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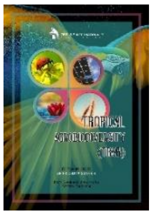

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RESEARCH ARTICLE

ABUNDANCE AND BIODIVERSITY OF ARTHROPOD FAUNA IN BRINJAL AGROECOSYSTEMS: AN ASSESSMENT OF THE IMPACTS OF COMMONLY USED INSECTICIDES IN BANGLADESH

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ABSTRACT

In the present study, the impacts of six insecticides commonly used by Bangladeshi brinjal farmers were evaluated on the abundance and biodiversity of arthropod pests and beneficial insects in brinjal ecosystem. The tested insecticides were: Tracer 45 SC (Spinosad), Belt Expert 48 SC (Flubendiamide 24% + Thiacloprid), Caprid 95 SP (Cartap + Acetamiprid), Fairhit 20 EC (Pyriproxyfen + Fenpropathrin), Thiami 70 WDG (Thiamethoxam + Imidacloprid) and Lumectin 10 WDG (Lufenuron + Emamectin Benzoate). The experiment was conducted using a randomized complete block design (RCBD) with four replications. The samples were collected at 10-days interval throughout the cropping period using sweep net, pitfall traps and yellow sticky traps. We have identified 54 morphospecies under 36 families and 10 orders and classified into five functional categories namely: herbivores, predators, parasitoids, pollinators, and detritivores. Among the orders, Coleoptera (13) was the most dominant, followed by Hemiptera (10), Diptera (9), Hymenoptera (7), Lepidoptera (4), Araneae (3), Orthoptera (3), Neuroptera (2), Thysanoptera (2) and Ispotera (1). Among six tested insecticides, Thiami 70 WDG @ 0.3g/L provided the highest pest suppression but resulted in the lowest Simpson biodiversity index and highest equitability, indicating low compatibility with beneficial insects and potentially harmful for brinjal ecosystem. In contrast, Tracer 45 SC @ 0.4 ml/L provided the highest efficacy against pest while maintaining the highest biodiversity index and lowest equitability that is close to the control, highlighting its ecological compatibility. In conclusion, the present study showed that insecticide selection potentially influences pest control and arthropod biodiversity, therefore, Tracer 45 SC @ 0.4 ml/L is recommended for effective pest control and maintaining highest biodiversity and lowest equitability and can be integrated into sustainable brinjal IPM programs.

KEYWORDS

Arthropod, abundance, biodiversity, brinjal, insecticides, Bangladesh

1. Introduction

Brinjal (*Solanum melongena* L.) is very popular and widely cultivated vegetable crop that is grown throughout the year although mainly cultivated in winter season. Not only in Bangladesh, it is an important crop in South and Southeast Asia due to its adaptability, high productivity and strong market demand. In Bangladesh, approximately 150,000 farmers cultivate brinjal on approximately 50,955 hectares of land, producing nearly 507,000 metric tons annually (BBS, 2020). The crop provides a main source of cash income for smallholder farmers, especially in densely populated rural regions where livelihood options are limited and brinjal climatization ensure regular returns. Not only demand as vegetable crop, brinjal cultivation is also important for contributing in country's food security, employment generation and rural income. However, this vegetable is severely infested by several insect pest at field condition because of its year-round cultivation, widespread adoption of high-yielding and hybrid varieties and inherent vulnerability to multiple insect pests often result in heavy pest pressure (Thapa, 2010). Consequently, farmers rely extensively on chemical insecticide use for crop protection. This situation highlights the urgent need for sustainable pest management strategies that ensure effective pest management along with conserving beneficial insects and maintaining agro-ecosystem stability.

Till now, it has been reported that brinjal crop has been attacked more than 140 insect pest species including aphids, jassids, whitefly, thrips, mites, brinjal shoot and fruit borer etc. (Sharma and Tayde, 2017). Majority of the brinjal farmers in Bangladesh exclusively rely on broad-spectrum chemical insecticides from different groups like organophosphate, organocarbamate, pyrethroids, neonicotinoid etc. (Akter et al., 2018). Among the cultivated vegetables in Bangladesh, the brinjal receive the highest insecticide load that directly or indirectly pose severe threats to human health and environments. This highest insecticide load not only increase the residues level in edible fruits but also severely contaminates the soil and water resources that leads to destruction of beneficial insects and disruption of ecological balance. Moreover, brinjal farmers widely use broad-spectrum insecticides that accelerates pest resurgence, resistance and further undermining long-term pest management efficiency ((Pedigo, 2002). Previous studies have reported that intensive insecticide use drastically alters arthropod community structure, reduce biodiversity and make agroecosystem instability (Alam et al., 2006). These concerns highlight the urgent need for environmentally sound and economically viable pest management strategies that conserve beneficial arthropods while ensuring sustainable brinjal production.

Biodiversity is a fundamental driver of ecosystem functioning,

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productivity and resilience in agroecosystems, operating across genetic, species, functional and ecosystem levels (Bengtsson et al., 2005). Biodiversity boosts agricultural productivity where each species, no matter how small, has an important role to play. The maintenance of biodiversity within agricultural environments is widely recognized as being essential for their agronomic sustainability (Schowalter, 2006; Chang et al., 2019). An important principle of integrated pest management is to maximize natural control, and, therefore, the temporal changes in arthropod abundance, diversity index, species richness and evenness are important considerations in designing pest management strategies. In brinjal ecosystem, various functional groups are existing namely herbivores, predators, parasitoids, pollinators and detritivores those make a shape in the brinjal field for sustainable ecosystem and stability (Sharma and Tayde, 2017). Brinjal is infested by several insect pests and accordingly majority of the farmers apply broad-spectrum insecticides for controlling insect pests (Akter et al., 2018). The multiple and indiscriminate application of broad-spectrum insecticides on brinjal hampers arthropod community structure, reduces functional biodiversity, and disturb the ecosystem by eliminating natural enemies (Pedigo, 2002; Alam et al., 2006). This disturbed ecosystem is not good for beneficial insects as well as ecosystem stability and finally pose a serious threat to environmental health, food safety and ecological balance.

Based on the critical role of arthropod biodiversity, particularly the abundance of beneficial insects, in sustaining brinjal agroecosystems, there is an urgent need to evaluate the impacts of commonly used insecticides on the arthropod biodiversity and abundances. Although some studies have examined the impacts of selected insecticides on arthropod communities in brinjal fields of Bangladesh comprehensive information on overall arthropod diversity, particularly beneficial groups such as predators, parasitoids, and pollinators remain limited (Amin et al., 2018). Therefore, the present study aimed to assess the abundance, community composition and biodiversity of arthropods in brinjal agroecosystems under insecticide-treated and untreated conditions, with the objective of generating evidence-based insights to support ecologically sound and sustainable pest management strategies.

2. Materials and Method

2.1 Time, plot preparation and seedling transplantation

The experiment was conducted from September 2024 to February 2025 at the field laboratory of the Department of Entomology, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh (24.75° N, 90.50° E). The experimental field was characterized by sandy loam soil with a pH ranging from 6.3 to 7.6 and was situated within the Old Brahmaputra Alluvial Tract, experiencing warm and humid subtropical climatic conditions. The brinjal hybrid variety ‘Singnath-1’ was used for the study. All recommended agronomic practices were uniformly followed throughout the cropping period. Prior to seedling transplantation, the land was thoroughly prepared and amended with well decomposed cow dung at a rate of 10-12 t ha^{-1}. Chemical fertilizers, including urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate were applied in accordance with the recommendations of BRRI (2018).

2.2 Design, insecticides and spray schedule

The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications per treatment. The insecticides evaluated and their recommended doses are presented in Table 1. A total of seven applications were performed at 10-day intervals, and arthropod data were recorded correspondingly. Plots were randomly assigned and spatially separated to minimize cross-treatment interference. Precautionary measures were implemented to prevent spray drift to control or adjacent plots, and applications were conducted between 09:00 and 11:00 h to avoid the effects of strong sunlight and wind-induced drift.

2.3 Arthropod sampling

In the brinjal ecosystem, arthropod fauna i.e., insect pests and beneficial insects coexists. Arthropods are distributed randomly in different microhabitats like soil, plants, and the aerial environment. Accordingly, sweep nets, colored sticky traps, and pitfall traps were used to collect arthropod samples. In each plot, two colored sticky traps and one pitfall traps were installed. Ground-dwelling arthropods were captured using a plastic bucket (15–20 cm diameter, 30 cm depth) buried such that the rim was level with the soil surface, allowing unobstructed movement of insects. Each bucket was filled one-quarter with detergent water, to which 5% glacial acetic acid was added as a preservative. Plant-dwelling insects were collected using a sweep net (32 cm diameter, 68 cm depth, mesh size <1 mm). In each plot, five sampling points were randomly selected, and five consecutive sweeps were performed at each point. The same procedure was applied for the rest of the experimental plots.

2.4 Sample preservation, sorting and counting

Arthropod samples were collected at 10-days interval. Samples collected from pitfall trap were kept in scintillation vial containing 90% ethyl alcohol and immediately placed in cool box. Samples collected through sweeping also followed the same procedures. On the other hand, insects containing yellow sticky traps were carried to the laboratory and kept in refrigerator for further activities. In the laboratory, specimens were carefully sorted, counted, and identified to multiple taxonomic levels, including (i) order, (ii) family, and (iii) morphospecies. Additionally, individuals were classified into functional groups, specifically herbivores and beneficial arthropods, to facilitate analysis of community structure and ecosystem function.

2.5 Measurement of diversity index

To assess the biodiversity in brinjal ecosystem with or without insecticides application, Simpson's diversity index was assessed (Simpson, 1949).

Simpson Diversity Index (D) = $1- \frac{\sum_{i=1}^{S}[ni(ni-1)]}{N(N-1)}$

[Value range: 0 -1 (0: No diversity, 1=Infinite diversity)]

Where, ‘ni’ is the proportion of individual for the ‘i^th^’ insect family and ‘S’ is the total number of insect family in the community (i.e., the richness), and ‘N’ is the total number insects of all species. The index value is influenced by both species richness and the evenness (equitability) of individual distribution across families. Equitability was measured by expressing Simpson's index, 'D', as a proportion of its maximum possible value.

Equitability, E= $\frac{D}{D_{max}}$

2.6 Statistical analysis

Biodiversity and equitability indices, including **Simpson’s diversity and evenness indices** were calculated using PAST software Version 5.3 (Hammer, 2001). The computed index values were subjected to analysis of variance (ANOVA) using STATISTIX version 10. Treatment means were separated using Duncan’s Multiple Range Test (DMRT) at the 5% level of significance, following (Gomez and Gomez, 1984).

Table 1: List of insecticides with their trade name and active ingredients

Treatments	Active Ingredients
Untreated Control	------
Tracer 45 SC @ 0.4 ml/L Water	Spinosad
Belt Expert 48 SC @ 0.5 ml/L Water	Flubendiamide 24% +Thiacloprid
Lumectin 10 WDG @ 1 g/L Water	Lufenuron+Emamectin Benzoate
Caprid 95 SP @ 1 g/L Water	Cartap + Acetamiprid
Fairhit 20 EC @ 1 ml/L Water	Pyriproxifen +Fenpropathrin
Thiami 70 WDG @ 0.3 g/L Water	Thiamethoxam + Imidacloprid

3. Results and Discussion

A total of 13,607 arthropod samples were collected from the experimental plots, among them 54 were morphospecies under 36 families and 10 orders (Table 2). The number of morphospecies varied from 1-13 under different orders (Figure 1). The highest morphospecies were under the order Coleoptera and that is 13, followed by Hemiptera (10), Diptera (9), Hymenoptera (7), Lepidoptera (4), Orthoptera (3), Araneae (3), Neuroptera (2), Thysanoptera (2) and Isoptera (1).

3.1 Morphospecies in brinjal ecosystem

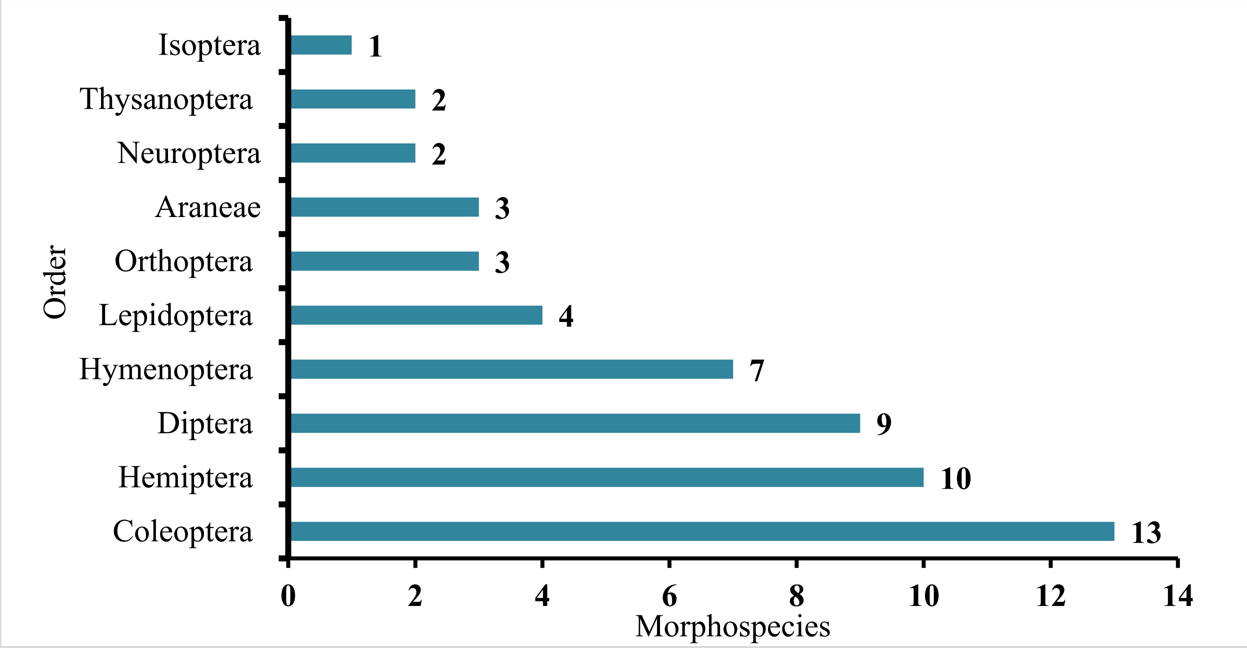

Figure 1: Number of morphospecies identified in brinjal eco-system (both control and insecticides treated condition) under each taxonomic order of the phylum Arthropoda.

3.2 Abundances of insect pests and beneficial arthropods in brinjal ecosystem

Table 2: Overall abundances of insect pests and beneficial arthropod species in brinjal ecosystem under control and insecticides treated condition.

(A) Herbivores

Common name/Morphospecies	Family	Order
Brinjal shoot and fruit borer	Pyralidae	Lepidoptera
Leaf roller	Noctuidae	Lepidoptera
Leaf hopper	Cicadillidae	Hemiptera
Aphids	Aphididae	Hemiptera
Short horned grasshopper	Acrididae	Orthoptera
Field cricket	Gryllidae	Orthoptera
Mole cricket	Gryllotalpidae	Orthoptera
Mosquito	Culicidae	Diptera
Thrips	Thripidae	Thysanoptera
Jassids	Cicadellidae	Hemiptera
White fly	Aleyrodidae	Hemiptera
Green vegetable bug	Pentatomidae	Hemiptera
Pentatomid bug	Pentatomidae	Hemiptera
Mealy bug	Pseudococcidae	Hemiptera
Rice bug	Coreidae	Hemiptera
Red pumpkin beetle	Chrysomelidae	Coleoptera
Flea beetle	Chrysomelidae	Coleoptera
Leaf beetle	Chrysomelidae	Coleoptera
Click beetle	Elateridae	Coleoptera
Epilachna beetle	Coccinellidae	Coleoptera
Common Cutworm	Noctuidae	Lepidoptera
Lepidopteran larvae	Variable	Lepidoptera
Termite	Termitidae	Isoptera

B. Predators

Common Name/Morphospecies	Family	Order
Lace wing	Chrysopidae	Neuroptera
Mantidfly	Mantispidae	Neuroptera
Wolf spider	Lycosidae	Araneae
Jumping spider	Salticidae	Araneae
Other spiders	Variable	Araneae
Big-eyed bug	Geocoridae	Hemiptera
Mirid Bug	Miridae	Hemiptera
Preying mantid	Mantidae	Dictyoptera
Ear wig	Forficulidae	Dermaptera
Lady bird beetle	Coccinellidae	Coleoptera
Tiger beetle	Carabidae	Coleoptera
Ground beetle	Carabidae	Coleoptera
Damselfly	Coenagrionidae	Odonata
Robber fly	Asilidae	Diptera
Soldier beetle	Cantharidae	Coleoptera
Long legged fly	Dolichopodidae	Diptera

C. Parasitoids

Common Name/Morphospecies	Family	Order
Tachinid fly	Tachinidae	Hymenoptera
Cotesia	Braconidae	Hymenoptera
Ichneumon wasp	Ichneumonidae	Hymenoptera
Trichogramma	Trichogrammatidae	Hymenoptera
Bee flies	Bombyliidae	Diptera

D. Pollinators

Common Name/Morphospecies	Family	Order
Honey bee	Apidae	Hymenoptera
Bumble bee	Apidae	Hymenoptera
Hover fly	Syrphidae	Diptera
House fly	Muscidae	Diptera
Swallow tailed Butterfly	Papilionidae	Lepidoptera
Blue bottle flies	Calliphoridae	Diptera
Long horn beetle	Cerambycidae	Coleoptera
Blow flies	Calliphoridae	Diptera

E. Detritivores

Common Name/Morphospecies	Family	Order
Dung beetles	Scarabaeidae	Coleoptera
Centipedes	Variable	Variable
Black soldier fly	Stratiomyidae	Diptera
Ants	Formicidae	Hymenopter
Rove beetle	Staphylinidae	Coleoptera
Carrion beetles	Silphidae	Coleoptera

Table 2 presents the overall abundance and composition of insect pests and beneficial arthropods in brinjal ecosystems under control and insecticide-treated conditions. In case of herbivores, a total of 23 morphospecies were identified under 18 families and 7 orders namely; Orthoptera, Hemiptera, Coleoptera, Diptera, Lepidoptera, Thysanoptera, and Isoptera. Under predators' functional group, there had 16 morphospecies under 12 families and 8 orders namely; Neuroptera, Araneae, Dictyoptera, Hemiptera, Diptera, Coleoptera, Dermaptera, and Odonata. Five parasitoids were identified under five families and two orders namely; Hymenoptera and Diptera. Pollinators consisted of eight morphospecies from 6 families across 4 orders namely; Hymenoptera, Diptera, Coleoptera, and Lepidoptera. Six detritivores were found in brinjal ecosystem and those were under 5 families and three orders. These results highlight the functional diversity of arthropod communities within brinjal agroecosystems and provide a basis for evaluating the ecological impact of insecticide applications.

3.3 Effects of insecticides on the abundances of arthropod pests in brinjal ecosystem

3.3.1 Sweeping net method

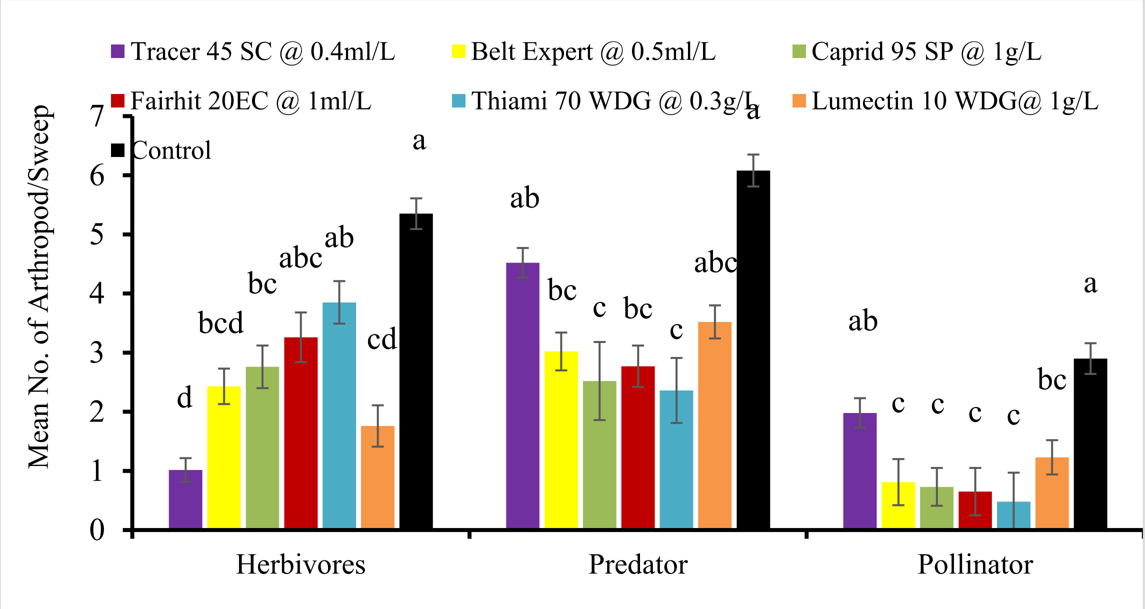

Figure 2: Abundances of arthropod fauna in brinjal eco-system collected through sweeping net under control and insecticides treated condition

Figure 2 showed the relative abundance of arthropod fauna in brinjal ecosystem when brinjal plants are treated with six selected insecticides. In case of herbivores, the most effective insecticide was Tracer 45 SC (1.01 ± 0.23/sweep) that was followed by Lumectin 10 WDG (1.76 ± 0.25/sweep), Belt Expert (2.43 ± 0.26), Caprid 95 SP (2.76 ± 0.17/sweep), Fairhit 20EC (3.26 ± 0.06/sweep) and Thiami 70 WDG (3.85 ± 0.36/sweep), with significant differences among treatments ($p < 0.01$). The highest herbivores were counted from untreated control plots (5.3 ± 0.17/sweep). In case of predator, the highest was recorded from untreated control (6.08 ± 1.46/sweep). In case of insecticides, Tracer 45 SC has provided the most safeties as maximum predators were counted from Tracer 45 SC treated plots (4.52 ± 1.23) that was followed by Lumectin 10 WDG (3.52 ± 1.03), Belt Expert (3.02 ± 1.05), Fairhit 20EC (2.77 ± 0.58), and Caprid 95 SP (2.52 ± 0.69) ($p < 0.01$). Thiami 70 WDG that is consisted of Thiamethoxam and Imidacloprid provided the most toxic effects on predators as the lowest was counted form this plots (2.36 ± 0.78). Almost similar trend was observed in case of pollinators group where most compatible insecticide was Tracer 45 SC and the most toxic was Thiami 70 WDG (Figure 2).

These results clearly indicate that Tracer 45 SC (Spinosad) effective controlled the herbivores populations in brinjal ecosystem while it was safe or less harmful for both predators and pollinators, suggesting its high compatibility along with IPM programmes. Previous studies indicate that spinosad is a selective and environmentally compatible insecticide that effectively controls target pests while conserving beneficial arthropods. As reported no significant adverse effects of spinosad on spider populations which constitute a major component of predatory fauna (Karthikeyan et al., 2008). Similarly, demonstrated that insect growth regulators such as lufenuron can be safely integrated into IPM programs without negatively affecting predatory arthropods in brinjal ecosystems (Islam and Das, 2017). In line with these findings, spinosad showed a suitable option for pest management in brinjal cultivation, offering effective pest suppression while preserving natural enemies and supporting sustainable integrated pest management strategies.

3.3.2 Pitfall trap method

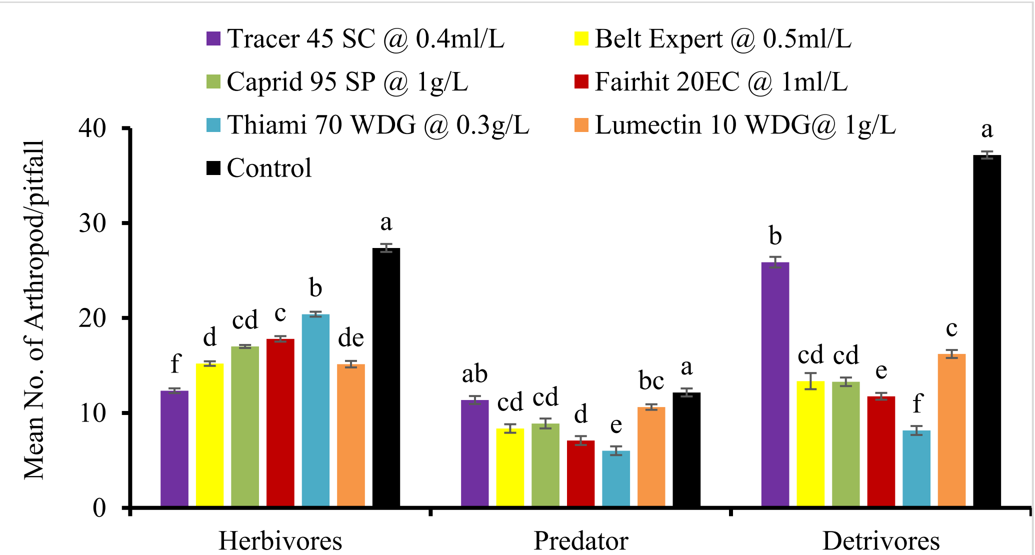

Figure 3: Abundances of arthropod fauna in brinjal eco-system collected through pitfall method under control and insecticides treated condition

Figure 3 showed the relative abundance of arthropod fauna collected through pan trap when brinjal plants were treated with six selected insecticides. The trend is more or less similar with sweeping net method. Specifically, the lowest number of herbivores were counted from Tracer 45 SC treated plots that was followed by Lumectin 10 WDG, Belt Expert, Caprid 95 SP, Fairhit 20 EC and Thiami 70 WDG respectively. The highest number of herbivores were counted form untreated control plots (27.38 ± 4.05/trap). There had a significant difference among the selected insecticides (P<0.001). Similar trend was found in case of predators where the highest was counted in case of control (12.16 ± 1.36) and lowest in Thiami 70 WDG (6.02 ± 0.67), highlighting its high toxicity to beneficials (p < 0.01). Results also showed that the highest detritivores were counted from untreated control (37.17 ± 3.45) that was followed by Tracer 45 SC, Lumectin 10 WDG and others. The most toxic was Thiami 70 WDG (8.15 ± 1.06) (P<0.01). Overall, Tracer 45 SC effectively suppressed herbivores while being comparatively less harmful to predators and detritivores, suggesting its potential as an eco-friendly option for integrated pest management.

It was reported that conventional insecticides are highly detrimental for beneficial insects and potentially threatened for ecological balance (Akter et al., 2018). Similar results were also obtained by (Mondal et al., 2023). They have demonstrated that the application of conventional insecticides for controlling sucking pests in tomato, a crop that is close to brinjal resulted in substantial reductions of beneficial arthropods, especially ladybird beetles and spiders. On the other hand, biopesticides and new generation insecticides like Spinosad, Lufenuron and Emamectin Benzoate are widely recognized for their greater selectivity and comparatively lower toxicity to non-target organisms. Their selective use allows effective suppression of key insect pests while minimizing adverse impacts on predators and other beneficial arthropods, making them suitable components of environmentally sound and sustainable IPM programs in brinjal ecosystems.

3.3.3 Yellow sticky trap method

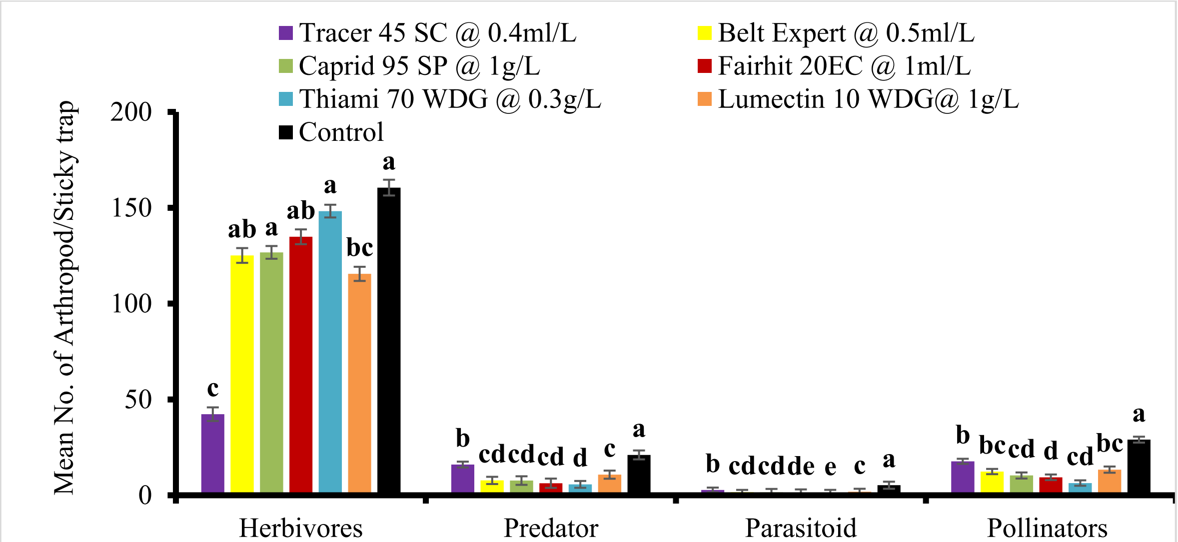

Figure 4: Abundances of arthropod fauna in brinjal eco-system collected through yellow sticky trap under control and insecticides treated condition

Figure 4 showed the relative abundance of arthropod fauna in brinjal ecosystem when collected through sticky traps under insecticides treated and control condition. The sticky trap captured mostly the herbivores and the less was pollinators and predators while very low was parasitoids. In case of herbivores, the highest was counted form untreated control (160.51 ± 3.78/trap) and the lowest was from Tracer 45 SC (42.30 ± 4.26). After control, the most effective insecticides were Thiami 70 WDG that was followed by Fairhit 20 EC, Caprid 95 SP and other respectively. In contrast, the highest beneficial insects i.e., predators, parasitoids and pollinators were recorded from Tracer 45 SC treated plots which confirms its less toxicity properties on the beneficial insects. As reported that plots without insecticide treatment supported higher arthropod diversity and abundance, highlighting the suppressive effect of chemical sprays on both pest and beneficial species (Akter et al**.**, 2018; Islam and Das, 2017; Prodhan et al., 2018).

3.4 Biodiversity and equitability of arthropod's fauna in brinjal ecosystem

The highest total abundance of different functional groups was recorded in the untreated control (3908), followed by Tracer 45 SC (2403), Lumectin 10 WDG (1801), Belt Expert (1643), Caprid 95 SP (1431), Fairhit 20 EC (1243) and Thiami 70 WDG (1174) in the brinjal ecosystem (Table 3). The control also exhibited the highest Simpson biodiversity index (0.82) followed by Tracer 45 SC (0.77), Lumectin 10 WDG at (0.74), Belt Expert at (0.69), Caprid 95 SP (0.66) and Fairhit 20 EC (0.63). In contrast, lower biodiversity index was noted for Thiami 70 WDG (0.58), indicating disruptions in biodiversity and uneven species distribution. In terms of equitability, Thiami 70 WDG recorded the highest value (0.22), followed by Fairhit 20 EC (0.20), Caprid 95 SP (0.18), Belt Expert (0.16), Lumectin 10 WDG (0.14), the lowest equitability index was shown in control plot (0.081) which in closely related with Tracer 45 SC (0.11). Lower equitability values suggest greater compatibility of arthropods with insecticides.

As documented arthropod biodiversity patterns in crop fields and reported significantly lower diversity indices under chemical insecticide treatments, whereas higher diversity was maintained under biopesticides or bacterial-fermented derivatives (Bakker et al., 2022; Rana et al., 2018; Altieri and Nicholls, 2018; Awal et al., 2015). Consistent with these findings, the present study demonstrates that Tracer 45 SC effectively suppresses herbivorous pests in brinjal while conserving beneficial arthropods. This indicates its suitability for maintaining stable and sustainable arthropod biodiversity in brinjal ecosystems.

Table 3: Biodiversity and equitability of arthropod's fauna in brinjal ecosystem

Functional group	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Herbivores	168	270	307	288	340	248	605
Predator	456	282	233	221	192	306	767
Detritivores	18	27	38	28	45	21	61
Parasitoid	1245	792	633	548	466	912	1624
Pollinators	514	270	220	158	130	312	849
Total	2403	1643	1431	1243	1174	1801	3908

Table 3 (cont): Biodiversity and equitability of arthropod's fauna in brinjal ecosystem							
Simpson biodiversity Index	0.77	0.69	0.66	0.63	0.58	0.74	0.82
Equitability	0.11	0.16	0.18	0.20	0.22	0.14	0.081

[T_1 = Tracer 45 SC (Spinosad), T_2 = Belt Expert (Flubendiamide 24% + Thiacloprid), T_3 = Caprid 95 SP (Cartap + Acetamiprid), T_4 = Fairhit 20 EC (Pyriproxyfen + Fenpropathrin), T_5 = Thiami 70 WDG (Thiamethoxam + Imidacloprid), T_6 = Lumectin 10 WDG (Lufenuron + Emamectin Benzoate) and T_7 = Control]

4. Conclusion

Generally, a large number of beneficial arthropods (parasitoids and predators) are co-existing with insect pests in brinjal ecosystem but their biodiversity is disturbed due to application of broad-spectrum toxic insecticides. Based on our current findings, Thiami 70 WDG (Thiamethoxam + Imidacloprid) @ 0.3g/L water proved the highest efficacy for controlling arthropod fauna but resulted in the lowest biodiversity index and the highest equitability. In contrast, Tracer 45 SC (Spinosad) @ 0.4 ml/L water was effective in controlling insect pests in brinjal ecosystem but less toxic and eco-friendly to the natural enemies, while also showing the highest biodiversity index and the lowest equitability. Considering that, Tracer 45 SC effectively controls pests in brinjal and is ecologically favorable, it is well-suited for inclusion in an Integrated Pest management (IPM) program. Future research should emphasize long-term field-based assessments, optimization of spray frequency and the integration of selective insecticides with biopesticides or other reduced-risk pesticides to achieve effective pest management while conserving arthropod biodiversity and ensuring sustainable brinjal production.

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Author Contribution

MRIJ: Conducted the field experiment, collected and sorted the data, performed data analysis, and prepared the draft manuscript; **GD:** Conceived and designed the experiment and finalized the manuscript; **MA:** Manuscript revision.

Conflict of Interest

The authors declare that there is no conflict of interest regarding this publication.

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