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DIVERSITY OF BUTTERFLIES (ORDO LEPIDOPTERA) AND FLOWER PLANTS IN MOUNT MURIA KUDUS, CENTRAL JAVA

Melisa Oktaviani Sukma[1]*, Lianah[2], Saifullah Hidayat[3]

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[1,2,3]Program Study of Biology and Biology Education, Faculty of Science and Technology, UIN Walisongo, Jl. Walisongo No. 3-5, Semarang City 50185 Central Java Indonesia, 024-7604554

e-mail:
*[1]melisaoktavianisukma@gmail.com
[2]lianahk58@gmail.com
[3]hidayatsaifullah@walisongo.ac.id

**Corresponding author*

Abstract. *Indonesian is a megadiverse country. Butterflies become one of the Indonesian diversities. Indonesian has the second-highest butterfly species in the world with more than 2000 species. Flower plants are used by butterflies as hostplants and foodplant. The aims of this research were to know butterflies' diversity and food plants in Mount Muria at Kudus City, Central Java. The research used the sampling transect method with three stations (along 2 km). The research was conducted in March and June 2020. The tools used were insect net, thermohygrometer, lux meter, digital camera, roll meter, GPS, jar, and identification book. Data on butterflies diversity were analyzed by Shannon-Wiener (H'), Evenness index (E), Relative Abundance (Pi), Simpson Dominance Index (D), Density (KR) Frequency (FR), and Important Value Index (IVI). Results of the research showed that at least 40 species of six family butterflies found at Mt. Muria. Butterflies at Mt. Muria area has a medium diversity, medium evenness, and low dominance. Leptosia nina has the highest relative abundance, frequency, density and IVI (Important Value Index). Butterflies were found frequently feeding on flowers as hostplants and foodplants. 31 species of flower plants were found at Mt. Muria. The most used plant as hostplants and foodplants by butterfly is Lantana camara, and Chromolaena odorata from Verbenaceae and Asteraceae.*

Keywords: *butterflies, diversity index, flower plant.*

Citation
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INTRODUCTION

Indonesian territory has many islands with various contours, from hill to mountain, from narrow until large with various flora, fauna, and microbes live (Triyono, 2013). Butterflies have many functions in the ecosystem, they provide the stability for the food webs, as herbivore, pollinators, prey of predators (Rusman et al., 2016), environment bioindicator, aesthetic, educational, endemic, conservation, ecological and cultural values (Sari, 2019). Many factors affect butterflies diversity namely canopy, hostplant, altitude, temperature, humidity, light intensity, weather, and season (Sari, 2019). One of the important components for butterflies' life is the availability of vegetation as a source of food, a place for breeding and shelter (Ruslan & Andayaningsih, 2016). Butterflies' preference for plants is a tendency or attraction of butterflies for plants. Flower plants used by butterflies as hostplant, foodplant, and activities place (Mas'ud et al., 2019). A positive re-

lationship has been found between butterfly diversity and plants, particularly in tropical regions, where insect show high abundance and species diversity (Majumder, 2013).

Earlier, a study on butterfly diversity in relation to nectar foodplants from Bhor Tahsil, Pune District, Maharashtra, India recorded a total of 64 butterfly species which dominated by family of Nymphalidae. A total of 90 nectar food plants were identified belong to 10 plant families. Plant of the Asteraceae family are more used by butterflies as nectar food plants (Nimbalkar et al., 2011).

Butterflies diversity in Indonesia has been recorded including in Mount Sago, West Sumatra, where184 species of butterfly and 56 species of nectar plants were recorded (Rusman et al., 2016). A total of 34 species of butterflies were reported in Mount Prau, Central Java (Purwowidodo, 2015). In Mount Slamet, 10 species endemic butterflies recorded in Java (Widhiono, 2014). Moreover, 17 species butterfly recorded in Mount Gede Pangrango National Park, West Java, (Dendang, 2009). Here, we studied diversity of flower plants and butterflies in Mount Muria, Central Java.

Mount Muria is located in three districts, namely Kudus, Pati, and Jepara districts (Malik & Kusumarini, 2019). Muria mountain in the Central Java area is a destination for religious tourism. Mt. Muria has an altitudinal gradient of 1602 m asl (above sea level), with destination object of Mt. Muria has slope of 700 m asl, the forest cover of the coffee plants, and protected forest (Widjanarko & Wismar'ein, 2011).

Based on data of Muria Studies and Perum Perhutani, Forest Management Unit (KPH) Pati on flora and fauna richness in Muria mountain, revealed that mount Muria has about 80 kinds of trees, palm, grass, and planted tress such as mahoni (*Swietenia mahagony*) planted in 1942, tusam (Pinus merkusii) planted in 1944, sengon (*Albizzia falcate*) planted sporadically, *Eucalyptus deglupa*, and coffee planted in 1942. Moreover, there are 5 kinds of sendok snake (Java cobra), green phyton, weling snake, welang snake, and the other animals, such Javan Hawk-eagle (*Spizaetus bartelsi*), deer (*Muntiacus muntjak*), long-tailed monkey (*Macaca fasciculari*), langur (*Trachypithecus auratus*), porcupine (*Hystrix javanica*), squirrel, wild boar (*Sus secrofa*), partridge, weasel, leopard, and kinds of bird such as hawk, sooty-headed Bulbul, kacer kembang, greater green leafbird, cucak kembang, owl, trucuk, woodpecker, flycather, bar-winged Prinia, truntung, plontang, honey bird, wern, hornbill, cuckoo, heron, woodpecker and horsfield's bushlark. Mount Muria also has the potential existence of Javan tiger (*Pantera tigris sondaica*) and Javan Hawk-eagle (*Nisaetus bartelsi*) (Widjanarko, 2016).

The field study was conducted by Puslitbang - Muria Center for Environmental Studies, Muria Kudus University Research Center and Yogyakarta Indonesia Institute of Niche on 4–14 August 2004 in the Muria mountain area by exploring the Semliro, Puncak Songolikur, Tempur, Nduplak, Mount Rowo, Colo, Air Tiga Raksa and Semliro areas covering Kudus, Pati, and Jepara districts. This research has identified 68 species of birds, one of which is the Javan hawk (*Spizaetus bartelsi*) or known as the Garuda bird. This bird is endemic to Java and protected as it is in a state of danger of extinction (endangered). In addition, the team also succeeded in making an inventory of 109 plant species belonging to 51 families, including grass, orchids and typical Muria trees: mranak, fruit types, such as mango, durian, cashew nut, tailings, papaya, rambutan, parijoto and pineapple (Widjanarko, 2016).

Based on those data, we know that Mount Muria has potential for butterfly diversity, so we studied butterfly diversity and flower plants in Mount Muria, Central Java. The aims of this research were to determine butterflies' diversity and flower plants in the Muria mountain at Kudus Central Java and observe the abiotic factors. Data on the butterfly diversity and flower plants in Mount Muria are necessary to support conservation effort.

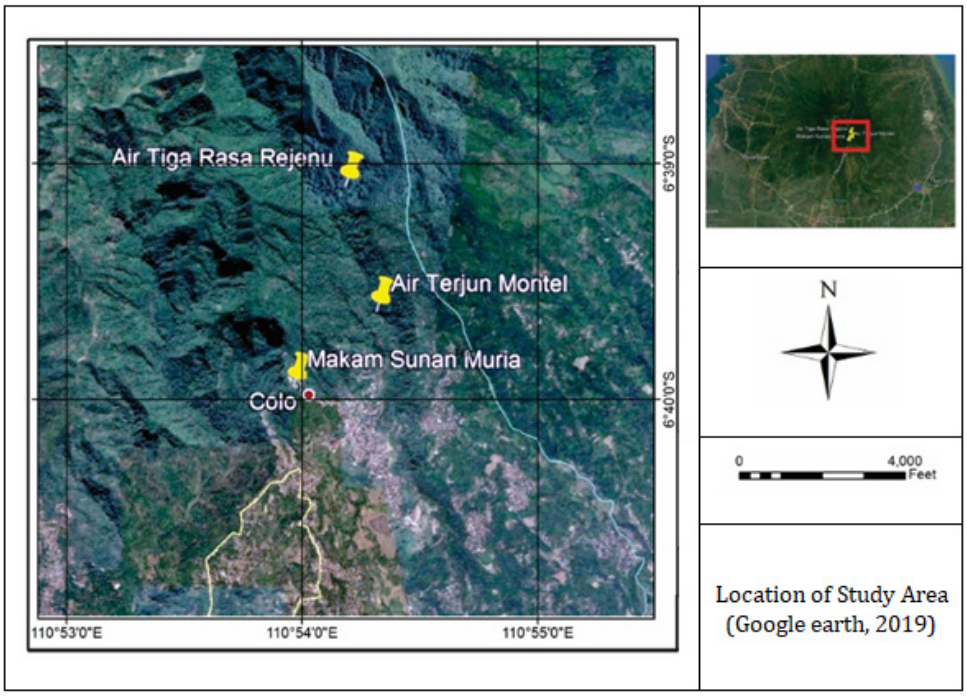

Figure 1. Location of Study Area (Source: Google earth, 2019).

MATERIALS AND METHODS

Muria mountain is located in the Kudus district Central of Java. The study area was divided into 3 Stations. Station 1 in Kembang River between 06°40'06.71" N and 110°54'23.08" E. Station 2 in Monthel waterfall between 06°39'41.36" N and 110°54'24.65" E. and, Station 3 in Rejenu between 06°39'09.51" N and 110°54'07.05" E.

Vegetation at stations 1, 2, and 3 was shrub-like plants, mostly of Asteraceae and Poaceae group. Station 1 is the lowest and closest place to residential areas. Station 2 has medium altitude, and station 3 has the highest altitude. Data collection was done through 2 repetitions within 2 months at March 10–16, 2020 and June 19–25, 2020. Butterfly collection was carried out from 08.00–15.00.

The tools used were insect net, thermohygrometer (Beurer), luxmeter (Extech 401025), digital camera (Canon PowerShot SX410 IS and Canon 1000D), GPS (Global Position System) Garmin Oregon 750, roll meter, jar, and identification book. The identification books for butterflies used were "*Lepidoptera Semarang Raya*" by Karyadi Baskoro (2018), "*Butterflies and Moth*" by David Carter (1992) and "*The Complete Field Guide to Butterflies of Australian*" by Michael F. Braby (2004). While, The identification books for plants used were "*Flora of Java*" by C. A. Backer, and R C Bakhuizen van den Brink Jr (1965), and "*Flora Pegunungan Jawa*" by C. G. G. J. Van. Steenis (2006).

This study focuses on butterflies' diver-

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sity and flower plants in Mt. Muria. Data in the research are amount and kinds of butterflies and flower plants that were successfully recorded in the station. Supporting data on this study were abiotic factors such as temperature, humidity, luminous intensity, and altitude.

The data collection used in this study was the sampling transect method. The butterfly was caught by the insect net along observation lines that had been determined. three stations as the sampling area were used with a difference of 2 km between stations. Each station is divided into three (30 × 10 m) sized substations (Figure 2). Flower plants visited by species of butterfly observed and identified on three stations area.

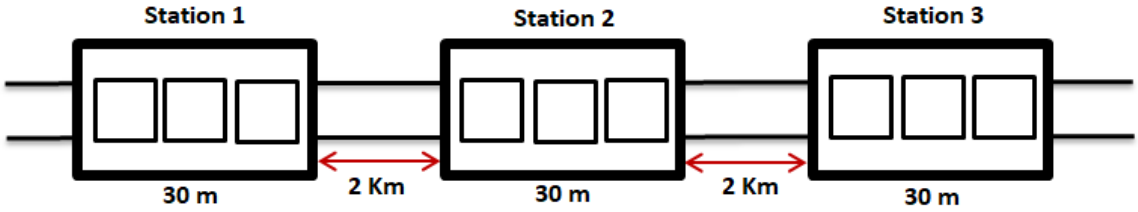

Figure 2. Station (Plot) Design of Research

Data analysis using descriptive method. Qualitative and quantitative morphological characterization was used for the description analysis (Lianah, et al., 2020). Butterfly species was identified using the butterfly identification books. Diversity was analyzed using Shannon-Wiener index diversity (H'), Evenness index (E), Relative Abundance (Pi), Simpson Dominance Index (D), Density (KR) Frequency (FR), and IVI (Important Value Index). Quantitative analysis of butterflies using the formula:

Shannon-Wiener Diversity Index

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

Note:
H' = Index of diversity (Shannon-Wienner)
Ni = Number of butterflies species -i
N = Total of all butterfly number (Rhadhiyah, 2017)

Evennes Index

$$E = \frac{H'}{H'max}$$

Note:
E = Index of evenness
H' = Index of diversity
H' max = Total of all butterfly number (Rhadhiyah, 2017)

Relative Abundance

$$Pi = \frac{ni}{N} x\ 100\ \%$$

Note:
Pi = Relative abundance
ni = Number of butterflies species
N = Total of all butterfly number (Dewi et al. 2016)

Domination

$$D = \sum_{i=1}^{S} \frac{ni\,(ni-1)}{N\,(N-1)}$$

Note:
D = Domination Index
N = Total of all butterfly number
ni = Number of butterflies species –*i*
(Nurmianti et al., 2015)

Density

$$\text{K-i} = \frac{\text{Number of individuals} - (i)}{\text{Total area of sample plot}}$$

$$\text{KR}(\%) = \frac{\text{Number of individuals} - (i)}{\text{Total area of sample plot}} \times 100\%$$

(Nurmianti et al., 2015)

Frequency

$$F = \frac{\text{Number of plots occupied by a species}}{\textit{Total number of plots}}$$

$$FR = \frac{\textit{Frequency of a species}}{\textit{Total Frequency of species}} \times 100\%$$

(Nurmianti et al., 2015)

IVI (Important Value Index)

IVI = KR + FR (Nurmianti et al., 2015)

RESULTS AND DISCUSSION

Research on the biodiversity of butterflies (Ordo Lepidoptera) and tropical flower plants on Muria mountain, Kudus Regency was carried out at three observation stations, which include the Kembang River (± 600 m), the Monthel Waterfall area (± 700 m), and the Rejenu area (± 800 m). Table 1 shows the data on the sampling results of species and the number of butterflies found during the study.

Based on the data in table 1, there are 40 species of butterflies recorded in the area of Mount Muria, Kudus Regency, Central Java. Divided into 6 families, namely Papilionidae 2 species, Pieridae 5 species, Nymphalidae 24 species, Rionidae 1 species, Lycaenidae 4 species, and Hesperiidae 4 species (Figure 3).

Figure 3 shows the total number of individuals of butterflies in Mount Muria, the highest species came from the Nymphalidae family, while the least came from the Rionidae family. Nymphalidae is the largest family in the ordo Lepidoptera. This is because this family has a wider distribution compared to other families. This family also has polyphagic properties, namely having many types of host plants and forage plants, these polyphagic properties help Nymphalidae continue to fulfill forage life even though the main host plant is not available so that it survive better all environmental conditions (Mogan et al., 2018).

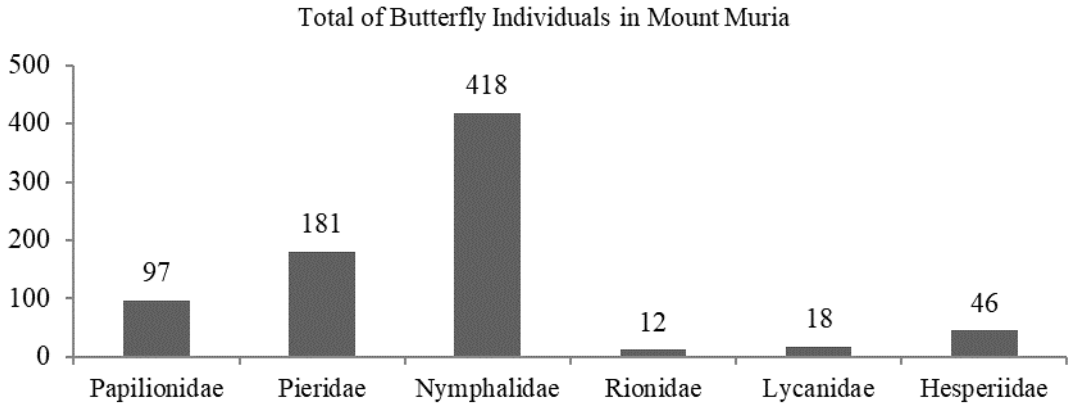

Figure 3. Total of Butterfly Individuals in Mount Muria

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Table 1. Data of Butterfly Species in Mt. Muria, Kudus Regency, Central Java

Ordo	Family	Genus	Species	Total Individuals
Lepidoptera	Papilionidae	Graphium	*Graphium sarpedon*	28
		Papilio	*Papilio memnon*	69
	Pieridae	Catopsilia	*Catopsilia pomona*	2
		Delias	*Delias belisama*	3
		Eurema	*Eurema blanda*	38
			Eurema hecabe	38
		Leptosia	*Leptosia nina*	100
	Nymphalidae	Chersonisia	*Chersonisia rahria*	75
		Danaus	*Danaus genetia*	5
		Doleschallia	*Doleschallia bisaltide*	1
		Elymnias	*Elymmnias hypernestra*	2
		Euploea	*Euploea climena*	1
			Euploea eunice	8
			Euploea mulciber	6
		Faunis	*Faunis canens*	4
		Hypolimnas	*Hypolimnas bolina*	19
			Hypolimnas anomala	4
		Junonia	*Junonia erogene*	2
			Junonia hedonia	12
			Junonia iphita	16
		Melanitis	*Melanitis leda*	1
		Mycalesis	*Mycalesis horsifieldii*	84
			Mycalesis perseus	21
		Neptis	*Neptis hylas*	17
		Orsotriaena	*Orsotriaena medus*	1
		Symbrenthia	*Symbrenthia hypselis*	19
			Symbrenthia anna	16
		Tanaecia	*Tanaecia palguna*	1
		Ypthima	*Ypthima horsifieldii*	79
			Ypthima nigricans	3
			Ypthima savara	21
	Rionidae	Zemeros	*Zemeros flagyas*	12
	Lycanidae	Arhopala	*Arhopala pseudomutha*	1
		Pithecops	*Pithecops corvus*	9
		Prosotas	*Prosotas dubiosa*	4
		Udara	*Udara akasa*	4
	Hesperiidae	Borbo	*Borbo cinnara*	2
		Hyrotis	*Hyarotis adrastus*	1
		Potantus	*Potantus omaha*	26
		Pesudocoladenia	*Pesudocoladenia dan*	17
1 Ordo	6 Family	30 Genus	40 Species	772 Individuals

The lowest species found were from the Rionidae family with only one species was found in the rionidae family, namely *Zemeros flegyas*. *Zemeros flegyas* has metallic brown wings. According to Sutra et al. (2012) Rionidae were the lowest because Rionidae family has a limited number of species, and they often perch underside the leaves so they are rarely found.

Table 2. Total nitrogen (Total-N) paddy and number of lateral roots at the end of experiment

Station	Index		
	Diversity of Species	Evenness	Domination
Station 1	2.93 (medium)	0.85 (almost evenly)	0.06 (low)
Station 2	2.83 (medium)	0.85 (almost evenly)	0.07 (low)
Station 3	2.70 (medium)	0.77 (almost evenly)	0.10 (low)

Results of the diversity index (H') at station 1 H' = 2.93, at station 2 H' = 2.83, and at station 3 H' = 2.70 (Table 2). In order to have high diversity, a community has to be composed of many species with even distributed individuals. So, from the data of the three stations, it shows that stations 1, 2, and 3 have a medium category of diversity index. The highest diversity index was found at station 1, while the lowest found at station 3. According to Rhadiyah (2017) when H' = 1 - 3, the diversity of species is medium. A community has high species diversity if the community is composed of many species (species) with the same species abundance. Conversely, if the community is composed of very few species, and a few dominant species, then diversity is low (Putra et al., 2013). So, station 1 has the highest diversity because at the station 1, found the highest number of butterfly species and the most abundant number of butterfly species.

The value of E has a range of around 0-1 where the value of E = 1 describes an evenly distributed state of the species, on the other hand, E≈0 indicates an evenness is low. In this study the evenness index at stations 1, 2, 3 are included in the "*almost evenly*" category (0.76 <E <0.95) (Fachrul, 2007). Evenness index in station 1, 2 and 3 are 0.85, 0.85 and 0.77 respectively. It shows that the evenness index on Mount Muria is "*almost evenly*". Lestari, et al., (2018) stated that the more evenly distributed species in an area, the better the environmental conditions, so that the more supportive of the species' survival.

The relative abundance index calculation shows that each station has a different index for each species. The highest relative abundance of species found in each station were *Papilio memnon* (0.14%) in station 1, *Mycalesis horsifieldii* (0.18%) in station 2, and *Leptosia nina* (0.21%) in station 3. Many species with the lowest relative abundance value in Mount Muria (KR = 0.004%), as were found only once during the observation, namely *Doleschillia bisaltide*, *Euploea climena*, *Melanitis leda*, *Orsotriaena medus*, *Tanaecia palguna*, *Arhopala pseudomutha*, *Prosotas dubiosa*, and *Hyarotis adrastus*. Husnia (2019) stated that the difference in the relative abundance index value is caused by the ratio between the number of species and the total number of all species found in the station. The number of butterfly species is also influenced by many factors, namely butterfly habitat, home range, research time, and abiotic factors.

The data from the three stations show that the index value of butterfly dominance in the Mount Muria area based on Simpson's criteria is classified as "low". The dominance index of the three stations 1, 2, and 3 shows the

minimum number due to D≈0, with the lowest dominance in station 1 (0.06). These results indicate that none of the species dominates in the three stations. Arisandi & Syamsi (2018), if the dominance index value close with the value of 1, then there are species that dominate other species in a community, on the contrary, if the dominance index value approaches the value of 0, it can be said that there are no species that dominate other species.

Leptosia nina species have the highest relative frequency of 0.03, the relative density of 0.13, and IVI of 0.16 . This shows that the distribution of the species and adaptability of *Leptosia nina* in Mount Muria, Kudus Regency is very good compared to other butterfly species. Hutasuhut (2018) stated the high-density value indicates that the distribution of the species is even. A high IVI indicates that these species live scattered and dominate in the Mount Muria area of Kudus Regency so that they have a great opportunity to maintain their growth and sustainability. Besides that, *Leptosia nina* is the main constituent that gives the greatest contribution to the stability of the butterfly community on Mount Muria, Kudus Regency. *Leptosia nina* has the highest IVI value because it is found in the highest number of species among other species.

While the lowest values of relative frequency, relative density, and IVI were owned by *Doleschillia bisaltide*, *Euploea climena*, *Melanitis leda*, *Orsotriaena medus*, *Tanaecia palguna*, *Arhopala pseudomutha*, and *Hyarotis adrastus* which had a relative frequency value of 0.011, a relative density of 0.001 and IVI of 0,012 meaning that the distribution in Mount Muria, Kudus Regency is uneven. In the case of *Catopsilia pomona* species, although it has a low frequency, the relative density and IVI values are still quite good. This shows that the spread is still sufficient.

As adult butterflies are only able to feed on fluids, flower nectar is the major source for sustenance in most species (Carter, 1992). During the observation, one type of flower plant was visited by one or several types of butterflies from one family or another. They actively visit flower plants to get nectar. Flower plants visited by butterflies during the observation are presented in Table 3. Flower plants found at three stations mostly belong to the Asteraceae family. Asteraceae is one of the largest families in the flowering plants (Angiosperms) (Karyati & Adhi, 2018).

There were 31 species of flowering tropical plant families belonging to 31 genera and 17 families. Graph of flower plants number can be seen in Figure 4, as follows:

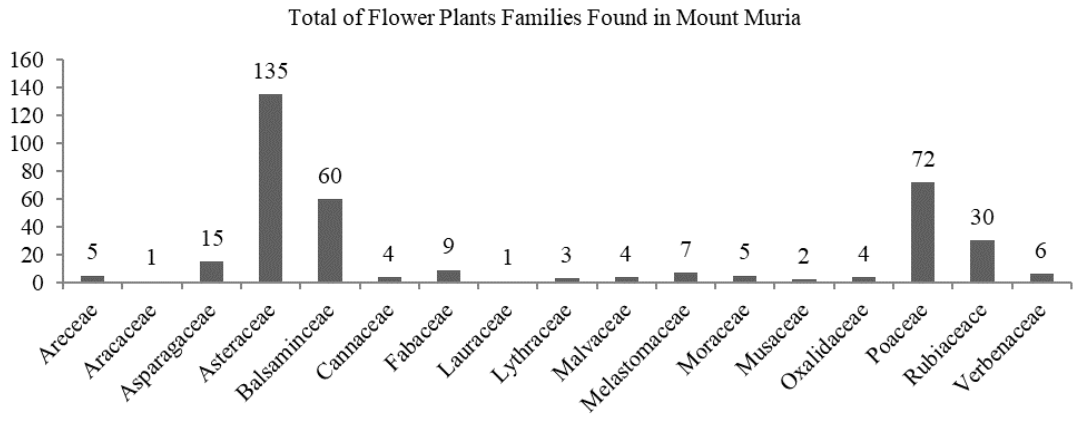

Figure 4. Total individual of Flower Plants Families Found in Mount Muria

Table 3. Data of Flower Plants found in the Mount Muria, Kudus Regency, Central Java

Family	Genus	Species and Local Name	Station			Total
			1	2	3	
Araceae	Alocasia	*Alocasia gigantea* (Bl) Hook.f. (Talas)	-	-	✓	3
	Caladium	*Caladium bicolor* (W. Ait.) Vent (Talas)	-	✓	-	1
	Homolaena	*Homaloena cordata* Schott (Talas)	✓	-	-	1
Arecaceae	Dysis	*Dypsis lutescens* H. Wendl. (Palem)	-	-	✓	1
Asparagaceae	Cordyline	*Cordyline fruticosa* (L.) A. Chev (Andong)	-	✓	✓	15
Asteraceae	Agerotum	*Ageratum conyzoides* L. (Babandotan)	-	✓	✓	70
	Bidens	*Bidens pilosa* L. (Ketul)	-	✓	✓	16
	Chromolaena	*Chromolaena odorata* L. (Kirinyuh)	✓	✓	✓	8
	Cosmos	*Cosmos caudatus* H.B.K (Kenikir)	✓	-	-	1
	Crassochepalum	*Crassocephalum crepidioides* (Benth) S. Moore (Sintrong)	-	✓	✓	21
	Sphagneticola	*Sphagneticola trilobata* L. (Wedelia)	✓	-	-	1
	Synedrella	*Synedrella nodiflora* L. Gaertn (Jotang Kuda)	-	✓	✓	16
	Thitonia	*Tithonia diversifolia* (Hemsl.) A. Gray (Paitan)	-	✓	-	2
Balsaminaceae	Impatiens	*Impatiens plathypetala* Lindl. (Pacar Banyu)	-	✓	✓	60
Cannaceae	Canna	*Canna discolor* Lindl. (Ganyong)	-	✓	-	4
Fabaceae	Calliandra	*Calliandra calothyrsus* Meisn. (Kaliandra)	✓	✓	-	5
	Mimosa	*Mimosa pudica* L. (Putri Malu)	-	✓	-	4
Lauraceae	Persea	*Persea americana* Mill. (Alpukat)	-	✓	-	1
Lythraceae	Cuphea	*Cuphea hyssopifolia* Kunth. (Taiwan Beauty)	-	-	✓	3
Malvaceae	Abelmoschus	*Abelmoschus moschatus* Medik. (Kapas hutan)	✓	-	-	1
	Sida	*Sida rhombifolia* L. (Sidaguri)	✓	✓	✓	3
Melastomataceae	Clidemia	*Clidemia hirta* (L.) D. Don (Harendong Bulu)	✓	✓	✓	7
Moraceae	Ficus	*Ficus septica* Burm.f. (Awar-awar)	✓	✓	✓	5
Musaceae	Musa	*Musa x paradisiaca* L. (Pisang)	-	✓	-	2
Oxalidaceae	Oxalis	*Oxalis barrelieri* L. (Calincing)	-	✓	✓	4
Poaceae	Brachiaria	*Brachiaria decumbens* Stapf. (Rumput Bede)	-	✓	✓	48
	Eleusine	*Eleusine indica* (L.) Gaerth (Rumput Lulangan)	-	✓	✓	21
	Imperata	*Imperata cylindrica* (L.) Raeusch. (Ilalang)	✓	-	-	3
Rubiaceae	Coffe	*Coffea canephora* Pierre ex A.Froehner (Kopi)	✓	✓	✓	30
Verbenaceae	Lantana	*Lantana camara* L. (Tembelakan)	✓	-	-	2
	Stachytarpheta	*Stachytarpheta cayennensis* (L.C, Rich) Vahl	✓	✓	✓	4
17 Family	31 Genus	31 Species				297

The discovery of flower plants at the research location supports the biodiversity of butterflies. Flower plants are used by butterflies both as a hostplant and a foodplant. This study shows that the largest family found was from the Asteraceae family. According to Karyati & Adhi (2018) Asteraceae or kenikir-kenikiran is one of the largest family in flowering plants (Angiosperms).

Flower plants of Asteraceae and Verbenaceae family are more used by butterflies as nectar foodplants, especially *Chromolaena odorata* of Asteraceae and *Lantana camara* of Verbenaceae. Members

of the butterfly family get nectar on both flowers. Shihan & Kabir (2015) stated that hexose sugars dominate in the nectars of Asteraceae are relatively strong in amino acids to compensate for the low sucrose-hexose ratio in the members of this family which attract butterflies.

Chromolaena odorata was the most commonly visited by butterflies. *Chromolaena odorata* found at the research stations had white flowers. Butterflies that visit this flower are from the family of Papilionidae, Pieridae, Nymphalidae, Lycaenidae and Hesperiidae.

A study by Nimbalkar et al. (2011) showed that 90 nectar food plants identified belonging to 10 plant families on Plants of the Asteraceae family are more used by butterflies as the nectar food plants in Bhor Tahsil of Pune District, Maharashtra, India. A study by Shihan & Kabir (2015) showed 55 species of butterflies identified were using *Chromolaena odorata* as a source of nectar in Bangladesh. Among genera members of Delias and Junonia, family Pieridae and Nymphalidae selected *C. odorata* as a favorite nectar plant respectively.

The *Chromolaena odorata* (L.) (Asteraceae) florets attract butterflies and are important nectar source for adult butterflies. The inflorescences consist of corymbs of cylindrical heads and the floral characteristics such as white to purple color of florets, short-tubed narrow corolla with deep seated nectar, the morning anthesis, and the flat-topped head inflorescence providing a standing platform are important attractants for visitation by butterflies (Shihan & Kabir, 2015).

The second most commonly visited species was *Lantana camara*. Butterfly flower visitors are from the family Papilionidae, Pieridae, Nymphalidae, Lycaenidae, and Hesperiidae. *Lantana camara* found in the study location had 2 flower color variations, pink and orange. Peniwidyawati et al. (2020) reported that the second most commonly visited species by Hymenoptera and Lepidoptera was *Lantana camara*. Nimbalkar et al. (2011) reported that *Lantana camara* has a flowering period throughout the year, so they are more used by butterflies as their food plants.

Lantana camara has an umbel-type inflorescence in terminals. This allowed insects to visit at the same time. Moreover, the corolla color, which changes from yellow in the opening, then changes to orange and gradually changes to reddish-orange, acts as the indicator of pollen maturity and nectar content. Therefore, *Lantana camara* is visually appealing for pollinators (Peniwidiyanti et al., 2020).

The highest diversity index (H') was found at station 1, one of the factors is the vegetation type of station 1 where flower plants with striking shapes and colors such as *Lantana camara*, *Cosmos caudatum*, and *Sphaghneticola trilobata* are easier to find, compared to stations 2 and 3, thus inviting many butterflies to do get nectar. Besides that, water sources that are closer to stations 2 and 3 are one of the factors supporting the high diversity of butterflies at station 1. Florida, et al., (2015) butterflies need habitats with high humidity cause it reduce dehydration or risk of the air lack.

Vegetation types at stations 2 and 3 were dominated by the Asteraceae, Poaceae, and Balsaminaceae groups. It also affects the types of butterflies that are found. It was easier to find small butterfly species such as butterflies members of Hesperiidae, Pieridae, and Nymphalidae in the genus *Mycalesis* and *Ypthima* in stations 2 and 3. According to Glassberg (2001), that Satyrinae subfamily which includes the genus *Mycalesis*, *Orsotriaena*, and *Ypthima* are often found in grass vegetation because

grass is their foodplant and species from this subfamily rarely visit flowers.

Table 4 shows the observed data of environment factors (abiotic factors) at three stations, including temperature, humidity, light intensity, and altitude. Butterflies are poikilotherm animals, so their body temperature will be influenced by environmental temperature, the optimal temperature will help the butterfly's metabolic processes run well.

Table 4. Environment Factors (Abiotic) at Three Research Stations

Measurement	Station		
	I	II	III
Temperature (°C)	30.2	31.5	28.65
Humadity (%)	62.6	68.9	68.15
Light Intensity (cd)	615.4	540.4	554.9
Altitude (m)	635	732	856

(Observation Hours at 08.00-15.00 West Indonesian Time)

Station 1 which is located on the Kembang River with an altitude of 635 m asl has an air temperature of 30.2°C, 62.6% humidity, and a light intensity of 615.4 cd. Station 2, which is located at Monthel Waterfall with an altitude of 732 m asl, has an air temperature of 31.5°C, the humidity of 68.9%, and light intensity of 540.4 cd. Station 3, located in Rejenu with an altitude of 856 m asl, has an air temperature of 28.6°C, 68.1% humidity, and a light intensity of 554.9 cd. Based on the measurement results of environmental factor parameters at the three research stations, it shows that the environment in the three stations is still in accordance with the optimal conditions required by butterflies. The abiotic environment for butterflies including air temperatures between 20-40°C, while the tolerance limit for butterfly light intensity ranges from 500-7500 lux (Azahra et al., 2016). Higher environment temperature, the lower humidity. The optimal humidity used by butterflies ranges from 60-70%, while breeding requires higher humidity, which is around 84-92%. Butterflies cannot adapt to environments with humidity of more than 92% (Febrita et al., 2014). Environmental conditions with high humidity may cause slow growth and development of butterflies (Chahyadi et al., 2020). Butterflies will be more active in environmental conditions with high temperatures because that is when their metabolism will increase. The light intensity factor will also have an effect on butterflies. Butterflies will spread their wings in the sun before flying to increase their body temperature (Lestari et al., 2018).

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