

**INSECT BIODIVERSITY IN TIGER CAMP, LUBUK MINTURUN: PADANG, INDONESIA****Zulyusri<sup>1</sup>, Zulgusma Aulia Putri<sup>1\*</sup>**<sup>1</sup>Biology Department, Padang State University, West Sumatera, Indonesia\*Email : [zulgusmaulia@gmail.com](mailto:zulgusmaulia@gmail.com)**Abstract**

*This study aims to explore insect diversity in the Tiger Camp area, Padang, through the analysis of three main indices: Diversity Index (H'), Dominance Index (D), and Balance Index (E). Data were collected through intensive field surveys, using insect net (sweep net) and hand shorting insect capture methods. The results of the study obtained 117 individuals, 59 species, 22 families, and 6 orders which showed that the Diversity Index (H') in the Tiger Camp area was 3.79, indicating a high level of species diversity. The Dominance Index (D) value of 0.03 indicates that no species significantly dominated the insect community. The Equilibrium Index (E) of 0.97 indicated a very even distribution of insect individuals among different species. These findings indicate that the insect community at Tiger Camp, Padang, has high diversity and good ecological stability. The high values of diversity and balance, as well as low dominance, indicate that the habitat in this area supports a healthy and sustainable environment for a variety of insect species. This study highlights the importance of natural habitat conservation to maintain biodiversity and ecosystem balance in the area.*

**Keywords:** *Insect, Biodiversity, Tiger Camp***Abstrak**

*Penelitian ini bertujuan untuk mengeksplorasi keanekaragaman serangga di kawasan Tiger Camp, Padang melalui analisis tiga indeks utama: Indeks Keanekaragaman (H'), Indeks Dominan (D), dan Indeks Keseimbangan (E). Pengumpulan data dilakukan melalui survei lapangan secara intensif, dengan menggunakan metode penangkapan serangga menggunakan jaring serangga (sweep net) dan hand shorting. Hasil penelitian diperoleh 117 individu, 59 jenis, 22 famili, dan 6 ordo yang menunjukkan bahwa Indeks Keanekaragaman (H') pada kawasan Tiger Camp sebesar 3,79 yang menunjukkan tingkat keanekaragaman jenis yang tinggi. Nilai Indeks Dominasi (D) sebesar 0,03 menunjukkan tidak ada jenis serangga yang mendominasi komunitas serangga secara nyata. Nilai Indeks Keseimbangan (E) sebesar 0,97 menunjukkan sebaran individu serangga sangat merata antar jenis serangga. Hasil penelitian ini menunjukkan bahwa komunitas serangga di Tiger Camp Padang memiliki keanekaragaman yang tinggi dan kestabilan ekologi yang baik. Nilai keanekaragaman dan keseimbangan yang tinggi serta nilai dominasi yang rendah menunjukkan bahwa habitat pada kawasan ini mendukung lingkungan yang sehat dan lestari bagi berbagai jenis serangga. Penelitian ini menyoroti pentingnya upaya konservasi habitat alam untuk menjaga keanekaragaman hayati dan keseimbangan ekosistem di kawasan tersebut.*

**Kata Kunci:** *Serangga, Keanekaragaman Hayati, Tiger Camp*

## PENDAHULUAN

Indonesia is a megadiverse country known for its extraordinary biodiversity. One of the main components of this biodiversity is insects, which are widely distributed in a variety of habitats ranging from tropical rainforests to agricultural lands. (Arma and Sari, 2020; Farid et al, 2023; Handru et al, 2023) Although insects are often overlooked in the general public's understanding of ecosystems, their role is vital in maintaining ecological balance and supporting the survival of various other organisms. While the diversity of insects in Indonesia has been widely recognized, much is still not understood about the species present, their distribution patterns, and ecological roles (Sodhi et al, 2010; Melin & Nasamsir, 2016; Hasim et al, 2017) Research on insect diversity is not only important for scientific purposes, but also has direct implications in nature conservation and sustainable agriculture.

Insects are the largest group of organisms in the world, with over one million species identified, and an estimated million species yet to be identified (Samways et al, 2020; Dorji et al, 2023). Insects are classified into about 30 orders, with some of the largest orders including Coleoptera (beetles), Lepidoptera (butterflies and moths), Diptera (flies), and Hymenoptera (bees, wasps, and ants). Insect diversity has a significant impact on various aspects of life, including agriculture, human health, and ecosystem balance (Sodhi et al, 2010; Halim et al, 2017; Duffus et al, 2021). Insects act as pollinators, predators, decomposers, and also as a food source for many other organisms (Basu et al, 2021). As pollinators, they contribute to food crop production and maintain plant diversity. Predatory insects help control pest populations that harm agricultural crops, while decomposer insects play a role in the decomposition process of organic matter, which helps cycle nutrients in the soil (Middleton et al, 2021; Parry H, 2022).

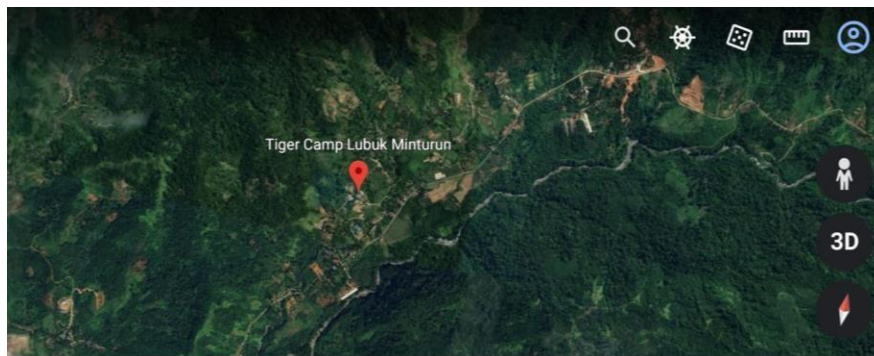
Lubuk Minturun is a 5 km area that is part of Koto Tangah Sub-district in Padang City with an elevation of 30-105 m. The area is known as the home industry center for ornamental plants, fruits and other perennials in Padang. The area is known as the home industry center for ornamental plants, fruits, and other perennial plants in Padang. Lubuk Minturun is also nicknamed "Kampung Flori" or "Floricultura Village" because of the many ornamental plants that are cultivated (Faiza & Idajati, 2023; Nabila & Fitriasia, 2023; Rahmatika et al, 2023). Coupled with its natural environment that creates a suitable habitat for insect diversity. These favorable conditions need to be confirmed through the presence of various types of insects. The availability of various plant species is very important for insect species, both as larvae and food. As one of the natural tourist sites, the Tiger Camp area has the attraction and advantage of biodiversity including insect diversity.

Given the important role of insects and the absence of insect diversity data in the Tiger Camp area, it is necessary to conduct research on insect diversity in the Tiger Camp Lubuk Minturun area, Padang. The results of this study can be used as a source of information on insect diversity.

## Method

### Study Area

This research was conducted in Tiger Camp, Lubuk Minturun, Padang with located at coordinates 0048'52" S 100024'01"E. Observation of the research location is carried out with the aim of knowing information about the place that is used as the object of research by recognizing the field conditions and the location of its coordinates. This research is a quantitative descriptive research by conducting data collection activities, analyzing data and interpreting data with the aim of making descriptions of events that occur (Rante et al, 2023).



**Fig 1.** Research Sites at Tiger Camp, Lubuk Minturun in Padang City (Source : Google Earth, 2023)

### Population and sampling

The population in this study were all insects found in the Tiger Camp area, Lubuk Minturun. Insect sampling was carried out using 2 methods:

- a. Insectnet (Sweep Net) Method. Insects were sampled using an insect net (sweepnet) by swinging the net from right to left 10 times (double swing) around the tree containing insects. Captured insects were then stored in a container filled with 70% alcohol and labeled.
- b. Hand trap method (Hand Collecting). The hand collecting method is a way of sampling that is done directly. Each type of insect found is collected using hands or tweezers, then put into a collection bottle that has

contained 70% alcohol. Observations were made of all types of insects that live around low plants, on the soil surface, between rocks, soil mounds, or wood breaks.

### Identification and Data Analysis

Insects were analyzed morphologically (color and shape) in a descriptive way to explain the morphology of each individual collected, the analysis was carried out quantitatively in a descriptive way. Insects were identified directly in the field and in the zoology laboratory. The identification process was guided by appropriate literature related to insect diversity. The identified insects were accumulated into a database using Microsoft Excel 2010 program.

## Result and Discusion

### Result

A total 117 insect individuals sampled in this study which identified into 59 species, 22 family, and 6 ordo (Table 1.)

Table 1. Insect Biodiversity in Tiger Camp, Lubuk Minturun

Ordo	Family	Genus (Spesies)	Σ	
Lepidoptera	Pieridae	<i>Appias olferna</i>	4	
		<i>Appias libythea</i>	1	
Lepidoptera	Papilionidae	<i>Catosilia pyranthe</i>	1	
		<i>Eurema blanda</i>	1	
		<i>Graphium doson</i>	1	
		<i>Papilio demoleus</i>	2	
		<i>Papilio demodocus</i>	3	
		<i>Papilio polytes</i>	1	
		<i>Papilio memnon</i>	1	
		Nymphalidae	<i>Charaxes amycus</i>	1
			<i>Melanitis phedima</i>	5
			<i>Junonia atlites</i>	6
	<i>Caligo illioneus</i>		1	
	<i>Danaus plexippus</i>		2	
	<i>Acraea terpsicore</i>		4	
	Lepidoptera	Erebidae	<i>Bicylus madetes</i>	1
			<i>Neptis sappho</i>	1
	Lepidoptera	Hesperiidae	<i>Junonia orithya</i>	1
<i>Orsotriaena medus</i>			1	
Lepidoptera	Erebidae	<i>Amata huebneri</i>	1	
		<i>Potanthus omaha</i>	2	
Lepidoptera	Hesperiidae	<i>Poanes hobomok</i>	1	
		<i>Divana diva</i>	1	
Lepidoptera	Castniidae	<i>Appias lycinda</i>	1	
		<i>Appias drusilla</i>	1	
Lepidoptera	Pieridae	<i>Phoebis sennae</i>	1	
		<i>Eurema daira</i>	1	
Lepidoptera	Pieridae	<i>Saletara liberia</i>	3	

Ordo	Family	Genus (Spesies)	Σ
Odonata	Libellulidae	<i>Orthetrum sabina</i>	11
		<i>Crocothemis servilia</i>	1
		<i>Sympetrum danae</i>	1
Hymenoptera	Vespidae	<i>Vespa affinis</i>	5
		<i>Polistes parametricus</i>	1
	Apidae	<i>Apis dorsata</i>	2
		<i>Apis mellifera</i>	2
		<i>Xylocopa violacea</i>	5
		<i>Xylocopa pubescens</i>	3
Hemiptera	Cicadellidae	<i>Bothrogonia ferruginea</i>	3
	Pentatomidae	<i>Chinavia hilaris</i>	1
	Alydidae	<i>Leptocoris oratoria</i>	1
	Pyrrhocoridae	<i>Dysdercus cingulatus</i>	1
	Coreidae	<i>Leptoglossus occidentalis</i>	1
		<i>Anasa tristis</i>	1
	Lygaeidae	<i>Melacoryphus lateraris</i>	1
	Pyrrhocoridae	<i>Pyrrhocoris apterus</i>	1
Coleoptera	Coccineliidae	<i>Coccinella sp</i>	1
		<i>Harmonia axyridis</i>	2
		<i>Hippodamia convergens</i>	4
		<i>Stegobium paniceum</i>	1
	Ptinidae		
Orthoptera	Acrididae	<i>Dissosteira carolina</i>	1
		<i>Locusta migratoria</i>	2
		<i>Melanoplus femurrubrum</i>	1
		<i>Acrida conica</i>	3
		<i>Valanga nigrocornis</i>	2
	Tettigoniidae	<i>Hexacentrus japonicus</i>	1
		<i>Mecopoda nipponensis</i>	1
		<i>Pseudophyllus titan</i>	5
	Gryllotalpidae	<i>Gryllotalpa gryllotalpa</i>	1
		<i>Teleogryllus oceanicus</i>	1
Total of Individual			<b>117</b>
Total of species			<b>59</b>
Total of family			<b>24</b>
Total of ordo			<b>6</b>

## a. Ordo Lepidoptera

Lepidoptera were collected with insect net during the observation. Lepidoptera had the most species found in this Tiger Camp area compared to other insect orders. A total of 43% of species were classified, including 7 different families. Most of the captures were from the family Pieridae (7 species); Papilionidae (8 species); Nymphalidae (23 species); Erebididae and Castniidae (1 species each); Hesperidae (7 species); and Hesperidae (3 species).

## b. Order Odonata

The ordo Odonata found only 1 family, the family Libellulidae. The family Libellulidae is a diverse and interesting group of dragonflies with a variety of sizes, colors, and behaviors. There are 13 species that

have been classified including *Orthetrum sabina* (11 species), *Crocothemis servilia* (1 species), and *Sympetrum danae* (1 species).

## c. Ordo Hymenoptera

The order Hymenoptera is a group of insects that includes ants, bees, and wasps. Through insect net and hand sorting, 2 families were found including the Vespidae family (6 species) and the Apidae family (12 species).

## d. Ordo Hemiptera

The ordo Hemiptera is also known as "half-winged insects". 9% of species were found and identified as 7 families including, families Cicadellidae (*Bothrogonia ferruginea*), Pentatomidae (*Chinavia hilaris*), Alydidae

(*Leptocorisa oratoria*), Pyrrhocoridae (*Dysdercus cingulatus*), Coreidae (*Leptoglossus occidentalis* and *Anasa tristis*), Lygaeidae (*Melacoryphus lateraris*), and Pyrrhocoridae (*Pyrrhocoris apterus*).

e. Ordo Coleoptera

The Coleoptera, known as the order of beetles, is one of the largest and most diverse insect orders in the world. In this observation, only 7% of the order was found. There are 2 family that have been identified

including Coccineliidae (7 species) and Ptinidae (1 species).

f. Ordo Orthoptera

Ordo Orthoptera is a group of insects that includes grasshoppers, crickets, and cockroaches. There are 3 family including Acrididae, Tettigoniidae, and Gryllotalpidae totaling 18 species. The percentage of insect diversity can be seen in the figure below (Fig 2.)

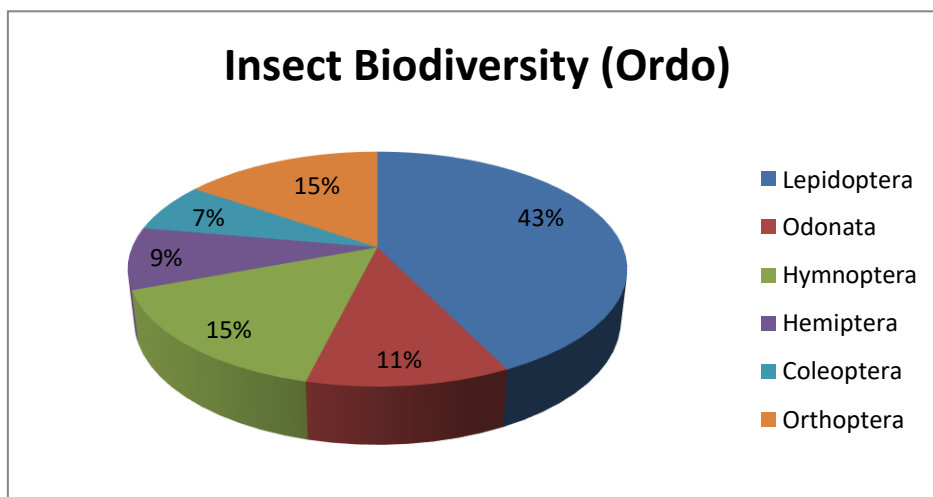


Fig 2. Insect biodiversity (Ordo Serangga) di Tiger Camp, Lubuk Minturun

Table 2. Diversity Index (H'), Dominance Index (D), dan Evenness Index (E)

Species Diversity Index (H')	Dominance Index (D)	Evenness Index (E)
3,79	0,03	0,97

Table 2 shows the results of the calculation of the species diversity index, dominance index and evenness index of insect species in the Tiger Camp area, Lubuk Minturun. The diversity index value is an indicator of the abundance or number of insect species in a particular area. In this area has an insect diversity index value of 3.79 which is classified as high. The dominance index in this area is low with a value of 0.03. A low dominance index indicates a community that has an even distribution of individuals among many species, without any species dominating significantly. And a high diversity index value with a value of 0.97 indicates that individuals in a community are evenly distributed among the species that exist.

Discussion

Tiger Camp Lubuk Minturun in Padang is an area surrounded by dense forest and lush vegetation and has rich biodiversity, with various types of flora and fauna. It serves not only as a conservation area but also as a

center for education, research, and ecotourism that benefits all. Tiger Camp is facing threats from human activities such as forest encroachment and climate change. Conservation efforts continue to be made to protect and preserve this ecosystem, one of which can be done is by inventorying various types of diversity, especially the insect class.

Insect biodiversity is a critical component of the global ecosystem, playing an important role in pollination, decomposition, and as part of the food chain. Recent studies show an alarming decline in insect populations around the world, which could have major consequences for ecological stability and agricultural productivity. For example, a study in 2022 highlighted that nearly 40% of insect species face extinction due to habitat loss, pesticide use, and climate change (Hallmann et al., 2022). The loss of insect diversity not only impacts the species directly involved, but also impacts the wider ecological network that relies on insects for a variety of functions, from pollination to nutrient

cycling (Sánchez-Bayo & Wyckhuys, 2019).

Efforts to mitigate the decline in insect biodiversity focus on habitat restoration, reducing pesticide use, and promoting sustainable agricultural practices. One effective strategy is the establishment of insect-friendly habitats within agricultural landscapes, which has been shown to support insect diversity and crop yields (Kleijn et al., 2021). In addition, policies aimed at reducing the use of harmful pesticides can have a positive impact on insect populations. For example, recent regulations in the European Union restricting the use of neonicotinoids have led to observable recoveries in some insect populations (Woodcock et al., 2021). These approaches underscore the importance of integrated conservation strategies that balance the needs of human agriculture with the preservation of insect biodiversity.

The most common order found during the observation was the order Lepidoptera. Lepidoptera is one of the most diverse insect orders, with more than 180,000 species identified. (Carus & Caineiro, 2024; Perveen & Khan, 2024). Studies on the diversity and composition of the Lepidoptera order have been conducted in several locations. For example, in the coffee plantation area of Waq Toweren village, Central Aceh Regency, 328 individuals consisting of 6 families and 39 species were found with a moderate diversity index of  $H' = 2.46$  (Marlisa et al, 2022). Tanahuala island area, North Sumatra 617 butterflies were collected with a diversity of 52 species, 42 genera and 9 families. High diversity index with a value of 3.00 (Mairawita & Herwina, 2023). The same thing is also in the Kedung Klurak area, Mojokerto with a diversity index value of 3.13 high category (Umami et al, 2024).

The order Lepidoptera has a huge ecological function. Many Lepidoptera species have symbiotic relationships with flowering plants, serving as important pollinators in ecosystems. Larvae are often herbivores specific to certain plant species, which can affect plant community dynamics. They are used as bioindicators of ecosystem health, which is indicated by the more butterfly species in a place indicating that the quality of the environment is still good (Apriana et al, 2022). In addition, they also act as the most efficient pollinators of flowers, and help in the survival of plants through the process of pollination (Ruslan & Yenisbar, 2022; Umami et al, 2024). With tremendous diversity, they play a key role

in the ecosystem as pollinators and part of the food chain. Efforts to understand and conserve Lepidoptera are an important step in maintaining ecosystem balance and global biodiversity.

One of the most commonly found species of the order Lepidoptera is *Junonia atlites*. *Junonia atlites* is a butterfly known as "gray pansyi" one of the interesting butterfly species of the Nymphalidae family (Shi et al, 2015; Saptarini et al, 2021; Hawkeswood, 2022; Ilhamdi et al, 2024). *Junonia atlites* has a pale gray upper wing color, while the underside of the wing is lighter in color. There are dark brown irregular lines in the post discal area and submarginal lines. The body size of *Junonia atlites* is medium, with wings that are about 55-65 mm long. This species has been found in large numbers because the Tiger Camp area is fed by a river. *Junonia atlites* is part of the insect diversity of the region. Their presence contributes to overall biodiversity and ecosystem balance (Comay et al, 2021).

In addition, *Orthetrum sabina* is also commonly found in the Tiger Camp area, Lubuk Minturun. The main body color is green with a black stripe along the abdomen. This dragonfly has a body length of about 35-40 mm and a wingspan of about 60-70 mm. The body is slender and elongated. The yap is transparent with a slight yellowish color at the base. Many rivers make one of the living places of *Orthetrum sabina*. Rivers provide habitats that suit the biological and ecological needs of dragonflies at various stages of their life cycle. The availability of water for reproduction, abundant food, protection from predators, and stable environmental conditions are key factors that make rivers ideal living areas for dragonflies (El Haissoufi et al, 2015; Kurnia et al, 2023).

The sparse Coleoptera population found in Tiger Camp, Padang is most likely due to a combination of environmental factors, resource availability, predation, human disturbance, soil and vegetation conditions. Tiger Camp Padang may have less favorable habitat for some Coleoptera species. Beetles often require specific habitats such as dense forest, weathered wood, or areas with specific vegetation types that may not be available in the area (Risichen et al, 2021; Bilton et al, 2023; Klarin et al, 2024). More studies and extensive surveys are needed to gain a better understanding of the distribution and abundance of Coleoptera in the area.

The value of the diversity index ( $H'$ ) of 3.79

in Tiger Camp, Lubuk Minturun indicates that the area has a very high species diversity. This means that there are many different insect species and the number of individuals within each species is quite varied. This indicates a healthy and diverse ecosystem, capable of supporting many types of insects. A low dominance index (D) value, such as 0.03, indicates that no insect species dominates significantly. In other words, the distribution of individuals among species is relatively even, with no single species overwhelmingly dominating the community, no significant dominance pressure of one or a few species over others, reflecting good ecosystem balance. And an evenness index (E) that approaches 1, such as 0.97, indicates that individuals of different species are very evenly distributed. That is, the number of individuals in each species is almost equal, indicating a balanced distribution among the species present. This indicates that no species is too few or too many compared to the others, which again indicates a balanced distribution and favorable habitat for various species (Ruslan et al, 2023).

Bioconservation of insect biodiversity involves strategies that aim to conserve and enhance insect populations through ecological and sustainable methods. One prominent approach is the creation and maintenance of natural habitats such as wildflower areas and insect hives in agricultural and urban areas. These habitats provide essential resources such as nectar, pollen, and shelter, which promote the survival and reproduction of various insect species (M'Gonigle et al., 2023). In addition, reducing pesticide use and adopting integrated pest management (IPM) practices can provide significant benefits to insect biodiversity. IPM strategies emphasize the use of natural predators, crop rotation, and biological control to manage pest populations, thereby minimizing reliance on harmful chemicals (Kremen & Miles, 2022).

Community engagement and education is also an important component of effective bioconservation efforts. Involving local communities in citizen science projects and conservation activities helps raise awareness about the importance of insects and empowers communities to contribute to biodiversity conservation (Hallmann et al., 2022). In addition, policies and regulations that support sustainable land use and protect habitats are essential for long-term conservation success. For example, recent legislative efforts in various countries have focused on protecting

pollinator habitats and reducing the use of neonicotinoids, a class of pesticides known to harm bees and other beneficial insects (Woodcock et al., 2023). These combined efforts highlight the importance of an integrated approach to conserving insect biodiversity that involves ecological practices, community participation and supportive policies.

Overall, these values indicate that Tiger Camp, Padang, has a diverse, balanced and stable insect ecosystem that can support a variety of insect species with evenly distributed populations and without excessive dominance. These findings emphasize the importance of maintaining existing habitat conditions at Tiger Camp to support insect species diversity and balance. Conservation efforts should focus on maintaining natural habitats and preventing environmental degradation. Continuous monitoring is needed to ensure that this diversity and balance is maintained, as well as to detect and respond to ecological changes that may occur.

### Conclusion

High insect diversity is a key indicator of a stable ecosystem. This stability is characterized by an even distribution of individuals among species (high E values), low dominance (low D values), and a high number of species and families. Factors such as habitat quality, healthy ecological interactions, resistance to disturbance, and natural controls all contribute to ecosystem stability. Stable ecosystems are more resistant to change and able to maintain their ecological functions sustainably, making the conservation and maintenance of these habitats extremely important.

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