



Butterfly Diversity (Lepidoptera: Papilionoidea) on Balak Island, Lampung Bay, Indonesia: Potential for Ecotourism and Conservation

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Abstract. Balak Island is located in Pedada Bay, Pesawaran Regency, Lampung Province, Indonesia, which is very close to various leading marine tourism destinations in Lampung. This island has a sloping beach and white sand with a hilly land topography with a maximum height of 84 meters above sea level and partly flat, making it suitable as an ecotourism location, with one of the existing biodiversity being butterflies (Lepidoptera: Papilionoidea). The aim of this research is to inventory the diversity of butterflies on Balak Island to be developed into ecotourism and conservation. Butterfly observations were carried out using the exploration method combined with the Visual Encounter Survey (VES). This observation used a camera for documentation and the observation time started from 08.00 WIB - 11.00 WIB and 14.00 WIB - 17.00 WIB or during the active butterfly hours so that it was possible to find various types of butterflies. There are 3 Families, including 4 types of Papilionidae, 5 types of Nymphalidae, and 3 types of Pieridae. Of the 12 types of butterflies found, one of them is a protected butterfly, namely *Troides helena*.

Keywords: papilionoidea, butterflies, ecotourism.

1 Introduction

Balak Island is administratively located in Pedada Bay and is part of Marga Punduh District, Pesawaran Regency, Lampung Province, Indonesia or at coordinates East: 519960.11 m E; North: 9363931.52 m S, WGS 84 Zone 48 South. This island is located close to the leading tourist islands in Lampung province. Balak Island has a sloping beach with white sand, while the topography on the land is hilly with a maximum height of 84 meters above sea level and partly flat.

Butterflies are insects belonging to the Lepidoptera order with the characteristic of scaly wings. These scales contain pigments that give color to the wings and body surface of butterflies (Ruslan et al., 2019). The striking characteristic is the color pattern that contrasts with the environment of its life cycle (Aziz, 2022), so that it attracts attention because of the beauty of its physical form and colors. In Indonesia, there are around 2,000 species of butterflies, including 26 protected species. Some of them are

even included in the IUCN Red List and their trade is regulated through CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (Setiawan et al., 2018).

The potential for butterfly diversity in an area can be utilized for the development and preservation of biodiversity through ecotourism activities. Ecotourism is a form of tourism that is closely related to the principle of conservation by maintaining the integrity and authenticity of its ecosystem (Adharani et al., 2020). Butterflies are one of the attractions of ecotourism because of their unique shapes and colors, interesting behavior, and different flight patterns (Dalem, 2021). Based on this, this study aims to inventory the diversity of butterflies on Balak Island to be developed into ecotourism and conservation. By knowing the diversity of butterflies in an area, it can be used as an object for planning butterfly ecotourism in the form of wildlife tourism. Through this activity, it is hoped that the existence of butterflies and their ecosystem can be preserved.

2 Method

The research was conducted in October 2024 on Balak Island, Lampung Province, Indonesia. Observations were made by conducting exploration and the Virtual Encounter Survey (VES) method.

3 Results and Discussion

The results of this study found 3 families, including 4 species from the Papilionidae family, 5 species from the Nymphalidae family, and 3 species from the Pieridae family (Table 1).

Table 1. Table captions should be placed above the tables.

Family	Species	Common Name
Papilionidae	<i>Troides helena</i>	<i>Common Birdwing</i>
	<i>Graphium agamemnon</i>	<i>Tailed Jay</i>
	<i>Papilio peranthus</i>	<i>Sunda Swallowtail</i>
	<i>Pathysa antiphates</i>	<i>Five-bar Swordtail</i>
Nymphalidae	<i>Danaus melanippus</i>	<i>White Tiger</i>
	<i>Grey glassy Tiger</i>	<i>Ideopsis juvena</i>
	<i>Mycalesis horsfieldi</i>	<i>Horsfield's Brushbrown</i>
	<i>Sailer</i>	<i>Neptis sp.</i>
	<i>Dward Crow</i>	<i>Euploea tulliolus</i>
Pieridae	<i>Common Emigrant</i>	<i>Catopsilia pomona</i>
	<i>Grass Yellow</i>	<i>Eurema sp.</i>
	<i>Stripped Albatross</i>	<i>Appias olferna</i>

The results of the study showed that Balak Island has a fairly high diversity of butterflies for an island with an area of about 25 hectares. Three families were found, namely Papilionidae, Nymphalidae, and Pieridae. The existence of these butterflies shows that Balak Island has an ecosystem that still supports the survival of various butterfly species. This is in line with the research of Aguirre-Gutiérrez et al. (2017) which states that vegetation diversity contributes greatly to insect diversity, including butterflies. Between one type of butterfly and another butterfly have different habitat needs and food sources. With the diversity of butterflies found, it can be an indicator of good habitat conditions on Balak Island. Plants that are sources of nectar for butterflies found on Balak Island include *Lantana camara*, *Ixora javanica*, *Clerodendrum peniculatum*. However, further analysis is still needed regarding the diversity of plants on the island that support the life of butterflies.

Based on the findings of this study, there is one protected butterfly species, namely *Troides helena*. This species is one of the species included in the CITES Appendix II list since 1979 (Soehartono & Mardiasuti, 2003). This butterfly has been protected in Indonesia by the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. P.106 / MENLHK / SETJEN / KUM.1 / 12/2018. This species is also included in the CITES (Convention of International Trade in Endangered Species) Appendix II list, so this butterfly cannot be traded unless it comes from captivity (CITES, 2019). With this status, conservation efforts are needed to maintain the existence of this species in nature. According to Sharma & Kumar (2022) species that are members of the Papilionidae family such as *Troides Helena* require special plants as a food source in the larval phase, including *Aristolochia tagala* from the Aristolochiaceae family.

Temperature, humidity, and light intensity affect the daily activities of butterflies. According to Irni et al. (2016), butterflies are more active in the morning (08.00 - 11.00 WIB) and afternoon (14.00 - 17.00 WIB). On Balak Island, this activity pattern was also observed, where the number of individuals found was higher in the morning compared to the afternoon, possibly due to more optimal temperatures and higher nectar availability at that time.

Efforts to develop ecotourism and butterfly conservation can be carried out on this island by enriching the diversity of plants as a source of nectar and hosts for butterfly larvae. Diverse vegetation provides a food source for butterfly larvae and adults. The presence of flowering plants is very important because adult butterflies depend on nectar as their main source of energy. Butterfly observation tours can be a special attraction for tourists who are interested in natural beauty and biodiversity. A study by Sharma & Kumar (2022) stated that biodiversity-based ecotourism can increase public awareness of the importance of conservation while providing economic benefits to local communities. However, human activities such as massive and environmentally unfriendly tourism activities can reduce the butterfly population (Setiawan et al., 2018). On Balak Island, although the level of human disturbance is still relatively low, increased tourism activities without proper management have the potential to threaten the sustainability of butterfly habitat in the future, therefore further management is needed to maintain the sustainability of butterflies on the island.

Butterfly conservation on Balak Island must be carried out in an integrated manner, considering their ecological role as pollinators and indicators of ecosystem health (Vickery, 2010). Based on the results of the study, several species found on Balak Island, such as *Troides helena*, are included in the protected category by CITES and IUCN. Therefore, conservation steps

can be taken on this island, including protecting natural habitats, monitoring butterfly diversity and populations regularly, and conducting public awareness campaigns.

4 Conclusion

This study shows that Balak Island has a fairly high diversity of butterflies, namely 12 species divided into three families, one of which is a rare protected butterfly, namely *Troides Helena*. With this uniqueness, butterflies on Balak Island have the potential to become a biodiversity-based tourist attraction.

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