

Conference Paper

Diversity of Important Pests and Natural Enemies in Rice Plants

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ABSTRACT

The main obstacle that is often faced by farmers is the presence of Plant Pest Organisms (OPT), one of the pests is the types of pests on rice plants. Diversity of pests and natural enemies of rice is an activity of collecting and compiling data and information regarding the presence of pests and natural enemies in rice cultivation. The purpose of the study was to obtain data on the types of pests and natural enemies in lowland rice cultivation. The results showed important pests on rice plants, namely green leafhoppers (*Nephotettix virescen*), walang sangit (*Leptocorisa oratorius*), brown leafhoppers (*Nilaparvata lugens*), armyworms (*Mythimna separate*), grasshoppers (*Oxya* spp), ganjur (*Orseolia oryzae*), birds finches (*Lonchura* sp) and mouse (*Rattus argentiventer*). As for natural enemies, namely spiders (*Lycosidae*), tomcat (*Paederinae*), dragonflies (*Orthetrum Sabina*), wasps (*Vespula germanica*) and beetle koksi (*Coccinella septempunctata*). The presence of natural enemies in rice cultivation can affect the level of pest populations in rice cultivation.

Keywords: Important pests, natural enemies, rice plants

Introduction

Rice is an important cereal crop and is used as a staple food by the Indonesian people. That is why rice production really needs to be increased. The increase in rice production is affected by nuisance which can result in a decrease in production. Some of the variables that affect the level of rice production are the use of varieties, use of fertilizers, farming methods, and pests (OPT). The main obstacle often faced by farmers is the existence of Plant Disturbing Organisms (OPT). Disturbing organisms are pests and weeds that can cause low rice productivity per hectare, and can even cause crop failure or puso.

One type of nuisance that harms farmers a lot is the type of insect pests, namely brown leafhoppers, green leafhoppers, rice bugs, rice stem borers, ganjur pests, armyworms, and several other insect pests that are often found whose existence can interfere with rice plants so that it has an impact on decreasing yields. One control that can be done to reduce the level of pest populations in rice fields is by using natural enemies. Natural enemies are organisms found in nature that can kill insects all at once, weaken insects, which can lead to death in insects, and reduce the reproductive phase of insects. Natural enemies usually reduce the population size of insects, or predators, by preying on individual insects.

Species diversity is a community trait that shows the level of diversity of the types of organisms in it. To obtain this species diversity, it is sufficient to have the ability to recognize and differentiate species even though one cannot identify the type of pest (Putra, 1994). The population of every organism in an ecosystem is never the same from time to time but fluctuates. Likewise, ecosystems formed from populations and their physical environment are constantly changing and growing over time. Pests and natural enemies in rice cultivation are often found in Randuagung gardens but the types have not been recorded so it is very good if scientific activities are carried out with the theme of diversity of important pests and natural enemies in rice plants.

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Material and Methods

This study is structured using normative legal study methods, is a study performed by examining the sources of library materials (secondary data) which are used as the basis for the study, in the

Time and place

The research started on January 3, 2022 until February 16, 2022. Located at Randuagung Garden No. 120A Singosari District, Malang Regency. The area of the research area is about 1200 m².

Materials and tools

The tools used in this study included a camera, yellow sticky trap, markers, insect nets, plastic cups and rulers. The materials used in this study were glue and yellow paint.

Research methods

The research method used is by installing yellow sticky traps at 3 location points from one plot of land with an area of 1200 m². In addition, the sweep net method (swing net trap) is also used for insects that are actively flying. Then, samples were taken from each treatment. Insects obtained from each trap in each treatment were collected and their orders and roles identified in the rice ecosystem were identified.

Observation of insect visits

Insect samples were collected using traps, namely yellow traps, sweep nets, and hand picking, carried out by monitoring 3 times during the vegetative period starting at 7 days, 14 days, and 21 days after planting in the field. The method used for insect visits uses scan sampling, which is observation and sampling in two time periods, namely in the morning (06.00-08.00 WIB), and in the afternoon (15.00-17.00 WIB). The research parameters are the identification of insects and the ecological role of insects.

Data analysis

To compare the high and low diversity of insect species, the Shannon Weininger index (Krebs, 1989) is defined as follows:

$$H' = -\sum p_i \ln p_i$$

H' = Shannon-Weiner Diversity Index

p_i = Proportion of the total number of i -th individuals to the total number of individuals

n_i = Individual of an i -th kind

N = Total number of individuals of all species

The magnitude of the Shannon-Weiner species diversity index (Krebs, 1989) is defined as follows, if:

$H' > 3$ = High Diversity

$1 < H' < 3$ = Medium Diversity

$H' < 1$ = Low diversity

The dominance index is calculated using the Simpson formula (Krebs, 1989) as follows:

$$C = \sum (P_i)^2$$

Where $P_i = \frac{n_i}{N}$

Information:

C = dominance index

N = Total number of individuals in the sample

n_i = Total number of individuals of species- i

Data from observations of the diversity of important pests and natural enemies in rice plants are displayed in tabular form and analyzed in Microsoft Excel 2019. The data obtained was then analyzed for diversity index using the ShannonWiener formula (Ismani et al., 2015).

Results and Discussion

Based on the results of observations, the total number of important pests found in rice plants in 3 observations was 73 individuals in the first observation, 50 individuals in the second observation and 57 individuals in the third observation. The pests caught consisted of 3 orders of Hemiptera, 1 order of Lepidoptera, 1 order of Orthoptera, and 1 order of Diptera. Based on the results of observations made (Table 1.) there are several types of insects that are classified as major pests in rice cultivation. Pests that are commonly found in rice cultivation areas are green leafhoppers (*Nephotettix virescens*), stink bugs (*Leptocoris oratorius*), brown planthoppers (*Nilaparvata lugens*), grasshoppers (*Oxya spp*), armyworms (*Mythimna separate*), ganjur (*Orseolia oryzae*).

Table 1. Important pests in rice plants

No	Family	Species	Name	Observation			Total	Role
				1	2	3		
1	Cicadellidae	<i>Nephotettix virescens</i>	green leafhoppers	15	12	24	54	Pest
2	Alydidae	<i>Leptocoris oratorius</i>	stink bug	12	6	3	21	Pest
3	Delphacidae	<i>Nilaparvata lugens</i>	brown leafhoppers	15	12	0	27	Pest
4	Acrididae	<i>Oxya spp.</i>	grasshopper	12	3	9	24	Pest
5	Noctuidae	<i>Mythimna separate</i>	armyworms	4	2	0	6	Pest
6	Cecidomyiidae	<i>Orseolia oryzae</i>	Ganjur	15	15	21	51	Pest
Total number of individuals				73	50	57	183	

The results of the diversity of important pests obtained from the calculation results table using the Shannon-Weiner formula (Krebs, 1989) in (Table 2.) obtained the results of the diversity index (H') of important pests in rice plants of 1.625 which is classified as moderate. According to Saragih (2008) that the abundance of insects in a habitat is determined by the diversity and abundance of feed and other resources available in that habitat. In addition to the results of the diversity index, the results of the dominance index (C) of important pests in rice plants were also obtained at 0.281 which is classified as moderate. The highest number of pests found came from the Cicadellidae family, namely the green leafhopper with 54 out of a total of 3 observations. Then followed by ganjur pests from the Cecidomyiidae family with 51 out of a total of 3 observations. According to Susilo (2007) in a natural ecosystem, a population of a type of insect or plant-eating animal is never explosive (explodes) because there are many controlling factors, both abiotic and biotic. Thus, in natural ecosystems, insects do not have the status of pests. In the agricultural ecosystem, these controlling factors have been reduced so much that sometimes the population explodes and becomes a pest (Susilo, 2007).

Table 2. Important pest ecological index values

No	Index	Mark	Category
1	Diversity (H')	1,625	Currently
2	Dominance (C)	0,281	Currently

Based on the results of further observations, namely the presence of natural enemies in rice plants, the total number of individuals in 3 observations was 31 in the first observation, 37 in the second observation and 28 in the third observation. The natural enemies obtained (Table 3.) consist of spider (*Lycosidae*), koki beetles (*Coccinella septempunctata*), dragonflies (*Orthetrum sabina*), toad (*Paederinae*) and wasps (*Vespula germanica*). In (Table 4.) the results of the diversity index (H') of important pests in rice plants showed a yield of 1.49 which is classified as moderate. According to Jumar (2000), that the existence of an organism in a place is influenced by environmental and food factors. The availability of food of suitable quality and sufficient quantity for an organism will increase its population rapidly. In addition to the results of the diversity index, the results of the dominance index (C) of natural enemies in rice plants were also obtained, which was 0.244 which was classified as moderate. The abundance of insect species is largely determined by their reproductive activity which is supported by a suitable environment and the fulfillment of their food source needs. The abundance and reproductive activity of insects in the tropics is strongly influenced by the season (Wolda & Wong, 1988).

Table 3. Natural enemies in rice plants

No	Family	Species	Name	Observation			Total	Role
				1	2	3		
1	<i>Lycosidae</i>	<i>Lycosidae</i>	Spider	3	6	0	9	Predator
2	<i>Coccinellidae</i>	<i>Coccinella septempunctata</i>	Beetle Koki	9	3	3	15	Predator
3	<i>Libellulidae</i>	<i>Orthetrum sabina</i>	Dragonflies	6	15	9	30	Predator
4	<i>Staphylinidae</i>	<i>Paederinae fuscipes</i>	Tomcat	10	10	10	30	Predator
5	<i>Vespidae</i>	<i>Vespula germanica</i>	Wasps	3	3	6	12	Predator
Total number of individuals				31	37	28	96	

Table 4. Ecological index values of natural enemies

No	Index	Mark	Category
1	Diversity (H')	1,498	Currently
2	Dominance (C)	0,244	Currently

Based on observations of the presence of natural enemies the most commonly found came from the families Libellulidae and Staphylinidae, the natural enemies were 30 toad and 30 dragonflies. Furthermore, the lowest natural enemies were from the Lycosidae family, namely 9 spiders. The existence of natural enemies is influenced by the habitat that is still maintained. Based on the results of observations on agricultural land in the Randuagung garden, there are still many natural habitats for natural enemies in the form of refugia plants. According to Altieri and Toledo (2007), flowering plants attract insects using the morphological and physiological characteristics of flowers, namely size, shape, color, fragrance, flowering period, and nectar and pollen content. Most of the insects prefer flowers that are small and large, tend to be open, with a long flowering time which is usually found in flowers from the Asteraceae family.

Conclusion

The diversity index value for pests is $H'=1.625$ which is classified as moderate and the dominance index value for pests is $C=0.281$ which is moderate. Then the diversity index value of natural enemies is $H'=1.498$ which is classified as moderate and the dominance index value is $C=0.244$ which is classified as medium. The results of observations were obtained from the activities of a diversity of important pests in rice plants, namely green leafhoppers (*Nephotettix virescens*), rice bugs (*Leptocorisa oratorius*), brown planthoppers (*Nilaparvata lugens*), armyworm

(*Mythimna separate*), grasshoppers (*Oxysa spp*), ganjur (*Orseolia oryzae*). As for natural enemies in inventory activities, namely spiders (*Lycosidae*), tomcat (*Paederinae*), dragonflies (*Orthetrum Sabina*), wasps (*Vespula germanica*) and koksi beetles (*Coccinella septempunctata*).

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