



## Insect Diversity in Organic Rice Field Areas in Sumberjambe

(Keanekaragaman Serangga pada Area Sawah Organik di Sumberjambe)

Ahmad Rusdy Awalludin, Ika Priantari\*, Indah Rachmawati Afrida

Biology Education Study Program, Faculty of Teacher Training and Education, Muhammadiyah University of Jember

\*Corresponding author: [ikapriantari@unmuhjember.ac.id](mailto:ikapriantari@unmuhjember.ac.id)

### Abstrak

Penelitian ini bertujuan untuk menganalisis keanekaragaman serangga di sawah organik yang ditanami varietas padi putih dan hitam. Perangkap kuning digunakan untuk menangkap serangga, dengan enam perangkap ditempatkan di setiap sawah. Perangkap terdiri dari mangkuk kuning berdiameter 12 cm yang diisi larutan alkohol 70% dan sabun, dipasang pada tongkat bambu sepanjang 30 cm dan direkatkan menggunakan selotip dua sisi. Pengambilan sampel dilakukan selama sembilan minggu pada tiga interval (minggu ke-3, ke-6, dan ke-9), dengan tiga replikasi setiap minggu. Serangga yang terkumpul diambil dengan hati-hati menggunakan kuas, diawetkan dalam botol berisi larutan alkohol 70%, dan diberi label untuk identifikasi plot. Pada minggu pertama, serangga di sawah padi putih meliputi famili Asilidae, Tachinidae, Chrysomelidae, Syrphidae, dan Tipulidae, sedangkan di sawah padi hitam ditemukan Asilidae, Tachinidae, Sphecidae, Ichneumonidae, Chrysomelidae, dan Coccinellidae. Pada minggu kedua, sawah padi putih mengandung famili Tachinidae, Asilidae, Sphecidae, Chrysomelidae, dan Hesperidae, sedangkan sawah padi hitam ditemukan famili Tachinidae, Hesperidae, Ichneumonidae, dan Chrysomelidae. Pada minggu ketiga, sawah padi putih ditemukan famili Tachinidae, Ichneumonidae, Hesperidae, Sphecidae, Coccinellidae, dan Chrysomelidae, sedangkan di sawah padi hitam ditemukan famili Tachinidae, Halictidae, dan Sphecidae.

Kata kunci: Keanekaragaman serangga, Sawah organik, Yellow paint trap

### Abstract

*This study aimed to analyze insect diversity in organic rice fields planted with white and black rice varieties. Yellow pan traps were used to collect insects, with six traps placed in each field. The traps, consisting of 12 cm yellow bowls filled with a 70% alcohol-soap solution, were mounted on 30 cm bamboo sticks and secured with double-sided tape. Sampling was conducted over nine weeks at three intervals (weeks 3, 6, and 9), with three replicates per week. Collected insects were carefully removed using a brush, preserved in bottles containing 70% alcohol, and labeled for plot identification. In the first week, insects in white rice fields included Asilidae, Tachinidae, Chrysomelidae, Syrphidae, and Tipulidae, while black rice fields contained Asilidae, Tachinidae, Sphecidae, Ichneumonidae, Chrysomelidae, and Coccinellidae. By the second week, white rice fields had Tachinidae, Asilidae, Sphecidae, Chrysomelidae, and Hesperidae, while black rice fields had Tachinidae, Hesperidae, Ichneumonidae, and Chrysomelidae. In the third week, white rice fields hosted Tachinidae, Ichneumonidae, Hesperidae, Sphecidae, Coccinellidae, and Chrysomelidae, whereas black rice fields included Tachinidae, Halictidae, and Sphecidae.*

*Keywords: Insect diversity, Organic rice fields, Yellow paint trap*

## INTRODUCTION

Insects are the most dominant species among other animals. As one of the biodiversity components, insects play many important roles in the food web, serving as herbivores, carnivores, and detritivores according to Strong et al.[1]. Besides these important roles, some insects can also act as bioindicators, and they are increasingly being studied because these insects can be used as indicators or markers of whether an ecosystem is polluted or not [2].

Not all insects can positively impact the surrounding environment. Some insects can be detrimental to an environment as plant pests (OPT). Plant pests are commonly found in tropical regions due to the tropical climate that supports their development. A type of insect that is a pest to plants, especially in rice-growing areas, is the planthopper. These insects belong to the order Hemiptera, such as *Nezara viridula*, *Leptocorisa* sp., and *Paraecosmetus* sp. They damage rice plants by sucking the sap from young rice grains, as stated by Moningka [3] [4].

Based on the research by [5], several pest insect species that attack rice fields have been identified, including the Black Ant (*Dolichoderus thoracicus* Smith). The attack of black ants occurs once the rice grains have emerged. The rice grains eaten by these ants turn yellowish-black, while the rice stems dry out and die. The Squash Bug (*Anasa tristis*) targets rice to sustain its life, causing the rice plants to dry out and eventually die. The Green Stink Bug (*Nezara viridula*) typically does not cause significant damage in normal agroecosystem management, but due to their specific place in the food chain, they have the potential to become harmful pests under certain ecosystem management by humans. The Rice Bug (*Leptocorisa acuta*) damages rice during the milky stage by sucking the grains, making them hollow. This pest is a primary or key pest that is almost

always present in every rice field. The Grasshopper (*Dissosteira carolina*) damages rice by eating the leaves, and this pest typically appears continuously from the start of planting until the harvest season. Lastly, the Beetle (*Oulema melanopus*) is small in size and generally does not pose a significant threat to agriculture because the amount of leaf they consume is minimal. However, if their population becomes uncontrollable, these beetles could potentially cause substantial damage [6].

## METHODS

This research was conducted in Sumber Jambe subdistrict, Jember Regency, from May to June 2024. The materials used in this study included soapy water and 70% alcohol. The tools used in the research were bamboo, yellow bowls, double-sided tape as an adhesive, a small brush, and plywood.

This study employed a qualitative method by conducting a survey of the location to be used as the research site, interviewing the owners of organic rice fields, and setting up traps in predetermined areas of the rice fields. The type of trap used was a yellow paint trap, and the traps were set up six times in a single rice field plot. Insect sampling was conducted once a day, with samples collected three times a week over a period of three weeks. To determine the relative frequency of which insects frequently visit the rice fields, the relative frequency (FR) formula was used as an indicator of the distribution of these insects.

$$FR = \frac{FM}{\sum FM} \times 100\%$$

$$FR = \frac{FM \text{ of each type per capture}}{FM \text{ of all types per capture}} \times 100\%$$

where

FR : Relative Frequency

FM : Absolute Frequency

To determine the diversity within organic rice fields, the insect diversity index is used to identify which insects are most dominant in a rice field using the following formula:

$$H' = - \sum P_i (\ln P_i)$$

where :

H' : Shannon-Wiener Diversity Index

P<sub>i</sub> : n<sub>i</sub>/N

n<sub>i</sub> : Number of individuals of species i

N : Total number of individuals

The value of H' ranges between:

< 1,5 : Low diversity

1,5-3,5 : Moderate diversity

> 3,5 : High diversity

To determine the importance of diversity within a rice field, the Importance Value Index (IVI) is used to identify which insect is the most dominant, using the following formula:

$$INP = FR + KR + DR$$

where :

INP : Importance Value Index

FR : Relative Frequency

KR : Relative Density

DR : Relative Dominance

## RESULT AND DISCUSSION

The diversity index, dominance, and evenness of the insect found in the rice field are presented in Table 1.

Table 1. Calculation Results of Insect Diversity Each Week

Location	Week	H'	D	E
PP	1	0.972471	0.425324675	0.60423
PH	1	1.341928	0.310169492	0.748944
PP	2	1.133881	0.407936508	0.70452
PH	2	0.507406	0.736172081	0.461861
PP	3	0.579401	0.75943233	0.323369841
PH	3	0.187765	0.92530828	0.170910949

PP (White Rice), PH (Black Rice), H'(Shannon-Wiener), D (Simpson's Dominance Index), E (Evenness)

Based on Table 1, the calculation results of diversity in white rice and black rice fields show that the diversity index for white rice is (H'=0.97). This indicates a low diversity in white rice in the first week. In contrast, black rice in the first week has a higher insect diversity compared to white rice, with a diversity index of (H'=1.34). This suggests that the diversity in black rice is still considered low and shows that the same

families can be found in almost all sampling points. Additionally, some families are likely dominating others, causing an imbalance in the ecosystem [7] [8].

For the diversity in white rice during the second week, the diversity index is (H'=1.13), which also indicates that the diversity in white rice is still considered low. Meanwhile, black rice has a lower value

compared to white rice, with a diversity index of ( $H'=0.50$ ), indicating that the diversity in black rice is very low compared to white rice. In the third week, the results for white rice show a diversity index of ( $H'=0.57$ ), which indicates that insect diversity in white rice is low. For black rice, the result is ( $H'=0.18$ ), indicating a very low diversity index in black rice, and the diversity in black rice in the third week is lower compared to white rice.

For the dominance index in white rice in the first week, the index is ( $D=0.42$ ). This means there is partial dominance by one or a few families found. In contrast, black rice has a lower dominance index than white rice, with an index of ( $D=0.31$ ), indicating that there is partial dominance by one or a few families found. In the second week, the dominance index in white rice is ( $D=0.40$ ), indicating a low dominance of insects in the white rice area, with one species dominating in the white rice area. In contrast, black rice shows a higher dominance than white rice, with a dominance index of ( $D=0.73$ ), but this is still considered low, and there is one insect family that dominates in the black rice area in the second week.

In the third week, the dominance result for white rice is ( $D=0.75$ ), indicating that one insect family dominates and that the dominance in white rice is still considered low. In black rice during the third week, the

dominance index is higher than in white rice, with an index of ( $D=0.92$ ). This indicates a relatively high dominance in black rice, meaning there is holistic dominance by one family found.

Regarding the evenness index, the result for white rice in the first week is ( $E=0.60$ ), meaning that nearly all insects can be found in almost every sampling location used. For black rice, the evenness result is ( $E=0.74$ ), indicating a medium evenness where almost all insects can be found in each sampling location.

In the third week, the evenness index result for white rice is ( $E=0.70$ ), indicating a medium level of evenness where nearly every insect can be found at all sampling locations used. For black rice in the second week, the evenness result is ( $E=0.46$ ), showing low evenness, meaning each insect can only be found in some sampling locations.

In the third week, the evenness index result for white rice is ( $E=0.32$ ), indicating low evenness or that each insect found can only be found at some sampling locations. For black rice in the third week, the result is ( $E=0.17$ ), indicating low evenness, meaning each insect species found can only be found at a few sampling locations, not evenly distributed across all sampling locations [1].

Table 2. Families with IVI Values at Each Rice Field Location

<b>Famili</b>	<b>White Rice</b>	<b>Black Rice</b>
Tachinidae	-	162.8499
Asilidae	87.5	-
Hesperidae	35.29412	-
Sphecidae	26.38889	-
Halictidae	-	23.74894

Ichneumonidae	18.16239	-
Chrysomelidae	18.05556	18.05556
Coccinellidae	-	15
Syrphidae	14.28571	-
Tipulidae	14.28571	-

Based on the research results on organic rice fields using yellow paint traps, a total of 10 families of insects were found: Tachinidae, Asilidae, Hesperidae, Sphecidae, Halictidae, Ichneumonidae, Chrysomelidae, Coccinellidae, Syrphidae, and Tipulidae. The IVI obtained from this study shows that the White Rice Planting area is dominated by Asilidae with an IVI of 87.5 (see Table 2). Asilidae are Diptera with long, slender mouths and an indentation between the eyes (see Figure 1). Adult flies are predators and mimic bees with their hairy bodies and bearded faces. Their larvae live in soil and decaying wood, feeding on the larvae of other insects. Asilidae are predatory flies that prefer open and sunny places with abundant vegetation and food sources. Rice fields provide an ideal habitat for Asilidae flies due to the abundance of food sources, leading to an increase in their population. These flies are predators of pest insects, thus helping in pest control within the rice field ecosystem. [9] [10].

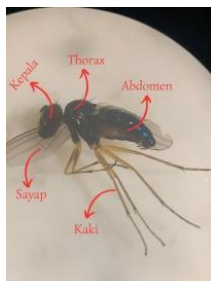


Figure 1. Family Asilidae

In the organic rice field with black rice, the IVI results show that Tachinidae flies are the

dominant family, with an IVI of 162 (see Table 2). Tachinidae are the second-largest family in the order Diptera and are characterized by a distinct post-scutellum, aristate antennae with single hairs, and abdomens often covered with bristles. Tachinidae flies typically lay their eggs on the host's body. During the larval stage, they consume the internal organs of their host. Tachinidae are parasitoid flies that live by feeding on their hosts (see Figure 2). These flies are commonly found in organic rice fields, particularly in black rice areas, due to the field conditions that suit their breeding habitat. The moist, warm environment and abundant food sources in the rice field support Tachinidae's development. Additionally, the presence of numerous pests in the rice fields provides opportunities for Tachinidae flies to lay their eggs on pest insects. When the eggs hatch, the larvae feed on the host from within, thereby aiding in pest control [11].

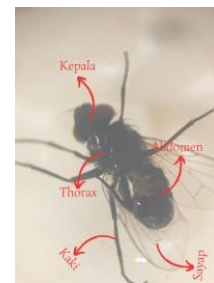


Figure 2. Family Tachinidae

The next family found is Hesperidae, which belongs to the order Lepidoptera, with an IVI of 35.2 (see Table 2). This family consists of small to medium-sized butterflies with

orange or brown wings and a stout body. Their antennae are characterized by tips that are bent or curved. Their heads are relatively wide, with eyes and antennae spaced quite apart. Many species rest with their forewings and hindwings spread at different angles [12].

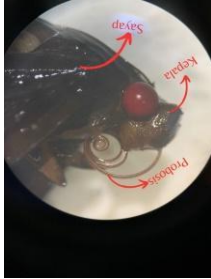


Figure 3. Family Hesperidae

The family Sphecidae, which belongs to the order Hymenoptera, has an IVI of 26.3 (see Table 2). This family can be recognized by its short pronotum and nearly hairless body. Another characteristic of this family is the presence of lobes on the lateral edges of the pronotum that do not touch the tegula. The larvae are parasitic, while the adults are insectivorous [13].

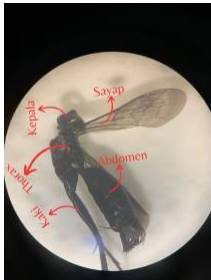


Figure 4. Family Sphecidae

The family Halictidae, which belongs to the order Hymenoptera, has an IVI of 23.7 (see Table 2). This family, known as sweat bees, can have various colors, but they are most commonly and prominently metallic. They are unique insects with a curved basal vein and two or three submarginal cells on the forewings. They are solitary and nest in the ground, feeding on pollen [14].

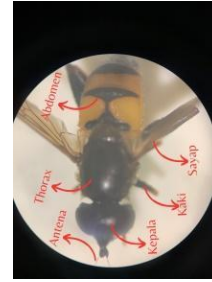


Figure 5. Famili Halictidae

The Family Ichneumonidae, which belongs to the order Hymenoptera, has an IVI of 18.1 (see Table 2). This family is one of the most commonly found in the order Hymenoptera and has many unique characteristics that make it stand out. Each forewing lacks a costa cell but has a horse-head-shaped cell in the middle of the wing. The antennae are very long, with 16 segments or more. Commonly known as slender wasps, the females have a long ovipositor that is often longer than their body. In addition to these features, Ichneumon wasps also have a two-segmented trochanter, which aids in identification. Many species in this family are internal parasitoids during the immature stages of their hosts, where they complete their development.



Figure 6. Family Ichneumonidae

The Family Chrysomelidae, which belongs to the order Coleoptera, has an IVI of 18.0 (see Table 2). The most distinctive feature of these beetles is their tarsi with 4 segments, with the third tarsal segment being notched at its junction with the fourth segment. These beetles are phytophagous but can also act as leaf miners or feed on roots. Some species are pests, feeding on, laying eggs, or

living within the galleries formed in trees [15].



Figure 7. Famili Chrysomelidae

The family Coccinellidae, which belongs to the order Coleoptera, has an IVI of 15 (see Table 2). Adult beetles are oval in shape and brightly colored. They appear to have three tarsal segments but actually have four, with the third segment being small and bead-like, embedded within the second segment. The larvae are flattened and covered in spines. Both larvae and adults feed on aphids [16].

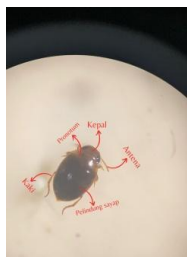


Figure 8. Family Coccinellidae

The Family Syrphidae, which belongs to the order Diptera, has an IVI of 14.2 (see Table 2). Hoverflies mimic the appearance of bees and wasps to reduce the likelihood of being preyed upon. They have false veins on their wings that split the radio-medial cross vein (these are actually just wing thickenings, not true veins). Their larvae are predators of aphids or live in decaying vegetation [17].



Figure 9. Family Syrphidae

The last family, Tipulidae, is one of the families within the order Diptera, with an IVI of 14.2 (see Table 2). With over 1,450 species, crane flies are the largest family in the order Diptera. They have long and fragile legs, prominent halteres, and a V-shaped suture dividing the dorsal side of the thorax. They are unique within this order due to their two anal veins reaching the wing margins and a radius with fewer than five branches. These insects are commonly found in damp areas or places with dense vegetation.

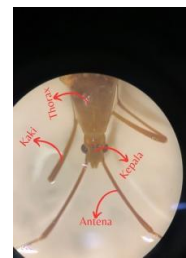


Figure 10. Family Tipulidae

## CONCLUSION

The types of insects found at the research location in an organic rice area with both white and black rice varieties, located in the Sumberjambe Subdistrict, showed the following results: In white rice, insect diversity values ranged with a diversity index ( $H'0.97-0.57$ ), dominated by the insect family Asilidae with an Importance Value Index (INP87.5). In contrast, in black rice, the diversity results showed a diversity index ( $H'1.34-0.18$ ), where the insect family Tachinidae dominated, with an (INP=162). The results indicate that black rice has a higher diversity index, with values ranging from ( $H' 1.34-0.18$ ).

## ACKNOWLEDGMENTS

Our gratitude goes to Allah SWT, the Almighty God, for giving His grace and guidance, we expressed our deepest

gratitude for all the efforts, guidance, and direction of various parties: Mr. Rohiqi, as the owner of the organic rice field, and Mr. Agung Sih Kurnianto, S.Si, M. Ling, who has been pleased to provide direction, input, take the time, support, and knowledge in the completion of this research.

### CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

### REFERENCES

- [1] A. Rizali, D. Buchori, and H. Triwidodo, "Keanekaragaman Serangga pada Lahan Persawahan-Tepian Hutan: Indikator untuk Kesehatan Lingkungan Insect Diversity at the Forest Margin-Rice Field Interface: Indicator for a Healthy Ecosystem," vol. 9, no. 2, pp. 41-48, 2002.
- [2] D. Elisabeth, J. W. Hidayat, and U. Tarwotjo, "Kelimpahan dan Keanekaragaman Serangga pada Sawah Organik dan Konvensional di Sekitar Rawa Pening," *J. Akad. Biol.*, vol. 10, no. 1, pp. 17-23, 2021.
- [3] A. R. Ervianna, M. Hadi, and R. Rahadian, "Kelimpahan Dan Keragaman Serangga OPT (Organisme Pengganggu Tanaman) dan Musuh Alaminya pada Tanaman Jagung dan Padi dengan Sistem Rotasi Tanaman," *Bioma Berk. Ilm. Biol.*, vol. 22, no. 1, pp. 59-69, 2020, doi: 10.14710/bioma.22.1.59-69.
- [4] A. Komarudin, Asrori, F. N. Hikmah, K. Sadiyah, and M. T. Muhabri, "Eco Enzyme: Upaya Pemanfaatan Limbah Rumah Tangga Untuk Kesehatan Masyarakat Desa Pecangakan," *Profetik J. Pengabd. Masy.*, vol. 1, no. 01, pp. 16-30, 2023, doi: 10.62490/profetik.v1i01.341.
- [5] M. Sarumaha, "Identifikasi serangga hama pada tanaman budidaya Holtikultura di desa bawolowalani," *J. Educ. Dev.*, vol. 8, no. 3, pp. 86-91, 2020.
- [6] A. RAHMAN, T. PAKKI, N. I. ULFA, and L. O. HUTTNI, "PENGARUH WARNA BUNGA TANAMAN KENIKIR TERHADAP KEANEKARAGAMAN SERANGGA PADA TANAMAN CABAI (*Capsicum Annum L.*)," *J. Agroteknos*, vol. 12, no. 1, 2022, doi: 10.56189/ja.v12i1.24612.
- [7] Hasbiadi, "1\*, 1 1," vol. 33, no. 3, pp. 1026-1039, 2023.
- [8] H. Purnomo and M. D. Parawangsa, "Keragaman Serangga Hama dan Musuh Alami Lahan Pertanian Padi Organik (*Oryza Sativa L*) Desa Rowosari Kecamatan Sumberjambe Kabupaten Jember," *Berk. Ilm. Pertan.*, vol. 6, no. 4, p. 170, 2023, doi: 10.19184/bip.v6i4.39180.
- [9] D. Suryadi *et al.*, "Model Manajemen Terpadu Pertanian Hortikultura Organik pada Lahan Sempit," *Proceeding Biol. Educ. Conf.*, vol. 14, pp. 118-125, 2017.
- [10] A. H. Thaha *et al.*, "Identifikasi keanekaragaman lalat pada peternakan unggas pedaging (Studi kasus: Teaching farm UIN Alauddin Makassar)," *Pros. Semin. Nas. Biol.*, vol. 7, no. 1, pp. 406-409, 2021, [Online]. Available: <https://journal3.uin-alauddin.ac.id/index.php/psb/article/view/24729>
- [11] K. Hymenoptera *et al.*, "WHICH OVERLOADED WITH RED CHILLI IN

- THE VEGETATIVE AND," vol. 14, no. 1, pp. 23-34, 2024.
- [12] N. L. M. D. Dasi, T. I. Ratna, and D. A. P. L. Sari, "Troides Psyche," *J. Fash. Des.*, vol. 2, no. 2, pp. 124-136, 2022, [Online]. Available: <https://jurnal2.isi-dps.ac.id/index.php/bhumidevi/article/view/1782/596>
- [13] S. Supriyadi, R. Wijayanti, R. B. Arniputri, and F. N. Azizin, "KOMUNIKASI SINGKAT Serangga pengunjung bunga tumbuhan liar dan potensinya untuk mendukung penyerbukan jambu mete ( *Anacardium occidentale* L ) Flower-insect visitors on wild plants and its potential to enhance pollination on cashew ( *Anacardium occidentale*," vol. 20, no. 3, pp. 269-274, 2023.
- [14] B. H. Pondaag, R. W. Tairas, and D. Kandowanko, "Serangga-Serangga Yang Berasosiasi Pada Tanaman Tomat(*Lycopersicum Esculentum* Mill.) Di Kelurahan Kamasi Kota Tomohon," *Cocos*, vol. 4, pp. 1-16, 2021.
- [15] M. L. Ilhamdi and M. Syazali, "Species Richness of Arboreal Beetle in Suranadi Nature Park Area and Its Potential as a Source of Science Learning in Elementary Schools," *J. Biol. Trop.*, vol. 22, no. 1, pp. 70-80, 2021, doi: 10.29303/jbt.v22i1.3225.
- [16] F. Rahmadan, R. Y. Wardi, and E. Sohriati, "IDENTIFIKASI KEANEKARAGAMAN JENIS SERANGGA YANG BERPOTENSI HAMA PADA TANAMAN JAGUNG (*Zea mays* L.) DI DESA BANGUN JAYA KECAMATAN TOMONI KABUPATEN LUWU TIMUR," *J. Biol. Sci.*, vol. 5, no. 2, pp. 1-7, 2023.
- [17] R. Koneri, M. D. Langoy, M. J. Nangoy, and Wakhid, "Pollinator insects in the Mount Tumpa Forest Park, Manado, North Sulawesi, Indonesia," *Biodiversitas*, vol. 25, no. 6, pp. 2415-2426, 2024, doi: 10.13057/biodiv/d250610.

*This page is intentionally left blank*