

Diversity and role of insects on vegetation around sugar palm (*Arenga pinnata*) plants in Tanjung Miring Village, Muara Enim Regency

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ABSTRACT

Arenga pinnata (sugar palm) was a crop of high ecological, economic, and social in South Sumatra, particularly in Muara Enim Regency. Despite its importance, limited scientific information regarding the diversity and ecological functions of insect communities associated with this species. This study aimed to identify and classify insect taxa specifically decomposers, phytophagous, pollinators, and natural enemies found in and around sugar palm stands in Tanjung Miring Village. Field observations were conducted using purposive sampling, and insect specimens were collected through four established methods: yellow sticky traps, pitfall traps, sweep nets, and manual hand collection. A total of 850 insect individuals were recorded, with the greatest abundance observed on trees possessing trunk diameters between 31–40 cm. Hymenoptera was the most frequently encountered order, with *Monomorium minimum* identified as the most dominant species. Among the collection methods, yellow sticky traps yielded the highest number of individuals. Biodiversity analysis revealed a Shannon-Wiener index (H') of 2.47, indicating moderate diversity. The evenness index (E) was 0.73, suggesting relatively low species distribution uniformity, while the dominance index (D) was 0.13, implying the absence of a single dominant species within the community. Statistical analysis using NCSS software demonstrated a significant effect of trap type on insect abundance, but no significant differences were found based on insect order, tree diameter, or observation period. These findings underscore the ecological importance of insect diversity in sugar palm ecosystems, as various functional groups such as pollinators, herbivores, and decomposers play vital roles in supporting the growth, productivity, and sustainability.

Keywords: diversity, insects, species, sugar palm, trap

INTRODUCTION

Sugar palm trees have become one of the potential natural resources in the Muara Enim region. One of them was found in Tanjung Miring Village. Sugar palm can grow in the tropics (Asyraf et al., 2022). This plant was able to thrive in various types of soil. Sugar palm has the ability to adapt both lowlands and highlands, up to 1,400 meters above sea level (Imraan et al., 2023). This plant could grow in various locations without requiring special care (Kenny & Jacob, 2021). In addition, sugar palm can adapt well to various environmental conditions (Krissetya et al., 2021). In Southeast Asian regions such as

Indonesia, Malaysia, and Thailand, sugar palms were commonly found around rivers or rural areas (Mujetahid et al., 2023) was included in the category of palm trees and was spread almost throughout Indonesia (Liputo et al., 2022).

The population of sugar palm trees continues to decline due to the large number of old plants that have lost their productivity. However, efforts to rejuvenate sugar palm trees have not been maximized (Simamora et al., 2021). Sugar palm was now in great demand because it was able to produce various products with high economic value (Egwutvongsa, 2021). Based on various studies conducted in Malaysia, the presence of palm trees has been proven to increase soil

fertility. This was due to its ability to improve soil structure (Muda et al., 2024). All parts of the sugar palm trees, from the roots, stems, leaves, to the fruit, have the potential to be utilized for various needs (Haryono et al., 2021). Sugar palm has various benefits, building materials, and conservation plants that play a role in critical land rehabilitation (Muda et al., 2024).

Many studies have shown that one of the factors affecting the growth of sugar palm was the presence of insects (Herlin et al., 2024). In every type of plant, including sugar palm, there were always insects. Insects were a group of animals with the highest species diversity in the world, with millions of species distributed and living in almost all types of habitats, both on land and in water (Kumar, 2024). In addition, insects also have an important role in the agricultural sector, including helping the pollination process, controlling pests, and increasing soil fertility through the decomposition process (Jankielsohn, 2023).

Based on research (Herlin et al., 2024), insects such as *Vespa affinis*, *Ypthima baldus* and *Apis cerana* act as pollinators. However, some studies only mention the presence of insects, not many have categorized insects based on their role. Similar research conducted by (Akbar et al., 2025) found that the main challenge in the development of sugar palm cultivation was the lack of public interest in optimally utilizing this plant. One of the reasons was the limited information on insects associated with sugar palm that was still very minimal, especially in Muara Enim Regency.

Until now, only a few studies have identified the diversity and ecological roles of insects found on sugar palm plants in this region. In this study, we focused on identifying different types of insects such as pollinators, phytophages, decomposers, and natural enemies and determining the most abundant species by using different types of insect traps. This was in accordance with the research objective to support more effective and sustainable management of sugar palm trees by recognizing the insects present in the palm trees and the role of insects. The purpose of this study was to increase understanding of what insects are present in palm trees and the role of insects living in sugar palm trees.

MATERIALS AND METHODS

Determination of Sample Tree

Sample trees were selected using purposive sampling method (Wardani et al., 2020), focusing on sugar palms that had already borne fruit and were in the flowering stage. Each selected tree was equipped with two types of traps—pitfall traps and yellow sticky traps—with four of each installed. Yellow sticky traps were used to monitor flying insects in the canopy, while pitfall traps targeted insects on the soil surface. Additionally, flying insects were collected using a sweep net, and hand-picking was employed to capture insects directly from the plants for easier collection.

Trap Installation

The traps used were pitfall traps and yellow sticky traps. Traps were set for 1 x 24 hours (Indriati et al., 2022). Pitfall traps were placed for insects on the ground, while yellow sticky traps on insects that were actively flying (Zulkifli et al., 2024). Each sugar palm tree sample was installed as many as 4 traps. In addition to using pitfall traps and yellow sticky traps, the capture of insects that were actively flying was done with a net trap or sweep net by swinging three times at each sampling point of sugar palm trees and hand-picking capture was done by looking at insects on the plant directly.

Insect Collection

Insect collection was carried out in the morning once a week (Amrulloh et al., 2022). Trapped insects were taken and then put into a vial bottle containing 70% alcohol and labeled. The use of yellow sticky traps could be replaced or could be reused if the trap was not damaged.

Insect Identification

Insect identification could be performed using a microscope, and the identification was carried out up to the order level by examining the morphology of the obtained insects and matching it with an insect identification book.

Observation Parameter

The things observed in this study were the number of insects and insect morphology. During field observations, environmental parameters

were observed, including weather conditions and soil texture of the sugar palm plants.

Observation of Insect Species Diversity in Sugar Palm

Observations were conducted by observing and counting the diversity of insect species captured. The insect data obtained were used to determine the values of species diversity index, species evenness, species dominance, and species similarity in each observation.

Calculating the Shannon Wiener Diversity Index

To compare the high and low diversity of insect species, namely the diversity of insect species and natural enemies according to (Siregar et al., 2022) the Shannon Wiener index (H) was used with the formula: $H' = - \sum (p_i \ln p_i)$.

Calculating the Berger-Parker Dominance Index

Species dominance was calculated with the Berger-Parker Species Dominance Index, a measure of diversity that showed the proportion of the most abundant species. According to (Darsono et al., 2020) the Berger-Parker index (d) used the following formula: $d = N_{\max}/N$.

Calculating the Shannon-Evenness Index

The Evenness Index indicates the total number of individuals distributed across each species. A high evenness index occurs when the total number of individuals was evenly distributed among all existing species. According to (Rohman et al., 2021), the evenness index (E) was expressed in the form of a Hill ratio as follows: $E = H'/\ln(S)$

Observation of Insect Species Diversity in sugar palm

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Data Analysis

The obtained insect data were analyzed using the NCSS software to observe the influence of

traps on insects, stem diameter on insects, observation weeks on insects, and traps on orders.

RESULT

The research was conducted in a 10,000 m² sugar palm field owned by Mr. Redi Kuswoyo, located in Tanjung Miring Village, Sungai Rotan District, Muara Enim Regency. The field was surrounded by approximately 60% rubber plantations and 30% rice fields. The local temperature ranges from 31°C to 32°C (Tabel 1).

Table 1. Description of sugar palms in Tanjung Miring Village

Research Land Conditions	
Farmer's Name	Redi Kuswoyo
Location of Farm	Side of Lematang River
Land area	1 ha
Type/Variety	Local
Planting method	Plants growing wild
Number of plant samples	20 Samples
Humidity	75%-90%
Temperature	31°C-32°C
Pesticide applications	-
Fertilization	-
Surrounding Vegetation	Weeds (Senduduk, fern, caladium, kirinyuh) North : Rubber Plantation and Rice Fields South : Rubber plantation East : Rubber plantation West : River

Insect Population in Sugar Palm

The results of the insects caught on this sugar palm land consisted of 11 orders namely Collembola, Coleoptera, Diptera, Demaptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Orthoptera, Odonata and Tysanoptera. The insect species found totaled 29 individuals with a total insect population of 497 individuals in yellow sticky traps, 365 individuals in pitfall traps, 63 individuals in sweep nets and 35 individuals in hand-picking techniques with a total of 960 individuals (Table 2). Based on the number of insects that are most abundant in the order Hymenoptera and Diptera, while insects with the least order was Dermaptera (Tabel 2). The results of the insect species index using 3 indices, namely the diversity index (H'), evenness index (E) and dominance index (D). The diversity index showed the value of $H'=2.47$ which means that the insect diversity index in the Tanjung Miring area was medium. The species evenness index $E=0.73$ which means the value of the insect species evenness index was low. The dominance

index value was $D=0.13$ which means there were no insects that dominate in the sugar palm area in Tanjung Miring.

There were 11 orders found in this research. Observations were made every week with a total of 5 weeks of observation. When viewed from

the week of observation, the number of insects with the order Hymenoptera showed a high number of insects among the number of insects with other orders. The number of insects with the order Diptera became the number of insects with the second highest order (Figure 1).

Table 2. Insect diversity in sugar palms

No	Ordo	Species	Trap				Σ	Role
			Yellow trap	Pitfall trap	Sweep Net	Visual		
1	Coleoptera	<i>Chalepus walshi</i>	0	0	3	0	3	Fitofag
		<i>Cicada bothrogonia</i>	0	0	1	0	1	Fitofag
		<i>Crioceris duodecimpunctata</i>	11	6	0	0	17	Fitofag
		<i>Eleodes fusiformis</i>	0	0	1	0	1	Dekomposer
		<i>Erotylidae</i>	0	4	0	0	4	Fitofag
		<i>Languria mozardi</i>	0	7	3	2	12	Fitofag
		<i>Luperaltica nigrialpis</i>	0	5	5	0	10	Fitofag
		<i>Onthophagus vulpes</i>	0	35	0	0	35	Dekomposer
		<i>Rhynchophorus ferrugineus</i>	0	0	0	2	2	Fitofag
2	Collembola	<i>Pseudosinella</i> sp.	0	41	0	0	41	Dekomposer
3	Dermaptera	<i>Forficula auricularia</i>	2	1	0	0	3	Dekomposer
4	Diptera	<i>Bactocera</i> sp.	13	2	0	0	15	Pollinator
		<i>Nephrotoma guestfalica</i>	127	28	0	0	155	Pollinator
		<i>Scholastes cincus</i>	12	3	0	0	15	Pollinator
5	Hemiptera	<i>Coreidae</i> sp.	5	8	0	0	13	Natural Enemies
		<i>Ectomocoris atrox</i>	2	0	0	0	2	Natural Enemies
		<i>Zelus Longipes</i>	0	0	4	0	4	Natural Enemies
6	Hymenoptera	<i>Camponotus atriceps</i>	37	23	0	0	60	Natural Enemies
		<i>Heterotrigona itama</i>	7	0	0	0	7	Pollinator
		<i>Monomorium minimum</i>	168	69	0	0	237	Natural Enemies
		<i>Polyrachis</i> sp.	49	113	0	0	162	Natural Enemies
		<i>Vespa affinis</i>	0	2	0	0	2	Pollinator
7	Isoptera	<i>Coptotermes</i> sp.	13	2	0	0	15	Dekomposer
8	Lepidoptera	<i>Ideopsis vulgaris</i>	0	0	2	0	2	Pollinator
		<i>Ypthima baldus</i>	6	0	14	4	24	Pollinator
9	Odonata	<i>Neurothemis fluctuans</i>	0	0	20	6	26	Natural Enemies
10	Orthoptera	<i>Melanoplus bivittatus</i>	3	16	8	20	47	Fitofag
		<i>Nisitrus vittatus</i>	0	0	2	1	3	Fitofag
11	Tysanoptera	Tysanoptera	42	0	0	0	42	Fitofag
Total (N)						960		
Index of Diversity (H')						2.47		
Evenness Index of Species (E)						0.73		
Index of Species Dominance (D)						0.13		

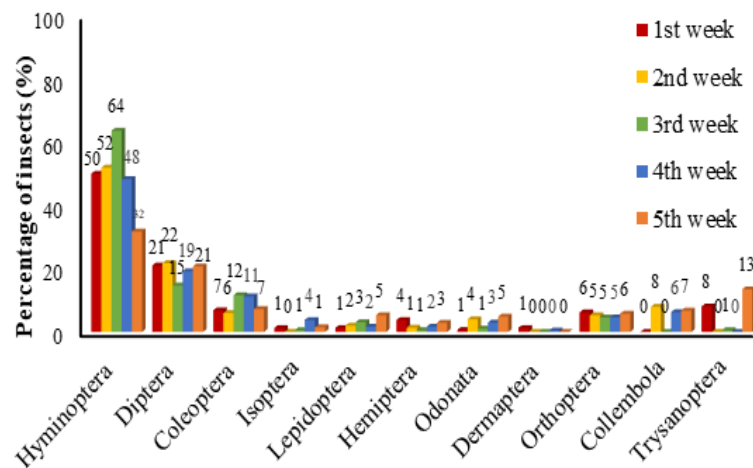


Figure 1. Observations of insect numbers by order on sugar palms

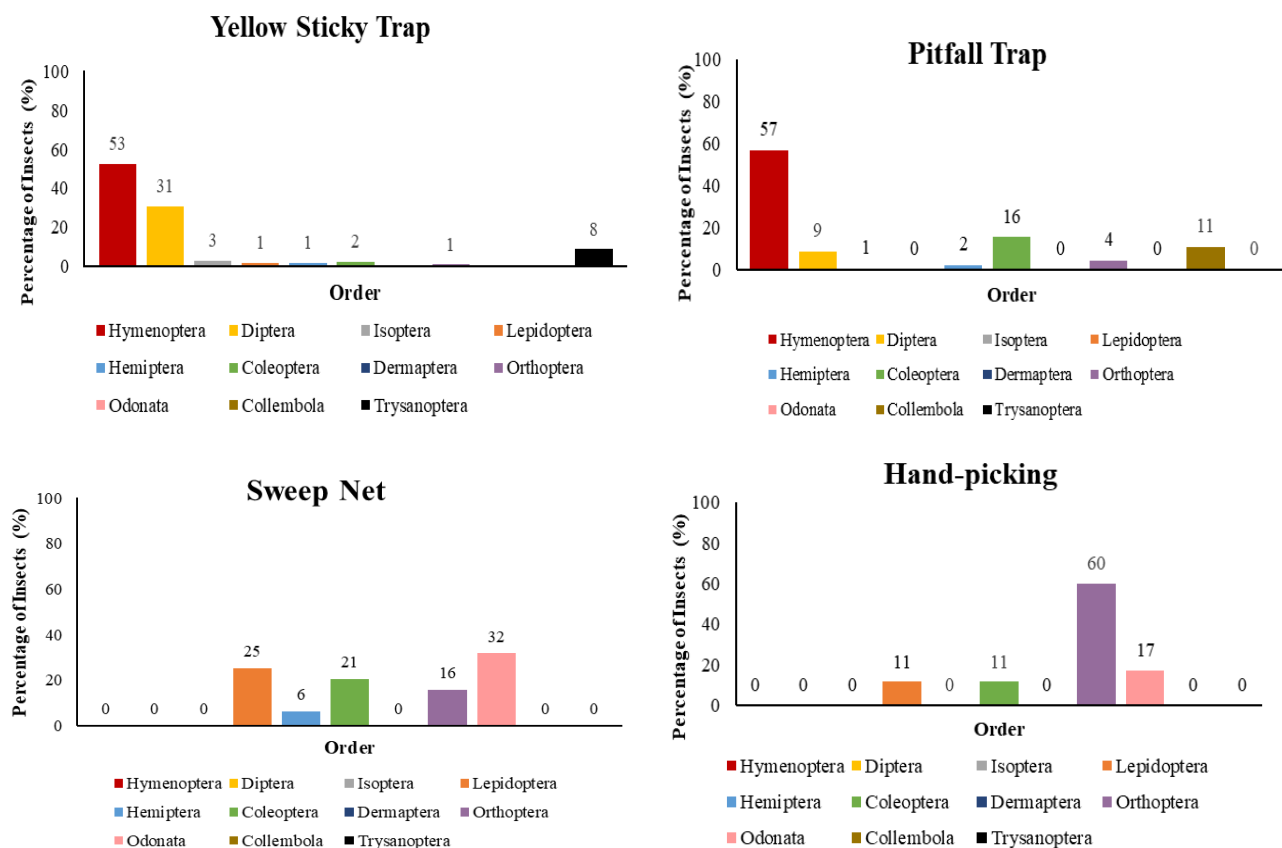


Figure 2. Comparison of insects based on traps set (a) yellow sticky trap, (b) pitfall trap, (c) hand-picking and (d) sweep net

This study was conducted by setting yellow sticky trap, pitfall trap, sweep net and hand-picking (Figure 2). These four traps showed different percentages of insect orders in each trap. In the yellow sticky trap, the order that was obtained the most was Hymenoptera with a percentage of 53%. Traps that use pitfall traps the highest order was obtained in Hymenoptera with

57%. Sweep net used in the number of insects obtained in the order Odonata with 32%. While the highest hand-picking order was Lepidoptera with 60%.

Based on the results of several insect roles that have been found, namely pollinators, phytophages, decomposers and natural enemies (Figure 3). This showed that in each week of

observation, the most insect roles found were natural enemies and pollinators while phytophages and decomposers had the least number of insects found in the sugar palm fields. The insects obtained were then grouped based on plant diameter to see the number of insect populations presented in the sugar palm (Figure 4). The most abundant plant diameters were found with sizes 31–40 as many as 850 insects. While the least number of insects found in the diameter of the tree with the size of 20–30 as many as 20 insects found.

Results of NCSS Analysis

The analysis results using NCSS on the trap against the percentage of insects obtained the results of P-Value <0.01, this value indicates a significant difference between the trap and the

percentage of insects obtained (Figure 5a). This result means there is no difference between palm trees on the percentage of insects obtained. The weekly observation of insects showed a P-value=0.32 (Figure 5b). Insects in the trees were more attracted to the yellow sticky trap. This was because yellow sticky traps can attract the attention of insects on yellow light waves reflected from yellow sticky traps (Zulkifli et al., 2024) In tree diameter on the percentage of insects, the result of P-value=0.53 (Figure 5c). Weekly observations of the percentage of insects obtained were not significantly different. In the trap against the order obtained results P-Value = 0.99 (Figure 5d). These results indicate that the traps against the order obtained were not significantly different.

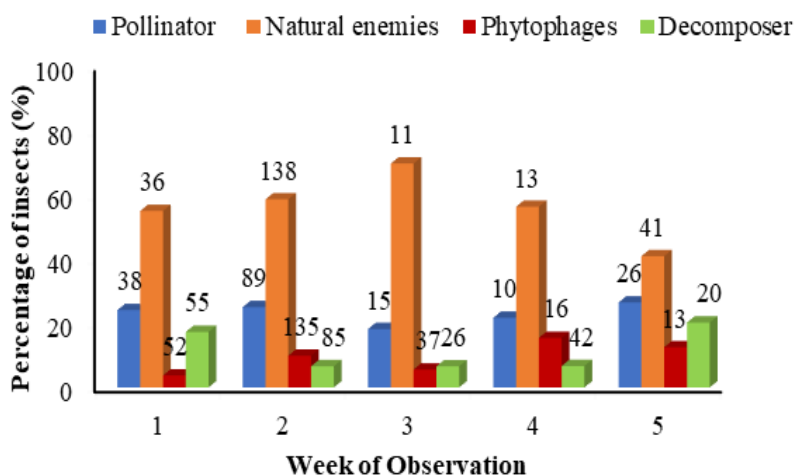


Figure 3. Observation of the number of insects based on their role in the sugar palm

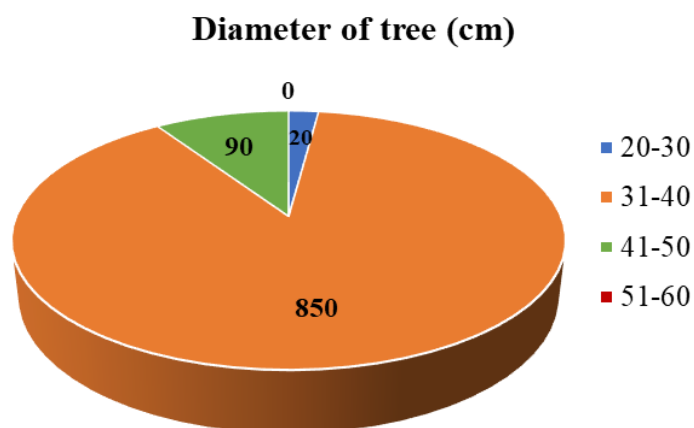


Figure 4. Number of insects based on trunk diameter in sugar palms

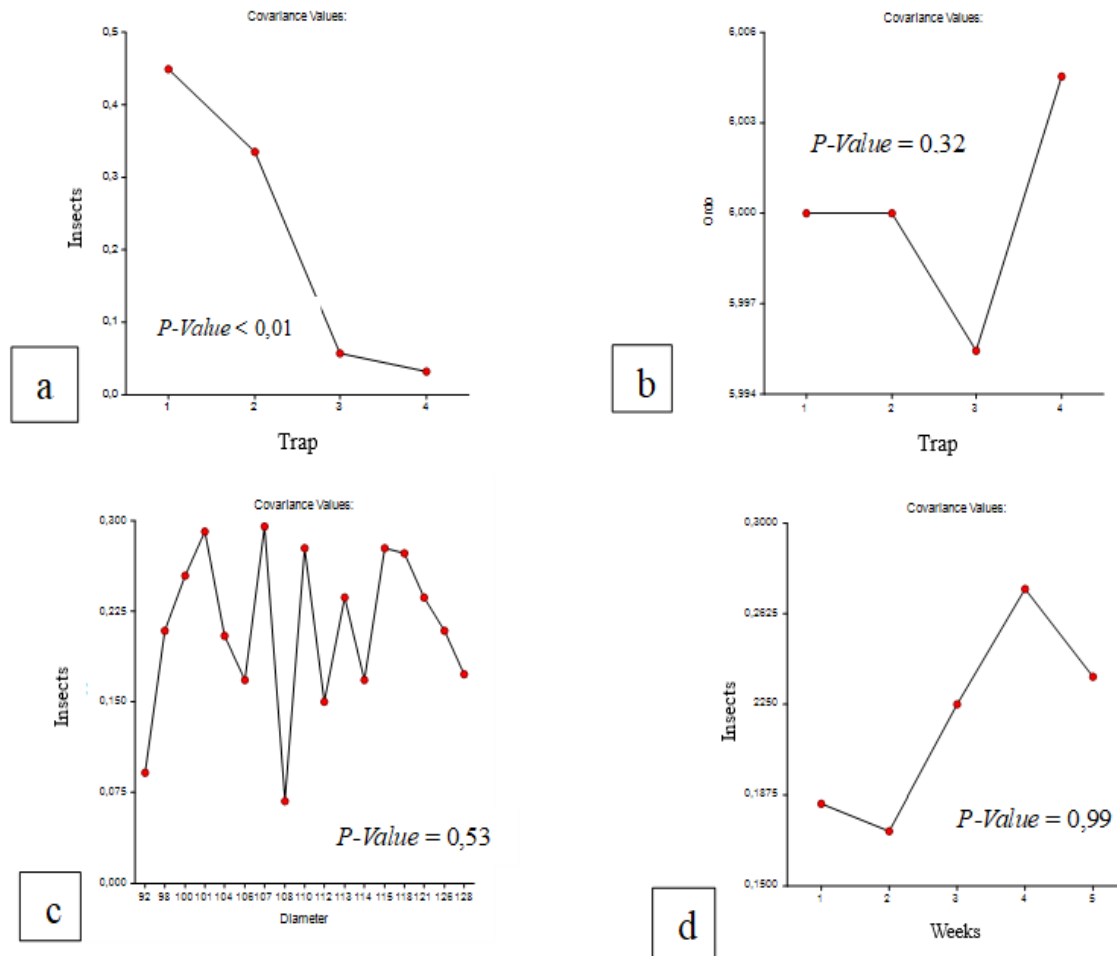


Figure 5. NCSS analysis results; a) Effect of traps on insects, b) Effect of observation, c) Effect of diameter on insects week on insects, d) Effect of traps on order

Insects Found in Sugar Palm

The following is the diversity of insects obtained from yellow sticky traps, pitfall traps, sweep nets and hand-picking installed on 20 palm plants. The order Hymenoptera became the order with the highest number of insects in sugar palm plants with yellow sticky traps and pitfall traps. In the order Hymenoptera, the highest number of insects was found in the species *Monomorium minimum* while the least number was found in the species *Heterotrigona itama*. The order Diptera in sugar palm fields was the second most abundant order after the order Hymenoptera. This order was found in yellow sticky traps and pitfall traps. In the order Diptera, the most common insect species was *Nephrotoma guestfalica*, while the least number of insects was *Scholastes cincus* and *Bactocera* sp.

In the order Coleoptera, the most species found were *Onthophagus vulpes* and the least

species found were *Cicada bothrogonia* and *Eleodes fusiformis*. In the Isoptera order obtained during this study only *Coptotermes* sp. Species with this order were obtained with yellow sticky traps and pitfall traps. In the Collembola order, the species obtained was *Pseudosinella* sp. which was found in pitfall traps. In the order Orthoptera with the species *Nisitrus vittatus* found in yellow sticky traps and pitfall traps in sweep net traps and visually obtained species *Melanoplus bivittatus*. The odonate order species found was *Neurothemis fluctuans* using sweep net traps and hand picking. In the order Lepidoptera, the most species obtained was *Ypthima baldus* and the least species obtained is *Ideopsis vulgaris*. Order Hemiptera insects with species *Coreidae* sp. obtained in yellow sticky trap and pitfall trap. While the species *Zelus Longipes* was only found in sweep net traps and *Ectomocoris atrox* species in yellow sticky traps.

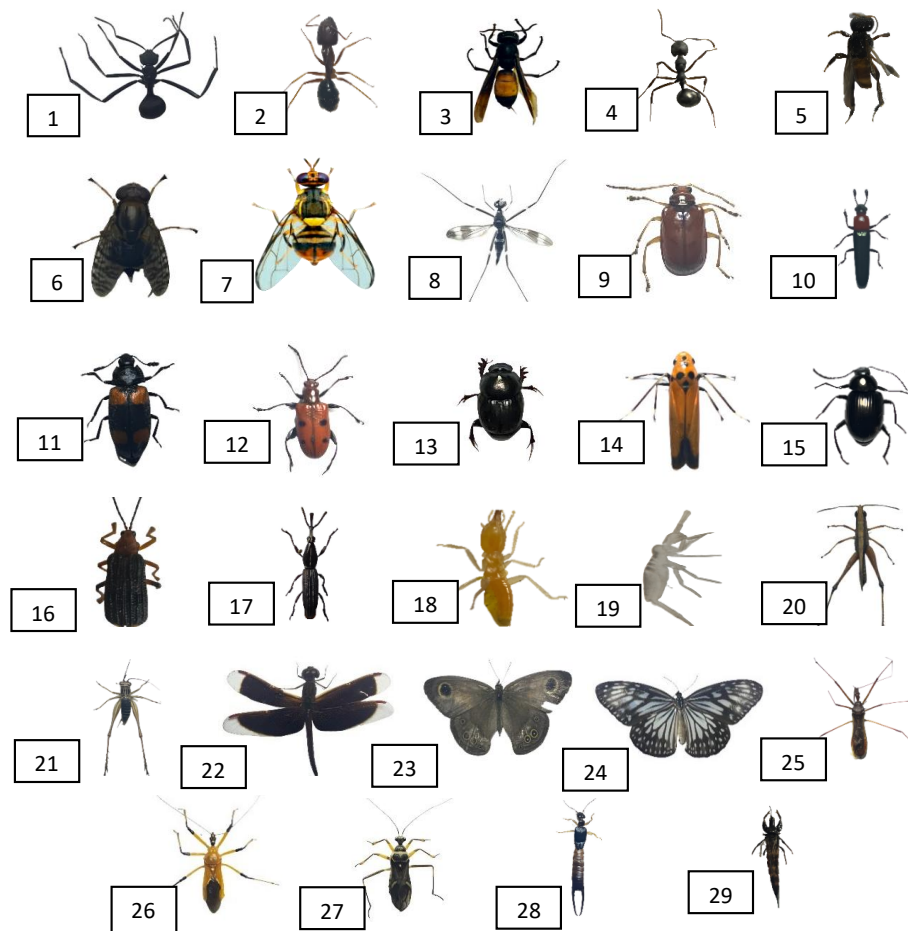


Figure 6. (1) *Polyrachis* sp., (2) *Camponotus atriceps*, (3) *Vespa affinis*, (4) *Monomorium minimum*, (5) *Heterotrigena itama*, (6) *Scholastes cinctus*, (7) *Bactocera* sp., (8) *Nephrotoma guestfalica*, (9) *Luperaltica nigralpis*, (10) *Languria mozardi*, (11) *Erotylidae*, (12) *Crioceris duodecimpunctata*, (13) *Onthophagus vulpes*, (14) *Cicada bothrogonia*, (15) *Eleodes fusiformis*, (16) *Chalepus walshi*, (17) *Rhynchophorus ferrugineus*, (18) *Coptotermes* sp., (19) *Collembola*, (20) *Pseudosinella* sp., (21) *Melanoplus bivittatus*, (22) *Nisitrus vittatus*, (23) *Neurothemis fluctuans*, (24) *Ypthima baldus*, (25) *Coreidae* sp., (26) *Zelus longipes*, (27) *Ectomocoris atrox*, (28) *Forficula auricularia*, (29) *Thrips*

DISCUSSION

Based on the research conducted in sugar palm fields in Tanjung Miring Village, 960 insects were found. This study used 4 traps with 5 weeks of observation (Table 1). There were 29 species of insects found in the sugar palm which were divided into 11 orders namely Coleoptera, Collembola, Diptera, Dermaptera, Hemiptera, Hymenoptera, Isoptera, Lepidoptera, Orthoptera, Odonata and Tysanoptera. The types of insect species associated with sugar palms in this area have many types. The more vegetation around the palm showed that the more diversity of insect species. Based on the results of interviews with sugar palm farmers in Tanjung Miring village (Table 1). Sugar palm that the farmers utilize in the area comes from plants that grow naturally.

The area of sugar palm in Tanjung Miring Village, Muara Enim Regency is 1 ha. There is a tributary of the Lematang River around the sugar palm trees and the land in this area is filled with shrubs. This could be a factor in the high population of insects associated with sugar palms (Herlin et al., 2024).

The insect species diversity index in Tanjung Miring Village (Figure 1) is $H' = 2.47$, indicating moderate diversity based on the index range of $1 < H' < 3$. This suggests that sugar palm fields support a moderate level of biodiversity, likely due to limited consideration of environmental factors in land management practices by palm farmers. The diversity index helps analyze the abundance and distribution of insect species in the area (Budiaman et al., 2023). The species evenness index is $E = 0.73$, indicating high

evenness. An evenness index closer to 0 suggests dominance by a few species, while values near 1 indicate that species are more evenly distributed (Latumahina et al., 2020). The dominance index is $D = 0.13$, which falls within the range $0 < D < 0.5$. This low value indicates that no single insect species dominates the community (Sunarsih et al., 2020). The habitat appears to offer sufficient resources such as shelter and food, supporting insect survival and growth (Table 2).

According to (Diarra et al., 2024), one of the three largest insect orders is Hymenoptera. The order Hymenoptera was the most commonly found order in this observation (Figure 1). The number of species obtained from this order was five insect species: *Monomorium minimum*, *Polyrachis* sp., *Camponotus atriceps*, *Heterotrigona itama*, and *Vespa affinis*. Ants, which belong to the family Formicidae, were relatively abundant and dominant. Ants serve various functions, including acting as predators of other insects, loosening the soil, and controlling pests (Buxton et al., 2021). Meanwhile, *Heterotrigona itama* and *Vespa affinis* function as pollinators of flowers and plants, contributing to the production of sugar palm fruits, which are beneficial. The order Diptera was the second most abundant order found after the order Hymenoptera. Diptera insects are beneficial to sugar palm. Their role is as pollinators. Three species from this order were identified: *Bactrocera* sp., *Nephrotoma guestfalica*, and *Scholastes cincus*. These insect species were commonly found in sugar palm plantations when the plants were flowering and fruiting.

In this observation, the order Coleoptera includes species that act as both phytophages and decomposers. The species functioning as decomposers are *Onthophagus vulpes* and *Eleodes fusiformis*. Soil moisture and environmental factors play a significant role in the distribution of ground beetles in this study. The species that act as phytophages include *Rhynchophorus ferrugineus*, *Luperaltica nigrialpis*, *Languria mozardi*, *Erotylidae*, *Crioceris duodecimputata*, *Cicada bothrogonia*, and *Chalepus walshi*. One of the most deadly pest species affecting palm plants is *R. ferrugineus* (Khairuddin et al., 2022).

The order Collembola was found only in pitfall traps. These organisms prefer moist environments with high organic matter content (Mawan et al., 2022). Collembola, a type of soil fauna, inhabit both the soil and its surface, playing a key role in breaking down organic material such as spores, dry leaves, and decomposing plant matter. The order Isoptera was found in both yellow sticky traps and pitfall traps. Its members function as decomposers, with *Coptotermes* sp. identified in this study. These termites consume organic matter and contribute to loosening soil structure, which benefits plant growth (Santhoshkumar et al., 2024).

Order Orthoptera on observations in the sugar palm fields found 2 species, namely *Melanoplus bivittatus* and *Nisitrus vittatus*. This orthoptera order can be an insect that acts as a phytophagous in sugar palm. Phytophagous insects that dominate come from the Orthoptera order. In this study, weed control was not carried out which made the high abundance of the Orthoptera order. Plants act as habitat for insects from the Orthoptera order. A suitable environment can affect the population size of these insects. Odonata orders were collected from sweep net and hand-picking. This order acts as a natural enemy. The species found in the sugar palm fields from this order is *Neurothemis fluctuans*. The presence of dragonflies in the ecosystem can be a natural enemy. In addition, it can control the mosquito population (Dasrat & Maharaj, 2021). Order Lepidoptera with the species obtained are *Ypthima baldus* and *Ideopsis vulgaris*.

The species found are one type of insect that has an important value. Lepidoptera order can be said to be pollinators, because in addition to nectar consumption, they also consume pollen and can transfer flower pollen to other flowers. One of the advantages of insect pollination is that it can increase fruit yield (Katumo et al., 2022). Pollination of plants will increase in line with the arrival of insect pollinators (Syari et al., 2023). Tysanoptera order was found in the yellow sticky trap. The insects in this order are *Thrips*. This order acts as a phytophagous. These insects feed on plants that have a variety of consequences. Starting from mild damage to very heavy damage.

In this research, the Hemiptera order is a species that becomes a natural enemy in sugar palm. Species of the Hemiptera order are *Coreidae* sp., *Zelus Longipes* and *Ectomocoris atrox*. The species found with the Hemiptera order is one of the important species against caterpillars that eat leaves in sugar palm. The sugar palm is a suitable habitat for these species. These species were found because of the abundance of wild vegetation as a natural habitat, one of which is ferns (Diratika et al., 2020). Meanwhile, the order that was found in this observation was the order dermaptera. This order was found in yellow sticky traps and pitfall traps. The dermaptera order was found with the species *Forficula Auricularia*. Soil arthropods of this order have an important role as decomposers. These soil arthropods aim to balance the organic cycle in the sugar palm fields.

In this case, yellow sticky trap, pitfall trap, sweep net and hand-picking were set (Figure 3). Of the four types of traps, the highest number of insects trapped was in the yellow sticky trap and pitfall trap and the least was hand-picking. This is because the colored yellow sticky trap can capture more types of insect species that come because the yellow color can provide a food stimulus impact that insects like. Therefore, the yellow color attracts the most insects to land (Daud et al., 2021). Pitfall traps are used for insects that live above ground, many insects are found using this trap so that animals that are active above ground or by chance lead to the trap and then fall into the pitfall trap.

Whereas in hand-picking capture and sweep net, relatively few insects are obtained because when capturing directly insects are not always presented and are influenced by high mobility (Surbakti et al., 2018). Insects found on oil palm plants have diverse ecological roles (Figure 3). *Polyrachis* sp. and *Monomorium minimum* function as natural enemies that help control pests. *Rhynchophorus ferrugineus* and *Oryctes rhinoceros* are phytophagous insects that are major pests because they damage plant stems and shoots. *Forficula auricularia* acts as a decomposer that helps decompose organic matter around the plant, while *Vespa affinis* and *Ypthima baldus* act as pollinators that help the reproduction process of palm plants.

The diameter of the tree trunk in the sugar palm field (Figure 4). The diameter of the tree at the size of 31-40 cm obtained a larger insect population with a total of 850 insects. Based on the results of Firmanto's research (2023) conducted at the same location on sugar palm land in Tanjung Miring Village, Muara Enim Regency. Showing that in young sugar palms the highest number of insects is found in the size of the diameter of the plant stem 20–50 cm. The diameter size of each palm was one of the determinants of the age of the palm. The greater the width of the trunk diameter, the less the number of insects presented (Patty et al., 2022).

The analysis results using NCSS on the trap against the number of insects obtained the results of P-Value <0.01, this value indicates a significant difference between the trap and the number of insects obtained (Figure 5a). This result means there is no difference between palm trees on the number of insects obtained. The weekly observation of insects showed a P-value=0.32 (Figure 5b). Insects in the trees were more attracted to the yellow sticky trap. This was because yellow sticky traps can attract the attention of insects on yellow light waves reflected from yellow sticky traps (Zulkifli et al., 2024). In tree diameter on the number of insects, the result of P-value=0.53 (Figure 5c). Weekly observations of the number of insects obtained were not significantly different. In the trap against the order obtained results P-Value = 0.99 (Figure 5d). These results indicate that the traps against the order obtained were not significantly different.

CONCLUSION

In research identified 15 insect species from 9 orders associated with sugar palm in Tanjung Miring Village. Natural enemies such as *Polyrachis* sp. and *Monomorium minimum*, phytophagous insects such as *Rhynchophorus ferrugineus* and *Oryctes rhinoceros*, decomposer like *Forficula auricularia*, while pollinator insects in sugar palm plants such as *Vespa affinis* were recorded. Yellow sticky traps captured the most insects. These results fulfill the research objectives and provide useful information for improving the management and utilization of

sugar palm through a better understanding of insect roles.

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