

Inventory of the butterfly fauna (Lepidoptera: Rhopalocera) of Kurudu Island (Japen Island Regency, Papua, Indonesia)

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Abstract: An inventory of the butterflies of Kurudu Island was conducted for about 7 days (22nd-28th October 2016) by using "Transect Count Method on Line Transect". This inventory revealed 90 butterfly species (Papilionoidea) including Papilionidae (11 species), Pieridae (7), Lycaenidae (23), Nymphalidae (34) and Hesperiidae (15). Based on the "Calculation of Species Richness and Shannon Wiener Diversity Index" (H'), Kurudu Island has a high diversity of butterflies, 90 species found in just 7 days of sampling with an H' value above 1 ($H'=1.629$). During sampling on Kurudu Island, *Ornithoptera priamus kasandra* (Papilionidae) was found.

Rangkuman: Inventarisasi keanekaragaman kupu-kupu di Pulau Kurudu, Kabupaten Kepulauan Yapen, dilakukan selama 7 hari aktif (tanggal 22 – 28 Oktober 2016) menggunakan metode Transek Count pada Line Transect. Dari hasil inventarisasi ditemukan 90 spesies kupu-kupu siang Superfamili Papilionoidea yang terdiri dari 11 spesies Famili Papilionidae, 7 spesies Famili Pieridae, 23 spesies Famili Lycaenidae, 34 spesies Famili Nymphalidae, dan 15 spesies Famili Hesperiidae. Berdasarkan hasil perhitungan jumlah Kekayaan Spesies (*Species Richness*) dan perhitungan Indeks Keragaman Shannon Wiener (H') terlihat bahwa Pulau Kurudu memiliki keanekaragaman kupu-kupu yang cukup tinggi yaitu 90 spesies yang ditemukan hanya dalam waktu 7 hari sampling dengan nilai H' di atas 1 yaitu 1.629. Selama pengambilan data di Pulau Kurudu ditemukan spesies kupu-kupu *Ornithoptera priamus kasandra* dari Famili Papilionidae.

Keywords: Inventory, Kurudu Island, Rhopalocera

Introduction

Kurudu Island is a small island between the mainland of New Guinea and Japen Island which is administratively included in the territory of Province of Papua, Indonesia. This island has a great diversity of flora and fauna compared to the mainland. Kurudu Island is suspected to have many endemic species because geographically this island is separated from the mainland of New Guinea (Pemprov Papua, 2008) and forms a stepping stone for the distribution of species.

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Kurudu Island is geographically located East from Japen Island (1°23'-2°46' S - 134°56'-135°40' E) with a surface of 301 km² (Pemda Kab. Kepulauan Yapen, 2010).

The diversity of butterflies (Papilionoidea) in Papua is very high, especially on the mainland. The diversity of butterflies on the mainland of Papua is well studied but for Kurudu Island this is hardly known. According to Parsons (1999) and Van Mastrigt (2014) the number of butterfly species in Papua (mainland and islands) is about 819 species, of which 27 species of Papilionidae (5 genera), 159 species of Hesperidae (31 genera), 145 species of Pieridae (10 genera), 26 species of Riodinidae (2 genera), 289 species of Lycaenidae (64 genera) and 173 species of Nymphalidae (57 genera). Although the diversity of species on the island is less than on the mainland, the number of endemic species on the island is relatively higher.

For the islands in the Cenderawasih Bay, Numfor, Supiori, Biak, and Japen, the number of butterfly species is about 291, including 20 Papilionidae species, 31 Hesperidae species, 30 Pieridae species, 4 Riodinidae species, 99 Lycaenidae species and 107 Nymphalidae species. Until now there were no data on the diversity of butterflies of Kurudu Island. Therefore the inventory survey of its species diversity up to subspecies level is necessary.

In addition, this research is expected to obtain basic species data on the small island of Kurudu which is very vulnerable to habitat destruction. The issue of district expansion area and intensive development of both, regency and district, also needs to be considered as it puts the species diversity of the island in danger. If research is not immediately carried out, there will be a possibility of extinction of species before they are found.

Materials and methods

The research was conducted on Kurudu Island (Appendix I), Japen Island Regency, for 7 days intensive observations from 22nd-28th October 2016. The subject of this study were all species of butterflies (Papilionoidea) on Kurudu Island. The method used in butterfly sampling was the "Transect Count on Line Transect" (Sutherland, 1996). The locations of the butterfly sampling on Kurudu Island (Appendix 2) were at the following coordinates and altitudes:

- Secondary Forest and Coastal Area of Kampung Kurudu (Kurudu Village):
1°50.170'-1°50.615' S - 137°01.941'-137°02.390' E, 3-4 meters above sea level.
- Secondary Forest and Coastal Area of Kampung Kirimri (Kirimri Village):
1°49.976'-1°50.412' S - 137°01.267'-136°59.472' E, 3 meters above sea level.
- Secondary Forest and Coastal Area of Kampung Mansior (Mansior Village):
1°50.728'-1°51.257' S - 137°02.511'-137°03.047' E, 3-5 meters above sea level.

The tools being used were: sweeping net, GPS (Global Position System), altimeter, cork/spare board, tweezers, tissue, paper bags (papillots), magnifying glass, plastic boxes/specimen boxes, thermometer, writing equipments, insect pins, label papers, digital camera, butterfly identification books/field manual books. The used chemicals were: Alcohol 96%, Acetyl Acetate and Potassium Cyanide.

Work Procedures

Butterfly sampling on Kurudu Island was done by the “Transect Count method on Line Transect” (Sutherland, 1996). Transects for butterfly sampling were placed in the village area, around coastal vegetation, along gardens and secondary forest. The length of each transect was 1 km and transect replication was also made at each sampling habitat. Transect replicating was done so that the obtained sampling data are more reliable and actually describe the estimation of the variety of butterflies in a habitat. The exact number of transect replication in each habitat was determined using the “species sample curve” method (Brower & Zar, 1984) by making a curve graphic of the cumulative number of species compared to the cumulative length of the transect (Figure 1).

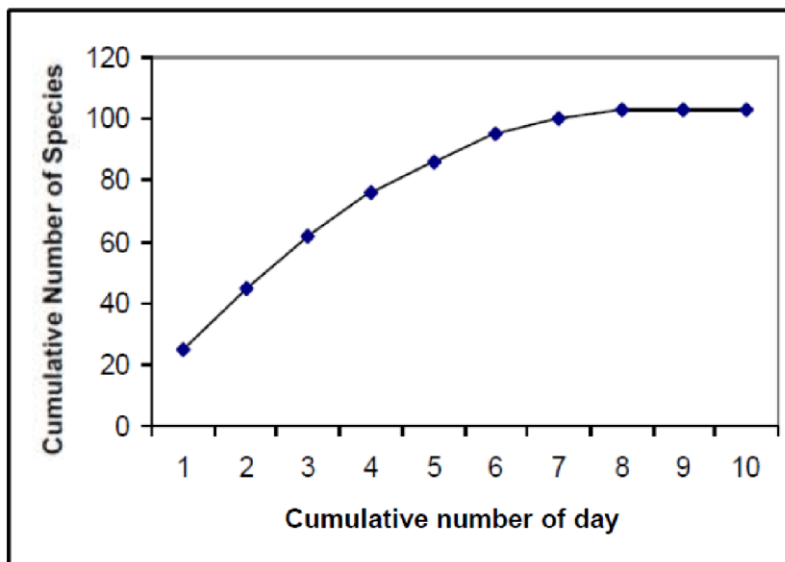


Fig. 1. The species sample curve

Butterfly sampling was performed along the transect with 2.5 m wide to the right and 2.5 m to the left up to a distance of 5 m in front of the observer (Fermon et al., 2001). Sampling was done on a sunny day at 08.00-16.00 WIT. The data recorded on each transect were the number of species and the number of individual/species. The identification of butterfly species was done directly when observed at the research site. For species that were not able to be identified directly, they were captured using an insect net and further identified in the Laboratory of Koleksi Serangga Papua (KSP).

Sampling results of collected butterfly samples were preserved and identified using literature by Van Mastrigt & Warikar (2013) and Parsons (1999).

Data Analysis

Data documentation including the diversity and abundance of butterflies were analyzed to produce the Species Diversity Index in each habitat. The “Shannon Wiener Index” (Shannon, 1948 and Zar, 1999; quoted in Kantartzi et al., 2010) was used to estimate the diversity index of butterflies in secondary forest habitat and along the coast with the following formula:

$$H' = - \sum pi \log pi$$

where : $pi = \frac{ni}{N}$

concluding: $H' = - \sum \frac{ni}{N} \log \frac{ni}{N}$

addenda:

- H' : Shannon Wiener Diversity Index
- ni : The individual number for species i
- N : The individual total number in sample
- pi : The individual number in a species per total individual number in sample
- \log : Logarithm

Results and discussion

The diversity of butterflies on Kurudu Island

Observation results on Kurudu Island during 7 days of intensively sampling (22nd-28th October 2016) resulted in recording of Papilionidae (11 species), Pieridae (7), Lycaenidae (23), Nymphalidae (34) and Hesperidae (15). Comparison of the number of each family is shown in fig. 2 below.

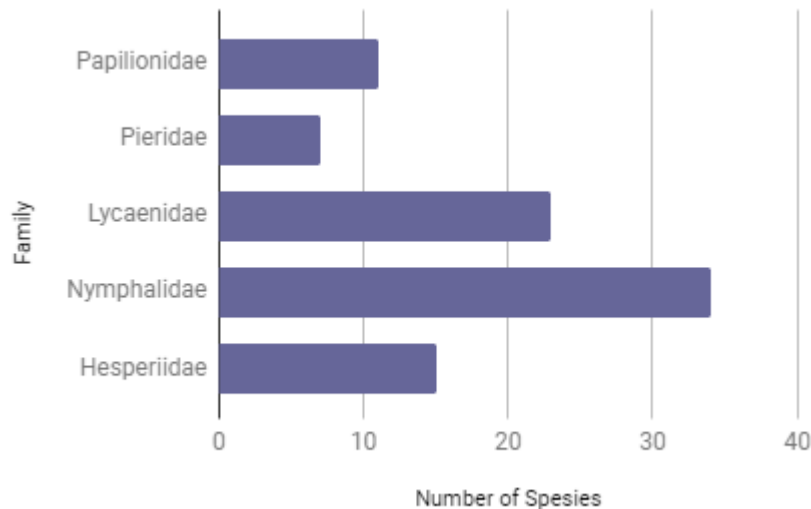


Fig. 2. The number of butterfly species on Kurudu Island

Fig. 2 above shows that the Nymphalidae are present with the highest number (34 species) followed by Lycaenidae, Hesperidae, Papilionidae and finally Pieridae which has the lowest number of 7 species. Nymphalidae are more numerous because in general it has the largest number of species, in Papua it is represented by 173 species in 57 genera. This family has a wide distribution, it has a wide

range of available food plants for the caterpillars (hostplant) and nectar flowers for the adults. During this inventory only a few Pieridae species were recorded on Kurudu Island.

Data on butterflies were recorded on Kurudu Island around coastal vegetation, along gardens and secondary forest. The accumulated number of butterfly species on each day is shown in Fig. 3.

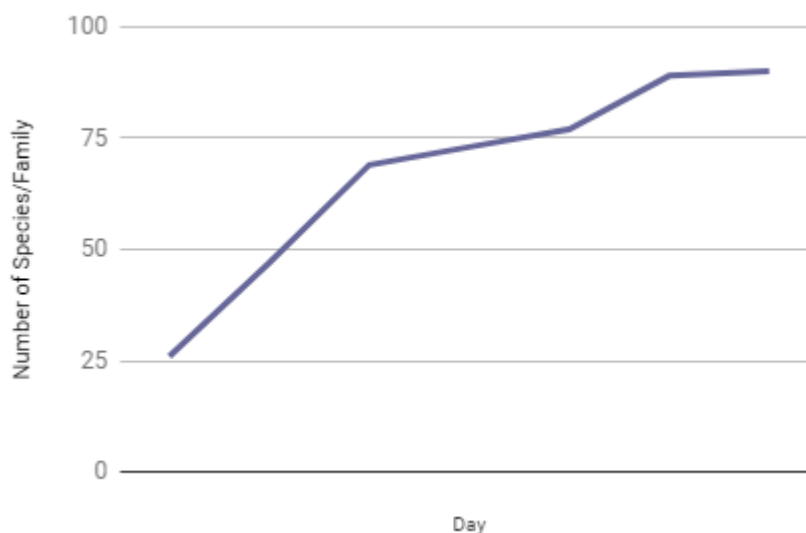


Fig. 3. The accumulated number of butterfly species

Fig. 3 shows that the accumulated line of species each day has started stationary. However, it is estimated that there will be a possibility of adding the number of new species if the number of sampling days is increased, which could possibly reach more than 100 species if sampling time (day) is added and the observation covers the entire island. The addition of the number of species per family during the observations can be seen in fig. 4 below.

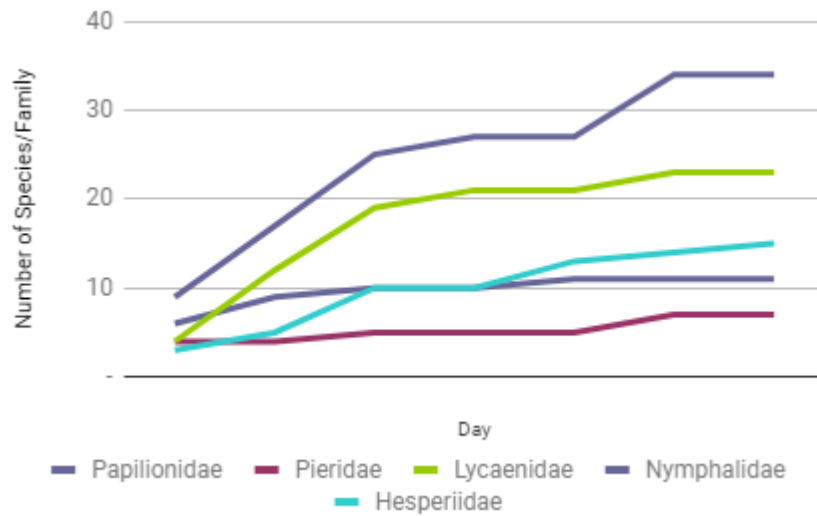


Fig. 4. The accumulated number of butterflies per family

Fig. 4 shows that the accumulated species lines of the six families have begun stationary. For the Hesperiiidae and Nymphalidae it is expected that there will be an increase of the number of new species because the lines have not been stabilized on the last day of observation.

The Diversity Index (Shannon Wiener Index) of butterflies on Kurudu Island

Shannon Wiener Index calculation was performed to see the diversity of the Papilionoidea species on Kurudu Island. Table 1 shows that Kurudu Island has a high diversity of butterflies shown by H' values above 1 (1.629). Table 1 also shows that the Nymphalidae, Hesperiiidae and Lycaenidae have a high species diversity index (H'=1.219, H'=1,067 and H'=1,064 respectively) comparing with the other two families, Pieridae and Papilionidae, which have a low species diversity index (H'=0.681 – H'=0.851).

Table 1. Species Diversity Index on Kurudu Island

No.	Family	Kurudu Island	
		Σ sp	H'
1	Papilionidae	11	0.851
2	Pieridae	7	0.681
3	Lycaenidae	23	1.064
4	Nymphalidae	34	1.219
5	Hesperiiidae	15	1.067
	Total	90	1.629

Some worthwhile observations

The appearance of some butterfly species found during observations very much resemble those on the mainland rather than those on Japen Island, for example in *Parthenos aspila* (Nymphalidae) (Fig. 5). This species is on Kurudu Island present in high numbers. Another species of importance is

Ornithoptera priamus kasandra (Papilionidae) (Fig. 6-7), a species that last year was included on the list of protected insects in Indonesia under *Peraturan Pemerintah Nomor 7 Tahun 1999* on Preservation of Plant and Animal Species.



Fig. 5. *Parthenos aspila* (Nymphalidae). Photo: Daawia Suhartawan.

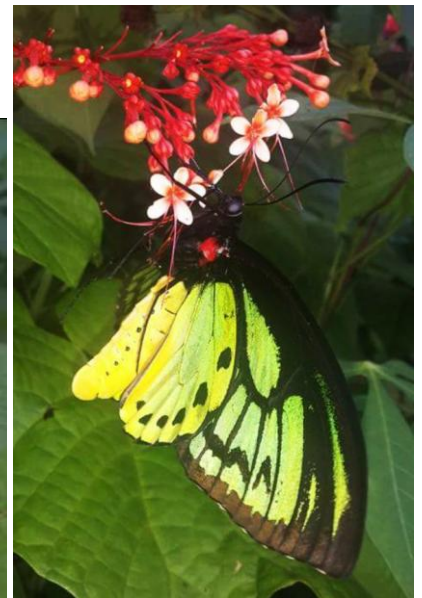


Fig. 6-7. *Ornithoptera priamus kasandra* (Papilionidae) on Kurudu Island. Photo: Daawia Suhartawan.

Conclusions

1. During 7 days of intensive field observations on Kurudu Island (22nd-28th October 2016) 90 butterfly species (Papilionoidea) were found: 11 species of Papilionidae, 7 species of Pieridae, 23 species of Lycaenidae, 34 species of Nymphalidae and 15 species of Hesperidae.
2. Based on the "Calculation of Species Richness" and "Shannon Wiener's (H') Diversity Index Calculation", it is shown that Kurudu Island has a high diversity of butterflies, 90 species were found in just 7 days of butterfly sampling with H' values above 1 (1.629).

3. The butterfly fauna on Kurudu Island is very likely influenced by the short distance of the island to the mainland of Papua which is the source of the species. For example, *Parthenos aspila* (Nymphalidae) is more similar in appearance to the populations existing on the mainland rather than those on the nearby Japen Island. During the recording of data on Kurudu Island *Ornithoptera priamus kasandra* (Papilionidae) was found, which last year was included on the list of protected insects in Indonesia under *Peraturan Pemerintah Nomor 7 Tahun 1999* about Preservation of Plant and Animal Species.

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