

Diversity Of Insect Pests In Rice Plant (*Oryza Sativa L*) in The Rice Fields Of South Kualuh District, North Labuhanbatu

Melfa Aisyah Hutasuhut*¹, Kartika Manalu², Icha Aurelia Ahmad³

^{1,2,3}Department of Biology, Faculty of Sains and Tecnology
Universitas Islam Sumatera Utara, Medan, North Sumatera, Indonesia

* Corresponding Author:

Email: melfa_aisyah@uinsu.ac.id

Abstract

*Eradicating rice pests in South Kualuh is difficult to do optimally, because most farmers do not understand the types of pests that attack their rice plants. The objective of this study was to obtain information about the type of pest insects in rice plants and to find out the diversity index of insect pests in rice plants. This research was conducted using trap method and collection of insects was done using a insect net. Observation data was analised using Shanon Wiener (H) diversity / diversity index. The result showed 13 types of pest insects which belongs to 10 families. That is *Tettigonia sp.* (Linnaeus, 1758), *Sogatella furcifera* (Horváth, 1899), *Nephotettix virescens* (Distant, 1908), *Cofana spectra* (Distant, 1908), *Atractomorpha crenulata* (Fabricius, 1793), *Erotides sp.* (Laporte, 1836), *Leptocorisa acuta* (Thunberg, 1783), *Aulacophora indica* (Gmelin, 1790), *Chrysochus cobaltinus* (LeConte, 1857), *Silba capsicarum* (McAlpine, 1956), *Hercostomus germanus* (Wiedemann, 1817), *Cnaphalocrosis medinalis* (Guenée, 1854), *Scirpophaga incertulas* (Walker, 1863). The diversity index of rice pest insects was categorized as moderate with a value of 2,35 and a dominance index of 0,108. This value indicates that the distribution of species is evenly distributed so that no insect species dominates in the area.*

Keywords : *Pest insects, insect diversity, rice plants*

1. INTRODUCTION

The agricultural sector indeed plays an important role. As much as it is vital for food supply, it is also plays role in contributing to the country's foreign exchange earnings as it is used as a source of income and provides employment for approximately 21 million agricultural households. Lack of food sources can pose economic, social and political threats that can disrupt national stability (Suryana, 2002). Rice is an annual plant that its ecological conditions are often unstable. This eventually caused the unstable balance of the insect population inside it (Untung, 1993). In the rice field ecosystem, there are various types of insects that depend on the rice field ecosystem. Some insects fully depend their lives to the rice plants, for example pests. While others become predators and some become parasitoids (Mahmudah, 2018).

Pests are an influential part of an agroecosystem that has the ability to affect agricultural yields. Eradicating rice pests (*Oryzasativa L.*) in the rice fields of Sidua Dua Village, Kualuh Selatan District is often difficult to be done in optimal, because the majority of farmers do not master the types of pests that struck their fields. As discussed above, it is necessary to carry out a research on the diversity of insect pests of rice plants (*Oryzasativa L.*) in Kualuh Selatan District, North Labuhanbatu Regency. So that various types of pests and their classifications can be identified. This research will hopefully help the farmers to wisely choose the right method and equipment to carry out eradication for the pests. The purpose of this study is to determine the types of insect pests of rice, diversity index, and dominance index in the rice fields of Kualuh Selatan District, North Labuhanbatu Regency.

II. METHODS

This research had been conducted in rice fields at Kualuh Selatan District, North Labuhanbatu Regency. This research was conducted from December 2019 to March 2020. The tools used in this study were insect nets,

sample bottles, tweezers, labellingstickers, microscope, loup, petri dish, tape meter, thermometer, hygrometer, and cotton. While the material used in this study is alcohol 70%. The insects were collected using the trap method which uses insect net as its main tool. The equipment used is insect nets, where the procedure is based on taking samples of insect pests caught by the insect nets by determining 3 observation locations in the rice fields. The insects were obtained by using insect net footage on the rice field. This process was carried out at 3 different locations with each sampling location area of 200 m²

The insects obtained from 3 locations were then taken to the laboratory to be observed based on the morphological characteristics and identified according to their species using an insect identification guidebook. The results obtained were analyzed using the Shannon-Wiener formula:

$H' = - \sum p_i \ln p_i$; $p_i = n_i / N$. The magnitude of the dominance index value of each insect pest group is calculated using the formula from Simpson (1949): $C = \sum (n_i / N)^2$

III. RESULT AND DISCUSSION

Based on the results of research that has been carried out, there are 3 observation locations, which are location I is adjacent to the highway, location II is in the middle of rice fields, location III is adjacent to residential areas, obtained 13 types, 10 families, and 5 insect pest orders on rice plants in Kualuh Selatan District, North Labuhanbatu Regency. The types of insects obtained are in table 1.

Table 1. Types of Rice Plant Insects found in Kualuh Selatan District, North Labuhanbatu Regency

Ordo	Famili	Spesies	Total		
			Locatio n		
			I	II	III
Coleoptera	Chrysomelidae	<i>Aulacophora indica</i> Gmelin	15	19	22
		<i>Chrysochus cobaltinus</i> LeConte	18	25	25
	Lycidae	<i>Erotides</i> sp.	5	8	8
Diptera	Dolichopodidae	<i>Hercostomus germanus</i> Wiedemann	34	29	28
	Lonchaeidae	<i>Silba capsicarum</i> McAlpine	52	66	52
Hemiptera	Alydidae	<i>Leptocoris acuta</i> Thunberg	18	43	37
	Cicadellidae	<i>Cofana spectra</i> Distant	46	76	58
		<i>Nephotettix virescens</i> Distant	42	24	27
	Delphacidae	<i>Sogatella furcifera</i> Horvath	85	91	68
Lepidoptera	Pyralidae	<i>Cnaphalocrosis medinalis</i> Guenee	37	48	43
		<i>Scirpophaga incertulas</i> Walker	44	44	33
Orthoptera	Pyrgomorphidae	<i>Atractomorpha crenulata</i> Fabricius	9	10	8
	Tettigoniidae	<i>Tettigonia</i> sp.	6	5	7
Jumlah			411	488	416

Notes: Location I : Adjacent to The Highway
 Location II : The Middle of Rice Fields
 Location III: Adjacent to Residential Areas

As presented in table 1, it shows that at location I there are 411 insects, 488 insects at location II, and 416 insects at location III. The highest number of insects found is at location II. Meanwhile, the least number of insects was found in location I. The highest number of individual insects is found in location II, because location II was in the middle of rice fields. This location is an ideal place for insects because it is not affected by the outside environment such as roads and residential areas. In addition, the humidity at location II is also

more humid than the other two locations. Location I had the least number of insect pests due to the location of the location which is on the edge of the main road. The rate of human transportation activity and air pollution can affect the development of insects. According to Odum (1996), a polluted ecosystem environment will have diversity disturbances which can affect the reduced number of species diversity in the area.

Based on the results of research from three observation sites, 13 species of rice plant insects were found, including *Leptocorisa acuta* Thunberg, *Aulacophora indica* Gmelin, *Cofana spectra* Distant, *Nephotettix virescens* Distant, *Sogatella furcifera* Horvath, *Silba capsicarum* McAlpine, *Scirpophaga intercalas* Walker, and *Tettigonia* sp. The insect pest species that had the highest number was *Sogatella furcifera* with a total of 244 individuals. Meanwhile, the insect pest species that had the least amount is *Tettigonia* sp. with a total of 18 individuals. The families found consisted of Tettigoniidae, Delphacidae, Cicadellidae, Pyromorphidae, Lycidae, Alydidae, Chrysomelidae, Lonchaeidae, Dolichopodidae, and Pyralidae. The family with the highest number of pests from the research results was the Cicadellidae with the types of *Nephotettix virescens* and *Cofana spectra*. The family that has the least number of pests in rice fields is the Tettigoniidae family.

Rice is the perfect host for some herbivore species. All parts of the rice plant can be eaten by herbivorous insects, the parts that are mainly eaten are young rice grains, stems, roots and leaves (Jumar, 2000). The Tettigoniidae family has the least number due to the low diversity of plants in the rice fields which affects the availability of food sources. In addition, the presence of predators also affects the pest population of this family.

Overall at the three locations the same species were found, although the observation locations were different. This is presumably because the insects found are species that specifically get food from rice plants. According to Rismunandar (1986), there are similarities in the species of pests that attack rice plants, even though the areas are different because of their food supplies and distribution capabilities. There are pests that attack according to the phase of development of the rice plant, therefore pests are found from the beginning of growth to harvest of the crop.

Diversity Index and Dominance Index

Table 2. Diversity Index and Dominance Index of Rice Plant Insects at Location I

No	Spesies	Jumlah	Ni/N	Ln.Pi	Pi.LnP i	(Ni/N) ²
1	<i>Atractomorpha crenulata</i>	9	0,022	-3,821	-0,084	0,0005
2	<i>Aulacophora indica</i>	15	0,036	-3,311	-0,121	0,0013
3	<i>Chrysocus cobaltinus</i>	18	0,044	-3,128	-0,137	0,0019
4	<i>Cnaphalocrosis medinalis</i>	37	0,090	-2,408	-0,217	0,0081
5	<i>Cofana spectra</i>	46	0,112	-2,190	-0,245	0,0125
6	<i>Erotides</i> sp.	5	0,012	-4,409	-0,054	0,0001
7	<i>Hercostomus germanus</i>	34	0,083	-2,492	-0,206	0,0068
8	<i>Leptocorisa acuta</i>	18	0,044	-3,128	-0,137	0,0019
9	<i>Nephotettix virescens</i>	42	0,102	-2,281	-0,233	0,0104
10	<i>Scirpophaga intercalas</i>	44	0,107	-2,234	-0,239	0,0115
11	<i>Silba capsicarum</i>	52	0,127	-2,067	-0,262	0,0160
12	<i>Sogatella furcifera</i>	85	0,207	-1,576	-0,326	0,0428

13	<i>Tettigonia</i> sp.	6	0,015	-4,227	-0,062	0,0002
	Total	411	1,00			
	Diversity Index (H')	-2,32				
	Dominance Index (C)	0,11				
	Evennes Index(E)	-0,91				

Based on the results of data analysis, at location I, the index of insect pest diversity (H ') was 2.32 with a dominance index value (C) of 0.11. The value (H ') indicates that the insect pest diversity index at location I is classified as moderate. Odum (1996) explains that diversity is identical to the stability of an ecosystem, that is, if the diversity of an ecosystem is relatively large, the condition of the ecosystem tends to be normal. Ecosystem areas that have diversity constraints tend to be moderate, on the problematic ecosystem areas that are polluted usually have a decrease in the diversity of species.

Meanwhile, the dominance index (C) at that location is categorized as low. This case shows that there are no species that dominate in that location. This is in line with the opinion of Odum (1996), the dominance index <0.50 means that there are almost no species that dominate (low), the dominance index value > 0.50 - <0.75 means the dominance index is moderate, while > 0.75 to close to 1 means that the dominance index is high.

Table 3. Diversity Index and Dominance Index of Rice Plant Insects at Location II

No	Spesies	Jumlah	Ni/N	Ln.Pi	Pi. LnPi	(Ni/N) ²
1	<i>Atractomorpha crenulata</i>	10	0,020	-3,888	-0,080	0,0004
2	<i>Aulacophora indica</i>	19	0,039	-3,246	-0,126	0,0015
3	<i>Chrysocus cobaltinus</i>	25	0,051	-2,971	-0,152	0,0026
4	<i>Cnaphalocrosis medinalis</i>	48	0,098	-2,319	-0,228	0,0097
5	<i>Cofana spectra</i>	76	0,156	-1,860	-0,290	0,0243
6	<i>Erotides</i> sp.	8	0,016	-4,111	-0,067	0,0003
7	<i>Hercostomus germanus</i>	29	0,059	-2,823	-0,168	0,0035
8	<i>Leptocorisa acuta</i>	43	0,088	-2,429	-0,214	0,0078
9	<i>Nephotettix virescens</i>	24	0,049	-3,012	-0,148	0,0024
10	<i>Scirpophaga intercalas</i>	44	0,090	-2,406	-0,217	0,0081
11	<i>Silba capsicarium</i>	66	0,135	-2,001	-0,271	0,0183
12	<i>Sogatella furcifera</i>	91	0,186	-1,679	-0,313	0,0348
13	<i>Tettigonia</i> sp.	5	0,010	-4,581	-0,047	0,0001
	Total	488	1,00			
	Diversity Index(H')	-2,32				
	Dominance Index(C)	0,11				
	Evennes Index (E)	-0,90				

Based on table 3, the calculation results show that the diversity index value (H ') at location II is 2.32. This value shows the diversity index value (H ') at location II of 2.32. This value shows that the diversity of insect pests in that location is categorized as medium. This matter is consistent with the opinion of Soegianto (1994) that a community has a large diversity of species if the community consists of many species, on the contrary, if the community is composed of a few species and only a few dominant species, then the species diversity is low.

As for the dominance index (C) at that location, the value is 0.11. This value indicates that the dominance index (C) of rice insect pests in that location is low. Similar to location I, there are also no species that dominate at location II. This is because in the generative phase of crop, the farmers increase the application of pesticides to reduce the rate of insect populations in rice plants. According to Fitriani (2016), the use of pesticides can reduce the population of natural enemies and non-target creatures. This matter can cause a decrease in species diversity in the agricultural ecosystem.

Table 4. Diversity Index and Dominance Index of Rice Pest Insects at Location III

No	Spesies	Jumla h	Ni/N	Ln.Pi	Pi. LnPi	(Ni/N) ²
1	<i>Atractomorpha crenulata</i>	8	0,019	-3,951	-0,076	0,0004
2	<i>Aulacophora indica</i>	22	0,053	-2,940	-0,155	0,0028
3	<i>Chrysocus cobaltinus</i>	25	0,060	-2,812	-0,169	0,0036
4	<i>Cnaphalocrosis medinalis</i>	43	0,103	-2,269	-0,235	0,0107
5	<i>Cofana spectra</i>	58	0,139	-1,970	-0,275	0,0194
6	<i>Erotides sp.</i>	8	0,019	-3,951	-0,076	0,0004
7	<i>Hercostomus germanus</i>	28	0,067	-2,698	-0,182	0,0045
8	<i>Leptocorisa acuta</i>	37	0,089	-2,420	-0,215	0,0079
9	<i>Nephotettix virescens</i>	27	0,065	-2,735	-0,178	0,0042
10	<i>Scirpophaga intercalas</i>	33	0,079	-2,534	-0,201	0,0063
11	<i>Silba capsicarium</i>	52	0,125	-2,079	-0,260	0,0156
12	<i>Sogatella furcifera</i>	68	0,163	-1,811	-0,296	0,0267
13	<i>Tettigonia sp.</i>	7	0,017	-4,085	-0,069	0,0003
	Total	416	1,00			
	Diversity Index(H')	-2,39				
	Dominance Index (C)	0,10				
	Evenness Index (E)	-0,93				

Based on the data in table 4, the diversity index (H ') value of insect pests in rice plants at location III is 2.39. This value indicates that the diversity index at that location is moderate. According to Saragih (2008), there are 3 categories of species diversity index values, namely, if $H' < 1$ then the diversity is categorized as low, if $H' > 1$ then the diversity is categorized as medium, if $H' > 3$ then the diversity is categorized as high. The dominance index (C) in that location is 0.10 which is classified as low.

The results of the calculation of the evenness index (E ') for the type of density in the location III is 0.93. According to Azis (2015), if $E' < 0.50$, then the community is in a depressed state. If $0.50 < E' < 0.75$ then the community is in a stable condition while $0.75 < E' < 1.00$ then the community is in an unstable condition. The evenness index value (E ') shall describe the stability of a community. The smaller the value of E ', so that the spread of organisms in the community which is dominated by certain species is not comprehensive and the opposite is the greater the value of E' or closer to one, so that the organisms in the community will spread out as a whole.

The evenness index (E ') at location III has a value that is almost close to 1, which indicates that rice cultivation in location III has a slightly higher value than the other two locations. This means that the rice plants in location III have a higher and more even distribution of individual insect pests. This is related to the increasing number of nutrient sources and hosts around the observation field that can be used to sustain their life. Based on the data in table 4, the diversity index (H ') value of insect pests in rice plants at location III is

2.39. This value indicates that the diversity index at that location is moderate. According to Saragih (2008), there are 3 categories of species diversity index values, namely, if $H' < 1$ then the diversity is categorized as low, if $1 < H' < 3$ then the diversity is categorized as medium, if $H' > 3$ then the diversity is categorized as high. Meanwhile, the dominance index (C) in that location is 0.10 which is classified as low.

The results of the calculation of the evenness index (E') for the type of insects in rice plants at location III were 0.93. According to Azis (2015), if $E' < 0.50$ then the community is in a depressed state. If $0.50 < E' < 0.75$ then the community is in a stable condition while $0.75 < E' < 1.00$ then the community is in an unstable condition. The evenness index value (E') can describe the stability of a community. The smaller the value of E', so that the spread of organisms in the community which is dominated by certain species is not comprehensive and the opposite is the greater the value of E' or closer to one, so that the organisms in the community will spread out as a whole.

Environmental Physical Factors at Research Site

Table 5. Data on Physical Environmental Factors at the Research Location

No	Environmental factors	Location			Mean
		I	II	III	
1	Suhu Udara	29,3° C	30,3° C	29, 2° C	29,6° C
2	Kelembaban Udara	57,7 %	60,6 %	58,3 %	58,8 %

The location of location I is a rice field which is directly adjacent to the main road. Dense human activity and the incessant speed of transportation near these locations have reduced the diversity of insect pests. The average value of the air temperature at that location is 29.3 ° C with an air humidity of 57.7%.

Location I has an average air humidity value that is lower than the other two locations. The low humidity of the air also affects the insect pest population. Humidity is an ecological aspect, which means that it affects the activities of organisms and prevents their spread. Insects need air humidity for their bodies which is usually obtained from the air and plants that have water (Mahmudah , 2018).

Location II is in the middle of rice fields. The average air temperature at that location is 30.3 ° C with an average humidity value of 60.6%. Air humidity at location II is the highest compared to the other two locations. This is because location II is in the middle of a rice field area so that it is not affected by the outside environment such as roads and residential areas. Temperature and humidity affect the diversity of insect pests. This matter is in accordance with Jumar (2000), which states that insects have a certain temperature range where they can live.

Location III is a rice field area directly adjacent to residential areas. The range of average air temperature at that location was 29.2 ° C followed by an average humidity value of 58.3%. Air humidity at location III is lower than location II. Temperature can influence insect activity and development. Humidity will affect the evaporation of insect body fluids, insect preferences for living and hiding places.

Based on the results of data analysis, from the three locations obtained a pest insect diversity index (H') of 2.35 with a value of dominance (C) is 0.108. Value (H') indicates that the diversity index in the research location is moderate. Meanwhile, the value (C) indicates that the dominance index in that location is low. Diversity index is included in a moderate condition due to the large number of insect species and their even distribution. Besides being influenced by environmental physicochemical factors, it is also caused by the presence of predatory insects. Another factor is the existence of a competition between insects that affects the diversity of insect species. Human activities such as applying insecticides can also affect the diversity of insects.

The abundance of species in insects is determined by their reproductive activities supported by an appropriate area and meeting the needs of food sources. Seasonal changes greatly affect food availability, reproductive activities and insect survival skills which directly affect abundance. The results of measurements of weather temperature at the research location ranged from 27-32 ° C. According to Jumar (2000), the efficient temperature range for insects is a minimum of 15 ° C, an optimum of 25 ° C, and a maximum of 45 ° C. This indicates that the air temperature at the location has not reached the maximum limit so that the insects can still breed well.

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IV. CONCLUSION

Based on the results of research on Pest Insect Diversity in Rice Plants (*Oryza sativa* L.) in Kualuh Selatan District, North Labuhanbatu Regency, it can be concluded:

1. There are 13 species of insect pests found, namely *Tettigonia* sp., *Sogatella furcifera* Horváth, *Nephotettix virescens* Distant, *Cofana spectra* Distant, *Atractomorpha crenulata* Fabricius, *Erotides* sp., *Leptocorisa acuta* Thunberg, *Aulacophora indica* Gmelin, *Chrysocharum Cobaltin* LeConte, *Silba capsicarum* McAlpine, *Hercostomus germanus* Wiedemann, *Cnaphalo crosismedinalis* Guenée, *Scirpophaga incertulas* Walker.
2. The Diversity Index (H') of rice plant pest insects (*Oryza sativa* L.) in Kualuh Selatan District is categorized as moderate with a value of 2.35 and Dominance Index (D) 0.108 with a low category.

3. Diversity Index (H') and Dominance Index (D) of insect pests of rice paddy (*Oryza sativa* L.) in Kualuh Selatan District indicate that the distribution of species is evenly distributed so that no insect species dominates in the area.

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