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The Diversity of Butterflies (Order: Lepidoptera) in Pondok Ambung, Tanjung Puting National Park, Kalimantan Tengah

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Abstract: National parks are one of a site to maintain biodiversity from any damage. Tanjung Puting National Park is one of the national parks in Indonesia with a wide variety of biodiversity, namely butterflies. The aims of this study were to determine the diversity of butterfly species in 5 sub-ecosystems in Tanjung Puting National Park. The five sub-ecosystems are Camp Ambung, post-burn forest, heath forest, lowland forest and swamp forest. In this study, the butterflies were caught through the hunting method by using insect nets and the trapping method by installing food traps. This study was conducted from February to March 2022 for twice times a day from 8 to 12 in the morning and 1 to 5 in the afternoon. The results showed that butterflies collected were 121 species of butterflies from 6 families in Pondok Ambung, Tanjung Puting National Park. In detail, there were 88 species in Camp Ambung, 19 species in the post-burn forest, 14 species in the heath forest, 65 species in the lowland forest, and 38 species in the swamp forest. The diversity index from highest to lowest was Camp Ambung (3.71), lowland forest (3.49), swamp forest (3.02), post-burn forest (2.61), and heath forest (2.36).

Keywords: Buterfly, diversity, forest, Indonesia, national park.

Introduction

Indonesia is a country that has high biodiversity. According to Darajati et al. (2016), Indonesia's geographical location (between the continents of Asia and Australia), its vast area, and its many islands (around 17,000) make Indonesia have high biodiversity. This country has 12% of mammal species and 36% of them are endemic, 17% of all bird species, 16% of all reptile and amphibian species, 25% of all fish species, and around 15% of all insect species in the world (Indrawan et al., 2012). Disclosure of the diversity of flora and fauna in this country continues today as it is vital for formulating conservation policies and utilizing their potential (Peggie, 2018). A database is needed that documents all existing biodiversity (Rugayah et al., 2004). Behind its extraordinary biological wealth, Indonesia has a high level of environmental threat, especially in species extinction and ecosystem damage. Environmental threat can cause a decrease in biodiversity (Suhartini, 2009). One of the efforts to protect Indonesia's biological wealth is to establish a national park. Tanjung Puting National Park is located in Kalimantan Tengah.

Insects are one of the most dominant animal groups on earth (Borror et al., 1992). They represent most of the species in terrestrial and freshwater ecosystems and become an important component of nearshore marine ecosystems. The diversity of insect species represents an equal adaptation variety to environmental conditions (Schowalter, 2006). One of the interesting insects is butterflies. Butterflies come from the order Lepidoptera. Butterflies are a small part of lepidoptera, which is less than 12%. There are about 155,000 known lepidoptera species in the world (Peggie 2011). About 90% of butterfly are found in tropical areas (Bonebrake et al., 2010).

Indonesia has around 1,600 types of butterflies (Peggie & Amir, 2006).

Butterflies play an important role in an ecosystem, one of which is as a plant pollinator. In addition, butterflies are known as environmental bioindicators. According to Harmonis & Saud (2017), butterflies are known as taxa that are sensitive to environmental changes. Many researchers have confirmed that degraded habitat will largely affect the composition of butterfly communities. This is the reason why butterflies are used as bioindicators of environmental change. The aims of this study was identify the diversity of butterfly species in 5 sub-ecosystems in Tanjung Puting National Park, Kalimantan Tengah. The data obtained are expected to add information about the diversity of butterflies in Tanjung Puting National Park.

Materials and Methods

Materials

The materials used were papilot paper, camphor, rambutan, and watermelon. Papilot paper was made of transparent paper that was cut and shaped into triangles. Papilot paper was used for storage of butterfly specimens. Camphor was used to keep specimens safe from ants. Rambutan and watermelon were used as butterfly food traps.

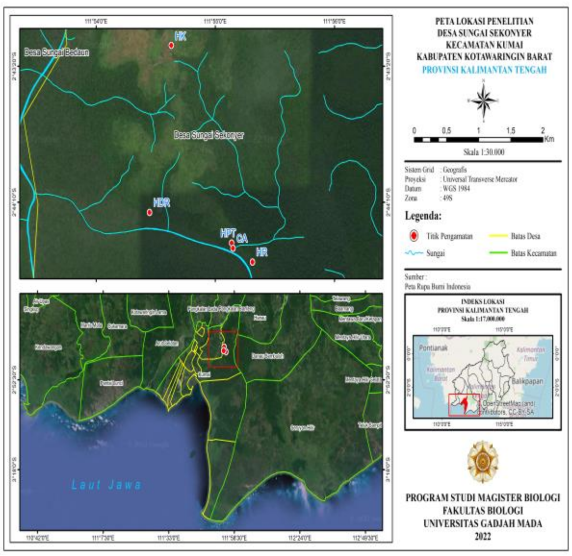

Figure 1. The Map of the Study Location in Tanjung Puting National Park

Methods

This study was conducted from February 23rd to March 31st 2022 in Pondok Ambung, Tanjung Puting National Park, Kalimantan Tengah in 5 different sub-ecosystems, namely Camp Ambung (CA), Post-Burn Forest (HPT), Swamp Forest (HR), Lowland Forest (HDR), and Heath Forest (HK). The butterfly data collection map was presented in Figure 1.

Result and Discussion

Diversity of butterfly types

The research results found that each subecosystem has different environmental conditions. The results of the study showed that a total of 121 species of butterflies were obtained from the 5 sub-ecosystems. The details of the species in the five sub-ecosystems can be seen in Table 1. Based on Table 1, the butterflies found in Pondok Ambung, Tanjung Puting National Park consist of 6 families namely *Papilionidae, Nympalidae, Pieridae,, Riodinidae, Lycaenidae and Hesperidae*. A total of 1,045 individuals were found in the five sub-ecosystems. Most butterfly species were found in the Camp Ambung (CA) sub-ecosystem with a total of 88 species. Meanwhile, the butterfly species found in the Swamp Forest, Lowland Forest, Heath Forest, and post-burn forest were 38 species, 65 species, 14 species, and 19 species respectively.

The results showed that Camp Ambung (CA) has the highest diversity of butterfly species out of the five ecosystems observed. It is maybe because Camp Ambung (CA) has more diverse vegetation. Irni et al. (2016) state that the presence of a type of butterfly and its abundance in a habitat is closely related to the diversity of types of food plants and host plants. It can be said that the more diverse the vegetation in a habitat, the more diverse the butterflies in that habitat. The more diverse the vegetation, the more food plants and host plants are available for butterfly development. Besides, Camp Ambung (CA) is located on the banks of the Sekonyer River which may affect the humidity in the Camp Ambung sub-ecosystem. Chahyadi et al. (2019) reveal that air humidity is an environmental factor affecting butterfly activity in finding food. Moreover, the area on the banks of the Sekonyer River is preferred by butterflies in line with Amir et al., (2003) that butterflies like areas of river banks.

Some butterflies were only found in certain sub-ecosystems such as *Papilio memnon* which is found in Camp Ambung. Some species can only be found in certain habitats due to the availability of feed (Panjaitan et al., 2020). *Citrus* sp plants were found in Camp Ambung which are the host plants for *Papilio memnon* larvae. Butterfly host plant for *Papilio memnon* are various such as the Rutaceae family, for example, *Citrus aurantifolia*, *Citrus aurantium*, *Citrus junos*, *Citrus maxima*, *Citrus medica*, *Citrus natsudaidai*, *Citrus reticulata*, *Citrus sinensis*, *Citrus unshiu*, *Fortunella japonica*, *Paramignya scandens*, and *Poncirus trifoliate* (Harmonis, 2021).The presence of *Citrus* sp plants allows the *Papilio memnon* butterfly to live in the Camp Ambung sub-ecosystem.

The study found some types of butterflies of which only one was found, for example, *Athyma reta*, *Euthalia merta*, and *Neptis anjana*. The low frequency of arrival of a butterfly species indicates that the species has a strong attachment to certain habitat components. Thus, they are only found in certain habitats and are sensitive to certain environmental conditions (Azahra et al., 2016). Subahar & Yuliana (2010) explain that the type of butterflies which were only found during the study was a high risk when there was a disturbance to their habitat. They are very vulnerable and may even become extinct.

Table 1. The diversity of butterfly data in 5 sub-ecosystem

No.	Types of Butterfly	Location of the Study				
		CA	HPT	HR	HDR	HK
	Papilionidae					
1	*Papilio iswara*	✓	✓	✓	✓	✓
2	*Papilio Memnon*	✓	-	-	-	-
3	*Graphium sarpedon*	✓	-	-	-	-
4	*Graphium evemon*	✓	-	-	-	-
5	*Graphium doson*	✓	-	-	-	-
6	*Graphium antiphates*	✓	-	-	-	✓
7	*Graphium delesserti*	✓	-	✓	-	✓
8	*Graphium agamemnon*	✓	✓	✓	-	✓
9	*Graphium bathycles*	✓	-	-	-	-
	Nymphalidae					
10	*Idea stolli*	✓	✓	-	✓	-
11	*Agatasa calydonia*	✓	-	-	✓	-
12	*Athyma larymna*	✓	-	✓	-	-
13	*Athyma asura*	✓	✓	-	-	✓
14	*Athyma reta*	✓	-	-	-	-
15	*Athyma clerica*	✓	-	-	-	-
16	*Neptis anjana*	✓	-	-	-	-
17	*Yphtima fasciata*	✓	-	-	-	-
18	*Lexias dirtea*	✓	✓	✓	✓	-
19	*Lexias cyanipardus*	✓	✓	✓	✓	-
20	*Lexias canescens*	-	-	-	✓	-
21	*Xanthotaenia busiris*	-	-	-	✓	-
22	*Euthalia merta*	✓	-	-	-	-
23	*Euthalia djata*	-	✓	-	-	-
24	*Tanaecia palguna*	✓	✓	-	-	-
25	*Tanaecia pelea*	✓	-	-	✓	-
26	*Tanaecia aruna*	✓	✓	✓	✓	-
27	*Tanaecia clathrata*	-	-	-	✓	-
28	*Tanaecia cocytus*	-	-	✓	✓	-
29	*Tanaecia cocytina*	✓	✓	✓	✓	-
30	*Euploea mulciber*	✓	-	✓	✓	✓
31	*Euploea radamanthus*	✓	-	✓	-	-
32	*Euploea crameri*	✓	-	-	-	-
33	*Thaumantis noureddin*	✓	-	-	-	-
34	*Thaumantis odana*	-	-	-	✓	-
35	*Thaumantis klugius*	-	-	-	✓	-
36	*Zeuxidia doubledayi*	✓	-	✓	-	-
37	*Zeuxidia aurelius*	✓	-	-	-	-
38	*Chersonesia peraka*	✓	-	-	-	-
39	*Vindula dejone*	✓	-	-	-	-
40	*Pantoporia aurelia*	-	-	✓	-	-
41	*Cirrocroa emalea*	✓	✓	✓	✓	✓
42	*Cupha erymantis*	✓	-	✓	-	-
43	*Mydosama fuscum*	-	-	✓	✓	-
44	*Mydosama pitana*	✓	-	✓	-	-
45	*Mydosama anapita*	✓	-	✓	✓	-
46	*Moduza procris*	✓	-	-	-	-
47	*Dophla evelina*	✓	✓	✓	-	-
48	*Prothoe franck*	✓	-	✓	✓	-
49	*Lasippa tiga*	✓	-	-	✓	-
50	*Lasippa heliodore*	✓	-	-	✓	-
51	*Lebadea martha*	-	-	-	✓	-
52	*Danaus melanipus*	-	-	-	-	✓
53	*Faunis gracilis*	-	-	-	✓	-
54	*Faunis stomphax*	-	-	-	✓	-
55	*Charaxes bernadus*	✓	-	✓	✓	-
56	*Pandita sinope*	✓	-	-	-	✓
57	*Ideopsis vulgaris*	✓	-	-	-	-
58	*Melanitis leda*	✓	-	-	-	-
	Pieridae					
59	*Gandaca harina*	✓	-	-	-	-
60	*Appias indra*	✓	-	-	-	✓
61	*Eurema nicevillei*	✓	✓	✓	✓	-
62	*Eurema sari*	✓	-	✓	✓	✓
63	*Eurema simulatrix*	✓	✓	✓	-	-
64	*Saletara panda*	✓	-	-	-	-
	Riodinidae					
65	*Paralaxita telesia*	-	-	-	✓	-

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No.	Types of Butterfly	Location of the Study				
		CA	HPT	HR	HDR	HK
66	*Paralaxita nicevillei*	✓	-	-	✓	-
67	*Paralaxita orphna*	✓	-	-	✓	-
68	*Taxila haquinus*	✓	-	✓	✓	-
69	*Laxita teneta*	✓	-	-	✓	-
	Lycaenidae					
70	*Lycaenopsis haraldus*	✓	-	-	-	-
71	*Curetis tagalica*	✓	-	✓	-	-
72	*Arhophala eumolphus*	✓	-	-	✓	-
73	*Arhopala centaurus*	✓	-	-	✓	-
74	*Arhopala atosia*	✓	-	✓	✓	-
75	*Arhopala avathina*	✓	✓	-	-	-
76	*Arhopala vihara*	-	-	-	✓	-
77	*Arhopala ariana*	-	-	-	✓	-
78	*Arhopala hypomuta*	✓	-	✓	✓	-
79	*Arhopala horsfieldi*	✓	-	-	-	-
80	*Arhopala silhentensis*	✓	-	-	-	-
81	*Arhopala agesias*	✓	-	-	-	-
82	*Arhopala epimuta*	-	-	-	✓	-
83	*Arhopala wildeyana*	✓	-	-	-	-
84	*Caleta elna*	✓	✓	-	-	-
85	*Ionolyce helicon*	✓	-	✓	✓	-
86	*Sinthusa nasaka*	-	-	-	✓	-
87	*Neocheritra amrita*	✓	-	-	✓	✓
88	*Hypolycaena erylus*	-	✓	-	-	-
89	*Rachana jalindra*	-	-	-	✓	-
90	*Purlisa gigantea*	✓	-	-	✓	-
91	*Thamala marciana*	-	-	-	✓	-
92	*Anthene emolus*	✓	✓	-	✓	✓
93	*Anthene lycaenina*	✓	✓	-	✓	-
94	*Drupadia theda*	-	-	✓	✓	-
95	*Drupadia ravindra*	✓	-	-	✓	-
96	*Drupadia estella*	✓	-	-	✓	✓
97	*Dacalana vidura*	✓	-	✓	✓	-
98	*Dacalana burmana*	-	-	-	✓	-
99	*Rapala pharetima*	✓	-	-	-	-
100	*Ritra aurea*	-	-	✓	✓	-
101	*Ramelana jangala*	-	-	✓	-	-
102	*Virachola kessuma*	✓	-	-	-	-
103	*Tajuria isaeus*	-	-	-	✓	-
104	*Allotinus sarrastes*	✓	-		✓	-
105	*Allotinus apries*	-	-	-	✓	-
106	*Chilaria balua*	✓	-	-	-	-
	Hesperidae					
107	*Matapa deprivata*	-	-	-	✓	-
108	*Ancistroides gemmifer*	-	-	-	✓	-
109	*Hasora vitta*	✓	-	-	-	-
110	*Hasora badra*	✓	-	-	-	-
111	*Hasora schoenherr*	✓	-	-	✓	-
112	*Burara etelka*	✓	-	-		-
113	*Seseria affinis*	-	-	-	✓	-
114	*Capila phanaeus*	✓	-	-	-	-
115	*Isma damocles*	-	-	✓	✓	-
116	*Tagiades gana*	✓	-	✓	✓	-
117	*Tagiades calligana*	✓	-	✓	✓	-
118	*Tagiades parra*	-	-	✓	✓	-
119	*Tagiades waterstradti*	✓	-	✓	-	-
120	*Darpa striata*	✓	-	-	-	-
121	*Unkana mytheca*	-	-	-	✓	-

CA: Camp Ambung, HPT: Post-burn forest, HR: Swamp forest, HDR: Lowland forest, HK: Heath forest

✓ : present

- : absent

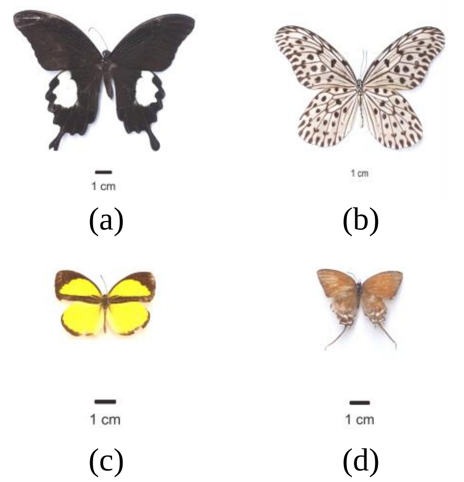

Figure 2. Several Butterfly Species Found During the Study (a) *Papilio iswara*, (b) *Idea stolli*, (c) *Eurema nicevillei*, (d) *Ritra aurea*

During the research, two species were found to be endemic to Borneo. They are *Paralaxita nicevillei* and *Laxita teneta* (Gohun et al. 2021). An endemic species is a species found in a certain area only and not found in other areas. This species is usually vulnerable to extinction, especially those on islands (Indrawan et al., 2012). These two endemic species are found in small amounts at Camp Ambung and Lowland Forest (table 1). Thus, further conservation efforts are needed.

Types of butterflies in Pondok Ambung Tanjung Puting National Park

This study found a total of 1,045 butterflies during 1.5 months in Pondok Ambung, Tanjung Puting National Park. The most common butterflies found were from the Nymphalidae family with 484 individuals, while the least was from the Riodinidae family with 21 individuals. The detailed percentage of each family found is presented in Figure 4. Based on Figure 3, the Nympalidae family is the most commonly found (46%), followed by the Lycaenidae (19%), Pieridae (14%), Papilionidae (11%), Hesperidae (8%), and Riodinidae (2%). The Nympalidae family is the most commonly found due to its largest number of species, polyphagous, and wide distribution compared to other families. This butterfly has a variety of colors such as brown, orange, yellow and black with sizes ranging from small to large (Koneri et al., 2022).

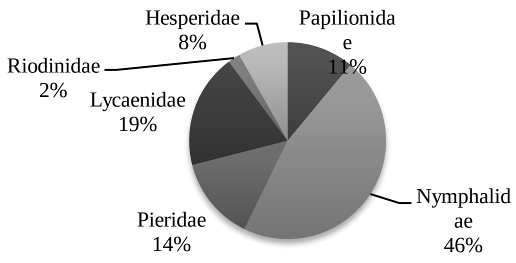

Figure 3. The percentage of butterflies by family in Pondok Ambung

Butterfly diversity index

Based on the results of the study, each sub-ecosystem has a different diversity index value. Calculation of the Shannon-Wiener diversity index refers to the variety of species and the number of each species. The highest butterfly diversity index is found in Camp Ambung with a value of 3.71 followed by the lowland forest (3.49), swamp forest at (3.02), post-burn forest (2.61), and heath forest (2.36). The butterfly diversity index in all sub-ecosystems is presented in Figure 4.

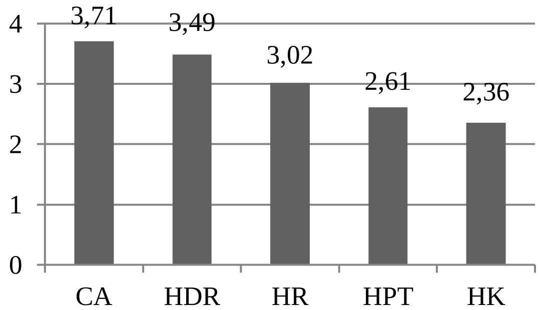

Figure 4. Butterfly Diversity Index in Pondok Ambung

The Camp Ambung (CA) sub-ecosystem is a forest area with diverse vegetation that allows butterflies to have abundant food sources. On the other hand, the Post-burn forest (HPT) is more open with less diverse vegetation dominated by shrubs in the form of ferns. Besides, there are *Schima walichi* trees planted after being burnt. Differences in vegetation conditions in the two sub-ecosystems affect the diversity of butterflies in the two locations. It is in line with Koneri & Saroyo (2011) that differences in the diversity index of butterfly species in a habitat are strongly influenced by the host plants of the butterflies. Vegetation variations also affect the presence and diversity of butterflies. Most researchers have confirmed that degraded habitat largely influences butterfly community composition (Harmonis & Saud, 2017). The habitats used by butterflies have the availability of host plants to feed their larvae and nectar-producing plants for their imago (Ilhamdi et al., 2018).

Conclusions

Based on the results of the research and discussion, it can be concluded that Pondok Ambung Tanjung Puting National Park has 121 types of butterflies with the dominance of the Nympalidae family. In detail, there are 88 species in Ambung Camp, 19 species of post-burn forest, 14 species of grassland forest, 65 species of lowland forest and 38 species of swamp forest. Camp Ambung has the highest diversity index value, namely 3.71, and the lowest for grassland forest, 2.36.

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