Relationships Between Butterfly with Feed Plants in Sangihe Islands, North Sulawesi, Indonesia

by Meis Nangoy 8

Submission date: 04-Jun-2021 12:32PM (UTC+0700)
Submission ID: 1600148062
File name: Relationships_Between_Butterfly_with_Feed_Plants_in_Sangihe.pdf (639.04K)
Word count: 5134
Character count: 29161

http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

OPEN ACCESS Pakistan Journal of Biological Sciences

ISSN 1028-8880
DOI: 10.3923/pjbs.2020.804.812

Research Article
Relationships Between Butterfly with Feed Plants in Sangihe Islands, North Sulawesi, Indonesia

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Abstract

Background and Objective: Interaction of butterfly with plants is a form of mutualism. Plants need help in pollination and at the same time, butterflies need food in the form of nectar and pollen. This research aimed to observe and analyze relationships between butterflies with feed plants in Sangihe Islands, North Sulawesi, Indonesia. **Materials and Methods:** Observations were conducted from April-August, 2019 by observing the preference of butterflies for flowering plants, the proboscis length of butterflies, the length of corolla tubes, the volume and sugar content of nectar and environmental factors. Data analysis included the relationship between the proboscis length of butterflies and the length of corolla tubes and the relationship of nectar volume and sugar level of nectar with environmental factors. **Results:** The results showed that there were 23 families and 52 species of plants visited by butterflies. The plants were visited by butterflies of 5 families, which included 43 species and 179 individuals. The number of butterflies visiting flowering plants varied. Based on the time of visit, the highest frequency of butterfly visits to flowering plants was obtained in the morning. Then, the frequency began to decline during the day. Meanwhile, the highest volume and sugar content of nectar were found in the morning and tended to decrease during the day. **Conclusion:** Relationships of butterflies with flowering plants was influenced by plant habitus, types of inflorescence, flower color, shape of corolla tube, volume and sugar content of nectar.

Key words: Lepidoptera, mutualism, nectar, flowering plants, proboscis, environmental factors

Citation: Roni Koneri, Meis Jacinta Nangoy and Saroyo, 2020. Relationships between butterfly with feed plants in Sangihe Islands, North Sulawesi, Indonesia. Pak. J. Biol. Sci., 23: 804-812.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

For their life, butterflies interact with host plants by laying their eggs on host plants and using host plants as feed for their larvae. Some butterfly species have specific host plant species. Adult butterflies need plants as a food source in the form of flower nectar[1].

Plants secrete varying amounts of nectar[2,3]. In addition to drinking nectar, some types of butterflies also eat pollen[4] and drink the juice of rotting fruit[5]. Butterfly has an elongated sucking mouthpart (proboscis) and a good sense of smell and butterfly is able to detect the color spectrum[6]. Some butterfly species are selective in visiting flowering plants as a source of nectar[7]. Nectar from flowers provides energy and flower pollen provides protein, lipids and vitamins[8]. Nectar is a complex compound produced by plant glands in the form of a sugar solution. The main composition of nectar is glucose, fructose and sucrose. Nectar also contains amino acids and lipids.

Several studies on relationships of butterflies with plants have been carried out including flowering time of butterfly nectar food plants is more sensitive to temperature than the timing of butterfly adult flight[9]. Ecosystem services of lepidoptera to the floral diversity of Mandapam Group of Islands[1]. Rusman *et al.*[10] have researched about butterflies (Lepidoptera: Papilionoidea) of Mount Sago, West Sumatra: diversity and flower preference.

Research on relationships of butterflies with feed plants in the Sangihe Islands, North Sulawesi, has never been conducted and reported. Butterfly diversity research is mostly conducted on the mainland of Sulawesi Island. In fact, this information is very important considering that at this time, the habitat of butterflies in the Sangihe Islands has undergone a change and has been turned into a plantation and settlement. In addition, data on butterfly diversity and its relationships with feed plants that are available to date are data taken several years ago and obtained only at certain locations. Meanwhile, current data on the overall distribution and diversity of butterflies in the Sangihe Islands are not yet available. In fact, Sulawesi is an area with a high rate of forest destruction. This research aimed to uncover relationships of butterflies with feed plants through observed and analyzed some variables which included feed preferences, the relationship between butterfly proboscis length with the corolla length and the volume and sugar content of flower nectar in the Sangihe Islands, North Sulawesi, Indonesia.

MATERIALS AND METHODS

Study site: Relationships between butterflies with plants was observed at two sub-districts and four villages in the Sangihe Islands, North Sulawesi. The villages that became the sampling points were Ulung Peliang Village, Kalinda Village (Tamako Sub-district), Kaluwatu Village and Laine Village (South Manganitu Sub-district). Field observations were conducted for 5 months from April-August, 2019 and in one month, 5-day observation was conducted.

Observation of relationships: Observation of butterfly relationships included preference of butterflies for flowering plants, butterflies proboscis length the corolla tubes length, the volume and sugar flower nectar content and environmental factors. Determination butterflies plants were done by observing, recording, documenting and identifying the plants visited by butterflies. The plants visited were also recorded by family, species, habitus, flower color, type of flower and types of butterflies that visited the plants. The plants that butterflies visited were taken and their specimens were stored on newspaper for identification purposes[11,12].

Proboscis length measurement: Measurement of the proboscis length was carried out on five species of butterflies (*Papilio rumanzovia*, *Danaus ismare alba*, *Ideopsis juventa totoliensis*, *Catopsilia pomona* and *Eurema tominia*) and for each species, the proboscises of 4 individuals were measured. Measurement of the proboscis length was conducted by placing a butterfly that had been collected on a paper. The curled proboscises were straightened with the help of needles and tweezers. The base and tip of the proboscis were marked on the paper. The proboscis length was obtained by calculating the distance between the base and the tip of the proboscis that had been marked on paper. The proboscis length was measured using a digital caliper.

Measurement of corolla tubes length: The measurement of corolla tubes length was carried out on 5 species of flowering plants visited by butterflies (*Ixora javanica*, *Oxalis barrelieri*, *Lantana camara*, *Bougainvillea spectabilis* and *Clerodendrum paniculatum)*. Corolla length was measured using a digital caliper.

Measurement of sugar and nectar: Further, the measurement of volume and sugar content of flower nectar was conducted on 3 species of plants visited by butterflies, namely,

Ixora javanica, *Hibiscus rosasinensis* and *Calliandra calothyrsus*. Measurements were taken at 07.00-08.00, 09.00-10.00, 11.00-12.00 and 13.00-14.00 Central Indonesian Time (UTC+8). Nectar volume was measured using a 5 µL micropipette, while nectar sugar concentrations were measured using a refractometer with a 0-33% Brix scale range. Nectar volume was measured by inserting the micropipette into nectaries. Meanwhile, nectar sugar contents were measured by placing the nectar on the glass of refractometer and then being directed toward the light[13]. If the measured flower had a small amount of nectar, then the sample could be added[3].

Measurement of environmental factors: Environmental factors were also measured at one hour intervals during butterfly observation. Environmental factors measured included air temperature and humidity, which were measured using a thermohygrometer, light intensity, which was measured using a luxmeter, wind speed measured using an anemometer and altitude and coordinates, which were measured using global positioning system (GPS).

Statistical analysis: Data analysis included the relationship between the proboscis length of butterflies and the length of corolla tubes and the relationship of volume and sugar content of nectar with environmental factors (temperature, humidity, wind speed and light intensity). The relationship test was performed with the Spearman correlation using[14] the statistical version 6.

RESULTS

Preference of butterflies plants: The observation on the number of flowering plants visited by butterflies showed a result of 23 families and 52 species of plants. The plants were visited by butterflies from 5 families, which included 43 species and 179 individuals. The butterflies that visited plants the most were *Graphium agamemnon*, which visited 14 species of plants and *Papilio polytes* and *Eurema blanda*, each visiting 12 species of plants (Table 1).

The family of plant that was frequently visited by butterflies was Asteraceae with 16 species of plants, followed by Malvaceae, with 4 species of plants. Plant families that were least visited by butterflies were Amaranthaceae, Annonaceae, Apocynaceae, Euphorbiaceae, Lauraceae, Musaceae, Nyctaginaceae, Oleaceae, Orchidaceae, Oxalidaceae and Melastomaceae, each of which was only one species of plant (Table 1). The plant species that were visited by butterflies the most (14 species) were *Ixora javanica*, followed by *Eupatorium inulifolium*, which was visited by 12 species of butterflies (Table 1).

The types of plant visited by butterflies included shrubs, herbs, trees and lianas. To obtain nectar as a food source, butterflies preferred to visit shrubs (56.98%) than herbs (30.73%), trees (10.61%) and lianas (1.68%) (Fig. 1a).

Butterfly visited frequency: Butterfly visited frequency was varied based on the color plant flowers. The colors of flowers that butterflies frequently visit were white (38.87%) and red (25.14%), while the less visited colors were blue and white-purple, with each frequency of butterfly visits of 1.12% (Fig. 1b).

Types of inflorescences visited by butterflies: There were 7 types of inflorescences visited by butterflies. The most visited inflorescence type was tube (28.49%), then head (27.93%). The least visited type of inflorescence was flag (3.35%) (Fig. 1c).

Families flowers visited by butterflies: The families flowering plants visited by butterflies were as many as 5 families. The butterfly families that visited plants the most were Papilionidae, with a frequency of 36.87% and Nymphalidae (27.93%). Meanwhile, the lowest frequency of visits was from the Hesperiidae family (Fig. 1d).

Visiting time: Based on the visiting time, it was found that generally, butterflies visited flowers in the morning. The highest number of butterfly visits occurred at 09.00-10.00 Central Indonesian Time, then between 7.00-08.00 Central Indonesian time. The time of the butterfly visit began to decrease from 11.00-14.00 (Fig. 2).

Butterfly proboscis length of and the corolla tube length: From the measurements of the butterfly proboscis length, it was found that *Papilio rumanzovia* had the longest proboscis, with an average proboscis length of 34.08 mm, when compared to other species. The butterfly that had the shortest proboscis was *Eurema tominia* with an average proboscis length of 5.95 mm (Table 2).

Butterflies from the Papilionidae family tended to visit flowers with an average corolla tube length of 16.43 mm and butterflies from the Nymphalidae family visited flowers with corolla tube lengths of 8.30 and 8.38 mm. Meanwhile, Pieridae visited the flowers with corolla tube lengths of 12.18 and

Table 1: Floral plants characteristics visited by butterfly species at Sangihe Islands

Nectar plants	Plant habits	Flower color	Flower type	Butterfly species
Acanthaceae				
Asystasia gangetica	Herb	White	Funnel	*Junonia hedonia, Eurema blanda, Eurema hecabe*
Sanchezia speciosa	Shrub	Yellow	Funnel	*Junonia hedonia, Crestis acilia*
Strobilanthes crispus	Shrub	Yellow	Funnel	*Mycalesis horsfieldi, Mycalesis janadarna*
Amaranthaceae				
Gomphrena globosa L.	Herb	Purple	Head	*Eurema blanda*
Annonaceae				
Annona muricata L.	Tree	Yellow	Head	*Graphium meyeri, Graphium agememnon*
Apocynaceae				
Catharantus roseus	Shrub	Pink	Tube	*Papilio polytes*
Asteraceae				
Acmella paniculata	Herb	Yellow	Head	*Danaus genutia*
Ageratum conyzoides	Herb	Purple	Head	*Danausismarealba, Papiliosataspes, Ypthimaloryma, Jamidessnelleni, Jamidaes aratus, Jamides celeno, Papilio demolion, Papilio polytes, Eurema tominia, Parthenos sylvia*
Caesalpinia pulcherrima	Shrub	Red	Brush	*Papilio gigon, Papilio polytes*
Cassia obtusifolia	Herb	Yellow	Fascicle	*Catopsilia pomona, Hebomia glaucippe celebensis*
Chromolaena odorata	Shrub	White	Head	*Papilio polytes, Lampides boeticus, Catopsilia pomona, Eurema hecabe, Graphium agememon, Vindura celebensis, Graphium milon, Papilio gigon, Idiopsis juventa totoliensis*
Clibadium surinamensis	Shrub	White	Head	*Hypolimnas bolina, Hypolimnas missipus*
Commelina benghalensis	Herb	Blue	Funnel	*Eurema tominia, Eurema blanda*
Elephantopus mollis	Herb	White	Brush	*Eurema tominia, Rapala ribbei*
Emilia sonchifolia	Herb	Purple	Head	*Danaus ismare alba, Jamides snelleni, Eurema tominia, Mycalesis horsfieldi*
Eupatorium inulifolium	Shrub	White	Head	*Euchrysops cnejus, Hypolimnas bolina, Jamides aratus, Jamides celeno, Junonia hedonia, Papilio helenus, Graphium agamemnon, Graphium meyeri, Catopsila pomona, Eurema tomina, Eurem hecabe, Eurema blanda*
Galinsoga parviflora	Herb	Yellow	Head	*Mycalesis janadarna*
Gynura crepidioides	Herb	White	Head	*Eurema blanda, Eurema hecabe*
Makania micrantha	Liana	White	Brush	*Pithecops phoenix, Lampides boeticus, Junonia hedonia,*
Sphagneticola trilobata	Herb	Yellow	Head	*Danaus genutia leucoglenes, Danus ismare alba, Euploea leucostictos, Jamides celeno*
Synedrella nodiflora	Herb	Yellow	Head	*Eurema blanda, Mycalesis janardana*
Vernonia altissima	Herb	Purple	Brush	*Papiliopoytes*
Euphorbiaceae				
Euphorbia heterophylla	Herb	White	Brush	*Gandaca harina, Eurema blanda, Borbo cinnara, Potanthus fettingi*
Fabaceae				
Calliandra calothyrsus	Shrub	Red	Brush	*Graphium agamemnon, Papilio ascalaphus, Graphium milon, Junonia hedonia intermedia, Graphium meyeri, Papilio sataspes*
Casia alata	Herb	Yelow	Flag	*Catopsila pomona, Hebomoia glaucippe*
Crotalaria mucronata	Herb	Yellow	Flag	*Danaus genutia leucoglene, Borbo cinnara, Ideopsis juventa tontoliensis*
Lamiaceae				
Clerodendrum paniculatum	Shrub	Red	Tube	*Papilio gigon, Papilio polytes, Junonia hedonia, Graphium agememon, Catopsilla pomona, Vindura celebensis, Graphium milon, Idiopsis juventa, Eurema hecabe*
Orthosiphon spicatus	Shrub	White	Tube	*Junonia hedonia intermedia, Mycalesis janardana, Eurema blanda*
Lauraceae				
Persea americana	Tree	White	Dish	*Hypolimnas bolina, Junonia hedonia*
Malvaceae				
Hibiscus rosasinensis	Shrub	Red	Dish	*Junonia hedonia, Papilio sataspes, Paclyopta poliponthes, Graphium agamemon, Papilio polithes*
Kleinhovia hospita	Tree	Pink	Dish	*Hebomia glaucippe celebensis*
Sida rhombifolia	Shrub	Yellow	Dish	*Eurema tominia, Eurema hacebe, Eurema blanda*
Urena lobata	Shrub	Pink	Dish	*Eurema blanda, Mycalesis janardana*
Melastomataceae				
Clidemia hirta	Shrub	White	Funnel	*Mycalesis janardana*
Melastoma malabathricum	Shrub	Purple	Funnel	*Danaus affinitis fulgarata*
Mimosaceae				
Mimosa diplotricha	Herb	Pink	Brush	*Jamides snelleni*
Mimosa pudica	Herb	Pink	Brush	*Jamides aratus, Eurema blanda, Eurema hecabe, Guttula blanda*
Musaceae				
Musa paradisiaca	Herb	White	Tube	*Hypolimnas bolina, Danaus genutia leucoglene*
Myrtaceae				
Eugenia aquea	Tree	White	Brush	*Hypolimnas bolina, Graphium agamemnon, Papilio ascalapus, Papilio rumanzovia*
Psidium guajava	Shrub	White	Brush	*Graphium agamemnon*

Table 1: Continue

Nectar plants	Plant habits	Flower color	Flower type	Butterfly species
Nyctaginaceae				
Bougainvillea spectabilis	Shrub	Orange	Tube	*Papilio gigon, Papilio polytes, Danaus ismare alba*
Oleaceae				
Jasminum sambac	Shrub	White	Tube	*Papilio polytes, Graphium milon*
Orchidaceae				
Spathoglottis plicata	Herb	Purple	Flag	*Papilio ascalaphus*
Oxalidaceae				
Oxalis barrelieri	Herb	Pink	Tube	*Papilio polytes, Eurema blanda, Eurema hecabe*
Melastomaceae				
Melastoma malabathricum	Shrub	Purple	Tube	*Eurema tominia, Eurema hecabe, Graphium agamemnon*
Piperaceae				
Piper betle L.	Shrub	Pink	Fascicle	*Graphium agememon*
Piper aduncum	Shrub	White	Fascicle	*Graphium meyeri, Papilio rumanzovia, Papilio gigon, Parthenos sylvia*
Rubiaceae				
Ixora javanica	Shrub	Red	Tube	*Papilio rumanzovia, Graphium meyeri, Papilio agamemnon, Papilio polytes, Papilio polyphontes, Eurema blanda, Eurema hecabe, Hypolimnas bolina, Danaus ismare alba, Catopsilia pomona, Vindule celebensis, Graphium milon, Papilio gigon, Ideopsis juventa*
Mussaenda pubescens	Shrub	Yellow	Dish	*Graphium agamemnon, Papilio sataspes, Papilio rumanzovia*
Rutaceae				
Citrus sp.	Tree	White	Dish	*Papilio rumanzovia, Graphium meyeri, Papilio sataspes, Papilio gigon, Papilio polytes, Papilio memmon, Papilio ascalapus, Graphium agememnon, Papilio demoleus, Eurema hecabe*
Verbenaceae				
Lantana camara	Shrub	Red	Tube	*Juonina hedonia, Vindule celebensis, Graphium agamemnon, Catopsilla pamona, Graphium milon, Papilio gigon, Ideopsis juventa, Papilio rumanzovia, Erionota thrak*
Stachytarpheta jamaicensis	Shrub	White-Purple	Tube	*Eurema tominia, Eurema hecabe*

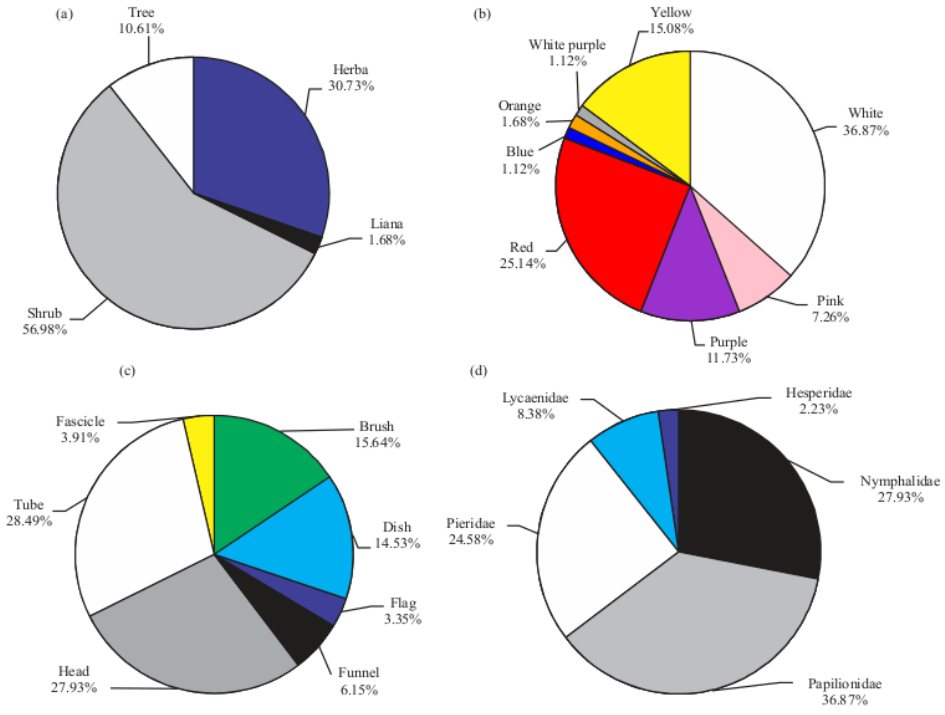

Fig. 1(a-d): Butterflies visit plants based on (a) Plant habits, (b) Flower color, (c) Flower type and (d) Plants visiting frequency

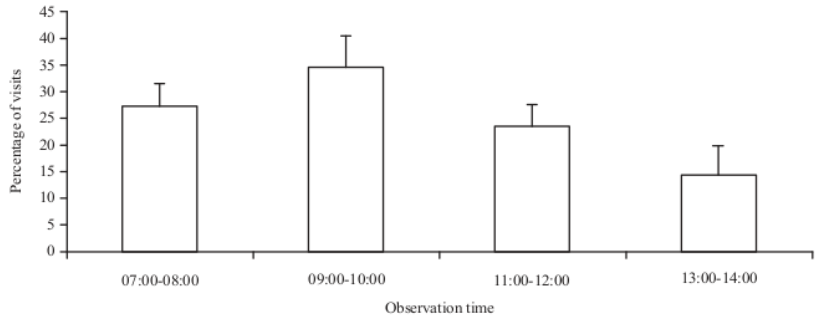

Fig. 2: Butterfly visiting frequency based on the observation time

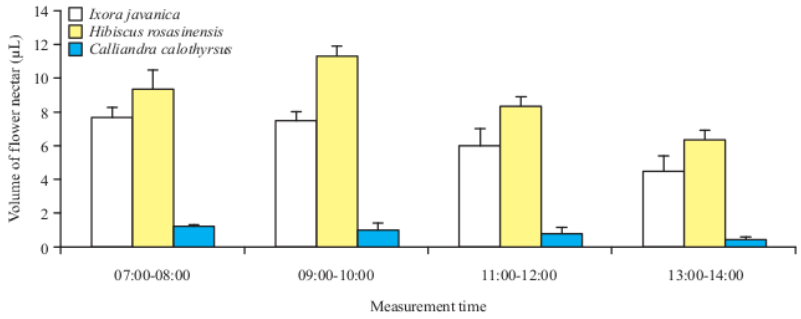

Fig. 3: Nectar volume based on observation time

Table 2: Correlation between butterfly proboscis length and crown flower length

Species	Proboscis length (mm) Mean±SD	Crown flower length (mm) Mean±SD
Papilio rumanzovia	34.08±1.28	16.43±8.51
Danaus ismare alba	12.53±1.84	8.30±0.73
Idiopsis juventa totoliensis	10.41±0.74	8.38±0.48
Catopsilia pomona	17.40±0.95	12.18±1.46
Eurema tominia	5.95±1.17	3.64±0.83

r = 0.72 (correlations are significant at p<0.050, n =20)

3.64 mm. Based on the correlation analysis, it was found that there was a positive correlation between the proboscis length of the butterfly and the corolla tube length of the flower visited (r = 0.72, p<0.050, n = 20) (Table 2).

Flower nectar volume and content: Based on measurements, the highest flower nectar volume was found in *Hibiscus rosasinensis* plants, ranging from 6.33-11.33 µL and subsequently *Ixora javanica* (4.50 -7.67 µL). The highest flower nectar volume was found in the morning (09.00-10.00 Central Indonesian time) and the volume tended to decrease during the day (Fig. 3).

The sugar content of nectar varied between one flower to another. The highest sugar content of nectar in the morning was found in *Hibiscus rosasinensis* (22-24%) and at noon was found in *Ixora javanica* (17.4-20.71%). Sugar content of flower nectar tends to be high in the morning and tends to decrease during the day (Fig. 4).

Volume and sugar content with environmental factors: Based on correlation test of nectar volume of three plant species with environmental factors, it was found that the volume of flower nectar was positively correlated with air humidity. The volume of nectar showed a negative correlation with air temperature, wind speed and light intensity (Table 3). This means that if air temperature, wind speed and light intensity were higher, the volume of flower nectar decreased. Correlation test of flower nectar sugar content with air humidity showed positive results. Meanwhile, nectar sugar content showed a negative correlation with air temperature, wind speed and light intensity (Table 4). This means that if air temperature, wind speed and light intensity were higher, sugar content of nectar decreased.

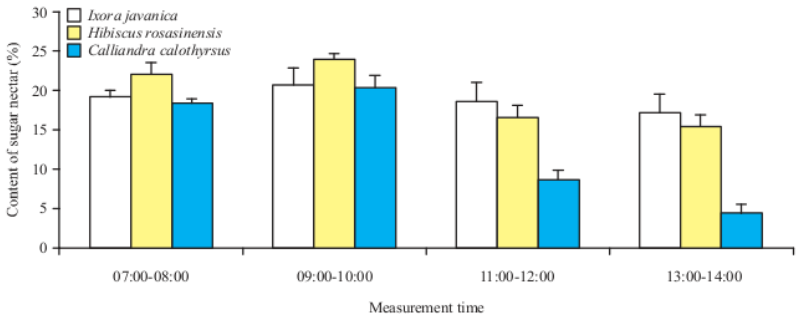

Fig. 4: Sugar content based on the observation time

Table 3: Correlation between nectar volume butterflies plants with environmental factors

Variables	Temperature	Humidity	Wind speed	Light intensity
Ixora javanica	-0.77*	0.88*	-0.52	-0.87*
Hibiscus rosasinensis	-0.33	0.57*	0.00	-0.42
Calliandra calothyrsus	-0.76*	0.76	-0.52*	-0.72*

*Correlations are significant at p<0.050, n = 12

Table 4: Correlation between nectar sugar content butterflies plants with environmental factors

Variables	Temperature	Humidity	Wind speed	Light intensity
Ixora javanica	-0.14	0.22	-0.42	-0.30
Hibiscus rosasinensis	-0.41	0.64*	-0.17	-0.59
Calliandra calothyrsus	-0.85*	0.56*	-0.78*	-0.81*

*Correlations are significant at p<0.050, n = 12

DISCUSSION

The preference of butterflies for plants varied between plant families and species. Plant family that many butterflies visit during observation was Asteraceae. This was due to the availability of plants from Asteraceae family in the study site. Moreover, the plants of the Asteraceae family flower throughout the season. According to Robson[15], most pollinating insects visited the flowers of the Asteraceae family and the Fabaceae family. The flowers of the Asteraceae plant usually have a small size and a less attractive color, although some have yellow, purple and white colors that attract many types of potential pollinators.

The observations found that the flowers of *Ixora javanica* and *Eupatorium inulifolium* were visited by butterflies the most. The visit of a butterfly to a flower is greatly influenced by the morphological and physiological characteristics of the flower, such as size, shape, color, scent, blooming period and nectar content. According to Tiple *et al.*[16] and Faheem *et al.*[17] several factors influenced the preferences of butterflies for feed plants. Those factors were habitus, lower shape, length of corolla tube and the color of nectar flowers, pollen and other rewards. Gombert *et al.*[18] argued that butterflies would be interested in visiting flowers as a source of nectar or food based on three characteristics, namely, flower shape, color and flower scent.

Flowers that were often visited by butterflies during observation were flowers that had white and red colors. Some studies reported that butterflies liked red, yellow, orange, blue and purple flowers[19,20]. According to Abrol[6], butterflies often visited brightly colored flowers, although sometimes butterflies also visited white flowers. Flowers that have bright colors (white, violet and yellow) can be captured and responded by the butterfly's senses. *Eupatorium inulifolium*, which was visited by many butterflies during observation, is a white flowering shrub of the Asteraceae family.

The type of inflorescences that butterflies often visit was tube. Flowers with inflorescences resembling tubes contain lots of nectar. The shape of the long corolla tube is a protection for plants to store nectar. The nectar can only be reached by certain types of pollinating insects, such as bees and butterflies that have proboscis to reach the nectar. Nimbalkar *et al.*[19] argued that butterflies were more likely to visit flowers that have tubular corolla than flowers that have other shaped corollas.

Proboscis length measurements showed that butterflies with large body sizes, such as those from the Papilionidae family, tended to have a longer proboscis size than butterflies with smaller bodies. This showed that flowers with long corolla tubes tended to be visited by butterflies with long proboscis and vice versa. Thus, there was a correlation between the length of the proboscis and the length of the corolla tube. This is in accordance with the reports of Rusman *et al.*[10] and Tiple *et al.*[16], which showed that the proboscis length of butterfly had a positive correlation with the length of the corolla.

Observation of the frequency of butterflies visiting flowering plants to obtain nectar showed that the highest visit was at 09.00-10.00 Central Indonesian Time. Visits tended to decrease during the day. The same thing happened when measuring the volume and sugar content of flower nectar. The low volume of nectar during the day was probably because the nectar had already been taken by other insects in the morning or had evaporated. This is in accordance with research of Efendi[21], which stated that there was high nectar secretion in the morning. The research of Fidalgo and Kleinert[22] reported that the sugar concentration of nectar was the highest in the morning, when temperatures were relatively low and humidity was high, with the highest peak of sugar concentrations between 9:25 and 9:55 am.

The volume and sugar content of flower nectar varies between plant species. Several studies regarding the volume and sugar concentration of flower nectar have been conducted. The nectar volume of *Lantana camara* ranges from 0.41-0.98 µL, nectar volume of *Hibiscus rosasinensis* ranges from 5.1-14 µL and nectar volume of *Coffea canephora* ranges from 0.4-1 µL[23]. Each type of plant secretes nectar content with different amounts and concentrations. The amount of nectar that is secreted is influenced by internal and external factors. Internal factors include the morphology and physiology of flowers. External factors that affect nectar quality are microclimate conditions and soil properties[23-25].

External factors that affect the volume and sugar content of nectar, based on the correlation test, were air temperature, air humidity, wind speed and light intensity. High temperatures affected nectar production through changes in nectar volume and sugar concentration. Nectar volume generally increases with increasing temperature, up to the species-specific optimum temperature. The air temperature above the optimum will cause the volume and sugar content of nectar to decrease[26].

CONCLUSION

The plant family that was frequently visited by butterflies to obtain nectar was Asteraceae. The relationship between butterflies with flowering plants was strongly influenced by plant habitus, flower color and inflorescence type. The volume and sugar nectar content were the highest in the morning but decreased during the day. This caused many butterflies to visit flowers in the morning as compared during the day. Factors affecting the volume and sugar content of flower nectar were air temperature, humidity, wind speed and light intensity.

SIGNIFICANCE STATEMENT

This study discovers the relationship between butterflies with feed plants was strongly influenced by the morphology of the flower, volume and sugar content of nectar. Asteraceae family was the butterfly plants in the Sangihe Island. The maintenance and management butterfly plants such as Asteraceae is key factor for butterflies conservation in the Sangihe Islands.

ACKNOWLEDGMENT

The author would like to thank the Directorate of Research and Community Service, Directorate General of Strengthening for Research and Development of the Ministry of Research, Technology and Higher Education of the Republic of Indonesia that has funded this research through the Basic Research scheme in accordance with the 2018 Budget Year Research Contract Number: 087/SP2H/LT/DRPM/2018, based on Decree Number: 7/E/KPT/2019 and Agreement/Contract Number: 128/UN12.13/LT/2019.

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