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Arthropod Preference Test Against Zinnia sp. in Oryza Sativa L.

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ABSTRACT

Arthropoda Preference Test has been carried out on Zinnia Sp. in paddy plantations (Oryza sativa L.). This study aims to determine the level of arthropod diversity in paddy cultivation areas using Zinnia sp. compared to rice without Zinnia sp. The method used is a survey method with purposive sampling which was determined intentionally. The results of the comparison of the two treatments showed that in the vegetative phase the number of pests, predators, and parasitoids was more without treatment than using treatment, while the generative phase used less treatment than without treatment. Indeed, from the number of species obtained, there was no signicant difference, but it was seen from the number of fewer pests and more predators with refugia plantations compared to those without refugia. This is evidenced by the comparison of rice yields obtained more with treatment than without treatment 561:429 in units of kg.

Keywords: arthropods, paddy, refugia, zinnia sp

1. Introduction

Rice production (Oryza sativa L) in South Kalimantan in 2017 was 2,452,366 tons while in 2018 it was 2,440,400 tons. The development of rice production in 2018 experienced a decrease in yield. The largest rice production (Oryza sativa L) in South Kalimantan was contributed by Barito Kuala Regency as much as 370,315 tons, Tapin as much as 344,470 tons in Hulu Sungai Tengah Regency with 299,649 tons, Hulu Sungai Selatan with 268,934 tons in Banjar Regency with 232,009 tons (Department of Food Crops and South Kalimantan Province Horticulture, 2019).

The Center for the Protection of Food Crops and Horticulture of South Kalimantan Province in 2017, pest attacks that attacked rice plants (Oryza sativa L) were 1,771.7 ha in 2018 as many as 923.5 ha and in 2019 as many as 694.5 ha. Efforts to increase the production of food crops, especially rice, always get various problems, one of which is Plant Pest Organisms (OPT) using trap plants, namely refugia plants. Refugia serves as a shelter for neutral and benecial insects. Because insects also have an interest in certain types of refugia. making it possible to reduce pest attacks on rice plants. The kinds of ower plants that function as refugia owers are Cosmos caudatus owers, god owers or sunowers, zinnia owers, marigold owers, Celosia argentea var. cristata, and Catharanthus roseus owers (Lilies, 1991).

2. Materials and Methods

This research was conducted in the rice fields of Banua Rantau, Banua Lawas District, Tabalong Regency. This research has been carried out for 4 months (January-April 2020). The method used in this research is a survey method *with purposive sampling* which is determined intentionally. The implementation of this research was carried out through 2 stages.

Research Preparation

Determination of location

Determination of the research location is done by means of field observations to determine the land to be used. This determination is based on a land area of 14 m × 14 m. At the shipyard, 4 observation plots on refugia plants and 4 observation plots on rice plants with a size of 2.5 m × 2.5 m were determined which would be installed with yellow traps and insect nets. The first land will be planted with refugia throughout the shipyard and for the second land only rice plants will be planted without using refugia.

The research determining by utilizing field observation data to determine the land to use, with a land area of 14 m × 14 m. four plots of observation of refugia plants and four plots with rice plants with a size of 2.5 m × 2.5 m, which will install with yellow traps and insect nets. The first with refugia in the paddy field, while for the second, only rice will be growing without the use of the refugia.

Planting Zinnia *sp.*

Planting *Zinnia* by sowing the seeds in the nursery media, then the refugia flowers will be transferred after the rice is planted to the paddy field.

Rice Planting Rice

Planting is carried out through several stages, the first is soaking the seeds for 2 days, the second is peeling, the rice that has been impacted will be moved after 8 days and the last is tracking.

*Making Yellow Traps (*Yellow Sticky Traps)

Yellow Traps (Yellow Sticky Traps) It is made of thick yellow plastic with a length of 30 cm and a width of 24 cm.

Research Implementation

Yellow Trap Installation

On that land, 8 points will be taken for the installation of yellow traps, so there are 16 yellow traps for the two experimental fields. The yellow trap was set at 08.00 am and will be taken the next day.

Insect Picking with Swing Net

Insect retrieval was carried out in the same plot as the yellow traps for catching arthropods. The insect nets were swung double over the surface of the refugia and rice plants. Arthropods can be caught at 08.00 or 16.00.

Observation

Observations were made in the vegetative and generative phases with observation intervals of two weeks and repeated 4 times. Then the catch with insect nets and yellow traps is put into bottles of mineral water that already contain 70% alcohol.

Identification

Insect pests, predators and parasitoids that have been collected were identified with a microscope and photographed. Furthermore, the morphological identification of the species using the insect determination key was carried out by (Lilies, 1991; Shepard & Ooi, 1991).

Data analysis

Observations obtained by various species of insect pests, predators, and parasitoids can be calculated based on the number of families and species and determined by the Diversity Index (H**)**, Dominance Index (D) and Evenness Index (E).

1. *Diversity Index (H′)*

Diversity index (H**'**) is calculated based on the formula according to Shannon-Weiver (Southwood, 1978):

$$\acute{H}' = -\sum_{n=1}^{S} \text{Pi ln Pi}$$

2. *Species richness index (R)*

The species richness index (R) was calculated using the formula according to Margalef in Ludwig and Reynold, 1988:

$$R = \frac{(S-1)}{\ln N}$$

3. Dominance index (D)

The dominance index is calculated using the formula according to Simpson (Ludwig & Reynolds, 1998):

$$D = \sum \left(\frac{ni}{N}\right)^2$$

4. Evenness index (E)

Evenness index (E) was calculated using the formula according to (Pielou 1984; Ludwig and Reynold, 1998):

$$E = \frac{H'}{ln\ S}$$

3. Results and Discussion

Based on the identification of arthropods obtained from observations using swing nets and yellow traps in the vegetative phase of rice planting with the addition of refugia and without refugia, it can saw in the following table:

Table 1. Insects found in rice fields with Zinnia sp. and without Zinnia sp. in the vegetative phase

Table X. Mean value of daily growth rate of catfish (*Clarias gariepinus*) during research

No	Spesies (total individuals)					
	Z	A1B2	A1B3	A2B1	A2B2	A2B3
1	Nilaparvata lugens (79)	1,03	1,04	0,91	0,91	0,94
2	Nephotettix sp. (2)	0,68	0,91	0,87	0,88	0,90
3	Musca domestica (11)	1,04	1,04	1,22	0,90	0,90
4	Agriocnemis pygmaea (10)	2,75	2,99	3	2,69	2,74
5	Micraspis sp. (7)	0,91	0,99	1	0,89	0,91

Description: Z = With *Zinnia* sp. WZ = Without *Zinnia* sp.
H = Pest P = Predator
Pt = Parasitoid

Table 2. Insects found in rice fields with *Zinnia* sp. and without *Zinnia* sp. in the generative phase (45 day after planting)

No	Spesies (total individuals)		Order		Family		Status	
	Z	WZ	*Z*	WZ	*Z*	WZ	*Z*	WZ
1	*Spodoptera* spp. (7)	*Nephotettix* sp. (34)	Lepidoptera	Homoptera	Noctuidae	Delphacidae	H	H
2	*Leptocorisa acuta*(24)	*Leptocorisa Acuta*(14)	Hemiptera	Hemiptera	Alydidae	Alydidae	H	H
3	*Conocephalus longipennis* (10)	*Conocephalus longipennis*(10)	Orthoptera	Orthoptera	Tettigoniidae	Tettigoniidae	P	P
4	*Agriocnemis pygmaea*(12)	*Oxyopes lineatipes*(9)	Odonata	Araneae	Coanagrionidae	Oxyopidae	P	P
5	*Tetragnatha maxillosa* Thorell (7)	*Tetragnatha maxillosa* Thorell (2)	Araneae	Araneae	Tertagnathidae	Tertagnathidae	P	P
6	*Micraspis* sp. (20)	*Euborellia stali*(9)	Coleoptera	Dermaptera	Coccinellidae	Carcinophoridae	P	P
	Total = 80	**Total = 78**						

Table 3. Insects found in rice fields with *Zinnia* sp. and without *Zinnia* sp. in the generative phase (60 day after planting)

No	Spesies (total individuals)		Order		Family		Status	
	Z	WZ	*Z*	WZ	*Z*	WZ	*Z*	WZ
1	*Spodoptera* spp.(15)	*Nephotettix* sp. (70)	Lepidoptera	Homoptera	Noctuidae	Cicadellidae	H	H
2	*Nilaparvata lugens*(6)	*Leptocorisa acuta* (34)	Homoptera	Hemiptera	Delphacidae	Alydidae	H	H
3	*Conocephalus longipennis*(7)	*Micraspis* sp. (2)	Orthoptera.	Coleoptera	Tettigoniidae	Coccinnellidae	P	P
4	*Agriocnemis pygmaea*(5)	*Conocephalus longipennis* (13)	Odonata	Orthoptera	Coanagrionidae	Tettigoniidae	P	P
5	*Euborellia stali*(4)	*Tetragnatha maxillosa* Thorell (11)	Dermaptera	Aranaeae	Carcinophoridae	Tertagnathidae	P	P
6	*Argiope canenulata*(5)	*Oxyopes javanus* (5)	Aranaeae	Araneae	Araineidae	Oxyopidae	P	P
7	*Micraspis* sp. (12)	*Brachmeria* sp. (3)	Coleoptera	Hymenoptera	Coccinnellidae	Chalcididae	P	Pt
8	*Oxyopes javanus* Thorell (10)	-	Araneae	-	Oxyopidae	-	P	-
9	*Cytorhinus lividipennis*(5)	-	Coleoptera	-	Miridae	-	P	-
	Total = 69	**Total = 138**						

Table 4. Insects found in rice fields with *Zinnia* sp. and without *Zinnia* sp. in the generative phase (75 day after planting)

No	Spesies (total individuals)		Order		Family		Status	
	Z	WZ	*Z*	WZ	*Z*	WZ	*Z*	WZ
1	*Nephotettix* sp. (2)	*Nephotettix* sp. (41)	Homoptera	Homoptera	Cicadellidae	Cicadellidae	H	H
2	***Cassida circumdata*(1)**	*Leptocorisa acuta*(20)	Coleoptera	Hemiptera	Chrysomelidae	Alydidae	H	H
3	*Micraspis* sp. (12)	*Micraspis* sp. (12)	Coleoptera	Coleoptera	Coccinellidae	Coccinnellidae	P	P
4	*Conocephalus longipennis*(10)	*Conocephalus longipennis*(11)	Orthoptera.	Orthoptera	Tettigoniidae	Tettigoniidae	P	P
5	*Tetragnatha maxillosa* Thorell (10)	*Tetragnatha maxillosa* Thorell (10)	Aranaeae	Aranaeae	Tertagnathidae	Tertagnathidae	P	P
6	*Oxyopes javanus*(5)	-	Aranaeae	-	Oxypidae	-	P	P
	Total = 40	**Total = 94**						

Various types of arthropods were found from several orders and families. In the vegetative phase in rice planting, fewer refugia using than without refugia. This response happens for several reasons, namely refugia plants are a food source for natural enemies, provide shelter for insects, predators to survive or find food (Landis et al., 2000). Striking flower colors and attractive colors can make insect pests or natural enemies interested in approaching flowers. (Rowan, 2011) said that insects that come to the plant attracting to the smells released by the plants (Adawiyah et al., 2020).

Insect pests found in the generative phase using refugia were lesser than those found in rice without refugia. The insect pests found in generative were *Leptocorisa acuta, Spodoptera* spp., *Nephotettix* sp., *Nilaparvata lugens*, and *Cassida circumdata*, while pests found in rice cultivation without the use of shelters were *Nephotettix* sp., *Leptocorisa acuta*. In the generative phase, planthopper (*Nephotettix* sp.) attacks on rice without refugia increased compared to the vegetative. In the generative, natural enemies found in treated rice plantations were more than pests, natural enemies found in untreated rice plantations were less than pests.

The results of the analysis of insect populations on rice plants using *Zinnia* sp and without using *Zinnia* sp. include Diversity Index (H'), Species Richness Index (R), Dominance Index (D), and Evenness Index (E) in table 5.

Table 5. Results of insect population analysis in rice plantations using *Ziniia* sp. and without *Zinnia* sp. in the vegetative and generative phases (45, 60 and 75 day after planting)

Indeks	ZV	WZV	ZG (45 hst)	WZG (45 hst)	ZG (60 hst)	WZG (60 hst)	ZG (75 hst)	WZG (75 hst)
H’	0,955 (low)	1,078 (Moderate)	1,678 (Moderate)	1,525 (Moderate)	1,544 (Moderate)	1,378 (Moderate)	1,204(Moderate)	1,443 (Moderate)
R	1,269 (low)	1,239 (low)	1,141 (Low)	1,147 (Low)	1,889 (Low)	1,217(Low)	1,355(Low)	0,874 (Low)
D	0,511 (low)	0,783 (Low)	0,205 (Low)	0, 265 (Low)	0,135 (Low)	0,335(Low)	0,265(Low)	0,305 (Low)
E	0,533 (low)	0,518 (Low)	0,936 (Low)	0,851 (Low)	0,702 (Low)	0, 279(Low)	0,675(Low)	0,896 (Low)

Description:
Z = With Zinnia sp.
WZ = Without Zinnia sp.
V = Vegetative
G = Generative

The diversity index (H') of insects in the vegetative phase in treated rice plants has a value of which means the diversity is low, while for control has a value of 1.078 which means the diversity is moderate. 0.955 treatment and without treatment are 1,269 and 1,239. This wealth index is categorized as low because the value 3.5 < R < 5.0 (Magurran, 1988). The low richness index is due to the uneven distribution of species. The Evenness Index (E) of rice using the treatment and without treatment was almost the same, namely 0.533 and 0.518 categorized as low. As for the dominance index of rice plants without using treatment, the value was higher, namely 0.783. Rice cultivation without using treatment there is a species that dominates while in rice planting without treatment the value is low, namely 0.511.

The generative phase (45) H' using the treatment had a moderate index value, but the value was higher than without treatment, namely 1.67 8 and 1.525. R using a treatment that is 1.141 and without treatment that is 1.147 categorized as low. The D-index values are low, 0.205 and 0.265, and are classified as small because they are not close to 1. At the same time, the E values in both treated and untreated rice cultivation were higher, 0.936 and 0.851, respectively, close to 1. For the generative phase (60) H' and R in rice planting using higher treatment than without treatment, where for rice planting using Zinnia sp. namely 1.544 and 1.889 while for rice without treatment 1.378 and 1.217. For E, 0.702 and 0.335 treatments. Overall, it was higher for rice cultivation using treatment and D value was equally low, where for rice cultivation using refugia (Zinnia sp.) 0.135 but rice without refugia (Zinnia sp.) was greater in value (0.335) seen as a whole still categorized small because it is close to 0.

Meanwhile, the generative phase (75) H' for treated rice was 1,204 and for untreated rice was 1,443. For R in rice cultivation using treatment is higher than treatment rice planting was in rice planting using treatment 1.355 and rice planting without treatment 0.874. Meanwhile, E in rice cultivation is 0.675, and rice without Zennia sp is 0.896. D rice planting using refugia is 0.265 and without refugia is 0.896. Where in rice planting using refugia. The dominance index is small, while the dominance index for no shelter is high because it is close to 1. The dominance index is a measure used to determine the extent to which a species dominates other groups, with a sufficiently large dominance that will lead to

community depression (Insafitri, 2010). Odum (1971) in (Adawiyah et al., 2020) said that the dominance index would be of the maximum value (1) if there are one dominant species in the ecosystem.

4. Conclusions

The number of pests, predators and parasitoids in the vegetative phase is more and less in the generative phase, the number of species obtained did not show any difference, but from the number of pests, there were fewer and more predators in the direfugia than without the refugia, and the addition of refugia in rice plantations can increase crop yields.

References

Adawiyah, R., Aphrodyanti, L., & Aidawati, N. (2020). Pengaruh Warna Bunga Refugia Terhadap Keanekaragaman Serangga Pada Pertanaman Tomat (Solanum lycopersicum). Jurnal Proteksi Tanaman Tropika, 3(2), 194–199.

Insafitri, I. (2010). Keanekaragaman, Keseragaman, Dan Dominansi Bivalvia Di Area Buangan Lumpur Lapindo Muara Sungai Porong. Jurnal Kelautan: Indonesian Journal of Marine Science and Technology, 3(1), 54–59.

Landis, D. A., Wratten, S. D., & Gurr, G. M. (2000). Habitat management to conserve natural enemies of arthropod pests in agriculture. Annual Review of Entomology, 45(1), 175–201.

Lilies, C. (1991). Kunci determinasi serangga. Kanisius. Yogyakarta, 223.

Magurran, A. E. (1988). Ecological diversity and its measurement. Princeton university press.

Rowan, D. D. (2011). Volatile metabolites. Metabolites, 1(1), 41–63.

Shepard, B. M., & Ooi, P. A. C. (1991). Techniques for evaluating predators and parasitoids in rice. In Rice insects: Management strategies (pp. 197–214). Springer.