

I. INTRODUCTION

1.1 Research Background

Insecta is a class under phylum Arthropoda with the highest level of species diversity to be found inside kingdom Animalia. There are around 800.000 described species of insects on Earth. Among 29 orders inside the Insecta class, Coleoptera, Lepidoptera, Diptera, and Hymenoptera are the four most speciose insect orders (Scudder, 2017). Order Lepidoptera itself originated in the Jurassic, at the middle of Mesozoic. The high diversity associated with lepidopterans arose alongside diversification of Angiosperms during the Cretaceous, before the extinction of non-avian dinosaurs. This coevolution made moths and butterflies important pollinators for flowering plants (Goldstein, 2017).

Papilionoidea is a clade under order Lepidoptera containing lepidopterans we commonly called as butterflies. This clade alone contains around 18.000 described species of butterflies worldwide. Cladistically all butterflies are moths with adults that are almost always diurnal (Mitter *et al.* 2017). Butterflies are important insect pollinators and environmental bioindicators. Habitat destruction and fragmentation from human developments have caused the decline of butterfly populations worldwide (Chowdhury, 2017).

Butterflies are holometabolous insects and therefore their larvae are very different from the adult forms. As lepidopterans with a long history of coevolution with flowering plants, the vast majority of adult butterflies are nectar feeders, with some species generalists in their flower preferences while others are specialists with a strict palette of flowers. Flower characteristics such as colour, shape, and size highly influence butterflies in their choosing of food source as their abilities to access flower nectar are also dependent on their own proboscis length, visual, and olfactory capabilities. As herbivorous insects, butterflies are common prey targets for many other insectivorous species (Rusman *et al.*,

2016). Around two thirds of butterfly species worldwide feed on a single plant family, whereas around a third are generalists feeding on more than one plant family. Butterflies feeding on Poaceae and Fabaceae families are often specialist species only targeting one of these families. These two plant families are geographically widespread and abundant in almost every bioregion (Kawahara *et al.*, 2023).

There are 43 superfamilies under Order Lepidoptera. Superfamily Papilionoidea itself has seven families under it, Papilionidae (Swallowtails), Nymphalidae (Brush-footed butterflies), Lycaenidae (Gossamer-winged butterflies), Hesperiiidae (Skippers), Riodinidae (Metalmarks), Pieridae (Whites, yellows, sulphurs), and Hedyliidae (American moth-butterflies) (Triant *et al.*, 2018). Butterflies diverged from the rest of nocturnal moth groups that consisted of the vast majority of Order Lepidoptera around the middle Cretaceous. This origin left the relict of Family Hedyliidae, known as American moth-butterfly because of its members having blended characteristics of butterflies and moths with limited distribution in Central and South America (McCullagh *et al.*, 2020). Butterflies as a group originate in the tropic and experienced the most speciation in tropical bioregions 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).

High species diversity of butterflies, especially in tropical regions, can be used as an indicator for environmental health. Butterflies are highly dependent on a healthy plant source of nutrient, such as its nectar, so adverse changes in an environment quickly cascade through the butterfly population. Environmental degradation such as pollution from mining and industrial activities quickly set animal diversity into general decline, but butterfly diversity declines even more surreptitiously. The warming of an environment because of climate change also puts butterflies in distress. High temperatures cause havoc

inside butterfly metabolism. All species of butterfly are poikilothermic and therefore depend on their surrounding temperature (Wiranti *et al.*, 2019). Butterflies use a much broader spectrum of food sources, outside of the main source of sipping nectar from flowers. Decaying carcasses, mineral mud, and rotten fruits are among the list of food sources that are commonly frequented by butterflies. Degradation and fragmentation in a butterfly habitat, contrived access to those various sources of food (Bibas *et al.*, 2021).

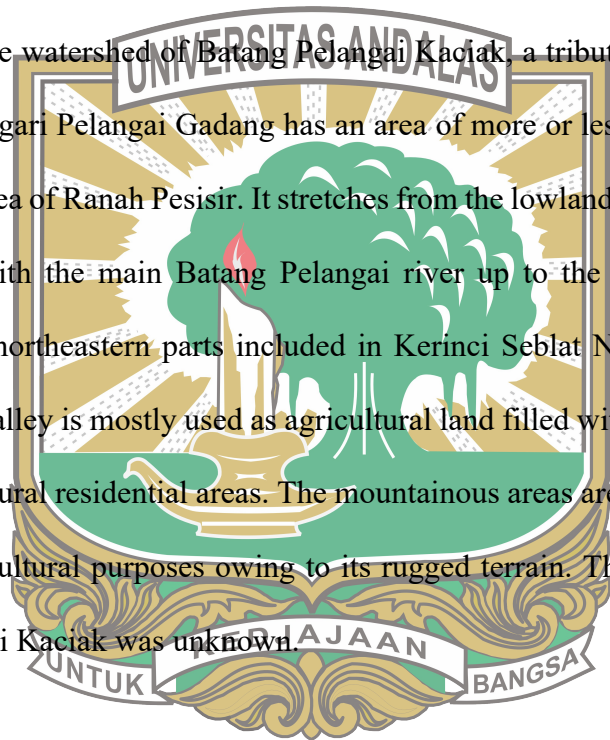
Indonesia is among the mega biodiversity countries in the world with a high diversity of animal and plant species, including a large diversity of butterflies, estimated to be around 2,000 species. Maintaining the existence of high diversity of butterfly species has various benefits for research, education, tourism, and conservation of nature. Diverse factors of the Indonesian archipelago result in disparate environmental conditions in each part of the region. Temperature, humidity, rainfall, and light intensity along with vegetation and predators, creates the difference in habitat type and resident species, including butterflies, with its different species having their own distribution reach across the archipelagic region (Amanda *et al.*, 2021).

Among the types of habitats in the tropical island that is Sumatra, butterfly diversity is highest in primary forest, while heavily disturbed lands such as farmland have the lowest number of butterfly species. Some butterfly species prefer to fly near the surface of the ground, while other species prefer the tree canopy according to their preferred food source and host plant, which made old growth forest with diverse plant species and wide vertical stratification rich in butterfly species (Muhelni *et al.*, 2016).

Continental islands that got cut off from its mainland because of rising sea level at the of the Ice Age, like Sumatra, Borneo, and Java, harbour only fractions of mainland Asia biota. These stranded mainland species have important consequences for the ecological processes affecting community structure of those islands. Therefore,

geographical history and historical happenstance play an important role in the species composition of the islands. Islands generally support fewer species than their mainlands, mainly as the result of their smaller landmass and fewer resources available. Dispersal of species and environmental characteristics of islands, including climate and geography, determine the chance that a species colonises and thrives. It has often been postulated that lower species richness on islands yields species with broader niches and increased density (Luk *et al.*, 2011).

Pelangai Kaciak is a nagari located in Ranah Pesisir, Pesisir Selatan, West Sumatra. Its area follows the watershed of Batang Pelangai Kaciak, a tributary of the main Batang Pelangai river. Nagari Pelangai Gadang has an area of more or less 119,64 km², around a fifth of the total area of Ranah Pesisir. It stretches from the lowland where Batang Pelangai Kaciak merges with the main Batang Pelangai river up to the western edge of Bukit Barisan, with its northeastern parts included in Kerinci Seblat National Park. The low-lying watershed valley is mostly used as agricultural land filled with rice paddies and corn fields divided by rural residential areas. The mountainous areas are still covered by forest, not used for agricultural purposes owing to its rugged terrain. The diversity of butterfly species in Pelangai Kaciak was unknown.



1.2 Research Problem

The problems of this research are as follows:

1. What are the butterfly species found in Pelangai Kaciak?
2. What is the biological index (Shannon-Wiener diversity index, dominance index, Simpson's index, and evenness index) among butterfly species in Pelangai Kaciak?

1.3 Research Objective

The objectives of this research are as follows:

1. To determine the butterfly species found in Pelangai Kaciak.
2. To determine the biological index (Shannon-Wiener diversity index, dominance Index, Simpson's index, and evenness index) among butterfly species in Pelangai Kaciak.

1.4 Research Significant

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

