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The Diversity of Phytophage and Entomophage Insect Species in Sugarcane Plantations Planted with Flowering Plants

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Abstract *:*
This study aimed to know the influence of planting the flowering plants in sugarcane plantation on the index value of diversity, domination, and the eveness of phytophage and entomophage insect species in sugarcane plantation. This study was done on two-month and six-month sugarcane of PT. Perkebunan Nusantara VII Cinta Manis District. The research location is located in Ketiau Village, Lubuk Keliat District, Ogan Ilir Regency, South Sumatra. The study was conducted from July to December 2018. Insects that came to flowering plants were collected by using fitfall traps, nets, and direct capture of insects that came. The results showed that the age of sugarcane affected the diversity of Entomophage and Phytophage insect species that came to the flowering plants. At 2-moth-old sugar cane plantations were found 42 species (388 individuals) and 6-month-old sugarcane plantations were found 41 species (284 individuals). The diversity of Phytophage and Entomophage species that came to flowering plants in the 2-month-old sugarcane plantations was almost the same as in the 6-month-old sugarcane plantations. Phytopage species diversity index values were 2.826 and 2.548, while Entomophage were 2.564 and 2.867.

Keywords: Flowering plants; sugarcane plantations; phytophage; entomophage

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1. Introduction

Plantation crops are very important in the base of agricultural natural resources. Plantation sub-sectors is the one of that has an important contribution in terms of value creation reflected in its contribution to gross domestic product of Rp. 159.75.9 billion in 2013[1].

South Sumatra is one of the provinces contributing the largest production of dry land plantation commodities, one of which is sugarcane commodity. The area of sugarcane in Cinta Manis dry land is approximately 25 thousands hectares [2]. Sugarcane (Saccharum officinarum) is the most important raw material in making sugar. The composition of the sap consists of about 75-80% water and about 20-25% dry matter [3], in this dry material sucrose content, sucrose accumulation in young stems is the lowest [4].

Pest insects control using flowering plants has not received much attention from farmers and companies engaged in agricultural production. Control with this method in sugarcane planting is expected to suppress attacks from stem and bud borer pests biologically. Biological control has advantages compared to other methods of control, because it does not have negative influence on agricultural products produced [5].

This biological control still tends to the use of entomophage insects to control agricultural insect pests. The use of parasitoid and predators insects has been widely practiced besides using biological agents. To control sugarcane borer pests, it has been been used Trichogramma spp parasitoid [6]. Failure in controlling can occur if the parasitoids and predators lack of food source (nectar or honey) for insects. Flowering plants can improve predator visited and polen suply and nectar and breeding sites and increasing fecundity predator [7]. The nectar and pollen content in flowers is also become attraction for insects. Marigold flower as rich source of nectar and polen for honeybee species [8]. Planting flowering plants with attractive colors around or at the edge of agricultural or plantations can increase the biological control of agricultural pests.

However, surprisingly there are few publications published where the addition of flowering plants has both increased natural enemy populations and increased pest suppression [9]. There are many types of flowering plants both single flowers and plural flowers and some even provide a source of food that is small or large. Flowers must be chosen carefully to provide resources that are easily accessed by natural enemies but not by moths or other pests that use pollen [10] or by predators or parasitoids from natural enemy species that are being sought for conservation [11].

Insects associated with sugarcane plantations have diverse expertise. These insects can act as phytophages, predators, pollinators [12]. Insects really like flowers, they visit flowers to get food sources, namely pollen and nectar. Because flowers attract large numbers of useful arthropods, that blooming marigold flower is attractedbt three species of honeybee viz. *A. Cerana* , *A.Florea* and *A. Dorsatabesides* four species from anthophoridae and one each from vespidae and scolidae. [13]. [13].

2. Materials and Methods

2.1. Place and Time

This study was conducted in a sugarcane plantation of PT. Perkebunan Nusantara VII Cinta Manis District Sugarcane Estate. The study location is located in Ketiau Village, Lubuk Keliat District, Ogan Ilir Regency, South Sumatra. The study in this location was done in July to December 2018. The research plots were located near sugarcane plantations aged 2 and 6 months.

2.2. Materials and Tools

The tools used in this study include stationery, jars, macro cameras (Nikon), microscopes, vial bottles, jars, tweezers, insect nets, insect traps, meters, insect identification key books and Past Software 2.1. The ingredients used are yellow cosmos flowers, marigolds flower seeds, bougenvillea flower seeds, and 70% alcohol.

2.3. Research Methodology

This research was conducted by using the experimental method. Experiment was carried out in sugarcane fields aged 2 and 6 months. There were 3 plant treatments carried out, first planting single type of flower, second planting 2 types of flowers, and third planting 3 types of flowers.

T_1 = A_1 B_1 C_1
Mix_2 = AB_2 AB_2 AB_2
Mix_3 = ABC

Note: (A) Yellow Cosmos flowers (*Cosmos sulpherus),*(B) Bougenvillea (*Zinnia elegans* Jacq), and (C) marrigold (*Tagetes electra).*

2.4. Prosedure

a. Determine Research Loacation

The area of sugar cane plantations owned by PT. Perkebunan Nusantara VII Cinta Manis District Sugarcane Estate South Sumatra reaches 2,733.0 hectares. The study was conducted on sugar cane plantations aged 2 and 6 months. Sugarcane planting plots with these criteria are located in Rayon IV plot. Location of flower seed planting was done on area of 100 m2 (20 m x 5 m) see (Figure 3.1).

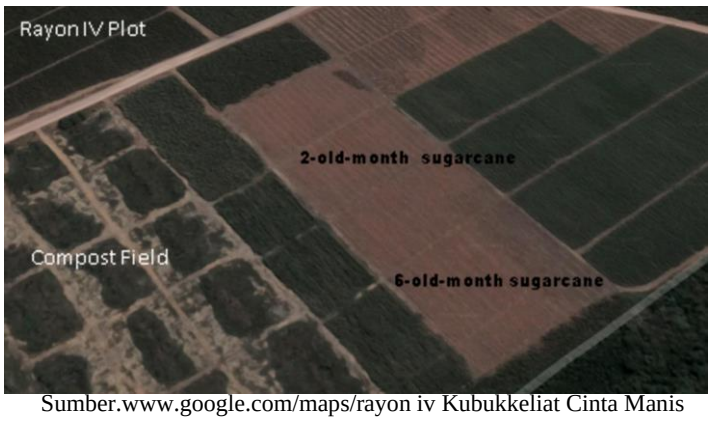

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Figure 3.1. Map of 2-month-old and 6-year-moth-old Sugarcane Planting Areas Planted with Flowering Plants

b. Making the Trap Equipment

Ground Insect Trap (Fit Fall Trap)

The trap was made of plastic cup with 12 ml volume (6.5 cm Top diameter, 9.5 cm height). On the cup was perforated at the height of 1 cm from the base to prevent rain water from entering.

Insect Nets

Insect nets were made of white gauze formed in cone with 60 cm height. Stick the gauze on 30 cm diameter steal and sew it with wire and after that attact it on 1 meter length net stick.

2.5. Planting the Flowering Plants

Cultivation of land using plow along the sugarcane plantations aged 2 and 6 months at an area of 100 m^2 (20 m x 5 m) with a spacing of 10 meters. Yellow cosmos seeds, bougenvillea, and marigolds are sown in the land along the sugarcane plantations that had been prepared. Watering was done every morning and evening on the land that had been sown with flower seeds.

2.6. The Installation of Pitfall Trap

a. Pitfall Trap

Pitfall trap had been used to catch the active insect on the surface of the ground. Dig a hole of 6.5 cm to be installed with pitfall traps in 3 points; the first was flower planting area, the second was sugar cane planting area, and

the third was between flowering plant and sugarcane planting area. Into the pitfall trap installed, it was inserted detergent liquid as high as 2cm. Examination of trapped insects by the pitfall trap was left in place 24 hours after being installed.

b. Insects Nets

Insect nets were used to catch insects in flowering plants and around sugar cane plants. The use of insect nets was done at 07.00 – 10.00 a.m. The insect net was swung on the surface of the flower plant by counting the 10 swing swings (5 left and 5 right). Insects caught in the net are put into plastic bags and tied with rubber and then labeled the date, day and place of the insects that were caught and then taken to the laboratory to be identified.

c. Visual Observation

The active insects that on the flowering plants were also documented. On the camera were set date, day, and place to take insect photos. Insects found on the flowera were identified. Observation of pitfall traps, nets, visuals was done every 1 week.

2.7. Insect Sample Identification

Samples that had been obtained were then identified. Identification was done at the Natural Enemy Laboratory of Cinta Manis Sugarcane Estate of PT. Perkebunan Nusantara VII by using identification books written [14],[15],[16],[17],[18]. Identification was conducted macroscopically and microscopically using a stereo microscope. The observed insects were made documentation in the form of photographs. Identification was done based on morphological characteristics to determine the Order, Family and Genus of Species.

2.8. Data Analyses

Number of species or number of individuals between surgacane plantations aged 2-month-old and 6-month-old was done using the analyses Chi-square goodness of fit test. Whereas for the analysis of insect species structure was calculated using (INP) Important Value Index, namely diversity using the Shannon index, dominance, evenness calculated with equations A.1, A.2, and A.3.

a. The Diversity Index

The result of sampling data in the field was done to count species as in the Shanon-Wiener calculation [19]:

$$H = -\sum pi \ln pi \qquad \text{..... A.1}$$

Note :

H = Diversity Index Shannon-Weiner
S = Number of Species
pi = ni/N
ni = Number of species individual at ...
N = The sum number of species

b. Dominance Index

Dominance Index, according to [17], can be counted by using the followinf formula:

$$e = \frac{H'}{H\,max} \qquad \text{.....A.2}$$

Note:

E = Uniformity Index
H_{max} = Maximum Diversity (ln S)
S = Species Number

Evenness Index values have criteria:

e< 0,5 = Evenness among species is low, because the individual wealth possessed by each species is very different.
e > 0,5 = The relationship between species is relatively even or the number of individuals of each species is relatively equal.

c. Eveness Index

According to [20] species dominance at each station that can be different, then it can be determined by Simpson's dominance index as follows:

$$\mathbf{D} = \sum \left(\frac{n_i}{N}\right)^2 \qquad \text{.....A.3}$$

Note:

D = Simpson Dominance Index
n_i = The number of individual species
N = Number of individual

The criteria of dominance is as follows:

D < 0,5 = There are no species that dominate other species or community structures in a stable condition
D > 0,5 = There are species that dominate other species or unstable community structures, due to ecological stress.

3. Results and Discussion

The results showed that the age of sugarcane can effect the diversity of entomophage and phytophage insects in flowering plants planted near sugarcane plantations aged 2 and 6 months. Phytophage and entomophage insects found on flowering plantations planted on sugarcane plantations aged 2 months were more than sugarcane plantations aged 6 months.

Picture 2. Morphology of flowering plants *Cosmos Sulphereus* (a) *Zinnia elegans* (b) *Tagetes electra* (c)

The results showed that the yellow color of flowers could affect the presence of entomophage and phytophage insects. In the Yellow Cosmos (*Cosmos Sulphereus*) were more insects found than on the paper flower (*Zinnia elegans*) and marigold (*Tagetes Electra*) plants. In Figure 2, it can be seen that (a) yellow cosmos flower is the dominant type of yellow flower, (b) bougainvillea flower has various flower color variants, and (c) marigold flower has a scent that can be a repellent or attractor for insects.

The number of flowering plant species that were planted near sugarcane planting could affect the number of insects found or coming to the flowering crop. Flowering plants which were planted monoculturally and polyculturallycould influence the number of insects found. The color and odor of flowers from flowering plants could affect the presence of phytophage and entomophage insects

3.1 The influence of 2-month-old and 6-month-old sugarcane plants on the diversity of entomophage and phytophage insect species surrounding flowering plants

The results showed that insect species found in flowering plantations that were planted near the 2-month-old sugarcane plantations were 42 species and in the 6-month-old sugarcane plantations there were 41 species. The number of phytophage insects in flowering plantations planted near the 2-month-old sugarcane plantations was 388 and in the 6-month-old sugarcane plantations there were 284. (Table 4.1)

		Sugarcane age (individual)		
Ordo/Family	Species	2 months	6 months	Σ
Coleoptera				
Carabidae	*Agonum* sp	13	0	13
	Amara sp	4	0	4
Chrysomelidae	*Altica aenescens*	20	6	26
	Aulacophora frontaslis	0	3	3
	Cassida vibex	0	14	14
	Adoxia benallae	11	0	11
	Callidex mumhypochalceum	13	0	13
	Hispellinusmultispinosus	3	0	3
Cerambycidae	*Hesthesis* sp.	4	0	4
Coccinelidae	*Coccinella transversals**	16	14	30
	*Coccinella septempunctata**	0	2	2
	*Pseudoscymnus sylvaticus**	6	9	15
	Harmonia quadripunctata	2	0	2
	*Cryptolaemus montrouzieri**	16	0	16
	Epilachna sumbana	4	0	4
	Sycmnus sp.	8	0	8
Curculionidae	*Meriphus* sp.	3	0	3
	Hypera sp.	27	17	44
Dytiscidae	*Rhantus suturalis*	4	0	4
Elateridae	*Ampedus balteatus*	3	0	3
Nitidulidae	*Aethina* sp.	4	0	4

Oedemeridae	*Nacerdes melanura*	5	0	5
Scarabaeidae	*Cyclocephala sp.*	10	0	10
Staphylinidae	*Carpelimus*	5	0	5
	Philonthus	0	7	7
Collembola				
Entomobrydae	*Entomobrya**	4	1	5
Diptera				
Challiphoridae	*Challiphora**	3	4	7
Dholichophidae	*Dolicphus**	0	9	9
	*Chrysoma leucopogon**	20	4	24
Sarcophagidae	*Sarcophaga carnaria**	9	4	13
Syrphidae	*Eristalis tenax**	0	5	5
Muscidae	*Musca sp.*	2	0	2
Hemiptera				
Coreidae	*Leptocorisa acuta*	5	1	6
Pentatomidae	*Nezara viridula*	0	8	8
Hymenoptera				
Appidae	*Apis melifera*	5	18	23
	*Amogilla quadnifasciata**	0	7	7
Braconidae	*Stenobracon nicevillei**	1	0	1
Elasmidae	*Elasmus nephantindis**	0	5	5
Formicidae	*Anoplolepis gracilipes**	0	11	11
	*Componotus lateralis**	15	0	15
	*Componotus sachalinensis**	13	0	13
	*Forelius pruinosus**	41	0	41
	*Oecophylla smaragdina**	23	12	35
	*Paratrechina longicornis**	0	20	20
	*Pheidole sp.**	0	5	5
Ichnemonidae	*Diagdema sp.**	1	0	1
Scelionidae	*Telenomus dignoides**	8	0	8
Vespidae	*Ancistrocenes trifasciatos**	0	7	7
	*Parancistrocerus declivatus**	7	0	7
Lepidoptera				
Erebidae	*Syntomoides syn amata*	0	9	9
Hespiridae	*Thymelicus lineola*	0	5	5
Nymphalidae	*Mycalesis perseus caesonia**	0	6	6
Pieridae	*Appias libythea**	0	7	7
	Appias olferna	10	2	12
Pterphoridae	*Emmelna monodactyla**	0	3	3
Mantodea				0
Mantidae	*Hierodula hanscaucasica**	5	9	14
	*Sphodromantis viridis**	0	8	8
Hymenopodidae	*Creobroter* sp.*	8	4	12
	Odontomantis sp.*	0	1	1
Odonata				
Libellulidae	*Neorothemis ramburii**	0	1	1
	*Orthetrum trinacria**	0	1	1
Orthoptera				
Acrididae	*Acrida* sp.	14	9	23
	Caelifera	0	2	2
	Chorthippus caliginosus	9	5	14
	Melanoplus flavidus	4	0	4
	Paracinema tricolor	0	9	9
	Phaneroptera nana	0	9	9
Gryllidae	*Gryllus asimilis*	0	1	1
Sum of Spesies		42	41	68
Sum of Individuals		388	284	672
Khi Kuadrat sum of spesies *p*		0(0.0001)		
Khi Kuadrat sum of individuals *p*		16.095** (<0.0001)		

Note: Entomophage *

**Significance (p) < 0,05

In Table 4.1 it can be seen that there were entomophage insect species found in flowering plants that are planted near sugarcane plantations at 6 months and 2 months. There were entomofag insect species which were only found in flowering plants planted near the 6-month-old sugarcane plantations. There were phytophage species that only found in flowering plants planted near 2-month-old sugarcane plantations but were not found in 6-month-old sugarcane plantations or vice versa. It showed that the age of sugarcane plants can affect the presence of phytophage insects that come to flowering plants.

3.2 The The Diversity Insect Species found on flowering plants yellow cosmos flower , marrigold flower, and paper flower planted near 2-month-old sugarcane plantations.

The results showed that the number of insect species in the flowering plants yellow cosmos flower planted near the 2-month-old sugarcane crops were 30 species. Insects species that were found in flowering plants marrigold were 13 species, and on flowering plants paper flower were 18 species. The number of insect individuals in the flowering plants yellow cosmos flower was more than flowering plants marrigold and paper flower. (Table 4.2).

Table 4.2. Insect Species found on flowering plants yellow cosmos flower , marrigold flower, and paper flower planted near 2-month-old sugarcane plantations at PTPN VII Cinta Manis.

Ordo / Family	Species	Insect found on flowering plants		
		Cosmos sulphereus	*Tagetes erecta*	*Zinnia elegans*
Coleoptera				
Carabidae	*Agonum* sp.	0	0	3
	Amara sp.	1	0	0
Cerambycidae	*Hesthesis* sp	1	0	0
Chrysomelidae	*Adoxia benallae*	0	0	0
	Altica aenescens	6	1	3
	Callidemumhypochalceum	2	0	0
	Hispellinusmultispinosus	2	0	0
Coccinelidae	*Coccinella transversals*	6	2	3
	Cryptolaemus montrouzieri	3	0	1
	Epilachna sumbana	3	0	1
	Harmonia quadripunctata	0	0	2
	Pseudosycmnus syvaticus	1	0	0
	Sycmnus sp.	2	0	1
Curculionidae	*Hypera* sp.	5	3	4
	Meriphus sp.	1	0	0
Dytiscidae	*Rhantus suturalis*	0	1	0
Elateridae	*Ampedus balteatus*	1	0	0
Nitidulidae	*Aethina* sp.	1	0	0
Oedemeridae	*Nacerdes melanura*	1	0	0
Staphylinidae	*Carpelimus*	0	2	1
Diptera				
Challiphoridae	*Challiphora*	0	0	1
Dholichophidae	*Chrysoma leucopogon*	5	0	0
Sarcophagidae	*Sarcophaga carnaria*	2	0	1
Muscidae	*Musca* sp.	0	1	0

Hymenoptera				
Appidae	*Apis melifera*	0	1	1
Braconidae	*Stenobracon nicevillei*	1	0	0
Formicidae	*Componotus lateralis*	2	1	1
	Componotus sachalinensis	2	1	1
	Forelius pruinosus	2	0	3
	Oecophylla snaragdina	3	2	0
	Parancistrocerus declivatus	1	0	1
Ichnemonidae	*Diagdema sp.*	1	0	0
Scelionidae	*Telenomus dignoides*	2	0	0
Hemiptera				
Coreidae	*Leptocorisa acuta*	1	0	0
Orthoptera				
Acrididae	*Acrida sp.*	2	1	2
	Chorthippus caliginosus	2	0	0
	Chiysocha	0	0	1
Mantodea				
Mantidae	*Hierodula hanscaucasica*	1	1	0
Hymenopodidae	*Creobroter sp.*	4	3	0
Sum of Species		30	13	18
Sum of I ndividuals		67	20	31
Khi khuadrat Sum of species *p*		0 (0.0001)		
Khi khuadrat sum of individuals *p*		0*(0.0001)		

In Table.4.2 it can be seen that there were ordo coleoptera species *Coccinella transversals* and *Altica aenescens* which were mostly found in flowering plants yellow cosmos flower. Otherwise there were insect species that were only found in flowering plants paper flower and marrigold but not found in the flowering plants yellow cosmos flower.

3.3 The Diversity Insect Species found on flowering plants yellow cosmos flower, marrigold flower, and paper flower planted near 6-month-old sugarcane plantations.

The results showed that the number of insect species in the flowering plants yellow cosmos flower was more than flowering plants paper flower and marrigold. Insects species that were found in flowering plants yellow cosmos flower were 32 species, and on flowering plants paper flower were 20 species. Insects species that were found in flowering plants marrigold were 18 species. (Table 4.3).

Table 4.3. Insect Species found on flowering plants yellow cosmos flower, marrigold flower, and paper flower planted near 6-month-old sugarcane plantations at PTPN VII Cinta Manis.

Ordo / Family	Species	Insect found on flowering plants		
		Cosmos sulphereus	*Tagetes erecta*	*Zinnia elegans*
Coleoptera				
Chrysmolidae	*Altica aenescens*	1	0	1
	Aulacophora frontaslis	1	0	0
	Cassida vibex	3	2	1
Coccinelidae	*Coccinella transversals*	4	1	2
	Coccinella septempunctata	0	0	0
	Sycmnus rebromaculatus	2	1	1
Curculionidae	*Hypera* sp.	3	2	2
	Philonthus	1	0	0

Diptera				
Dholichophidae	*Dolicphus comatus*	2	1	1
	Chrysoma leucopogon	2	0	0
Sarcophagidae	*Sarcophaga carnaria*	0	0	0
Syrphidae	*Eristalis tenax*	1	1	0
Hymenoptera				
Appidae	*Apis melifera*	3	1	4
	Amogilla quadnifasciata	0	0	3
Elasmidae	*Elasmus nephantindis*	5	0	0
Formicidae	*Anoplolepis gracilipes*	3	1	1
	Oecophylla smaragdina	4	1	2
	Paratrechina longicornis	4	2	2
	Pheidole sp.	2	0	0
Vespidae	*Ancistrocenes trifasciatos*	0	4	3
Hemiptera				
Coreidae	*Leptocorisa acuta*	1	0	0
Pentatomidae	*Nezara Viridula*	3	0	1
Lepidoptera				
Erebidae	*Syntomoides syn amata*	1	2	3
Hespiridae	*Thymelicus lineola*	1	0	1
Nymphalidae	*Mycalesis perseus caesonia*	1	1	2
Pieridae	*Appias libythea*	3	0	0
Pyralidae	*Chilo sacchariphagus*	1	0	0
Pterphoridae	*Emmelna monodactyla*	1	0	0
Odonata				
Libellulidae	*Neurothemis ramburii*	1	0	0
	Orthetrum trinacria	0	0	1
Mantodea				
Mantidae	*Hierodula hanscaucasica*	5	2	0
	Sphodromantis viridis	4	2	0
Hymenopodidae	*Creobroter* sp.	2	1	0
	Odontomantis sp.	1	0	0
Orthoptera				
Acrididae	*Acrida* sp.	2	1	1
	Caelifera	1	0	0
	Chorthippus caliginosus	1	0	1
	Paracinema tricolor	1	0	2
	Phaneroptera nana	0	0	2
Sum of species		32	18	20
Sum of individuals		71	26	37
Khi kuadrat sum of species *p*		0 (0.0001)		
Khi kuadrat sum of individuals *p*		0*(0.0001)		

In Table 1.3 it can be seen that there were insects only found in flowering plants yellow cosmos flower planted. There were insects species that were only found in flowering plants paper flower planted. The species was *Orthertrum tricacria*, otherwise there were insect species not found in flowering plants paper flower but found in flowering plants yellow cosmos flower and marrigold.

3.4 Index of Diversity, Dominance and Evenness of Entomophage and Phytophage Insects on Flowering Plants Planted near Sugarcane Plantation aged 2 and 6 months

The result of the research showed that the diversity index, dominance index, and evenness index of phytophage and entomophage insect species on flowering plants planted near 2-month-old and 6-month-old sugarcane plantation was relatively the same.Based on the diversity index criteria, it can be seen that the diversity of phytophage and entomophage insect species in flowering plants planted near sugarcane plantations was relatively similar. (Table 4.4)

Table.4.4 The index of diversity, dominance, and evenness of entomophage and phytophage insect species on flowering plants planted near the sugarcane plantation.

Community Characteristics	On the flowering plants near the sugarcane crops …			
	2 months	Denomination	6 months	Denomination
Number of individual (N)	388	Individual	284	Individual
Diversity index (H')	3.433	-	3.497	-
Dominance Index (D)	0.041	-	0.035	-
Evenness Index (E)	0.735	-	0.784	-

In table 1.4 it can be seen that the dominance index value is smaller than 0.5 and the evenness index is greater than 0.5. This shows that there were no dominant entomophage and phytophage insect species. And it also shows that the spread of phytophage and entomophage insect species in flowering plants was relatively evenly distributed in flower plants planted near sugarcane plantations aged 2 months and 6 months old.

Table. 4.5 Index of diversity, dominance and evenness of phytophage and entomophage species in flowering plants that were planted near sugarcane plantations

Community Characteristics	insects in flowering plantations in sugarcane plants aged			
	2 months		6 months	
	Phytophage	Entomophage	Phytophage	Entomophage
Number of individual (N)	200	175	107	145
Diversity index (H')	2.564	2.826	2.548	2.867
Dominance Index (D)	0.096	0.073	0.089	0.067
Evenness Index (E)	0.721	0.767	0.798	0.764

Table 4.6 Effect of diversity of flowers which were planted monoculturally on the presence of phytophage and entomophage insect species.

Kinds of flower	2 months		6 months		
	Phytophage	Entomophage	Phytophage	Entomophage	∑
Yellow Cosmos	32	36	26	47	141
Marigold	10	10	8	18	46
Bougainvillea	17	14	19	18	68
Sum of Species	59	60	53	83	255

In Table 4.5. it can be seen that the number of individual of entomophage insects in flowering plants near the 2-month-old sugarcane plants was less than the number of phytophage individual insects. However, in flowering plants that were planted near 6-month-old sugarcane plantations the number of entomophage insect individuals was greater than the number of phytophage insect individuals. This shows that sugarcane plantations aged 2 and 6 months planted with flowering plants can affect the number of entomophage insect individuals.

The result showed that the diversity of entomophage insect species on flowering plants in 2-month-old and 6-month-old sugarcane plantations was higher than that of phytophage insects. The number of individual phytophage insect species in flowering plants planted near 2-month-old sugarcane plantations was more than entomophage insects. Conversely, the number of individual species of phytophage insects in flowering plants planted near the 6-month-old sugarcane crops was less than the entomophage insect species (Table 4.5)

3.5 The Effect of Flowering Plants on the Existence of Phytophage and Entomophage Insect Species on Flowering Plants that are Planted near the Sugarcane Plantations aged 2 and 6 months.

The results showed that the type of flowering plants planted near sugarcane plantations aged 2 and 6 months could affect the species of phytophage and entomophage insects found. The entomophage insects found were higher than the phytophage insect species. In flowering plants that were planted near 2-month-old sugarcane plantations were found relatively similar insect species number. Conversely, insect species found in 6-month-old sugarcane plantations were more than in 2-month-old sugarcane plantations (Table. 4.5)

Table 4.7 Effects of diversity of flowers that planted polyculturally on the presence of phytophage and entomophage insect species.

Kinds of flowers	2 months		6 months		
	Phytophage	Entomophage	Phytophage	Entomophage	∑
Yellow cosmos+ Bougenvillea	26	30	23	27	106
Bougainvillea+ Marrigold	29	29	15	16	89
Yellowcosmos+ Marigold	26	36	13	13	88
K+M+K (Mix)	32	46	28	21	127
Sum of Species	113	141	79	77	410

In Table 4.6 it can be seen that the insects found on Yellow Cosmos plants planted near sugarcane plantations aged 2 and 6 months were 55.3% more than on marigolds and bougainvillea flowers. Insect species found on marigold plants were 26.7% smaller than on bougainvillea, predicted it was influenced by the smell or aroma caused by marigold flowers. There were insects using eyes that only attracted to the yellow color. Yellow is a bright and bright color compared to other colors.

The results showed that the type of flowering plants that were planted polyculturally near sugarcane plantations aged 2 and 6 months could affect the species of phytophage and entomophage found. The number of entomophage insects was found more than phytophage insect species. In flowering plants planted near sugarcane plantations aged 2 months and 6 months, it was found that phytophage insect species and entomophage insect species were the same in number. (Table 4.6).

In Table 4.7, it can be seen that the insects found in the polyculture flowering plants (Yellowcosmos - Bougainvillea) planted near sugarcane plantations aged 2 and 6 months were 25.8% more than the Bougainvillea-Marigold and YellowCosmos-Marigold flowering plants. Phytophage insect species and entomofag insect species found in flowering plants that were planted near the 2 and 6 month old sugarcane plantations were 30.9% greater than the flowering plants above (Table 4.6). It shows that the more flowering plant population can affect the presence of insect species.

The results showed that the diversity index of entomophage species and phytophage insects in flowering plants planted near sugarcane plantations aged 6 months was higher with a value of 3.49 than flowering plants planted near sugarcane plantations aged 2 months with a value of 3.43. Research of [21] states that the diversity index can be used to express the relationship of species abundance in the commnity, the higher the diversity index, the better the relationship of species abundance in the community or stable.

The results showed that the dominance index of entomophage and phytophage insect species in flowering plants that were planted near 2-month-old sugarcane plantations and flowering plants that were planted near 6-month-old sugarcane plantations were 0.041 and 0.035 or the dominance is smaller than 0.5 which means that there were no entomophage insect species and phytophage insects species that dominate, or community structures were stable [22].

The results showed that the evenness index of entomophage insect and phytophage insects species on flowering plants planted near 2-month-old sugarcane plantations and on flowering plants that were planted near 6-month-old sugarcane plantations were 0.735 and 0.784 or E> 0.5 which means the evenness between relative species evenly distributed or the number of individuals of each species is relatively the same. According to [23] the evenness index ranged from 0 to 0.979, this figure shows that the individual existence of each species in a location were quite balanced.

4. Conclusion

1. Flowering plants that were planted near sugarcane plantations in 2-month-old and 6-month-old can affect the insect species entomophage and phytophage which comes to flowering crop.
2. The three types of flowering plants that were planted near sugarcane plantations in 2-monht-old and 6-month-old, yellow cosmos flower are more effective the presence of entomophage and phytophage insects

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