ha) and Marginal Benefit Cost Ratio (MBCR) was also obtained from Neem oil treated plot (10.2). The Neem oil @ 5ml/L of water + 1–2 drops Tween 20 at 7 days interval performed the best and can be recommended to use for suppressing fruit fly infestation.

Keywords: Biorational insecticides, *Bactrocera cucurbitae*, *Cucurbita moschata*, infestation.

Introduction

Sweet gourd (*Cucurbita moschata*), a very popular vegetable, is cultivated approximately in 6.83% land area in Bangladesh (Paul *et al*. 2024). A total of 2.5 lakh ton of sweet gourd was produced in Bangladesh in the year of 2023 (BBS 2023). The average yield of sweet gourd in Bangladesh is 9.22 ton per hectare in the summer season and 11.0 ton per hectare in the winter season (Afroz *et al*. 2020). It is an incredibly rich source of carbohydrates, vitamins, carotenoid pigments and minerals (Khan 2014, Islam *et al.* 2017). A total of 21 arthropod species attack cucurbitaceous crops in Bangladesh, among them cucurbit fruit fly (*Bactrocera cucurbitae*) is the major insect pest of sweet gourd (Ali *et al*. 2016, Islam *et al*. 2017). Female fruit flies lay eggs under the surface of the fruit; after hatching, the maggots feed on the inner pulp and is capable of causing up to 71.5% fruit infestation on sweet gourd (Afroz *et al*. 2020). Synthetic insecticides such as Karate 2.5 EC, Ripcord 10 EC and Shobicron 425 EC are frequently used for controlling cucurbit fruit flies in Bangladesh (Ahmed *et al*. 2022). Due to long exposure to chemical insecticides, different acute and chronic diseases such as cancers, DNA damage, oxidative stress, neurological disorders, and respiratory, metabolic, and thyroid effects are caused in human bodies (Curl *et al*. 2020). Chemical insecticides also have detrimental effect on predator (Mollah *et al.* 2012), parasitoid (Mollah and Khatun 2023) and non-target insects (Mollah *et al.* 2017). In contrast, the biorational insecticides are environmentally sound and less toxic insecticides for controlling insect pests (Horowitz and Ishaaya 2004). Moreover, biorational bioinsecticides were reported to be effective against many insect pests including cotton aphid, *Aphis gossupii* (Mollah and Khatun 2024), green leafhopper, *Amrasca biguttula* (Mollah 2024) and shoot and fruit borer of brinjal (Mollah *et al.* 2022, Mollah 2025). Nowadays, Biorational insecticides are gaining popularity as they are less hazardous to human and environmental health (Parajuli *et al*. 2022).

Biorational insecticides present numerous possibilities for addressing the infestation of cucurbit fruit fly. The application of biorational insecticides, including Tracer

45 SC (Spinosad) at a concentration of 1 ml/L, Mycotal (*Lecanicillium muscarium*) at 3 g/L, and Ambush 1.8 EC (Abamectin) at 2 ml/L, resulted in plant protection rates of 41.67%, 36.37%, and 11.75% respectively (Rahman *et al*. 2019). For this reason, biorational insecticides can be a sustainable solution for controlling the cucurbit fruit fly. Therefore, the present study aimed to evaluate some new formulation of bioinsecticides against the cucurbit fruit fly.

Materials and methods

Experimental site and the treatments used in the experiment: The research was conducted at the experimental field of the Department of Entomology, Gazipur Agricultural University, Gazipur-1706, during January to June 2023. The experiment was conducted in the Randomized Complete Block Design (RCBD) with 3 replications. The field was divided into 3 blocks and each block contained 8 plots. Each plot measured 3m×2m, with 1m plot to plot and block to block distance in both cases. Eight treatments, including an untreated control, were allotted in each block. The treatments were as follows, Neem oil @ 5ml/L of water + 1–2 drops Tween 20, Mahogany oil @ 5 ml/L of water + 1–2 drops Tween 20, Bio-clean 5 SL (De-limonin 5%) @ 1 ml/L of water, Bio-action 1.5 SL (Matrine 1.5%) @ 3ml/L of water, Biotrin 0.5 AS (Matrine 0.5%) @ l ml/L of water, Spinomax 44.03 SC (Spinosad 44.03% w/w) @1 ml/L of water, BiomaxM 1.2 EC (Abamectin 1.2%) @ 1 ml/L of water and an untreated control (using tap water only). The treatments were randomly allotted to each plot within the block.

Seedling raising and intercultural operations: The "BARI MISTIKUMRA-1" seedlings were transplanted in the experimental field with 1 m gap between two plants and rows. There were 6 pits in each plot, each was measured 45 cm in diameter and depth, respectively. The fertilizers included urea 55–85 kg/ha, MoP 28–55 kg/ha, and TSP 45–50 kg/ha were applied in the field according to Fertilizer Recommendation Guide 2018 (BARC, 2018). For the best plant growth, several intercultural operations were carried out periodically, including fertilization, weeding, soil loosening, watering, and the installation of trellises with bamboo stakes.

Application of treatments and calculation of fruit infestation and yield: The application of treatments was started after initiation of fruit fly infestation in field (45 days after transplanting). The treatments were applied at a 7-day interval until the final harvest. Total 6 sprays were done during the experimental period. The data of fruit infestation by number and weight, the number of fruit fly larva per fruit and the yield (MT/ha) was recorded.

The calculation of fruit infestation was calculated by using the following formula:

$$\text{Percent fruit infestation (n/n)} = \frac{\text{Number infested fruit}}{\text{Total number of fruits}} \times 100$$

$$\text{Percent fruit infestation (w/w)} = \frac{\text{Weight of infested fruit}}{\text{Total weight of fruit}} \times 100$$

The reduction of fruit infestation over untreated control was calculated by using the following formula:

$$\text{Percent reduction on infestation over untreated control} = \frac{Nu - Nt}{Nu} \times 100$$

Where, N_u = Number of fruit fly larva in untreated plot and N_t = Number of fruit fly larva in treated plot.

After harvesting all the mature fresh fruits (infested and non-infested), the total yield per plot was calculated. The unit was placed as MT/ha. Management cost was calculated by adding the costs incurred for labour and input for each treatment. The Gross return was measured by multiplying the total yield by the unit price of the product at that time. The Net return was calculated by subtracting management cost from gross return.

The marginal benefit cost ratio (MBCR) calculated by using the following formula:

$$\text{MBCR} = \frac{\text{Adjusted net return}}{\text{Total management cost}} \times 100$$

Data **analysis:** The data was analyzed by IBM SPSS and RStudio software. One-way ANOVA was performed followed by Duncan's Multiple Range Test (DMRT) to separate means in IBM SPSS. The determination of p-value at 5% level of significance and the bar was prepared by using RStudio.

Results and discussion

Effect of biorational insecticides on the fruit infestation: Biorational insecticides showed effect on fruit infestations (Table 1). The total number of infested fruit ranges from 2.0 to 4.0. The highest number of infested fruits were collected from Mahogony oil (4.0) and Biotrin 0.5 AS (4.0) treated plot which was followed by untreated control (3.7) and Bio-action 1.5 SL (3.7) treated plot. The lowest number of infested fruits were collected from Neem oil (2.0) treated plot which was followed by Bio-Clean 5 SL (3.0), and Spinomax 44.03 SC (3.3) and Biomax M 1.2 EC (3.3) treated plots (Table 1).

The rate of fruit infestation by number ranged from 18.7 to 69.4%. The highest infestation was found in untreated control (69.4%), followed by Mahogany oil (54.8%), Biotrin 0.5 AS (46.7%), Biomax M 1.2 EC (43.5%) and Bio-action 1.5 SL (43.3%) treated plot. The lowest infestation was found in Neem oil (18.7%) treated plot, followed by Spinomax 44.03 SC (36.9%) and Bio-Clean 5 SL (39.9%) treated plots (Table 1).

The infested fruit weight ranges from 2.4 to 4.5 kg. The highest weight of infested fruit was collected from Bio-Clean 5 SL (4.5 kg) treated plot, followed by Spinomax 44.03 SC (3.9 kg), Biomax M 1.2 EC (3.9 kg) treated plot. Following, the same weight of infested fruit was collected from Biotrin 0.5 AS and untreated control plot such as 3.9 kg. the lowest weight of infested fruit was collected from Neem oil (2.4 kg), followed by Mahogony oil (3.1 kg) and Bio-action 1.5 SL (3.8 kg) treated plots (Table 1).

The rate of fruit infestation by weight ranged from 17.1 to 59.1%. The highest infestation was found in untreated control (59.1%) plot, followed by Mahogany oil (38.9%), Biotrin 0.5 AS (38.9%), Biomax M 1.2 EC (36.8%) and Bio-Clean 5 SL (36.1%) treated plot. The lowest infestation was found in Neem oil treated plot (17.1%), followed by Spinomax 44.03 SC (30.2) and Bio-action 1.5 SL (33.1%) treated plots (Table 1).

The percentage of fruit infestation reduction over untreated control by number ranged from 21 to 73.1%. The highest reduction over untreated control was found in Neem oil (73.1%) treated plot, followed by Spinomax 44.03 SC (46.8%), Bio-Clean 5 SL (42.5%) and Bio-action 1.5 SL (37.6%) treated plot. The lowest reduction over untreated control was found in Mahogany oil (21.0%) treated plot, followed by Biotrin 0.5 AS (32.7%) and Biomax M 1.2 EC (37.3%) treated plot. The percentage of fruit infestation reduction over untreated control by weight range from 34.2 to 71.1%. The highest reduction over untreated control was observed in Neem oil (71.1%) treated plot, followed by Spinomax 44.03 SC (48.9%), Bio-action 1.5 SL (44.0%) and Bio-Clean 5 SL (38.9%) treated plot. The lowest reduction over untreated control was observed in Mahogany oil and Biotrin 0.5 AS (34.2%) followed by Biomax M 1.2 EC (37.7%) treated plot (Figure 1).

The highest rate of fruit infestation reduction over untreated control both cases of number and weight was observed from Neem oil treated plot (Figure1). The fruit fly is (*Bactrocera cucurbitae*) a serious insect pest of sweet gourd. After mating, an adult female insect can lay 225 ± 25 eggs in batches of 1–2 up to several dozen (Sohrab *et al*. 2018). They feed inside the pulp and causes severe damage. It was reported that Neem oil considerably reduces the cucurbit fruit fly (*Bactrocera cucurbitae*) infestation rather than different botanical and biopesticides (Sultana *et al.* 2017, Alam and Khan 2021, Sultan *et al.* 2022).

Sparks *et al*. (1995) reported that Spinosad has relatively broad-spectrum activity and has been effectively used for the control of many species of insect pests of Lepidoptera attacking various crops without any harmful effect to other arthropods.

Influence of biorational insecticides on larval count per infested fruit: At the immature stage of sweet gourd, the larval count ranged from 121.0 to 217.3. The highest larval count was found in the untreated control (217.0) plot, followed by Mahogany oil (184.0), Biotrin 0.5 AS (177.7), Biomax M 1.2 EC (174.3), Bio-action 1.5 SL

Table 1. Effect of different biorational insecticides on sweet gourd fruit infestation by cucurbit fruit fly

Treatment	No. of infested fruit per plot	Wt. of infested fruit per plot	Rate (%) of fruit infestation (n/n)	Rate (%) of fruit infestation (w/w)
Neem oil	2.0 ± 0.6b	2.4 ± 0.1b	18.7 ± 4.1c	17.1 ± 0.6c
Mahogany oil	4.0 ± 0.0a	3.1 ± 0.3ab	54.8 ± 2.4ab	38.9 ± 3.8ab
Bio-Clean 5 SL	3.0 ± 0.0ab	4.5 ± 0.1a	39.9 ± 3.2bc	36.1 ± 0.5bc
Bio-action 1.5 SL	3.7 ± 0.3a	3.8 ± 0.9ab	43.3 ± 6.7bc	33.1 ± 5.7bc
Biotrin 0.5 AS	4.0 ± 0.0a	3.9 ± 0.2a	46.7 ± 3.3ab	38.9 ± 1.7ab
Spinomax 44.03 SC	3.3 ± 0.3ab	3.9 ± 0.4a	36.9 ± 1.9bc	30.2 ± 2.4bc
BiomaxM 1.2 EC	3.3 ± 0.3ab	3.9 ± 0.3a	43.5 ± 3.6bc	36.8 ± 2.1bc
Untreated control	3.7 ± 1.2a	3.9 ± 0.2a	69.4 ± 2.8a	59.1 ± 1.9a
CV	8.7	12.2	5.1	6.3

In columns, means having different letter(s) are significantly different at 5% level of significance (P=0.05%) according to Duncan's Multiple Range Test (DMRT).

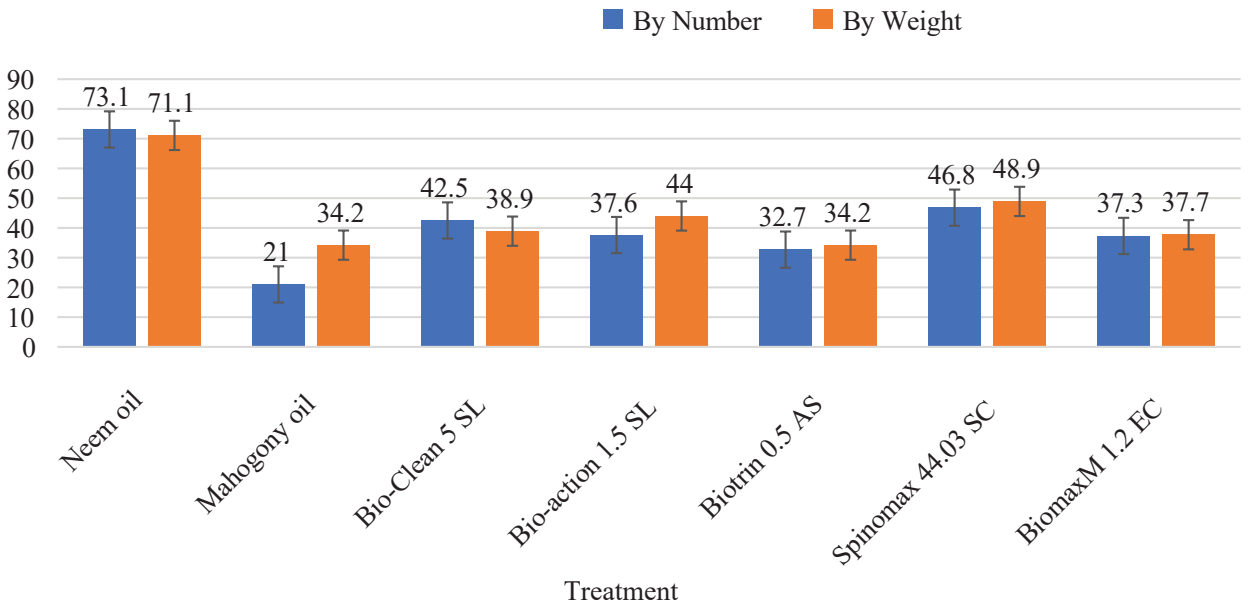


Figure 1. Rate of fruit infestation (by number and weight) reduction over untreated control of sweet gourd by cucurbit fruit fly biorational insecticides.

(172.7) treated plot. The lowest larval count was found in Neem oil (121.0) treated plot, followed by Spinomax 44.03 SC (164.3) and Bio-Clean 5 SL (172.0) treated plot (Table 2).

At the mature stage of sweet gourd, the larval count ranged from 290.0 to 358.3. The highest larval count was found in untreated control (358.0), followed by BiomaxM 1.2 EC (337.3), Biotrin 0.5 AS (335.3), Mahogany oil (332.0) and Bio-action 1.5 SL (331.3) treated plot. The lowest larval count was found in Neem oil (290.0) treated plot, followed by Spinomax 44.03 SC (312.0) and Bio-Clean 5 SL (323.3) treated plot (Table 2).

Table 2. Effect of biorational insecticides on cucurbit fruit fly larval count per infested fruit at pre-maturity and post-maturity stage

Treatment	Number of larvae per fruit	
	Immature fruit	Mature fruit
Neem oil	121.0 ± 4.9c	290.0 ± 20.8b
Mahogany oil	184.0 ± 9.2ab	332.0 ± 12.8ab
Bio-Clean 5 SL	172.0 ± 7.4ab	323.3 ± 19.1ab
Bio-action 1.5 SL	172.7 ± 7.1ab	331.3 ± 10.4ab
Biotrin 0.5 AS	177.7 ± 4.5ab	335.3 ± 34.2ab
Spinomax 44.03 SC	164.3 ± 8.1bc	312.0 ± 12.1ab
BiomaxM 1.2 EC	174.3 ± 5.5ab	337.3 ± 11.8ab
Untreated control	217.3 ± 5.8a	358.3 ± 26.4a
CV	14.7	10.6

In columns, means having different letter(s) are significantly different at 5% level of significance (P=0.05%) according to Duncan's Multiple Range Test (DMRT).

At the immature stage, the range of reduction of larval count over untreated control was 15.3 to 44.3%. The highest percentage of reduction over untreated control was found in Neem oil (44 .3%) treated plot, followed by Spinomax 44.03 SC (24.4%), Bio-Clean 5 SL (20.8%) and Bio-action 1.5 SL (20.5%) treated plot. The lowest percentage of reduction over untreated control was found in Mahogany oil (15.3%), followed by Biotrin 0.5 AS (18.2%) and BiomaxM 1.2 EC (19.8%) (Table 2).

At the mature stage of fruit, the range of reduction over untreated control was 5.9 to 19.1%. The highest percentage of reduction over untreated control was found in Neem oil (19.1%), followed by Spinomax 44.03 SC (12.9%), Bio-Clean 5 SL (9.8%) and Bio-action 1.5 SL (7.5%). The lowest percentage of reduction was found in Biomax M 1.2 EC (5.9%), followed by Biotrin 0.5 AS (6.4%) and Mahogany oil (7.3%) (Table 2).

A single female cucurbit fruit fly can lay 188 to 250 eggs in its lifespan (Sohrab *et al.* 2018). After hatching the fruit fly larvae feed inside the pulp of the fruit (Dhillon *et al.* 2005). The infested fruit decomposes due to secondary microbial infection and losses market value (Akter and Sohel 2020). The rate of reduction of larval count after spray was lower in Neem oil (Figure 2). Sultana *et al*. (2020) also found that cucurbit fruit fly infestation is lower in Neem Leaves treated plot rather than many biopesticides.

Influence of biorational insecticides on the abundance of natural enemies: Bio-rational insecticides affected the abundances of different natural enemies of sweet gourd plant. The data were taken after 72 hours of each spray. All the bio-rational insecticides have a significant effect on the abundance of natural enemies. The highest black ant abundance was found in untreated control (9.3) plot, followed by Mahogony oil (9.0), Neem oil (8.0), Bio-Clean 5 SL (7.0) and BiomaxM 1.2 EC (6.3) treated plot. The lowest black abundance was found in Biotrin 0.5 AS (3.3) treated plot, Spinomax 44.03 SC (5.7) and Bio-action 1.5 SL (5.7) treated plot (Table 3).

The abundance of ladybird beetle ranges from 2.0 to 3.7. The highest ladybird beetle abundance was found in the untreated (3.7) plots, followed by Mahogony oil (3.0), Neem oil, Bio-Clean 5 SL and BiomaxM 1.2 EC, showed the same result, such as 2.7 (Table 3). The lowest abundance of ladybird beetle was found in Spinomax 44.03 SC (2.0) treated plot, followed by Biotrin 0.5 AS (2.0) and Bio-action 1.5 SL (2.3) treated plot (Table 3).

In the case of predatory spiders, statistically there is no significant difference between the treatments. However, the abundance ranges from 2.3 to 4.3. The highest abundance was found in untreated control (4.3) plot, followed by Mahogony oil (3.3), Bio-action 1.5 SL (3.3), BiomaxM 1.2 EC (3.3) and Neem oil (3.0) treated plot. The lowest abundance of predatory spiders was found in

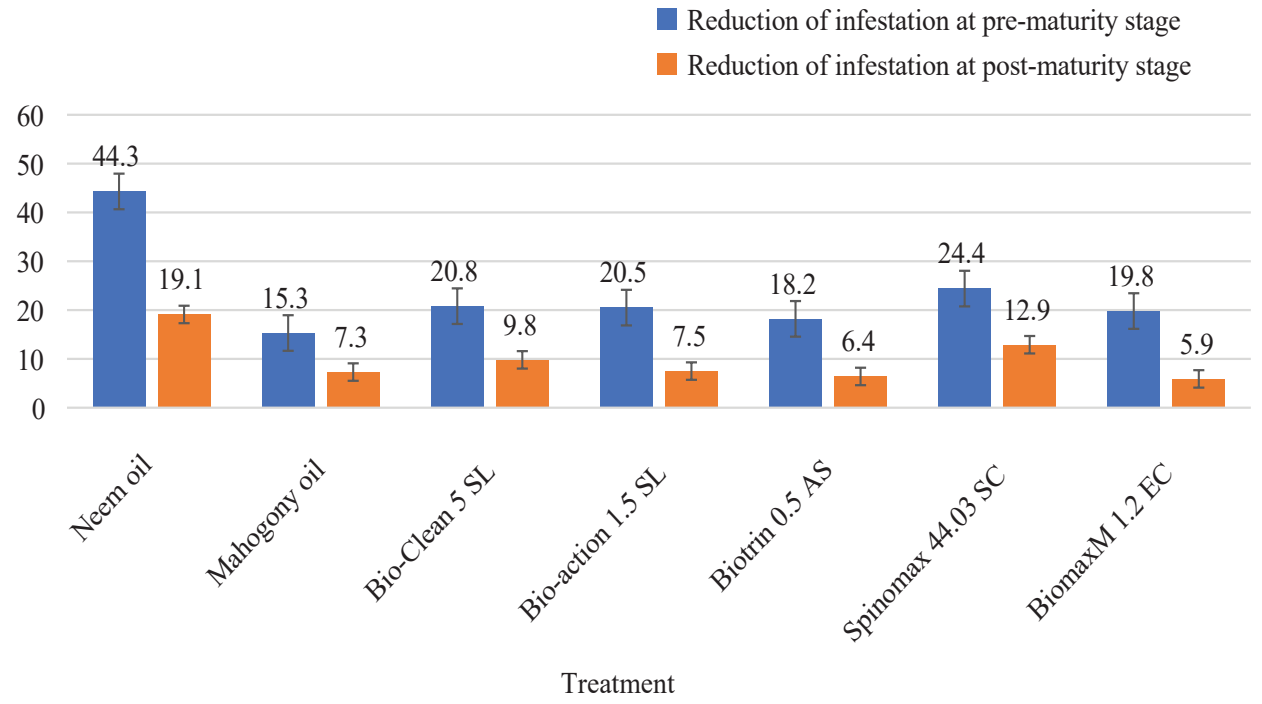


Figure 2. Percentage reduction of cucurbit fruit fly larval count over untreated control at immature and mature stage of fruit at different treatments.

Table 3. Mean abundance of different natural enemy per plot in sweet gourd field treated with different biorational insecticides

Treatment	Abundance of natural enemy		
	Black ant	Ladybird beetle	Spider
Neem oil	8.0 ± 0.6ab	2.7 ± 0.3ab	3.0 ± 1.5a
Mahogony oil	9.0 ± 0.6ab	3.0 ± 0.6ab	3.3 ± 1.5a
Bio-Clean 5 SL	7.0 ± 1.0ab	2.7 ± 0.3ab	2.7 ± 0.7a
Bio-action 1.5 SL	5.7 ± 0.7bc	2.3 ± 0.7ab	3.3 ± 0.9a
Biotrin 0.5 AS	3.3 ± 0.3c	2.0 ± 0.6b	2.3 ± 0.3a
Spinomax 44.03 SC	5.7 ± 0.3bc	2.0 ± 0.0b	2.7 ± 0.3a
Biomax M 1.2 EC	6.3 ± 0.3abc	2.7 ± 0.3ab	3.3 ± 0.3a
Untreated control	9.3 ± 0.7a	3.7 ± 0.3a	4.3 ± 0.7a
CV	12.3	14.1	15.7

In columns, means having different letter(s) are significantly different at 5% level of significance (P=0.05%) according to Duncan's Multiple Range Test (DMRT).

Biotrin 0.5 AS (2.3), followed by Bio-Clean 5 SL (2.7) and Spinomax 44.03 SC (2.7) treated plot (Table 3).

Biotrin 0.5 AS showed the lowest abundance of all the natural enemies. This is because after spraying Bio-action 1.5 SL, the abundance of different insects is reduced, so the natural enemy migrate to other places. Or, Biotrin 0.5 AS may have little toxic effect on insects and natural enemies. Continuously spraying bio-rational insecticides, the insect abundance was reduced in the plots, and the natural enemy abundance was reduced.

Efad *et al*. (2021) studied the effect of bio-rational insecticides namely Azadirachtin, Spinosad and Abamectin on the abundance of beneficial arthropods like ladybird beetles, syrphid flies, black ants, and spiders in the field of brinjal and reported their abundance entire the season. In their study, the abundance of ladybird beetle and black ant was statistically similar in Spinosad and Abamectin treated plots along with untreated control plot. There was no statistical variation in the abundance of syrphid fly and spiders among the treatments.

Calculation of yield and marginal benefit cost ratio: Bioinsecticides affects the yield (ton/ha) and calculation of marginal benefit cost ratio. The highest yield was obtained from Neem oil (23.8 ton/ha) treated plot, followed by Spinomax 44.03 SC (21.5 ton/ha), Bio-Clean 5 SL (20.7 ton/ha), Bio-action 1.5 SL (18.7 ton/ha) and Biomax M 1.2 EC (17.8 ton/ha) treated plot. The lowest yield was found in the untreated control (11.0 ton/ha), followed by Mahogany oil (13.5 ton/ha) and Biotrin 0.5 AS (16.7 ton/ha) treated plots (Table 4).

When harvesting, the wholesale market price of sweet gourd was 15 Tk/kg. The highest gross return was obtained from Neem oil (357500.0 Tk/ha), followed by Spinomax 44.03 SC (322500.0 Tk/ha), Bio-Clean 5 SL (310000.0 Tk/ha), Bio-action 1.5 SL (280000.0 Tk/ha) and Biomax M 1.2 EC (267500.0 Tk/ha) treated plot. The lowest gross return was obtained from the untreated control (165000.0 Tk/ha) plot, followed by Mahogany oil (202500.0 Tk/ha) and Biotrin 0.5 AS (250000.0 Tk/ha) treated plot (Table 4).

The highest net return was obtained from Neem oil (340300.0 Tk/ha) treated plot, followed by Spinomax 44.03 SC (305000.0 Tk/ha), Bio-Clean 5 SL (291500.0 Tk/ha), Bio-action 1.5 SL (261800.0 Tk/ha) and Biomax M 1.2 EC (249200.0 Tk/ha) treated plot (Table 4). The lowest net return was obtained from the untreated control (165000.0 Tk/ha) plot, followed by the Mahogany oil (185245.0 Tk/ha) and Biotrin 0.5 AS (231700.0 Tk/ha) treated plot.

The highest adjusted return was obtained from Neem oil (175300.0 Tk/ha), followed by Spinomax 44.03 SC (140000.0 Tk/ha), Bio-Clean 5 SL (126500.0 Tk/ha) and Bio-action 1.5 SL (96800.0 Tk/ha) treated plot. The lowest was obtained from Mahogany oil (20245.0 Tk/ha), followed by Biotrin 0.5 AS (66700.0 Tk/ha) and BiomaxM 1.2 EC (84200.0 Tk/ha) treated plot.

The highest MBCR was obtained from Neem oil (10.2), followed by Spinomax 44.03 SC (8.0), Bio-Clean 5 SL

Table 4. The analysis of marginal benefit-cost ratio (MBCR) of biorational insecticides against cucurbit fruit fly

Treatment	Yield (ton/ha)	Management cost (Tk)	Gross return (Tk)	Net return (Tk)	Adjusted net return (Tk)	MBCR
Neem oil	23.8	17200.0	357500.0	340300.0	175300.0	10.2
Mahogany oil	13.5	17255.0	202500.0	185245.0	20245.0	1.2
Bio-Clean 5 SL	20.7	18500.0	310000.0	291500.0	126500.0	6.8
Bio-action 1.5 SL	18.7	18200.0	280000.0	261800.0	96800.0	5.3
Biotrin 0.5 AS	16.7	18300.0	250000.0	231700.0	66700.0	3.6
Spinomax 44.03 SC	21.5	17500.0	322500.0	305000.0	140000.0	8.0
Biomax M 1.2 EC	17.8	18300.0	267500.0	249200.0	84200.0	4.6
Untreated control	11.0	0.0	165000.0	165000.0	0.0	-

The price per kg of sweet gourd was 15Tk.

(6.8) and Bio-action 1.5 SL (5.3) treated plot. The lowest MBCR was obtained from the, Mahogany oil (1.2) treated plot followed by Biotrin 0.5 AS (3.6) and Biomax M 1.2 EC (4.6) treated plot (Table 4).

Conclusion

The Neem oil @ 5ml/L of water +1–2 drops Tween 20 at 7 days interval showed the best result for controlling cucurbit fruit fly among all the biorational insecticides. Although it did not show any lethal effect on cucurbit fruit fly, it created a protective layer on fruit which prevented the fruit flies from laying eggs. So, the Neem oil @ 5ml/L of water + 1–2 drops Tween 20 at 7 days interval is recommended for controlling the cucurbit fruit fly.

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References

Afroz M, Amin M, Miah M and Hossain. 2020. Incidence of major insect pests on sweet gourd germplasm. Bangladesh Journal of Agricultural Research. 44: 621-630.

Ahmed F, Sheikh B, Rahman M, Rahman MM, Afroz M and Amin R. 2022. Efficacy of selected insecticides in cucurbit fruit fly management. Ecology Journal. 4: 117-120.

Akter T and Sohel MMH. 2020. Biology of the cucurbit fruit fly*, Bactrocera cucurbitae* (*Coq*) on host bottle gourd, *Lagenaria siceraria*. Journal of Bioscience and Agriculture Research. 25: 2098-2106.

Alam R and Khan MR. 2021. Efficacy of some biopesticides for the management of cucurbit fruit fly (*Bactrocera cucurbitae Coquillett*) infesting bottle gourd (*Lagenaria siceraria*) in Barind tract of Bangladesh. Journal of Entomology and Zoology Studies. 9: 203-207.

Ali MR, Chowdhury MSU, Karim MA, Hossain MMA and Mustafi BAA. 2016. Pest Risk Analysis (PRA) of Cucurbits in Bangladesh. Department of Agricultural Extension, Bangladesh. 227 p.

BARC. 2012. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council, Farmgate, Dhaka-1215. pp. 1-284.

BBS. 2023. Summary crop Statistics Area, Yield Rates and Production of Minor crops 2021-22 and 2022-23. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka. 296 p.

Curl CL, Spivak M, Phinney R and Montrose L. 2020. Synthetic pesticides and health in vulnerable populations: agricultural workers. Current Environmental Health Reports. 7: 13-29.

Dhillon MK, Singh R, Naresh JS and Sharma HC. 2005. The melon fruit fly, *Bactrocera cucurbitae*: A review of its biology and management. Journal of Insect Science. 5: 1-16.

Efad K, Hossain MS, Swapon MAH, Talukder MR and Ahmed M. 2021. Environment friendly management approaches of brinjal shoot and fruit borer. Bangladesh Journal of Ecology. 3: 69-74.

Horowitz AR and Ishaaya I. 2004. Biorational Insecticides - Mechanisms, Selectivity and Importance in Pest Management. In: Horowitz AR and Ishaaya I, editors. Insect Pest Management: Field and Protected Crops. Springer, Berlin, Heidelberg, New York. pp. 1-28.

Islam MA, Alam MJ, Islam M and Islam MK. 2017. Up scaling and field validation of bio-rational based integrated management package against fruit fly of sweet gourd at Jessore region. Eco-friendly Agriculture Journal. 10: 124-126.

Khan MMH. 2014. Effect of different management tactics on the incidence and movement of red pumpkin beetle, *Aulacophora foveicollis* on the leaves of sweet gourd, *Cucurbita moschata*. Jahangirnagar University Journal of Biological Sciences. 3: 73-80.

Mollah MMI, Rahman MM, Alam MZ. 2012. Toxic Effect of Some Insecticides on predatory lady bird beetles (Coleoptera: Coccinellidae) in country bean (*Lablab purpureus* L.) field. World Journal of Zoology. 7: 347-350.

Parajuli S, Shrestha J, Subedi S and Pandey M. 2022. Biopesticides: a sustainable approach for pest management. SAARC Journal of Agriculture. 20: 1-13.

Paul A, Miah MRU, Talukder MR, Bishnu A and Hossain MS. 2024. Effectiveness of biorational insecticides applied on sweet gourd for controlling red pumpkin beetle. Bangladesh Journal of Entomology. 32: 135–146.

Rahman MM, Howlader MTH, Islam KS and Morshed MN. 2019. Efficacy of three biopesticides against cucurbit fruit fly, *Bactrocera cucurbitae Coquillett* (Diptera: Tephritidae) and yield of bitter gourd. Journal of Bangladesh Agricultural University. 17: 483-489.

Sohrab CS, Prasad and Hasan W. 2018. Study on the biology and life cycle of cucurbit fruit fly, *Bactrocera cucurbitae* (*Coquillett*). Journal of Pharmacognosy and Phytochemistry. 1: 223-226.

Sparks TC, Thompson GD, Larson LL, Kirst HA, Jantz OK, Worden TV, Hertlein MB and Busacca JD. 1995. Biological characteristics of the spinosyns: a new naturally derived insect control agent. Proceedings of the Beltwide Cotton Conference. 2: 903-907.

Sultana MS, Azad MAK and Islam MS. 2020. Screening of some botanicals for eco-friendly control of cucurbit fruit fly (*Bactrocera cucurbitae*) infestation in experimental cucumber field. Journal of Environmental Science and Natural Resources. 13: 38-42.

Sultana T, Uddin MM, Rahman MM and Shahjahan M. 2017. Host preference and eco-friendly management of cucurbit fruit fly under field conditions in Bangladesh. Asian-Australasian Journal of Bioscience and Biotechnology. 2: 55-59.