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Diversity of Plant Visiting Insects of Intercrop *Lantana camara* in Oil Palm Plantation

Keanekaragaman Spesies Serangga Pengunjung Tanaman Sela Lantana camara pada Perkebunaan Kelapa Sawit

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ABSTRAK

Bunga tanaman refugia dapat mejadi pendukung aplikasi pengendalian hama secara hayati. Serangga pengunjung tanaman berbunga khususnya Tanaman *Lantana camara*. Penelitian ini bertujuan untuk mengetahui keanekaragaman serangga yang mengunjungi tanaman bunga tembelekan yang ditanam diantara tanaman kelapa sawit. Penelitian ini menggunakan metode *Scan Sampling* atau pengamatan langsung. Serangga yang ditemukan di tanaman *L. camara* diambil dan diidentifikasi. Hasil penelitian menunjukkan ada 11 spesies yang termasuk kedalam 11 famili dan 7 ordo. Nilai indeks keanekaragaaman spesies serangga yang mengunjungi ke tanaman Bunga *L. camara* rendah. Yang berarti bunga *L. camara* tidak menarik bagi serangga. Indeks kemerataan spesies dan indeks dominansi berkisaran antara 0,31-0,60 yang berarti dominansi sedang. Serangga yang dominan ditemukan pada bunga *L. camara* ialah *Bothrogonia addita*. Pada tanaman bunga *L. camara* yang ditanami di antara tanaman kelapa sawit ditemukan 11 spesies, Ke11 spesies itu ialah *O. salticus, A. coquebertii, B. tabaci, B. addita, Componotus* sp., *H. itama, A. violae, C. gemmatus, I. elegans, A. crenulate, L. marginicollis.* Serangga yang mengunjungi kebunga *L. camara* pada pagi hari lebih banyak dari pada yang dating pada sore hari dengan jumlah berturut- turut 11 spesies, 268 individu dan 9 spesies, 141 individu. Serangga yang dominan ditemukan pada bunga *L. camara* ialah *B. addita.*

Kata kunci: keanekaragaman, serangga, *Lantana camara*

ABSTRACT

Refugia plant flowers can be a support for biological pest control applications. Insects are visitors to flowering plants, especially the *Lantana camara* plant, which is interesting to study. This study aimed to determine the diversity of insects that visit flower plants planted among oil palm plants. This study used the Scan Sampling method or direct observation. Insects found *in L. camara* plants were collected and identified. The results showed that there were 11 species belonging to 11 families and 7 orders. The index value of the diversity of attack species from *L. camara* flower plants was low. Which means *L. camara* flowers are not attractive to insects. The species evenness index and dominance index ranged from 0.31-0.60 which means moderate dominance. The dominant insect

found in L. camara flowers is Bothrogonia addita. In L. camara flower plants planted among oil palm plants, 11 species of arthropods belonging to 11 families and 7 orders were found. The 11 species are *O. salticus, A. coquebertii, B. tabaci, B. addita, Componotus* sp., *H. itama, A. violae, C. gemmatus, I. elegans, A. crenulate, L. marginicollis.* Insects that came to *L. camara* flowers in the morning were more than those that came in the afternoon with a successive number of 11 species, 268 individuals and 9 species, 141 individuals. The dominant insect found in *L. camara* flowers is *B. addita.*

Keywords: diversity, insect, *Lantana camara*

INTRODUCTION

Pests are the cause of the decline in the amount of oil palm crop production. The fireworm (*Setothosea asigna)* is an important pest of oil palm plants(Sukphing & Sehunae, 2021). Each tail of this caterpillar can eat leaves of 300-500 cm^2 (Saleh & Siregar, 2017). This pest attacks both young and old plants(Sahid et al., 2018). This insect infestation can cause yield losses of 78% in the first year and 40% in the second year (Suparman et al., 2014). High levels of insects cause this pest to become an important pest of oil palm crops.

The existence of natural habitats in an ecosystem is very important in maintaining the existence of natural enemies (Rizali et al., 2019). A very large number of pest occurrence result from the imbalance of the ecosystem in an area (Rashid et al., 2012). The ecositem equilibrium is influenced by the presence of natural enemies associated with the ecosystem (Kamarudin & Arshad, 2016). The natural enemies such as parasitoids and predators are influenced by the flowering plants that favor biodiversity (Jamian et al., 2017)

Such a flowering plant as *Lantana camara* has many benefits. One of the benefits of this flowering plant is that it can be a refugia plant that has a role as an alternative habitat for entomopag (Karenina et al., 2020). This plant can also be used as an active ingredient for economical and evironmentally friendly bioinsecticides (Culver & Precious, 2018). It can grow with a diameter of 2-4 mm having yellow, red, light and white color (Dash et al., 2015).

Yet, research on this plant has not been done much. Therefore, the study aimed to find out the insect diversity index of insect visitors to intercropping in oil palm plantations.

MATERIALS AND METHODS

Time and Place of Research

This study was carried out in the Oil Palm Plantation, Faculty of Agriculture, Universitas Sriwijaya, Indralaya from July 2022 to October 2022 (Figure 1).

Source: Google Maps 2022

Figure 1. Layout of research plots on oil palm plantations, Faculty of Agriculture, Universitas Sriwijaya

Observation Methods

The method used Direct Observation (*Scan Sampling*) and counted the number of species and individuals of insects visiting this flowering plant.

Work Procedure

The Making of Bunds

The making of bunds was carried out by measuring a benchmark measuring 4 x 1 m. There were six measured bunds with relatively equal distances. On all 4 sides were attached ropes to form a quadrangular bund. Then the weeds were cleaned and then the soil was loosen using hoes and hand tractors. The loose soil was given dolomite and let it be for 2 weeks. The soil was given manure and re-loosen for inserting the manure into the soil.

***Lantana camara* Planting**

The *L. camara* plants were purchased from the houseplant dealers. They were 8 weeks old, with each plant height ranging from 15-30 cm. Then the seedlings were transferred from the polybags to the bunds in which each bund was planted 4 plants, having a distance among the plants of about 70 cm (Culver & Precious, 2018). (Figure 2a)

Plant Maintenance

Watering

The watering was conducted in two ways, daily and once a week. Daily watering was carried out while the seedlings of flowers were still small. After the plant already had several new flowers, the watering was performed once a week by filling a 1.5 L mineral water bottle plugged into the area around the plant. Each bund had 4 installed plastic bottles (Figure 2b).

Fertilization

Fertilizing was carried out after the plant grew flowers. The fertilizing used NPK fertilizer. A prepared solution of 2 g of NPK fertilizer was mixed with 1 liter of water, allowing it to dissolve for approximately overnight. After that the plants were fertilized by watering each plant with 1liter of fertilizer for one bund (Figure 2c).

Sampling

Arthropod sampling to be identified was conducted by the *Scan Sampling* method (direct observation) in the field. The observations were made once a week for 8 weeks, having the state of complete arthropod's body. After that, the insects were stored in a plastic cup containing alcohol.

Insect Identification

Identification was carried out by looking at the specific morphological features of each insect. The identification used the insect determinant key book written by Achmad Sulthoni (1991) and the google lens. The observed parameters were the number of species existing in the tethered flower and the degree of diversity of such insects.

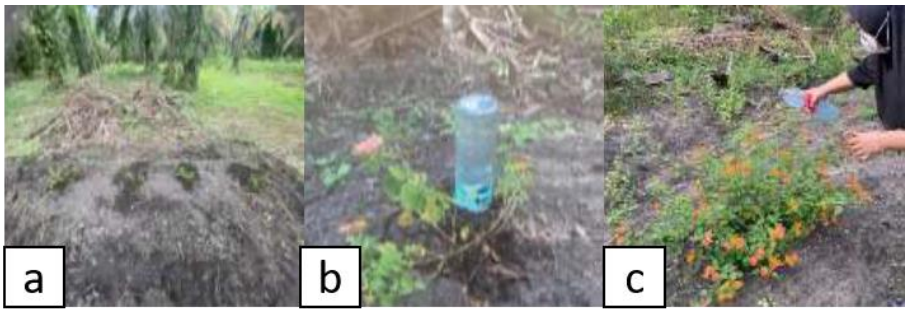

Figure 2. Activities of planting and caring for Lantana camara flower plants, planting (a), watering using plastic bottles (b), fertilizing using liquid fertilizer (c)

Observation Parameters

Data Analysis

The resulting data were presented in the form of tables and drawings, using the Shannon-wienner diversity index formula (**H'**), dominance index (**D**), and evenness index (**E**),

Shannon-wienner Diversity Index (H')

$$H' = -\sum = \left(\frac{ni}{N}\right) \ln\left(\frac{ni}{N}\right)$$

Remarks:
H' = Shannon-wienner Diversity Index (H')
pi = Comparison between the number of a species and the overall species (,□□-□.)

Species Dominance Index (D)

$$E = \left(\frac{H'}{In\ S}\right)$$

Remarks:
D : Dominance Index
Pi : Proportion of Total sample based on i^{-th} species (Belamkar & Jadesh, 2014)

Species Evenness Index (E)

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

Remarks:
E : Species evenness index
H' : Shannon-Wiener diversity index (Siregar et al., 2016)

RESULTS

Role of Arthropod

The results of the study shower that there were 11 species belonging to 11 families and 7 orders. The found species acted as predators, pollinators, and phytophagous. Table 1 showed that the species of insects active in the morning were more numerous than those in the afternoon. The found dominant species in *L. camara* was *B. addita.* The found pollinating insects were dominated by the hymenoptera (Table 1).

Tabel 1. Arthropod species in *Lantana camara* plants planted among the oil palm plantations of the Faculty of Agriculture, Universitas Sriwijaya

Orders/ Family	Species	Role	Observation Period		Total
			07.00-09.00	15.00-17.00	
Araneae					
Lycosoidea	*Oxyopes salticus*	Predators	13	5	18
Hemiptera					
Pyrrhocoridae	*Antilochus coquebertii*	Predators	2	4	6
Cicadellidea	*Bemisia tabaci*	Phytophagous	9	47	56
Aleyrodidae	*Bothrogonia addita*	Phytophagous	102	0	102
Hyminoptera					
Formicidae	*Componotus* sp.	Pollinators	28	47	75
Apidae	*Heterotrigona itama*	Pollinators	31	0	31
Lepidoptera					
Nymphalidae	*Acraea violae*	Pollinators	16	8	24
Mantodea					
Hymenopodidae	*Creobroter gemmatus*	Predators	2	3	5
Odonata					
Coenagrionidae	*Ischnura elegans*	Predators	5	4	9
Ortoptera					
Pyrgomorphidae	*Atractomorpha crenulate*	Phytophagous	40	17	57
Acrididae	*Leptysma marginicollis*	Phytophagous	20	6	26
Number of Species			11	9	
Number of individuals			268	141	409

Diversity of Insect

Insects and arthropods visiting the dominant *L. camara* plants were *B.addita*, *Componotus* sp, and *A.crenulate* presented in Figure 3. The results of observations conducted in the morning found 11 species. The 11 species belonged to 11 families and 7 orders. There were species found in all bunds; there were some species found only in certain bunds (Table 2).

Table 2 showed the insects visiting the *L. camara* plant in the morning as many as 268 heads. The dominant species found in *L. camara* plant was *Bothrogonia addita* amounting to 102 heads, the number of the most common insect found in the 2nd bund was 59 individuals. The afternoon observations on L. *camara* plant found eight species of arthropod belonging to 8 families and 7 orders. There were 2 species found in all bunds and there were species found only in certain bunds (Table 3).

Table 3 showed the insects visiting the L. *camara* plant in the afternoon as many as 141 heads. The most dominant species came from the species of *B. addita* and *Componotus* sp. with a total number of 47 heads. The most insects were found in the bund 1 with amounting to 35 heads. Based on the results of observations conducted in the morning and evening in L. *camara* plants planted in oil palm plantations, the species diversity index, species evenness index, and species dominance index were presented in Table 4.

Table 4 it could be seen that the average species diversity index in the morning is higher than in the afternoon. The average species evenness index in the morning and evening was not much different. And the average species dominance index in the morning and evening is relatively the same.

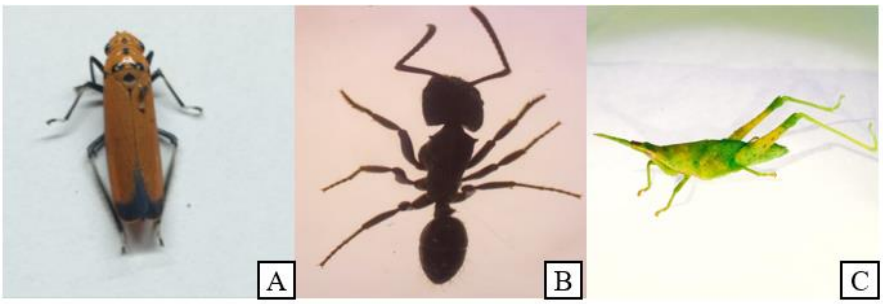

Figure 3. Insects and arthropods visiting the dominant *L. camara* plants. *Bothrogonia addita* (A), *Componotus* sp. (B), *Atractomorpha crenulate* (C)

Table 2. Number of Insects acquired in bunds in the morning observation

Orders	Species	Insects Acquired in Bunds						Total
		1	2	3	4	5	6	
Araneae	*Oxyopes salticus*	1	1	1	6	3	1	13
Hemiptera	*Antilochus coquebertii*	0	0	0	0	2	0	2
	Bemisia tabaci	3	3	3	0	0	0	9
	Bothrogonia addita	10	23	19	20	16	14	102
Hyminoptera	*Componotus* sp.	8	6	5	5	0	4	28
	Heterotrigona itama	4	8	3	5	5	6	31
Lepidoptera	*Acraea violae*	1	5	1	3	2	4	16
Mantodea	*Creobroter gemmatus*	*0*	0	0	0	2	0	2
Odonata	*Ischnura elegans*	2	1	1	0	0	1	5
Ortoptera	*Atractomorpha crenulate*	6	10	2	3	9	10	40
	Leptysma marginicollis	3	2	4	1	4	6	20
Number of Species		9	9	9	7	7	8	
Number of individuals		38	59	39	43	43	46	268

Table 3. Number of Insects acquired in bunds in the afternoon observation

Orders	Species	Insects Acquired in Bunds						Total
		1	2	3	4	5	6	
Araneae	*Oxyopes salticus*	2	0	2	0	0	1	5
Hemiptera	*Antilochus coquebertii*	1	0	1	0	0	2	4
	Bemisia tabaci	0	0	0	0	0	0	0
	Bothrogonia addita	12	4	4	9	10	8	47
Hyminoptera	*Componotus* sp.	14	6	9	3	7	8	47
	Heterotrigona itama	0	0	0	0	0	0	0
Lepidoptera	*Acraea violae*	0	4	3	0	0	1	8
Mantodea	*Creobroter gemmatus*	1	0	1	0	1	0	3
Odonata	*Ischnura elegans*	1	1	0	2	0	0	4
Ortoptera	*Atractomorpha crenulate*	3	1	2	3	3	5	17
	Leptysma marginicollis	1	0	0	2	21	6	
Number of Species		8	5	7	5	5	7	
Number of individuals		35	16	22	19	23	26	141

Table 4 Average species diversity index, species evenness index and species dominance index at observation time

Observation Period	Diversity Index	Dominance Index	Evenness Index
Morning 07.00-09.00	1.691	0.824	0.380
Aftenoon 15.00-17.00	1.491	0.771	0.400

DISCUSSION

This study found 7 orders and 11 families. The insect diversity has its own role between each species (Yanti et al., 2023). The diversity of predators insects depends on the diversity of herbivores, besides it also depends on the diversity of plants (Roberts et al., 2015), Many parasitoids and predatorss take nectar and pollen as nutrients. Several types of pollinators visiting the *L. camara* plant came from the Hymenoptera and Lepidoptera orders (Anggraini et al., 2021). In this observation, the insects found with the highest numbers was the *B. addita* species, a pest that attacked almost all parts of the plant, such as flowers, leaves and fruit (Yanti et al., 2023). After that, ants played the role of pollinators (Sharma & Meena, 2019). They are also entomofauna that eat dead bodies (Ramos-Pastrana et al., 2018).

The diversity of locusts affects the diversity of existing parasitoid and predatorss, and is influenced by the surrounding plants (Indahsari et al., 2022).

The insects of the orthoptera order of the family Pyrgomorphidae were also found in the field practice this time. (Ademolu et al., 2015) state that insects from this family are included in macrofauna that are often found in oil palm plantations that serve as determinants of soil quality. In addition, in this study, *Antilochus conquebertii* Fabr from the family of Pyrrhocoridae was found, which played the role of a predators (G et al., 2015).

The dominant insect was found in *L. camara* plants was *Bothrogonia addita*. In the flowering plants of *L. camara* planted among the oil palm plants, 11 species of arthropods belonging to 11 families and 7 orders were found. The 11 species were *O. salticus, A. coquebertii, B. tabaci, B. addita, Componotus* sp., *H. itama, A. violae, C. gemmatus, I. elegans, A. crenulate, L. marginicollis.* The insects that date *L. camara* in the morning are more numerous than those dating in the afternoon with a successive number of 11 species, 268 individuals and 9 species, and 141 individuals. The dominant insect found on *flowers of L. camara* was *B. addita.*

CONCLUSION

The dominant insect was found in *L. camara* plants was *Bothrogonia addita*. In the flowering plants of *L. camara* planted among the oil palm plants, 11 species of arthropods belonging to 11 families and 7 orders were found. The 11 species were *O. salticus, A. coquebertii, B. tabaci, B. addita, Componotus* sp., *H. itama, A. violae, C. gemmatus, I. elegans, A. crenulate, L. marginicollis.* The insects that date *L. camara* in the morning are more numerous than those dating in the afternoon with a successive number of 11 species, 268 individuals and 9 species, and 141 individuals. The dominant insect found on *flowers of L. camara* was *B. addita.*

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