Research article **Bangladesh Journal of Entomology**
ISSN (Print): 1021-1004, ISSN (Online): 3007-3332, Website: www.bangladeshes.org
Bangladesh J. Entomol. (2025) 33(1): 1-11

PREVALENCE OF SUCKING INSECTS AND THEIR NATURAL ENEMIES ON OKRA PLANTS TREATED WITH BIO-RATIONAL INSECTICIDES

Md. Jobayer Ahmed[1], Md Ruhul Amin[1], Farha Tamanna Ila Haque[1], Tasfia Tasnim Moon[1] and Md. Ramiz Uddin Miah[1]*

[1]Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh

Received: 15 February 2025; Accepted: 10 April 2025, DOI: http://doi.org/10.63759/bje.33.1.1

ABSTRACT

The study was conducted in the experimental field of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur-1706 to evaluate the efficacy of seven bio rational insecticides against sucking pests (jassid, aphid and whitefly) on okra variety BARI Dherosh 2. The study was comprised of seven bio rational treatments vtz. Bio-Clean 5 SL (De- limonin) @1ml L^{-1} water, Biomax M 1.2 EC (Abamectine) @1ml L^{-1} water, Phytoclean (Potassium salt of fatty acid 40%) @10ml L^{-1} water, Bio-Action 1.5 SL (matrine) @3ml L^{-1} water, Spinomax 44.03 SC (Spinosad) @1ml L^{-1} water, Phytomax (Azadiractin 0.1%) @ 5ml L^{-1} water and Biotrin 0.5 AS (Matrine) @1ml L^{-1} water. The bio rational insecticides were applied six times at seven days interval during the okra growing season. Among the tested bio rational insecticides Biotrin 0.5 AS (matrine) @1ml L^{-1} water after 24, and 72 hours of application resulted the lowest jassid, aphid and whitefly abundance. Biotrin 0.5 AS (Matrine) @1ml L^{-1} water had greater effect on jassid, aphid and whitefly revealed significantly lower levels of leaf infestation by number.

***Keywords*:** *Abelmoschus esculentus*, pests, beneficial arthropods, management

INTRODUCTION

Vegetables are a fundamental part of the human diet, with okra (*Abelmoschus esculentus* L.) being one of the most important and popular vegetable crops in Bangladesh. In 2019–2020, Bangladesh produced approximately 48400 t of okra on 10522 ha, with a yield of 4.6 t ha^{-1} (BBS 2020), significantly lower than the 7–12

*Corresponding author: ramizmiah@bsmrau.edu.bd

t ha^{-1} yield in developed countries. Okra is mostly grown in the Kharif season, but it can also be grown in arid regions and is nearly always available in locations with favorable climates (Memon *et al*. 2004). With an annual production of 5507000 t, India is the world's largest producer of okra. Around the world, 1117806 ha are used to grow okra, with an average yield of 7.8 t ha^{-1} and an annual production of 8706312 t (Samim *et al*. 2018). India, Turkey, Japan, Iran, Bangladesh, Malaysia, Thailand, Ethiopia, and Pakistan are the principal producers of okra (Benjawan *et al*. 2007).

Okra production faces challenges due to low plant density, poor fertilization, pest infestations, and lack of quality seeds. Insect pests, particularly jassids, aphids, leafhoppers, whiteflies, and thrips, cause significant yield losses (Asi *et al*. 2008) by damaging plants and spreading diseases like Yellow Vein Mosaic Disease and Cotton Leaf Curl Virus. The population of jassids remained relatively stable throughout the okra growing season, while the abundance of thrips, jassids, shoot and fruit borer varied based on the genetic traits and biochemical constitute of the okra plants (Miah *et al*. 2024).

Shoot and fruit borers also inflict severe damage. Their larvae bore into shoots and fruits, causing malformed pods and wilted shoots. Infestations can lead to a 40–56% reduction in yield, with significant losses occurring if pests are not controlled during early crop stages (Hossain *et al*. 2022). Excessive use of chemical pesticides harms biodiversity, pollinators, and human health, while also leading to pest resistance. Environmentally friendly alternatives and integrated pest management can reduce these negative impacts and promote sustainable okra production. The objectives of the present study are to evaluate safer, effective insecticides for controlling okra's sucking pests and to explore methods for conserving beneficial arthropod biodiversity.

MATERIALS AND METHODS

Study location and climatic conditions: The research was conducted at the research field and laboratory of the Department of Entomology, BSMRAU, Gazipur, Bangladesh, from April to August 2023, to evaluate the efficacy of biorational insecticides against major sucking pests of okra and their impact on natural enemies.

The study was conducted during the rainy season, when high humidity and rainfall were conducive to both crop growth and pest activity.

Cultivation of okra plants: Seeds of okra **(**variety BARI Okra-2) seeds were obtained from BARI, Gazipur. Seeds were soaked for 12 hours before direct sowing on April 3, 2023, at 10:30 AM. The study used a Randomized Complete Block Design (RCBD) with three replications, having 24 plots (3 m × 2 m each). Each plot had 18 plants, spaced 50 cm apart, with one meter row spacing and buffer zones. Cow dung (5000 kg ha^{-1}), TSP (120 kg ha^{-1}), and MP (110 kg ha^{-1}) were applied during land preparation. Urea (150 kg ha^{-1}) was top-dressed in two splits at 25 and 45 days after sowing. Weeding began 20 days after sowing and continued every 15 days. Regular irrigation was provided, especially during flowering and fruiting, with excess water drained promptly. The study tested seven biorational insecticides: Biotrin, Bio-Clean, Biomax M, Phytoclean, Bio-Action, Spinomax, and Phytomax, including water spray as control.

Insecticide application and data collection: Insecticides were applied weekly using a calibrated knapsack sprayer from May 7, 2023, under low-wind conditions during off-peak sunlight hours. Pests were monitored 24 and 72 hours after spraying by inspecting five randomly selected leaves per plant. Natural enemies, including ladybird beetles, ants, and spiders, were tracked using pitfall traps at the same intervals to evaluate the impact of pesticide treatments on beneficial arthropods. Data on pest abundance, natural enemies, fruit conditions, and yield were recorded. Parameters included pest incidence, infestation rates, natural enemy populations, and total okra yield per hectare.

Statistical analysis: Data were analyzed using one-way ANOVA and Tukey's HSD test at a 5% significance level, employing IBM SPSS version 20.0. These statistical tools were used to assess the effects of treatments on pest populations, natural enemies, and yield.

RESULTS AND DISCUSSION

A study on bio-rational insecticides for managing okra jassid revealed significant differences in leaf infestation rates (%) and jassid counts after 24 hours and 72 hours of spraying ($p < 0.05$) (Table 1). Following the first spray, jassid counts per 5 leaves/

plant ranged from 5.0±0.6 (Biotrin) to 18.7±0.7 (control). Biotrin was the most effective. Similar trends were observed after the second spray, with counts ranging from 7.0±0.6 (Biotrin) to 23.0±1.2 (control). After the third spraying Jassid counts varied from 9.0±0.6 to 29.0±1.2 per 5 leaves plant^{-1}, with significant differences ($p < 0.05$). The lowest count was with Biotrin (9.0±0.6). Biotrin and Spinomax showed statistically similar results. After the fourth spraying Jassid numbers ranged from 11.3±0.3 to 32.3±0.9 per 5 leaves plant^{-1}. After the fifth spraying, jassid counts ranged from 15.7±0.3 (Biotrin) to 38.0±1.2 (control), with significant differences ($p < 0.05$). Biotrin was most effective. Similar trends were observed after the sixth spraying, with counts ranging from 19.3±0.3 (Biotrin) to 41.0±1.2 (control). After the fifth spray, jassid counts ranged from 17.0±0.6 (Biotrin) to 40.0±1.2 (control), with Biotrin and Spinomax showing statistically similar results. After the sixth spray, counts ranged from 21.0±0.6 (Biotrin) to 43.0±1.2 (control). Biotrin remained the most effective, followed by Spinomax, Bio-action, and Bio-clean.

Aphid populations were significantly lower in all treatments compared to control after each of the six sprayings after 24 and 72 hours which is presented in Table 2. After the first spraying, Biotrin showed the lowest population of 3.0±0.6, followed by Spinomax (4.3±0.3), Bio-action (4.7±0.9), and Bio-clean (6.7±0.3), while the control had the highest of 11.7±0.3. Similar trends were observed in the second spraying. In the third spray, Biotrin had the lowest population (7.0±0.6) and the control had the highest of 22.0±2.5. The fourth spraying showed (9.6±0.3) as the most effective, with the control of 24.0±0.6. After the fifth spraying, Biotrin (11.0±0.6) again showed the best, and the control had the highest count of 27.3±0.3. In the sixth spraying, Biotrin showed the lowest aphid population (16.0±0.6), where the control had 33.0±1.2. After 72 hours in the first spraying, Biotrin showed the lowest infestation (4.7±0.3). After the second spraying, Biotrin remained the most effective (6.3±0.3), where the control had the highest (4.6±0.9). In the third spraying, Biotrin had the lowest (8.3±0.3), where the control had 21.0±1.0. After the fourth spraying, Biotrin was the most effective (11.0±1.2), and the control had the highest (24.3±0.9). In the fifth spraying, Biotrin showed the lowest count (14.0±0.6), where the control had the highest (30.3±0.3). The sixth spraying also showed that the Biotrin was the most effective (17.6±0.3).

Effect of different bio-rational insecticides on the abundance of whitefly on okra plant after 24 and 72 hours of sprays is presented in Table 3. Whitefly populations were significantly lower in all treatments compared to control. In the first spraying, Biotrin was the most effective (1.7±0.3), followed by Spinomax (3.0±0.6), Bio-Action (3.7±0.3), and Bio-Clean (5.0±0.6). Biotrin revealed the most effective in subsequent sprayings, with populations ranging from 1.7±0.3 to 33.0±1.2. After 72 hours of first spraying, Biotrin was the most effective (3.0±0.6). Biotrin remained the most effective in subsequent sprayings, with counts ranging from 5.0±0.6 to 25.0±1.2, where the control consistently had the highest populations. Spinomax and Bio-Action treatments showed statistically similar results across all sprayings.

Ant counts in pitfall traps (Table 4) were significantly lower in treated plots compared to control of 24 and 72 hours after all six sprayings. Biotrin consistently showed the lowest counts, ranging from 2.3±0.3 to 13.3±0.7, while the control had the highest, ranging from 5.3±0.3 to 20.3±0.3. Spinomax and Bio-action also showed appropriate reductions, with Spinomax often statistically similar to that of Biotrin. Phytoclean, Phytomax, Bio-max M, and Bio-clean showed moderate effectiveness and were statistically similar in most sprayings. Ant counts in pitfall traps of 72 hours of spraying showed significant reductions across all treatments compared to the control. After the second spraying, counts ranged from 7.7±0.3 (Biotrin) to 13.7±0.3 (control). The sixth spraying, counts ranged from 14.3±0.3 (Biotrin and Spinomax) to 19.3±0.7 (control).

Ladybird beetle counts after 24 hours of spraying (Table 5) was highest in control plot across all the tested treatments. Biotrin consistently had the lowest counts, ranging from 1.7±0.3 to 9.7±0.3 across six sprayings, while the control ranged from 4.3±0.3 to 17.7±0.3. Phytomax, Bio-max M, and Bio-clean often showed statistically similar results, while Bio-action and Spinomax were statistically comparable to Biotrin in later sprayings. Phytoclean consistently had the second-highest counts after the control. Ladybird beetle counts after 72 hours of spraying ranged from 3.0±0.0 (Biotrin) to 18.7±0.7 (control), with the control consistently having the highest counts.

The number of spiders found in pitfall traps after 24 and 72 hours of the first spraying is presented in Table 6. The data indicated that spider numbers across the treatments varied from 3.0±0.6 to 7.3±0.3. The control plot had the highest

spider count of 7.3±0.3, followed by Phytoclean and Phytomax, having 6.0±0.0 and 6.0±0.6, respectively. Spider counts ranged from 3.7±0.3 to 9.7±0.3 after the second spray. After the 3rd spraying, spider counts ranged from 5.3±0.3 (Biotrin) to 11.7±0.3 (control). After the 5th spraying, counts ranged from 7.3±0.3 (Biotrin) to 18.3±0.3 (control). After the 6th spraying, counts ranged from 9.3±0.3 (Biotrin) to 20.7±0.3 (control). The number of spiders found in pitfall traps after 72 hours of the first spraying ranged from 3.7±0.3 to 8.3±0.3. The control plot had the highest count of 8.3±0.3, followed by Phytoclean of 7.0±0.6, Phytomax of 6.7±0.3. After the second spraying ranged from 4.7±0.7 to 10.3±0.3. The control plot had the highest number of spiders (10.3±0.3). The spider counts ranged from 6.3±0.3 to 15.3±0.3 after the third spray. After the fourth spray spider counts ranged from 9.0±0.0 to 16.0±0.6. The control plot had the highest number of spiders of 16.0±0.6. The table 6 showed that the number of spiders after the sixth spray among the treated plots ranged from 11.0±0.6 to 20.3±0.9. Control plot had the highest number of spider (20.3±0.90 followed by Phytoclean (19.7±0.9), Phytomax (17.3±1.2), Bio-max M (16.0±1.2), Bio-clean (16.0±0.6), Bio-action (14.0±1.0), Spinomax (13.3±0.3), and Biotrin (11.0±0.6). Bioaction and Spinomax treated plots were statistically similar. Biomax M and Bioclean treated plots were also statistically similar.

Table 1. Effect of different bio rational insecticides on the abundance of jassid on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	5.0±0.6e	7.0±0.6e	9.0±0.6e	11.3±0.3f	15.7±0.3e	19.3±0.3e	6.0±0.6f	8.3±0.3f	11.0±0.6e	14.0±0.6f	17.0±0.6e	21.0±0.6g
Spinomax	6.0±0.6de	9.0±0.6de	13.0±0.6e	15.7±1.2ef	20.7±0.7e	25.3±0.9de	7.7±0.3ef	12.0±0.6ef	14.7±0.3de	18.0±0.6ef	23.0±1.2e	29.0±0.6fg
Bioaction	8.3±0.9de	11.7±0.3ce	14.3±0.7de	17.7±0.3de	22.3±0.7de	27.3±0.9d	10.3±0.3de	13.3±0.3ce	16.3±0.3cd	20.7±0.3de	25.3±0.9de	31.0±1.2ef
Bioclean	11.0±0.6cd	14.0±0.6bd	17.0±0.6cd	20.0±0.6cd	25.7±0.3cd	30.0±0.6c	12.0±0.6cd	15.7±0.3bd	19.0±0.6bc	23.0±0.6cd	29.0±1.2cd	33.0±0.6de
Biomax M	12.0±1.2bc	15.3±0.7bc	19.7±0.3bd	24.0±1.2bd	29.3±0.3bc	32.7±1.2c	13.7±0.3cd	17.3±0.3bc	22.3±0.3ac	27.0±1.2bc	31.7±0.3c	36.7±0.7cd
Phytomax	13.3±0.9ab	16.7±0.3ac	22.0±1.0ac	26.3±0.7ac	29.7±1.5b	34.7±0.3bc	14.7±0.3bc	19.0±0.6ab	24.3±0.9ab	30.0±1.2b	34.0±1.2bc	38.3±0.9bc
Phytoclean	15.0±0.6ab	17.7±0.3ab	23.0±0.6ab	27.7±0.3ab	32.7±0.3b	37.7±0.9b	16.7±0.3ab	21.0±0.6ab	27.0±0.6a	31.0±1.0b	37.0±0.6ab	39.3±0.9b
Control	18.7±0.7 a	23.0±1.2a	29.0±1.2a	32.3±0.9a	38.0±1.2a	41.0±1.2a	22.0±0.6a	26.0±0.6a	31.0±0.6a	36.0±0.6a	40.0±1.2a	43.0±1.2a

Data expressed as mean ± SD. Means not sharing a common letter within the same column is seemed significantly different according to Tukey's posthoc test at a significant level of $P \leq 0.05$.

Table 2. Effect of different bio rational insecticides on the abundance of aphid on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	3.0±0.6 d	5.0±0.6 d	7.0±0.6 c	9.6±0.3 f	11.0±0.6 f	16.0±0.6 f	4.7±0.3 e	6.3±0.3 e	8.3±0.3 e	11.0±1.2 f	14.0±0.6 f	17.6±0.3 f
Spinomax	4.3±0.3 d	6.6±0.9 cd	9.6±0.3 bc	11.3±0.7 ef	14.7±0.7 e	18.3±0.9 ef	6.0±0.6 de	8.0±0.6 de	11.0±0.6 de	12.6±1.5 ef	16.6±0.3 ef	19.6±0.9 f
Bioaction	4.7±0.9 cd	7.0±0.6 cd	10.3±0.3 bc	13.6±0.3 de	16.3±0.3 de	22.0±1.2 de	5.7±0.7 ce	8.6±0.7 ce	12.3±0.3 cd	15.3±0.9 df	19.6±0.7 de	24.6±0.9 e
Bioclean	6.7±0.3 bc	8.3±0.3 bc	11.6±0.3 bc	15.6±0.3 cd	18.6±0.9 cd	25.0±0.6 cd	7.0±0.6 ce	9.6±0.3 bd	14.0±0.6 bd	16.6±0.9 bd	23.0±1.2 cd	26.3±0.3 de
Biomax M	7.3±0.7 b	9.0±0.6 bc	12.6±1.3 b	16.0±1.0 cd	21.0±1.2 bc	26.3±1.3 bd	8.0±0.6 cd	11.0±0.6 bd	14.0±1.0 bd	19.3±0.3 bc	24.3±0.3 bc	28.3±0.9 cd
Phytomax	7.3±0.3 b	8.6±0.3 bc	13.0±0.6 b	17.6±0.3 bc	23.3±0.9 b	29.3±0.9 ac	8.3±0.3 c	10.6±0.7 bc	15.0±0.6 bc	19.6±0.9 bc	27.0±1.2 ab	30.6±0.3 bc
Phytoclean	9.0±0.6 b	11.0±0.6 b	13.6±0.9 b	19.3±0.9 b	24.3±0.7 ab	30.3±1.7 ab	10.7±0.3 b	11.6±0.7 b	16.3±0.7 b	21.0±0.6 ab	28.7±0.7 a	32.6±0.3 b
Control	11.7±0.3 a	14.0±0.6 a	22.0±2.5 a	24.0±0.6 a	27.3±0.3 a	33.0±1.2 a	13.3±0.9 a	14.6±0.9 a	21.0±1.0 a	24.3±0.9 a	30.3±0.3 a	39.6±1.2 a

Table 3. Effect of different bio rational insecticides on the abundance of whitefly on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	1.7±0.3e	3.7±0.3f	5.7±0.3f	8.3±0.9e	11.0±0.6f	13.7±0.3g	3.0±0.6f	5.0±0.6f	7.0±0.6f	9.7±0.3f	12.0±1.2g	15.3±0.3e
Spinomax	3.0±0.6e	4.0±0.6ef	7.0±0.6e	9.3±0.3d	11.7±0.3e	15.3±0.7f	4.3±0.3f	6.0±1.0e	8.0±0.6e	11.0±1.0e	13.7±0.9f	17.7±0.3d
Bioaction	3.7±0.3de	6.0±0.6de	9.3±0.3de	12.7±0.3cd	14.3±0.9de	17.7±0.7ef	5.7±0.3e	7.3±1.2e	11.7±0.9de	13.7±0.3de	16.0±1.0ef	19.3±0.3d
Bioclean	5.0±0.6cd	7.3±0.9cd	11.7±0.3cd	13.7±0.7c	17.0±1.2cd	22.0±0.6de	6.7±0.9de	9.7±0.3d	13.0±1.2d	15.3±0.3d	19.0±0.6de	22.3±0.9cd
Biomax M	6.3±0.3bd	8.0±0.6bc	13.0±1.2bc	16.0±1.2b	19.7±0.3bc	23.0±1.2cd	7.3±0.3cd	11.0±0.6cd	15.7±0.7c	18.0±1.2c	21.3±0.9cd	25.3±0.9b
Phytomax	7.7±0.3bc	9.3±1.2bc	15.0±1.2b	17.0±1.2b	22.0±1.2b	25.0±1.0b	8.7±0.3bc	13.0±1.0bc	16.3±1.2bc	20.3±0.9bc	23.0±1.2bc	27.3±0.7b
Phytoclean	7.7±0.7ab	10.3±0.3b	16.3±1.2b	18.3±0.3b	23.3±1.5b	28.0±0.6ab	9.7±0.3b	13.3±0.3b	17.3±0.7b	20.7±0.3b	27.3±0.9ab	30.3±0.9ab
Control	9.7±0.3a	12.7±0.9a	18.0±1.2a	21.0±1.2a	27.7±0.3 a	33.0±1.2a	11.7±0.3a	15.0±0.6a	19.7±0.9a	25.0±1.2a	30.7±0.3a	36.7±0.3a

Data expressed as mean ± SD. Means not sharing a common letter within the same column is seemed significantly different according to Tukey's posthoc test at a significant level of $P \leq 0.05$.

Table 4. Effect of different bio rational insecticides on the abundance of black ant on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	2.3±0.3d	6.3±0.3e	8.0±0.0e	8.0±0.6e	12.3±0.3f	13.3±0.7c	3.0±0.0c	7.7±0.3c	9.3±0.3c	9.7±0.9f	13.3±0.3e	14.3±0.7c
Spinomax	2.7±0.3cd	6.7±0.3de	8.7±0.7e	11.3±0.7d	13.3±0.7ef	13.7±0.3c	2.7±0.3c	8.3±0.3bc	9.3±0.7c	12.7±0.7e	14.7±0.9de	14.3±0.3c
Bioaction	3.0±0.6bd	7.7±0.3de	10.7±0.3d	12.7±0.3d	15.0±0.6de	15.3±0.3bc	2.7±0.6c	9.0±0.0ac	11.0±1.0bc	13.3±0.3de	16.3±0.3cd	16.7±0.3bc
Bioclean	3.7±0.3bd	8.3±0.3ce	12.0±0.0cd	13.3±0.7cd	15.7±0.3cd	16.7±0.3b	3.7±0.7bc	9.3±0.3ab	13.3±0.3ab	14.3±0.9ce	17.3±0.3bc	17.3±0.3ab
Biomax M	3.7±0.0bd	9.7±0.3bd	12.3±0.3c	15.0±0.0bc	16.7±0.3bd	16.7±0.7b	3.7±0.0bc	10.7±0.3ab	13.7±0.7ab	16.3±0.3bd	18.0±0.6bc	18.0±0.6ab
Phytomax	4.0±0.6ac	10.0±0.0ac	12.7±0.3bc	15.3±0.3bc	17.3±0.3bc	16.7±0.3b	4.3±0.7ac	11.0±0.6a	13.7±0.7ab	16.0±0.6ac	19.0±0.6ab	17.7±0.7ab
Phytoclean	4.3±0.3ab	11.0±0.6ab	14.0±0.0ab	15.7±0.3ab	18.3±0.3ab	17.3±0.3b	5.0±0.3ab	12.3±0.7a	15.0±0.6a	17.7±0.3ab	19.7±0.3ab	19.0±0.6ab
Control	5.3±0.3a	12.3±0.3a	14.7±0.3a	17.7±0.3a	20.3±0.3a	20.3±0.3a	5.7±0.9a	13.7±0.3a	15.7±0.3a	19.0±0.0a	21.3±0.3a	19.3±0.7a

Table 5. Effect of different bio rational insecticides on the abundance of lady bird beetle on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	1.7±0.3c	3.0±0.0e	3.3±0.3e	6.0±0.0c	7.3±0.3d	9.7±0.3e	3.0±0.0b	3.7±0.3c	4.3±0.3c	7.7±0.3b	8.0±0.0d	11.0±0.6c
Spinomax	2.3±0.3bc	3.7±0.3de	4.3±0.3de	7.0±0.6c	7.7±0.3d	10.7±0.7de	2.7±0.3 ab	5.0±0.0bc	5.3±0.3c	7.7±0.3b	8.7±0.3cd	11.7±0.3bc
Bioaction	2.0±0.6bc	4.3±0.3de	6.0±0.6cd	7.0±1.0c	8.0±0.6d	11.0±0.0de	3.0±0.6 ab	5.7±0.3ac	7.0±0.0b	8.3±1.2b	9.3±0.9cd	12.0±1.0bc
Bioclean	2.7±0.3bc	4.7±0.3ce	6.7±0.3c	8.3±0.3bc	8.7±0.3d	12.3±0.3cd	3.3±0.7 ab	6.0±0.6ab	7.7±0.3b	9.3±0.3b	9.3±1.2cd	13.3±0.7bc
Biomax M	2.0±0.0ac	5.3±0.3bd	7.3±0.3bc	8.0±0.6bc	11.0±0.6c	13.7±0.3c	4.0±0.0 ab	6.3±0.7ab	8.3±0.3b	9.0±0.0b	11.7±0.9bc	14.7±1.5c
Phytomax	3.0±0.6ac	6.3±0.3ac	7.3±0.3bc	8.3±0.3bc	12.0±0.0bc	14.0±0.6bc	3.7±0.7 ab	7.3±0.3a	8.3±0.3b	9.7±0.3b	14.3±0.3ab	14.7±0.7ac
Phytoclean	3.7±0.3ab	6. ±0.7ab	8.7±0.3ab	9.7±0.3ab	13.7±0.3ab	15.7±0.3b	4.7±0.3ab	7.3±0.7a	10.3±0.3a	10.0±0.6ab	14.7±0.9ab	15.7±0.9ab
Control	4.3±0.3a	7.3±0.3a	9. 7±0.3a	11.7±0.3a	15.3±0.3a	17.7±0.3a	5.3±0.9a	7.7±0.3a	11.7±0.3a	12.3±0.3a	16.7±0.3a	18.7±0.7 a

Table 6. Effect of different bio-rational insecticides on the population of spider on okra plant after 24 and 72 hours of different sprays

Treatment	24 hours						72 hours					
	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray	1st Spray	2nd Spray	3rd Spray	4th Spray	5th Spray	6th Spray
Biotrin	3.0±0.6d	3.7±0.3e	5.3±0.3 d	7.7±0.3e	7.3±0.3e	9.3±0.3d	3.7±0.3b	4.7±0.7d	6.3±0.3d	9.0±0.0d	8.7±0.3f	11.0±0.6d
Spinomax	3.3±0.7d	4.3±0.7de	6.3±0.3cd	8.7±0.3de	8.3±0.3e	12.3±0.3c	4.0±0.6b	5.7±0.9cd	7.3±0.7cd	10.3±0.3d	9.7±0.3ef	13.3±0.3cd
Bioaction	3.0±0.0cd	5.3±0.3ce	6.7±0.3cd	8.3±0.3de	10.3±0.3d	13.7±0.3c	3.7±0.9b	6.3±0.3bd	7.7±0.3cd	9.3±0.3d	11.3±0.3e	14.0±1.0cd
Bioclean	4.7±0.3bd	6.0±0.6bd	7.3±0.3c	9.7±0.3d	12.3±0.3c	14.3±0.7bc	5.7±0.9ab	6.7±0.3bd	8.3±0.3cd	11.0±0.6cd	14.0±0.0d	16.0±0.6bc
Biomax M	5.3±0.7ac	6.7±0.3bc	7.7±0.3c	11.3±0.3c	13.7±0.3c	14.3±1.2bc	5.0±1.2ab	6.7±0.7bd	8.7±0.3 c	12.7±0.3bc	15.0±0.0cd	16.0±1.2bc
Phytomax	6.0±0.6ab	7.7±0.7ab	9.3±0.3b	12.3±0.3bc	15.3±0.3b	16.7±0.3b	6.7±0.3ab	9.0±0.6ac	11.3±0.7b	13.7±0.3b	16.7±0.7bc	17.3±1.2ac
Phytoclean	6.0±0.0ab	8.0±.0ab	10.3±0.3ab	13.3±0.3ab	17.3±0.3a	20.0±0.6a	7.0±0.6ab	8.3±.7ab	13.0±0.6b	14.7±0.7ab	18.0±0.6ab	19.7±0.9ab
Control	7.3±0.3a	9.7 ±0.3a	11.7±0.3a	14.7±0.3a	18.3±0.3a	20.7±0.3a	8.3±0.3a	10.3±0.3a	15.3±0.3a	16.0±0.6a	19.3±0.3 a	20.3±0.9a

Data expressed as mean ± SD. Means not sharing a common letter within the same column is seemed significantly different according to Tukey's posthoc test at a significant level of $P \leq 0.05$.

The present findings align with those of Miah *et al*. (2019), Tripura *et al*. (2018) where neem-based treatments effectively reduce insects like jassid and whitefly populations, as Biotrin and Spinomax demonstrated statistically similar reductions in pest abundance. According to Mohammad *et al*. (2018) the efficacy of bio-rational insecticides like Biotrin, Spinomax, and neem-based treatments significantly reducing pest populations in okra plant. Singh *et al*. (2021) and Akramuzzaman *et al*. (2018) highlighted the effectiveness of biorational insecticides like Biotrin in reducing okra pests while preserving natural enemies and these findings were comparable, with the present study and support their role in sustainable pest management. Similarly, Khan *et al*. (2024) reported that Biotrin and Spinomax effectively reduce pest populations, including okra jassid, aphids, and whiteflies, while minimally impacting on beneficial insects like ladybird beetles and predatory spiders, further underscoring for sustainable pest management practices. In this study Biotrin, applied at 1ml L^{-1} water of 7-day interval, showed the lowest population of pests and highest yield, while being less harmful to beneficial insects. This study highlights the potential of botanicals for sustainable pest management, reducing reliance on toxic insecticides.

ACKNOWLEDGEMENT

The research was accomplished with the funding support of the University Grants Commission of Bangladesh to whom the authors are very grateful.

REFERENCES

AKRAMUZZAMAN, M., UDDIN, M. M. & ISLAM, K. S. 2018. Biorational management of okra jassid (*Amrasca devastans*). Prog. Agril. **29**: 205-212.

ASI, M. R., AFZAL, M., ANWAR, S. A. & BASHIR, M. H. 2008. Comparative efficacy of insecticides against sucking insect pest of cotton. *Pak. J. life Soc. Sci.* **6**: 140-142.

BBS (Bangladesh Bureau of Statistics). 2020. Year book of Agricultural statistics of Bangladesh. Government of the People's Republic of Bangladesh. p. 41.

BENJAWAN, C., CHUTICHUDET P. & KAEWSIT S., 2007. Effect of green manures on growth yield and quality of green okra (*Abelmoschus esculentus L*) har lium cultivar. *Pak. J. Biol. Sci.* **10**: 1028-1035.

HOSSAIN, M. S., AFROZ, M., MAZED, M. K., MIAH, M. R. U. & AMIN, M. R. 2022. Biochemical constituents in okra cultivars affect the infestation of shoot and fruit borer, *Earias vitella* F. *J. Ent. Res*. **46**: 944-948.

KHAN, M. S. I., RAHMAN, M. M., HOSSAIN, M. S., HOSSAIN, M. E. & RIMI, T. A. 2024. Efficacy of insecticides against major sucking insect pests of okra and their effect on natural enemies. *Indian J. Entomol*. **86**: 739-742.

MOHAMMAD, A., ALAM, S. N., MIAH, M. R. U., AMIN, M. R. & SAIF, H. B. 2018. Bio-rational management packages of jassid and shoot and fruit borer of okra. *Bangladesh J. Agric. Res*. **43**: 323-332.

MIAH, M. R. U., CHANDA, R., AMIN, M. R., HOQUE, M. A. & SEDDIQUE, A. A. 2024. Reduction of sucking insect abundance using botanicals for proper growth and yield of okra. *Bangladesh J. Ecol*. **1**: 1-5.

MEMON, A. J., ABRO, G. H. & SYED, T. S. 2004. Varietal resistance of okra against *Earias* spp. *J. Ent.* **1**: 1-5.

QHURESHI, Z. 2007. Breeding investigation in bhendi (*Abelmoschus esculentus* (L.) Moench). Master Thesis, University of Agriculture Sciences, GKVK, Bangalore, India.

SAMIM, S., SOOD, S., SINGH, A., VERMA, A. & KAUR, A. 2018. Morphological characterization of okra [*Abelmoschus esculentus* (L.) Moench]. *Intl. J. Cur. Microbio. Appl. Sci.* **7**: 2011-2019.

SINGH, S., YADAV, G. S., DAS, A., DAS, B., DEVI, H. L., RAGHURAMAN, M. & KUMAR, A. 2021. Bioefficacy, environmental safety and synergistic impacts of biorational formulations against whitefly, leafhopper and blister beetle in organic okra ecosystem. *J. Agril. Sci*. **159**: 373-384.

TRIPURA, K., AMIN, M., MIAH, M. & KAYESH, E. 2018. Effect of intercropping and neem oil on okra plant characteristics, insect pest diversity and virus infection. *Bangladesh j. entomol*. **28**: 27-35.

YAMAGUCHI, M. (1998). World Vegetables-Principles, Production and Nutritive Values. Van Nasfirand Reinhoid. New York, USA. p. 415.