How will oil palm expansion affect to butterflies diversity in Jambi, Indonesia?

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Abstract. The convertion of forest functions to oil palm plantations has an impact on biodiversity. One of the impacts of biodiversity may affect the butterflies diversity. This research was conducted in one of the oil palm areas in PT. Humusindo in Jambi. The purpose of this study were to determine the diversity and active time of butterflies in oil palm plantations of PT. Humusindo Jambi. The study was conducted for 2 months. Sampling method used for this research were scan sampling in the oil palm plantation area by capturing using insect nets. Butterflies are captured using insect nets then counted, marked (to avoid repeated calculations) and released again. Observation separated per one hour starting at 08.00 am to 04.59 pm. The results showed the highest diversity index of butterflies found was at 13.00-13.59 (H'=2.39) with total species number was 34 species. Overall, the butterfly diversity index found was relatively low (H '= 1.78) with total species number was 54 species. The most dominant butterfly species found at each time of observation was *Yptima praenubila*. The conservation status of all species found were common species (there is no endemic species) and least concern in the conservation status.
Keywords: Butterfly, biodiversity, oil Palm, Jambi

1. Introduction

Southeast Asia has a larga number of tropical forest, reaching abaout 11% of total tropical forest in the world [1]. Palm oil (*Elaeis guineensis* Jacq) is one of the agricultural crops that contributes the most to deforestation of tropical forests in Southeast Asia [2]. The high activity of land opening for oil palm plantations threatens the sustainability of tropical forests in Southeast Asia. Malaysia and Indonesia are the countries that have the largest oil palm plantations in the world, reaching 6.7 million hectares, thus contributing greatly to clearing forests into oil palm plantations in Southeast Asia [1]. Forests conversion to oil palm plantations resulted in habitat fragmentation [3].

Another impact of oil palm plantations is reducing species diversity compared to forests [4]. Disruptions due to changes of land use from forest to oil palm plantations have an impact on the

endemic species, thus, this impact have a potential to make an endemic species extinct. For example, 47 species (23.5%) of amphibians in Malaysia and 146 species (21.9%) of mammals in Indonesia were listed as threatened on the IUCN Red line [5]. The ecological impact of oil palm plantations depends on how large the forest area that effected by deforestation, and to extent that is affecting the biodiversity, including the butterflies. This study discussed the population and species richness of butterfly in oil palm plantations in Jambi Indonesia.

2. Study sites and methods

This research was conducted on August-October 2018 in the Biodiversity Enrichment Experiment Plot (BEEP) on oil palm plantations of PT. Humusindo Jambi. Observations and identification of specimens were carried out in Laboratory of Insect Systematic, Department of Plant Protection, IPB University, Bogor.

Observation and collection of butterflies was carried out by surveying directly on the predetermined observation plots in the oil palm plantation areas. The study were conducted from 08:00 am to 16:59 am. Observations of butterflies included species name, number of individuals, and time of periods. Butterfly samples were collected using insect nets for identification purposes. Butterflies were captured using insect nets then counted, marked (to avoid repeated calculations) and released again.

Data analysis of butterfly diversity were conducted by using the Shannon-Wiener index (H') and evenness index (E) [6]. The correlation between butterfly abundance and plot area was analyzed by Pearson correlation with significance value p=0.05), and similarity of butterfly species was analysed using Bray-Curtis Similarity in R 2. 11.0 program [7]. The butterfly were identified using the guide book [8].

3. Results and discussion

The number of butterflies species found in oil palm plantations was 54 species with H˙index = 1.78 (table 1), which classified as a relatively low diversity index [6]. Butterflies found in the oil palm plantation area were butterflies that commonly found in gardens and around settlements. This means that there are no endemic species of Jambi [8].

Table 1. Abundance and species richness of butterflis in the oil palm plantation

Time	Number of species	Abundace Mean±SE	Shannon Index (H')	Simpson Index (D)	Evenness Index
08.00-08.59	20	22.15±6.95	1.74	0.70	0.29
09.00-09.59	30	15.57±6.98	2.12	0.77	0.28
10.00-10.59	29	18.45±8.72	2.05	0.75	0.27
11.00-11.59	33	15.42±7.00	2.15	0.77	0.26
12.00-12.59	32	14.38±6.40	2.22	0.78	0.29
13.00-13.59	34	13.85±5.36	2.37	0.83	0.32
14.00-14.59	30	17.30±7.87	2.19	0.77	0.30
15.00-15.59	32	14.16±5.80	2.29	0.81	0.31
16.00-16.59	33	15.82±9.01	1.85	0.66	0.19
Total	54	81.09±38.39	1.78	0.69	0.11

Generally, butterflies can still be found in around the garden if there are still flowering plants that produce nectar [9]. Butterfly data is separated every one hour of observation. The observation of butterflies abundance showed the highest number at 08.00-08.59, which mean that the butterflies was

more active at theis time. At that time, the sun began to penetrate the oil palm canopy and butterflies began to actively foraging and drying the wings in the lower vegetation.

The Simpson index analysis showed that high values that mean there is a species that stands out in community compared to other species. In other words, the number of individuals of each species found is not evenly distributed at the observation location. This is supported by the evenness index. In this research, the evenness index value is low (0.19 to 0.32), meaning the evenness of the species in oil palm plantations across the time is uneven. At the time of observation, there were certain species that dominate the vulnerable time. The most dominant species of butterflies in oil palm plantations were 10 species, namely *Y. praenubila, Y. metora, M. mineus, L. nina, J. alecto, I. juventa, E. hecabe, E. congruens, A. olferna* and *A. binghami*. The *Y. praenubila* species dominant in each observation time compared to other species (figure 1).
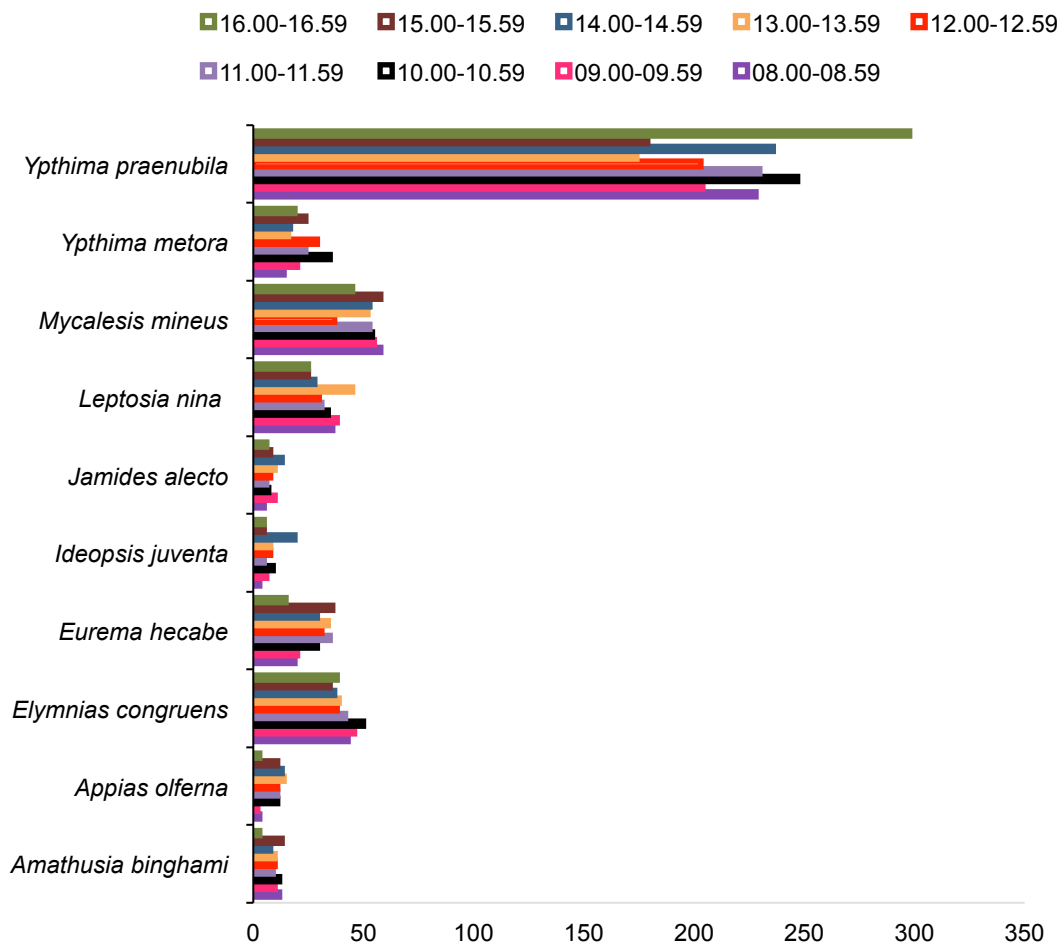

Figure 1. The abundance of ten species of butterfly found in each observation time

The active populations number of butterfly in each hour of observation varied. The highest number of butterflies individual was found at 10.00-11.59, but the highest number of species were active in 13.00-13.59 (figure 2). Until 16.00-16.59, we found foraging activities of butterflies. If the weather condition are raining or drizzling, there are no butterflies actively flying on oil palm plantations. The weather at the time of observation tends to be bright, because in August to September were estimated

still in the dry season. Environmental factors, such as temperature and humidity affect the activity of butterflies [10]. Rainfall also affects the activity of butterflies [11].
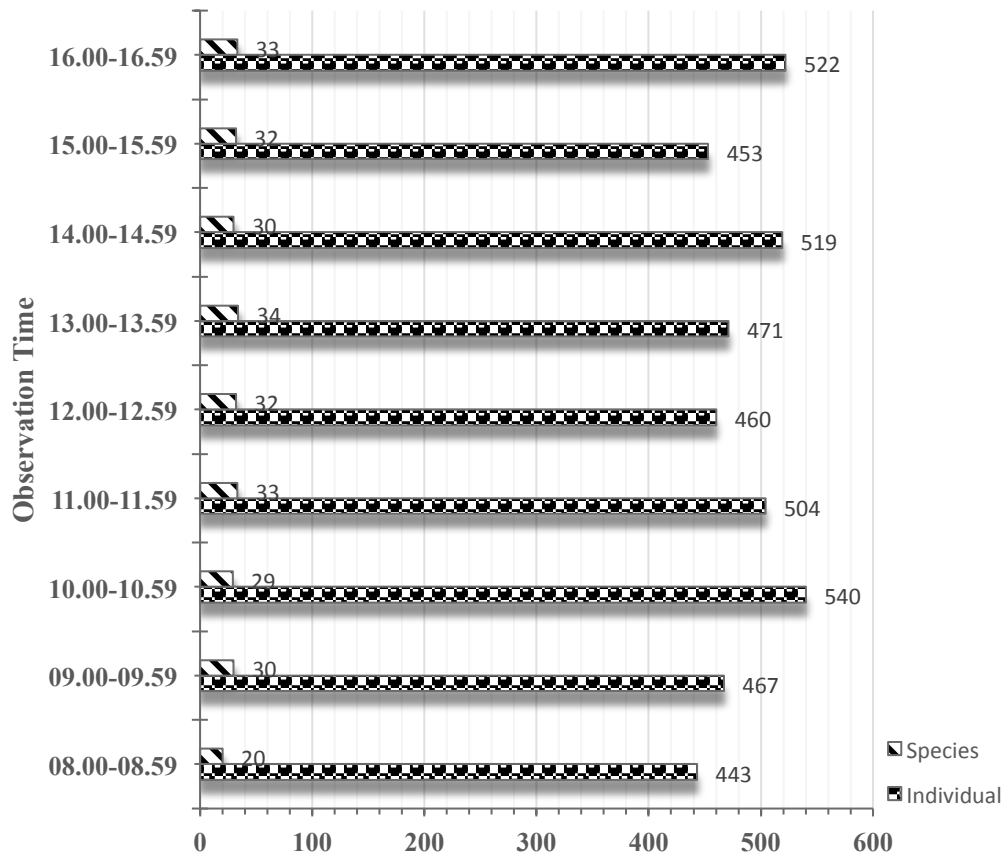

Figure 2. Number of species and individuals of butterflies found in oil palm plantations Jambi

Based on the Bray-Curtis analysis (figure 3), the population of butterflies spread evenly at all times of observation. This means that 54 butterfly species found were active species from 08.00-16.59 in the oil palm plantation areas. This is probably due to the fact that oil palm plantation was monoculture thus having smaller canopy causing sunlight penetrate to plantation floor. This situation caused the butterflies still get sunlight until 16:59 pm [12].

Butterflies species found in oil palm plantations of this study were different as was reported in close location in 2017 [13]. In Harapan Forest using the fruit trap method, successfully found 24 species of Nymphalids [13]. Other research reported 17 species of butterflies found in the forest compared to 10 species in the oil palm plantations [13]. Oil palm plantations have an impact on the loss of biodiversity [14]. Species of butterfly found in the forest was higher and unique compared to other habitats [12]. Butterflies are one of the organisms that can be used as a good indicator to assess environmental condition. Butterflies are sensitive to microclimate changes and light levels. Larvae and imago of butterfly interact with different host plants [15].
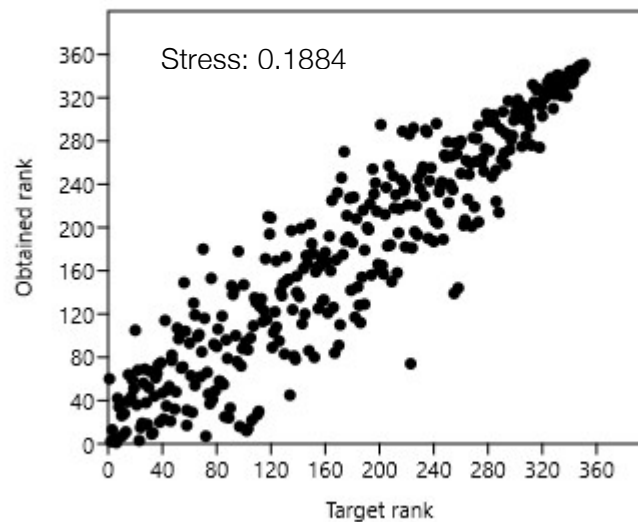
Figure 3. Distribution of butterfly species in each observation time based on Bray-Curtis Similarity analysis.

4. Conclusion

Butterflies species found in oil palm plantations were butterflies that commonly found in the garden. This research showed no endemic butterflies species found in oil palm plantation in Jambi. The diversity index of butterflies found in oil palm plantations in Jambi was relatively low. Further research is needed to examine the engineering of suitable habitats for flora and fauna among oil palm plantations for the survival of local biodiversity.

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