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Host Plant Preferences of Butterflies (Lepidoptera: Rhopalocera) in Sriwijaya University Campus of Indralaya, South Sumatra

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Abstract
Hostplants are important for butterflies becaue the plants are where they lay their eggs and catterpilars will to eat after. A study to about butterflies diversity and their host plant preferences has been carried out in July-September 2014 in Sriwijaya University Campus of Indralaya, South Sumatra. This research was to determine the preferences and identify the various species larval host plants and nectar sources of butterflies in Sriwijaya University Campus of Indralaya. We applied sampling points using purposive sampling method. Our findings suggest that there were 8 larval host plant family Achantaceae, Annonaceae, Cleomaceae, Fabaceae, Lauraceae, Malvaceae, Passifloraceae and Rutaceae. The nectar host plants are 8 Family of plants consisting of Achantaceae, Asteraceae, Loganiaceae, Malvaceae, Oxalidaceae, Passifloraceae, Rubiaceae and Verbenaceae. The highest percentage of host larvae in Family Rutaceae and Achantaceae of 23% and a low of Malvaceae by 7%. The highest nectar host is Family Verbenaceae by 32% and the lowest is Family Loganiaceae with 2%.

Keywords: green campus, hostplant, insect, larva, Sumatra.

Introduction

The most important factor for a butterfly's life is food that serve as food for both the larval and imago stages (Dennis *et al.* 2004). The butterflies host plants are very specific and differ between larval hosts and imago hosts (Aprillia *et al.* 2020). More than 300.000 different species of plants, divided among *c.* 300 families, and butterfly larvae use a very wide variety of these food (Vane-Wright 2015).

There are various species of plants that are preferred by insects compared to other types of plants both as a nesting place and as a place for insect development (Suwarno 2004). The process of host selection by adult insects goes through a series events, each previous event paves the way for the next event. Adult insects select hosts through mechanisms related to phototaxis, anemotaxis and geotaxis. Sight or smell is a remote sensing mechanism that can pick up insects that are already present in host habitat to host plant (Herlinda *et al.* 2004). Adult butterflies lay eggs on certain plants which will also be the main food source for their larvae. When butterflies suck flower nectar as food, the pollen sticks to the butterfly's legs so that it can help the pollination process. The activity of butterflies sucking nectar really helps pollination so butterflies are said to be pollinators of flowering plants (Arrummaisha *et al.* 2014).

The examination of the the link between preferences of host plants and butterfly biology has been adressed by entomologist (Dennis *et al.* 2024). There are few study on preferences host plant in a laboratory scale, but there is little information about preferences directly in nature. Study using host plant and insect has been conducted in Sriwijaya University Campus of Indralaya.The aim of this research is to determine butterfly preferences for larval and imago host plant types and to identify larval

and imago host plant types found in the Sriwijaya Indralaya University campus zone.

Methods

The method used in this research is the exploration method, determining the sampling location was carried out using the purposive sampling method, which is the method used to determine sampling points based on certain considerations. Observation locations were selected based on differences in habitat characteristics such as vegetation type and structure, openness of the area, temperature and humidity, canopy density, and the presence of water sources (Yustian *et al.* 2017; Aprillia *et al*. 201). Sampling was carried out during the butterfly's active time at 08.00-15.00 WIB. Initial observations were made on the presence of butterflies and their activities. Observe the leaves with holes and check whether there are butterfly eggs or larvae. Apart from that, we also observed the types of plants visited by butterflies for oviposition.

The eggs and larvae found are taken to the Butterfly House of the Biology Department and maintained according to the host plants found in the field until the larvae turn into adult butterflies, then identification is carried out. Plant identification was carried out in the plant taxonomy laboratory using the selected plant identification handbooks (Engel & Phummai 2000). Identification of larvae and adult butterflies uses selected references (Igarashi & Fukuda 1997, 2000; Tan & Khoon 2012; Igarashi & Harada 2015; Iqbal *et al.* 2021).

Results and Discussion

There are 8 larval host plants consisting from family Achantaceae, Annonaceae, Cleomaceae, Fabaceae, Lauraceae, Malvaceae, Passifloraceae and Rutaceae (Table 1, Fig. 2). The most preferred host plants for butterflies are from the Annonaceae and Rutacea families, which both consist of 3 species, and Passifloraceae 2 species, while the least preferred ones are from the Achantaceae, Cleomaceae, Fabaceae, Lauraceae, and Malvaceae families with 1 species.

Table 1. Butterflies larval host plant preferences found in Sriwijaya University Campus of Indralaya.

No	Butterfly species	Family of Hostplant	Name of Hostplant
1.	*Acraea violae*	Passifloraceae	*Passiflora foetida*
		Passifloraceae	*Piriqueta racemosa*
2.	*Appias lybithea*	Cleomaceae	*Cleome rutidosperma*
3.	*Catopsilia Scylla*	Fabaceae	*Senna obtusifolia*
4.	*Doleschallia bisaltidae*	Achantaceae	*Asystasia intrusa*
5.	*Graphium agamemnon*	Annonaceae	*Annona muricata*
		Annonaceae	*Annona reticulata*
6.	*Graphium sarpedon*	Annonaceae	*Annona muricata*
		Annonaceae	*Annona squamosa*
		Lauraceae	*Persea americana*
7.	*Hypolimnas bolina*	Achantaceae	*Asystasia intrusa*
		Malvaceae	*Sida acuta*
8.	*Ideopsis juventa*	Apocynaceae	*Nerium oleander*
9.	*Junonia hedonia*	Achantaceae	*Asystasia intrusa*
10.	*Papilio demoleus*	Rutaceae	*Citrus hystrix*
		Rutaceae	*Citrus aurantifolia*
		Rutaceae	*Citrus sinensis*
11.	*Papilio memnon*	Rutaceae	*Citrus sinensis*
12.	*Papilio polytes*	Rutaceae	*Citrus aurantifolia*

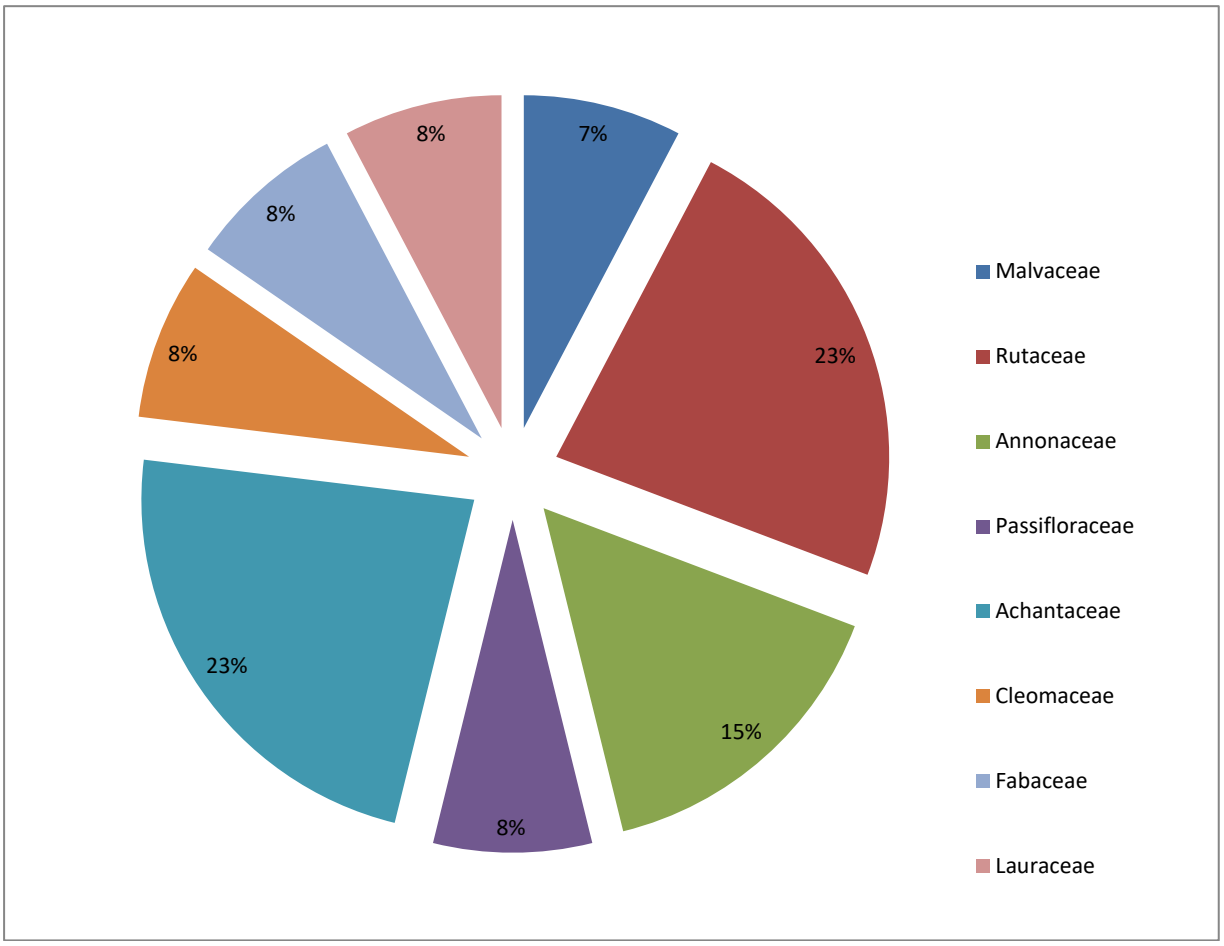

Figure 1. Percentage of preferences for larval host plant types based on family.

The percentage of larval host plant species preferences can be seen in Fig. 1. The percentage of butterflies' preference for the larval host plant family is the highest for Family Rutaceae and Achantaceae families with 23% each, while the lowest is from the Malvaceae family with 7%. Butterflies preference for larval host plants is influenced by various conditions. The occurence of a species of host plant based on indications of the presence of eggs, larval feeding activity and the presence of pupae of this species of butterfly on the leaves and stems of the plant (Dennis *et al.* 2004).

Butterflies' preference for choosing plants as a food source for larvae is related to their level of selectivity. Based on research that has been carried out, *Appias lybithea* is a type of butterfly in the Unsri campus area that is Monophagous which chooses the *Cleome rutidosperma* plant from the Cleomaceae family as a food source for its larvae with a preference percentage of 8%. The leaves of this plant have trichomes so they feel tangible when touched. The nitrogen and water content of this plant is high, namely 4.99% and 69%. The absence of eggs or larvae on other plants indicates that *Appias libythea* has a specific host in the Unsri Indralaya campus area. According to Yustitia (2012), *Gynadropis gynandra* (Cleomaceae) is the food for *Appias libythea* found on the UPI campus. Robinson *et al.,* (2001) found *Capparis* (Capparaceae), *Drypetes* and *Putranjiva* (Putranjivaceae), while Igarashi & Fukuda (2000) recorded *Drypetes matsumurae* in Japan and Taiwan, *D. littoralis* in Palawan and *D. deplanchei* in Australia. This shows that there is the latest information in this research, that the *Cleome rutidosperma* plant from the Cleomaceae family is a food source for *Appias libythea* butterfly larvae.

The *Catopsilia scylla* species also has a specific host plant for its larvae, namely *Senna obtusifolia* from the Fabaceae family with a preference percentage of 8%. *S. obtusifolia* is a plant with compound leaves, soft leaf texture and aromatypical. The nitrogen content in this plant is 2.38% and the water content is 87.7%. The presence of *S. obtusifolia* throughout the Sriwijaya University campus means that the *C. scylla* butterfly is abundant and easy to find. According to Carter (1992), states that the larvae of this type of butterfly eat the leaves of plants from the genus *Loranthus* and *Dendropthoe* or a type of parasitic plant that lives on trees. These two species of plants are not found in the field. The absence of other food sources for the butterfly larvae *C. scylla*, and the abundance of *S.obtusifolia* indicate this species is a specific host.

Fig. 2. (1) *Cleome rutidosperma*, (2) *Citrus sinensis*, (3) *C. hystrix*, (4) *C.aurantifolia*, (5) *Persea Americana,* (6) *Senna obtusifolia*, (7) *Passiflora foetida*, (8) *Piriqueta racemosa*, (9) *Anonna squamosa*, (10) *A. reticulata* (11) *A. muricata* (12) *Sida acuta*, (13) *Asystasia intrusa.*

Preferences for larval host plants found in the Unsri Indralaya campus area are mostly food from larvae of the Papilionidae family, namely the Genus *Papilio* and *Graphium*. Butterflies from the Genus *Papilio* like *Citrus* spp. from the Rutaceae family as food with a percentage level of 13%, while the *Graphium* genus such as *Graphium sarpedon* and *Graphium agamemnon* like host plants with a percentage level of 15% from the Annona genus, namely *Annona muricata, A. reticulata,* and *A. squamosa*, while *Graphium doson* likes *Persea americana* as food for the larvae. Subahar & Yuliana (2010) reported that plants from the Annonaceae family are specific hosts for the *Graphium* genus and the Rutaceae family for the *Papilio* genus. Meanwhile, according to Putra (2012) stated that Papilionidae larvae have specific host plants, namely from the genera *Citrus, Aristolochia*, and *Umbellifera*. Meanwhile, larvae from the genus *Graphium* choose plants from the Annonaceae family.

Based on this research, it can be seen that there is a high percentage of preference for larval host plants from the Rutaceae family (23%) and the Anonnaceae family (15%) compared to other families. This is because several types of butterfly larvae, such as the genus *Graphium,Papilio, Acraea*, and *Hypolimnas bolina*, have polyphagous properties. The nature of this polyphagus is influenced by the characteristics of the plant source of food for the larvae, because the choice of food is very dependent on

the taste ability of the larvae and the oviposition level of the female. The chemical content of the leaves also influences the level of oviposition, especially as an attractant that invites females to lay eggs. According to Soekardi (2007), butterfly larvae are specialist herbivores that can only eat the leaves of certain types of plants. Most types of butterflies are monophagous which can only eat one species of plant, but there are also butterfly larvae which can eat several specific plant species. The abundant availability of food in the form of larval host plants from the Rutaceae family and the Anonaceae family in the Unsri campus area causes the level of preference to be high for the two plants from this family.

One species of butterflies, *Acraea violae* is an abundant species of butterfly so it is easy to find and is evenly distributed throughout the Unsri Campus area. This species has known widely distributed in Sumatra and Indonesia (Iqbal *et al.* 2019, 2020). It is well known from several studies that the food of *Acraea violae* larvae is from the Passifloraceae family (Kunte 2000). Field observations found that this type of butterfly is polyphagous with two types of host plants found for its larvae, namely *Piriqueta racemosa* and *Passiflora foetida*. These two types of plants belong to the Passifloraceae family. According to Kunte (2000) the host plants for *Acraea violae* larvae come from the Loganiaceae, Cucurbitaceae and Passifloraceae families (*Passiflora edulis, P. foetida, P. subpeltata, P. siamica, Adenia cardiophylla* and *A. hondala*). Sasikala *et al.* (2011) investigated vitro anti oxidant activities and it is assumed that *P. foetida* contains poison which is secreted by the larvae and then passed on to adult butterflies in the form of a yellow liquid that the butterfly secretes for protection against predators.

One species of plant can not only host the larvae of one type of butterfly but can also host the larvae of other types of butterflies. The *Asystasia intrusa* plant, which is the host for the larvae of Doleschallia bisaltidae, turns out to also be the host for *Hypolimnas bolina* and *Junonia hedonia*. The chemical content of plants is the main reason for preference by butterflies apart from leaf morphology because butterfly survival is greatly influenced by the nutrition obtained at the larval stage. According to Soekardi (2007), the larval stage is very active in carrying out feeding activities to store energy for growth and development. The accumulated energy will be used to carry out metamorphosis. Lack of nutrition will cause the larvae to shorten their life cycle and make butterfly growth less than optimal.

Apart from choosing *Asystasia intrusa*, the *Hypolimnas bolina* butterfly (family Nymphalidae) also chose *Sida acuta* as a host for its larvae when butterfly eggs were found on the leaves of this plant. This situation can occur due to the similarity of the chemical content of the leaves and their morphology. Between *Asystasia intrusa* and *Sida acuta*, there are no similarities in leaf morphology, but the same chemical content can be smelled from the aroma which is thought to be an attractant for oviposition. The chemical content, namely the water and nitrogen content of *Sida acuta*, is 66.2% and 2.89% lower when compared with *Asystasia intrusia* was 93.5% and 3.28%. Field observations showed that *Asystasia intrusa* was preferred over *Sida acuta* both in terms of the number of individuals found and the frequency of discovery. According to Peggy and Amir (2006), the food source for Nympalidae Butterflies is the Annonaceae, Leguminoceae, Compositae and Poaceae families and has a high ability to survive in various types of habitat because it is polyphagous.

Several species of butterfly larvae is monophagus, but many of them are polyphagus. The larvae are able to adapt to maintain their survival even in conditions of drought during the long dry season, this is because of their polyphagus nature which, if the main host species is reduced, can choose plants with similar chemical content as food. Characteristics like this are a strategy to maintain the continuity of the species so that it continues to exist in nature. According to Setiawan *et al.* (2020), the length of the life cycle is determined by the quality and quantity of the host plant because for its growth the larvae need water and nitrogen from the plants they eat.

Asystasia intrusa is one common common host plant, which is often found in each research location, makes the *Doleschallia bisaltidae* butterfly common. This is because *Asystasia intrusa* specifically serves as food for its larvae, not only one type of butterfly depends on this plant as a source of larval food, but *Junonia hedonia* also uses this plant as food for its larvae. The chemical content of this plant, namely water content of 93.5% and nitrogen of 3.28%, greatly influences the growth and development of larvae so that they can become imago and continue their life cycle. According to Aprillia *et al.* (2020), the nature of polyphagus and monophagus is determined by the presence of a permanent host in nature. If a butterfly is very dependent on one type of plant, its survival is closely related to the availability of its host.

Based on field research, the *Graphium sarpedon* butterfly observed apparently prefers *Persea americana* over *Annona muricata* which is known as its main host. This can be seen during field observations that the frequency and number of individual larvae found is higher in *Persea* compared to

other types of *Annona*. Kennedy (2008) studied mechanism of host plant selection and it is assumed that there are other factors influences to host plant selection. According to Wijaya (2007), insects prefer to eat softer plant tissue. Hard plant tissue can interfere with the insect's feeding process. It is thought that this is the cause of *G. sarpedon's* higher preference for *Persea americana*, which has softer leaves, compared to *A. muricata,* which is stiffer.

Monitoring throughout the year 2015 of butterfly species in the Unsri campus area found as many as 40 species (Lamin *et al.* 2016). However, based on research, only 14 species of host plants were found for 12 butterfly species. One of the factors that causes larvae from other types of butterflies to not be found is the change of seasons. This is because this research was conducted at the end of the hot and long dry season into the rainy season. During the dry season, butterflies are generally not found much because there are few host plants during that season. According to Hamer *et al.* (2003) stated that temperature affects the growth of adult butterfly food plants so that it is related to the number of types and individuals of butterflies. The temperature factor plays an important role in suboptimal growth and wilting of host plants.

Entering the rainy season, new butterflies will begin to mate and oviposition. However, the rainy season is also a vulnerable season for the immature stage of butterflies. Physical factors such as exposure to rain will make rotting of pupae more prone to occur, in addition to parasitoid attacks. The activities of butterfly larvae will also be disrupted during the rainy season and this will result in many deaths as well as the emergence of predators. According to Untari (2010), the existence of butterflies is greatly influenced by climate, a climate that is too cold or a climate that is too hot is not liked by butterflies, thus affecting their life cycle and ability to survive.

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