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Butterfly Species and Nectar Source Preferences at Khairun University Campus, Ternate, North Maluku

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Abstrak

Kupu-kupu memiliki peran ekologis yang sangat penting dalam ekosistem, salah satunya adalah membantu penyerbukan pada tumbuhan berbunga. Keberadaan kupu-kupu pada suatu wilayah sangat bergantung pada ketersediaan sumber nektar sebagai pakan utama bagi kupu-kupu dewasa. Penelitian ini bertujuan untuk mengidentifikasi jenis kupu-kupu yang terdapat di lingkungan kampus Universitas Khairun dan menginventarisasi tumbuhan berbunga yang berpotensi menjadi sumber nektarnya. Penelitian ini dilaksanakan di Kampus I Universitas Khairun, Akehuda, Kecamatan Ternate Utara, Kota Ternate, Maluku Utara selama bulan November 2024. Pengambilan data menggunakan metode survei perjumpaan visual (*visual encounter survey method*) dengan melihat dan mencatat secara langsung jenis kupu-kupu yang terbang dan hinggap pada bunga, juga jenis-jenis tumbuhan berbunga yang ditemukan. Pengambilan data dilakukan pada pagi hari pukul 08:00-10:00 WIT dan sore hari pukul 16:00-18:00 WIT (Waktu Indonesia Timur) sesuai dengan waktu kupu-kupu beraktivitas. Berdasarkan hasil penelitian diketahui bahwa Kupu-kupu yang ditemukan di lingkungan kampus I Universitas Khairun terdiri atas 8 jenis dari 3 Famili yaitu Famili Lycaenidae, Nymphalidae, dan Pieridae. Ada 11 jenis tumbuhan berbunga yang berpotensi menjadi sumber nektar bagi kupu-kupu di lingkungan kampus ini. *Tridax procumbens* merupakan jenis tumbuhan berbunga yang dapat menjadi sumber nektar bagi semua jenis kupu-kupu di lingkungan kampus Universitas Khairun.

Kata kunci: *Asteraceae, Lycaenidae, Nymphalidae, Pieridae*

Abstract

Butterflies have a very important ecological role in the ecosystem, one of which is to help pollinate flowering plants. The existence of butterflies in an area is highly dependent on the availability of nectar sources as the main food for adult butterflies. This study aims to identify the species of butterflies found in the Khairun University campus environment and inventory flowering plants that have the potential to become nectar sources. This research was conducted at campus I of Khairun University, Akehuda, North Ternate Subdistrict, Ternate City, North Maluku during November 2024. Data were collected using the visual encounter survey method by directly observing and recording the species of butterflies that flew and landed on flowers, as well as the species of flowering plants found. Data collection was carried out in the morning at 08:00-10:00 WIT and in the in the afternoon at 16:00-18:00 WIT (Eastern Indonesian Time) according to the time of butterfly activity. Based on the results of the study, it is known that the butterflies found in the campus I, Khairun University consist of 8 species from 3 families, namely the Lycaenidae, Nymphalidae, and Pieridae families. There are 11 species of flowering plants that have the potential as a source of nectar for butterflies in this campus. *Tridax procumbens* is a flowering plant species that could be a source of nectar for all species of butterflies in the campus environment of Khairun University.

Keywords: Asteraceae, Lycaenidae, Nymphalidae, Pieridae

INTRODUCTION

Butterflies are a group of insects from the Order Lepidoptera with more than 28,000 species worldwide. Butterflies have a very important ecological role in the ecosystem, one of

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which is to help pollinate flowering plants (Ghazanfar et al., 2016). Pollination is the process of moving pollen to the stigma. Pollination with the help of butterflies occurs when butterflies fly from one flower to another to obtain a food source in the form of nectar. Pollen is attached to the butterfly's body when the butterfly sucks the nectar and is carried away when the butterfly moves to another flower (Barrios et al., 2016).

The presence of butterflies in an area is highly dependent on the availability of nectar sources as the main food for adult butterflies. Nectar is a complex compound containing glucose, fructose, sucrose, amino acids, and lipids (Koneri et al., 2020). Nectar produced by flowering plants has a different amount and quality in each plant (Alam et al., 2019). This is largely influenced by the characteristics of these plants such as plant size, flowering type, flower size, flower age, sexual stage in flowers, and flower position in flowering (Lu et al., 2015).

Butterflies have a short life cycle and are therefore very sensitive to environmental changes. The presence of butterflies in an environment indicates the quality of the environment. A healthy environment will attract more butterfly species (Chowdhury et al., 2023). Research on butterflies in the campus environment has been conducted on several campuses in Indonesia. The results showed that there were 34 butterfly species found at Pinang Masak Campus, Jambi University (Dewi et al., 2016), there were 24 butterfly species at Sam Ratulangi University, Manado (Mogan et al., 2018), and there were 20 butterfly species at Pattimura University, Ambon (Wakano & Moniharapon, 2019). Research on butterfly species in the campus environment is very important because it can provide insight into the sustainability of butterfly populations and the contribution of campus vegetation to local biodiversity conservation (Suparman et al., 2020). This research can serve as a basis for conservation efforts and management of green landscapes on campus to improve the carrying capacity of habitats for butterflies.

Campus I of Khairun University has a variety of flowering plants that have the potential to be a source of nectar for butterflies, but so far there has been no study that specifically identifies butterfly species and their nectar sources in the environment. Therefore, it is necessary to conduct research on butterflies and their nectar sources in the campus environment of Khairun University. This study aims to identify the species of butterflies found in the campus environment of Khairun University and inventory flowering plants that become potential sources of nectar.

METHODS

This research was conducted at Campus I of Khairun University, Akehuda, North Ternate, Ternate City, North Maluku during November 2024. This research is a qualitative study to determine the species of butterflies found in the campus I of Khairun University and the species of flowering plants that can be a source of nectar for these butterflies. Data collection uses a visual encounter survey method by directly seeing and recording the species of butterflies that fly and land on flowers (Basri & Zakaria, 2021), as well as the species of flowering plants found. Data collection of butterfly species is carried out twice every week in the morning at 08:00-10:00 WIT because at this time the nectar content in flowers is highest so that the butterflies are most active at this time and in the afternoon at 16:00-18:00 WIT when the nectar content in flowers has dropped (Koneri et al., 2020).

The data on butterfly species and flowering plants found in the campus environment of Khairun University were documented for the identification process. The butterfly identification process uses a number of butterfly identification books, namely Dewi et al. (2023), Panjaitan et al. (2021), Rohman et al. (2019), and Schulze (2015). Flowering plants found in the campus environment were identified using the identification book Parlupi et al.

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(2019) and Setyawati et al. (2015). The classification of butterflies was sourced from the Insecta.pro catalog (https://insecta.pro/) and the classification of flowering plants was sourced from the Plantamor catalog (https://plantamor.com/). The data on butterfly species and flowering plants in the campus environment of Khairun University are presented in the form of tables and figures.

Figure 1. Research location at campus I of Khairun University, Akehuda (Source: Google Earth)

RESULTS AND DISCUSSION

Based on the observation, 8 species of butterflies from 3 families were found at campus I, Khairun University. These butterflies are *Zizina otis* from the Lycaenidae Family, *Elymnias hypermnestra*, *Ideopsis vulgaris*, and *Ypthima pandocus* from the Nymphalidae Family, and *Appias libythea*, *A. olferna*, *Catopsilia pomona*, and *Eurema hecabe* from the Pieridae Family. This data can be seen in Table 1.

Table 1. Species of butterflies in campus I of Khairun University

No.	Family	Species of Butterflies
1	Lycaenidae	*Zizina otis* (Fabricius, 1787)
2	Nymphalidae	*Elymnias hypermnestra* (Linnaeus, 1763)
3	Nymphalidae	*Ideopsis vulgaris* (Butler, 1874)
4	Nymphalidae	*Ypthima pandocus* Moore, [1858]
5	Pieridae	*Appias libythea* (Fabricius, 1775)
6	Pieridae	*Appias olferna* Swinhoe, 1890
7	Pieridae	*Catopsilia pomona* (Fabricius, 1775)
8	Pieridae	*Eurema hecabe* (Linnaeus, 1758)

Classification source: https://insecta.pro/

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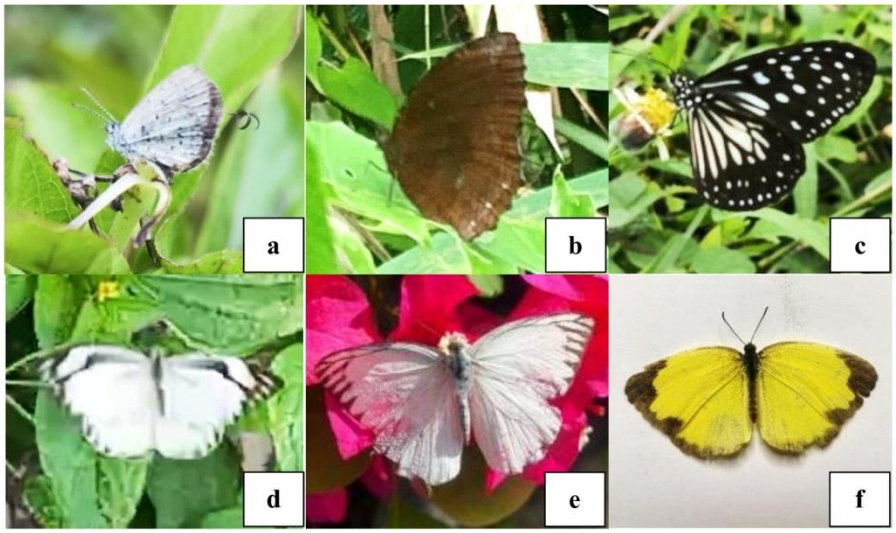

Figure 2. Butterflies in campus I of Khairun University: a. *Zizina otis*; b. *Elymnias hypermnestra*; c. *Ideopsis vulgaris*; d. *Appias libythea*; e. *Appias olferna*; f. *Eurema hecabe*

The butterflies were observed flying and visiting various plant species in the campus environment, either only as a perch or as a source of food in the form of nectar. There were 22 species of flowering plants from 15 families found in campus I of Khairun University. The species of flowering plants can be seen in Table 2.

Table 2. Species of flowering plants in the campus I of Khairun University

No	Family	Flower Species		Habitus	Flower Color
		Scientific Name	Indonesian Name		
1	Acanthaceae	*Asystasia gangetica* (L.) T. Anderson	Rumput israel	Bushes	White
2	Acanthaceae	*Ruellia prostrata* Poir.	Kencana	Bushes	Purple
3	Acanthaceae	*Ruellia tuberosa* L.	Kencana ungu	Bushes	Purple
4	Amaranthaceae	*Celosia argentea* L.	Boroco	Bushes	Pink
5	Apocynaceae	*Allamanda cathartica* L.	Alamanda	Shrubs	Yellow
6	Asteraceae	*Cyanthillium cinereum* (L.) H.Rob.	Sawi langit	Herbs	Purple
7	Asteraceae	*Synedrella nodiflora* (L.) Gaertn.	Jotang kuda	Herbs	Yellow
8	Asteraceae	*Tridax procumbens* L.	Gletang	Herbs	Yellow
9	Cleomaceae	*Cleome rutidosperma* DC.	Maman lanang	Herbs	Purple
10	Commelinaceae	*Commelina diffusa* Burm.f.	Aur-aur	Herbs	Blue
11	Cucurbitaceae	*Melothria pendula* L.	Mentimun merambat	Creepers	Yellow
12	Cyperaceae	*Cyperus mindorensis* (Steud.) Huygh	Teki badot	Grass	White
13	Cyperaceae	*Cyperus* sp.	Teki	Grass	Brown
14	Fabaceae	*Mimosa pudica* L.	Putri malu	Bushes	Pink
15	Malvaceae	*Hibiscus tiliaceus* L.	Waru	Trees	Yellow
16	Nyctaginaceae	*Bougainvillea spectabilis* Willd.	Bunga kertas	Shrubs	Pink
17	Nyctaginaceae	*Mirabilis jalapa* L.	Bunga pukul empat	Bushes	Yellow
18	Petiveriaceae	*Rivina humilis* L.	Getih-getihan	Bushes	White
19	Poaceae	*Eragrostis viscosa* (Retz.) Trin.	Jukut karukun	Grass	Red
20	Poaceae	*Setaria viridis* (L.) P.Beauv.	Rumput setaria	Grass	Green
21	Portulacaceae	*Portulaca oleracea* L.	Krokot	Herbs	Yellow
22	Rubiaceae	*Ixora chinensis* Lam.	asoka cina	Shrubs	Red

Classification source: https://plantamor.com/

Butterflies found on campus environment visit different flowers for nectar. *Zizina otis* is a small butterfly with a wingspan of up to 3 cm. It has blue-brown on upper and brown with patterns in the center and margins of the lower surface of wings. Flowering plants that are

potential nectar sources for this butterfly are gletang (*Tridax procumbens*) (Mape et al., 2022; Mukherjee & Hossain, 2021; Variya & Trivedi, 2024), sawi langit (*Cyanthillium cinereum*) (Mape et al., 2022; Variya & Trivedi, 2024), kencana ungu (*Ruellia tuberosa*) (Samanta et al., 2022), and rumput israel (*Asystasia gangetica*) (Sumah, 2024).

Elymnias hypermnestra is a medium-sized butterfly with a wingspan of up to 7 cm. Male and female butterflies have different colors of the upper surface of the wings. Butterflies found in the campus environment are male butterflies with black forewings and brown hindwings. The female butterflies have brighter wing coloration resembling that of butterflies of the genus *Danaus*, but with scalloped wing margins. According to Subahar & Yuliana (2010), this butterfly frequently visit tembelekan flowers (*Lantana camara*) for nectar. However, this flower was not found in the campus environment. This flower is known to grow around the back road of campus I of Khairun University.

Ideopsis vulgaris is a medium-sized butterfly with a wingspan of up to 8 cm. It has black wings with white elongated patterns on the upper and lower surfaces of the wings. This butterfly was observed sucking nectar from gletang flower (*Tridax procumbens*). Another nectar source for this butterfly in the campus environment is asoka (*Ixora chinensis*) (Koneri et al., 2020).

Ypthima pandocus is a medium-sized butterfly with a wingspan of up to 4.5 cm. It has dark brown wings with one large circular pattern on the leading edge of forewings and two small circular patterns on the trailing edge of hindwings. Flowering plants that are potential nectar sources for this butterfly in the campus environment are rumput israel (*Asystasia gangetica*) (Rusman et al., 2016) and gletang (*Tridax procumbens*) (Yek et al., 2024).

Appias libythea is a medium-sized butterfly with a wingspan of up to 5 cm. The wing color between male and female butterflies is different. Male butterflies have a dominant white upper wing surface color with black edges, while female butterflies have a dominant black upper wing surface color with white patterns in the middle and wing edges. These butterflies were seen sucking nectar from jotang kuda flower (*Synedrella nodiflora*). Another flower that is also a potential nectar source for this butterfly is gletang (*Tridax procumbens*) (Mallick & Virdi, 2024; Yek et al., 2024).

Appias olferna is a medium-sized butterfly with a wingspan of up to 7 cm. This butterfly also has different wing colors between males and females. Butterflies found in the campus environment is male butterflies that have a dominant white wing color with black edges. Plants that have the potential as a source of nectar for this butterfly in the campus environment are gletang (*Tridax procumbens*) (Mape et al., 2022).

Catopsilia pomona is a medium-sized butterfly with a wingspan of up to 8 cm. It has pale yellow wings. Flowering plants that have the potential to be a source of nectar for this butterfly in the campus environment are maman lanang (*Cleome rutidosperma*), putri malu (*Mimosa pudica*) (Aminah et al., 2020), asoka (*Ixora chinensis*) (Koneri et al., 2020), rumput israel (*Asystasia gangetica*) (Pertiwi et al., 2021), gletang (*Tridax procumbens*) (Gandhi & Kumar, 2015; Mallick & Virdi, 2024; Nimbalkar et al., 2011), alamanda (*Allamanda cathartica*), and bunga kertas (*Bougainvillea spectabilis*) (Samanta et al., 2022),

Eurema hecabe is a medium-sized butterfly with a wingspan of up to 5 cm. It is bright yellow with black wing margins. The lower surface of the wings have an irregularly shaped pattern. Flowering plants that are potential nectar sources for this butterfly are boroco (*Celosia argentea*) (Nimbalkar et al., 2011), rumput israel (*Asystasia gangetica*), asoka (*Ixora* sp.), putri malu (*Mimosa pudica*), gletang (*Tridax procumbens*) (Deepika et al., 2014; Gandhi & Kumar, 2015; Koneri et al., 2020), jotang kuda (*Synedrella nodiflora*) (Usharani & Raju, 2018), and kencana ungu (*Ruellia tuberosa*) (Samanta et al., 2022). A graph of the relationship between butterflies and flowering plants that are potential nectar sources can be seen in Figure 3.

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Figure 3. Graph of butterflies and their nectar sources in campus I of Khairun University

Based on the graph in Figure 3, it is known that *Catopsilia pomona* and *Eurema hecabe* butterflies have flowering plants that have the most potential as a source of nectar compared to other butterflies in the campus environment, namely 7 species of plants. *Appias olferna* butterflies only have one species of plant that has the potential as a source of nectar in the campus environment. The graph also shows that of the 22 species of flowering plants found in the campus environment, only 11 species of plants have the potential to be a source of nectar for butterfly species. These flowering plant species are *Allamanda cathartica*, *Asystasia gangetica*, *Bougainvillea spectabilis*, *Celosia argentea*, *Cleome rutidosperma*, *Cyanthillium cinereum*, *Ixora chinensis*, *Mimosa pudica*, *Ruellia tuberosa*, *Synedrella nodiflora*, and *Tridax procumbens*.

According to Koneri et al. (2020), the relationship between butterflies and flowering plants is influenced by plant habitus, flowering type, and flower color. However, based on observations, all species of plants that have the potential as a source of nectar for butterflies in the campus environment have different habitus. *Asystasia gangetica*, *Ruellia tuberosa*, *Celosia argentea*, and *Mimosa pudica* are shrubs. *Cleome rutidosperma*, *Cyanthillium cinereum*, *Synedrella nodiflora*, and *Tridax procumbens* are herbs. *Allamanda cathartica*, *Bougainvillea spectabilis*, and *Ixora chinensis* are shrubs. The color of each of these flowers also varies. *A. gangetica* has white flowers. *C. rutidosperma*, *C. cinereum*, and *R. tuberosa* have purple flowers. *I. chinensis* has red flowers. *B. spectabilis*, *C. argentea*, and *M. pudica* have pink flowers. *A. cathartica*, *S. nodiflora*, and *T. procumbens* have yellow flowers. These flowering plants can be seen in Figure 4.

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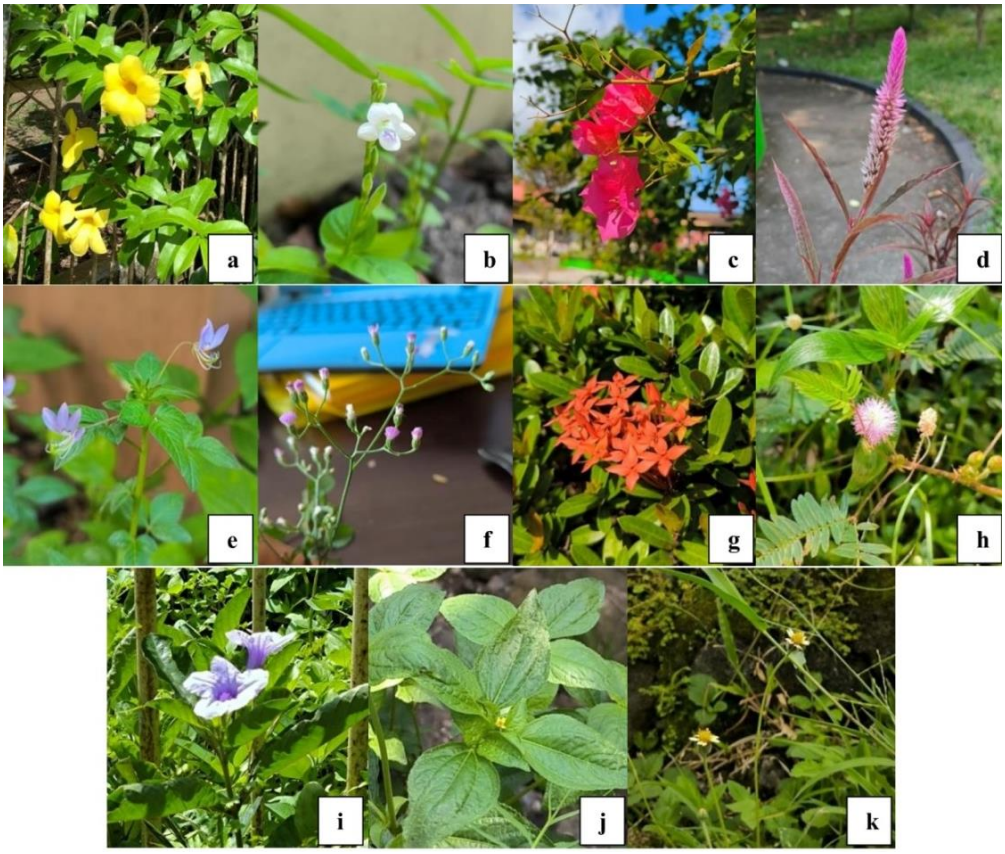

Figure 4. Flowers that are potential nectar sources of butterfly in the campus environment of Khairun University: a. Alamanda (*Allamanda cathartica*); b. Rumput israel (*Asystasia gangetica*); c. Bunga kertas (*Bougainvillea spectabilis*); d. Boroco (*Celosia argentea*); e. Maman lanang (*Cleome rutidosperma*); f. Sawi langit (*Cyanthillium cinereum*); g. Asoka (*Ixora chinensis*); h. Putri malu (*Mimosa pudica*); i. Kencana ungu (*Ruellia tuberosa*); j. Jotang kuda (*Synedrella nodiflora*); k. Gletang (*Tridax procumbens*)

The selection of flowering plants as a nectar source for butterflies is also influenced by other factors such as the length of the corolla tube, the amount of nectar, and the quality of the nectar (Mukherjee & Hossain, 2021). Flowers with long, tubular corollas restrict butterfly species that have short proboscis from absorbing nectar. This causes small butterflies with short proboscis to only be able to suck nectar from flowers that have a short corolla tube size as well. Based on the results of research Tiple et al. (2009), it is known that butterflies from the Lycaenidae Family prefer flowers with short corolla tubes because of their relatively short proboscis of 6-7 mm, Nymphalidae have a tendency to suck the nectar of plants with a fairly deep corolla of 10 mm because the proboscis length ranges from 10-11 mm, and Pieridae prefer flowers with a deeper corolla of 10-15 mm because the proboscis length is 13-15 mm. The tendency of flower selection based on the size suitability between the proboscis length and the length of the corolla tube causes differences in nectar source preferences for butterflies. This is also supported by the results of research Szigeti et al. (2020) that butterflies with longer proboscis more often visit flowers with deep corolla than butterflies with short proboscis. So that intraspecific morphological variation in plants and butterflies as pollinators is an important factor in the selection of nectar sources.

Based on the results of the study described in Figure 3, it is known that of the 11 species of flowering plants that have the potential as a source of nectar, there is one species of plant that has the potential to be a source of nectar for all species of butterflies found in the campus environment. This plant is *Tridax procumbens*. *T. procumbens* is a herbaceous plant from the Asteraceae Family with a height of 30-60 cm. This flower is in the form of a capitulum which

is composed of small flowers called florets. The florets on this flower consist of two types, namely ray floret and disc floret. Ray floret are flowers that are found on the edge. These are female flowers that are only 5-6 in number and have 3-4 white to pale yellow corolla lobes. Disc floret are flowers found in the center with a very large number, bisexual, and have 5 yellow corolla lobes (Areces-berazain, 2024). Ray florets are nectarless, while disc florets produce nectar and pollen. It is the disc floret that are often taken for nectar by pollinators, especially butterflies (Varalakshmi et al., 2012).

Based on the results of research Varalakshmi & Raju (2013), it is known that there are 27 species of butterflies from 5 families that seek nectar in *Tridax procumbens* flowers, while based on the results of research Mallick & Virdi (2024) it is known that there are 34 species of butterflies reported to visit this flower to obtain nectar. The number of butterfly species that visit *T. procumbens* flowers to obtain nectar is caused by many factors, including the size of the corolla tube on the disc flower and the nectar content. Based on the results of research Tiple et al. (2009), it is known that the average size of the tube in *T. procumbens* disc floret is 5 mm. This short corolla tube size causes the nectar in this flower to be reached by the proboscis of many species of butterflies, not only butterflies with long proboscis, but also small butterflies with short proboscis such as *Zizina otis*. In addition, this flower also has a high nectar content. The total volume of nectar produced per flower is 9.36 µl with a sugar concentration of 18-22% ((Varalakshmi & Raju, 2013). The volume of nectar in these flowers is much higher than the volume of nectar in *Asystasia gangetica* flowers which is only 2-4.7 µl per flower (Mocharla & Aluri, 2021). *T. procumbens* flower nectar also contains five essential amino acids namely arginine, histidine, lysine, threonine, and valine, and 10 non-essential amino acids namely alanine, amino butyric acid, cysteine, cystine, glutamic acid, glycine, hydroxyproline, proline, and serine. This shows that the nectar in this flower is a source of sugar, amino acids, and protein so that this flower is a potential food source for butterflies (Varalakshmi et al., 2012).

CONCLUSIONS

Butterflies found in Campus I of Khairun University consisted of 8 species from 3 families, namely *Zizina otis* from the Lycaenidae Family, *Elymnias hypermnestra*, *Ideopsis vulgaris*, and *Ypthima pandocus* from the Nymphalidae Family, and *Appias libythea*, *A. olferna*, *Catopsilia pomona*, and *Eurema hecabe* from the Pieridae Family. Flowering plants found in the campus environment amounted to 22 species, but only 11 species of flowering plants that have the potential to be a source of nectar for butterflies, namely *Allamanda cathartica*, *Asystasia gangetica*, *Bougainvillea spectabilis*, *Celosia argentea*, *Cleome rutidosperma*, *Cyanthillium cinereum*, *Ixora chinensis*, *Mimosa pudica*, *Ruellia tuberosa*, *Synedrella nodiflora*, and *Tridax procumbens*. *Tridax procumbens* is a flowering plant species that has the potential to be a source of nectar for all species of butterflies in the campus I of Khairun University.

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