

BUTTERFLY DIVERSITY (LEPIDOPTERA: PAPILIONOIDEA) IN KALOY LIMESTONE HILL, TAMIANG HULU DISTRICT, ACEH TAMIANG REGENCY

KEANEKARAGAMAN KUPU-KUPU (LEPIDOPTERA: PAPILIONOIDEA) DI BUKIT KAPUR KALOY, KECAMATAN TAMIANG HULU, KABUPATEN ACEH TAMIANG

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(received October 2023, revised November 2023, accepted December 2023)

ABSTRAK

Penelitian mengenai kupu-kupu pernah dilakukan di berbagai wilayah Provinsi Aceh, misalnya di Aceh Besar, Aceh Selatan, Aceh Tengah, dan Langsa. Namun, hingga saat ini belum ada penelitian kupu-kupu di wilayah Aceh Tamiang, khususnya Kaloy. Terdapat beragam tipe habitat di Kaloy, salah satunya yaitu Bukit Kapur Kaloy (KLH) yang memiliki berbagai macam jenis tumbuhan yang mendukung keanekaragaman kupu-kupu. Penelitian ini bertujuan untuk menganalisis keanekaragaman kupu-kupu di KLH. Pengamatan dilakukan dari bulan Desember 2022 hingga Januari 2023 (pada akhir musim penghujan) menggunakan metode *standard walk* dengan 6 kali pengulangan pengamatan. Hasil menunjukkan terdapat 32 spesies yang terdiri dari 4 famili, dengan famili Nymphalidae sebagai famili yang paling banyak ditemukan dan *Junonia hedonia* sebagai spesies yang paling banyak ditemukan. Pengamatan ekologi terhadap populasi kupu-kupu pada saat penelitian yaitu nilai indeks keanekaragaman (H') antara 2,24-2,46 dan nilai dominansi antara 0,11-0,13. Keanekaragaman kupu-kupu dari KLH dapat dijadikan sebagai informasi tambahan bagi keanekaragaman kupu-kupu di Indonesia, terutama di Provinsi Aceh. Selain itu, penelitian ini dapat dijadikan referensi kedepan untuk manajemen konservasi di Kaloy.

Kata kunci: diversitas, ekosistem, Lepidoptera.

ABSTRACT

Studies on butterflies have been done in Aceh region, like Aceh Besar, Aceh Selatan, Aceh Tengah, and Langsa. But there is no research about butterfly from Aceh Tamiang, especially in Kaloy. There are many habitat types in Kaloy, one of them is Kaloy Limestone Hills (KLH) with many vegetation in there that support butterfly diversity. This research aims to analyze butterfly diversity from KLH. Field observations were conducted from December 2022 – January 2023 (in the end of rainy season) using the standard walk method with six observation sessions. The result showed there were 32 species belonging to four families, with Nymphalidae as the most families found and *Junonia hedonia* as the most species found. The ecological assessment of butterfly populations at the time of the research were butterfly diversity indexes (H') were between 2.24-2.46 and the dominance indexes (D) were between 0.11-0.13. Butterfly diversity from KLH is additional information to butterfly database in Indonesia, especially Aceh Province. Also, this information can be a future reference for conservation management in Kaloy.

Keywords: diversity, ecosystem, Lepidoptera.

INTRODUCTION

Butterfly is important as plant pollinator (Koneri & Maabuat 2016), environmental bioindicator (Kocher & Williams 2000; Swaay 2012), and also as pest at the larva stage (Nair *et al.* 2014). Butterfly (Lepidoptera) comprised 19.022 species (EoL 2022). In Indonesia, 1.900 species were recorded, with more than 1.000 species recorded in Sumatra (Iqbal *et al.* 2021). Some studies about butterfly diversity had been done in Indonesia, like Jambi

(Rahayu & Basukriadi 2012), Central Java (Widhiono 2015), North Sulawesi (Koneri & Nangoy 2019), and others. In Aceh, there were studies about butterfly diversity from Aceh Besar (Suwarno *et al.* 2013), Aceh Selatan (Rosnita *et al.* 2015), Aceh Tengah (Marlisa *et al.* 2022), and Langsa (Sari *et al.* 2023). But there is no research on butterfly diversity from Aceh Tamiang, especially in Kaloy.

Kaloy village located in Tamiang Hulu District, Aceh Tamiang Regency. There are



Figure 1. Map of study site: A. Aceh; B. Aceh Tamiang; C: Kaloy Limestone Hill (Google earth, 2022); D: Station 1; E: Station 2; F: Station 3 (photograph by Nurjannah, 2022).

many habitats type in there, i.e. forest, plantation, agriculture, river, and the special one is limestone hill. Kaloy Limestone Hill (KLH) is an ecotourism that presents natural scenery with a river and a variety of plant vegetation which is become the factor that affects butterfly diversity. Unfortunately, this ecotourism is now neglected and not well managed.

This research aimed to determine the diversity of butterfly in KLH which can be additional information on the butterfly database in Indonesia, especially Aceh Province. This research also can be used as a reference for future research and conservation management in Kaloy as support to increase the value of ecotourism in KLH.

MATERIALS AND METHODS

Study Site

This research was conducted at Kaloy Limestone Hill (KLH) in Tamiang Hulu District, Aceh Tamiang Regency ($4^{\circ}11'30''$ N, $97^{\circ}53'05''$ E, 35 m elevation) with the temperature range from 23-35°C and the humidities range from 53-77%. Data collection established at 3 stations with each station length being 200 m (Figure 1). These stations were based on the habitat type. Station 1 is a hills area with a stone quarry and relatively sparse canopy cover. Station 2 is an abandoned resident oil palm plantation area near the river and surrounded by shrubs. Station 3 is a limestone hill with *Albizia* plantation area near the river.

Field survey and data collection

Butterflies were recorded once a week for six observation sessions from December 2022 to January 2023 (in the end of rainy season), from 09.00 to 16.00 GMT+7 on a sunny day using the standard walk method (Pollard & Yates 1993; Swaay 2012; Sumiati *et al.* 2018). Some specimens were collected to facilitate identification. Identified butterfly species were marked on the wings then released back to nature after data was recorded. Identification was done using morphological character and photographs which were then compared to relevant literature including Peggie & Amir (2006), Baskoro *et al.* (2018), Rohman *et al.* (2019), Harmonis (2021), and Iqbal *et al.* (2021). Plant species data were also recorded and used to analyze the potential source of the hosts or foodplant according to data from survey and literature (Soekardi 2007; Rusman *et al.* 2016; Pahman *et al.* 2022). Butterfly specimen saved in Biology Laboratory, Universitas Samudra.

Data analysis

Ecological aspects used to assess the ecology of butterfly in the study site included diversity and dominance index. To analyze the diversity index using the Shanon-Wiener Diversity Index formula (Krebs, 1999) and to analyze dominance index using the Simpson Dominance Index formula (Magurran, 2004). The diversity index can be classified into low (<1), medium (1-3), and high (>3). The dominance index range between 0 and 1.

RESULTS AND DISCUSSION

There were 32 species (Figure 2) belonging to four families of butterflies recorded from KLH with 125 individuals (Table 1), and likely

increased in further studies. The number of species found comprised around 3.2% of the total butterflies identified in Sumatra (around 1000 species) (Iqbal *et al.* 2021). This result is higher than other studies in Aceh, e.g 25 species in Aceh Selatan (Rosnita *et al.* 2015) and 31 species in Pulau Raya Aceh Jaya (Yusuf *et al.* 2018).

This result was affected by many factors, like conditions of the study site, the method, the time, also the length of the observation period. For example, research in Aceh Selatan found 25 species of butterfly due to the conditions of the study site which is an agriforest area that possibly has a few plants diversity that can be hosts or food plant for butterfly. Also, in that study in Aceh Selatan, the observation was done only once with no repetition. However, this result is fewer than studies in Aceh Besar by 60 species (Suwarno *et al.* 2013), Aceh Tengah by 36 species (Marlisa *et al.* 2022), and Langsa by 36 species (Sari *et al.* 2023). This condition was also influenced by various factors. For example, the good condition of the study site in Aceh Besar because of vegetation succession planning after the tsunami in Aceh increased the diversity and density of plants. A variety of plants also showed by the study in Langsa. There were 33 plants which supposed as hosts and foodplant. The high plant diversity can be the carrying capacity for butterfly. The time and length of observation also influenced the result, like the study from Aceh Besar was carried out for two months with intervals once every two days.

The ecological assessment for butterfly population at the time of the research (in the end of rainy season) indicates good results with all stations have medium category for diversity index (H') value of 2.24-2.46, while the butterfly



Figure 2. Butterfly species in Kaloy Limestone Hill, Aceh: (A) *Graphium agamemnon*, (B) *Papilio memnon*, (C) *Papilio polytes*, (D) *Athyma perius*, (E) *Cyrestis cocles*, (F) *Danaus melanippus*, (G) *Doleschallia polibete*, (H) *Elymnias hypermnestra*, (I) *Elymnias nesaea*, (J) *Euploea camaralzeman*, (K) *Euploea mulciber*, (L) *Faunis canens*, (M) *Hypolimnas bolina*, (N) *Ideopsis vulgaris*, (O) *Junonia almana*, (P) *Junonia atlites*, (Q) *Junonia hedonia*, (R) *Junonia orithya*, (S) *Lasippa tiga*, (T) *Lexias pardalis*, (U) *Moduza procris*, (V) *Neptis hylas*, (W) *Parantica aspasia*, (X) *Thaumantis klugius*, (Y) *Tirumala septentrionis*, (Z) *Delias hyparete*, (AA) *Eurema alitha*, (AB) *Eurema hecabe*, (AC) *Gandaca harina*, (AD) *Leptosia nina*, (AE) *Udaiana cynis*, (AF) *Jamides celeno* (photograph by Sari and Nurjannah 2023).

Tabel 1. Butterfly species recorded at KLH area.

| Family | Species | Station | | | Total | Conservation status |
|--|--|-----------|-----------|-----------|------------|---------------------|
| | | 1 | 2 | 3 | | |
| Papilionidae | <i>Graphium agamemnon</i> (Linnaeus, 1758) | - | - | 1 | 1 | NE |
| | <i>Papilio memnon</i> Linnaeus, 1758 | - | 1 | - | 1 | NE |
| | <i>Papilio polytes</i> Linnaeus, 1758 | - | - | 1 | 1 | NE |
| Nymphalidae | <i>Athyma perius</i> (Linnaeus, 1758) | - | - | 1 | 1 | NE |
| | <i>Cyrestis cocles</i> Fabricius, 1787 | - | 2 | - | 2 | NE |
| | <i>Danaus melanippus</i> (Cramer, [1777]) | 3 | - | 6 | 9 | NE |
| | <i>Doleschallia polibete</i> Cramer, 1782 | 1 | 1 | - | 2 | NE |
| | <i>Elymnias hypermnestra</i> Linnaeus, 1763 | - | 2 | - | 2 | NE |
| | <i>Elymnias nesaea</i> (Linnaeus, 1764) | - | - | 1 | 1 | NE |
| | <i>Euploea camaralzeman</i> Butler, 1866 | - | - | 1 | 1 | NE |
| | <i>Euploea mulciber</i> (Cramer, [1777]) | 1 | - | 4 | 5 | NE |
| | <i>Faunis canens</i> Hübner, [1826] | 1 | - | - | 1 | NE |
| | <i>Hypolimnas bolina</i> (Linnaeus, 1758) | - | 7 | 5 | 12 | NE |
| | <i>Ideopsis vulgaris</i> (Butler, 1874) | 6 | - | 8 | 14 | LC |
| | <i>Junonia almana</i> (Linnaeus, 1758) | 2 | 4 | - | 6 | LC |
| | <i>Junonia atlites</i> (Linnaeus, 1763) | 1 | 1 | - | 2 | NE |
| | <i>Junonia hedonia</i> (Linnaeus, 1764) | 5 | 10 | 7 | 22 | NE |
| | <i>Junonia orithya</i> (Linnaeus, 1758) | 1 | 1 | - | 2 | LC |
| | <i>Lasippa tiga</i> (Moore, 1858) | 1 | - | - | 1 | NE |
| | <i>Lexias pardalis</i> (Moore, 1878) | - | 1 | - | 1 | NE |
| | <i>Moduza procris</i> (Cramer, [1777]) | 1 | - | - | 1 | NE |
| | <i>Neptis hylas</i> Linnaeus, 1758 | 1 | 2 | - | 3 | NE |
| | <i>Parantica aspasia</i> (Fabricius, 1787) | 2 | - | 12 | 14 | NE |
| <i>Thaumantis klugius</i> Zinken, 1831 | - | 1 | - | 1 | NE | |
| <i>Tirumala septentrionis</i> (Butler, 1874) | - | - | 1 | 1 | NE | |
| Pieridae | <i>Delias hyparete</i> (Linnaeus, 1758) | 1 | - | 1 | 2 | NE |
| | <i>Eurema alitha</i> (Felder dan Felder, 1862) | 1 | - | - | 1 | LC |
| | <i>Eurema hecabe</i> (Linnaeus, 1758) | - | 1 | - | 1 | LC |
| | <i>Gandaca harina</i> (Horsfield, [1829]) | - | 1 | 2 | 3 | NE |
| | <i>Leptosia nina</i> (Fabricius, 1793) | - | 2 | - | 2 | NE |
| | <i>Udaiana cynis</i> Hewitson, 1866 | - | 2 | - | 2 | NE |
| Lycaenidae | <i>Jamides celeno</i> (Cramer, [1775]) | - | 7 | - | 7 | NE |
| Total species | | 15 | 17 | 14 | 32 | |
| Total individuals | | 28 | 46 | 51 | 125 | |

Notes: -: Not Present; LC: Least Concern; NE: Not Evaluated

Table 2. Diversity and dominance index.

| Station | Diversity Index (H') | Dominance Index (D) |
|-----------|----------------------|---------------------|
| Station 1 | 2.44 | 0.11 |
| Station 2 | 2.46 | 0.11 |
| Station 3 | 2.24 | 0.13 |

dominance index (D) value of 0.11-0.13 (Table 2). The plant inventory in all stations yielded 11 species of plants that can be used as hosts and food plant (Table 3.). The diversity indexes from all stations were categorized as medium with a range value of 2.24-2.46. The highest index was at station 2 but it is not much different from the other station. This condition is due to the supporting factors of a variety of plants becoming hosts or/and food-plant for butterfly. Eight plants in Station 2 can be both host and food plants, namely *Pueraria phaseoloides*, *Mimosa pudica*, *Melastoma malabathricum*, *Urena lobata*, *Lantana camara*, *Stachytarpetta indica*, *Ficus hispida*, and *Elaeis guineensis* when the other station has 6 plants (Station 1) and 5 plants (Station 3). This condition was also supported by the water source from the river in station 2. Among the all stations, Station 3 has the lowest vegetation for food and hostsplant of butterfly. This situation became one of the

factors that affect butterfly diversity. Other factors come from technical issues, such as hilly areas that make it hard to do observation. The dominance indexes range from 0.11 to 0.13. This was categorized as low dominant, which means that there were no species that dominated in those areas. The dominance index was influenced by species number and individual species distribution.

The most family found was family Nymphalidae with 22 species (68.75%), followed by family Pieridae with 6 species (18.75%), family Papilionidae with 3 species (9.37%), and the lowest number from family Lycaenidae with 1 species (3.12%). At the species level, *Junonia hedonia* was the most species found (17.6%). Fourteen species were only recorded by a single individual each, namely *Graphium agamemnon*, *Papilio memnon*, *Papilio polytes*, *Athyma perius*, *Elymnias nesaea*, *Euploea camaralzeman*, *Faunis canens*, *Lasippa tiga*, *Lexias pardalis*,

Table 3. Plant species that used by butterfly as hosts or/and food plant.

| Family | Species | Station | | |
|----------------------|--------------------------------|----------|----------|----------|
| | | 1 | 2 | 3 |
| Arecaceae | <i>Elaeis guineensis</i> | - | √ | - |
| Asteraceae | <i>Cromolaena odorata</i> | √ | - | √ |
| Fabaceae | <i>Mimosa pudica</i> | √ | √ | - |
| | <i>Pueraria phaseoloides</i> | - | √ | - |
| Malvaceae | <i>Urena lobata</i> | - | √ | √ |
| Melastomaceae | <i>Melastoma malabathricum</i> | √ | √ | - |
| Moraceae | <i>Ficus hispida</i> | - | √ | - |
| Poaceae | <i>Imperata cylindrica</i> | √ | - | √ |
| Verbenaceae | <i>Lantana camara</i> | √ | √ | √ |
| | <i>Stachytarpetta indica</i> | √ | √ | √ |
| Total species | | 6 | 8 | 5 |

Moduza procris, *Thaumantis klugius*, *Tirumala septentrionis*, *Eurema hecabe*, and *Eurema alitha*.

The most family found in KLH showed a similar pattern to other butterfly diversity studies in Indonesia, in which family Nymphalidae become the dominant (Oqtafiana *et al.* 2013; Gosal *et al.* 2016). The reason for this situation is that the family Nymphalidae has the most species member, around 34.21% of all known butterflies (Widjaja *et al.* 2014). Also, this family has a broad range distribution and many of the species are polyphagous that provide them to has many varieties of hosts dan foodplant (Lamatoa *et al.* 2013; Lestari *et al.* 2015). On the other hand, family Lycaenidae became the lowest number of species found in KLH by one species, *Jamides celeno*. This result was also similar to other areas in Indonesia, such as in Kendal by 2 species (Oqtafiana *et al.* 2013). In KLH, *Jamides celeno* only found in Station 2 due to existence of *Pueraria phaseoloides* as its hostplant (Susanthi & Arya 2022).

Based on IUCN Red List (2023), there are five species categorized as Least Concern (LC), while the others are Not Evaluated (NE). According to the Indonesian regulation from the Indonesian Ministry of Environment and Forestry No. 106 in 2018, there are also no protected butterflies. The butterflies from KLH also not on the list of CITES Appendices list. Although there are no priority butterfly species for conservation, this result still require attention considering that several species only found a single individual.

CONCLUSION

The research showed 32 species of butterfly recorded from Kaloy Limestone Hill,

Aceh Tamiang, Aceh. Species composition follows a common pattern from other areas, with Nymphalidae as the most family found. The ecological assessment indicates good results for diversity index (H') and dominance index (D) for butterfly populations at the end of rainy season. The vegetations also support the butterfly diversity as hosts or/and food plants. Further studies are needed with long sampling period, especially during the dry season to support the conservation of the butterfly in KLH.

ACKNOWLEDGEMENT

The authors thanked to village head of Kaloy, Tamiang Hulu District, who provided permission for research. The authors also thanked Imti Y. Wafa and Wendy A. Mustaqim who assisted with some butterfly species and identified plant species.

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