JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 8 No. 2 May 2026

DOI :https://doi.org/10.36378/juatika.v8i2.5252
eissn 2656-1727
pissn 2684-785X
pages : 408 – 412

RESEARCH ARTICLE Open Access

Diversity Insect Plant Jackfruit (*Artocarpus Heterophyllus*) on Land Orgosol, MARDI, Selangor, Malaysia

Muhammad Fachri Ansyida Ritonga[1], Wizni Fadhillah[1,*], Suhana Bt Yusuf[2]

Abstract

This study aims to identify and analyze the diversity of insect species on jackfruit (Artocarpus heterophyllus) plants in the MARDI organic farmland, Selangor, Malaysia. Data collection was conducted over 12 days, from September 23 to October 4, 2025, using two primary methods: Yellow Sticky Traps (YST) and manual capture. The data obtained included the number of individuals from various insect orders, including Hemiptera, Coleoptera, Diptera, Hymenoptera, Dictyoptera, Lepidoptera, and Orthoptera, as well as Arachnida, totaling 4,245 individuals. The results showed that the order Hymenoptera (predators) dominated with 1,589 individuals, followed by Hemiptera (600) and Diptera (beneficials) (463), while the lowest number was recorded in Orthoptera (6 individuals). The highest Shannon-Wiener diversity index (H') value was observed on day 6 (1.950), indicating a relatively balanced ecosystem, whereas the lowest value occurred on day 9 (1.597) due to the dominance of predatory Hymenoptera. The highest species richness (Margalef index) was also recorded on day 6 (2.88), indicating robust species diversity, and species similarity (Sorensen index) reached a maximum value of 1.0 on day 12, indicating the stability of the insect community. Overall, these results indicate fluctuating insect population dynamics, with a tendency toward ecosystem stability by the end of the observation period.

Keywords: DI, Insects, Monitor, Plants Fruitful, Time

1. Introduction

Insect pests are a significant cause of post-harvest losses in corn. They occur throughout the distribution chain, from the field to storage. Large insects contribute to post-harvest losses, with the extent of damage depending on the pest population, region, and agroecosystem of the planting area (Susanti et al., 2022). Although insects are often associated with causing plant damage, it is important to note that not all insects are harmful. In fact, some insects provide beneficial effects. Insects play a valuable role in agriculture as pollinators and as agents of biological control (Nasution et al., 2024)

Jackfruit is a tropical plant with high economic value in Malaysia, including the Selangor region. Besides being a source of nutritious and economically valuable fruit, this plant also provides a complex habitat for various insect species. The dense canopy structure and morphology of jackfruit leaves provide shelter and foraging areas. (Djaya et al., 2022)

Malaysian Agricultural Research and Development Institute (MARDI) in Selangor is a leading agricultural research and development center that is actively implementing organic farming systems. MARDI's organic farmland serves not only as a production site but also as a field laboratory for understanding the ecological balance and role of various organisms in natural farming systems. With minimal use of synthetic chemicals, the insect population in this area reflects the natural dynamics of insect communities in an ecosystem relatively free from anthropogenic disturbance.

Insect diversity is a key component in maintaining ecosystem balance, particularly in agricultural environments. own role is very ecological , wide and complex, encompassing functions as pollinators, decomposers, predators, and parasitoids. According to Septiadi and Mundiyah (2020), high species diversity indicates good ecosystem stability because various organisms interact and complement one another in carrying

*Correspondence: wiznifadillah@umsu.ac.id
1) Universitas Muhammadiyah Sumatera Utara - Jl. Kapten Muchtar Basri No. 3, Glugur Darat II, Kota Medan, Sumatera Utara 20238, Indonesia
2) Pest and Disease Management Programmer, Malaysian Agricultural Research and Development Institute (MARDI), 43400 Serdang, Selangor Malaysia

out their functions.

Besides their crucial role in ecosystem balance, insects also have a complex relationship with cultivated plants. Some insect species act as pests, reducing crop productivity through feeding, disease transmission, or tissue damage. However, there are also groups of insects that act as predators and parasitoids, naturally suppressing pest populations. (Haneda & Halimah, 2025) The interaction between these two groups creates unique community dynamics, where population balance is a key factor in maintaining the stability of the agricultural ecosystem. In organic farming systems, this natural balance is key because there is no synthetic pesticide intervention that could disrupt the trophic chain.

Environmental factors such as humidity, temperature, rainfall, and vegetation structure significantly influence insect diversity and abundance in an area. Organic agriculture generally has more complex microhabitats than conventional agriculture, because it supports greater plant diversity, uses natural fertilizers, and maintains healthier land. This matter allows existence more. There are many types of insects, including herbivores, predators, parasitoids, and pollinators. Therefore, studying insect diversity in organic farming systems provides a comprehensive picture of the ecological balance and potential interspecific interactions within them. (Moningka et al., 2012) .

In the jackfruit agricultural ecosystem, the presence of various insect groups, including orders Hymenoptera, Diptera, Hemiptera, and Coleoptera, is an important indicator of the plant's ecological condition. Every order has its own role, from pollination to pest control. Some of them are good indicators of environmental quality because they can only live in stable, biologically diverse ecosystems (Yanti et al., 2024). Therefore, observing the composition and fluctuations of insect populations on jackfruit plants in organic farmland can provide a deeper understanding of ecosystem stability and the effectiveness of field-applied organic farming practices.

In addition to environmental factors, agricultural management practices significantly influence the presence of insects in a given area. The use of organic fertilizers, crop rotation, and biological control methods plays a vital role in fostering a more diverse insect community. In organic farming, predatory and parasitoid insects have greater opportunities to thrive because toxic chemicals are absent, which can disrupt their life cycles. This observation contrasts with conventional farming, which often suppresses biodiversity through the use of insecticides and herbicides. Therefore, understanding insect communities within organic farming systems is essential for optimizing ecological balance and enhancing the sustainability of agricultural production. (Utari et al., 2024) .

2. Material and Methods

This study used a field survey method with a quantitative descriptive approach to analyze the diversity of insect species on jackfruit (Artocarpus heterophyllus) plants at MARDI's organic farm in Selangor, Malaysia. The study location was selected purposively because it is a well-managed organic farming area free from pesticides and synthetic chemicals. The study was conducted for 12 days, from September 23 to October 4, 2025, with insect sampling conducted at specific time intervals.

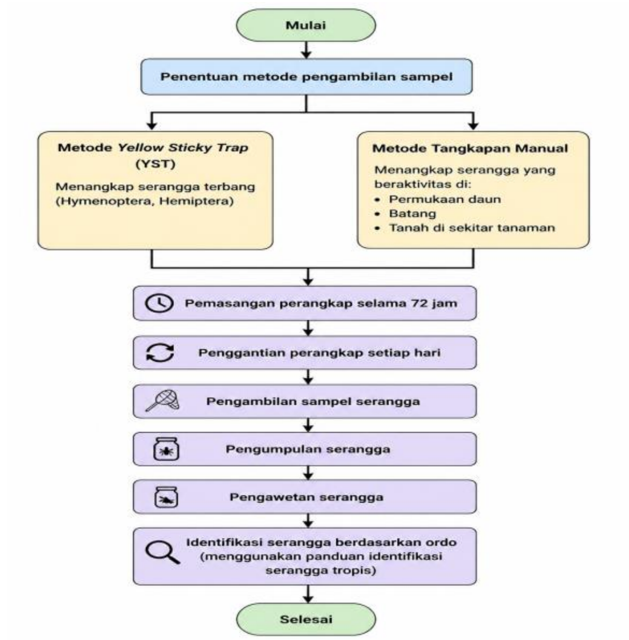

Figure 1. Research flow diagram

Data collection was carried out using two main techniques: YST (Yellow Sticky Trap) traps and manual capture (handpicking). YST traps were installed around the jackfruit canopy to capture flying insects such as Diptera, Hymenoptera, and Hemiptera, while the manual capture method was used to capture insects active on the surfaces of leaves, stems, and soil around the plant. Each trap was installed for 72 hours and replaced on each sampling day. The captured insects were then collected, preserved, and identified based on the order using a tropical insect identification guide.

The data obtained consisted of the number of individual insects per order during 12 days of observation. The identification results were then analyzed to calculate relative abundance, species richness, and diversity indices using several ecological parameters, i.e.,:

1) Shannon–Weiner Diversity Index (H') to determine the level of insect species diversity;
2) Margalef Species Richness Index (d) to measure the number of species relative to the number of individuals;
3) Sorensen Species Similarity Index (Cs) to assess community similarity between observation days.

Data analysis was conducted quantitatively and comparatively across sampling days (Day 3, Day 6, Day 9, and Day 12). Index values were then interpreted to assess levels of insect diversity, community stability, and population dynamics in the organic farming ecosystem. The results were presented in tables, graphs, and diagrams to facilitate understanding of insect presence and dominance patterns throughout the study period.

3. Results and Discussion

Table 1. Insect Abundance Based on Order and Family in Jackfruit Plants (MARDI, Selangor)

No	Order Family Species	Number of Individuals	Percentage (%)
1	Hymenoptera Formicidae Ants	600	18.1
	Apidae bees	750	22.5
	Argidae Flies	239	7.2
2	Hemiptera Aphididae Aphids	371	11.2
	Aleyrodidae whitefly	223	6.7
3	Diptera Culicidae Mosquitoes	116	3.5
	Tephritidae Fruit Flies	185	5.6
	Cylindrotomid Flies	145	4.4
4	Coleoptera Coccinellidae Beetles	455	13.6
5	Dictyoptera Blattidea Cockroach	80	2.4
9	Arachnida Araneidae Spiders	85	2.5
10	Orthoptera Acrididae Grasshoppers	6	0.3
11	Lepidoptera Gelechiidae Moths	67	2.0
	Total	**3,322**	**100**

From the table above, the Hymenoptera order is the most dominant, with 1,589 individuals (48.1%), followed by Hemiptera (17.9%) and Diptera (13.5%). Meanwhile, the order with the lowest abundance is Orthoptera (0.3%), comprising only 6 individuals. The dominance of Hymenoptera indicates the high activity of natural predators in the MARDI organic farming ecosystem, which helps control pest populations without chemical pesticides.

In a general way, pattern abundance shows that the community in the field, MARDI's organic jackfruit farming is dominated by beneficial insects, such as predators and parasitoids, which are much more numerous than pests. This finding aligns with the characteristics of organic farming systems, which provide an ideal environment for natural enemies and pollinating insects, thereby enabling a balanced ecosystem without the need for pesticides.

3.1. Comparison of Insect Abundance Between Observation Days

Observations showed variations in insect abundance across observation days, although the community remained generally dominated by beneficial insects. Weather conditions, flower and leaf availability, and the activity of natural predators can influence day-to-day differences in insect abundance.

Table 1 Average Abundance of Insects Based on Orderly Observation Every Day Observation

Insect Order	Day 1	Day 2	Day 3	Day 4	Average
Hymenoptera	45	50	48	52	48,75
Diptera	20	22	18	25	21,25
Coleoptera	8	6	7	9	7,5
Lepidoptera	5	4	6	5	5
Hemiptera	3	5	4	4	4
Others	2	3	3	2	2.5
Total	83	90	86	97	89.0

Hymenoptera remained dominant on all observation days, demonstrating the important role of predators and parasitoids in natural pest control. The abundance of Diptera was also quite significant, supporting pollination activities and ecosystem balance.

Pest insects (Coleoptera, Lepidoptera, Hemiptera) remained, but their numbers were much lower than those of beneficial insects, indicating that the organic system was effective in maintaining balance. Inter-day variations were not extreme, indicating relatively stable ecological conditions on MARDI's organic farmland.

3.2. Species Diversity, Richness, and Similarity Index

The results of the index analysis provide an overview of the insect community structure, species variation, and the level of similarity between observation days. The indices used include the Shannon-Wiener Index (H') for diversity, the Margalef Index (R) for species richness, and the Jaccard (Cj) for similarity of species between days.

Table 2. Results Index Diversity And Riches Species

Day Observation	Number of Species (S)	Number of Individuals (N)	Shannon-Wiener Index (H')	Margalef Index (R)
Day 1	12	83	2.15	3.35
Day 2	13	90	2.28	3.54
Hari 3	12	86	2,19	3,37
Hari 4	14	97	2.35	3,62
Average	12.75	89	2,24	3,47

An H' value > 2 indicates that the insect community has a fairly high diversity, with the dominance of beneficial insects maintained. A Margalef Index (R) > 3 indicates a fairly high species richness, meaning that organic land supports the existence of various insect species. Relatively stable diversity between days indicates a balanced ecosystem with minimal external disturbances.

Table 3. Similarities Species Interday (Index Jaccard)

Day compared to	Jaccard Index (Cj)
Day 1 vs Day 2	0.78
Day 1 vs Day 3	0.75
Day 1 vs Day 4	0.70
Day 2 vs Day 3	0.80
Day 2 vs Day 4	0.76
Day 3 vs Day 4	0.77

A Cj value > 0.7 indicates that the similarity of species between days is relatively high. This indicates that the insect community structure is stable and there are no major fluctuations in species composition.

The research results show that the insect community on MARDI's organic farmland has a balanced structure, high diversity, and good ecological stability. Overall, beneficial insects such as predators, parasitoids, and pollinators dominate the population, while insect pests remain present but in relatively low numbers. This condition aligns with the characteristics of organic farming systems, which provide ideal habitats for natural enemies of insect pests and, at the same time, support increased pollination and plant productivity.

Analysis of insect abundance. Interday observations revealed minor dynamics, particularly in Diptera and certain pest groups. However, Hymenoptera, as a predator-parasitoid group, remained dominant, indicating that community stability was maintained. This result is reinforced by high interday Jaccard Index values (>0.7), indicating relatively high species similarity and a sustainable community structure. These minor fluctuations are a natural indication of insect adaptation to environmental factors such as weather, food availability, and interspecific interactions.

The results for the diversity index (Shannon-Wiener) and species richness (Margalef) showed high values, indicating that MARDI's organic farmland can sustainably support a diverse array of insect species. This diversity is important because it increases ecosystem resilience, ensuring stability despite short-term changes in environmental conditions.

In terms of ecological roles, beneficial insects function as natural pest controllers and plant pollinators, while pest insects remain present as part of the natural interactions that maintain the balance of the food web. This interaction reflects the classical ecological principle that species diversity enhances ecosystem stability and function. Organic farming systems effectively facilitate this natural interaction by providing a hospitable habitat. And safe from pesticides.

Figure 2. Several Types of Successfully Caught Insects

4. Conclusion

Insect community on MARDI's organic farmland has high diversity, a balanced population, and good ecosystem stability. Beneficials such as predators, parasitoids, and pollinators dominate, while pests remain at low levels, indicating a balance that does not depend on chemical pesticides. Fluctuation in population between days is relatively small, and the Mark Index and Jaccard Index show a stable community structure, as well as strong ecological resilience. This result confirms that organic system agriculture not only protects plant productivity but also supports natural pest control, a sustainable ecosystem, and biodiversity preservation.

Acknowledgments

The authors would like to thank the University of Muhammadiyah North Sumatra and MITRA Malaysian Agricultural Research and Development Institute (MARDI) Malaysia for their support in terms of program facilities and infrastructure, which greatly assisted the success of this research, and to our friends who have helped in the process and implementation of this research.

References

Bahri, S. (2019). Ekstraksi kulit batang nangka menggunakan air untuk pewarna alami tekstil. *Jurnal Teknologi Kimia Unimal*, 2(November), 73–88.

Djaya, L., Anastasya, J. O., & Sianipar, M. S. (2022). Keragaman predator dan parasitoid serangga hama tanaman ciplukan (*Physalis peruviana* L.) fase generatif di Desa Kadakajaya. *Jurnal Agrikultura*, 33(2), 115–125.

Haneda, N. F., & Halimah, W. N. (2025). Perbandingan dua metode perangkap serangga (the differences between two methods of soil fauna trap in Dramaga). *Jurnal Silvikultur Tropika*, 16(1), 20–27.

Moningka, M., Tarore, D., & Krisen, J. (2012). Diversity of natural enemies species on wet rice-field insect pests. *Eugenia*, 18(2).

Nasution, M. F. H., Hashim, N. A., Tarigan, D. M., & Susanti, R. (2024). Keragaman jenis serangga pada areal permakultur di Bukit Kor, Terengganu, Malaysia. *Jurnal Agroplasma*, 11(1), 175–181.

Septiadi, D., & Mundiyah, A. I. (2020). Strategi pengembangan usaha tani sayuran berbasis pertanian organik. *AGRIFO*, 5(1).

Susanti, R., Fadillah, W., & Puspita, R. (2022). Aplikasi suhu terhadap mortalitas hama *Sitophilus zeamais* dan *Tribolium castaneum* pada jagung. *Agrotechnology Research Journal*, 6(1), 16–20. https://doi.org/10.20961/agrotechresj.v6i1.55423

Utari, A., Maharani, Y., & Sudarjat. (2024). Keanekaragaman serangga dan fungsinya pada tiga tipe perkebunan kopi arabika (*Coffea arabica* L.) di Kecamatan Pangalengan, Kabupaten Bandung. *Jurnal Agrikultura*, 35(3), 494–505.

Yanti, O., Yudiawati, E., & Setiono. (2024). Keanekaragaman serangga pada tanaman padi sawah (*Oryza sativa* L.) di Kecamatan Pangkalan Jambu Kabupaten Merangin. *Jurnal Sains Agro*, 9(2).