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Initial Checklist of Butterflies (Lepidoptera: Rhopalocera) in Punti Kayu Recreation Forest, Palembang, South Sumatra

INA APRILLIA[1*], OCTAVIA SUSILOWATI[2], DIAN MUTIARA[3] & MUHAMMAD IQBAL[1]

[1]*Department of Biology, Universitas Indo Global Mandiri, Jalan Jend. Sudirman No. 629, Palembang 30129, South Sumatra, Indonesia*
**Corresponding Author. E-mail: inaaprillia@uigm.ac.id; https://orcid.org/0000-0003-3531-2445*
E-mail: miqbal@uigm.ac.id; https://orcid.org/0000-0002-6657-0183
[2]*South Sumatra Natural Resources Conservation Center, Jl. Kol. H Burlian Km. 6 No. 79, Palembang 30153, South Sumatra, Indonesia*
E-mail: octavia.susilowati@gmail.com; https://orcid.org/0000-0002-8583-4105
[3]*Department of Biology, Universitas PGRI Palembang, Jl. Jend. A. Yani, Lorong Gotong Royong 9/10 Ulu, Palembang 30116, South Sumatra, Indonesia*
E-mail: dihartaa@gmail.com; https://orcid.org/0009-0001-4911-9622

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Abstract
The Punti Kayu Recreation Forest is a managed urban green space in Palembang City, South Sumatra Province, Indonesia. Over three survey periods in 2010, 2012, and 2019, a total of 16 butterfly species from five families were recorded. Surveys were conducted using opportunistic observations and photographic documentation of butterflies along walking transects inside the forest. The Nymphalidae family was the most dominant, with an increasing trend in species richness observed over time. The findings highlight the importance of urban green spaces for supporting butterfly diversity and emphasize the need for continued conservation efforts, including the creation of butterfly-friendly habitats and protection of existing green spaces.

Keywords: checklist, butterfly diversity, pine forest, Punti Kayu Recreation Forest, urban area.

Introduction

Indonesia is renowned for its rich biodiversity, with butterflies being one of the most fascinating and ecologically important groups of insects and arthropods (Shahabuddin *et al.,* 2005; Rachman *et al.,* 2024). As one of the world's biodiversity hotspots, Indonesia is home to over 2,500 species of butterflies, many of which are endemic to specific islands or regions (Peggie 2011, 2014). The country's unique geography and climate have created a variety of habitats that support a wide range of butterfly species (Tsukada & Nishiyama 1982, Parsons 1999, Vane-Wright & de Jong 2003).

Sumatra, one of Indonesia's largest islands, is known for its lush rainforests and diverse wildlife (Iqbal *et al*. 2021; Aprillia & Iqbal 2024). The island's butterfly fauna is particularly rich, with many species found nowhere else in the world (Setiawan *et al.* 2020; Iqbal *et al.* 2022). Sumatra's unique geography, with its mountain ranges and lowland forests, supports a wide range of butterfly habitats, from the tropical rainforests of the lowlands to the cloud forests of the highlands (Aprillia *et al.* 2018; Aprillia *et al.* 2020). Despite its importance, Sumatra's butterfly diversity remains understudied, particularly in urban areas. In recent years, there has been growing interest in the study of urban biodiversity, including butterflies (Iqbal *et al.* 2020; Aprillia *et al.* 2025).

Urban ecosystems in cities like Palembang, particularly the Punti Kayu Recreation Forest, provide a unique chance to discover the diverse butterfly populations thriving within them (Tzortzakaki *et al.* 2019; Han *et al.* 2022). These green spaces can serve as habitats for a variety of butterfly species, providing important ecosystem services and supporting urban biodiversity (Winarni *et al.* 2023; Aprillia *et al.* 2024). This study aims to contribute to our understanding of butterfly diversity in urban areas of Sumatra, with a focus on the Punti Kayu Recreation Forest in Palembang. By documenting the butterfly species found in this area, we can better understand the importance of urban green spaces for biodiversity conservation.

Methods

The study took place in the 50-hectare Punti Kayu Recreation Forest in Palembang, South Sumatra, Indonesia (Fig. 1), a managed urban green space with a mix of natural and planted vegetation (Figs. 2 and 3). Field surveys were conducted over three visits in 2010, 2012, and 2019 to observe, photograph, and identify butterflies based on their morphological features. The identification process was aided by relevant references on Sumatran butterflies.

Study Site. The study was conducted in the Punti Kayu Recreation Forest, Palembang, South Sumatra, Indonesia. The forest is a managed urban green space with a mix of natural and pine *Pinus merkusii* planted vegetation (BKSDA Sumsel 2025). The Punti Kayu Recreation Forest (02°56'S, 104°43'E) is situated in Alang-Alang Lebar Subdistrict (formerly Sukarami Subdistrict), Palembang City, South Sumatra Province, Indonesia. Established in 1985, this 50-hectare forest is divided into 38.8 hectares of terrestrial forest and 11.2 hectares of swampy area (Wijaya 1997). Historically, the forest was home to two small rivers, the Seluang and Kemang rivers, which appear to have vanished from the site (Iqbal *et al.* 2016).

Figure 1. The Punti Kayu Recreation Forest in Palembang, South Sumatra, appears to be surrounded by human settlements based on satellite imagery.

Sampling Period. Field surveys were conducted to collect data on the butterfly species present in the forest, and photographs were taken to document their morphological features. The sampling period for this study consisted of three visits to Punti Kayu Recreation Forest, conducted on 30 December 2010, 28 May 2012, and 15 November 2019. These surveys were conducted accidentally in relation to other ecological fieldwork activities, rather than as part of a continuous monitoring program. During these visits, butterflies were observed and photographed, and incidental observations were made to note their behavior and habitat preferences.

Species Identification. The butterfly from Punti Kayu Recreation Forest has been identified through a detailed examination of its morphological features including wing coloration and pattern, venation, and body characteristics such as antennae and palpi. This approach allows for accurate classification and understanding of the species. To ensure the accuracy of the identification, relevant references specific to the butterflies of Sumatra were consulted. These references provide a comprehensive understanding of the morphological characteristics, behavior, and distribution of butterfly species in the region. The identification process drew upon a range of established sources, including works by D'Abrera (1986), Fleming (1989), Seki *et al*. (1991), Amnuay (2012), Kirton (2014), and Corbet *et al.* (2020).

Figure 2. The Punti Kayu Recreation Forest is predominantly covered with Pine trees *Pinus merkusii* (Photograph: Muhammad Iqbal).

Figure 3. Pockets of natural vegetation and wetland habitats remaining in Punti Kayu Recreation Forest (Photograph: Muhammad Iqbal).

Results and Discussion

A total of 16 butterfly species from five families were recorded in the Punti Kayu Recreation Forest, Palembang, South Sumatra (Table 1). The cumulative lince chart illustrates a notable increase in butterfly species across three survey periods (Fig. 4). In Period I (2010), only 1 species was recorded, bringing the total to 1 species. By Period II (2012), the number of recorded species surged to 11, elevating the total to 12 species. Although the number of new species recorded in Period III (2019) decreased to 4 the cumulative total continued to rise, reaching 16 species. This trend suggests a gradual expansion in butterfly diversity over the nearly decade-long survey period, with the most significant growth observed between 2010 and 2012 (Fig. 5).

Table 1. The list of the species of butterflies found in Punti Kayu Recreation Forest, Palembang City, South Sumatra Province. Notes: Period I (Survey on 30 Dec 2010), Period II (Survey on 28 May 2012), and Period III (Survey on 15 Nov 2019).

No.	Species	Family	Period		
			I	II	III
1	*Papilio polytes*	Papilionidae			+
2	*Graphium agamemnon*	Papilionidae		+	
3	*Eurema sari*	Pieridae		+	
4	*Delias hyparete*	Pieridae			+
5	*Hypolimnas misippus*	Nymphalidae	+		
6	*Catopsilia pomona*	Nymphalidae		+	
7	*Junonia hedonia*	Nymphalidae		+	
8	*Parantica agleoides*	Nymphalidae		+	
9	*Junonia atlites*	Nymphalidae		+	+
10	*Tanaecia munda*	Nymphalidae		+	
11	*Mycalesis horsfieldi*	Nymphalidae		+	
12	*Ypthima baldus*	Nymphalidae		+	
13	*Miletus symethus*	Lycaenidae		+	
14	*Hasora badra*	Hesperiidae			+
15	*Lambrix salsala*	Hesperiidae			+
16	*Oriens paragola*	Hesperiidae		+	

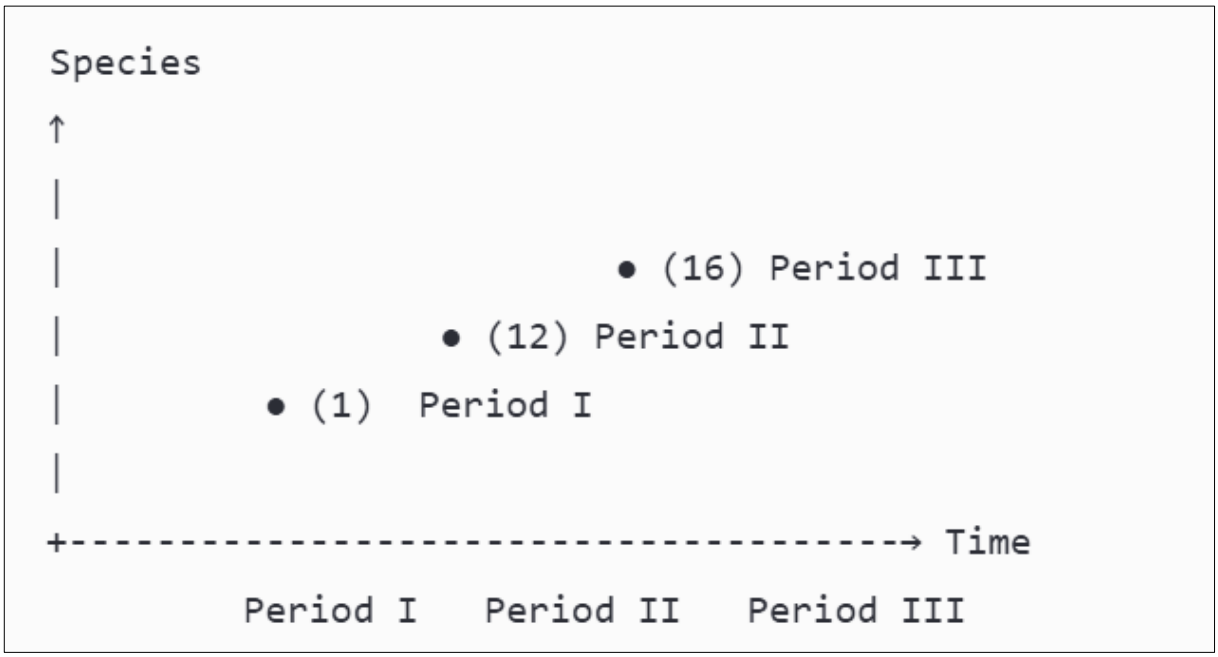

Figure 4. The cumulative chart showing the increase in butterfly species across the three survey periods at Punti Kayu Recreation Forest, Palembang City, South Sumatra Province.

Figure 5. Photographic documentation of butterflies from Punti Kayu Recreation Forest, Palembang City, South Sumatra Province: 4a. *Papilio polytes*, 4b. *Graphium agamemnon*, 4c. *Eurema sari,* 4d. *Delias hyparete*, 4e. *Hypolimnas misippus*, 4f. *Catopsilia pomona*, 4g. *Junonia hedonia*, 4h. *Junonia atlites* (Photographs: Muhammad Iqbal).

The butterfly species were observed across three survey periods and categorized by family as follows (Fig. 6): Papilionidae had 1 species in both 2012 and 2019; Hesperiidae had 2 species in 2012 and 1 species in 2019; Pieridae had 1 species in both 2012 and 2019; Nymphalidae had 1 species in 2010, 7 species in 2012, and 1 species in 2019; and Lycaenidae had 1 species recorded in 2012.

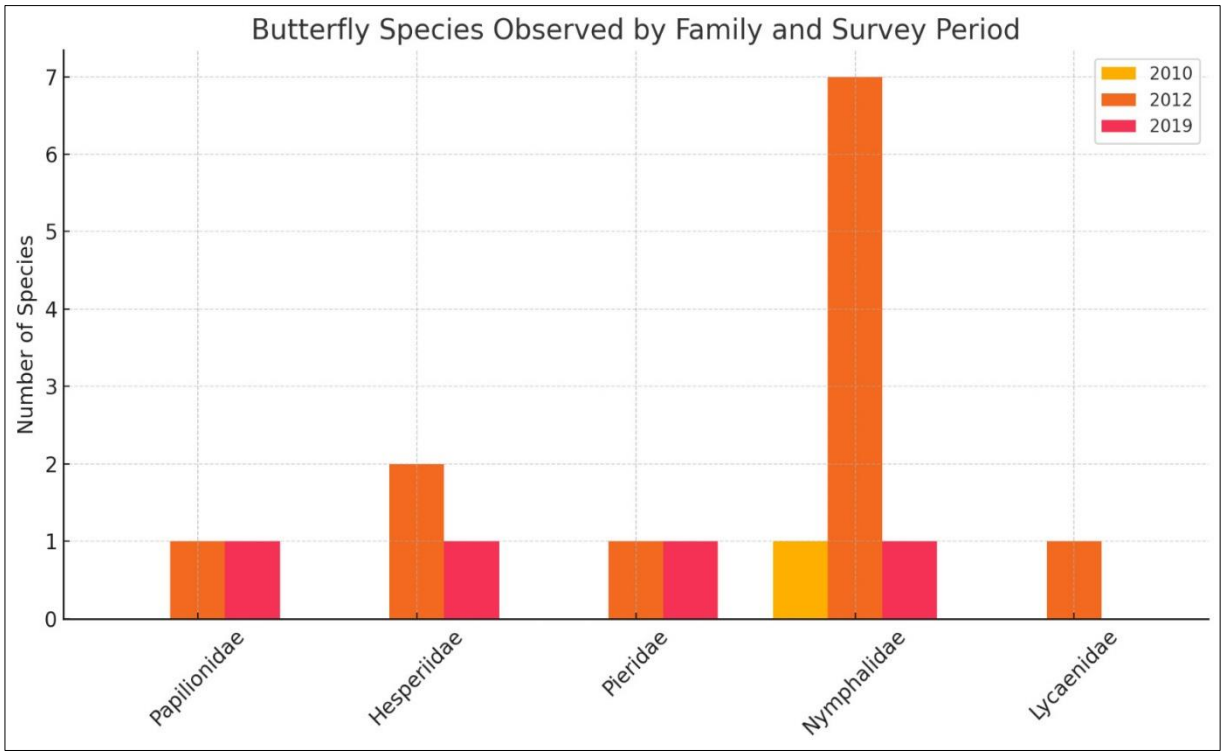

Figure 6. The grouped bar chart showing the number of butterfly species observed by family across the three survey periods (2010, 2012, and 2019).

Research has shown that urban forests can serve as mini conservation sites for butterflies, supporting a diverse range of species. Studies on butterfly populations in urban areas have yielded interesting insights, with the Nymphalidae family consistently showing the highest number of individuals (Fang *et al.* 2024). According to Ruslan *et al.* (2023), urban forests of Cibubur Arboretum and University of Indonesia, as isolated green spaces within rapidly growing urban areas, offer a unique opportunity for urban biodiversity research, conservation, education, and citizen science, with one study recording 30 species from six families. Similarly, research in Pontianak City from April 2022 to May 2023 using the Pollard Walk technique found 27 butterfly species from five families spread across four green spaces, highlighting the importance of these areas for supporting urban butterfly diversity (Rushayati & Azahra 2024).

In our study, a total of 16 butterfly species from five families were recorded. The most represented family was Nymphalidae, followed by Hesperiidae, Pieridae, Papilionidae, and Lycaenidae. Morphologically, members of Nymphalidae are often large, brightly colored, and easier to detect in surveys, which may also contribute to their higher representation in our dataset. Their wing patterns and venation characteristics allow reliable identification in the field (Corbet *et al.* 2020; Kirton 2014). The dominance of the Nymphalidae family in our survey can be explained by their ecological adaptability. Many Nymphalidae are generalists with wide larval host plant ranges, tolerance to disturbed habitats, and high dispersal ability (Bonebrake et al. 2010; Braby 2019). These traits enable them to persist in fragmented and urbanized landscapes such as Punti Kayu Recreation Forest. In contrast, families such as Papilionidae and Lycaenidae are often more habitat-specialized and may require undisturbed environments or specific larval host plants, which might be scarce in urban green spaces.

These findings emphasize the need for continued conservation efforts in urban areas, including the creation of butterfly-friendly habitats and the protection of existing green spaces. Furthermore, urban planning strategies that incorporate green infrastructure can help support local biodiversity and promote ecosystem services. By prioritizing urban biodiversity, cities can become more sustainable and resilient, while also providing opportunities for citizens to engage with nature and promote environmental

awareness. Additionally, citizen science initiatives can play a crucial role in monitoring butterfly populations and informing conservation efforts in urban areas. Studies on butterfly populations in urban areas have yielded similar insights, with Nymphalidae consistently dominant (Fang et al., 2024).

Initial checklist of butterflies highlights the importance of preserving and enhancing urban green spaces, such as the Punti Kayu Recreation Forest, to support biodiversity conservation. However, given the preliminary nature of this checklist, it is likely that additional species will be recorded in future studies, underscoring the need for ongoing research and monitoring. Efforts to promote sustainable urban planning and management practices can help to protect and restore butterfly habitats, ultimately contributing to the conservation of urban biodiversity. Future studies could investigate the impact of urbanization on butterfly diversity and abundance, as well as the effectiveness of conservation efforts in protecting urban butterfly populations.

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