

## **Diversity of Butterflies in The Papilionoidea Superfamily (Lepidoptera) in Residential Areas Of Jambi City**

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**Abstract.** Butterflies are species with various benefits at each level of ecological niches, including their role as environmental quality bioindicators. The presence of human settlements poses a challenge to maintaining the sustainability of various species, including butterflies. This research aims to determine the diversity and dominance of butterfly species in residential areas in Amuntai, Kota Jambi. Data collection was conducted using an exploratory method by exploring the research location once a week in the morning for two months. In this study, 8 butterfly species were found from 2 families, namely Pieridae consisting of 3 species (*Leptosia nina*, *Eurema hecabe*, *Appias libythea*) and Nymphalidae consisting of 5 species (*Neptis hylas*, *Elymbias nesaea*, *Junonia hedonia*, *Junonia orithya*, *Junonia atlites*) with H' value of 1.97 and D value of 0.15.

**Key words:** Butterfly, bioindicator, habitat, pollinator, biodiversity

### **INTRODUCTION**

Indonesia possesses a high biodiversity of butterflies globally, ranking second only to Brazil. The butterflies found in Indonesia comprise approximately 2,000-2,500 species

out of the total 17,500 species, with some being listed on the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List as protected species [1].

Butterflies belong to the insect group known as Lepidoptera, signifying insects

whose entire body surface is nearly covered by scales, imparting patterns and colors to their wings. Butterflies are among the most well-known and frequently encountered insect types due to their beautiful and diverse forms and colors. Generally, they are diurnal, meaning they are active during the daytime [2].

Insects are anthropocentrically categorized as beneficial or harmful, aligning with their roles within each ecological niche. Butterflies represent a category of insects that provide benefits across various ecological niches. Apart from serving as pollinators, butterflies also function as bioindicators of environmental health [3]. Butterflies play a significant role in ecological processes, serving as excellent ecological bioindicators in the living environment [4] due to their sensitivity to habitat degradation and climate change. Additionally, butterflies contribute as pollinators, playing a role in maintaining ecosystem balance [1].

Butterflies have significant value for humans in terms of economic, ecological, aesthetic, educational, conservation, and cultural aspects. The presence of butterflies as pollinators helps maintain ecological balance. Meanwhile, the biodiversity of butterflies in a habitat can be used as a bioindicator of habitat damage due to their

sensitivity to environmental changes [5]. Diverse species of butterflies can be found in various places at different ecological levels, ranging from forests, coastlines, plantations, rice fields, to residential areas. This research was conducted using purposive sampling, determining the research location based on specific objectives, namely, in the residential area of Amuntai Kota Jambi, which still has various flowering plants and green open spaces.

## **MATERIALS AND METHODS**

This research was conducted over a two-month period in June-July 2021 in the Amuntai Residential Area, Kota Jambi, utilizing an exploratory method by exploring the research location for butterfly data collection once a week during the specified period from 08:00 AM to 11:00 AM. The tools employed in this study included an insect net, hand counter, papillote paper, killing bottle, and drying box. The materials used in this research comprised 10% chloroform, cotton, and pieces of rubber bands inserted into the killing bottle.

Recordings of collected butterflies included each known species identified by its specific name and unidentified species, with each unidentified butterfly species being placed into papillote paper for temporary

storage before undergoing the preservation process for identification using the spreading setting method and drying for 12 hours in a drying box [3]. Butterfly identification was carried out using determination books by Peggi & Amir (2006) [8] and Borror et al. (1992) [9].

Data analysis employed the Shannon-Wiener diversity index to ascertain the biodiversity of butterfly species and the Simpson index to determine butterfly species dominance. The species diversity index was computed using the Shannon-Wiener formula ( $H' = - \sum p_i \ln p_i$ ), where  $H'$  represents the Shannon-Wiener diversity index, and  $p_i$  denotes the proportion of the  $i$ -th species in the total sample [3]. The species dominance index was calculated using the formula

Simpson Index (C)

$$C = \sum_{i=1}^s \left[ \frac{n_i}{N} \right]^2$$

Note:

C: Simpson's dominance index

$n_i$ : number of individuals of the  $i$ -th species

$N$ : total number of individuals

$S$ : number of genera

## RESULTS AND DISCUSSION

In this study, 8 butterfly species were identified from 2 families, namely Pieridae, consisting of 3 species (*Leptosia nina*, *Eurema hecabe*, *Appias libythea*), and Nymphalidae, consisting of 5 species (*Neptis hylas*, *Elymbias nesaea*, *Junonia hedonia*, *Junonia orithya*, *Junonia atlites*).

Taxon	Species	Agregate Number of Individuals
Lepidoptera	<i>Leptosia nina</i>	4
Pieridae	<i>Eurema hecabe</i>	10
	<i>Appias libythea</i>	9
Lepidoptera	<i>Neptis hylas</i>	8
Nymphalidae	<i>Elymbias nesaea</i>	2
	<i>Junonia hedonia</i>	3
	<i>Junonia orithya</i>	8
	<i>Junonia atlites</i>	5
Individual Total		49
Species Total		8
Indeks Shannon-Wiener ( $H'$ )		1,97
Indeks Simpson (D)		0,15



B



A

*Junonia orithya* (A) Dorsal; (B) Ventral  
(Papilionoidae: Nymphalidae)



*Appias libythea* (Papilionoidae: Pieridae)

The results of species diversity analysis with the Shannon-Wiener index ( $H'$ ) indicate that the butterfly species diversity in Amuntai Housing, Kota Jambi is categorized as moderate, with  $H' = 1.97$ , and possesses the index ( $D$ ) of 0.15. The range of values for the Simpson index ( $D$ ) is between 0 and 1. In the analysis, as the Simpson index approaches 0, the number of individuals of each species is relatively equal to the number of individuals of other species. Conversely, if the analysis result approaches 1, it signifies the dominance of one species with a higher number of individuals [1].

In this study, numerous species were identified from the Nymphalidae family. The Nymphalidae family, in general, has a widespread distribution, especially in well-lit areas with sufficient sunlight, such as plantation areas. Members of this family exhibit active and swift butterfly characteristics. The Nymphalidae family has a broad food preference, feeding on various

plant species from different families, including Annonaceae, Asteraceae, Moraceae, Rubiaceae, and Anacardiaceae. This is attributed to the polyphagous nature of Nymphalidae species, which have a preference for multiple plant species [5]. This characteristic facilitates the widespread occurrence of butterfly species from the Nymphalidae family in various habitats, including residential areas.

Furthermore, the family of Asteraceae plants represents the most favored type of plants by butterflies of the Nymphalidae family [1]. This is attributed to the nectar content produced by these plants, ranging from 2.3% to 56.5% fructose, 3.2% to 67.3% glucose, and 0% to 90.3% sucrose [6].

In the Pieridae family, only three species were found in this study. According to Roland (2006), members of the Pieridae family are active species in the pollination process of ornamental plants. Some host plants for Pieridae species include Cappmaceae, Asteraceae, Capparidaceae, Fabaceae, and Loranthaceae [10].

The low diversity index of butterflies in this residential environment is due to the limited availability of food preferences for butterflies, especially flowering plants that provide nectar for pollinators. The results of this study indicate that the ecosystem stability with butterfly bioindicators in

Amuntai Kota Jambi housing is low. This aligns with the research by Van Vu & Quang Vu (2011), which indicates higher ecosystem stability in secondary forests compared to residential areas [11]. However, research conducted by Sumah & Apriniarti (2019) shows that the  $H'$  analysis results in residential areas are  $H' = 3.16$  and in secondary forests,  $H' = 3.34$ . Biodiversity in secondary forests is higher compared to residential areas, possibly due to the greater availability of food in secondary forests compared to residential areas [7].

The results of our study align with the research conducted by Sumah & Apriniarti (2019). The analysis indicates that the  $H'$  index in our study has a value of only 1.97 [7]. This demonstrates a highly significant difference when compared to research conducted in secondary forests. The availability of food emerges as a determinant of butterfly species diversity in each location. This suggests that ecosystem stability is notably higher in forested areas compared to residential areas, as indicated by butterfly bioindicators.

## CONCLUSION

A total of 8 butterfly species from 2 families, namely Pieridae consisting of three species, *Leptosia nina*, *Eurema hecabe*,

*Appias libythea*, and *Nymphalidae* consisting of five species, namely *Neptis hylas*, *Elymbias nesaea*, *Junonia hedonia*, *Junonia orithya*, *Junonia atlites*. The low biodiversity index in these butterflies is attributed to the limited variety of plant species in the residential environment that can serve as attractants for butterfly species. However, the availability of wild plants can serve as an alternative food source for butterflies.

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