

Diversity of butterflies (Lepidoptera: Papilionoidea) in pelangai kaciak, West Sumatra, Indonesia

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Abstract

Butterflies play a vital role in natural ecosystems as agents of plant pollination and bioindicators of environmental change. Butterfly species richness may be declining due to increasing deforestation and forest conversion. This study aims to identify the diversity of butterflies found in Pelangai Kaciak, West Sumatra, Indonesia. Sampling was carried out in August 2024. The butterflies were caught using insect nets method. A total of 265 individuals were obtained consisting of 46 species belonging to 35 genera and five families. The largest number of species found in the Nymphalidae family (23 species), followed by Pieridae (eight species), Papilionidae (six species), Hesperidae (five species), and Lycaenidae (four species). The most common species found was *Junonia atlites* from the Nymphalidae family. Among the 46 butterfly species obtained, there was one species, namely *Troides amphrysus*, one of the protected butterfly species in Indonesia. The results of butterfly identification show high diversity in the area research. The results of the butterfly identification showed high diversity in the area.

Keywords: Biodiversity, bioindicator, butterfly, lepidoptera, pollinator

Introduction

Butterflies (Lepidoptera: Papilionoidea) are a large group in the class Insecta (insects) group Endopterygota which have an important role in nature as pollinators of flowering plants, food sources for other animals, and bioindicators of natural ecosystem. The Lepidoptera order is included in the top three orders with the most species, after Coleoptera and Diptera (Scudder, 2017) [11]. Butterflies as a group originate in the tropic and experience the most speciation in tropical regions such as Neotropic, Palearctic, Australasia, and Indomalaya. Those speciation events caused butterfly diversity to have an equatorial band of high diversity flanked by northern and southern lower diversity regions. (Kawahara *et al.*, 2023) [4]. Butterflies can be found in various lowlands and highlands of all continents except Antarctica. The butterfly group has around 18,000 species in nature, with around 2,000 species found in Indonesia (Mitter & Cummings, 2017) [6].

Endemic species that can only be found in Indonesia reach more than 35% of the total species. Around 890 butterflies species can be found on the island of Sumatra. The butterfly family that is most commonly found in Sumatra is Nymphalidae, which is the butterfly family with the most species in the world (Pratiwi & Dahelmi, 2019) [8]. On the island of Sumatra, high butterfly diversity can be found with the highest biodiversity in primary rainforests. Meanwhile, land highly disturbed by human activities such as agricultural land have the fewest number of butterfly species. Primary tropical rainforest with diverse plant species and extensive vertical stratification end up having a wide variety of butterfly species (Muhelni *et al.*, 2016) [7].

Butterflies are holometabolous insects so that their larval forms are very different from their adult forms. Lepidoptera has a long history of coevolution with flowering plants, most adult butterflies are nectar feeders, with some species being generalists in their flower preferences while other species are specialists with narrow flower choices. Flower characteristics such as color, shape, and size greatly

influence butterflies in choosing food sources because their ability to access flower nectar also depends on the length of the proboscis, visual, and olfactory abilities. As herbivorous insects, butterflies are common prey for many insectivore species (Rusman *et al.*, 2016) [9].

Butterflies have other food sources besides their most famous food source, flower nectar. Animal carcasses, mineralized mud, and rotten fruits are some of the food sources that butterflies often visit (Bibas *et al.*, 2021) [1]. Many species of butterflies, particularly the male seek out nutrients in certain moist substances such as mud, wet soil and sand, dung and urine of mammals, animal carcasses and other decaying materials. They obtain sodium and amino acids from those fluids. Many species of butterflies also puddle on the river banks to suck sodium and amino acid from the moist mud (Suwarno *et al.*, 2019) [13]. Butterflies can be divided into three large groups based on their preferred food (feeding guild), namely, nectar-feeders, fruit-feeders, and omni-feeders. The presence of butterflies in a place is influenced by various factors such as the composition of plant species, water availability, temperature, pollution, and sunlight. Butterflies can survive in a temperature range of 18°C to 38°C. The highest butterfly diversity can be found in tropical rainforests that are not disturbed by human activities according to the factors above (Gulo *et al.*, 2020) [3].

High butterfly diversity, especially in tropical areas, can be used as an indicator of environmental health. Butterflies are highly dependent on healthy plant nutrient sources, such as nectar, so environmental changes can rapidly affect butterfly populations. Environmental degradation such as pollution from mining and industrial activities cause a general decline in animal diversity, but butterfly diversity is declining more rapidly. Climate change also threatens butterfly diversity (Wiranti *et al.*, 2019) [15]. Butterfly distribution and abundance depends on variations in weather for the short-term as well as alterations and disturbances in habitat quality. Abundance of butterflies is tightly tied to abiotic factors such as temperature and humidity, making butterflies

important environmental bioindicators (Suwarno *et al.*, 2019) [12]. Habitat destruction and fragmentation due to human development have caused a decline in butterfly populations worldwide, including in Indonesia (Chowdhury *et al.*, 2017) [2].

The research location was in Pelangai Kaciak, West Sumatra, Indonesia. Pelangai Kaciak is located in the western part of Bukit Barisan which includes lowlands and highland tropical forests with an altitude of around 1,600 meters above sea level. Pelangai Kaciak follows the Batang Pelangai Kaciak river basin which has its headwaters in Bukit Barisan and is still within the Kerinci Seblat National Park area until the river joins with the Batang Pelangai Gadang river.

The objectives of this research are to determine the butterfly species that can be found in Pelangai Kaciak and the biological index between butterfly species in Pelangai

Kaciak. The results of this research are expected to provide information about the species of butterfly, species composition, and diversity of butterflies in Pelangai Kaciak, West Sumatra, Indonesia.

Material and Methods

Study Area

The field work was conducted in Pelangai Kaciak, West Sumatra, Indonesia (1°48'10.0"S 100°52'25.0"E) (Figure 1). Air temperature ranges from 26-33°C and humidity at 53-84%. Butterfly sampling in the field used the insect net method in the morning and evening. All samples were then analyzed at the Animal Taxonomy Laboratory, Department of Biology, Andalas University. The research was carried out from August to November 2024. This study used a descriptive quantitative method with an observational approach.

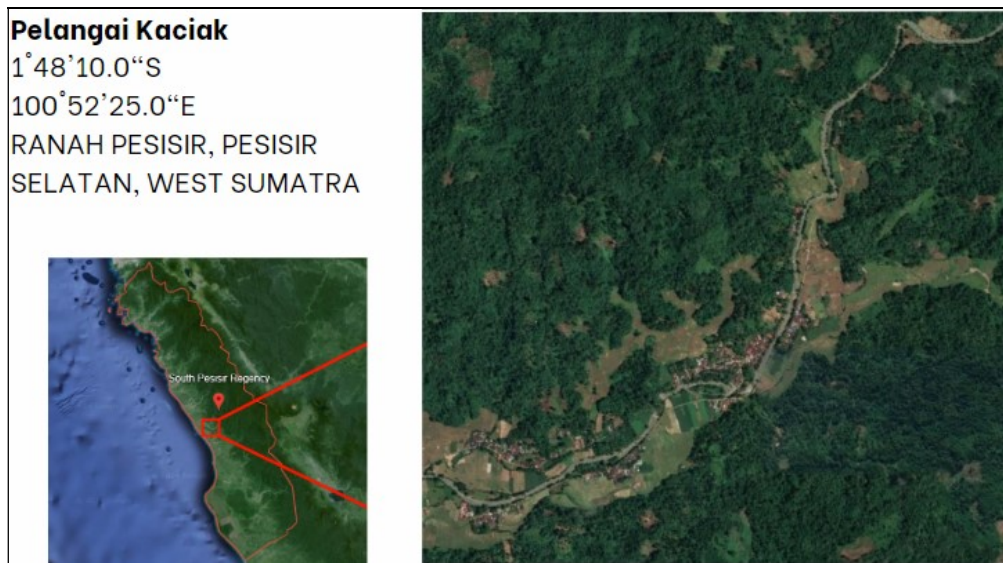


Fig 1: Location of Pelangai Kaciak, West Sumatra, Indonesia (Google Earth, 2025)

Research Procedure

In the Field

The research was conducted in the land along the Batang Pelangai Kaciak River, West Sumatra. Butterfly sampling was carried out using the transect walk method in the research area. Potential specimens were directly captured with insect nets. Butterfly specimens were preserved using standard protocols (Salmah *et al.*, 2002) [10]. The preserved specimens were pierced in the thorax using insect needles. The wings were positioned open and held with the help of plastic sheets arranged with several needles on styrofoam.

In the Laboratory

The collected samples were taken to the Animal Taxonomy Laboratory for species identification of each individual. Butterfly samples were photographed and then measured. The specimens were dried in an insect oven at a temperature of 36-40°C for 3-7 days. After completely dries, the butterflies will be placed in a collection box and labeled accordingly. Photographs were taken using a digital camera. The photo of representative species was prepared using photo editing software. Butterflies were identified using the iNaturalist website and a butterfly identification reference book (Tsukada, 1991) [14].

Data Analysis

Data analysis was carried out using biological indices in the form of diversity index (Shannon Wiener) following $H' = -\sum P_i \ln P_i$ (Σ =sum of P_i =the proportion of the entire community made up of species i multiplied by $\ln P_i$ =natural log of P_i) with $H' > 3$ indicating high diversity. Evenness index is calculated using $J' = H'/\ln S$ formula (H' =diversity index value divided by $\ln S$ =natural log of total number of unique species), nearer to 1 being maximum evenness. Simpson index is $D_s = 1/(\sum n(n-1)/N(N-1))$ formula, Σ =sum, n =number of individuals, and N =individuals total number (Magurran, 2004) [5]. This aims to quantitatively determine the composition of butterfly species at the research location.

Result and Discussion

The research successfully identified various types of butterflies from five main families. The sampling process was carried out by the active insect nets method. Through this method, it was the presence of five main butterfly families that were successfully captured and identified, namely Hesperidae, Lycaenidae, Nymphalidae, Papilionidae, and Pieridae.

Using the insect net method, the Hesperidae family, five genera were found with five different species, with a total of six individuals (2,3%). The Lycaenidae family consists of

four genera and four different species, with a total of 24 individuals (9,1%). Meanwhile, the Nymphalidae family showed the highest diversity, covering 18 genera with 23 identified species and a total of 159 individuals (60%). The Papilionidae family consists of three genera and six species, with a total of 15 individuals (5,7%). Finally, the Pieridae family consists of five genera with eight different species and 61 individuals (23%) (Table 1, Figure 2).

Table 1: The butterfly species obtained in Pelangai Kaciak, West Sumatra, Indonesia.

Family	Species	Number of Individuals
I. Hesperidae	1. <i>Notocrypta paralyos</i>	1
	2. <i>Polytremis lubricans</i>	1
	3. <i>Potanthus omaha</i>	2
	4. <i>Tagiades japetus</i>	1
	5. <i>Udaspes folus</i>	1
	Subtotal 6	
II. Lycaenidae	6. <i>Catochrysops panormus</i>	2
	7. <i>Jamides alecto</i>	20
	8. <i>Lampides boeticus</i>	1
	9. <i>Nacaduba berenice</i>	1
	Subtotal 24	
III. Nymphalidae	10. <i>Acraea terpsicore</i>	6
	11. <i>Amathusia phidippus</i>	1
	12. <i>Athyma perius</i>	2
	13. <i>Cupha erymanthis</i>	2
	14. <i>Danaus melanippus</i>	1
	15. <i>Discophora sondaica</i>	1
	16. <i>Doleschallia bisaltide</i>	1
	17. <i>Euploea tulliolus</i>	1
	18. <i>Hypolimnas anomala</i>	2
	19. <i>Hypolimnas bolina</i>	20
	20. <i>Ideopsis vulgaris</i>	4
	21. <i>Junonia almana</i>	12
	22. <i>Junonia atlites</i>	42
	23. <i>Junonia hedonia</i>	7
	24. <i>Junonia iphita</i>	1
	25. <i>Junonia orithya</i>	5
	26. <i>Melanitis leda</i>	6
	27. <i>Mycalesis mineus</i>	23
28. <i>Neptis hylas</i>	17	
29. <i>Parantica aspasia</i>	1	
30. <i>Pantoporia paraka</i>	1	
31. <i>Phalanta phalantha</i>	2	
32. <i>Tanaecia munda</i>	1	
	Subtotal 159	
IV. Papilionidae	33. <i>Graphium agamemnon</i>	1
	34. <i>Graphium sarpedon</i>	2
	35. <i>Papilio demoleus</i>	6
	36. <i>Papilio nepheles</i>	1
	37. <i>Papilio polytes</i>	4
	38. <i>Troides amphrysus</i>	1
	Subtotal 15	
V. Pieridae	39. <i>Appias libythea</i>	23
	40. <i>Appias lyncida</i>	1
	41. <i>Catopsilia pomona</i>	7
	42. <i>Catopsilia pyranthe</i>	6
	43. <i>Catopsilia scylla</i>	2
	44. <i>Eurema sari</i>	15
	45. <i>Letopsia nina</i>	6
	46. <i>Phrissura cynis</i>	1
	Subtotal 61	
	Total Species	46
	Total Individual	265

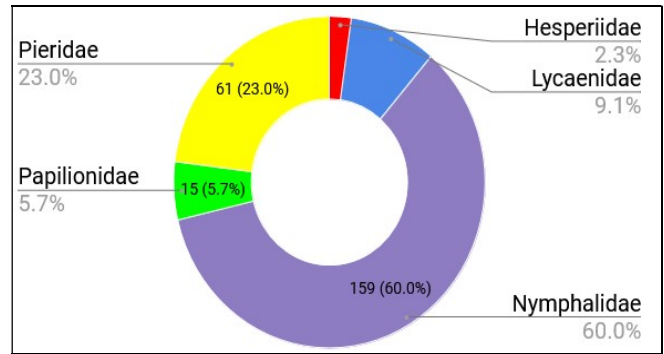


Fig 2: Number of individuals and percentage of each butterfly family captured using insect nets

The butterfly family most commonly found in Pelangai Kaciak is Nymphalidae, which itself is the butterfly family with the most species in the world (Pratiwi & Dahelmi, 2019) [8]. The fewest individuals are members of Hesperidae. At the species level, the three highest number of individuals are *Junonia atlites* (42), *Mycalesis mineus* (23), and *Appias libythea* (23). Species with the highest number of individuals in Nymphalidae is *Junonia atlites*, the most numerous species in the biggest family. The tied in position of second most numerous species, *Appias libythea*, is the most commonly found species in the family Pieridae. Lycaenidae has *Jamides alecto* as its most common representative. Papilionidae is often represented by *Papilio demoleus*. The only species in Hesperidae which is not a singleton is *Potanthus omaha*. Twenty species were only found from a single individual. The total number of butterfly individuals from all families are 265 and the total number of species are 46 species (Table 1). These results indicate the high diversity of butterflies in the Pelangai Kaciak (Rusman *et al*, 2016) [9].

Table 2: Recapitulation of biological Index from butterfly identification data obtained through capture using insect net

Parameter Index	Values
Shannon-Wiener Diveristy Index	3.102
Evenness Index	0.810
Simpson Index	0.933

The species obtained with insect nets were 46 species from 35 genera and individual butterflies obtained with insect nets were 265. The analysis of the butterfly community captured using an insect net in Pelangai Kaciak indicates a high level of diversity (Table 2). The diversity index from the identification of butterflies caught by insect nets was 3.102, denoting Pelangai Kaciak having high butterfly diversity. The evenness index was 0.810, pointing to no single species heavily dominating the area. The Simpson index value is 0.933, which indicates a high probability that two randomly selected individuals belong to different species, signifying a highly diverse butterfly community. Overall, the butterfly community in Pelangai Kaciak exhibited a well-balanced structure with high species diversity and low species dominance, as can be seen from the representative species from each family obtained (Figure 3). This suggests that the ecosystem at the study site can support butterfly diversity, providing environmental conditions that allow various species to thrive. One of Indonesia's protected butterfly species found in Pelangai Kaciak is *Troides amphrysus*. Only one individual

was found. Research by Rusman *et al.* (2016)^[9] found five individuals of this species on Mount Sago, West Sumatra. Yolanda & Purnama (2016)^[16] also found eight individuals of this *Troides amphyrus* species in Rokan Hulu District, Riau Province, Sumatra.



a. *Junonia atlites*



b. *Troides amphyrus*



c. *Appias libythea*



d. *Jamides alecto*



d. *Jamides alecto*

Fig 3: Representatives of each butterfly family in Pelangai Kaciak, *Junonia atlites* (Nymphalidae), *Troides amphyrus* (Papilionidae), *Appias libythea* (Pieridae), *Jamides alecto* (Lycaenidae), and *Notocrypta paralysos* (Hesperiidae)

Conclusion

Butterflies found in the Pelangai Kaciak area consist of 46 species, 35 genera from five families, namely Papilionidae, Hesperiidae, Pieridae, Nymphalidae, and Lycaenidae. Sampling using insect nets obtained high butterfly diversity in the area around the Pelangai Kaciak river. Therefore, further research is needed, especially with different capture methods. Further research is needed on the bioecology of butterflies found in this study, especially protected species such as *Troides amphyrus*.

Acknowledgements

We sincerely thank each and every member of the field crew, Adib Sutera Dewangga, Thania Valensia, Muhammad Farhan Aqsa, and Aqbal Bin Syafii, for their insightful ideas and dedication to the research. This study was funded by the financial funding provided by Universitas Andalas through Research Grant No: 119/UN16.19/PT.01.03/ PSS/2024 on behalf of Dahelmi.

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